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Three new species of *Diomus* Mulsant (Coleoptera: Coccinellidae: Diomini) from the Brazilian Highlands

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Diomus Mulsant, 1850 (Coleoptera: Coccinellidae) is the richest Neotropical genus of Coccinellidae, representing 15% of the total diversity of these insects in South America. These Coccinellidae are tiny, inconspicuous beetles that are difficult to identify without examining the male genitalia. This paper presents three new species of this genus from the Brazilian Highlands: *Diomus chrysocyon* Duarte-de-Mélo sp. nov.; *Diomus solus* Duarte-de-Mélo sp. nov.; and *Diomus avidus* Duarte-de-Mélo sp. nov.. This work reveals unusual morphological aspects not previously reported for *Diomus*.

Keywords: Cerrado, Group F, Group H, Neotropical Region; Taxonomy.

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INTRODUCTION

Diomus Mulsant, 1850 (Coleoptera: Coccinellidae) corresponds to more than 90% of the species of Diomini Gordon, 1999 described for the New World and Australia, and is the only genus among the six genera in this tribe that occurs elsewhere on the planet (Vandenberg & Hanson 2019). In addition to *Diomus*, the following genera occur in the Americas: *Decadiomus* Chapin, *Heterodiomus* Brèthes, and *Moiradiomus* Vandenberg & Hanson. Six species of *Heterodiomus* and more than 250 species of *Diomus* are found in South America; the latter represent approximately 15% of all lady beetles diversity on the continent (González 2016).

Diomus was proposed by Mulsant (1850) as a subgenus of *Scymnus* Kugelann. Weise (1895) elevated the group to genus status,

but this act was disregarded by several subsequent authors (e.g. Gorham 1897; Casey 1899; Korschefsky 1931; Mader 1955) and only became widespread after studies by Gordon (1976; 1985), culminating in the establishment of the tribe Diomini (Gordon, 1999).

Despite recent advances in understanding the characterization of Diomini (Gordon 1999; Pang & Ślipiński 2009, 2010; Vandenberg & Hanson 2019), and the distinction of *Diomus* as a separate group, this genus remains quite heterogeneous, containing more than 400 species (González 2016), 134 of which occur in Brazil (Almeida et al. 2025). These are inconspicuous, minute beetles with highly variable external morphology, and it is rare to determine species without examining the male genitalia, with many being described from a single male type; the species are usually placed into one of eight groups based on the male genitalia (Gordon 1999).

Considering that descriptions of new species provide evidence for a better understanding of a group and the evolutionary relationships it involves; this study aims to present three new species of *Diomus*, including revealing morphological characteristics not previously known for this genus.

MATERIAL AND METHODS

The material examined of *Diomus* was collected by the second author in the urban area of Brasília, Distrito Federal, capital city of Brazil, where adults were found in a citrus orchard.

Adult specimens were identified using key for *Diomus* species of South America (Gordon, 1999) and recent descriptions of new species (González & Honour 2011; González 2016; Ramos et al. 2020) by analyzing male genitalia. For this purpose, the genitalia were dissected and cleaned in potassium hydroxide (KOH) solution (10%) for better visualization.

Adult and genitalia photographs were taken with a Leica DMC 2900 digital camera coupled to a Leica M205 C compound stereomicroscope. Images were processed using Adobe Photoshop CC 2019 (version 20.0). The specimens were double mounted with the genitalia in micro-vials containing pure glycerin for deposition and preservation.

Labels of the examined material have been transcribed in quotation marks (“”), with slashes (/) separating the lines and double slashes (//) separating the labels.

This work takes into account the latest morphological terminology (Ślipiński 2007) and classification for Coccinellidae (Che et al. 2021); follows the South American species descriptions in the revision of Diomini (Gordon 1999) and recent works on *Diomus* (González & Honour 2011; González 2016; Ramos et al. 2020).

The types of the new species are deposited in the Coleção Entomológica Padre Jesus Santiago Moure (DZUP), Universidade Federal do Paraná, Curitiba, Paraná, Brazil (Lúcia M. Almeida).

RESULTS

Diomus Mulsant, 1850

Scymnus (*Diomus*) Mulsant, 1850: 951. Gorham 1897: 226; Korschefsky 1931: 116; Mader 1955: 955. *Diomus*: Weise 1895: 144; Gordon 1976: 319; 1985: 315; Gordon & Hilburn 1990: 277; Gordon 1999: 13; Pang & Ślipiński 2009: 642; González & Honour 2011: 1; González 2016: 47; Vandenberg 2018: 114; Vandenberg & Hanson 2019: 262; Ramos et al. 2020: 1.

Type species. *Coccinella thoracica* Fabricius, 1801; by subsequent designation of Korschefsky (1931).

Mulsant (1850) proposed *Diomus* as a subgenus of *Scymnus* based on similarities such as: (1) a strongly indented prothorax anteriorly that largely exposes the head, (2) epipleura without foveae, and (3) short antennae with a truncated apical antennamere; however, he recognized that *Scymnus* and *Diomus* have distinct abdominal postcoxal lines. Weise (1895) elevated *Diomus* to a genus because the species in this group differ from *Scymnus* in having partially connate ventrites I and II and an abdominal postcoxal line descending to the posterior margin of the ventrite, characteristics that are still useful in distinguishing Diomini from other groups.

New World *Diomus* differs from *Decadiomus* and *Moiradiomus* in having eleven antennomeres (Vandenberg & Hanson 2019). The species of *Diomus* and *Heterodiomus* can be separated by characteristics of the prosternum; in *Diomus* the prosternum is emarginate anteriorly and its carinae extend from the process to its anterior margin (Gordon 1999).

***Diomus chrysocyon* Duarte-de-Mélo sp. nov.**
(Fig. 1A–D, Fig. 2A–D)

Diagnosis. *Diomus chrysocyon* Duarte-de-Mélo **sp**. **nov**. is externally similar to several *Diomus* species from South America, e.g. *Diomus genialis* Brèthes, 1925 and *Diomus leondai* González, Ramos & Lemos, 2020. The male genitalia of *D. chrysocyon* Duarte-de-Mélo **sp**. **nov**. is more similar to that of *Diomus cantius* Gordon, 1999 from Venezuela, but *D. cantius* has a penis guide with subparallel to convergent sides in ventral view and a penis capsule with a well-developed outer arm with a convex apex, whereas *D. chrysocyon* Duarte-de-Mélo **sp**. **nov**. has a penis guide with sinuous sides in ventral view and a penis capsule with outer arm less developed with truncate apex.

Description. *Male*. Length 1.33 mm, width 0.98 mm. Form elongate oval. Color reddish and black; frons, antennae, mouthparts, pronotum, hypomera, elytral disc and apex, epipleura, abdomen margins and apex, and legs reddish. *Head*. Color reddish. Punctures fine, surface with smooth appearance. Pubescence yellowish, sparce. Frons at least 2.2 times the width of an eye. Labrum about 3.8 times wider than long. Apical maxillary palpomere slightly securiform. Antennae with 11 antennomeres. *Thorax*. Pronotum reddish; punctures on lateral margins larger than on head, with distance of a diameter. Scutellum triangular, black. Prosternum reddish on anterior and lateral margins and brownish on process. Meso- and metaventrite black. Prosternum apically emarginated, with prosternal carina from anterior margin to the process apex. Metaventrite postcoxal line complete, with extension up to the basal 1/4 of metaventrite. Tarsi trimerous. *Elytra*. Color reddish, with lateral borders, basal area and apical 2/5 to 4/5 of sutural margins brownish; scutellar area triangularly **black**; this elytral dark triangular macula with abrupt constriction on 2/5 of suture. Punctures larger than pronotal ones, coarse with a distance of twice the diameter and fine with less than a diameter close to the margins. *Abdomen*. Reddish with middle area of ventrites I–III brownish. Abdominal postcoxal line complete, descending, closely parallel to the posterior margin and up to lateral margin of ventrite I. Ventrite V apex with emargination medially, about 1/5 of ventrite length. Ventrite VI with apex convex (Fig. 2A). *Genitalia*. Tegmen more than two times longer than wide (Fig. 2B). Penis guide asymmetrical, subtriangular, with

sinuous sides in ventral view; triangular in lateral view (Fig. 2C). Parameres 1.5 times longer than penis guide; apex round and wider than base. Penis with flagellum about 1/4 of its length; penis capsule with basal emargination, outer arm small and truncate and inner arm three times longer than wide and with bifurcation at apex (Fig. 2D). *Female*. Unknown.

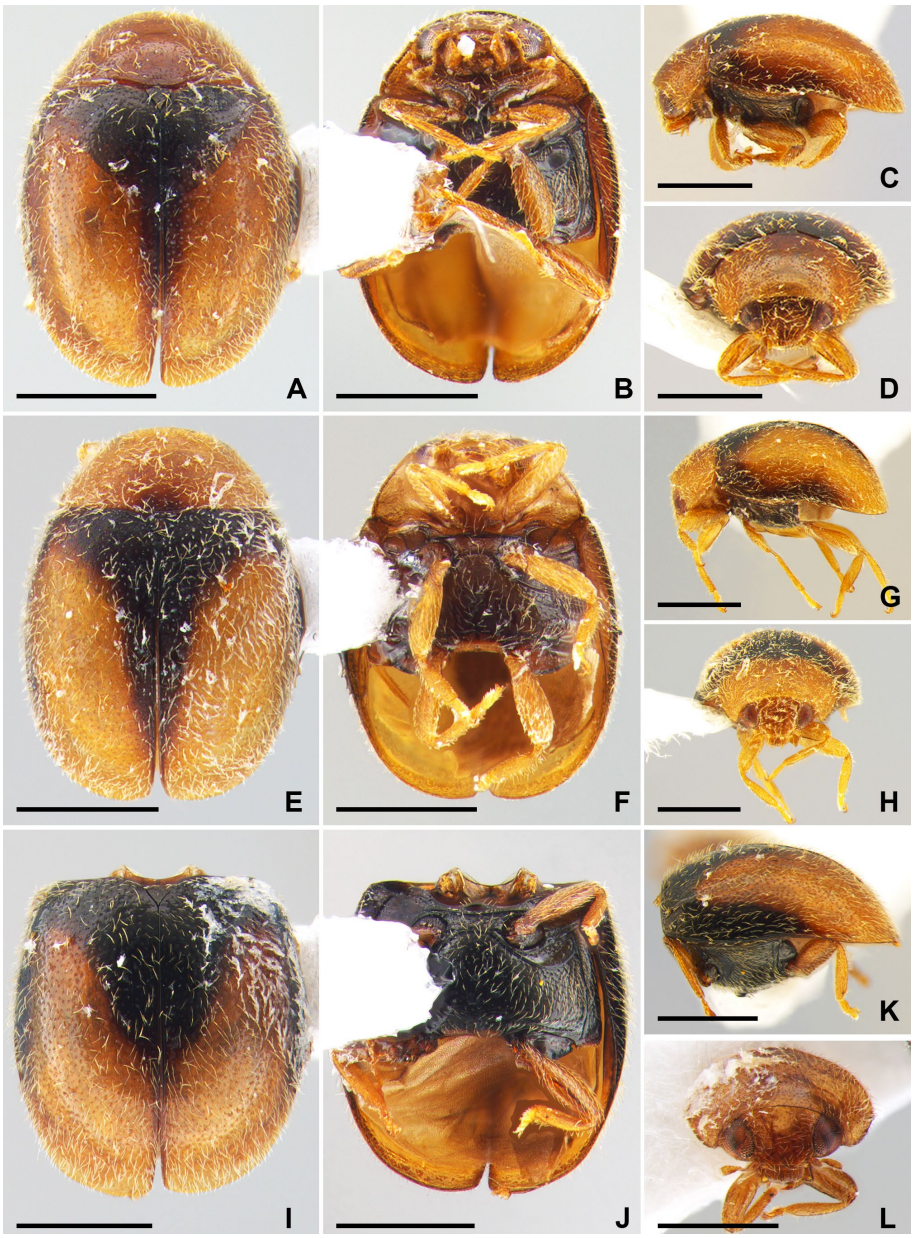

Figure. 1. Habitus of three new species of *Diomus* Mulsant, 1850 from the Brazilian Highlands. A–D: *Diomus chrysocyon* Duarte-de-Mélo **sp**. **nov**. E–H: *Diomus solus* Duarte-de-Mélo **sp**. **nov**. I–L: *Diomus avidus* Duarte-de-Mélo **sp**. **nov**. Scale bars = 0.5 mm.

Type material. Holotype ♂: "Brasília-DF / 05.XI.2023 / LIMA, I.M.M. (leg) // Em *Citrus* com / *Orthezia* sp. e / *Aleurocanthus woglumi*" 1 ex. [DZUP 327666]

Etymology. The specific epithet is a noun in apposition meaning "golden dog". It refers to *Chrysocyon brachyurus* (Illiger, 1815), an omnivorous canid endemic to South America that occurs in the type locality of *Diomus chrysocyon* Duarte-de-Mélo **sp**. **nov**. and whose pelage color arrangement resembles the color pattern seen in this new species of lady beetle.

Remarks. *Diomus chrysocyon* Duarte-de-Mélo **sp**. **nov**. has the same male genitalia pattern as the species of the "Group F" of South American *Diomus* proposed by Gordon (1999).

Diomus solus Duarte-de-Mélo sp. nov. (Fig. 1E–H, Fig. 2E–H)

Diagnosis. *Diomus solus* Duarte-de-Mélo **sp**. **nov**. is similar to some *Diomus* species from South America, e.g. *Diomus titus* Gordon, 1999 and *Diomus torresi* González, 2016. The male genitalia of *D. solus* Duarte-de-Mélo **sp**. **nov**. is more similar to those of the species in "Group F" due to the penis with a long apical flagellum with about 1/4 of its length, but these species have a penis capsule with an obsolete outer arm and a long, slender inner arm, while the penis capsule of *D. solus* Duarte-de-Mélo **sp**. **nov**. has a small triangular outer arm and an obsolete inner arm, which is unique in *Diomus*.

Description. *Male*. Length 1.31 mm, width 0.96 mm. Form elongate oval. Color reddish and black; frons, antennae, mouthparts, mostly pronotum, hypomera, elytral disc and apex, epipleura, abdomen margins and apex, and legs yellowish. *Head*. Color yellowish. Punctures fine, surface with smooth appearance. Pubescence yellowish, sparce. Frons at least two times the width of an eye. Labrum about 2.6 times wider than long. Apical maxillary palpomere securiform. Antennae with 11 antennomeres. *Thorax*. Pronotum reddish, except by a small basomedian spot brownish; punctures fine, surface with smooth appearance. Scutellum triangular, black; reddish on the middle area. Prosternum reddish on anterior and lateral margins and brownish on process apex. Meso- and metaventrite brownish. Prosternum apically emarginated, with prosternal carina from anterior margin to the process apex. Metaventrite postcoxal line complete, with extension up to the basal 1/4 of metaventrite. Tarsi trimerous. *Elytra*. Color yellowish, with lateral borders, basal area and apical 3/5 of sutural margins brownish; scutellar area triangularly **black**; this elytral dark subtriangular macula with sides smoothly convergent up to sutural apex. Punctures coarser than pronotal ones, with a distance of a diameter. *Abdomen*. Color reddish. Abdominal postcoxal line incomplete, descending, closely parallel to the posterior margin and up to lateral margin of ventrite I. Ventrite V apex with shallow emargination medially. Ventrite VI with apex convex (Fig. 2E). *Genitalia*. Tegmen more than two times longer than wide (Fig. 2F). Penis guide asymmetrical, subtriangular, with sides slightly divergent at base and convergent at apical half in ventral view; triangular in lateral view (Fig. 2G). Parameres 1.25 times longer than penis guide; apex round and wider than base. Penis with flagellum about 1/4 of its length; penis capsule with basal margin oblique, outer arm small, triangular, and inner arm obsolete (Fig. 2H). *Female*. Unknown.

Type material. Holotype ♂: "Brasília-DF / 05.XI.2023 / LIMA, I.M.M. (leg) // Em

Citrus com / *Orthezia* sp. e / *Aleurocanthus woglumi*" 1 ex. [DZUP 327667]
Etymology. The specific epithet refers to the unique male genitalia of this new *Diomus* species.

Remarks. *Diomus solus* Duarte-de-Mélo **sp**. **nov**. shares similar male genitalia with species of "Group F" of South American *Diomus* proposed by Gordon (1999), but its unusual penis capsule makes it difficult to place this species in this or any other genitalia-based group besides its own.

Figure 2. Abdomen and genitalia of three new species of *Diomus* Mulsant, 1850 from the Brazilian Highlands. A–D: *Diomus chrysocyon* Duarte-de-Mélo **sp**. **nov**. E–H: *Diomus solus* Duarte-de-Mélo **sp**. **nov**. I–L: *Diomus avidus* Duarte-de-Mélo **sp**. **nov**. Scale bars = 0.5 mm.

***Diomus avidus* Duarte-de-Mélo sp. nov. (Fig. I–L, Fig. 2I–L)**

Diagnosis. *Diomus avidus* Duarte-de-Mélo **sp**. **nov**. resembles some *Diomus* species from South America, e.g. *Diomus chrysostum* Gordon, 1999 and *Diomus leonard* Gordon, 1999. The abdomen and male genitalia of *D. avidus* Duarte-de-Mélo **sp**. **nov**. are more similar to that of *D. chrysostum* also from Brazil, but *D. chrysostum* has parameres as long as the penis guide and penis capsule without ramification at the base of any arm, while *D. avidus* Duarte-de-Mélo **sp**. **nov**. has parameres longer than the penis guide and penis capsule with ramification at the base of the outer arm.

Description. *Male*. Length 1.59 mm, width 1.07 mm. Form elongate oval. Color reddish and black; frons, antennae, mouthparts, pronotum, hypomera, elytral disc and apex, abdomen margins and apex, and legs except meso- and metacoxae reddish. *Head*. Color reddish. Punctures

fine, surface with smooth appearance. Pubescence yellowish, sparce. Frons at least 1.7 times the width of an eye. Labrum about 2.1 times wider than long. Apical maxillary palpomere slightly securiform. Antennae with 11 antennomeres. *Thorax*. Pronotum reddish; punctures larger than on head, with distance of a diameter on lateral margins. Scutellum subtriangular, black. Prosternum reddish. Meso- and metaventrite black. Prosternum apically emarginated, with prosternal carina from anterior margin to the process apex. Metaventrite postcoxal line complete, with extension up to the basal 1/4 of metaventrite. Tarsi trimerous. *Elytra*. Color reddish, with lateral borders, humeral, basal and scutellar areas and apical 3/5 of sutural margins brownish; scutellar area triangularly b**lack with convergent round borders sutura**; this elytral dark subtriangular macula with extension up to half of sutural length. Punctures larger than pronotal ones, with distance of a diameter on apical area. *Abdomen*. Reddish with middle area of ventrites I–II black. Abdominal postcoxal line incomplete, descending, closely parallel to the posterior margin and up to lateral margin of ventrite I. Ventrite V apex with emargination medially, about 1/5 of ventrite length. Ventrite VI apex concave (Fig. 2I). *Genitalia*. Tegmen about 1.5 times longer than wide (Fig. 2J). Penis guide asymmetrical, subtriangular, with sinuous sides in ventral view; subrectangular in lateral view, dorsal keel at base and dorsal keel all over the ventral margin (Fig. 2K). Parameres 0.75 times the length of penis guide; apex with acute projection towards penis guide. Penis with flagellum about 1/2 of its length; penis capsule very sclerotized, inner arm about two times longer than outer arm with a perpendicular apex to its own base, and outer arm with ramification at base (Fig. 2L). *Female*. Unknown.

Type material. Holotype ♂: "Brasília-DF / 06.XI.2023 / LIMA, I.M.M. (leg)" 1 ex. [DZUP 327668]

Etymology. The specific epithet is the Latin word for "eager" and refers to the voracious nature typical of *Diomus* species.

Remarks. *Diomus avidus* Duarte-de-Mélo **sp**. **nov**. has the same male genitalia pattern as the species of "Group H" of South American *Diomus* proposed by Gordon (1999).

DISCUSSION

The three species were collected in a citrus orchard in an urban area of Brasília, capital of Brazil, where *Citrus* sp. were infested with *Orthezia* sp. and *Aleurocanthus woglumi* Ashby, 1915. This city is located in the Brazilian Highlands, a plateau in the heart of the Brazilian territory where the main biome is the Cerrado (tropical savanna).

In his review of the South American Diomini, Gordon (1999) described about 85% (114) of the *Diomus* species currently known for Brazil. Similarly, Pang & Ślipiński (2009, 2010), described about half of the 60 species occurring in Australia, suggesting the possibility of more than 80 new species yet to be described. Since then, the circumscription of New World Diomini has been realigned to include only species with: (1) a flattened asymmetrical antennal club with an oblique apex; (2) a trimerous tarsi; and (3) a non-recurved descending abdominal postcoxal line that merges with the posterior margin of the ventrite (Vandenberg & Hanson 2019). Despite this, New World *Diomus* retains the same definition and has been shown to be a highly speciose genus in Coccinellidae.

In this paper we present novel information with the description of these three new species. *Diomus avidus* Duarte-de-Mélo **sp**. **nov**. is only the second species of "Group H" described from Brazil and the fourth in total. *Diomus solus* Duarte-de-Mélo **sp**. **nov**. shows similarities to the genitalia pattern of "Group F", but the penis capsule isolates it into its own genitalia-based group. Brazil now has 137 known species of *Diomus*.

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