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Two new species of *Golofa* Hope, 1837 (Coleoptera: Melolonthidae: Dynastinae) from the Colombian Andes, South America.

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Abstract

Objective: To describe two new species of the genus *Golofa*. **Scope:** To expand the list of species of the tribe Dynastini for Colombia. **Methodology:** We reviewed the specimens of the genus *Golofa* deposited in the Colección Familia Pardo-Locarno CFPL-COL, establishing differences between the species already identified and the specimens type used for the description of the two new species reviewed in this manuscript. **Main results:** We described two new species of *Golofa* Hope, 1837, showing photographic records with diagnostic value. The number of species for Colombia is increased to nine, thus, the synopsis of species is formed as follows: *Golofa aegeon* Drury, 1773, *Golofa antiqua* Arrow, 1911, *Golofa claviger* Linnaeus, 1771, *Golofa eacus* Burmeister, 1847, *Golofa paradoxa* Dechambre, 1975, *Golofa pelagon* Burmeister, 1847, *Golofa porteri* Hope, 1837, *Golofa farallonensis* n. sp. Pardo-Locarno & Villalobos-Moreno y *Golofa veliae* n. sp. Pardo-Locarno & Villalobos-Moreno. **Conclusions:** These records ratify the Tropandean distribution of the group, evidencing the little biological and biogeographic knowledge of this group in Colombia. The results indicate a great diversity of the genus in the country, so that, the study of species distribution is recommended.

Key words. Colombia, distribution, Dynastini, new species, Tropandean.

Dos nuevas especies de *Golofa* Hope, 1837 (Coleoptera: Melolonthidae: Dynastinae) de los Andes Colombianos, América del Sur.

Resumen

Objetivo: Realizar la descripción de dos nuevas especies del género *Golofa*. **Alcance:** Ampliar el listado de especies de la tribu Dynastini para Colombia. **Metodología:** Se revisaron los especímenes del género *Golofa* depositados en la Colección Familia Pardo-Locarno CFPL-COL, estableciéndose diferencias entre las especies ya identificadas y los ejemplares tipo usados para la descripción de las dos nuevas especies que se revisan en el presente manuscrito. **Principales resultados:** Se describen dos nuevas especie de *Golofa* Hope, 1837, presentándose registros fotográficos con valor diagnóstico. Se amplía a nueve el número de especies para Colombia, quedando la sinopsis de especies conformada así: *Golofa aegeon* Drury, 1773, *Golofa antiqua* Arrow, 1911, *Golofa*

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claviger Linnaeus, 1771, *Golofa eacus* Burmeister, 1847, *Golofa paradoxa* Dechambre, 1975, *Golofa pelagon* Burmeister, 1847, *Golofa porteri* Hope, 1837, *Golofa farallonensis* n. sp. Pardo-Locarno & Villalobos-Moreno y *Golofa veliae* n. sp. Pardo-Locarno & Villalobos-Moreno. **Conclusiones:** Estos registros ratifican la distribución tropandina del grupo, evidenciándose el poco conocimiento biológico y biogeográfico de este grupo en Colombia. Los resultados indican una gran diversidad del género en el país. Se recomienda ampliar el estudio de la distribución de las especies mencionadas.

Palabras clave. Colombia, distribución, Dynastini, nuevas especies, tropandino.

INTRODUCTION

"*Discovery consists of seeing what everybody has seen and thinking what nobody has thought*" Albert Szent-Gyorgyi.

In accordance with Ratcliffe & Le Tirant (2017) the New World genus *Golofa* Hope, 1837 currently has about 29 species, this data may vary by the authors. The species are found from central Mexico to northern Argentina and Chile, 13 species in Central America and 15 species in South America (Dechambre, 1983; Itis, 2019; Lachaume, 1985, 1992; Morón, 1995; Ratcliffe *et al.*, 2013; Ratcliffe & Le Tirant, 2017; Voirin, 1994). In recent publication, Ratcliffe & Le Tirant (2017) described a last new species for Peru (*Golofa limogesi* Ratcliffe and Le Tirant).

In Colombia, the Dynastinae subfamily is represented by 42 genera and more than 200 species (Endrödi, 1966, 1970, 1985; Gasca-Álvarez & Amat, 2010; Restrepo *et al.*, 2003). The genus *Golofa* is the most diverse of tribe Dynastini in Colombia (9 species), distributed, mostly, in the Andean high mountains from Nariño to Sierra Nevada de Santa Marta (Howden & Campbell, 1974; López-García *et al.*, 2015; Pardo-Locarno, 1993, 2005; Pardo-Locarno & Rubiano, 1994; Restrepo *et al.*, 2003). These large beetles, usually, of colorful appearance and very famous, are very well represented in large collections. However, their biology and ecology remain very poorly known (Eberhard, 1977; Morón & Pardo-Locarno, 1994; Pardo-Locarno, 1993, 2005).

Including the two new species described in this document, the synopsis of the species of Colombia would be formed by: *G. aegeon* Drury, 1773 (¿?), *G. antiquus* Arrow, 1911 (Valle), *G. claviger* Linnaeus, 1771 (Cundinamarca), *G. eacus* Burmeister, 1847 (Antioquia, Cundinamarca, Tolima, Valle, Santander), *G. paradoxus* Dechambre, 1975 (Boyacá), *G. pelagon* Burmeister, 1847 (¿?), *G. porteri* Hope, 1837 (Antioquia, Cauca, Cundinamarca, Quindío, Tolima, Valle, Santander), *G. farallonensis* Pardo-Locarno & Villalobos-Moreno, n. sp (Valle del Cauca, Cauca) y *G. veliae* Pardo-Locarno &

Villalobos-Moreno, n. sp (Nariño) (Gasca-Álvarez & Amat, 2010; Restrepo *et al.*, 2003; Villalobos-Moreno *et al.*, 2017). This research describes two new species of the genus *Golofa* based on specimens of the Colección Familia Pardo-Locarno (CFPL-COL).

MATERIALS AND METHODS

The specimens studied corresponding to adult of genus *Golofa*, deposited in the Colección Familia Pardo-Locarno (CFPL-COL), which, for several years, were designated as possible new species but remained unidentified, while the diagnosis was verified and more specimens to the series type were collected. The bibliographic source consulted was Dechambre (1983), ITIS (2019), Lachaume (1985), Morón (1995, Ratcliffe (2003), Ratcliffe *et al.* (2013), Ratcliffe & Le Tirant (2017) and Voirin (1994). To the description of species was used the characters proposed by Endrödi (1970), Ratcliffe (2003) and Ratcliffe *et al.* (2013), which included males body (no females were obtained) and aedeagus characters.

The measurements were taken with a caliper by using a representative specimen that was assigned as the type. Photographs of type specimens were taken in dorsal and lateral view. The genitalia images were taken in lateral and frontal view, to illustrate clearly the structure of the parameres. We used a digital camera Pentax K10D (macro lens Elicar 90 mm 1:1) and digital stereoscopy Vision^{R}.

RESULTS

Golofa farallonensis Pardo-Locarno & Villalobos-Moreno, new species

(Fig. 1–2)

Holotype: ♂, COLOMBIA, Valle del Cauca, Jamundi, Farallones de Cali, 2,180 masl, Jul. 1985 (Alberto Jordán & Luis Carlos Pardo-Locarno *leg.*), on the floor, deposited in CFPL-COL, Palmira, Valle del Cauca, Colombia. **Paratypes:** ♂, COLOMBIA, Valle del Cauca, Saladito, Cerro San Antonio, 2,200 masl, 25 May. 1987 (Luis Carlos Pardo-Locarno & Eufrasio Mora *leg.*) on the floor, deposited in CFPL-COL. ♂, COLOMBIA, Cauca, Silva, Apr. 1996 (Luis Carlos Pardo-Locarno & Libia Mercedes Puerta-Paz *leg.*), on the floor, deposited in CFPL-COL.

Morphology

MALE: *Golofa farallonensis* n. sp. is identified by its strong and convex body (Fig. 1A, 1B). Length: 29–43mm. Body width: 15–22mm. Pronotum and elytra light yellow to dark; head, cephalic horn, pronotal margins, elytral margins, legs and abdomen are black. A dark and amorphous spot on each side of the pronotum. Head with the front densely punctate, some rough, with clear and sparse setae, without paired tubercles; frontoclypeal region with a horn that, in *minor* males, is almost vestigial, while in *major*

males is very long, black, oily, with a basal half wide, with punctures, teeth and setae in the back, apical half with the back edge clearly dentate (4–5 teeth backwards); the rest without horns and curved backward (Fig. 1B). Clypeus with apex short, narrow and with a wide and shallow V-shape emargination, obtuse and rounded angles. Eyes with interocular width equivalent to 2.4–2.5 eyes diameters. Mandibles very slight sinuous at the apex, very shallow opening. Antenna 10–segments, club slightly shorter that the antenomeres II–VII. Pronotum with the disc glabrous, with a long black horn, vertical, with the apical third curved forward, apex subtly thickened and with a dense golden pubescence; basal half with a black and setaceous groove, which begins at the anterior pronotal edge and it projects to the middle of the horn; *minor* male with a obtuse, dark, punctate and setaceous tubercle, in both cases, the anterior base of the horn is very punctate, with thick and coalescent points; the rest of the pronotum with small and sparse punctate, equivalent to 4–5 diameters of separation between them, but denser close to the pronotum edge. Proesternal process medium and strong, apex slender and rounded, multisetaceous. Elytra finely chagrined, rows of punctures deformed near to suture, very rough, laterals more defined and with a more colourful sheen close to the suture and rather matte on the sides; elytral suture black without an edge of punctures. Scutellum light brown with black edges. Pygidium obtuse, redounded, sternal face with few punctures, very small, vertical face densely setaceous and punctate. Propygidium with two bands of groove convergent, which are thicker basally. Legs strong; protibia with three teeth, the apical two more united between them, longitude of tarsomere I equivalent to the tarsomeres II–III; mesotibia with two spurs apical and lateral; metatibia with two spurs short, apical and y obtuse. The basal tarsomere of meso and metatibia have an apical spiniform projection. Ventral region with the fifth sternum with small and scarce punctures. Genitalia: Parameres symmetric, distinctive, very open, leaving a large opening between them, apex acuminate and pubescent (Fig. 2).

FEMALE: Unknown.

Diagnosis. *Golofa eacus* Burmeister and *G. aegeon* Drury affinis. It is located in the group of lustrous species, brown yellow, with cephalic and thoracic horn. Protibia tridentate. Clypeus somewhat elongated, smoothly sinuous, with rounded outer edges. Apex of mandibles distinctly incised. Head without paired tubercles. Prothoracic tubercle upright. Anterior edge of the pronotum with a narrow groove, black, hedge, extending from the anterior margin of the pronotum to the base of the horn. Pronotum disc irregularly punctuated, with shallow, almost superficial punctures, separated by 2 to 5 diameters. Elytra very lustrous, densely punctuated, punctures large. Sutural striae like a straight line, dark amber. Parameres distinctive, large, symmetric, completely open, contracted to the apex.

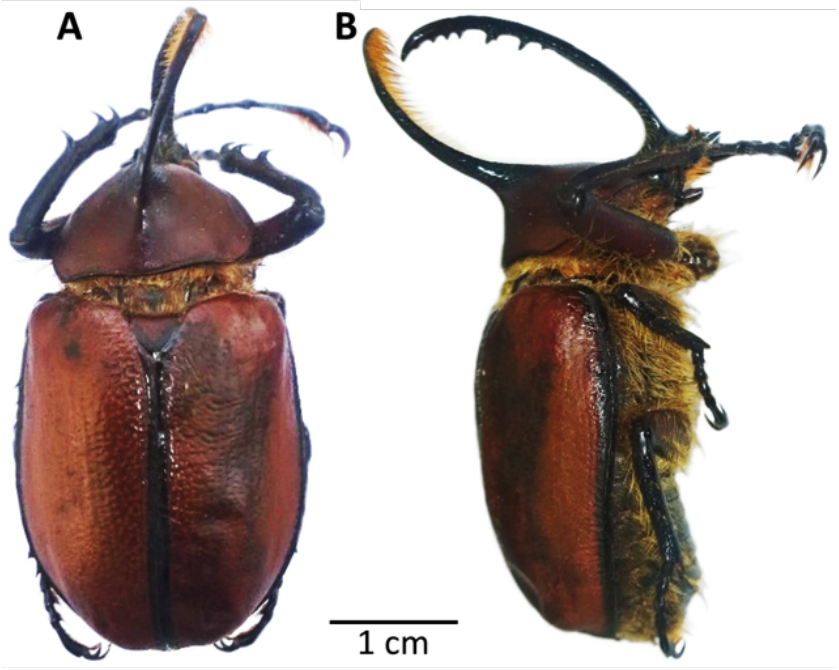

Figure 1. *Golofa farallonensis* new species. **A.** *Major* male in dorsal view; **B.** *Major* male in lateral view.

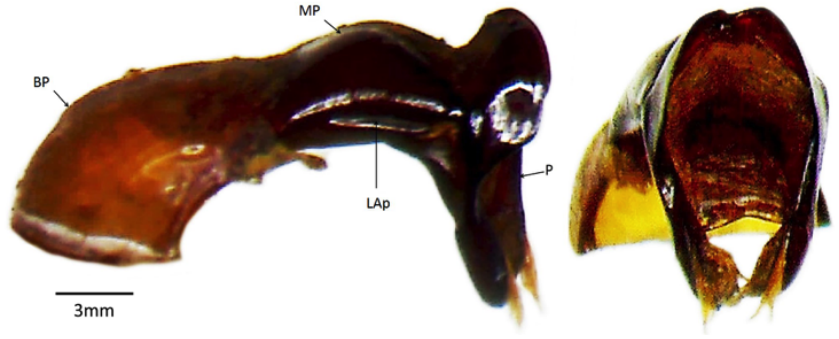

Figure 2. Figure 2. Genitalia of *major* male of *Golofa farallonensis* new species. LAp: lateral apophysis; P: parameres; BP: basal piece; MP: medium piece or tecto.

Distribution. Based on the material examined, we can affirm that *Golofa farallonensis* is distributed in the Andean jungles in the south of the Colombian Western Range (Fig. 5).

Etymology. This specie has been dedicated to the "Farallones de Cali", mountains magnifies of Colombian Western Range, which decorate the capital of Valle del Cauca Department. The "Farallones de Cali" are recognized as priceless relicts of the flora and fauna of the Colombian Andes and the World. In these mountains, the first author took his initial steps to entomology.

Golofa veliae Pardo-Locarno & Villalobos-Moreno, new species
(Fig. 3–4)

Holotype: ♂, COLOMBIA, Nariño, Pasto, 2,550 masl, 3 Oct. 1993 (Pablo Arteaga *leg.*), on the floor, deposited in CFPL-COL, Palmira, Valle del Cauca, Colombia. **Paratype**: ♂, COLOMBIA, Nariño, Pasto, 2,550 masl, 8 Nov. 1993 (A. Cifuentes *leg.*), on the floor, deposited in CFPL-COL.

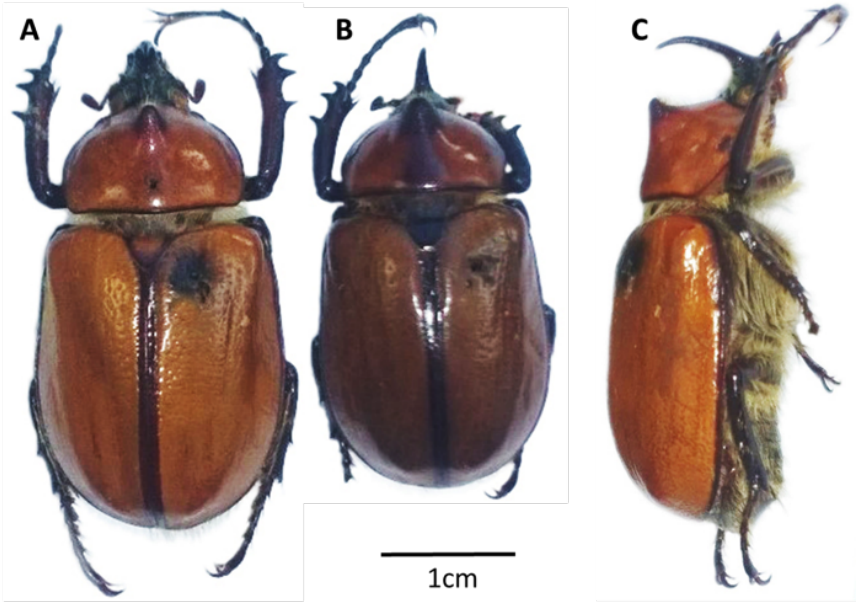

Figure 3. *Golofa veliae* new species. **A.** *Medium* male in dorsal view; **B.** *Minor* male in dorsal view; **C.** *Medium* male in lateral view.

Morphology

MALE: *Golofa veliae* n. sp. is identified by the body strong and convex (Fig. 3A–B). Length: 19–27mm. Body width: 15–20.5mm. Pronotum and elytra brown yellowish to brown reddish. Cephalic horn, pronotal margins, elytral margins, legs and abdomen are black. A dark and amorphous spot on each side of the pronotum. Head with the front densely punctate, rough, the punctures are more intense close to the eyes, with clear and sparse setae, without tubercles paired; frontoclypeal region with a horn (8 mm in *medium* males, 6 mm in *minor* males), while in medium males it is very long, curved backward, with the posterior basal region finely dentate and with setae, apex fine and without teeth (Fig. 3B). Clypeus short, with narrow and shallow V-shape emargination, short, rounded and narrow angles. Eyes with interocular space equivalent to 2.5–3.0 eyes diameters. Mandibles with almost truncate apex, very softly-emarginated, slightly rounded and angled. Mentum with the widest base and gently narrowed or sinuous on each side (compared with Dechambre 1975: Fig. 26). Antenna 10–segments, club slightly shorter that the antenomeres II–VII. Pronotum with the disc glabrous, with a strong horn shorter than cephalic horn, projected in oblique direction and forward, with a darker apex, densely punctate, with abundant golden setae; in the anterior side, the basal half has a black groove, setaceous, which start in the anterior pronotal edge and it projects to the middle of the horn; in *major* and *minor* males, the anterior base of horn is very punctate, points thick and coalescent; around the disc of pronotum with small punctate, little dense, equivalent to 4–5 diameters of separation, but more dense close to pronotum edge; marginal border whole and black. Proesternal process long, apex rounded multisetaceous. Elytra glabrous, rough, finely chagrined, with punctures similar to the pronotum, separated 3–4 diameters or more, row of punctures clearly visible, edge of elytra black; elytral suture clearly defined as a thick and very distinctive line, dark brown to light brown, does not include punctures, in a side it has a line of punctures that is projected from the scutellum to 3/4 of the longitude of elytra. Scutellum with medium punctures and scales in one case (holotype) and almost absent in the other (paratype). Pygidium convex, obtuse, rounded, multisetaceous, vertical face densely setaceous and punctate, small and irregularly distributed punctures, sometimes united, other sparse, with a dense band of yellow o light setae. Propygidium with two stridulatory bands wide, subparallel and with striates deeper basally and very fines on the apex. Legs strong; protibia with three teeth subequals, the apical two very subtly united between them, longitude of tarsomere I almost 1.5 times longer that the tarsomere II; mesotibia with tow contiguous, apical, lateral and subequals spurs; metatibia with three short, apical and obtuse teeth. The basal meso and metatarsomere with an apical spiniform projection. Ventral region with the fifth sternite with small scares punctures. Genitalia: long parameres, asymmetric, distinctive, recess of right paramere slight, apex acuminate and pubescent (Fig. 4).

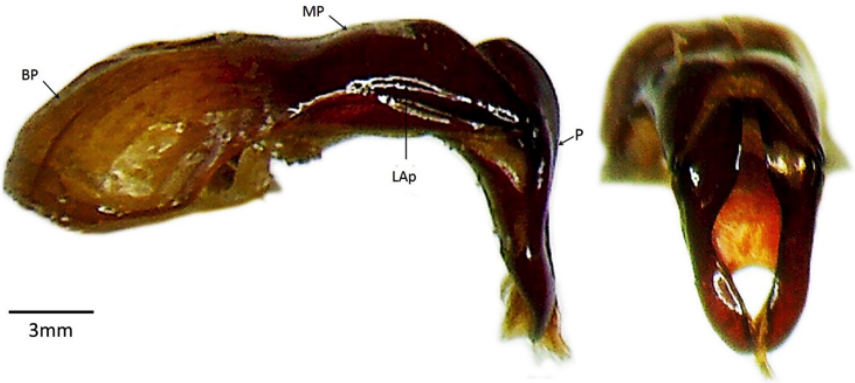

Figure 4. Genitalia of *medium* male of *Golofa veliae* new species. LAp: lateral apophysis; P: parameres; BP: basal piece; MP: medium piece or tecto.

FEMALE: Unknown.

Diagnosis. *Golofa obliquicornis* Dechambre affinis. It is located in the group of lustrous species, brown yellow, with cephalic and thoracic horn. Protibia tridentate. Clypeus short, smoothly sinuous, with rounded outer edges. Mandibular apex very smoothly emarginated, almost truncated. Head without paired tubercles. Mentum with the widest base and gently narrowed or sinuous on each side (compared with Dechambre 1975: Fig. 26). Prothoracic tubercle oblique. Anterior edge of the pronotum with a narrow groove, black, hedge, extending from the anterior margin of the pronotum to the base of the horn. Pronotum disc with shallow, almost superficial punctures, separated by 2 to 5 diameters. Elytra very lustrous, with dense but shallow punctures. Sutural striae like a straight line, dark amber. Parameres clearly asymmetric. All these characteristics separate them from *G. obliquicornis*, which is observed with paired horns on the head, the truncated mandible with entire apex, protorax and elytra much more punctuated, anterior edge of the protorax with a wide, shallow groove, mentum with a base narrower than the middle part (compared with Dechambre 1975: Fig. 26), finally parameres almost right, not asymmetrical.

Distribution. Based on the material examined, we can affirm that *Golofa veliae* is distributed in the Andean jungle of the southern side of the Colombian Massif, near the border with Ecuador (Fig. 5).

Etymology. This specie is dedicated to Mrs. Velia Yolanda Locarno, mother of the first author, like a sincere demonstration of respect and love for the most important human being on the planet: THE MOTHER.

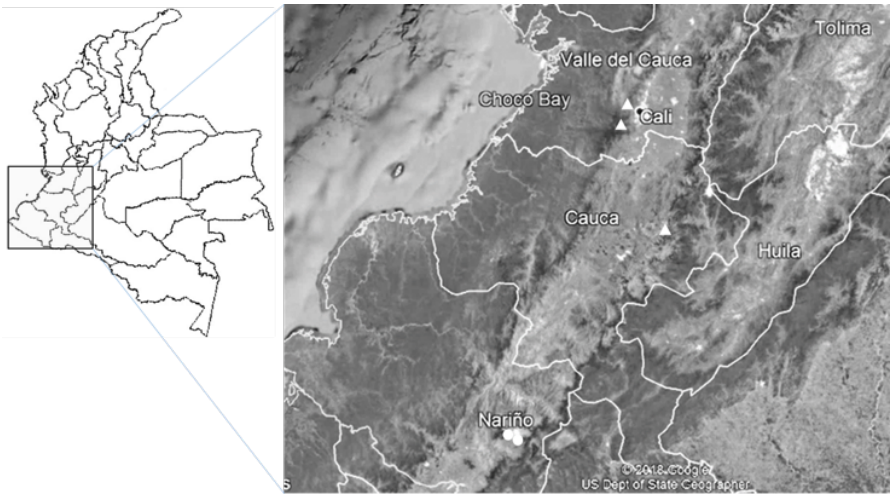

Figure 5. Map of distribution of *Golofa farallonensis* (•) and *Golofa veliae* (○).

DISCUSSION

The genus *Golofa* Hope is very famous in the collections because the singular and attractive aspect, however, the taxonomy has always been erratic and confuse (Arrow, 1911). Besides, this group have great emptiness in the biological and ecological knowledge (Moron, 1995; Moron & Pardo-Locarno, 1994). As highlighted by Ratcliffe & Le Tirant (2017), the taxonomy of this genus requires a thorough review; some species have been described based on a single specimen, there is uncertainty about the distribution of others, and the biology of many species is unknown. An attempt to solve some of these problems was made by Moron (1985), who reviewed the species of Mexico, and contributed to the taxonomy of the group with new data of males and females, providing for first time, comparative characters of females genitalia.

The records of the present manuscript had all the uncertainties noted above. The specimens, although formerly separated, had not been described by the taxonomic uncertainty of the group and by the hope of adding new specimens to the type series. The latter was not achiever and finally we decided to describe the new species with the available material; making new collections is complicated by current Colombian legislation and the difficulty in financing field trips. The few specimens of *G. veliae* obtained indicate an evolutionary linkage near to *G. obliquicornis*, as if it were a geographical point in the differentiation. *G. farallonensis* must be common in some collections, but its great similarity with *G. eacus* makes necessary to review the genitalia. On the other hand, the genitalia of G. *farallonensis* is very different from other *Golofa* and it looks like some species of Oryctini.

CONCLUSIONS AND RECOMMENDATIONS

In accordance with the previously exposed, the species of the group are still typically Tropandean (highland), therefore, with an island distribution. Besides, the ones species described in this manuscript add more uncertainties to the subject, since its basic biological aspects remain unknown. We recommend expanding the studies of these organisms in Colombia, especially in life cycles, host and ecological aspects. In this context, the distribution is a vital aspect, since the rapid changes of the environmental map, marked by the fragmentation of habits and the dynamics of global warming, which could be affecting these creatures.

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