

A fifth species of the genus
Hybochaetodus Arrow, 1909 from
southern Peru highlands (Coleoptera:
Scarabaeoidea: Hybosoridae)

Una quinta especie del género
Hybochaetodus Arrow, 1909 de las
altiplanicies del sur de Perú (Coleoptera:
Scarabaeoidea: Hybosoridae)

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ABSTRACT. A new species of Anaidinae, *Hybochaetodus qorilazo* nov. sp. is described, discussed and illustrated based on specimens collected in Cusco department. The new species is the fifth of the Peruvian endemic genus *Hybochaetodus*.

Key words: Anaidinae; Neotropics; scavenger scarab beetles; South America; systematics

RESUMEN. Se describe, discute e ilustra una nueva especie de Anaidinae, *Hybochaetodus qorilazo* nov. sp. con base en especímenes recolectados en el departamento de Cusco. La nueva especie es la quinta del género endémico peruano *Hybochaetodus*.

Palabras clave: Anaidinae; Neotrópico; escarabajos carroñeros; Sudamérica; sistemática

INTRODUCTION

The neotropical subfamily Anaidinae includes six genera and 60 extant species mainly inhabiting tropical environments and feeding on dung, carrion and fungi (Ocampo, 2006a, b; Král & Hájek, 2014; Ocampo, 2021). In Peru, this subfamily comprises three genera and 13 species, which 77% are Peruvian endemisms: *Anaides* Westwood, 1845 (four species), *Chaetodus* Westwood, 1845 (five species) and *Hybochaetodus* Arrow, 1909 (four species) (Ratcliffe *et al.*, 2015; Ocampo, 2021).

The genus *Hybochaetodus* was described by Arrow (1909) for to accommodate *Hybochaetodus obscurus* Arrow, 1909 based on two specimens from Vilcanota, Cusco. This genus is defined by the following combination of characters (Ocampo, 2006a): Body elongate, sides subparallel, dorsum convex, elytral apex rounded; head surface areolate-ocellate or punctate, frontoclypeal suture obsolete, mandibles protruding beyond labrum; pronotum convex, rugo-punctate with large posteriomedial fovea; scutellum subtriangular; elytra elongate, convex, surface costate; hind wings obsolete; prosternum biconcave, metasternum short at middle, abdominal sternites 2-4 with medial longitudinal keel poorly developed; meso and metatibiae slender, outer margin with 2 longitudinal rows of teeth; parameres symmetrical, with dorsal extensions. The phylogenetic analysis conducted by Ocampo (2006a) for the family Hybosoridae placed the genus *Hybochaetodus* as the sister group to all other genera within Anaidinae.

Apart from *Hybochaetodus obscurus*, three other species of the genus have been described to date. The second species, *Hybochaetodus flaco* Ocampo, 2002 was described based on a single male specimen collected in Esperanza (Elfin forest at 2900 m), Cusco (Ocampo, 2002). New records for *H. obscurus* were provided by Ocampo (2006a), around 30 specimens from three localities in Cusco department (2900–4000 m). In the same year, third and fourth species of *Hybochaetodus* were described, *Hybochaetodus disruptus* Ocampo, 2006 based on two female specimens from Kimbiri (Elfin forest at 2445 m) and *Hybochaetodus erugocarinatus* Ocampo, 2006 based on two male and three female specimens from Kosñipata (Elfin forest at 2700 m), both localities also in Cusco department (Ocampo, 2006b). Thus, all known species of the genus *Hybochaetodus* were found at different altitudes in a relatively small area of southern Peru. This distribution pattern and the speciation process that produced it seem to fit the sky-islands dynamic previously recognized for other Scarabaeoidea taxa, *Geotrupes* Latreille, 1796 (Coleoptera: Geotrupidae) and *Phanaeus* MacLeay, 1819 (Coleoptera: Scarabaeidae) in the mountains of Oaxaca, Mexico (Kohlmann *et al.*, 2018; Arriaga-Jiménez *et al.*, 2020).

The objective of this paper is to describe a new species of *Hybochaetodus* from Chilloroya, Cusco in southern Peru. Also, offer new records for *H. obscurus* and provide comments about altitudinal distribution of the five species known for this genus.

MATERIALS AND METHODS

Body measurements, morphological terms and descriptive standards for density and size of punctures and setae were based on most recent revision of subfamily Anaidinae (Ocampo, 2006a) and species descriptions of genus *Hybochaetodus* (Ocampo, 2006b). The phylogenetic species concept (Wheeler & Platnick, 2000) is followed in this work, which defines a species as the smallest aggregation of populations diagnosable by a unique combination of character states.

Type specimens of the new species were deposited in Museo de Entomología Klaus Raven Büller (MEKRB) and Museo de Historia Natural Javier Prado (MUSM). Specimens of three previously described *Hybochaetodus* species were also examined at MEKRB and MUSM entomological collections. Label data is quoted verbatim; different lines of the label are separated by a diagonal slash (/) and different labels are indicated by square brackets ([]).

When it was necessary, specimens were dissected to better examination. Parameres were extracted, treated for 10 minutes in 20% KOH, washed with distilled water and adhered to a small piece of cardboard. Specimens were photographed with a Canon EOS Rebel T5i DSLR, equipped with Macro lens and rail. Each image includes a series of photos taken in different planes, which were stacked with the Combine ZP software (Hadley, 2006). Drawings were done by the prints of photographs, observations with stereomicroscope and digital improving with Inkscape software. Distribution maps were elaborated using Simple Mappr (Shorthouse, 2010) and Google Earth.

***Hybochaetodus qorilazo* sp. nov.** Giraldo, 2023

<http://zoobank.org/urn:lsid:zoobank.org:act:1CC10849-6821-4BF6-8E18-42928DD924C5>

(Figures 1–3)

Type locality: Chilloroya (14°30'09.63" S, 71°46'52.51" W), Provincia de Chumbivilcas, Cusco, Peru.

Deposit of types. Museo de Entomología Klaus Raven Büller, Universidad Nacional Agraria La Molina, Lima, Peru (MERKB); Museo de Historia Natural Javier Prado, Universidad Nacional de San Marcos, Lima, Peru (MUSM).

Type material. Holotype (male): [PERU, Cusco, Chumbivilcas/Chilloroya, pajonal, 4020 m/-14.5026S, -71.7812W/V-2012, J. Jara coll.] with red holotype label [*Hybochaetodus/qorilazo* HOLOTYPUS/Det. A. Giraldo, 2023] (MUSM). Twenty two paratypes (17 ♂♂, 5 ♀♀) with the same label data as holotype. All paratypes bearing yellow labels [*Hybochaetodus/qorilazo* PARATYPUS/Det. A. Giraldo, 2023] (10 ♂♂, 3 ♀♀) (MEKRB), (7 ♂♂, 2 ♀♀) (MUSM).

Description. Holotype male (Fig. 1A-C). Length 7.5 mm; width 4.0 mm. Color piceous black, with coppery shine on head and pronotum. Head. Frons in dorsal view nearly flat; overall surface punctate, rugose on sides; punctures dense, size big. Frontoclypeal suture obsolete. Clypeus shape subtrapezoidal, apex weakly rounded, surface densely punctate. Clypeal margins weakly reflexed, vertical surface of apex blunt. Labrum truncate, apex slightly indented, dorsal surface with fringe of setae; lateral margins rounded. Mandibles with external surface sculptured at base, sparsely setose, apex acute, slightly reflexed; scissorial area with small, preapical tooth. Labium with apex of mentum slightly indented, surface sparsely setose. Antennae with 10 antennomeres; antennomeres 2–7 monoliform; antennal club with 3 antennomeres; basal antennomere of club cupuliform, capable of receiving penultimate and ultimate segments. Pronotum. Surface convex, 0.6 times as long as wide; surface punctate on disc, rugose on sides and base; punctures dense, big. Base with deep, elongated triangular fovea in middle. Anterior margin weakly beaded; lateral margins beaded, arcuate, weakly denticulate; posterior margin weakly beaded, curved, not projected medially. Anterior angles nearly straight; posterior angles rounded. Scutellum. Shape triangular, surface glabrous, apex acute, visible area small. Elytron. Oval, slightly flattened dorsally, apex rounded; surface with 12 fine striae; interval surface with V-shaped sculpture; intervals 1, 4, 7, 10 and 13 carinate; carinae smooth, flattened; carina 1 complete, extended from base to declivous area; carinae 4 and 7 interrupted at posterior fourth; carina 10 anastomosed at anterior third, interrupted at posterior fourth; carina 13 interrupted at posterior third. Elytral lateral margin slightly denticulate, border not reflexed. Epipleuron shagreened, wider from humeral angle to two thirds of its length, tapered toward apex. Hind wing. Vestigial. Venter. Prosternal surface transversely strigulate; prosternal shield with posteriomedial process poorly developed. Meso- and metasternal surface strigulate. Proepisternal surface strigulate. Abdominal sternites transversely strigulate. Legs. Procoxal surface strigulate. Metatrochanter with posteriomedial tooth absent. Femoral surface vermiculate to strigulate, sparsely setose. Pro-, meso-, and metatibiae slender. Protibia with three subtriangular teeth and small denticles on outer margin; middle and apical

teeth with pointed apex, basal teeth with blunt apex; dorsal surface with two setose, longitudinal carinae, setae sparse; protibial spur subequal than apical tooth, curved at apex, apex rounded. Pro-, meso-, and metatarsomeres 1 longer than 2; protarsomere 1 with small ventral tooth; tarsomeres 2–4 subequal in length; tarsomere 5 longer than 4. Pro-, meso-, and metatarsal claws shorter than tarsomeres 5, simple, curved. Meso- and metatibial outer surface with two longitudinal rows of teeth, teeth small, with one seta at base of each tooth. Meso- and metatibial medial spurs longer than external spurs; spurs with apex acuminate. Aedeagus with length ratio phallobase: parameres = 1.75: 1, parameres with pointed apices, in lateral view with an oval notch extending from middle towards apex (Fig. 2A), and in dorsal view with apical half completely folded (Fig. 2B).

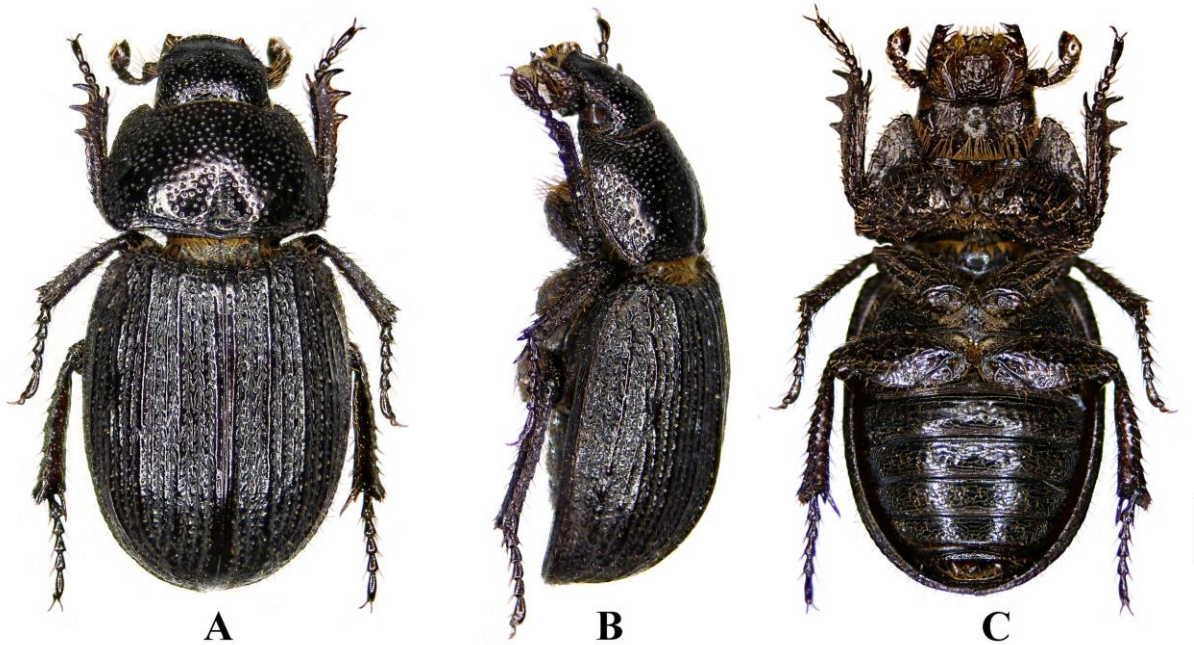


Figure 1. Habitus of *Hybochaetodus qorilazo* nov. sp., male holotype from Cusco, Chilloroya. A) dorsal, B) dorsolateral, C) ventral. Scale bar = 1 mm.

Intraspecific variation. Four specimens have carina 7 broken at middle of elytral length and eight specimens have carina 10 not anastomosed at anterior third of elytral length. Anomalies in protibial teeth were observed only in two specimens, either with fused apical teeth or with rounded basal tooth. Females are distinguished from males by the mesotibial spurs subequal in length.

Etymology. The term "qorilazo" is a combination of Quechua word "ccori" meaning gold, and Spanish word "lazo" meaning lasso. It is an appellative for highland ranchers of Chumbivilcas who are recognized for their skill to lassoing cattle, strong character and free spirit.

Comparative material examined. *Hybochaetodus disruptus* Ocampo, 2006: (1 ♀): [PERU: CU, Kimbiri Camp./Wayrapata 2445 msnm/12°50'10.1" S, 73°29'42.6" W/NTP-97 trap with fish C06/13.vii.1998, Gorky Valencia] [WA04.0813.C06/Plot04 Camp. Wayrapata/Smithsonian BCO pipeline/Elfin forest bait trap NTP-/97 with rotting fish C06] [*Hybochaetodus/disruptus*/Ocampo/det. V. M. DIEGUEZ M. 2007] (MUSM).

Hybochaetodus erugocarinatus Ocampo, 2006: (1 ♀): [PERU: DEPTO. CUSCO/Distrito Kosñipata, 18.i.2000/Km. 6 Trocha Union, 2700 msnm/ leg. Gorky Valencia] [Plot00 (Upper Manu)/13°03' S, 71°17' W/Elfin Forest/Bait Trap with Rotting Fish] [*Hybochaetodus erugocarinatus*/ALLOTYPE/F.C. Ocampo] (MUSM); (1 ♂): [PERU: CU, Kosñipata, km 6/Trocha Union 2700 msnm/13°03' S, 71°17'

W/NTP-97 trap, with fruit C05/14.i.2000, Gorky Valencia] [km 00.0114. C05/Plot 00 Camp. Proy. Trocha/Union MHNC (Upper Manu)/Elfin forest, bait trap NTP-/97 with rotting fruit C05] [*Hybochaetodus/erugocarinatus/Ocampo/Det. G. Valencia 2007*] (MUSM).

Hybochaetodus obscurus Arrow, 1909: (4 ♂♂) [PERU, Apurimac, Andahuaylas, Huancarama, 3892 m, -13.68383S, -73.02391W, /01-III-2022, A. Giraldo coll.] [*Hybochaetodus/obscurus* Arrow, 1909/Det. A. Giraldo, 2023] (MERKB, MUSM); (1 ♂, 1 ♀) [PERU: AP. Cotabambas/Challhuahuacho, CCPP/Cahuanhuire/14°09'59.6" S, 72°22'20.6" W/4759 m, 13-14.iii.2015/L. Sulca & I. Medina] [*Hybochaetodus/obscurus* Arrow, 1909/Det. A. Giraldo, 2023] (MUSM); (1 ♂) [PERU: AP. Cotabambas/Coyllurqui, Contahiri/14°1'56.28" S/72°20'55.11" W, 4299 m/22.ix.2021 J. Aragon] [*Hybochaetodus/obscurus* Arrow, 1909/Det. A. Giraldo, 2023] (MUSM); (1 ♂) [PERU: AP. Cotabambas/Tambobamba, CC/Choquecca, 14°3'13.06" S/72°15'14.69" W 4097 m/05.iv.2021 J. Aragon] [*Hybochaetodus/obscurus* Arrow, 1909/Det. A. Giraldo, 2023] (MUSM); (1 ♀) [PERU: AP. Cotabambas/14°4'42.39" S/72°13'32.85" W 3912 m 24-/26.i.2017 J. Suarez] [*Hybochaetodus/obscurus* Arrow, 1909/Det. A. Giraldo, 2023] (MUSM); (1 ♀) [PERU: AP./Challhuahuacho, CCPP/Huaracoyo/14°15'21.1" S, 72°19'58.8" W/4642 m, 09-10.iii.2015/ L. Sulca & I. Medina] [*Hybochaetodus/obscurus* Arrow, 1909/Det. A. Giraldo, 2023] (MUSM); (2 ♂♂) [PERU: AP. Grau, Progreso/Palcca, 14°1'30.24" S/72°26'6.85" W, 4029 m, 29-/30.iii.2021, R. Coronel] [*Hybochaetodus/obscurus* Arrow, 1909/Det. A. Giraldo, 2023] (MUSM); (10 ♂♂, 5 ♀♀) [PERU, Cusco, Canas/Langui, Langui Lake mirador/ -14.459S -71.293W, 4296 m/28-II-2022, A. Giraldo coll.] [*Hybochaetodus/obscurus* Arrow, 1909/Det. A. Giraldo, 2023] (MEKRB, MUSM); (1 ♂) [PERU DEPTO.

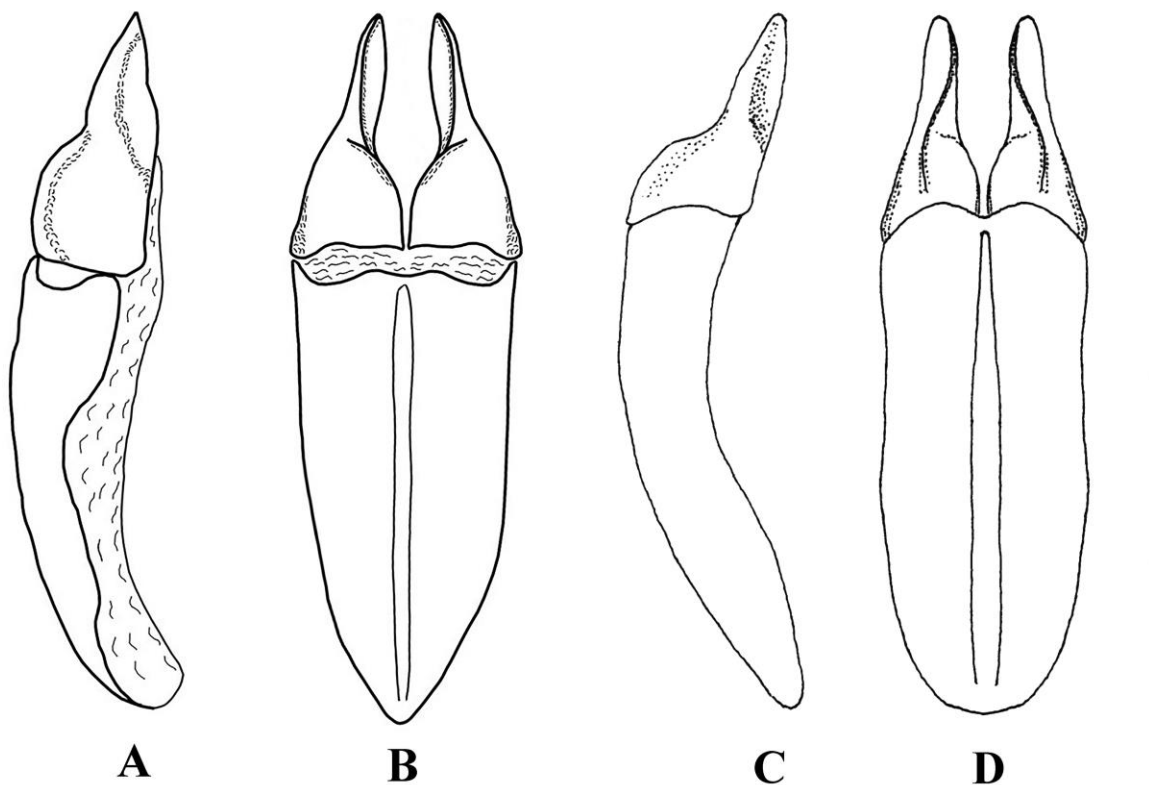


Figure 2. Male genitalia of *Hybochaetodus* species. A, B) *Hybochaetodus gorilazo* nov. sp., A) lateral view, B) dorsal view; C, D) *Hybochaetodus obscurus*, C) lateral view, D) dorsal view (modified from Ocampo, 2002). Scale bar = 0.5 mm.

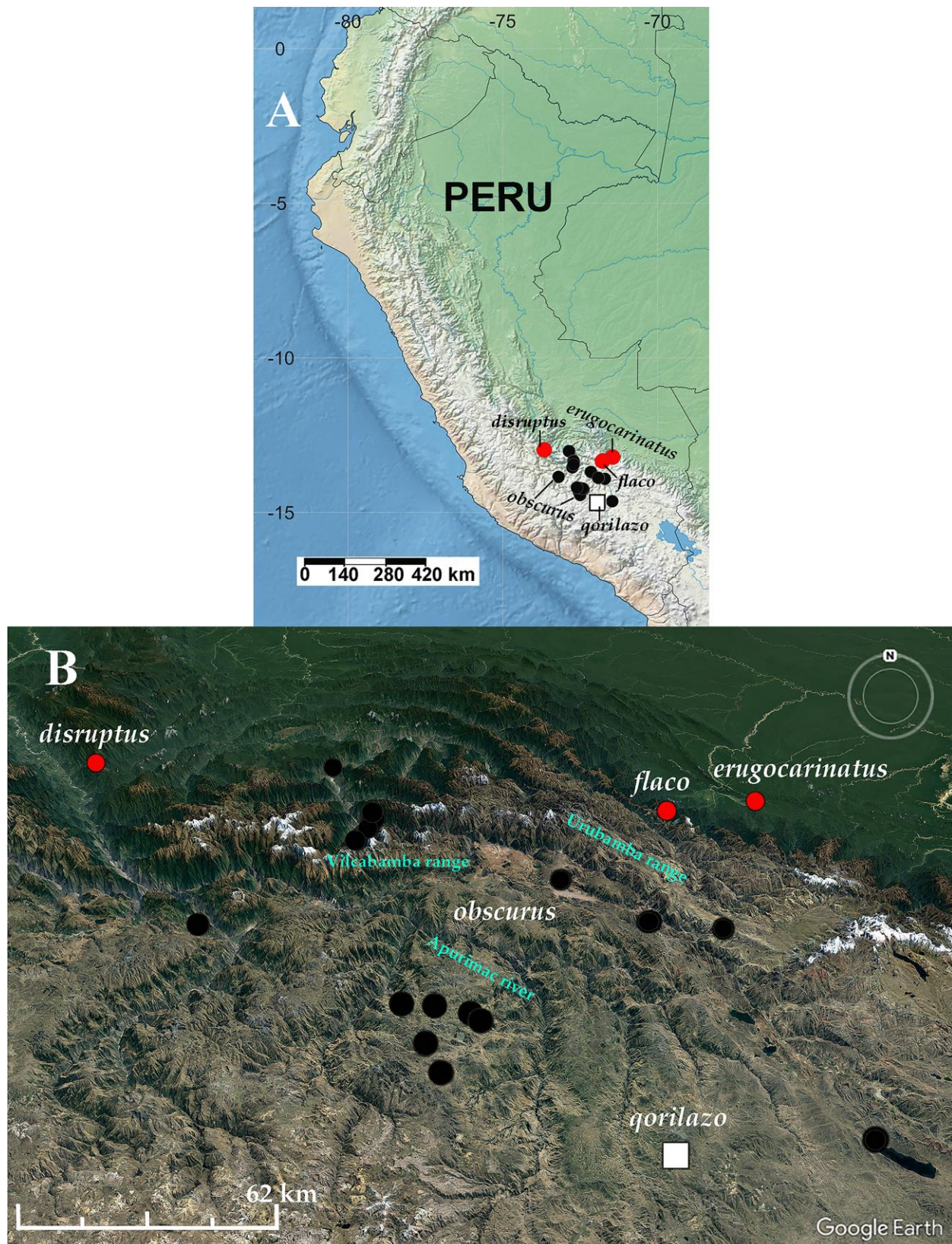


Figure 3. Distributional map of *Hybochaetodus* species. A) Peruvian territory, B) Apurimac and Cusco regions; *H. obscurus* (black circles); *H. disruptus*, *H. erugocarinatus* and *H. flaco* (red circles); *H. qorilazo* nov. sp. (white squares).

CUSCO/Comunidad de Salkantay/Parcela N°3 Proy. Chacan/26 April 2004, 4200 msnm/leg. Gorky Valencia] [N. F. at Cusco city/13°27'78" S, 71°59'82" W/pitfalltrap] [*Hybochaetodus obscurus*/Arrow/Det. F. C. Ocampo 2006] (MUSM); (1 ♂, 1 ♀) [PERU DEPTO CUSCO/Comunidad de Salkantay/Parcela N°3 Proy. Chacan/26 Abril 2004, 4200 msnm/leg. Gorky Valencia] [N. F. at Cusco City/13°27'78" S 71°59'82" W/bait trap with rotting fish] [*Hybochaetodus/obscurus* Arrow/Det. G. Valencia 2007] (MUSM); (3 ♀♀) [PERU: CU. Sant. Hist./Machupicchu, Wiñayhuayna/2740 msnm/pitfall trap, F01-10/17.iv.2004, Gorky Valencia] [WI 02.0417. F01-10/Plot 02 Wiñaywayna, Proy./Ampliac. Invent. Fauna S. I./Machupicchu MHNC/Elfin Forest] [*Hybochaetodus/obscurus* Arrow/Det. G. Valencia 2007] (MUSM); (1 ♂) [PERU: CU, Quispicanchi/Dist. Andahuaylillas/13°42'40.1" S, 71°43'52.3" W/3903 m 8.i.2021/M. Gill] [*Hybochaetodus/obscurus* Arrow, 1909/Det. A. Giraldo, 2023] (MUSM); (1 ♂) [PERU: CU, Quispicanchi/Dist. Andahuaylillas/13°42'41.7" S, 71°44'25.4" W/4275 m 8.i.2021/M. Gill] [*Hybochaetodus/obscurus* Arrow, 1909/Det. A. Giraldo, 2023] (MUSM) NEW RECORDS.

Previous key to species of genus *Hybochaetodus* (Ocampo, 2006b) should be modified in the following way for to include the new species

1. Pronotum with posterior margin sinuous or with a distinctive medial projection; pronotal posterior angles nearly right-angled.....2
- Pronotum with posterior margin curvilinear to nearly straight, without a distinctive medial projection; pronotal posterior angles rounded.....4
2. Elytron with four distinctive, smooth, continuous carinae; carinae extended from elytral base to apical declivity area.....*H. erugocarinatus* Ocampo
- Elytron without distinctive, continuous, smooth carinae.....3
3. Elytral shape globose; elytral disc convex; all five elytral carinae distinctively interrupted.....*H. disruptus* Ocampo
- Elytral shape elongate; elytral disc nearly flat; one lateral, discal carina; carina continuous, not interrupted.....*H. flaco* Ocampo
4. Elytron with five continuous carinae on intervals 1, 4, 7, 10 and 13.....*H. obscurus* Arrow
- Elytron with one continuous carina on interval 1, carinae interrupted or discontinuous to varying degrees on intervals 4, 7, 10 and 13.....*H. qorilazo* sp. nov.

DISCUSSION

Hybochaetodus qorilazo is distinguishable from the four species previously described because the following combination of characters: body shape shortened ($L/W = 2.0$); pronotum with posterior margin curvilinear to nearly straight and posterior angles rounded; elytra slightly flattened dorsally; elytral carinae on intervals 1, 4, 7, 10 and 13, carina 1 complete, carinae 4 and 7 interrupted at posterior fourth, carina 10 anastomosed on anterior third, and carina 13 discontinuous at posterior third; elytral margin slightly denticulate and parameres with diagnostic shape (Figs. 1, 2). The new species is more similar to *H. obscurus*, but while *H. obscurus* has complete carinae in elytral intervals 1, 4, 7, 10 and 13, (Arrow, 1909; Ocampo, 2006b) (Fig. 8) and parameres with basal half folded in dorsal view (Fig. 2C, D), *H. qorilazo* is distinguished by having complete carina in elytral interval 1 and incomplete carinae in elytral intervals 4, 7, 10 and 13, and parameres with apical half folded in dorsal view. It is not surprising that differences between *H. obscurus* and *H. qorilazo* are focused on elytral carinae design and parameres shape, since interspecific diagnostic characters for *Hybochaetodus* species have been only detected in pronotum, elytra and parameres (Ocampo, 2006b).

Intraspecific variation has not been studied for other *Hybochaetodus* species (Ocampo, 2002; 2006b). This task is currently hindered for *H. disruptus*, *H. erugocarinatus*, and *H. flaco*, because the small number of specimens available for each of them. In the case of *H. obscurus*, examination of specimens housed at MEKRB and MUSM show the following intervals of length (7.0–8.0 mm) and width (3.5–4.0 mm). Also, it could be observed that elytral carinae are mostly entire, sometimes broken at short intervals and protibial teeth are blunt in a few specimens.

At current state of knowledge, distribution of the genus *Hybochaetodus* is restricted to a relatively small area of Apurimac and Cusco regions in southern Peru (Fig. 3A). The five species are distributed following a replacement pattern along an altitudinal gradient (Fig. 3B), where *H. obscurus* has the widest altitudinal range (2900–4300 m), and the other species appear restricted to either high Andean grasslands around 4000 m (*H. qorilazo*) or montane forests between 2400–2900 m (*H. disruptus*, *H. erugocarinatus* and *H. flaco*). As can be observed in the distribution pattern of *Hybochaetodus*, the three species inhabiting montane forests exhibit disjoint distributions, *H. disruptus* west of the Vilcabamba range, while *H. flaco* and *H. erugocarinatus* were found at different altitudes east of the Urubamba range. Similarly, the species that inhabits high Andean grasslands, *H. qorilazo*, seems to be restricted to a high plateau located to the east of the Apurimac canyon. In contrast, *H. obscurus* is distributed over a broader geographic area covered by grasslands, montane forests, and reforestation plots in the Vilcabamba and Urubamba highlands, as well as those highlands located west of the Apurimac canyon. The speciation process that delineated the current distribution pattern of *Hybochaetodus* species could be another case of the sky-islands dynamic, as evidenced for some Mexican species of the genera *Geotrupes* and *Phanaeus* (Kohlmann *et al.*, 2018). According to this vicariant speciation model and its evidence for Mexican scarabaeoid taxa, species persisted in high-elevation refugia (montane forests) during interglacial periods, having a higher probability of diverging, and conversely presented genetic interchange at lower elevations during glacial periods (Arriaga-Jiménez *et al.*, 2020). If *Hybochaetodus* speciation could be explained by this or another model, it will require more systematic collecting efforts across the aforementioned altitudinal gradient and paleobiogeographical studies that contribute to a better understanding of the geological history of the southern Peruvian Andes.

Regarding trophic preferences of *Hybochaetodus*, label data and comments presented by Ocampo (2006b) pointed out that specimens have been collected in pitfall traps baited with either human dung or rotting organic matter (fish, chicken, fruit). The material examined here and field observations by the author suggest that cattle dung could be the main food resource for *H. obscurus* and *H. qorilazo* in high Andean environments, due to the high frequency of domestic ungulates in these areas. Taking this evidence into account, optimal sampling of these species should use a combination of pitfall traps baited with dung and carrion and, if possible, different baits of each sort to assess diet preferences.

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