

# Revision of the genus *Altitaiyus* Weinreich (Coleoptera, Lucanidae, Lucaninae)<sup>1</sup>

Paschoal C. Grossi<sup>2</sup> & Lúcia M. Almeida<sup>2</sup>

<sup>1</sup>Contribution number 1788 of Department of Zoology, Universidade Federal do Paraná, Brazil.

<sup>2</sup>Laboratório de Sistemática e Bioecologia de Coleoptera (Insecta), Departamento de Zoologia, Universidade Federal do Paraná, Caixa Postal 19020, 81531-980 Curitiba-PR, Brazil. Fellowship CNPq. paschoal.grossi@gmail.com; lameida@ufpr.br.

---

ABSTRACT. Revision of the genus *Altitaiyus* Weinreich (Coleoptera, Lucanidae, Lucaninae). The South American genus *Altitaiyus* Weinreich is revised and now includes six species, *A. rotundatus* (Boileau), *A. ruficollis* (Lüderwaldt), *A. godinhorum* (Bomans & Arnaud), *A. dulceae* (Bomans & Arnaud), *A. trifurcatus* (Grossi & Racca-Filho) and *A. koikei* **sp. nov.** (Minas Gerais, Brazil). All species are described and illustrated. For the first time male and female genitalia are illustrated for five species and observations on the behavior of two species are included.

KEYWORDS. Flightless species; Itatiaia; Neotropical; paramo-like; Sclerostomini.

RESUMO. Revisão do gênero *Altitaiyus* Weinreich (Coleoptera, Lucanidae, Lucaninae). O gênero sul americano *Altitaiyus* Weinreich é revisado e agora inclui seis espécies, *A. rotundatus* (Boileau), *A. ruficollis* (Lüderwaldt), *A. godinhorum* (Bomans & Arnaud), *A. dulceae* (Bomans & Arnaud), *A. trifurcatus* (Grossi & Racca-Filho) and *A. koikei* **sp. nov.** (Minas Gerais, Brazil). Todas as espécies são descritas e ilustradas. A genitália do macho e da fêmea de cinco espécies são ilustradas pela primeira vez e observações sobre o comportamento de duas espécies são incluídas.

PALAVRAS-CHAVE. Campos de altitude; espécies braquípteras; Itatiaia; Neotropical; Sclerostomini.

---

The Brazilian Atlantic Forest is one of the most important hotspots of the World with more than 8,000 endemic known species (Tabarelli *et al.* 2003; Tabarelli *et al.* 2005). This region includes one of the highly endemic assemblages of world Lucanidae, and by the continuous destruction of its habitats each year they become more restricted. In the same region of Atlantic forest there are other important vegetation types, such as the paramo-like “campos de altitude” (Fig. 36), which is restricted to the highest peaks of southeast of Brazil (Safford 2001). These high mountains are the habitat of some interesting flightless Brazilian lucanids and each species is restricted to a very limited range, sometimes with a species associated with a single peak. This kind of restricted endemism may be of concern for conservation of these species (*e.g.* Geertsema & Owen 2007; Holloway 2007).

The species of *Altitaiyus* are restricted to the mountains of “Serra da Mantiqueira”, situated near the borders of three Brazilian States (Minas Gerais, Rio de Janeiro and São Paulo). Each species seems to have a relictual distribution. The group was last revised by Weinreich (1960), when it had only three species and was treated as a subgenus of *Sclerostomus* Burmeister (1847). Before Grossi and Racca-Filho (2004), all *Altitaiyus* species were reported from “Itatiaia”, with an altitudinal reference. With such vague data and because of the species are highly restricted distributions, it was impossible to know where they were collected. Upon further research into the precise distributional ranges it was possible to learn that the species are allopatric and found in, a very restricted area, with less than one hectare for each species.

Taxonomic history of *Altitaiyus*.

After examining the Lucanidae Collection of the Museum of Brussels in Belgium, Boileau (1902) described *Sclerostomus rotundatus* based on a single male. Lüderwaldt (1931) described *Sclerognathus ruficollis*, erroneously placing it in a long-synonymized genus. The name *Sclerognathus* was preoccupied by *Sclerognathus* Vallenciennes, 1844, a fish genus (Paulsen 2005). Benesh (1960) treated both species as *Sclerostomus* and placed them in his tribe, Sclerostomini (Benesh 1955).

In the same year and the same day (30-IV-1960) Weinreich (1960) published a revision of some genera of South American Lucanidae. In this work he divided *Sclerostomus* into six subgenera, with *S. rotundatus* designated as the type-species of his new subgenus *Altitaiyus*. Weinreich also included *S. ruficollis* in *Sclerostomus* (*Altitaiyus*) and two species that have subsequently been moved to other genera (Grossi & Paulsen 2009).

More than 30 years passed until Bomans and Arnaud (1996, 2002) published two new species of *Sclerostomus* (*Altitaiyus*) from Itatiaia, Rio de Janeiro State, Brazil, based on many specimens collected by C. L. Godinho Jr. and D. Godinho. These two species were illustrated and compared with *S. (A.) rotundatus*. Grossi & Racca-Filho (2004) published one more new species, increasing the distribution of the subgenus to the southwest areas of Serra da Mantiqueira, Minas Gerais State and presented a key for the Brazilian species within the subgenus. Recently, Grossi & Paulsen (2009) elevated the *Altitaiyus* to generic status.

## MATERIAL AND METHODS

Specimens and taxonomic material. This study was possible by the loaned material from seven institutions and private collections. A total of 181 specimens were studied. Acronyms from Institutions are from (Evenhuis & Samuelson 2008) when available.

- CMNC Canadian Museum of Nature, Ottawa, Canada (F. Génier);  
 EPGC Everardo and Paschoal Grossi Collection, Nova Friburgo, Rio de Janeiro, Brazil (E. J. Grossi);  
 IBSP Instituto Biológico de São Paulo, São Paulo, Brazil (S. Ide);  
 IOC Instituto Oswaldo Cruz, Rio de Janeiro, Brazil (J. Costa);  
 MNHN Muséum National d'Histoire Naturelle, Paris, France (S. Boucher);  
 MNRJ Museu Nacional da Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil (M. A. Monné);  
 MZSP Museu de Zoologia da Universidade de São Paulo, São Paulo, Brazil (S. Casari);  
 MTD Staatliches Museum für Tierkunde, Dresden, Germany (O. Jäger).

Conventions used in this work for morphological characters follow Holloway (1960, 2007) and Paulsen (2005).

*Altitaiyus* Weinreich

*Altitaiyus* Weinreich 1960: 54. Type-species: *Sclerostomus rotundatus* Boileau, 1902, by original designation.

Description. Length: 10.0–17.0 mm. Width: 4.5–7.9 mm. Body short, with sides sub parallel, convex dorsally. Dorsal and ventral surface glabrous. Brachypterous species with hind wings extremely reduced with one to three millimeters in length. Color/surface: Opaque to shining dark, some species being brownish and sometimes reddish. Head: Transverse and smooth, with a central depression, as wide as pronotal width in males (except in *A. ruficollis*), short; surface punctate, disc almost not depressed, smaller than pronotal width in females and punctate. Males' eyes not prominent, sometimes not visible from above. Temporal process wide and rounded, not prominently projected. Males' mandibles well developed, cylindrical in cross section, as long as or longer than head, upturned with apex slightly or widely bifurcated or trifurcated and incurved; internally armed with conical teeth; ventral surface glabrous (lacking rows of setae). Females' mandibles shorter than head, slightly incurved with apex acute; internally with one strong, flattened tooth. Maxillae with lacinia shorter than galea; lacinia with apex hooked or not (in females always hooked); hooklets sometimes present in both galea or lacinia in both sexes. Antennae 10-segmented, geniculate. Scape as long as the rest of the antennae, somewhat curved and with a weak groove apically. Club three-antennomered, first and second antennomeres with distal margin tomentose, third one with apical half tomentose. Pronotum: Form strong, convex, as high as wide in males with sides sinuous or

convex, border complete or not. Anterior margin convex or concave, sometimes at middle weakly emarginate (males); in females simply convex. Anterior angles rounded or truncate. Elytra: Shape rhomboid, convex, sometimes shorter than head and pronotal length together; striae represented by longitudinal lines of punctures; surface glabrous; humeral tooth absent. Legs: Anterior tibiae flattened, serrate with 4–5 well developed external teeth and smaller teeth among them, the two apical teeth being stronger and somewhat forward directed. Mesotibiae with one large acute median tooth and with three smaller teeth basally. Metatibiae with one acute tooth at the beginning of the basal third and sometimes with or without a proximal smaller tooth. Arolium elongate with 2–3 at apex (usually 2; the three bristled condition was observed only in two male specimens of *A. dulcea* and not on all tarsi). Abdomen: Venter with abdominal length smaller than an elytra half; surface smooth, sparsely punctate, punctures small; fifth sternite more punctate and distally rounded, in females longer than in males. Male genitalia: Genital capsule simple. Basal piece narrowing to base, sometimes abruptly; median lobe elongate with sides parallel or sinuous, anteriorly and posteriorly deeply emarginate, almost as long as paramere length; parameres large, with setose apex; base with an internal curved spine-like projection; internal sac permanently eversible, never longer than aedeagus with apex expanded and without papillae; internally with a longitudinal strap-like sclerite and sometimes with two other darkish elongated subparallel sclerites. Female genitalia: Styli present; dorsal plate longer than styli with apex quadrate or rounded. Bursa copulatrix pear-shaped with surface wrinkled. Spermatheca long and C-shaped; spermathecal gland with elongate duct, apex enlarged or not. Accessory gland when expanded larger than entire genitalia.

Diagnosis. *Altitaiyus* can be distinguished from other South American lucanine genera by the following characters: truncate, convex, robust body, with general aspect rhomboid in both sexes. Brachypterous species. Males' head and pronotum transverse, wider than both elytra together (except in *A. ruficollis*). Females' head as wide as one elytral width, slightly convex and weakly punctate. Males' mandibles glabrous ventrally, upturned with apices bifurcated or trifurcated; basal teeth well developed. Pronotum in both sexes without any projection or tubercles, in males almost smooth, in females sparsely punctate. Elytra with longitudinal striae of punctures; interstriae simple (not carinate). Parameres entire, at base with a spine like curved projection.

Distribution. Southeastern Brazil.

Remarks. *Altitaiyus* with *Zikanus* Grossi are the only brachypterous genera of Brazilian Lucanidae. The strong body shape and flattened anterior tibiae are unique among the Brazilian Sclerostomini.

The species of *Altitaiyus* are restricted to the Serra da Mantiqueira Mountains above 2,000 meters of altitude. They are distributed near the limits of three States (Minas Gerais, Rio de Janeiro and São Paulo) in the municipality of Itatiaia,

Itamonte and Passa Quatro. Each species of *Altitaiyus* seems to have a very restricted habitat as some species distributions have been observed by the first author to be isolated by mountains or streams.

#### Key for the species of *Altitaiyus*

1. Male mandibles longer than head in lateral view. Females' head slightly convex on disc; pronotum entirely punctate, punctures moderate to coarse ..... 2  
Male mandibles shorter than head in lateral view. Females' head concave on disc; pronotum smooth, finely punctate. Clean specimens with blue iridescence ..... 5
2. Male head near anterior margin at middle with a conspicuous process. Mandibles with apex trilobed .....  
..... *A. trifurcatus* (Grossi & Racca-Filho)  
Male head simple, without any process. Mandibles with apex bilobed ..... 3
3. Male mandibles robust, with apical bifurcation wide and with at most three internal teeth. Females' canthi projected externally; internally with a strong and hollowed dorsal concavity; pronotal disc moderately densely punctate; punctures size moderate. Elytra with lines of moderately sized punctures .....  
..... *A. rotundatus* (Boileau)  
Male mandibles slender with apical bifurcation narrow. Females without the combination of characters listed above ..... 4
4. Male pronotum projecting forward and with a small pit at middle. Females' canthi not projected, in the same plane as eye surface, concavity when present situated more laterally; pronotal disc densely punctate; punctures size large. Elytra with lines of large to coarse punctures .....  
..... *A. dulcea* (Bomans & Arnaud)  
Male pronotum not projecting forward, widely concave anteriorly. Females' canthi less concave than *A. dulcea*; pronotal disc moderately punctate; punctures moderate. Elytra with lines of fine to moderate punctures .....  
..... *A. godinhorum* (Bomans & Arnaud)
5. Male mandibles with a strong upturned basal tooth; pronotum in both sexes reddish, with anterior margin slightly concave. Elytral punctures fine .....  
..... *A. ruficollis* (Lüderwaldt)  
Male unknown. Female pronotum and elytra totally red with elytral punctures moderate to large .....  
..... *A. koikei* **sp. nov.**

#### *Altitaiyus rotundatus* (Boileau, 1902)

(Figs. 1, 2, 12, 17, 21, 26, 31)

*Sclerostomus rotundatus* Boileau, 1902: 43 (description and illustration); Lüderwaldt 1935: 530 (monograph); Blackwelder 1944: 197 (checklist); Didier & Séguy 1953: 166 (796) (*Pycnosiphorus*) error; Weinreich 1958: 285; Benesh 1960: 36 (catalog); Mizunuma & Nagai 1994: 281 (plate 117, plate 496-1,3,4); Krajcik 2001: 19 (catalog Part I); Krajcik 2003: 166 (catalog Part II).

*Sclerognathus rotundatus*; Van Roon 1910: 45 (catalog-error).

*Sclerognathus zikani* Ohaus, 1929: 158 (description); Didier 1931: 174 (synonymy).

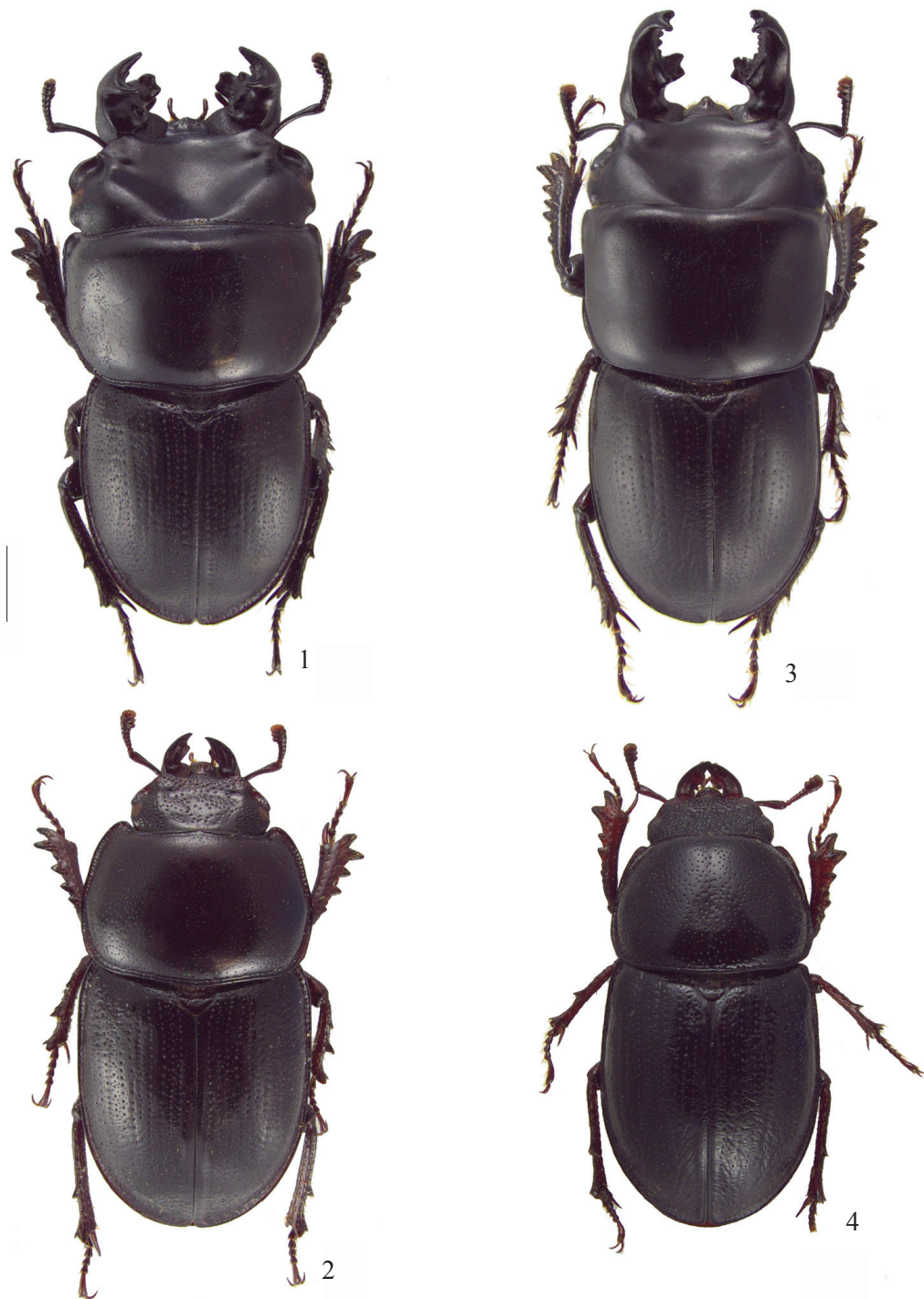
*Sclerostomus zikani*; Lüderwaldt 1935: 531 (monograph).

*Sclerostomus* (*Altitaiyus*) *rotundatus*; Weinreich 1960: 78 (revision and illustrations); Maes 1992: 51 (catalog); Grossi & Racca-Filho 2004: 4 (key).

Description. Males (Fig. 1) n=57. Females (Fig. 2) n=54. Length: 10.0–16.8 mm. Width: 4.5–7.9 mm. Color: Predominantly black, venter and legs somewhat reddish. Head: Disc excavate behind anterior margin in males; female's head punctate; punctures large to coarse; disc not excavated. Temporal process prominent in large males, in small males obscure and in females absent. Labrum transverse, median lobe conical and elevated, disc with paired excavations; anteriorly and laterally setose. Female with labrum less setose, trilobed. Mandibles strongly upturned, widely bifurcate apically (Fig. 21), as long as head length in males; internally from base to apex, basal tooth trapezoid with three obtuse angles, above it two conical processes, the basally smaller; along the mandibles with none to three small teeth; minor and median males with mandibles similar to major males but overall reduced. Female with mandibles (Fig. 26) dorsally and laterally with longitudinal excavations. Maxillae (Fig. 31) with lacinia apex acute, lanciform in male; female with lacinia abruptly hooked; galea with 1-2 internal hooklets, one very strong. Pronotum: Shape transverse, with sides somewhat parallel, at middle weakly concave; integument smooth, when punctate, punctures concentrate near posterior margin; punctures fine to moderate; anteriorly slightly emarginate at middle (males); female pronotum not transverse, sides near rounded; surface moderately punctate; punctures moderate to large. Elytra: Surface shiny and striate with 10-15 complete striae of fine to coarse punctures separated by three punctures diameter, basal and lateral punctures larger. Wings: Both sexes with strongly reduced wings with just a little more than one millimeter; venation almost absent with some long setae. Legs: Anterior tibiae very expanded distally with two stronger external teeth, the apical directed forwards; at middle with 2-5 smaller teeth; basally unarmed. Male genitalia: Dorsal plate of genital capsule with sinuous apex; lateral plates elongated; stalk of sternite narrow near apex and abruptly expanded. Aedeagus (Fig. 12) with median lobe apex in ventral view with a deep Y-shaped emargination. Female genitalia: (Fig. 17) Styli asymmetric; accessory gland as large as sclerotized structures; bursa copulatrix strongly expanded at middle with apex narrow; spermatheca C-shaped with apical part longer than basal one; spermathecal gland longer than spermatheca with enlarged apex. Supra-anal projection subrectangular, narrower than the distance between styli.

Diagnosis. This species is distinguished from *A. godinhorum* and *A. dulcea* by the following combination of characters: Body generally more robust, not elongate. Male mandibles not slender and with a wide apical bifurcation. Male pronotum on anterior margin with a weak emargination at middle and not projected. Female with almost moderate punctures on pronotum and elytra. Also this species can be





Figs. 1–4. Male and female dorsal habitus. 1–2. *Altitaiayus rotundatus*; 1. Male; 2. Female. 3–4. *Altitaiayus godinhorum*. 3. Male; 4. Female.

distinguished from the others by its distribution, occurring from Rebouças Lodge to near the base of Prateleiras Plateau, the only place where it can be found.

**Distribution.** Southeastern Brazil, Rio de Janeiro State, Itatiaia.

**Type Material.** Holotype (IRSN) not examined.

**Material examined.** BRAZIL. 98 specimens: 35: Rio de Janeiro, Itatiaia,

Prateleiras, III-2004, P. Grossi col.; 4: 15-III-1994, C. L. Godinho leg.; 3: III-IV-1996, C. L. Godinho leg.; 2: III-IV-1994, C. L. Godinho leg.; 1: 05-III-1995, C. L. Godinho leg.; 1: 11-II-1993, C. L. Godinho leg. (EPGC); 22: III-1930-35, J. F. Zikán; 4: 17-III-1926, J. F. Zikán; 6: 15-III-1935, J. F. Zikán; 1: 17-III-1930, J. F. Zikán (IOC); 1: 13-IV-1990 Celso Godinho Jr. col.; 1: 15-III-1935, J. F. Zikán; 1: 17-III-1926, J. F. Zikán; 1: 2-1922 D. Mendes; 3: 3: III-1926, J. F. Zikán; 3: 16-IV-1990, Celso Godinho Jr. col. (MNRJ); 5: 22: III-1930-35, J. F. Zikán (MZSP); 2: PARAGUAY, Amambay (wrong data) (CMNC).

**Remarks.** This species has a restricted distribution. It has

been found only in the Prateleiras Valley at elevations from about 2,300 to 2,500 meters. This seems to be the species with the largest distribution, although still with a very restricted extent, indicating that projects must be done to know the real range of this species as with the others. Adults were observed walking on the soil during the hottest hours of the day. A single male was seen guarding two females inside a chamber, a behavior which has been observed in other groups of Lucanidae indicating that with this, the male can guarantee the oviposition of female in that substrate (Araya 1989; Araya and Ôbuchi 1992).

Two specimens, a male and a female from CMNC have labels indicating collection in Paraguay, however we think it is impossible, because the species are endemic to the Itatiaia Plateau.

### *Altitatiayus godinhorum* (Bomans & Arnaud, 1996)

(Figs. 3, 4, 13, 18, 22, 27, 32)

*Sclerostomus* (*Altitatiayus*) *godinhorum* Bomans & Arnaud, 1996: 4 (description and illustrations); Mizunuma & Nagai 1994: 281 (plate 117, 496-2, misidentified as *Sclerostomus rotundatus* Boileau); Grossi & Racca-Filho 2004: 4 (key).

*Sclerostomus godinhorum*; Krajcik 2001: 19 (catalog Part I), 2003: 166 (catalog Part II).

**Description.** Males (Fig. 3) n=13. Females (Fig. 4) n=6. Length: 11.0–16.9 mm. Width: 4.9–6.8 mm. Color: Dorsal surface black, somewhat opaque; legs and mouth parts ventrally reddish colored, especially in small specimens and females. Head: Males head with disc strongly excavated, anteriorly elevated and flat just before anterior margin; anterior margin somewhat elongated; temporal process rounded and wide, not prominent. Females head somewhat convex and with punctures moderate to large. Labrum subtriangular shaped, anteriorly at middle with a conical projection, anterior angles almost straight (male). Labrum (female) with two lateral excavations anteriorly and one transverse at the disc. Mandibles slender (male majors), longer than head (Fig. 22), gradually upturned to apex and with a narrow apical bifurcation; inferior lobe of bifurcation shorter than superior; at dorsal basal margin with a flat, triangular process; basal tooth strong, bifurcate, tooth acute to obtuse; dorsally at base with a convex process; distally at internal margin with 0-5 small teeth. Minor and median males with similar mandibles but smaller in proportion and in some cases, without distal teeth. Female mandibles (Fig. 27) with dorsal margin and excavation well marked. Maxillae (Fig. 32a) with lacinia a little separated from galea, each one with three hooklets (males). Females with lacinia hooked, short with apex truncate (Fig. 32b); galea with a single hooklet. Pronotum: Shape elongate, a little wider than both elytra and slightly flattened on disc, almost parallel; surface smooth; anterior margin widely emarginated, in major males bilobed, lateral margins somewhat concave. Females with pronotum rounded; without emargination; surface moderately punctate; punctures fine to moderate. Elytra: Surface finely punctate with or without 7-9 striae; punctures fine to moderate. Wings: Form reduced; shape and length as in *A. rotundatus*. Legs: Overall as in *A.*

*rotundatus*. Anterior tibiae with 4-7 external teeth, increasing in size distally. Male genitalia: Dorsal plate of genital capsule with rounded apex; pleurites with internal margin at middle sinuous; stalk of sternite with apex almost parallel, slightly expanded. Aedeagus (Fig. 13) with median lobe almost the same length as parameres, V-shaped and narrow. Female genitalia: (Fig. 18). Styli narrow, elongated; accessory gland larger than the sclerotized structures of genitalia; bursa copulatrix elongated, with sides parallel; spermatheca wrinkled with slightly enlarged apex; spermathecal gland longer than spermatheca with apex dilated; apex subequal in width and length. Supra-anal projection sub-rectangle shaped, wider than both styli width.

**Diagnosis.** This species is related to *A. rotundatus* and *A. dulceae* and can be distinguished from them by its less punctate pronotum and elytra, anterior margin of head somewhat elongated, male pronotum in dorsal view parallel and widely emarginated anteriorly; distinct genitalia in both sexes. The male mandibles of *A. godinhorum* and *A. dulceae* have a similar shape, being slender with a narrow bifurcated apex, but with pronotal shape completely different, *A. dulceae* with a forward directed pronotum with emargination restricted to midline.

**Distribution.** Southeastern Brazil, Rio de Janeiro State, Itatiaia.

**Type Material.** Holotype (BMNH) not examined, 5 paratypes studied and listed in examined material.

**Material examined.** BRAZIL. 19 specimens. 3 paratypes: Rio de Janeiro, Itatiaia, 13-II-1991, Celso Godinho col.; 2 paratypes: 16-V-1990/ Celso Godinho col. (MNRJ); 3: III-IV-1996, C. L. Godinho leg.; 1: 12-III-1991, C. L. Godinho leg.; 1: III-IV-1995, C. L. Godinho leg.; 1: 15-III-1996, C. L. Godinho leg.; 2: 15-III-1994, C. L. Godinho leg.; 1: 15-IV-1996, C. L. Godinho leg.; 1: II-2000, C. L. Godinho leg.; 3: III-IV-1993, C. L. Godinho leg.; 1: 15-II-94/ C. L. Godinho leg. (EPGC).

**Remarks.** The restricted distribution is between the known distribution of *A. rotundatus* (Southeastern) and *A. dulceae* (Northwestern). The only data on the labels reads Itatiaia, without any more precise locality information. Fragments of *A. godinhorum* were found on the ground at Morro do Couto at elevations above 2,500 m, one of the tourist trails of Itatiaia plateau. Nothing is known about its biology.

### *Altitatiayus dulceae* (Bomans & Arnaud, 2002)

(Figs. 5, 6, 14, 19, 23, 28, 33)

*Sclerostomus* (*Altitatiayus*) *dulceae* Bomans & Arnaud, 2002: 6 (description and illustrations); Grossi & Racca-Filho 2004: 4 (key).

**Description.** Males (Fig. 5) n=14. Females (Fig. 6) n=12. Length: 12.0–17.0 mm. Width: 5.0–7.0 mm. Color: Dorsal surface black; legs, venter and mouthparts reddish. Head: Males with disc excavated, excavation deeper anteriorly. Anterior area above canthus with a wide lateral concavity. Female head somewhat convex at disc, also of elongated aspect. Temporal process prominent; rounded externally;

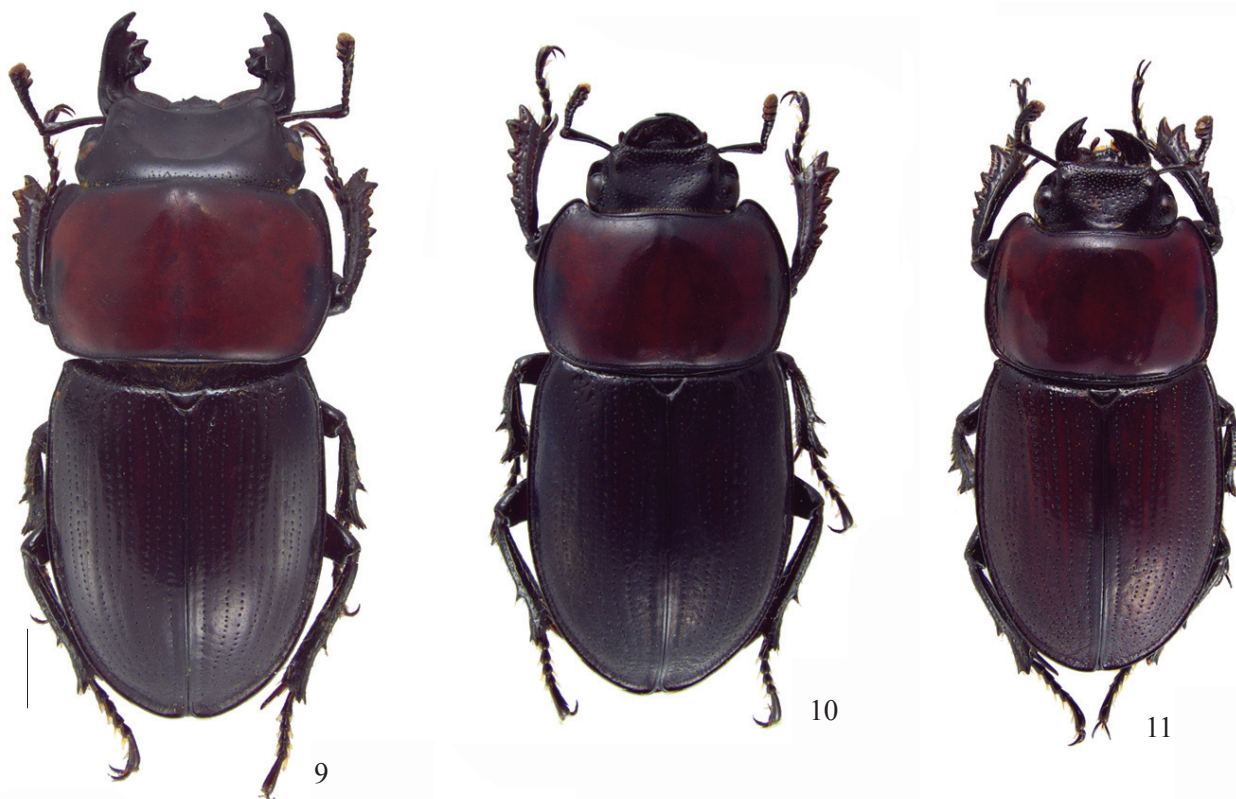




Figs. 5–8. Male and female dorsal habitus. 5–6. *Altitaiyus dulceae*; 5. Male; 6. Female. 7–8. *Altitaiyus trifurcatus*, 7. Male; 8. Male head and mandibles detailed.

clearly narrowed anteriorly, elongated. Labrum subtriangular, apex rounded; dorsally at midline with a weak carina (males). Female labrum subrectangular with anterior margin convex at middle, laterally depressed. Mandibles of male majors longer than head (Fig. 23), slender and upturned, with apex narrowed bifurcate, each bifurcation rounded, the upper lobe smaller; distally with 0-5 internal teeth; basal tooth bifurcate

but variable being more or less bifurcate; superior margin with an erect triangular tooth with its base as wide as basal tooth width; medium and minor males with mandibles as long as head. Female with mandibles with an acute forward directed tooth; dorsal excavation shallow (Fig. 28). Maxillae (Fig. 33a) with apex acute, distinctly separated from galea, not hooked (males). Females with a slender hooked lacinia;



Figs. 9–11. Male and female dorsal habitus. 9–10. *Altitaiyus ruficollis*; 9. Male; 10. Female. 11. *Altitaiyus koikei*, Female.

galea with one hooklet (Fig. 33b). Pronotum: Shape convex, trapezoidal, anteriorly wider and higher; surface smooth; anterior margin projected forwards with a weak excavation at middle (males), smaller males with projection reduced. Female pronotum rounded, without projection, moderately punctate; punctures large, near posterior margin becoming coarse. Elytra: Form convex in both sexes, with 11–16 striae of punctures; punctures large to coarse; striae separated by 1–2 punctures diameter. Wings: Shape extremely reduced. Legs: Anterior tibiae with 3–6 external teeth, increasing in size distally. Male genitalia: Dorsal plate of genital capsule oval, apex rounded, pleurites simple; stalk of sternite with apex divergent. Aedeagus (Fig. 14) with V-shaped median lobe, deeply emarginated. Female genitalia: (Fig. 19) Styli short and subquadrate; accessory gland with same size of sclerotized structures; bursa copulatrix somewhat rounded laterally; spermatheca C-shaped; spermathecal gland elongated with expanded apex, becoming narrower at apex. Supra-anal plate as wide as internal distance of styli, with a membranous area at center.

**Diagnosis.** This species is distinguished from *A. rotundatus* and *A. godinhorum* by the male pronotal shape, projecting forward and trapezoidal in *A. dulcea* and emarginate and rectangular to quadrate in the others; pronotum and elytra with punctures larger; male and female genitalia also distinct.

**Distribution.** Southeastern Brazil, Minas Gerais State,

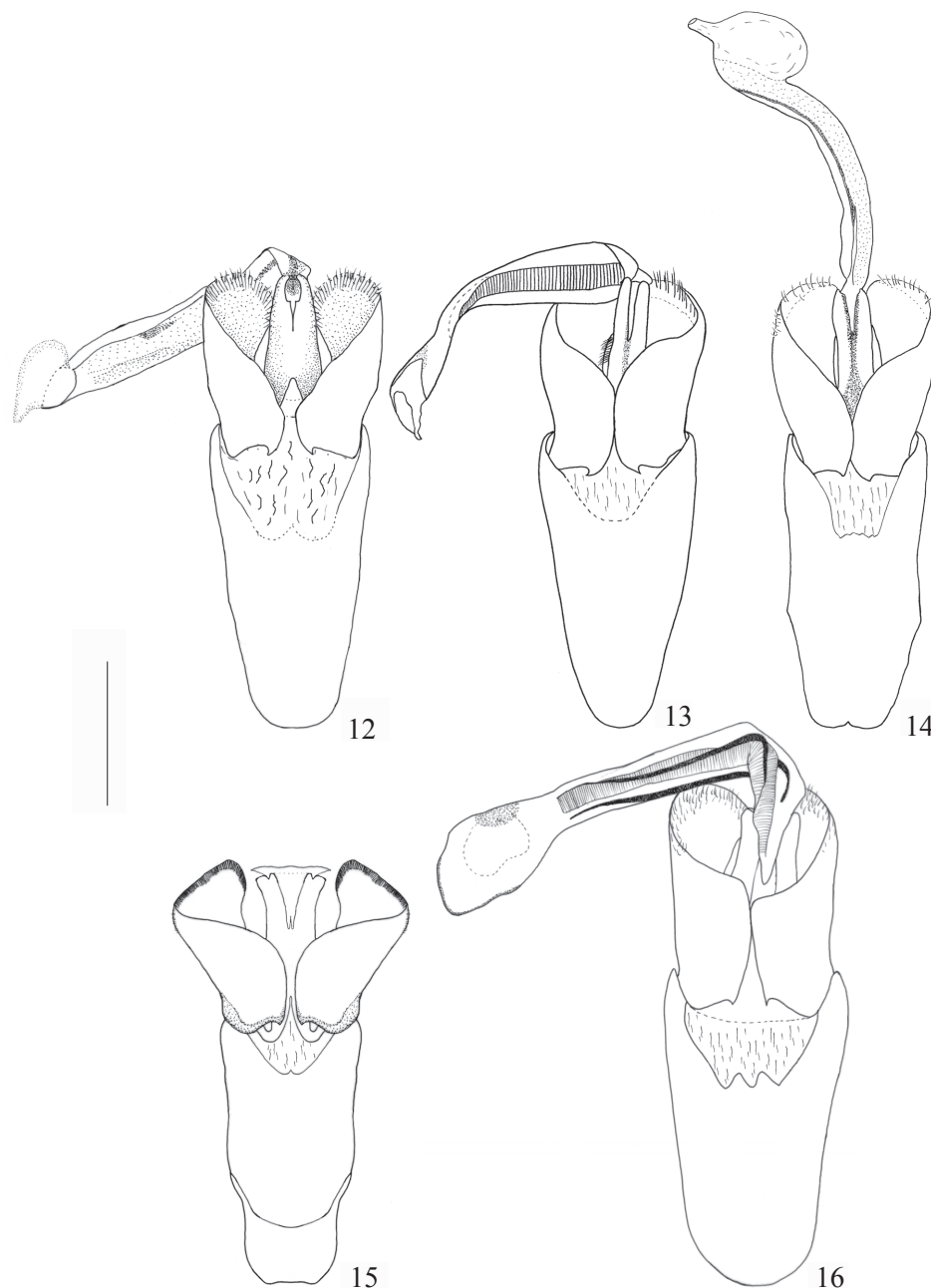
Itamonte and Rio de Janeiro State, Itatiaia.

**Type Material.** Holotype (BMNH) not examined. Four paratypes examined from the first author's collection.

**Material examined.** BRAZIL. 26 specimens. 2 paratypes: Rio de Janeiro, Itatiaia, II–III–2001, C. L. Godinho leg.; 1 paratype: Rio de Janeiro, Itatiaia, 15–II–1999, C. L. Godinho leg.; 1 paratype: Rio de Janeiro, Itatiaia, 10–II–1999, C. L. Godinho leg.; 4: 10–II–2000; 1: 12–III–1999; 1: 18–II–1999; 1: 16–II–1999; 1: 19–II–2001; 1: III–1999 (EPGC); 2: II–III–2000; 11: Minas Gerais, Itamonte/ Itatiaia, Trilha Maromba, Serra Negra, III–2004, P. C. Grossi col. (EPGC).

**Remarks.** This species is the one with the greatest punctuation within the genus, and it could be confused with *A. godinhorum* except for the male pronotum. Females are difficult to separate from each other, and the best way to do this is to collect both sexes together. The only material available for this study was that from EPGC. Unfortunately there are no projects or collections for the region of Serra da Mantiqueira, which would be the way to better understand the life history of this species.

The specific locality of it was not known until 2004, when some specimens were found near the borders of Rio de Janeiro and Minas Gerais States in a trail called Serra Negra in the Municipality of Itamonte in Minas Gerais State. It is very probable that the information given in the original description was not precise and it was impossible to know where to collect this species. A single male was observed in a small hole at the ground closing it with its mandibles. Also



Figs. 12–16. Aedeagi in ventral view. 12. *Altitaiyus rotundatus*; 13. *Altitaiyus godinhorum*; 14. *Altitaiyus dulceae*; 15. *Altitaiyus trifurcatus*. 16. *Altitaiyus ruficollis*.

many holes were observed, and by the diameter, is possible that they were of *Altitaiyus*.

***Altitaiyus trifurcatus* (Grossi & Racca-Filho, 2004)**  
(Figs. 6, 8, 15, 24)

*Sclerostomus (Altitaiyus) trifurcatus* Grossi & Racca-Filho, 2004: 4. (original combination).

Description. Male (Fig. 7) n=1. Length: 16.0 mm. Width: 6.0 mm. Color: Dorsal surface opaque black, legs and base of mandibles with some reddish tint. Head: Shape transverse, two times wider than long; near anterior margin at middle

with a conical and vertical process (Fig. 8); disc strongly excavated; vertex laterally convex; eyes located at lateral face of head, not visible from above. Temporal process rounded. Labrum triangular with anterior angles acutely projected. Mandibles totally upturned, about 90°, each one with a trifurcate and slightly recurved apex; basal tooth vertical, subtriangular and transverse; a flattened, large, rounded and emarginated internal tooth at middle (Figs. 8, 24). Pronotum: Form convex; surface smooth; anterior margin with a slight concavity at middle. Elytra: Dorsal surface convex, sparsely punctate with eight striae; punctures fine; near suture with 2-3 longitudinal impressed lines. Wings: Very reduced. Legs: Protibiae with four external teeth, two at middle and two





Figs. 17–20. Female genitalia in ventral view. 17. *Altitaiayus rotundatus*; 18. *Altitaiayus godinhorum*; 19. *Altitaiayus dulcea*; 20. *Altitaiayus ruficollis*.

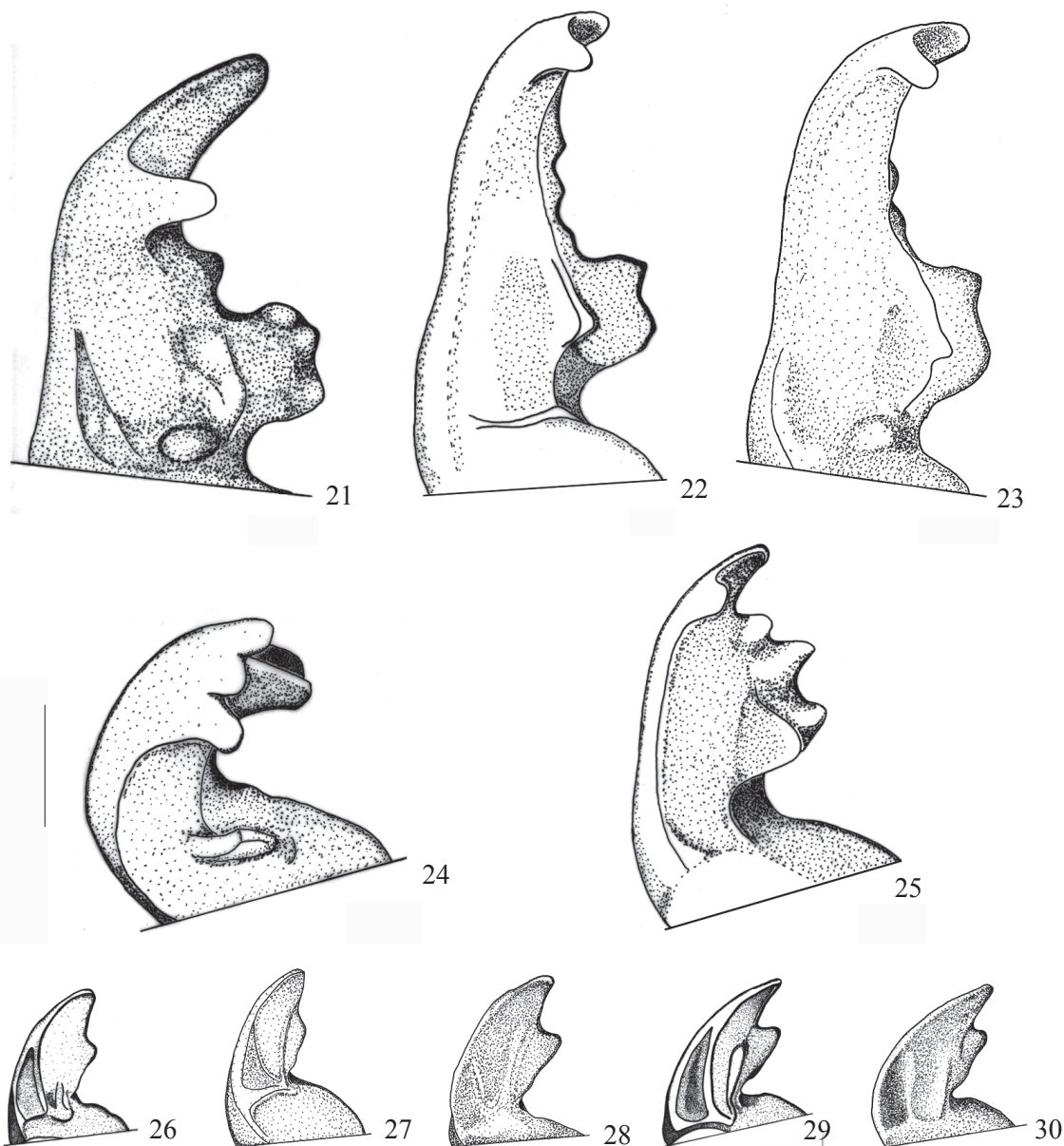
more developed at apex; meso- and metatibiae with median external tooth. Male genitalia: Dorsal plate of genital capsule wide, apex rounded and with a transverse pigmented and sinuous area at middle; pleurites rounded; stalk of sternite with apex divergent. Aedeagus (Fig. 15) with apex of median lobe divergent, each lobe with a weak emargination; base of central emargination with an acute narrow projection.

**Diagnosis.** This species is readily distinguished by its opaque body surface, trifurcate mandibular apex and the conspicuous conical process on the head. Also, it has almost impunctate elytra, with only fine punctures.

**Distribution.** Southeastern Brazil in Serra Fina at Minas Gerais State.

**Type Material.** Holotype (MNRJ) examined, labeled: a) white label, "COLEÇÃO E. & P. GROSSI" b) white label, "BRAZIL, Minas Gerais/Passa Quatro, Serra Fina/ Trilha da Toca do Lobo, 2800 m, / 07-XI-1999, R. Koike col." c) Red label, "*Sclerostomus (Altitaiayus) trifurcatus* n. sp./ HOLOTYPE/ Grossi & Racca-Filho det. 2004". Specimen with label determination "*Altitaiayus trifurcatus* (Grossi & Racca-Filho, 2004)/ P. C. Grossi det. 2008".

**Remarks.** This is the most peculiar species of the genus and it is only known from the holotype male. It was found dead and is incomplete, lacking the antennal funiculus and three apical tarsomeres of the left fore tarsi. At the moment, it is the species with the most southeastern distribution along with the new species described here. These two species are totally isolated from the others at the central area of the highest mountains of Serra da Mantiqueira. Nothing is known about its biology.



Figs. 21–30. Male and female mandibles in dorsal aspect. 21, 26. *Altitaiyus rotundatus*; 22, 27. *Altitaiyus godinhorum*; 23, 28. *Altitaiyus dulcea*; 24. *Altitaiyus trifurcatus*; 25, 29. *Altitaiyus ruficollis*; 30. *Altitaiyus koikei*.

***Altitaiyus ruficollis* (Lüderwaldt, 1931)**

(Figs. 9, 10, 16, 20, 25, 29, 34)

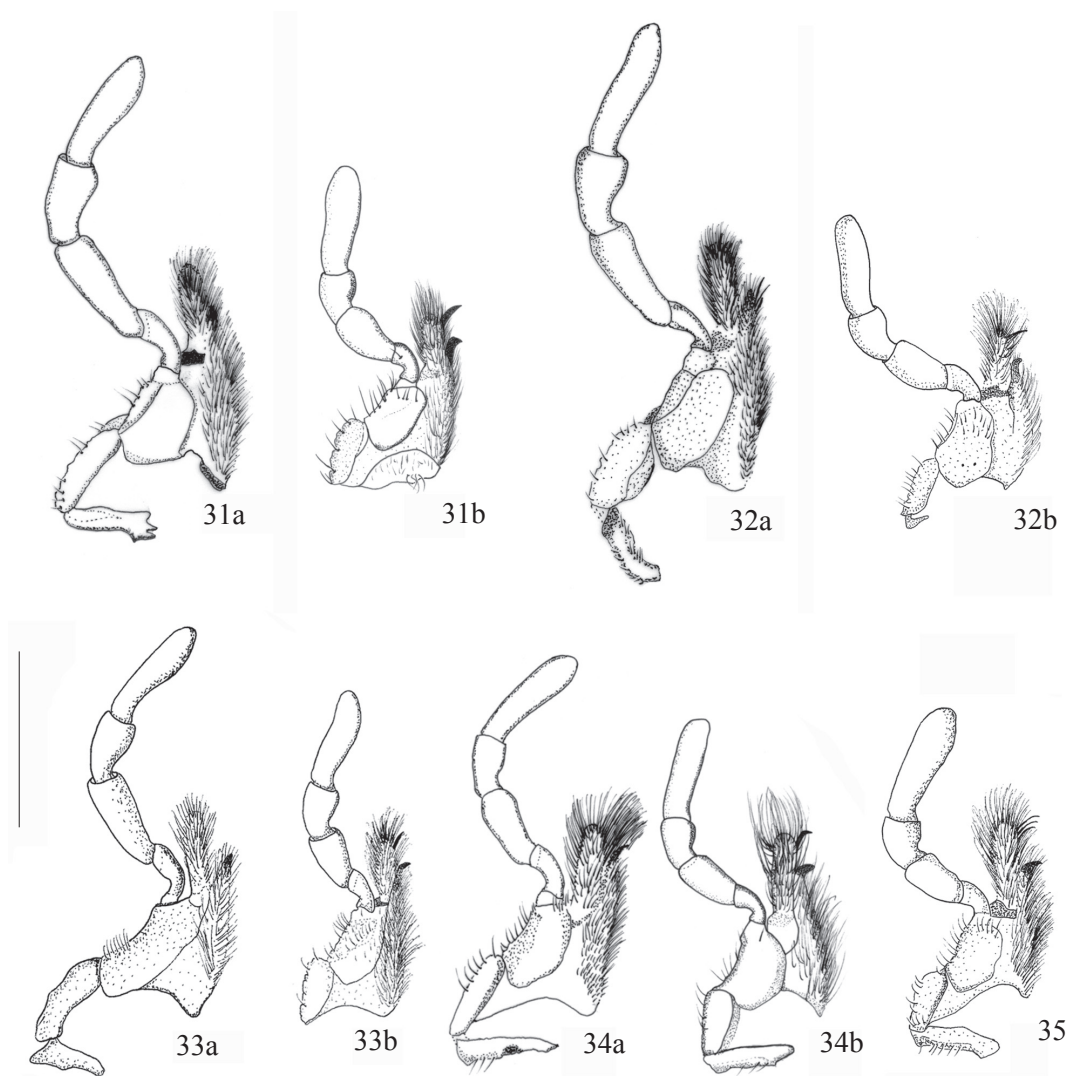
*Sclerognathus ruficollis* Lüderwaldt 1931: 425 (description); Nagel 1934: 430 (larvae and biology).

*Sclerostomus ruficollis*; Lüderwaldt 1935: 530 (monograph and illustrations); Blackwelder 1944: 196 (catalog); Didier & Séguéy 1953: 166 (*Pycnosiphorus* error; Benesh 1960: 36 (catalog); Krajcik 2001: 19 (catalog Part I); Krajcik 2003: 166 (catalog Part II).

*Sclerostomus (Altitaiyus) ruficollis*; Weinreich 1960: 79 (revision and illustrations); Maes 1992: 51 (catalog); Grossi & Racca-Filho 2004: 4 (key).

**Description.** Males (Fig. 9) n=11. Females (Fig. 10) n=12. Length: 12.0–17.0 mm. Width: 4.0–5.6. Color: Head, elytra, legs and venter shiny reddish black, pronotum from light to dark blood red with a small black lateral spot in each side.

Clean specimens with a blue iridescence dorsally. Head: Disc excavated; anterior margin and angles clearly elongated in males, females with shorter head, less elongated; disc and anterior margin moderate to densely punctate; punctures moderate to large. Temporal process not prominent. Labrum anteriorly at middle with an obtuse projected process (males), in females less projected with anterior angles almost straight. Mandibles in dorsal view shorter than head; slightly upturned and with a weak apical bifurcation. Major and median male mandibles internally along ventral margin with a group of 3 acute teeth; minor males with only 2 teeth (Fig. 25). Female mandibles (Fig. 29) dorsally with 2 longitudinal grooves. Maxillae with lacinia hooked in both sexes, in males with apex slightly curved (Fig. 34a), females abruptly curved and with a strong hooklet on galea (Fig. 34b). Pronotum: Convex,



Figs. 31–35. Left maxillae of male (a) and female (b) in dorsal aspect. 31. *Altitaiayus rotundatus*; 32. *Altitaiayus godinhorum*; 33. *Altitaiayus dulcea*; 34. *Altitaiayus ruficollis*; 35. *Altitaiayus koikei*.

surface smooth and blood red in both sexes, males with anterior margin weakly emarginate at middle; midline with a slight longitudinal excavation, females pronotum rounded, without emarginations. Elytra: Shape elongate, longer than both pronotum and head together; sparsely punctate with 6–10 striae, punctures fine. Wings: Reduced with length a little more than three millimeters. Legs: Anterior tibiae with 4–6 external teeth, increasing in size distally. Male genitalia: Dorsal plate of genital capsule oval with rounded apex, pleurites simple; stalk of sternite with apex parallel-sided. Aedeagus (Fig. 16) with median lobe not exceeding parameres length, apically with a deep, V-shaped bifurcation. Female genitalia: (Fig. 20) Styli short, wide; accessory gland smaller than sclerotized structures of genitalia; bursa copulatrix wider at middle; spermatheca entirely C-shaped; spermathecal gland a little longer than spermatheca with simple apex. Supra-anal plate narrower than internal styli width.

**Diagnosis.** This species can be readily distinguished

by the following combination of characters: dorsal surface strongly shiny with blue iridescence in clean specimens; body bicolored, with blood red pronotum and black elytra; male mandibles less upturned with distinct internal teeth and apex weakly bifurcate; female mandibles with two longitudinal excavations; elytral and wings length with a distinct shape, more elongated than in preceding species; abdominal sternites more strongly punctate.

**Distribution.** Southeastern Brazil, in Rio de Janeiro State at Itatiaia's Plateau.

**Type Material.** Type series (MNRJ) examined, labeled: Male: a) White label, "male symbol" b) White label, "318" c) Handwritten white label, "Itatiaia/ 2-1922/ D. Mendes" d) Black bordered red label, "TYPUS" e) Handwritten white label, "*Sclerognathus* male symbol/ *ruficollis* n. sp./ Luederw. det. 30./ Typo" (sic) f) Red label, "SCLEROGNATHUS/ RUFICOLLIS/ Lüderwaldt, 1931/ LECTÓTIPO/ det. P. C. GROSSI, 2007" LECTOTYPE HERE DESIGNATED. Female: a) White label, "female symbol" b) White label, "318" c) Handwritten white label, "Itatiaia/ 2-1922/ D. Mendes" d) Black interrupted bordered red label, "TYPUS"





Fig. 36. Itatiaia Plateau with Agulhas Negras peak at background.

e) Handwritten white label, “*Sclerognathus* female symbol/ *ruficollis* n. sp./ Luederw. det. 30./ Typo” (sic) f) Yellow label, “SCLEROGNATHUS/ RUFICOLLIS/ Luederwaldt, 1931/ PARALECTÓTIPO/ det. P. C. GROSSI 2007” PARALECTOTYPE HERE DESIGNATED. Both specimens with determination label “*Altitaiyus ruficollis*/ (Luederwaldt,1931)/ P.C. Grossi det. 2008”.

Material examined. BRAZIL. 21 specimens. 9: Rio de Janeiro, Itatiaia, Agulhas Negras, 10-XI-1933, F. J. Zikán; 2: 9-XI-1933; 1: 20-XI-1933 (IOC); 3: 10-XI-1933 (MNRJ); 2: 10-XI-1933 (MZSP); 1: 10-XI-1933 (IBSP); 1: 02-XII-2006, J. P. Condack col.; 1: XII-2007, J. P. Condack col. (EPGC); 1: 10-XI-1933 (MTD).

Remarks. This is the only species which biology is known. Nagel (1934) described the larvae and its behavior whereby all adults, pupae and larvae were found together inside rock cracks feeding on a mix of soil, moss and lichens. Probably other species of the genus have similar behavior and larval substrate because all species are brachypterous and their habitats are similarly characterized by the absence of wood.

Almost all studied specimens were collected during 1920 and 1930 and only two female specimens were collected recently in the same specific locality but in December. In summer the weather conditions at these high mountains are extremely difficult and it rains all the time. This is the most northeastern species of *Altitaiyus*, although probably on the other side of Agulhas Negras could be some more species, as they do not fly and have a limited capacity of dispersal.

***Altitaiyus koikei* Grossi, sp. nov.**  
(Figs. 11, 30, 35)

*Altitaiyus koikei* sp. nov. holotype labeled: a) White label, “COLEÇÃO E & P GROSSI”; b) White label, “BRAZIL, Minas Gerais/ Passa Quatro, Serra Fina/ Trilha da Toca do Lobo, 2800 m, / 07-XI-1999, R. Koike col.”;

c) Red label, “*Altitaiyus koikei*/ HOLOTYPE/ Grossi, 2008”. Deposited at Coleção de Entomologia Pe. J. S. Moure, Universidade Federal do Paraná, Curitiba, Paraná, Brazil (DZUP).

Holotype description. Female (Fig. 11) n=1. Length: 13.5 mm. Width: 5.5 mm. Color: Dorsal surface of pronotum and elytra, part of femora and metasternum shiny bood red; head and other structures shiny black. Body with a blue iridescence. Head: Shape transverse, almost two times wider than longer and a little wider than one elytron width; disc excavated, moderate to densely punctate; punctures moderate to large, concentrated anteriorly (near anterior margin) and posteriorly above eyes, vertex smooth; anterior margin distinctly elongate. Labrum trapezoidal, anteriorly projected, each side near anterior margin with a transverse setose excavation, setae long. Mandibles (Fig. 30) incurved with apex acute; internally with one sinuous tooth with a rounded apex; longitudinal dorsal excavations shallow. Maxillae (Fig. 35) with lacinia hooked; galea with three hooklets. Pronotum: Form convex, rounded, border complete, almost smooth, punctures fine and concentrated near lateral margins, narrow; each side with a C-shaped black spot. Elytra: Form convex, somewhat elongate, longer than both pronotum and head together; surface punctate with 11 striae, punctures moderate to large separated by 2-3 puncture diameter; apex densely punctate, punctures moderate. Legs: Protibiae strongly armed externally, left with five and right with 6 teeth, the 2 distal teeth bigger, acute and forward directed, the proximal teeth smaller, obtuse and subequal in size. Mesotibiae with four external teeth, just before middle a bigger acute and backward directed tooth, above it three smaller decreasing in size proximally. Metatibiae with a single external median tooth.

**Diagnosis.** This species is related to *A. ruficollis* from which it is distinguished by red elytra, narrower pronotum, larger elytral punctures and elytral declivity more densely punctate, ocular canthus rounded, mandibles with shallow longitudinal excavations. Both species have abdominal sternites strongly punctate in opposition to the other species in the genus that have at most finely punctate abdominal sternites.

**Etymology.** The specific epithet is homage to a friend Mr. Ricardo T. Koike, a coleopteran enthusiast and great lucanid collector who kindly provided to the first author one more new species of *Altitaiyus*.

**Distribution.** Southeastern Brazil in Minas Gerais State.

**Remarks.** This species and *A. trifurcatus* are the more southeastern members within the genus and were found at the same locality. Maybe there are more species waiting for discovery, but access is extremely difficult and the area is sometimes impossible to reach. This new species with *A. ruficollis* form a group with blue iridescence, female pronotum almost smooth and female head distinctly excavated. The body is also more elongated with slender wings. Nothing is known about its biology, but the specimen described here was collected alive walking on the soil and was maintained alive for two months without feeding.

**Acknowledgments.** We would like to thank all the assistance received from collectors, curators and collection managers who provided the specimens here studied. In special we would like to thank Dr. Miguel A. Monné (MNRJ), Dr. Jane Costa (IOC), Dr. Sonia Casari (MZSP), Dr. Sergio Ide (IBSP), Dr. François Génier (CMNC) and Dr. T. Deuveau (MNHN) for the loaned material. We also thank Dr. Nicolas Degallier by the pictures obtained of *A. boileaui* and information provided of the MNHN and Dr. Everardo J. Grossi by logistical support and encouragement to the first author. We also thank J. P. Kondak for the two recently collected specimens of *A. ruficollis* and photographs of a live specimen. We are grateful to two anonymous reviewers for their constructive criticism of the manuscript. This work was part of the MSc. thesis of PCG, which was granted by CNPq.

## REFERENCES

- Araya, K. 1989. Oviposition behavior of Japanese lucanid beetles (Coleoptera). *Nature and Insects* **24**: 6–14.
- Araya, K. & T. Ôbuchi. 1992. Life histories of Japanese lucanid beetles (Coleoptera: Lucanidae). 2) *Prismognathus angularis* Waterhouse. *Nature and Insects* **27**: 24–32.
- Benesh, B. 1955. Some notes on Neotropical stagbeetles (Coleoptera: Lucanidae). *Entomological News* **66**: 97–104.
- Benesh, B. 1960. *Coleopterorum Catalogus Supplementa, Pars 8: Lucanidea* (sic), Berlin, 178 p.
- Blackwelder, R. E. 1944. Checklist of the Coleopterous Insects of Mexico, Central America, the West Indies, and South America. Part 2. *United States National Museum Bulletin* **185**: 195–197.
- Boileau, M. H. 1902. Note sur quelques Lucanides du Musée de Bruxelles. *Mémoires de la Société entomologique de Belgique* **9**: 33–46.
- Bomans, H. & P. Arnaud. 1996. Description d'une nouvelle espèce brésilienne du genre *Sclerostomus* Burmeister (Coléoptère Lucanidae). Bulletin de liaison de l'Association Entomologique pour la Connaissance de la Faune Tropicale. *Besoiro* **2**: 2–4.
- Bomans, H. & P. Arnaud. 2002. Description d'une nouvelle espèce brésilienne du genre *Sclerostomus* Burmeister (Coléoptère Lucanidae). Bulletin de liaison de l'Association Entomologique pour la Connaissance de la Faune Tropicale. *Besoiro* **8**: 6–7.
- Burmeister, H. 1847. Lucanidae, p. 304–530. In: *Handbuch der Entomologie. 5 (Coleoptera Lamellicornia, Xylophila et Pectinicornia)*. Berlin, VIII+584 p.
- Didier, R. 1931. Étude sur les Coléoptères Lucanides du globe. XIII. Notes synonymiques. *Librairie speciale Agricole* **8**: 174 p.
- Didier R. & E. Séguy. 1953. Catalogue illustré des Lucanides du Globe. Texte. *Encyclopedie Entomologique*, Serie A **27**: 1–223.
- Evenhuis, N. L. & A. G. Samuelson. 2008. *Abbreviations for Insect and Spider Collections of the World*. Available at <http://hbs.bishopmuseum.org/codens/codens-inst.html> (access September 2008).
- Geertsema, H. & C. R. Owen. 2007. Notes on the habitat and adult behaviour of three red-listed *Colophon* spp. (Coleoptera: Lucanidae) of the Cape Floristic Region, South Africa. *Journal of Insect Conservation* **11**: 43–46.
- Grossi, P. C. & F. Racca-Filho. 2004. A new Brazilian stag beetle of the genus *Sclerostomus* Burmeister, 1847 (Insecta: Coleoptera: Lucanidae). *Zootaxa* **575**: 1–4.
- Grossi, P.C. & M.J. Paulsen. 2009. Generic limits in South American stag beetles: taxa currently misplaced in *Sclerostomus* Burmeister (Coleoptera: Lucanidae: Lucaninae: Sclerostomini). *Zootaxa* **2139**: 23–42.
- Holloway, B. A. 1960. Taxonomy and phylogeny in the Lucanidae (Insecta: Coleoptera). *Records of the Dominion Museum* **3**: 321–365.
- Holloway, B. A. 2007. *Lucanidae (Coleoptera) Fauna of New Zealand 61*. Manaaki Whenua Press, 254 p.
- Krajcik, M. 2001. *Lucanidae of the World. Catalogue-Part I. Checklist of the stag Beetles of the World*, Czech Republic, 108 p.
- Krajcik, M. 2003. *Lucanidae of the World. Catalog-Part II. Encyclopedia of the Lucanidae (Coleoptera: Lucanidae)*, Czech Republic, 197 p.
- Lüderwaldt, H. 1931. Duas espécies novas da família dos Lucanídeos (Coleoptera, Lamellicornia). *Revista do Museu Paulista* **17**: 423–426.
- Lüderwaldt, H. 1935. Monografia dos Lucanídeos Brasileiros. *Revista do Museu Paulista* **XIX**: 447–574.
- Maes, J. M. 1992. Lista de los Lucanidae (Coleoptera) del mundo. *Revista Nicaragüense de Entomología* **22**: 1–60 (pars A), 61–121 (pars B).
- Mizunuma, T. & S. Nagai. 1994. *The Lucanid beetles of the world*. Tokyo, Mushi-sha, 337 p.
- Nagel, P. 1934. Zur Systematik und Biologie von *Sclerostomus ruficollis* Luederwaldt, nebst Beschreibung der Larve (Col. Lucanidae). *Revista de Entomologia* **4**: 429–435.
- Ohaus, F. 1929. Neue Lucaniden (Ins. Col.) des Senckenberg-Museums. *Senckenbergiana* **11**: 155–159.
- Paulsen, M. J. 2005. A revision of the southern South American stag beetles of the genus *Sclerostomus* Burmeister (Coleoptera: Scarabaeoidea: Lucanidae). *Zootaxa* **1060**: 1–26.
- Safford, H. D. 2001. Brazilian Páramos. III. Patterns and rates of postfire regeneration in the Campos de Altitude. *Biotropica* **33**: 282–302.
- Tabarelli, M.; L. P. Pinto; J. M. C. Silva & C. M. R. Costa. 2003. The Atlantic Forest of Brazil: endangered species and conservation planning, p. 86–94. In: C. Galindo-Leal & I. G. Câmara (eds.). *The Atlantic Forest of South America: biodiversity status, trends, and outlook*. Washington, Center for Applied Biodiversity Science e Island Press, 488 p.
- Tabarelli, M.; L. P. Pinto; J. M. C. Silva; M. M. Hirota & L. C. Bedê. 2005. Desafios e Oportunidades para a Conservação da Biodiversidade da Mata Atlântica Brasileira. *Megadiversidade* **1**: 132–138.
- van Roon, G. 1910. *Coleopterorum Catalogus, Pars 8 Lucanidae*. Berlin, W. Junk, 70 p.
- Weinreich E. 1958. Die südamerikanische Lucanidengattung *Pycnosiphorus* (Ins. Col.). *Senckenbergiana Biologica* **39**: 265–288.
- Weinreich, E. 1960. Revision südamerikanischer Lucanidae (Ins. Col.), II Die Gattungen *Charagmophorus*, *Metadorcus*, *Scortizus*, *Apterodorcus*, *Beneshius*, *Sclerostomus* und *Pycnosiphorus* (Tafel 3-12). *Senckenbergiana Biologica* **41**: 41–95.

Received 1/2/2010; accepted 24/11/2010

Editor: Marcela Laura Monné