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A NEW GENUS OF TROGLOBITIC CARABID BEETLE FROM BRAZIL (COLEOPTERA, CARABIDAE, ZUPHIINI)

PEDRO GNASPINI
SERGIO A. VANIN
NILZA M. GODOY

ABSTRACT

The new Zuphiini genus Coarazuphium *gen. n. is described for three troglobitic species of central-eastern Brazil:* C. tessai *(Godoy & Vanin, 1990) comb. n., type species, from "Gruta do Padre", Santana, Bahia state;* C. cessaima *sp. n., from "Lapa do Bode", Itaetê, Bahia state; and* C. bezerra, *sp. n., from "Lapa do Bezerra", São Domingos, Goiás state. All three species have very reduced eyes and pigmentation.*

Keywords: Coleoptera, Carabidae, Zuphiini, Brazil, caves, *Coarazuphium,* gen. n.

INTRODUCTION

Until recently, the Neotropical Zuphiini were represented by the genera *Metaxidius* Chaudoir, 1852, *Mischocephalus* Chaudoir, 1862, *Pseudaptinus* Castelnau, 1835, *Thalpius* LeConte, 1851, and, in the Zuphiina, *Zuphium* Latreille, 1806 (Reichardt, 1977). Godoy & Vanin (1990) described *Parazuphium tessai* from a Brazilian cave; the generic assignment was based on the key and diagnosis of the genera *Zuphium* and *Parazuphium* Jeannel, 1942 from the

Departamento de Zoologia, Instituto de Biociências, Universidade de São Paulo, Caixa Postal 11461, 05422-970, São Paulo, SP, Brasil. E-mail: gnaspini@ib.usp.br; savanin@ib.usp.br

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revision of Baehr (1984, 1985, 1986). This species mostly fitted into *Parazuphium* (which was not represented in the Americas so far) than in *Zuphium* (which has several American species, including Brazil). However, some characters differed from those of *Parazuphium*. Later, several specimens of another troglobitic zuphiine were collected in another cave of Bahia state; and more recently one male of a third species was collected in a cave of Goiás state. These three species shared some characters with species of the genus *Parazuphium* (e.g., several setae on the first antennal segment, instead of only one of *Zuphium*; and a sinuose apex of the elytra, instead of the truncate apex of *Zuphium*); and some with species of *Zuphium* (e.g., the normally elongate aedeagus, different from that of *Parazuphium*, which has a pronounced narrowing between the body and the tip of the aedeagus). On the other hand, they shared some characters which differ from those of the two cited genera (e.g., the first antennal segment is not so long when compared with second to fourth segments together). Besides, all three species share troglomorphic characters like reduction of eye and of pigmentation. Herein we describe a new genus to include these three Brazilian troglobitic species.

Methods and Materials

The specimens used in this study were either maintained in 70% alcohol or dried specimens mounted on cards fixed on entomological pins. To dissect the genitalia, the specimens were relaxed in boiling water. Some structures with much adhered tissue were cleaned for a few minutes in hot 10% KOH. The dissected genitalia were mounted in PVA on a microslide, which was attached to the same pin. Drawings were made with a camera lucida microscope and measurements were taken from these drawings.

The type material of the species studied herein are deposited in the collection of the Museu de Zoologia da Universidade de São Paulo, São Paulo (MZSP).

Systematics

Coarazuphium, gen. n.

Type Species. *Parazuphium tessai* Godoy & Vanin 1990, from Gruta do Padre, Santana, Bahia state, Brazil.

Diagnosis and Description. In addition to the typical characters of the

tribe, described in Baehr (1984, 1985, 1986): Head distinctly separated from neck, with lateral margins subparallel. [Mouth parts are fully described for *C. tessai* by Godoy & Vanin (1990).] First antennal segment elongate, shorter than second to fourth together (from 0.65 to 0.85 as long as 2nd-4th together), dorsally with a very long tactile seta and with some additional setae; third and fourth segments subequal. One pair of setae laterally to the reduced eyes (or the place where it would be, in the case of eyeless species), and one or two pairs of setae behind eyes, near hind border of temples (the lateral pair is always present, and the more internal pair may be absent). With a long, conspicuous seta rather ventrally behind posterior border of eye. Pronotum subtrapezoidal; with one pair of long anterior marginal setae, and one pair of smaller posterior marginal setae at hind angles. Elytra depressed, striae indistinct to scarcely visible; apex sinuose to deeply sinuose; with seven setae, being three anterior-lateral, three posterior-lateral, and one at apex. Aedeagus weakly distorted, inner sac with some spinose areas; bearing a ventral projection to attachment of left paramere. Left paramere club-shaped, with a ventral projection to attachment to the aedeagus; right paramere smaller than left, and sometimes deformed. Genital segment elliptical (fig. 11).

Etymology. The name is derived from Tupi (Brazilian native language) for "Coara" (hole, cave) + *Zuphium*, referring to the cavernicolous habit of this genus, which is close to *Zuphium*. Gender neutral.

Discussion. *Coarazuphium* gen. n., differs from *Zuphium* by having first antennal segment bearing several setae, one pair of lateral-ventral setae behind eyes, and apex of elytra sinuate; from *Parazuphium* by having apex of aedeagus not deeply cut from body, and genital segment circular; and from both by having lateral margins of head rounded, first antennal segment smaller than 2nd-4th together, and one pair of setae laterally (and not anteriorly) to the eyes.

Coarazuphium bezerra, sp. n.

(figs. 1 - 5)

Holotype, male. Type locality and data: Brazil: Goiás: São Domingos, Lapa do Bezerra, 01.viii.1993, L. Horta col.

Diagnosis and Description. Holotype: Length (from apex of mandibulae to apex of elytra): 4.05 mm; width (at widest region of elytra): 1.4 mm. General colour yellowish to pale brown. Dorsal integument entirely covered with short

recumbent hairs. Head (figs 1-2) as long as wide, subtrapezoidal, wider at 1/4 from base; 1.1 times as long as pronotum; dorsal surface bearing one pair of setae internally to the eyes, one pair posteriorly at margin of head, and two pairs close to posterior margin of head (one lateral and one more internally); ventral surface bearing one pair of anterior setae at same distance between margin of head and gular area, and one pair medially, close to gula. Eyes present, but very reduced; placed at the end of antennal impression at the head. Antenna (fig. 1) 4.4 times as long as pronotum; first segment 0.8 times as long as 2nd-4th together; 2nd 0.3 times as long as 1st, and 0.65 times as long as 3rd; segments 3rd to 11th subequal, varying from 0.45 to 0.52 times as long as 1st. Pronotum (figs 1-2) as long as wide, trapezoidal, wider at 1/4 from apex; with median impression extending slightly more than half the length of pronotum; dorsal surface bearing one pair of setae at anterior angles and one pair of shorter setae at posterior angles; ventral surface bearing one pair of anterior setae medially. Legs (fig. 1): Pro- and mesotrochanters bearing one medial seta at posterior margin; metatrochanter lacking setae. Profemur with several long and short setae at posterior margin. Protibia 1.45 times as long as tarsus; meso- and metatibiae subequal to tarsi; together, protibia and tarsus 2.15 times, mesotibia and tarsus 2.45 times, and metatibia and tarsus 3.35 times as long as pronotum. Elytra (fig. 1) free, together 1.55 times as long as wide, wider at 2/3 from base; 2.95 times as long as pronotum; apex slightly sinuate; for elytral setation, see remarks. Hind wing lacking. Aedeagus (figs 3-5) curved and somewhat elongate; left paramere wide and subtriangular, right paramere a smaller and almost oval plate.

Etymology. The epithet is given in appositon as a toponymic for the name of the cave where the species was collected.

Remarks. The only specimen available unfortunately lacks most elytral setae. However, the setal map may be deduced from the few available setae, the setal punctures, and comparing with the other species of the genus. At each elytron it would be: three very long at anterior angle, followed by four very small marginal (although having deep punctures) medially, followed by three very long at the posterior half at margin, and one very long seta at apex.

Coarazuphium cessaima, sp. n.

(figs. 6 - 11)

Holotype, male. Type locality and data: Brazil: Bahia: Itaetê, Lapa do Bode, 07.ix.1993, E. Trajano col. 4M 2F paratypes with the same data. Other paratypes: Brazil: Bahia: Itaetê, Lapa do Bode, 04.ix.1991, P. Gnaspini col., 2M 3F.

Diagnosis and Description. Holotype: Length (from apex of mandibulae to apex of elytra): 5.25 mm; width (at widest region of elytra): 1.4 mm. General colour pale yellowish brown; integument almost transparent. Dorsal integument entirely covered with short recumbent hairs. Head (figs 6-7) elongate, 1.3 times as long as wide, subrectangular, wider at half (at insertion of lateral setae); 1.15 times as long as pronotum; dorsal surface bearing one pair of setae internally to the end of antennal impression at the head, one pair posteriorly at margin of head, and one pair close to posterior angles; ventral surface bearing one pair of anterior setae at same distance between margin of head and gular area, one pair almost medially, close to gula, and one pair near posterior angles. Eyes absent. Antenna (fig. 6) 5.2 times as long as pronotum; first segment 0.75 times as long as 2nd-4th together; 2nd 0.25 times as long as 1st, and 0.45 times as long as 3rd; segments 3rd to 11th subequal, varying from 0.51 to 0.57 times as long as 1st. Pronotum (figs 6-7) somewhat elongate, 1.2 times as long as wide, subtrapezoidal, wider at 1/6 from apex; with median impression extending about 3/4 the length of pronotum; dorsal surface bearing one pair of setae at anterior angles and one pair of shorter setae at posterior angles; ventral surface bearing one pair of anterior setae medially. Legs (fig. 6): Pro- and mesotrochanters bearing one medial seta at posterior margin; metatrochanter lacking setae. Profemur with several long and short setae at posterior margin. Protibia 1.1 times as long as tarsus; meso- and metatibiae subequal to tarsi; together, protibia and tarsus 2.5 times, mesotibia and tarsus 2.8 times, and metatibia and tarsus 3.85 times as long as pronotum. Elytra (fig. 6) free, together 1.95 times as long as wide, wider at half; 3.0 times as long as pronotum; apex strongly sinuate; bearing three very long setae at anterior angle, followed by four very small marginal setae (although having deep punctures) medially, followed by three very long setae at the posterior third at margin, and one very long seta at apex. Hind wing lacking. Aedeagus (figs 8-10) curved and somewhat elongate; left paramere somewhat wide with margins subparallel pointing at apex, right paramere longer and slimmer than left.

Etymology. The epithet, given in aposition, is derived from Tupi for "ceçaima" (= blind) because of the eyeless condition of the species, in comparison with the other two known species which still have very reduced eyes.

Remarks. Most type specimens of *C. cessaima* are parasitized by an unidentified species of Laboulbeniales (Ascomycetes). In males, the fungal ectoparasites appear ventrally on the body, as on the thoracic and abdominal sternites, and legs; and in females, the fungi occurs on the elytra. According to Crowson (1981), this different distribution of the fungi is related to the kind of

transmission, which mainly occurs during copulation. As the sexual dimorphism is very weak in *C. cessaima*, the placement of the fungi on the body of the insects helps on the first recognition of the sex, which can secondly be supported by seeing the male genitalia (when it is the case) through the transparent integument and/or by dissection.

Coarazuphium tessai (Godoy & Vanin), comb. n.

Parazuphium tessai Godoy & Vanin 1990

Material examined: Brazil: Bahia: Santana, Gruta do Padre, vii.1986, F. Chaimowicz col., 1 M holotype, 1 F paratype.

Godoy & Vanin (1990) gave a fully description of the species, including mouth parts (which should be added to the description of the present genus).

Addtional Description and Comparative Diagnosis. Length (from apex of mandibulae to apex of elytra): 5.3 mm; width (at widest region of elytra): 1.6 mm. Head 0.95 times as long as wide, subtrapezoidal, wider at 1/3 from base; 1.25 times as long as pronotum; dorsal surface bearing one pair of setae internally to the eyes, one pair posteriorly at margin of head, and one pair close to posterior angles; ventral surface bearing one pair of anterior setae at same distance between margin of head and gular area, one pair almost medially, close to gula, and one pair posteriorly, close to gula. Eyes present, but very reduced; placed at the end of antennal impression at the head. Antenna 4.95 times as long as pronotum; first segment 0.85 times as long as 2nd-4th together; 2nd 0.25 times as long as 1st, and 0.55 times as long as 3rd; segments 3rd to 11th subequal, varying from 0.40 to 0.47 times as long as 1st. Pronotum 0.9 times as long as wide, trapezoidal, wider at 1/4 from apex; with median impression extending slightly more than half the length of pronotum; dorsal surface bearing one pair of setae at anterior angles and one pair of shorter setae at posterior angles; ventral surface bearing one pair of anterior setae medially. Legs: Pro- and mesotrochanters bearing one medial seta at posterior margin; metatrochanter lacking setae. Profemur with some long and short setae at posterior margin. Protibia 1.45 times as long as tarsus; mesotibia subequal to tarsus; metatibia shorter (0.95 times as long) as tarsus; together, protibia and tarsus 2.25 times, mesotibia and tarsus 2.45 times, and metatibia and tarsus 3.3 times as long as pronotum. Elytra free, together 1.65 times as long as wide, wider at 2/3 from base; 3.1 times as long as pronotum; apex slightly sinuate; [as told by available setae, setal punctures and comparison with other species:] bearing three very long setae at anterior angle, followed by

four very small marginal setae (although having deep punctures) medially, followed by three very long setae at the posterior half at margin, and one very long seta at apex. Hind wing lacking. Aedeagus curved and somewhat elongate; left paramere somewhat thin and subrectangular, right paramere a very small and almost oval plate.

Key to Species of *Coarazuphium,* gen. n.

1. Eyeless; maximum width of elytra at middle ..... *C. cessaima,* sp. n.
   With very reduced eyes; maximum width of elytra near apices 2
2. Two pairs of dorsal setae at the posterior border of head; head slightly wider than pronotum (1.05) and much narrower than elytra (0.55).....
   .....*C. bezerra,* sp. n.
   One pair of dorsal setae at the posterior border of head; head wider than pronotum (1.2) and narrower than elytra (0.7).....
   ..... *C. tessai* (Godoy & Vanin)

Biological Notes, Geographical Distribution and Troglobitic Evolution

All three known species show typical troglomorphisms, such as reduction or absence of pigmentation, eyes, and wings; and elongation of appendages and antennae. However, their elytra are still not fused together. All were collected wandering near streams or pools. Among them, when comparing shape and propotions of some structures, *C. cessaima* shows the more modified features, such as eyelessness (whereas the others have reduced eyes), elongate head and pronotum (whereas the others have them subtrapezoidal), elongate elytra, and more elongate legs. The other two are rather similar in shape with only few differences, such as the more transverse head and the more elongate antenna of *C. tessai.*

They are known so far only from a few caves from the Bambuí Speleological Province (fig. 12). Specimens of other carabid tribes (including troglobites) are found in other Brazilian caves, but zuphiines were recorded so far only from these three caves in Bahia and Goiás states (Gnaspini & Trajano, 1994). Besides, these zuphiines are the Brazilian troglobitic arthropod species known so far which show the most derived troglomorphic features. This fact led Gnaspini & Trajano (1994) to predict that more highly derived troglobites would be collected in the drier northern part of Bambuí Province. We here predict that, as other caves in this region are better surveyed from a faunistic

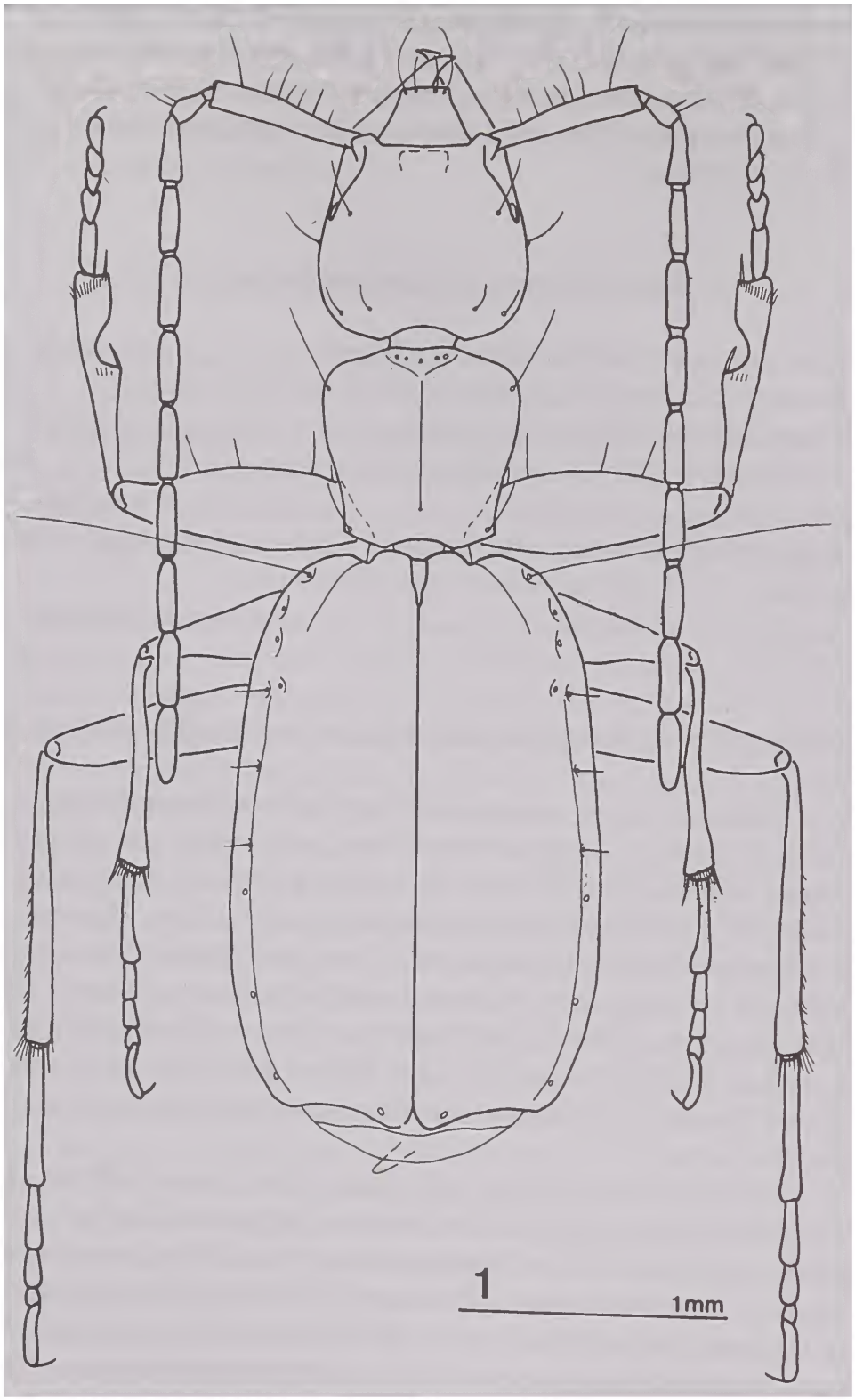
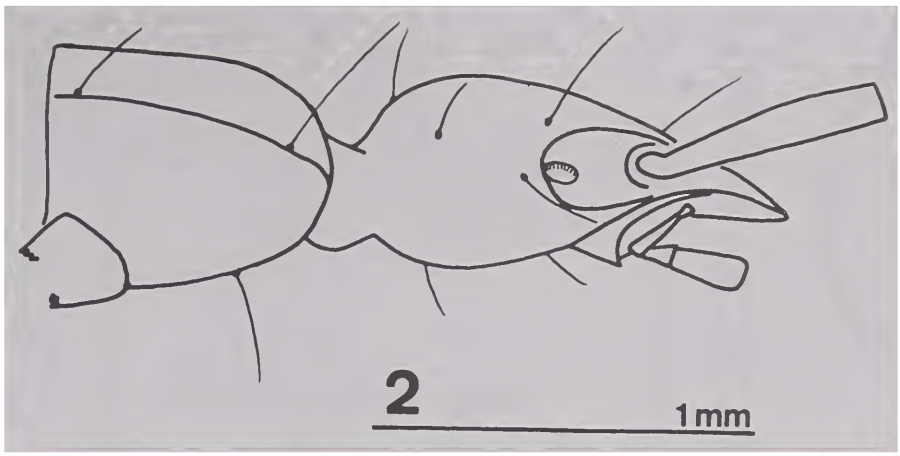
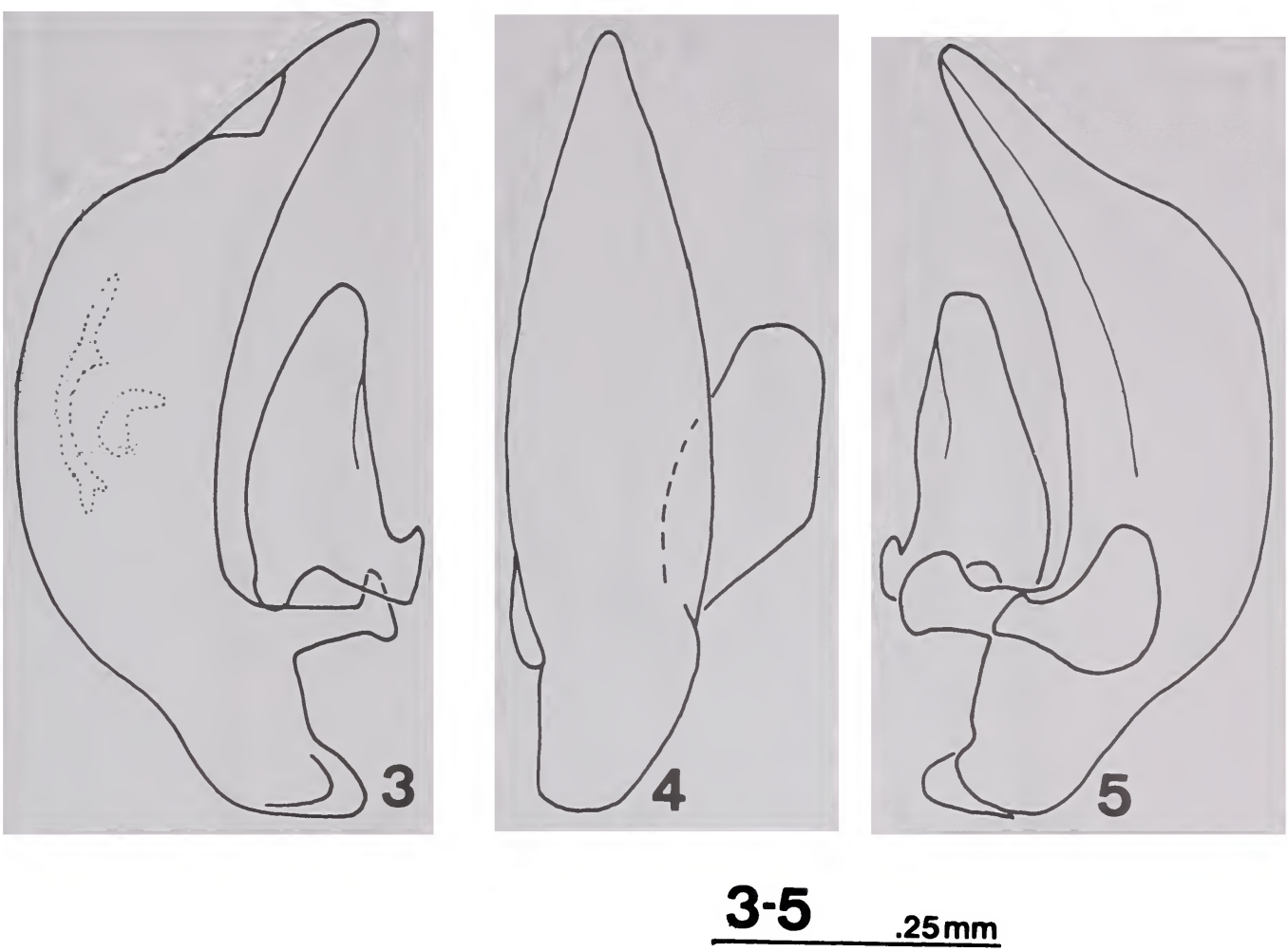


Figure 1. *Coarazuphium bezerra,* sp. n., male holotype, habitus.





Figures 2-5. *Coarazuphium bezerra,* sp. n., male holotype. 2, head and apex of pronotum, lateral view; 3-5, aedeagus, left, dorsal and right views.

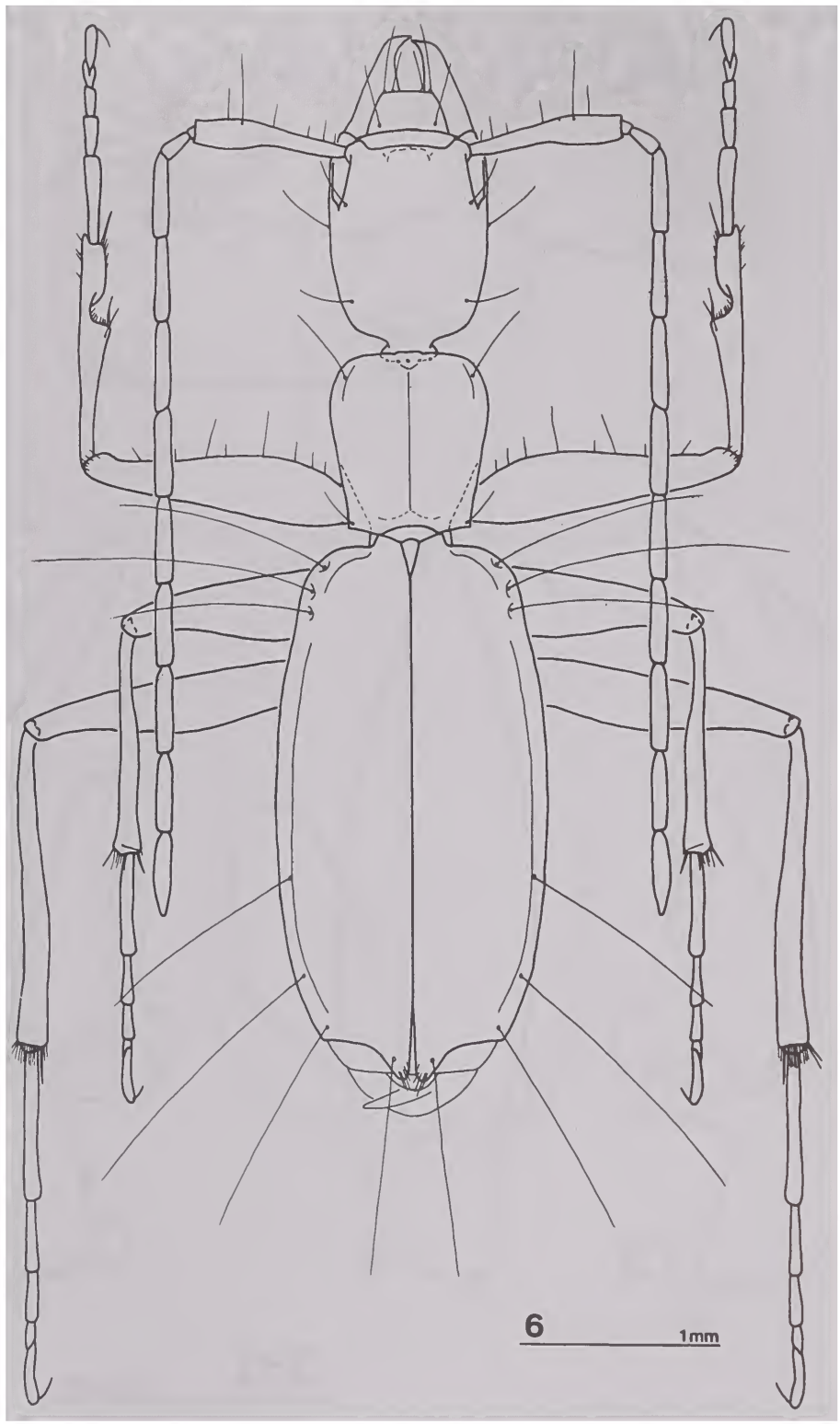
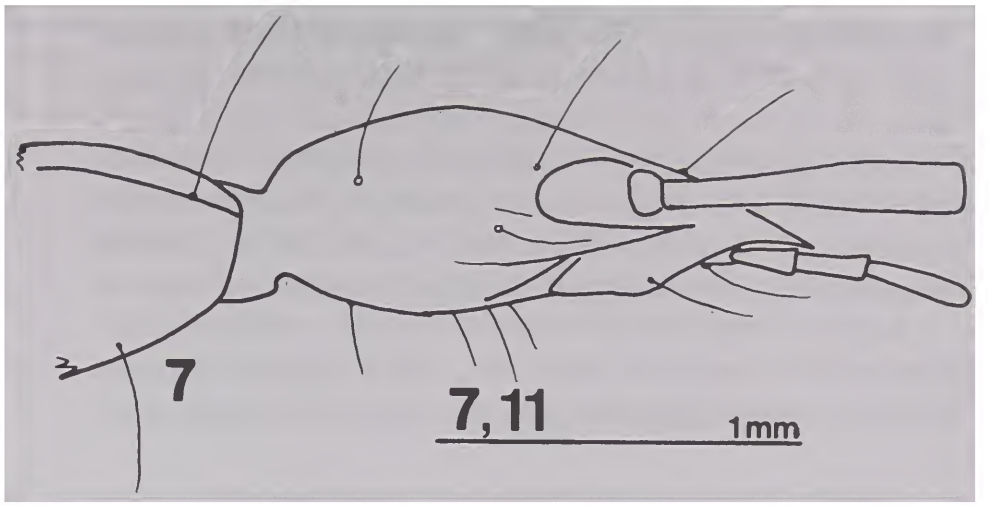
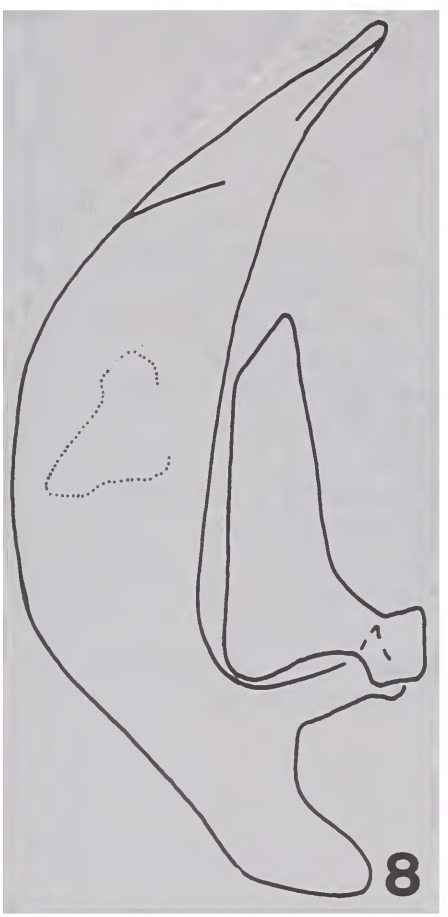
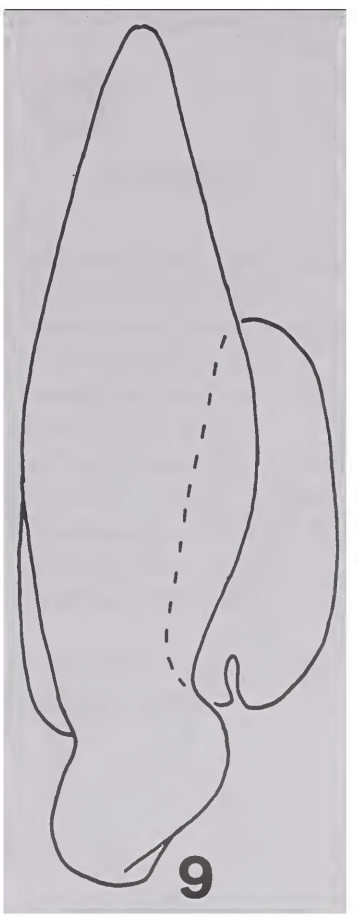
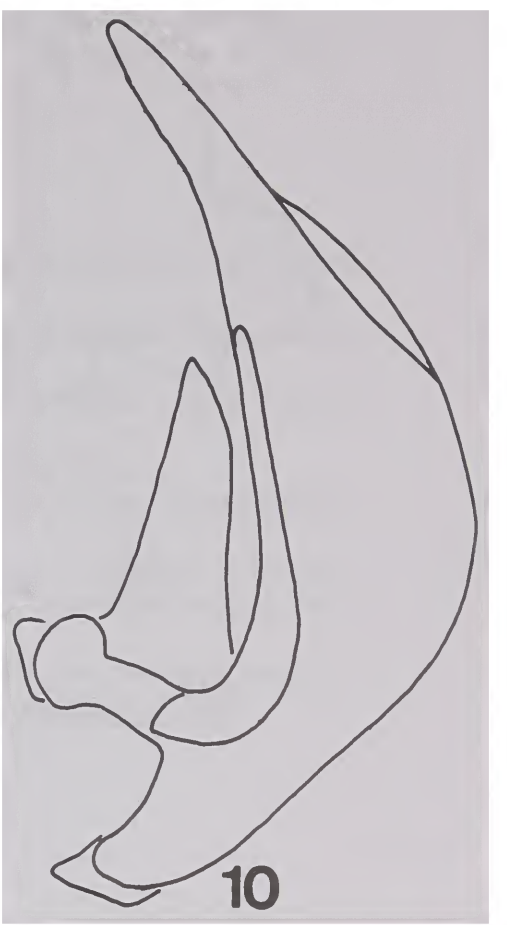


Figure 6. *Coarazuphium cessaima,* sp. n., male holotype, habitus.









8-10 .25mm

Figures 7-11. *Coarazuphium cessaima,* sp. n., male holotype. 7, head and apex of pronotum, latcral view; 8-10, aedeagus, left, dorsal and right views; 11, genital segment.

point of view, more species of *Coarazuphium* will be recorded, giving the possibility of a better understanding and of a phylogenetic and evolutionary study of the group.

On the other hand, as pointed out by Gnaspini & Trajano (1994), these highly derived troglobitic features are due to a long-term isolation inside the subterranean environments, which took place under the drier climate to which the region was in the past and is still submitted in the present. As is also discussed by that authors, it is largely accepted in the literature that cave arthropods are related to litter epigean and/or endogean ancestrals, which already inhabited humid habitats. Therefore, because the three known *Coarazuphium* spp. share

Figure 12. Map showing Brazilian Speleological Provinces (shaded province = Bambuí Speleological Province) and the type localities of *Coarazuphium spp.* (**b**= *C. bezerra;* **c** = *C. cessaima;* **t**= *C. tessai*).

synapomorphic characters (with which we herein defined this genus), the ancestral species should have been epigean and lived in forested (or, at least, humid) areas, and occurred at least in part of the region where the genus occur nowadays. From the ancestral, several lineages invaded the caves from the northern Bambuí Province, where they become isolated with the progressive shrinkage of humid environments. Thence, the origin of the genus takes back to the time when the area was not drying yet, which is probably the Tertiary.

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