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NEW SPECIES OF COPRINI (COLEOPTERA: SCARABAEIDAE: SCARABAEINAE) TAKEN FROM THE PELAGE OF THREE TOED SLOTHS (*BRADYPUS TRIDACTYLUS* L.) (EDENTATA: BRADYPODIDAE) IN CENTRAL AMAZONIA WITH A BRIEF COMMENTARY ON SCARAB-SLOTH RELATIONSHIPS

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NEW SPECIES OF COPRINI (COLEOPTERA: SCARABAEIDAE: SCARABAEINAE) TAKEN FROM THE PELAGE OF THREE TOED SLOTHS (*BRADYPUS TRIDACTYLUS* L.) (EDENTATA: BRADYPODIDAE) IN CENTRAL AMAZONIA WITH A BRIEF COMMENTARY ON SCARAB-SLOTH RELATIONSHIPS

BRETT C. RATCLIFFE[1]

ABSTRACT

Two of three species of Scarabaeidae associated with the three toed sloth in the vicinity of Manaus, Amazonas, Brazil are described as new: *Trichillum adisi* and *Uroxys besti*. The pupa and third stage larva of *T. adisi* are described. Ecological aspects of the sloth-scarab associations are discussed.

A project was initiated in 1977 at the Instituto Nacional de Pesquisas da Amazonia (INPA) in Manaus, Amazonas, Brazil, to learn more about the arthropods associated with the three toed sloth, *Bradypus tridactylus* L. The sloths inhabiting the forests in the vicinity of Manaus had various species of Scarabaeidae, Pyralidae, and Acarina dwelling in their fur, and an attempt was made to establish the relationship between the mammal host and its resident arthropods. One of the first steps in this study was to identify the organisms being dealt with, and during this process I established that two of the three species of Scarabaeidae found on the sloths in the Manaus area were undescribed. These two species are in the genera *Trichillum* and *Uroxys*.

Trichillum adisi Ratcliffe, new species

(Figs. 1-20)

Type Material.—Holotype male, labeled "BRASIL: Amazonas, Ilha do Curari, I-25-1978, R. Best, taken from *Bradypus tridactylus.*" Allotype female with same data as holotype. Types deposited at INPA-Manaus. Paratypes (117) with the following data: (a) as holotype (28 males, 27 females); (b) as holotype but with dates of IV-1978 (5 larvae, 3 pupae), VI-2-1977 (5 males, 2 females), VI-14-1977 (1 female), VI-24-1977 (1 male, 1 female), VII-18-1977 (3 males), VII-20-1977 (1 female); (c) BRAZIL: Amazonas, Paricatuba, VI-14-1977, J. Adis, taken from *Bradypus tridactylus* (2 males, 1 female); (d) Manaus, Amazonas, BRAZIL, VI-2-1977, J. Adis, taken from *Bradypus tridactylus* (12 males, 23 females); (e) BRASIL: Pará, Belem, Museu Goeldi, VII-7-1977, J. Adis, taken from *Bradypus tridactylus* (1 male, 1 female). Paratypes deposited in the collections of INPA (Manaus), Museu Paraense Emilio Goeldi (Belem), Universidad de São Paulo (São Paulo), Canadian National Collection of Insects (Ottawa), National Museum of Natural History (Washington, D.C.), American Museum of Natural History (New York), Field Museum of Natural History (Chicago), California Academy of Sciences (San Francisco), British Museum of Natural History (London), Muséum National d'Histoire Naturelle (Paris),

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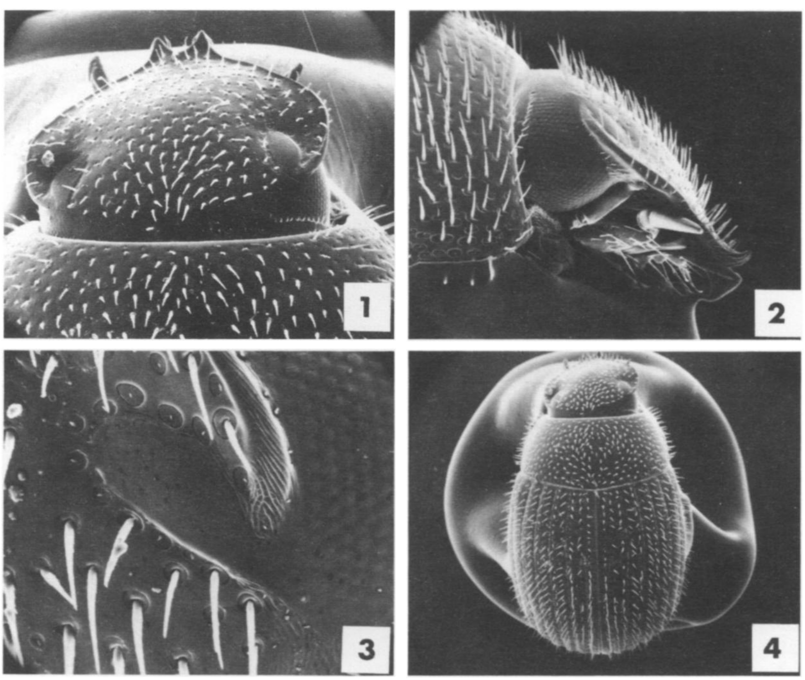
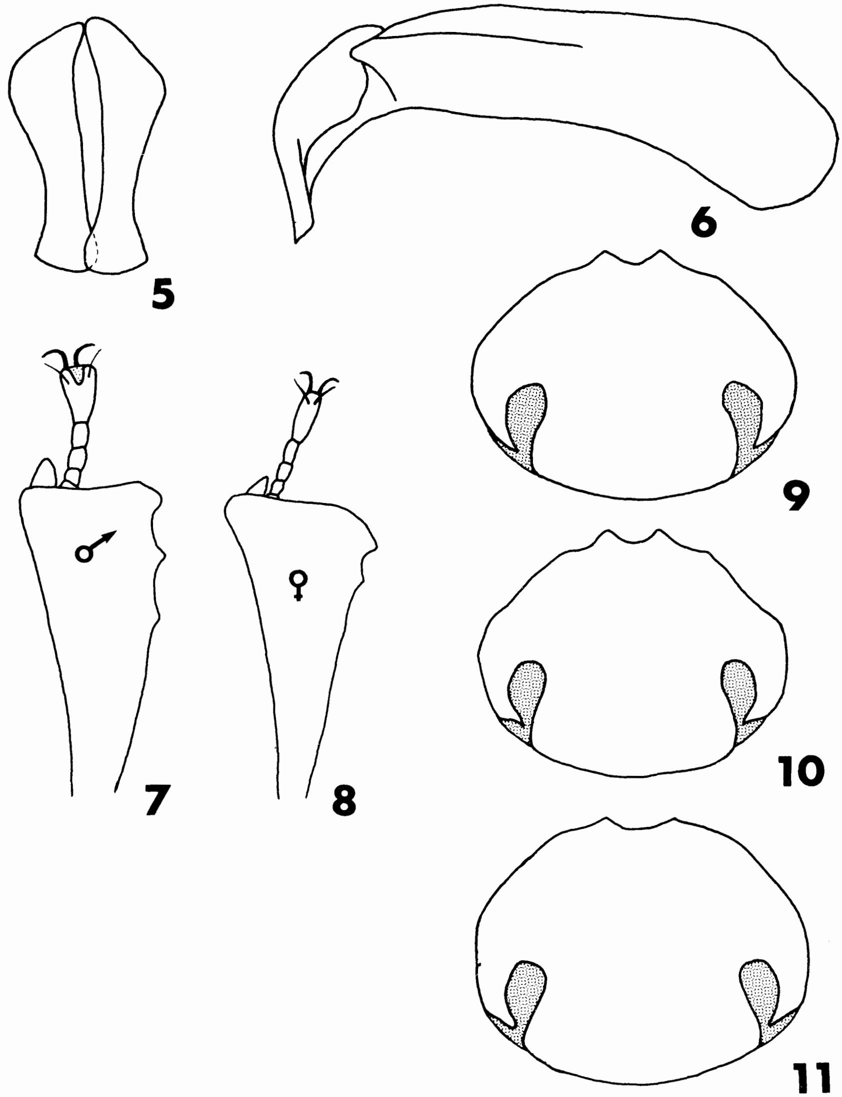
Zoologisches Museum der Humboldt Universität (Berlin), University of Nebraska (Lincoln), Henry F. Howden (Ottawa), Antonio Martinez (Buenos Aires), Brett C. Ratcliffe (Lincoln).

Holotype.–Male. Length 3.1 mm; greatest width 1.7 mm. Color piceus, strongly shining between punctures. *Head:* Frons and clypeus (Figs. 1-2) weakly and evenly convex, densely, setigerously punctate; punctures ocellate, moderately large, moderately deep, most separated by about 1 diameter; setae long, erect, straw colored. Surface between punctures impunctate, nearly smooth. Apex of clypeus with 2 acute teeth, notch between teeth broadly obtuse; a very feeble swelling laterad of each tooth. Base of eye (in dorsal view) (Fig. 3) abruptly narrowed by eye canthus, 3-4 facets wide. Interocular width 5.66 transverse eye diameters (at widest part of eye). *Metasternum:* Concave between middle coxae, densely, setigerously punctate; punctures small, separated by more than 1 diameter. Setae long, straw colored. *Pronotum:* Widest at base, sides gently curved, basal angle obtuse, anterior angle acute. Surface densely, setigerously punctate similar to head; punctures on disc ocellate, moderate in size, moderately deep, separated by about 1 diameter; punctures becoming a little larger and denser on sides, separated by less than a diameter; setae long, erect, straw colored. Surface between punctures impunctate, nearly smooth. Base finely margined. *Elytra* (Fig. 4): Sutural stria impressed. Eight impressed striae between suture and humerus, each stria consisting of a row of elongate punctures; punctures connected or nearly so, moderate in size, shallow. Intervals between striae weakly convex, nearly smooth except for 2 strong rows of setigerous punctures, one running length of each margin of interval; first interval (from suture) with only 1 row of setigerous punctures; punctures moderate in size, deep, separated by about 1 diameter; setae long, erect, straw colored. *Pygidium:* Convex in lateral



Figs. 1-4. *Trichillum adisi.* Fig. 1. Dorsal view of head. Fig. 2. Lateral view of head. Fig. 3. Dorsal view of right eye. Fig. 4. Dorsal view.

view, posterior border margined. Surface setigerously punctate, punctures small, shallow, separated by much less than a single diameter; setae moderate in length, erect, straw colored. *Genitalia* (Figs. 5-6): relatively simple, median margin of left paramere slightly overlapping median margin of right at apex. *Legs:* Forelegs with 5th tarsomere enlarged (Fig. 7), excavated dorsally at apex. Posterior tibia enlarged, but not strongly so.



Figs. 5-11. *Trichillum adisi.* Figs. 5-6. Caudal and lateral view of parameres. Figs. 7-8. Right foreleg of male and female respectively showing differences in tarsomeres. Figs. 9-11. Dorsal view of head illustrating variation in apex of clypeus.

Allotype.—Female. Length 2.9 mm; greatest width 2.0 mm. Color of head and pronotum piceous with faint cupreous sheen; elytra greenish black. As holotype except in the following respects: *Legs:* Forelegs with 5th tarsomere normal, not enlarged or dorsally excavated (Fig. 8).

Variation.—Males (52 paratypes): Length 2.3-3.2 mm; greatest width 1.5-1.9 mm. The paratypes do not differ appreciably from the holotype except for color and the form of the apex of the clypeus. Color ranges from ferrugineous (probably teneral specimen) to piceous (the majority) to head and pronotum piceous with a cupreous sheen and elytra greenish black. Apex of clypeus varies from simply bidentate to ocular lobe either side of clypeal teeth pronounced (Figs. 9-10).

Females (57 paratypes): Length 2.6-3.1 mm; greatest width 1.4-2.0 mm. The females vary in the same respects as do the males except that several female specimens were noted to have a nearly emarginate clypeal apex (Fig. 11) as opposed to a distinctly bidentate apex. The pronounced ocular lobes laterad of the clypeal teeth were not seen in any of the female examples.

Remarks.—The enlarged 5th tarsomere of the foreleg in the male immediately places this species in Martinez's (1967) subgenus *Eutrichillum* which now consists of seven species. *Trichillum adisi* differs from all other species in the subgenus in that it possesses biseriately punctate elytral intervals whereas the others have uniseriately punctate intervals.

Trichillum hirsutum Boucomont (1928) was unknown to Martinez (loc. cit.) when he reviewed the genus, and he questioned whether this species belonged with *Trichillum* or *Pedaridium.* He gave it the status of *incertae sedis* based on his lack of morphological information. Boucomont indicated in his description that *T. hirsutum* possessed biseriately punctate elytral intervals (similar to *T. adisi),* but the original description is otherwise too general to be of diagnostic value. I have examined the type of *T. hirsutum* (deposited at Paris) and have arrived at several interesting conclusions. The female type definitely belongs in the subgenus *Eutrichillum* of *Trichillum;* it is not a *Pedaridium.* Secondly, the elytral intervals ARE NOT biseriately punctate as originally described but are uniseriately punctate. The row of punctures in the first two intervals are lateral whereas the row of punctures in the remaining intervals are medial, but there is still only one row of punctures per interval. I have a series of *Trichillum* taken in baited pitfall traps in Manaus that are conspecific with the type of *T. hirsutum,* and I am now satisfied as to the easy separation of *T. hirsutum* and *T. adisi* based on the series of each species I have before me.

Because of the now clarified status of the species comprising the subgenus *Eutrichillum,* a key to the adults is presented as well as the subgeneric key proposed by Martinez (loc. cit.). Generic and subgeneric diagnoses are also found in Martinez (loc. cit.).

Key to the Subgenera of *Trichillum*

(after Martinez, 1967)

1. Hind tibia gradually widened to apex. Pronotum totally and uniformly setigerously punctate. Male with 5th tarsomere of anterior tarsus enlarged at apex, dorsally excavated to receive claws. Female with 5th tarsomere normal . . . . *Eutrichillum*

1′. Hind tibia abruptly and grossly enlarged at apex. Pronotum with disc smooth or microscopically punctate, only occasionally with a few setigerous punctures. Male with 5th tarsomere of anterior tarsus normal . . . . *Trichillum*

KEY TO THE SPECIES OF *Eutrichillum*

1. Elytral intervals distinctly biseriately punctate . . . . *adisi* Ratcliffe (Brazil)
1′. Elytral intervals distinctly uniseriately punctate 2

2(1′). Clypeofrontal carina present 3
2′. Clypeofrontal carina absent 4

3(2). Elytral striae faint. Length 3 mm . . . . *boucomonti* Saylor (Brazil, Paraguay)
3′. Elytral striae strongly impressed. Length 4 mm . . . . *hirsutum* Boucomont (Brazil)

4(2′). Head with front sparsely punctate . . . . . . *pauliani* Balthasar (Brazil)
4′. Head with front densely punctate 5

5(4′). Size small, length less than 2.5 mm . . . . *minutum* Saylor (Paraguay)
5′. Size large, length greater than 2.5 mm 6

6(5′). Clypeal and ocular lobes continuously rounded. Size less than 3 mm . . . . *vejdovsky* Balthasar (Bolivia)
6′. Clypeal and ocular lobes separately rounded. Size greater than 3.3 mm . . . . *hystrix* Arrow (Argentina)

Etymology.—This species is named in honor of Joachim Adis who collected many of the specimens in this study and who initiated the project of studying the arthropods living in the pelage of three-toed sloths in Manaus.

IMMATURE STAGES

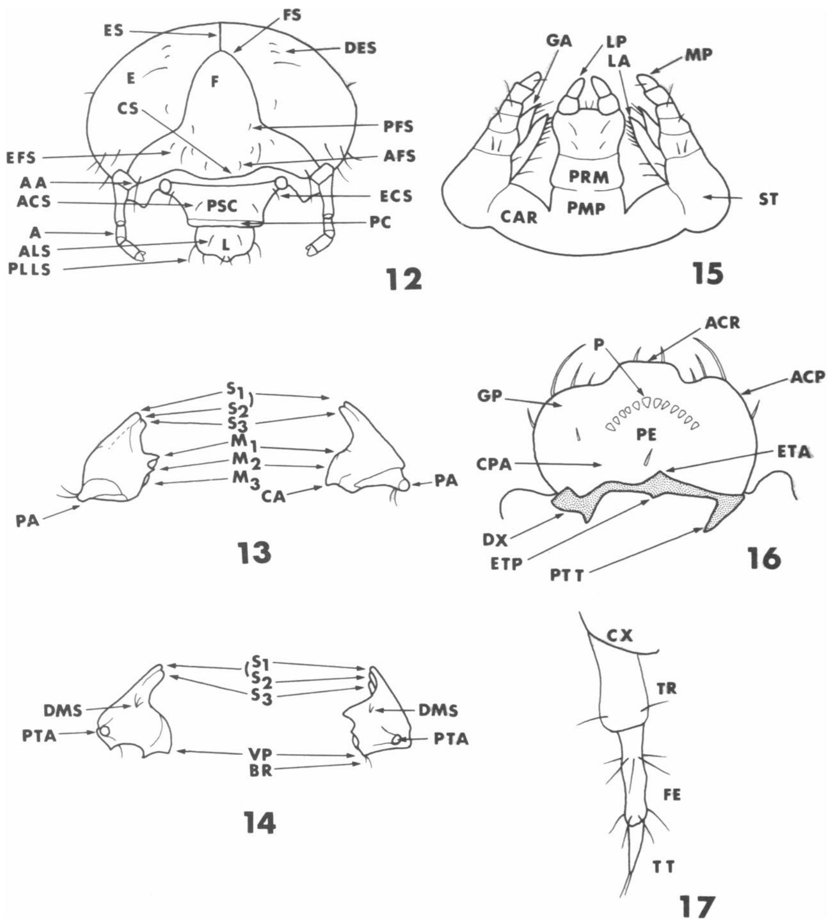
The immature stages of *Trichillum* were previously unknown and are here described. The descriptions are based on 5 third instar larvae and 3 pupae which were reared on sloth dung in the laboratory at INPA-Manaus. The immature stages were the progeny of adult beetles taken from local sloths and placed on sloth dung for breeding purposes. Larvae and pupae were found inside the small fecal pellets of the sloth. Manipulation and formation of sloth feces by adult beetles was not observed and may not occur; instead, the adult beetles probably utilize the fecal pellets in their present form and deposit an egg inside the pellet.

Trichillum adisi Ratcliffe

Third Stage Larva

(Figs. 12-17)

Larva scarabaeiform, only slightly hump-backed. Length 2.9-3.5 mm; width of head capsule 0.91-0.97 mm. Color cream white with sclerotized area darker.



Figs. 12-17. *Trichillum adisi,* 3rd instar larva. Fig. 12. Frontal view of head. A, antenna; AA, seta of anterior angle of frons; ACS, anterior clypeal seta; AFS, anterior frontal seta; ALS, anterior labral seta; CS, clypeal suture; DES, dorsoepicranial setae; E, epicranium; ECS, exterior clypeal seta; EFS, exterior frontal setae; ES, epicranial suture; F, frons; FS, frontal suture; L, labrum; PC, preclypeus; PFS, posterior frontal seta; PLLS, posterolateral labral setae; PSC, postclypeus. Fig. 13. Dorsal aspect of mandibles. CA, calyx; M_{1-3}, molar lobes; PA, preartis; S_{1-3}, scissorial teeth. Fig. 14. Ventral aspect of mandibles. As in Fig. 13 plus: BR, brustia; DMS, dorsomolar setae; PTA, postartis; S_{1-3}, scissorial teeth; VP, ventral process. Fig. 15. Ventral aspect of labium and maxilla. CAR, cardo; GA, galea; LA, lacinia; LP, labial palpus; MP, maxillary palpus; PMP, postmentum; PRM, prementum; ST, stipes. Fig. 16. Epipharynx. ACP, acanthoparia; ACR, acroparia; CPA, chaetoparia; GP, gymnoparia; DX, dexiotorma; ETA, anterior epitorma; ETP, posterior epitorma; P, phobae; PE, pedium; PTT, pternotorma. Fig. 17. Lateral view of left mesothoracic leg. CX, coxa; FE, femur; TR, trochanter; TT, tibiotarsus.

Cranium (Fig. 12): Surface smooth, not noticeably sculptured. Pre- and postclypeus (PC, PSC), labrum (L), and mandibles darker than epicranium (E). Epicranial suture (ES) distinct, slightly depressed, depression continuing forward longitudinally to about middle of the frons (F). Frontal suture (FS) weakly impressed, difficult to delineate, arcuate. Clypeofrontal suture (CS) depressed, distinct. Frons with following arrangement of setae: a single posterior frontal seta (PFS) near midpoint of lateral margin of frons on each side; 1 large and 2 small exterior frontal setae (EFS) on each side below posterior frontal setae; a single anterior frontal seta (AFS) near anterior margin of frons either side of middle; each anterior angle (AA) of frons with a single, long seta. Epicranium with 4 dorsoepicranial setae (DES) on each side.

Clypeus: Form trapezoidal. Postclypeus with a single anterior clypeal seta (ACS) either side of midline closer to lateral margin; a single long exterior clypeal seta (ECS) present in basal angle. Preclypeus poorly delimited from postclypeus.

Labrum: Form subquadrate, apex symmetrically trilobed. A single long anterior labral seta (ALS; Ratcliffe and Chalumeau, 1980) present on disc either side of middle; 2 long posterolateral labral setae (PLLS) on each lateral margin; apex with 2 setae immediately either side of midline.

Antenna: 4-segmented; first (basal) segment longest, segments 2-3 subequal in length, fourth segment extremely small and short, appearing as an appendage of third segment. Apex of third segment laterally with a very small sensory cone.

Mandibles (Figs. 13-14): Subtriangular, asymmetrical. Scissorial (cutting) area with 3 scissorial teeth ($S_{1\ 2\ 3}$) on left mandible, 2 scissorial teeth (S_{1+2}, S_3) on right mandible; teeth bladelike, subequal. Left mandible with molar area divided into 3 lobes, distal lobe (M_1) triangular, acute, larger than middle lobe (M_2); middle lobe triangular, acute, very small; basal lobe (M_3) large, obtuse. Right mandible with molar area bilobed, lobes (M_1 and M_2) obtuse, irregular in shape, M_1 smaller than M_2. Calyx present at base of proximal lobe. Basolateral angle of each mandible on dorsum with articulating area, the preartis (PA). Dorsum of each mandible lacking setae. Venter of each mandible with a compact cluster of about 1-3 very small setae; basomedial angle with a ventral process (VP); basolateral angle with knob-like postartis (PTA).

Maxilla (Fig. 15): Cardo (CAR), stipes (ST), galea (GA), lacinia (LA), and maxillary palpi (MP) present. Cardo subquadrate, longer than wide, gradually expanding from base. Stipes suboval, longer than wide. Galea subacuminate, with 2 large, stout setae at apex. Lacinia with acute apex and 6 strong, short setae on median margin. Maxillary palpus 4-segmented, all segments subequal in length; segments 1-2 each with a lateroapical seta, apical segment with a mediolateral seta. Base of palpifer with 2 strong spines.

Labium (Fig. 15): Ventral surface with large, subquadrate postmentum (PMP), subdivided prementum (PRM), and a pair of 2-segmented labial palpi (LP). Proximal sclerite of prementum with 2 setae at base and 2 setae on disc. Dorsal surface of glossa lacking setae. Oncylus (= hypopharyngeal sclerome) located posterior to dorsal surface of labial glossa, asymmetrical, produced anteriorly into an acute process.

Epipharynx (Fig. 16): Form subovate, apex symmetrically trilobed. Acroparia (ACR) with 2 slender setae. Acanthoparia (ACP) with 4 stout setae on each side. Gymnoparia (GP) present and distinct. Chaetoparia (CPA) bare except for a single short bristle. Pedium (PE) longer than wide, noticibly convex, bare except for a single strong bristle and a single moderate bristle near center; anterior border with 10-12 short spines (phobae) arranged in an arc. Tormae asymmetrical, united mesally. Laeotorma not differentiated from pternotorma (PTT); pternotorma elongate, triangular. Dexiotorma (DX) short, subquadrate. Posterior epitorma (ETP) present, distinct, triangular; anterior epitorma (ETA) present but not distinct.

Legs (Fig. 17): Subequal in length, each consists of short coxa (CX), long trochanter (TR), a long femur (FE), and a tibiotarsus (TT) about half the length of femur. A circlet of 5-6 short setae at middle and apex of femur, 2-3 setae near apex of trochanter; tibiotarsus with 2 small apical setae, apical claw lacking.

Body: Prothoracic shield with weak lateroanterior projections. Dorsa of abdominal segments each with a few moderately long setae in a transverse row. Pleural lobes with sparse, short setae. Venter of last abdominal segment without pallidia, instead teges with small, very sparse setae.

Trichillum adisi Ratcliffe

Pupa

(Figs. 18-20)

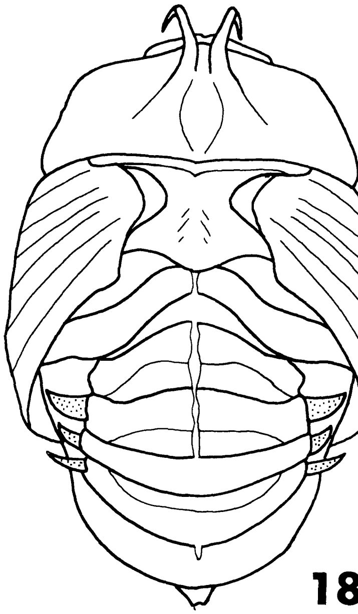
Length 3.0-3.1 mm. Shape oval, stout. Color white to castaneous in specimens close to eclosion. Head bent very sharply beneath thorax, mouthparts directed ventrally; antennae and palpi apparent; clypeus and front with numerous fine setose punctures. Pronotum glabrous, transverse, widest at base; disc longitudinally keeled either side of middle, keel extending forward into a long, filamentous support projection. Scutellum large, apex sinuate, clearly defined. Elytra and wings closely appressed and curving ventrally around body to about 7th abdominal segment; elytra with strong striae and fine setae visible. Legs with fine setae; last pair covered by wings. Abdomen with 9 segments, glabrous, spiracles not seen; segments 3-5 each with a stout, lateral filamentous support projection which is visible dorsally and laterally but less so ventrally because of wings; projections long, stout, fleshy, all subequal in length, last projection less stout than others.

Remarks.—The Scarabaeinae have previously been characterized (Ritcher 1966) as having 2-segmented legs, but this now seems to be inaccurate for all members of the subfamily in view of the 4-segmented legs reported here for *Trichillum adisi.* The *Trichillum* larvae observed in this study develop within a small fecal mass (similar to many other coprines), and so it would seem that their feeding strategies may be similar. If this is the case, however, the rationale for non-fusion of the leg segments (as opposed to other members of the subfamily) becomes unclear without further study. The lack of fusion of the leg segments may reflect different types of use or degree of use of these appendages in *Trichillum.*

Uroxys besti Ratcliffe, **new species**

(Figs. 21-25)

Type Material.—Holotype male, labeled "Manaus, Amazonas, BRAZIL, III-9-1978, R. Best, collected from *Bradypus tridactylus.*" Allotype female with same data as holotype except date of IV-24-1978. Types deposited at INPA-Manaus. Paratypes (92) with the following data: (a) as holotype (3 males, 3 females); (b) as holotype but with dates of I-28-1978 (1 male, 2 females), II-26-1978 (2 females), III-27-1978 (1 male, 11 females), III-28-1978 (2 females), IV-22-1978 (1 female), IV-24-1978 (2 males, 11 females), IV-26-1978 (1 male, 2 females), V-15-1978 (3 males, 3 females), V-31-1978 (3 males, 7 females), VI-1978 (4 males, 6 females), VI-2-1977 (2 males, 17 females; J. Adis Coll.), VI-18-1977 (1 female), VI-19-1978 (1 female), X-5-1977 (1 male); (c) BRASIL: Amazonas, Reserva Ducke, 26 km NE Manaus, IX-13-1977, B.C. Ratcliffe, dung pitfall trap (1 male). Paratypes deposited in the collections of INPA (Manaus), Museu Paraense Emilio Goeldi (Belem), Universidad de São Paulo (São Paulo), Canadian National Collection of Insects (Ottawa), National Museum of Natural History (Washington, D.C.), American Museum of Natural History (New York), Field Museum of Natural History (Chicago), California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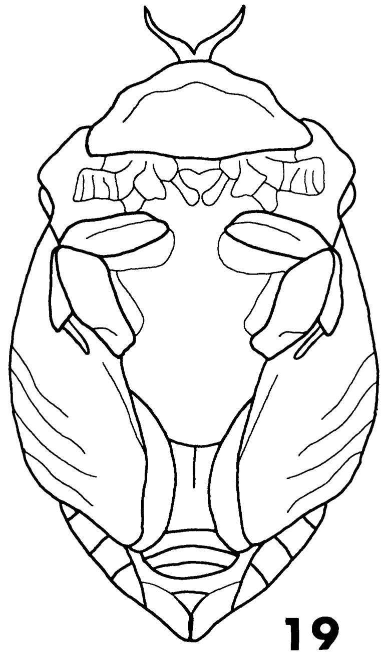
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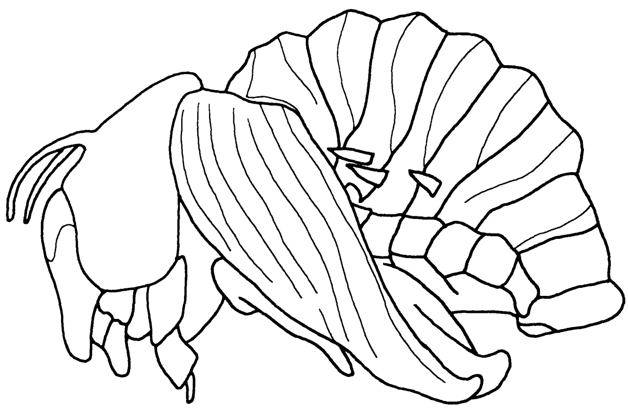
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Figs. 18-20. *Trichillum adisi*, pupa. Dorsal, ventral, and lateral views.

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Holotype.—Male. Length 7.4 mm; greatest width 4.4 mm. Color nearly black, very shining. Form as in Fig. 21. *Head* (Fig. 22): Front in form of semicircle due to form of clypeofrontal carina; surface weakly concave, densely punctate; punctures small and minute mixed, small punctures deep, separated by about 2 diameters; minute punctures shallow, sparsely interspersed among small punctures; non-punctate surface smooth, shining. Clypeofrontal carina a strong, forward projecting arc connected on each side to apex of eye. Clypeus bidentate at apex, each tooth strong, subtriangular and separated by a broad U-shaped notch; surface similar to that of front. Eye relatively large, eye canthus not strongly constricting eye at base; interocular width (as measured between apex of each eye) about 4.6 transverse eye diameters (at widest point of eye). *Metasternum:* Surface punctate as on front and clypeus; center base of sternite with an oval, shallow depression extending as a shallow, longitudinal sulcus anteriorly ⅔ distance of sternite. Sides between mesocoxae parallel for ⅔ length of mesocoxa then angled medially to form an acute point just posteromedially of suture between prosternum and mesosternum. *Pronotum:* Base with a transverse row of large, shallow punctures. Sides weakly arcuate at middle, widest at about apical third, narrowest at apical angle. Basal angle very broadly obtuse, apical angle a right angle. Surface densely punctate, punctures small and minute mixed; small punctures deep, separated by about 2 diameters; minute punctures shallow, sparsely interspersed among small punctures; non-punctate surface smooth, shining. Lateral sulcus nearly straight, longitudinal, deep. *Elytra:* Intervals densely punctate, punctures small and minute mixed; small punctures deep, separated by about 2 diameters; minute punctures shallow, sparsely interspersed among small punctures; non-punctate surface smooth, shining. Each stria strongly impressed (usually deeper at extreme apex) with large, shallow punctures separated by 1-2 diameters (closer posteriorly). *Pygidium* (Fig. 23): Convex in lateral view, twice as wide as long. Base weakly arcuate either side of middle, apex obtusely rounded. Surface punctate and shining as on head, pronotum and elytra. *Genitalia:* Figs. 24-25.

Allotype.—Female. Length 7.1 mm; greatest width 4.4 mm. As holotype except in the following respects: *Head:* Punctation denser, punctures separated by about 1 diameter on front and clypeus. Interocular width slightly greater. *Metasternum:* Punctation a little less dense than head, similar to holotype. *Pronotum:* Sides widest at about middle, not abruptly narrowed anteriorly at apical third as in holotype. *Pygidium:* A little more densely punctate as on head.

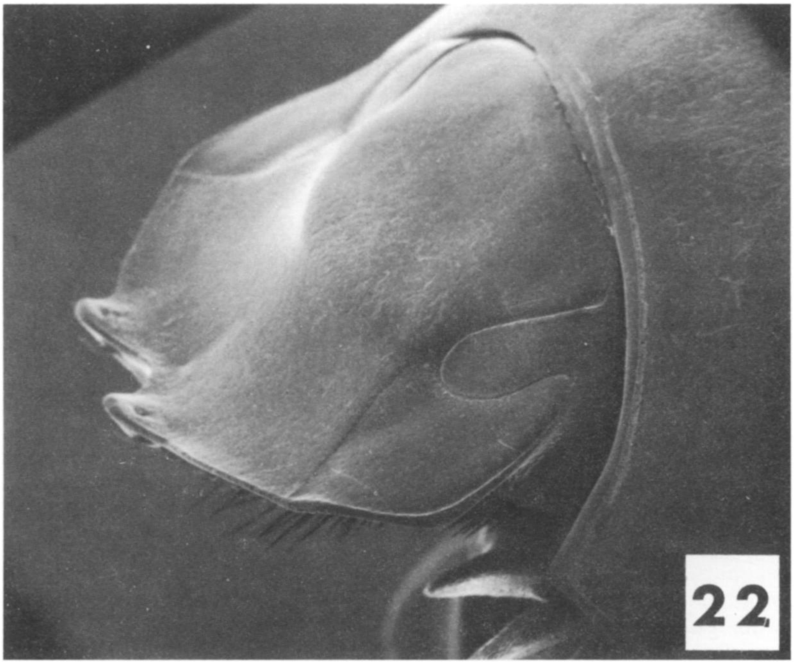
Variation.—Males (22 paratypes): Length 7.0-8.4 mm; greatest width 4.1-4.8 mm. The paratypes do not differ significantly from the holotype except for color and the form of the lateral pronotal sulcus. Color differs only slightly from dark to light piceous; the pronotal sulcus in some examples is longer and more curved inwardly at the apex, nearly reaching into the apical angle.

Females (70 paratypes): Length 5.5-8.8 mm; greatest width 3.2-4.5 mm. Variation among the females is slight. Color varies from ferruginous (teneral specimen) to light to dark piceous. Interocular width 4.0-4.7 transverse eye diameters. Head and pygidium as allotype to a little less punctate than allotype (i.e., similar to holotype). Lateral pronotal sulcus extends nearly into anterior angle of pronotum in a few specimens.

Remarks.—The very strong, curved frontoclypeal carina, relatively large eyes, large punctures at the base of the pronotum, distinctly punctured elytral striae, body size, and highly shining surface should serve to separate *Uroxys besti* from other species in the genus. *Uroxys besti* appears to resemble *U. gorgon* Arrow and *U. batesi* Harold, but the combination of characters listed above will characterize *U. besti.*

The pygidium is so highly lustrous in non-greasy specimens that the printed label beneath the specimen is usually reflected quite clearly on the pydigial surface.

Etymology.—This species is named in honor of Robin Best who collected many of the specimens from *Bradypus tridactylus.*



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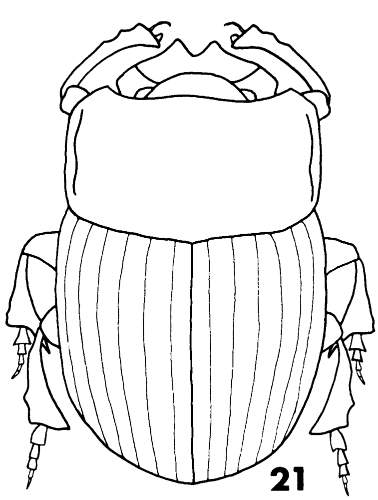

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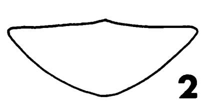

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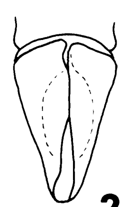

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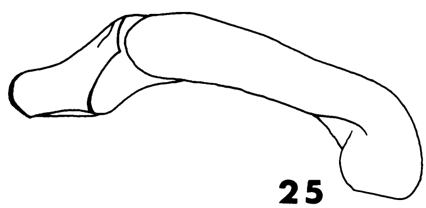

25

Figs. 21-25. *Uroxys besti.* Fig. 21. Dorsal habitus. Fig. 22. Dorsolateral view of head. Fig. 23. Caudal view of pygidium. Figs. 24-25. Caudal and lateral views of parameres.

Ecological Discussion

Scarab beetles found in the pelage of sloths have been reported only rarely. Boucomont (1928) reported *Trichillum* (now *Pedaridium* sensu Martinez, 1967) *bradyporum* from a living sloth *(Bradypus infuscatus=tridactylus)* in Costa Rica, and this occurrence was further discussed by Balthasar (1939) who briefly mentioned the presumed morphological adaptations of this beetle for living on sloths. Balthasar also stated that the *Trichillum* lived near the anus of the host feeding on traces of its excrement, but that is only speculation as Balthasar did not observe this. Arrow (1933) described *Uroxys gorgon* based on specimens taken from *Bradypus gorgon* (= *tridactylus*) in Colombia (not Costa Rica as given by Halffter and Matthews, 1966), and Martinez found specimens of a *Uroxys* sp. on a *Bradypus* in Bolivia (Halffter and Matthews, loc. cit.). Askew (1971) uncritically used literature sources to erroneously claim that *Uroxys gorgon* and *Trichillium* (sic) *brachyporum* (sic) were parasitic on *Bradypus.* In the Manaus region I have identified several specimens of *Uroxys,* probably *batesi* Harold, taken from the pelage of *Bradypus tridactylus,* but the sampling of sloths in this area has shown that *U.* prob. *batesi* is quite uncommon whereas the new *Trichillum* and *Uroxys* are relatively abundant.

The role played by scarabs living on sloths remains an enigma for the most part. It is generally suspected that these beetles are phoretic coprophages dwelling on the sloth until such time as it defecates. The scarabs can then abandon their host and feed on the freshly deposited dung. *Trichillum adisi* was seen to do this, and larvae and pupae were recovered from the small dung pellets of the sloth. Consequently, I am also able to describe the larva and pupa for this species. To my knowledge, however, no other scarab has been reported actually breeding in sloth dung . . . including the new *Uroxys* described here.

Sloths descend from the trees to defecate at approximately weekly intervals and *bury* their dung in a shallow hole excavated by the hind feet. Burial of the dung effectively and immediately precludes its utilization by generally foraging coprophages (Scarabaeidae, Diptera etc.) because it is not detectable and, therefore, never found. *Uroxys besti* was seen to shred and bury small portions of sloth dung in subterranean shafts (in the laboratory); they were not observed to produce young using the dung from the sloths from which they were collected. In no instance have immature Scarabaeidae been found in the fur or near the anus of a sloth, and I am certain that immature beetles do not develop there. The question remains, then, where do the larvae of sloth-inhabiting *Uroxys* develop?

There is also the question of how beetles detect and find a sloth host after the beetle emerges from the pupa (presumably a terrestrial or arboreal occurrence), or how disembarked beetles find a sloth host again after feeding or ovipositing away from the host (also presumably a terrestial or arboreal activity). Do the scarabs fly among the tree-tops searching randomly for sloths? Do they wait to pounce on sloths which have come down from the trees to defecate? Do they respond to odors from the sloths and orient to these odors? We do not know the answers to these questions.

Lastly, what are the activities of those scarabs that reside on a sloth host which is feeding in the canopy of a varzea (seasonally flooded) forest during high water? The sloths continue to descend at weekly intervals during high water, but now defecate into the water where the scarabs cannot follow. If the dung pellets of the sloth are a food resource and an oviposition site for these beetles, then the scarabs are up a tree (as it were) for 2-5 *months* out of the year while the forest is flooded. What are the beetles feeding on? Where do the larvae develop? Do the adults leave the sloths and, if so, where do they go? Do they inhabit the arboreal nests of other mammals and birds where they might find fecal material for food? Scarabs living on sloths which are feeding in inundation forests continue to provide us with more questions than we have answers.

Robin Best (INPA-Manaus) conducted several tests in Manaus on the attractiveness of sloth dung using baited pitfall traps placed in forested areas where dung beetles were known to occur commonly. His results were dramatic because NO coprophagous insects were attracted to the dung pellets. Best noted (personal communication, 1977) that others working on sloth ecology had also observed a singular absence of coprophagous insects feeding on sloth dung with the exception of certain Pyralidae (Lepidoptera) (Waage and Montgomery, 1976). Not only are sloth feces generally unavailable to coprophages (because it is buried) but it is also apparently very unattractive to these animals. It would appear, then, that when adult or larval scarabs do feed on sloth dung, it is a specialized strategy for obtaining food and for avoiding competition.

This may be especially true for *Trichillum adisi* described in this study. I have observed (Ratcliffe, in preparation) that *Trichillum boucomonti* Saylor and *Trichillum hirsutum* Boucomont showed a distinct preference for carrion over human feces during a prolonged period of baited pitfall trapping in forests near Manaus: *T. boucomonti:* 81% carrion, 19% feces, sample size 94 (study A); *T. hirsutum:* 92% carrion, 8% feces, sample size 12 (study A); *T. hirsutum:* 93% carrion, 7% feces, sample size 16 (study B). Howden and Nealis (1975) also demonstrated carrion preference of an undetermined *Trichillum* in their study at Leticia, Amazonas, Colombia. During a five day period of trapping in February 1972, Howden and Nealis observed no *Trichillum* at monkey or human feces, but three specimens were taken at carrion. During a subsequent five day period of trapping in February 1974, no *Trichillum* were taken at human feces, but one specimen was taken at carrion.

The evidence to date suggests that members of the genus *Trichillum* are primarily saprophages which occasionally resort to coprophagy. While there is no evidence to indicate that *Trichillum adisi* is not also saprophagous (except for negative pitfall data in areas where sloths and presumably sloth beetles are known to occur), the coprophagy exhibited by this species for sloth dung might indicate a radical shift in foraging behavior to exploit a previously little-utilized food source as well as to decrease the intense competition for food resources that has been reported for Neotropical dung beetles.

In summary, parasitism by these scarabs can be ruled out as there is no evidence to support this hypothesis. *Trichillum adisi* is known to be phoretic and undoubtedly gains added protection by living in the pelage of the sloth as well as presumably being assured a regular food supply and oviposition site. This mode of life, or variations of it, may hold true for other Scarabaeinae which live on *Bradypus*. Apparently no advantage is gained by the sloth host for harboring these insects, thus denying a commensal relationship.

Uroxys besti demonstrated no inclination to oviposit on the dung of its host, and so we do not know what the larvel habits are; the strong feeling remains, however, that it too is a phoretic coprophage.

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