



Taxonomic review of the Neotropical genus *Moriosomus* Motschulsky (Insecta: Coleoptera, Carabidae, Morionini) with notes on the way of life of the species

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Abstract

Moriosomus Motschulsky 1855 is a Neotropical genus containing three species in the carabid beetle tribe Morionini. *Moriosomus* adults are found under tree bark and in rotting logs in rainforests; larvae are unknown. This revision of *Moriosomus* includes diagnoses, descriptions, illustrations, and distributional data for all three known species, including *Moriosomus motschulskyi* Erwin & Moore, **new species** (“PERU, HUÁN[UCO], Divisoria,” Cordillera Azul, 1600m, 08° 54' 0 S, 075° 40' 0 W). We provide an identification key to the species based on adult external structure. We clarify the date of the description of the genus *Moriosomus*, which is 1855, rather than 1864 as it is often incorrectly cited in the literature. In addition, we define the tribe Morionini and provide a key for identification of the two genera resident in the Western Hemisphere.

Key words: Colombia, Costa Rica, Nicaragua, Ecuador, Panamá, Perú, INBio, Carabidae, Morionini, *Moriosomus* Motschulsky 1855

Resumen

Moriosomus Motschulsky 1855 es un género Neotropical que contiene tres especies de la tribu Morionini de carábidos. Los adultos de *Moriosomus* se encuentran bajo la corteza y sobre ramas en putrefacción en los Bosques Lluviosos, sus larvas son desconocidas. Esta revisión de *Moriosomus*, incluye diagnóstico, descripción, identificación y distribución de las tres especies conocidas, incluyendo *Moriosomus motschulskyi* Erwin & Moore, **nueva especie** (“PERU, HUÁN[UCO], Divisoria,” Cordillera Azul, 1600m, 08° 54' 0 S, 075° 40' 0 W). Se incluye una clave de identificación de las especies basada en caracteres morfológicos externos de los adultos y la fecha de descripción del género *Moriosomus* es 1855, enés de 1864, comúnmente citada incorrectamente en la literatura, es esclarecida. Además, definimos la tribu Morionini y proveemos una clave para la identificación de los géneros presentes en el Hemisferio Occidental.

Palabras clave: Colombia, Costa Rica, Nicaragua, Ecuador, Panamá, Perú, INBio, Carabidae, Morionini, *Moriosomus* Motschulsky 1855

Introduction

Moriosomus Motschulsky 1855 is a Neotropical genus in the carabid beetle tribe Morionini. *Moriosomus* was known to contain two species: *M. seticollis* Straneo 1985, described from two specimens, one each from Ecuador and Colombia, and the commoner and widespread Central American species *M. sylvestris* Motschulsky 1855, known from Lower Middle America (Fig. 1). In this paper, we revise this genus, including description of a third species from Perú, *Moriosomus motschulskyi* Erwin & Moore, **new species**.

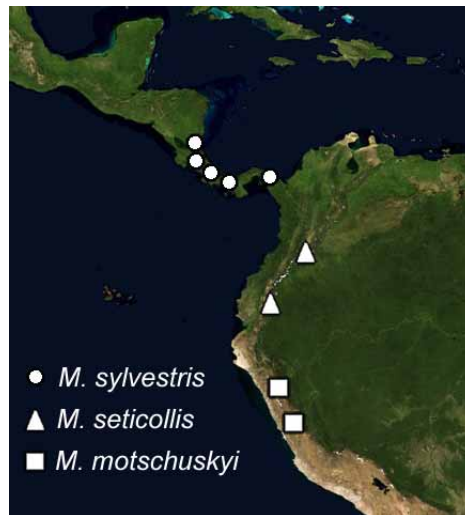


FIGURE 1. Map of Lower Middle America, the West Indies and northwestern South America in the Western Hemisphere, featuring the known distribution of *Moriosomus* Motschulsky.

Moriosomus species are generally found in rotting logs (Will, 2006, and numerous specimen label notes made by F. Nevermann in Costa Rica). Adults of the Central American species, *M. sylvestris*, are fully winged and live below 1100m altitude, whereas adults of the two South American species, *M. seticollis* and *M. motschuskyi* n. sp., are flightless and known only from the highlands above 1500m. Within Carabidae, flightlessness is commonly associated with species living at higher altitudes, or on islands.

This is the seventh in a series of papers with diagnoses of new taxa and re-descriptions of known taxa in the beetle family Carabidae from Costa Rica (Erwin 2000, 2002, 2004a, 2004b, 2004c; Erwin *et al.* 2004) and other Neotropical countries. Previous contributions toward our knowledge of the Neotropical carabid fauna include Erwin (1973a, 1973b, 1974a, 1982, 1991, and 1994).

Materials and Methods

Species boundaries were judged by examination of the external structural features of adults. Species concepts follow those previously described for carabid beetles (Erwin & Kavanaugh 1981, Kavanaugh & Erwin 1991). The formats for species diagnosis and the validation of scientific names follow, as closely as possible, those suggested in Erwin & Johnson (2000) and applied in Erwin (2000, 2004a, 2004b, 2004c). Information on all three *Moriosomus* species will be posted in the Encyclopedia of Life, Smithsonian Institution website (<http://www.eol.si.edu>) and the Tree of Life (<http://www.tolweb.org>).

Ninety-three specimens of *Moriosomus* were examined for this study. Specimens were either borrowed from, or studied at, the following institutions: Academy of Natural Sciences, Philadelphia (ANSP); California Academy of Sciences, San Francisco (CASC); Field Museum of Natural History, Chicago (FMNH); INBio, San José/Santo Domingo, Costa Rica (INBio); Kansas University Natural History Museum (SEMC); Museum of Comparative Zoology, Harvard University, Cambridge (MCZC); National Museum of Natural History, Washington, DC (NMNH), University of Alberta, Strickland Museum, Edmonton (UASM); the American Museum of Natural History (AMNH) and the Kipling Will Collection at the University of California, Berkeley (KWWC).

The habitus images of the adults were taken with a Wild M400 microscope and AutoMontage software. Leg orientation differs among habitus images. Figure captions include an ADP number, which is a unique identification number for the specimen that was illustrated or photographed and links the specimen and associated illustrations and/or image to additional information in electronic databases at the NMNH.

Geographical data are presented for species based on all known specimens available at the time of manuscript preparation. Georeferences have been determined from locality information provided on specimen labels. We report latitude and longitude in degrees, minutes and seconds and we use “0” for minutes or seconds that are not available. We provide a distribution map for the Costa Rican species, *M. sylvestris* (Fig. 8). Here, English vernacular names are proposed, as common names are becoming increasingly needed in conservation applications.

Length and width measurements follow the conventions suggested by Ball (1972) and Kavanaugh (1979). Apparent body length (ABL) is measured from apex of labrum to apex of longer elytron. Standardized body length (SBL) is the sum of the lengths of the head (measured from the apex of the clypeus to a point on midline at level of the posterior edge of the compound eyes), pronotum (measured from apical to basal margin along midline), and elytron (measured from apex of scutellum to apex of the longer elytron). Total width (TW) is measured across both elytra at their widest point.

Accounts of Taxa

Tribe Morionini Brullé, 1835

Diagnosis: Head with deep frontal depressions, dentiform processes project above antennal insertion points, antennomeres 4–11 moniliform, eyes prominent (except in the two species of *Hyperectenus* Alluaud, 1935 occurring in western and central Africa). Pronotum with deep linear depressions posteriorly along each side of midline. Elytron with plica not externally visible. Fore tibia with apex expanded and with an apico-laterally produced spine (except in the five species of *Morionidius* Chaudoir, 1880 occurring in the Oriental Region) (see Will 2003).

Notes. Adults are shiny and deep black to piceous (pitchy-brown). According to Allen (1968), five characters define this tribe; antennomeres 4–11 moniliform, elytra with internal plica (not visible externally), pronotum with 4–12 setae on lateral margin, interneur 8 with setiferous punctures forming a zig-zag pattern rather than a straight line, and endophallus with a sclerotized rod-like process. However, as noted by Will (2003), none of these character states are present in all members of this tribe. In fact, moniliform antennae is the only character state shared by all morionine species. A worldwide revision of the tribe is needed.

New World Genera of Morionini

Morion Latreille 1810

Moriosomus Motschulsky 1855

Key to the Neotropical Genera of Morionini

- 1 Mentum tooth without a medial notch. Pronotum and elytra markedly convex; form short. Male with biseriate white squamo-setae ventrally on tarsomeres 1–3 of forelegs.....*Moriosomus* Motschulsky
- 1' Mentum tooth with a medial notch. Pronotum and elytra depressed or slightly convex; form elongate. Male with biseriate white squamo-setae ventrally on tarsomeres 2–3 of forelegs.....*Morion* Latreille

***Moriosomus* Motschulsky, 1855**

Type species: *Moriosomus sylvestris* Motschulsky, 1855:19, original monotypy.

Type locality: Obispo, Panamá.

Proposed English vernacular name. Robust carabid beetles.

Diagnosis. Mentum tooth without medial notch. Body robust, pronotum and elytra convex, pronotum with lateral margins rounded anteriorly, posteriorly with short distinct sinuation near hind angle (Figs. 2–4).

Description. Size medium for tribe and family, ABL = 11.5 to 17.2 mm, SBL = 11.3 to 17 mm, TW = 4.0 to 5.8 mm. *Luster:* Surface shiny. *Head:* Antennae with scape glabrous, antennomeres 2–3 with ring of setae at apex, antennomere 4 sparsely setiferous in apical 2/3; antennomeres 5–11 densely setose on lateral margins, sparsely setiferous along midline; labial palpus with penultimate palpomere bisetose, other palpomeres glabrous. *Pterothorax:* Scutellum small; elytra convex; humerus moderately prominent with small dentiform projection; parascutellar interneur absent; intervals convex. *Legs:* Hind legs arched, otherwise normal for Morionini. Male with biseriate white squamo-setae ventrally on tarsomeres 1–3 of forelegs. *Abdomen:* Abdomen with sterna III–VI glabrous other than a pair of ambulatory setae on each; sternum VII with a latching device on the lateral dorsal margin (as noted in Allen 1968 for *Morion*). *Male genitalia* (Figs. 5–7): Phallus anopic; in dorsoventral aspect (Figs. 5a–b, 7a–b) broad, basal bulb crested, dorsal surface extensively membranous, apex more or less broadly subtruncate; laterally (Figs. 5c–7c), with shaft curved ventrad, apical portion narrowed and bent sharply. Endophallus with or without patches of microtrichia. Parameres (Figs. 5b–7b) glabrous, left wider than right, latter more or less digitiform. *Female reproductive tract* (Fig. 8): Spermathecal gland and associated diverticula attach at the base of the spermatheca; gonocoxite-2 as long as gonocoxite-1, narrow and with acute apex, otherwise similar to *Morion monilicornis* Latreille (see Liebherr and Will, 1998, Fig. 41).

Geographic distribution. The geographical range of this genus extends in Lower Middle America from Nicaragua to Panamá, and in northwestern South America from Colombia southward to Perú (Fig. 1). Both South American species are known from the cis-Andean highlands above 1500m, whereas the Central American species is found only below 1100m.

Notes. Date of the first description of *Moriosomus* is cited by many previous authors as 1864. However, Motschulsky first described the type species, *M. sylvestris*, in 1855 at which time he included that species in the new genus *Moriosomus* (see Appendix for details).

Species of *Moriosomus* Motschulsky

Moriosomus motschulskyi Erwin & Moore **new species**, Perú.

Moriosomus seticollis Straneo 1985. Colombia, Ecuador.

Moriosomus sylvestris Motschulsky 1855. Costa Rica, Nicaragua, Panamá.

Key to the species of *Moriosomus* Motschulsky 1855

- 1 Clypeus with anterior margin shallowly emarginated; Elytron with interval 7 carinate or costiform in posterior third 2
- 1' Clypeus bilobed medially, dentiform laterally, each dentiform projection setose; Elytron with interval 7 rounded, not carinate *M. motschulskyi* Erwin & Moore **n. sp.**
- 2(1) Elytron with interneurs punctuate; Interval 7 carinate in posterior third; Pronotum with four setae on each lateral margin; Prosternum, including intercoxal process, glabrous; Submentum with four setae
..... *M. sylvestris* Motschulsky

- 2' Elytron with interneurs smooth; impunctate, Interval 7 costiform in posterior third; Pronotum with with six setae on each lateral margin; Prosternum, including intercoxal process, sparsely setose; Submentum with two setae*M. seticollis* Straneo

***Moriosomus motschulskyi*, Erwin & Moore, new species**

(Figs. 2, 5)

Holotype. “Peru: Huán[uco], Divisoria,” Cordillera Azul, 08° 54’ 0 S, 075° 40’ 0 W, 1700m, September 25, 1946, F. Woytkowski. (AMNH: ADP108774, male).

Derivation of specific epithet. The word “motschulskyi” is a Latinized genitive eponym, based on the surname of Victor Ivanovitsch Motschulsky, also known as Victor von Motschulsky, a Russian entomologist who first recognized the genus *Moriosomus*.



FIGURE 2. *Moriosomus motschulskyi*, Erwin & Moore, **new species**, male, ADP108774, habitus, ABL=14.5 mm.

Proposed English vernacular name. Motschulsky’s robust carabid beetle.

Diagnosis. With the attributes of the genus as described above and elytral intervals impunctate, interval 7 evenly rounded, not carinate; and clypeus bilobed medially, dentiform paramedially, each dentiform projection setose. Size relatively large for genus, SBL > 15.5 mm.

Description. (Fig. 2). Size relatively large, ABL = 15.9 to 17.2 mm, SBL = 15.8 to 17.0 mm, TW = 5.8 mm. *Color:* Head, pronotum and elytra black, legs dark rufous, base of tibia and tarsomeres of middle and posterior legs infuscated. *Microsculpture:* Dorsal surface with very fine transverse sculpticells. *Head:* Frons glabrous, clypeus bilobed medially, dentiform paramedially, each dentiform projection setose; labrum emarginate with 5–6 setae on anterior margin; mandibles large with scrobe wide, lateroventral margin of mandible explanate and markedly rounded; submentum with two pairs of setae. *Prothorax:* Pronotum markedly convex, wider than long, with seven setae along lateral margin, six evenly distributed in anterior 2/3 and one at hind angle, lateral margin beaded in posterior 2/3; prosternum including intercoxal process sparsely setose. *Pterothorax:* Metepisternum subquadrate, lateral and anterior margins subequal, Metasternum sparsely setose, Elytra not fused along suture. Elytral interneurs smooth, impunctate. Metathoracic wing small scale, vestigial. *Abdomen:* Sternum VII at posterior margin with a pair of ambulatory setae. *Male genitalia:* (Fig. 5) Phallus

progressively more infuscated distally; basal bulb crested (Fig. 5a), broadly rounded; ostium length 2/3 shaft length, ventral left margin (Fig. 5b) markedly sinuate, ventral right margin slightly sinuate; apex flattened dorso-ventrally, markedly curved ventrally (Fig. 5c), and broadly rounded. Endophallus with two microtrichial fields. Parameres (Fig. 5b): left in ventral aspect slightly oblong, with distal margin broadly rounded, longer and broader than right.

Dispersal potential. These beetles are flightless and therefore they must walk to disperse. Accordingly, the species may be expected to have a markedly restricted geographical range.

Way of life. Available evidence suggests that this species may be confined to high altitude forests and that its members are active in the dry season.

Other specimens examined. Allotype, female (NMNH: ADP108833). Perú: Huánuco, Chichao, 25 km below Carpish, 09° 43' 0 S, 076° 06' 0 W, 2500m, September 9, 1946, F. Woytkowski.

Geographic distribution. This species is known only from two specimens from two localities in Huánuco Department, Perú, in the Cordillera Oriental of the Andes.

Moriosomus seticollis Straneo

(Figs. 3, 6, 8)

Type specimens. **Holotype** not examined. Colombia: without precise locality data. Straneo Collection, Genoa, Italy, male. **Paratype** examined. Ecuador: Pichincha, W. San Juan, old road, Quito - Sto. Domingo, under logs, 00° 39' 0 S, 078° 21' 0 W, 1981–2134 m, June (Ecuador Expedition 1982, H.E. Frania Collection #122), (NMNH: ADP108773, male).

Proposed English vernacular name. Hairy-thorax robust carabid beetle.



FIGURE 3. *Moriosomus seticollis* Straneo, male, ADP108773, habitus, ABL= 13.5 mm.

Diagnosis. With the attributes of the genus as described above and pronotum as long as wide or slightly longer than wide, lateral margin with six setae; elytron with interneurs smooth, not punctulate; submentum with two setae; prosternum and prosternal intercoxal process sparsely setose. Size medium, SBL = 15mm.

Description. (Fig. 3). Size medium, ABL = 14 to 15.6 mm, SBL = 15 mm, TW = 4.9 to 5.2 mm (smaller measures from Straneo 1985). *Color:* Head, pronotum and elytra black, legs very dark rufous. *Microsculpture:* Dorsal surface of head with isodiametric sculpticells, dorsal surface of pronotum and elytra with very fine transverse sculpticells. *Head:* Frons setose, two setae on left side, one seta on right side; clypeus shal-

lowly emarginate, with one seta on each side near anterior margin; labrum emarginate with six setae on anterior margin; mandibles relatively narrow for genus, lateroventral margin of mandible slightly explanate; submentum with one pair of setae. *Prothorax*: Pronotum markedly convex, slightly longer than wide, with six setae along lateral margin, five evenly distributed in anterior 2/3 and one at hind angle, lateral margin beaded; prosternum and prosternal intercoxal process sparsely setose. *Pterothorax*: Metepisternum about quadrate, lateral margins slightly longer than and anterior margin, metasternum sparsely setose. Elytra apparently fused along suture. Interval 7 carinate; Interneurs of elytron smooth, impunctate. Metathoracic wing small scale, vestigial. *Abdomen*: Sternum VII with four or five setae in males and two setae in females. *Male genitalia*: (Figs. 6a–c) Phallus progressively more infuscated distally; basal bulb crested (Fig. 6a), subacute; ostium length 2/3 shaft length; ventral left and right margin slightly sinuate (Fig. 6b); apex flattened dorso-ventrally, curved ventrally, and broadly rounded (Fig. 6c). Endophallus unarmed, microtrichial fields not apparent. Parameres subequal in length; left paramere in ventral aspect (Fig. 6b) almost quadrate, distal margin very broad, subtruncate. *Female reproductive tract* (Fig. 8): Spermathecal gland and associated diverticula attach at the base of the spermatheca; gonocoxite-2 as long as gonocoxite-1, narrow and with acute apex.

Dispersal potential. Like adults of *M. motschulskyi*, these beetles are flightless and therefore they must walk to disperse. Accordingly, the species may be expected to have a markedly restricted geographical range.

Way of life. Available evidence suggests that this species may be confined to high altitude forests and that its members are active in the dry season.

Other specimens examined. ECUADOR: COTOPAXI PROV., Las Pampas vic., 1800–2000m, 00° 25' 0 S, 078° 57' 0 W April–May (K.W. Will) (KWWC: 5 females, 4 males) (CASC: 1 female, 1 male).

Geographic distribution. Adults of this species have been recorded from Colombia and Ecuador, in the Cordillera Oriental of the Andes.

Moriosomus sylvestris Motschulsky

(Figs. 4, 7, 9)

Type specimens. According to Keleinikova (1976), three syntypes from Panamá are in the Collection of the Zoological Museum in Moscow. A lectotype has not been designated. Type material was not examined. According to Motschulsky (1855: 200, see Appendix), these specimens were collected from the virgin forests of Obispo, Panamá.

Proposed English vernacular name. Lowland robust carabid beetle.



FIGURE 4. *Moriosomus sylvestris* Motschulsky, male, ADP007358, habitus, ABL= 12.8 mm.

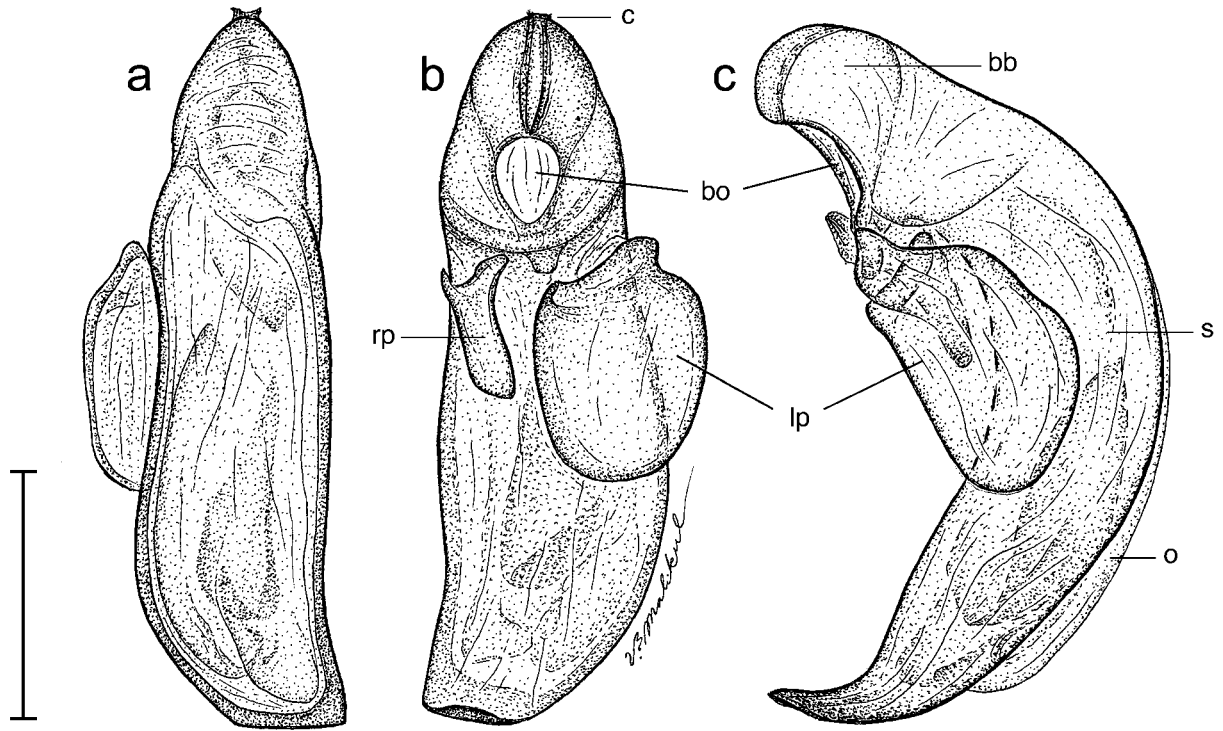


FIGURE 5. *Moriosomus motschulskyi* Erwin & Moore, **new species**, ADP108774. Male genitalia, including phallus, endophallus, and parameres – (a) dorsal aspect, (b) ventral aspect, and (c) left lateral aspect. Legend: bb— basal bulb; bo—basal opening; c—crest of basal bulb; s—shaft; o—ostium; rp—right paramere; lp—left paramere.

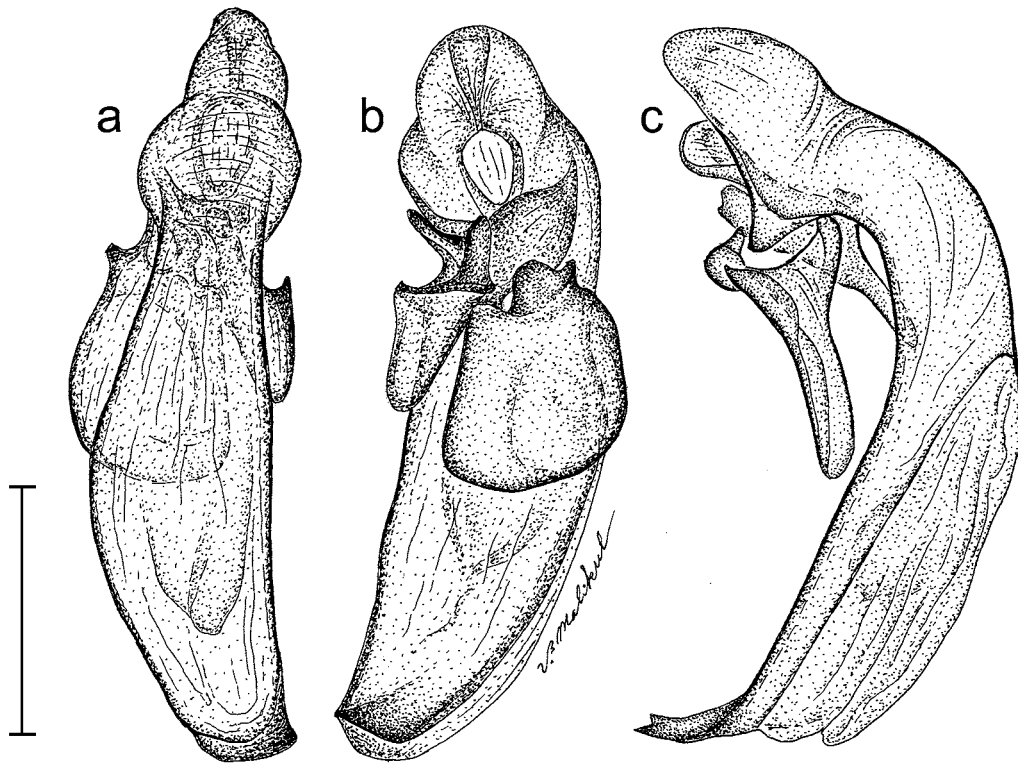


FIGURE 6. *Moriosomus seticollis* Straneo, ADP108773. Male genitalia, including phallus, endophallus, and parameres – (a) dorsal aspect, (b) ventral aspect, and (c) left lateral aspect.

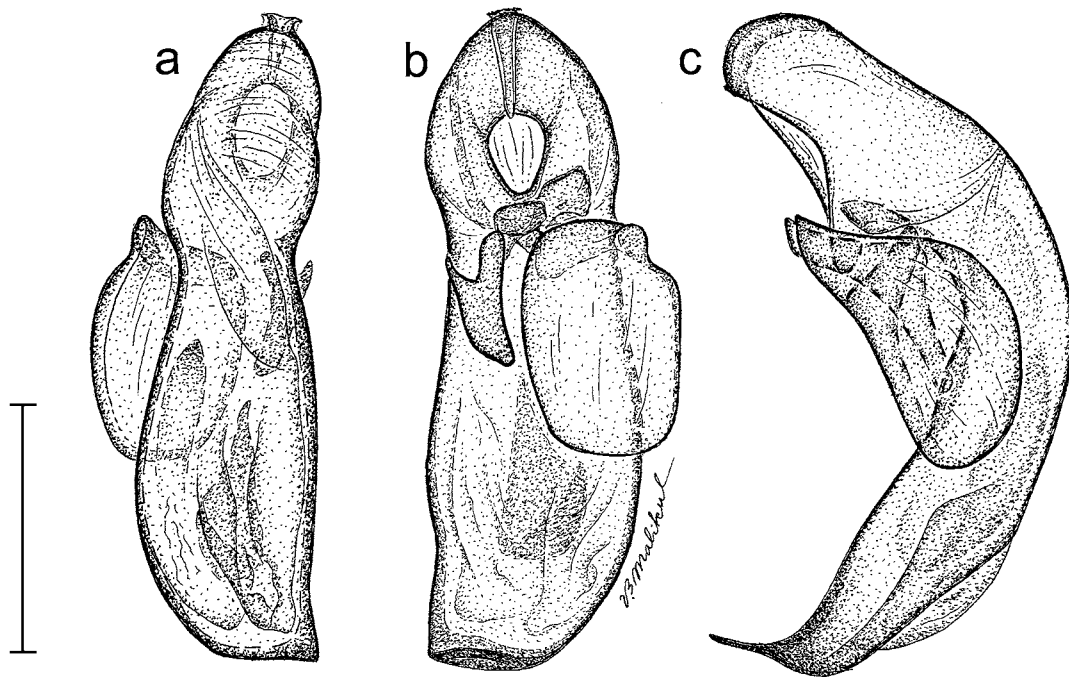


FIGURE 7. *Moriosomus sylvestris* Motschulsky, ADP003301. Male genitalia, including phallus, endophallus, and parameres – (a) dorsal aspect, (b) ventral aspect, and (c) left lateral aspect.

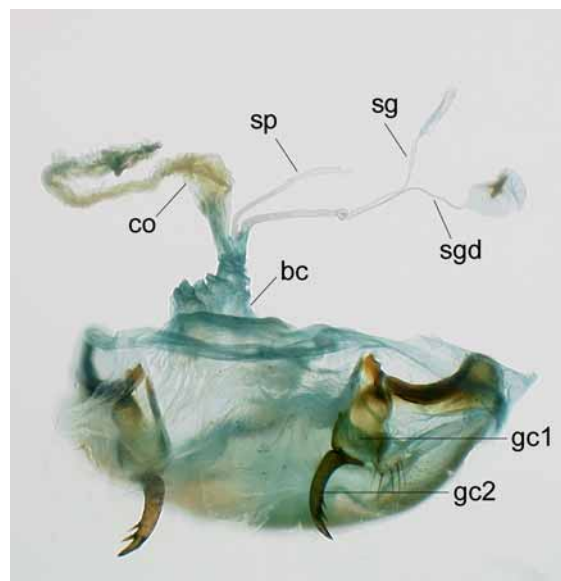


FIGURE 8. *Moriosomus seticollis* Straneo. Ventral view of female reproductive tract. bc = bursa copulatrix; co = common oviduct; sp = spermatheca; sg = spermatheca appended gland; sgd = spermatheca gland duct diverticula; gc1 = gonocoxite-1; gc2 = gonocoxite-2.

Diagnosis. With the attributes of the genus as described above and pronotum wider than long, lateral margin with four setae; elytron with interneurs punctulate; submentum with four setae; prosternum and prosternal intercoxal process glabrous. Size relatively small for genus, SBL < 14.6 mm.

Description. (Fig. 4). Size relatively small, ABL = 11.5 to 14.5 mm, SBL = 11.3 to 14.3 mm, TW = 4.0 to 4.6 mm. *Color:* Head, pronotum and elytra black, legs very dark rufous, base of tibia and tarsomeres of mid-

dle and posterior legs infuscated. *Microsculpture*: Dorsal surface with microlines shallowly impressed, effaced in some areas, sculpticells transverse. *Head*: Frons glabrous, clypeus shallowly emarginate, with one seta on each side near anterior margin; labrum emarginate with six setae on anterior margin; mandibles large with scrobe wide, lateroventral margin of mandible explanate and rounded; submentum with two pairs of setae. *Prothorax*: Pronotum markedly convex, wider than long, with four setae along lateral margin, three evenly distributed in anterior 2/3 and one at hind angle, lateral margin beaded in posterior 2/3; prosternum and prosternal intercoxal process glabrous. *Pterothorax*: Metepisternum with lateral margins twice as long as anterior width, metasternum with one pair of setae. Elytra separate from one another. Interval 7 carinate, markedly so in posterior 1/3; interneurs punctate (Fig. 4). Metathoracic wing normally developed. *Abdomen*: Sternum VII with a pair of setae posteriorly in males and females. *Male genitalia*: (Figs. 7a–c). Phallus slightly infuscated distally; basal bulb crested (Fig. 7a), subacute; ostium length less than 1/2 shaft length; ventral surface (Fig. 7b) distad basal opening slightly tuberculate (not apparent on illustration); apex narrowly rounded. Endophallus with one large microtrichial field; tubular without obvious margins; Parameres subequal in length; left paramere (Fig. 7b) in ventral aspect distinctly oblong, with distal margin broadly rounded.

Dispersal potential. This species seems to have the best dispersal potential of the three described species in the genus. Adults are fully winged and the species has a relatively wide range.

Way of life. Available evidence suggests that this species may be confined to lowland tropical forests in association with rotting logs and that its members are active in all months of the year.

Other specimens examined. COSTA RICA: Alajuela, P.N. Guanacaste, Sect. San Ramon, 620m, 10° 52' 59" N, 085° 24' 28" W, LN318100,381900, March (K. Taylor) (INBIO: CRI002211334, #2763, female), E.B. San Ramon, R.B. San Ramon, 27 km N & 8 km W San Ramon, 810m, 10° 13' 04" N, 084° 35' 46" W, July (J. Ashe, R. Brooks & Z. Falin) (KUNHM: ADP106581, #CRIABF00 076, male); CARTAGO, Turrialba, 600m, 09° 53' 0" N, 083° 39' 0" W, LN574947,208307, (CAS: ADP007358, male; CAS, ADP007360, female), (O. Bryant) (CAS: ADP008580, female), June – July, (K.W. Cooper) (MCZ: ADP048515, sex unknown), Estación Barbilla, P.N. Barbilla, 2 km S Turrialba, Sendero a Rio Barbilla, 600m, 09° 58' 52" N, 083° 27' 15" W, LN5963870, 218279, February (W. Arana) (INBIO: INB0003130187, #61588, female), IICA Experimental Station - CATIE, 1.6 km N Turrialba, Rio Reventazon, 600m, 09° 53' 0" N, 083° 39' 0" W, LN574947, 208307, June–July (K.W. Cooper) (MCZ: ADP048522, sex unknown); GUANACASTE, Estación Cacao, P.N. Guanacaste, SW slope, Volcán Cacao, 1000 – 1400m, 10° 59' 26" N, 085° 25' 40" W, LN323300, 375700, September (C. Chaves) (INBIO: CRI000331766, #87, female), Estación Pitilla, P.N. Guanacaste, 9.0 km S Santa Cecilia, 700m, 10° 59' 33" N, 085° 25' 46" W, LN330200,380200, August (C. Moraga) (INBIO: CRI001639919, #2322, male; CRI002029798, #3198, female), November (C. Moraga) (INBIO, CRI001162525, #2449, female), July (F.A. Quesada) (INBIO: CRI000499872, #1, male), January (P. Rios) (INBIO: CRI002214592, #4358, female), February (P. Rios, C. Moraga & R. Blanco) (INBIO: CRI000124249, male), August (INBIO, CRI002051854, #3171, female); HEREDIA, Los Arbolitos, 30m, 10° 38' 36" N, 084° 00' 12" W, LN536100, 291400, March (F. Araya) (INBIO: CRI001676857 = ADP087194, #1952, male), Estación Biológica La Selva, 3.0 km S Puerto Viejo, Finca La Selva, 50 – 150m, 10° 25' 55" N, 084° 00' 32" W, LN535500, 268000, July (J.C. Solomon) (NMNH: ADP027722, female), Estación El Ceibo, Z.P. La Selva, 400 – 600m, 10° 19' 40" N, 084° 04' 49" W, LN527700,256500, April (C. Chaves) (INBIO: CRI000210626, #73, male), Puerto Viejo, 5 mi. Up Sucio River, R.T. Allen 1965 (UASM, female) ; LIMÓN, Finca Colombiana, April (W.M. Mann) (NMNH: ADP007359, female), Parismina, Finca Salvadora, 10m, 10° 12' 0" N, 083° 38' 0" W, December (F. Nevermann) (NMNH: ADP003310, male, ADP007354, female), Puerto Limón, Toro Amarillo, 300m, 10° 00' 0" N, 083° 02' 0" W, November (F. Nevermann) (NMNH: ADP003312, female; ADP003311, female; ADP007355, female; ADP007357, female), Rio Reventazon, Ebene, Hamburg Farm, 10m, 10° 15' N, 083° 28' W, March (F. Nevermann) (NMNH: ADP003307, female), August (NMNH: ADP003305, female; ADP003306, female), September (NMNH: ADP003300, male; ADP003303, female; ADP007353, female), October (NMNH: ADP003304, female; ADP003301, male; ADP003302, female), 18 km E Guapiles, Las

Mercedes, 10m, 10° 10' 0 N, 083° 37' 0 W, February (F. Nevermann) (NMNH: ADP003309, female), nr Guapiles, La Emilia, 250 – 300m, 10° 13' 0 N, 83° 47' 0 W, September (D. Rehn) (ANSP: ADP068104, male), P.N. Tortuguero, Agua Fria, Sendero Real, 50m, 10° 25' 14" N, 083° 34' 52" W, LN266825, 582339, August (W. Porras, B. Gamboa, D. Brinceno, & M. Moraga) (INBIO: INB0003871792, male), R.B. Hitoy Cerere, Talamanca, Cerro Bitarkara, 1025m, 09° 38' 25" N, 083° 08' 15" W, LS398841, 558082, October (B. Gamboa) (INBIO: INB0003888874, #78494, female), R.V.S. Barra del Colorado, Rio Sardinias, 10m, 10° 34' 0 N, 83° 32' 0 W, LN291500, 564700, July (F. Araya) (INBIO; CRI000690608 = ADP093613, female), October (INBIO: CRI002355209 = ADP093613, #6336, female), R.V.S. Barra del Colorado, 30.0 km N Cariari, Sector Cerro Cocori, Finca de E. Rojas, 150m 10° 35' 29" N, 083° 42' 29" W, LN286000, 567500, January (E. Rojas) (INBIO: CRI001856266, #2549, female; CRI001856293, #2549, female; CRI001856294, #2549, male), R.V.S. Gandoca-Manzanillo, Manzanillo, 0m, 09° 38' 00" N, 082° 43' 00" W, LS398100,610600, August (K.E. Taylor) (INBIO: CRI000763404 = ADP005404, female), Estación Hitoy Cerere, R.B. Hitoy Cerere, 100m, 09° 40' 34" N, 083° 01' 33" W LN184600, 643400, March (E. Rojas) (INBIO: CRI002413180, #49775, male; CRI002413179, #49775, female), March–April (G. Carballo) (INBIO: CRI000445411, female), R.V.S. Jaguarandi, R.V.S. Barra del Colorado, 30.0 km N Cariari, Sector Cerro Cocori, Finca de E. Rojas, 150m, 10° 32' 24" N, 083° 42' 59" W, LN286000, 567500, April (E. Rojas) (INBIO: CRI000768578, female; CRI000768633, male; CRI001786337, #2824, female); PUNTARENAS, P.F. Golfo Dulce, Peninsula de Osa, Rancho Quemado, 200m, 08° 40' 44" N, 083° 34' 00" W, LS292500, 511000, June (F.A. Quesada) (INBIO: CRI000861949, male; CRI000861952, male), July (INBIO: CRI000736362, female), August (INBIO: CRI000889745, male), September (INBIO: CRI001190431, female), R.V.S. Golfito, Golfito, Sector El Tajo, 100–200m, 08° 40' 11" N, 083° 11' 55" W, LS291500, 551500, September (W. Porras, B. Gamboa, D. Brinceno, & M. Moraga) (INBIO: INB0003881119, #76846, male), Estación Agujas, P.N. Corcovado, Golfito, Sendero Homo, 250–350m, 08° 32' 12" N, 083° 25' 03" W, LS276750, 526650, July (R. Gonzales) (INBIO: INB0003309842, #57250, male), Sendero Ajo, 300m, 08° 32' 12" N, 083° 25' 03" W, LS276750,526650, September (A. Azofeifa) (INBIO: INB0003364193, #64437, female), Estación Esquinas, Peninsula de Osa, 200m, LS301400,542200, June (J. Quesada) (INBIO: CRI001132028, female), Estación Quebrada Bonita, P.N. Carara, Potero Grande, Buenos Aires, Los Angeles, 700m, 09° 03' 30" N, 083° 06' 58" W, LS334500, 560500, February (M. Ramirez, J.F. Quesada, G. Mora, & M.A.Zumbado) (INBIO: CRI002502016, #45471, male; CRI002502015, #45471, female), Estación Quebrada Bonita, R.B. Carara, Táracoles, 50m, 09° 46' 0 N, 084° 36' 0 W, LN469850, 194500, March–April (P. Campos) (INBIO: CRI000545040, female), April (R.A. Zuniga) (INBIO: CRI001024597, female), August (R.M. Guzmán) (INBIO: CRI002326724 = ADP87588, #6176, male; CRI002326725 = ADP87588, #6176, female), November (J. C. Saborio) (INBIO: CRI001969744 = ADP087572, #2470, female), Estación Sirena, P.N. Corcovado, Peninsula de Osa, 0–100m, 08° 28' 0 N, 083° 35' 0 W, LS270500, 508300, February (G. Fonseca) (INBIO: CRI000126941, female), March (G. Fonseca) (INBIO: CRI002441354, female), March–April (G. Fuentes) (INBIO: CRI000772536, male), April (G. Rodriguez) (INBIO: CRI000496092, female; CRI000496120, female), June (N. Obando) (INBIO: CRI000278302 = ADP087592, female; CRI000644482 = ADP087592, female), June (J.C. Saborio) (INBIO: CRI000328904, female), Estación Tuva, R.V.S. Rio Pior, Golfito, 0–50m, 08° 24' 21" N, 083° 20' 31" W, LS262284, 535746, September (B. Gamboa) (INBIO: INB0003881119, #78218, female); SAN JOSÉ, San José, 1160m, 09° 56' 0 N, 084° 05' 0 W, (M.V. Valerio) (NMNH: ADP003313, male; ADP003314, female). **PANAMA:** Canal Zone, Barro Colorado Island, 9° 10' N, 079° 50' W, May, (P.J. Darlington, Jr.) (MCZ: ADP0003315, male; ADP0003316, female), January (H. Dybas) (FMNH: ADP0007356, male), May (R.T. Allen) (NMNH: ADP0011069, male; ADP0011070, male); PANAMA, Cerro Campana, 1000m, 08° 40' N, 079° 56' W, December (T.L. & L.J. Erwin) (NMNH: ADP0003308, female). **NICARAGUA:** none.

Geographic distribution. The geographical range of this species extends in Lower Middle America from Panamá to Nicaragua (Bates 1882). The distribution of this species within Costa Rica is shown in Figure 8.

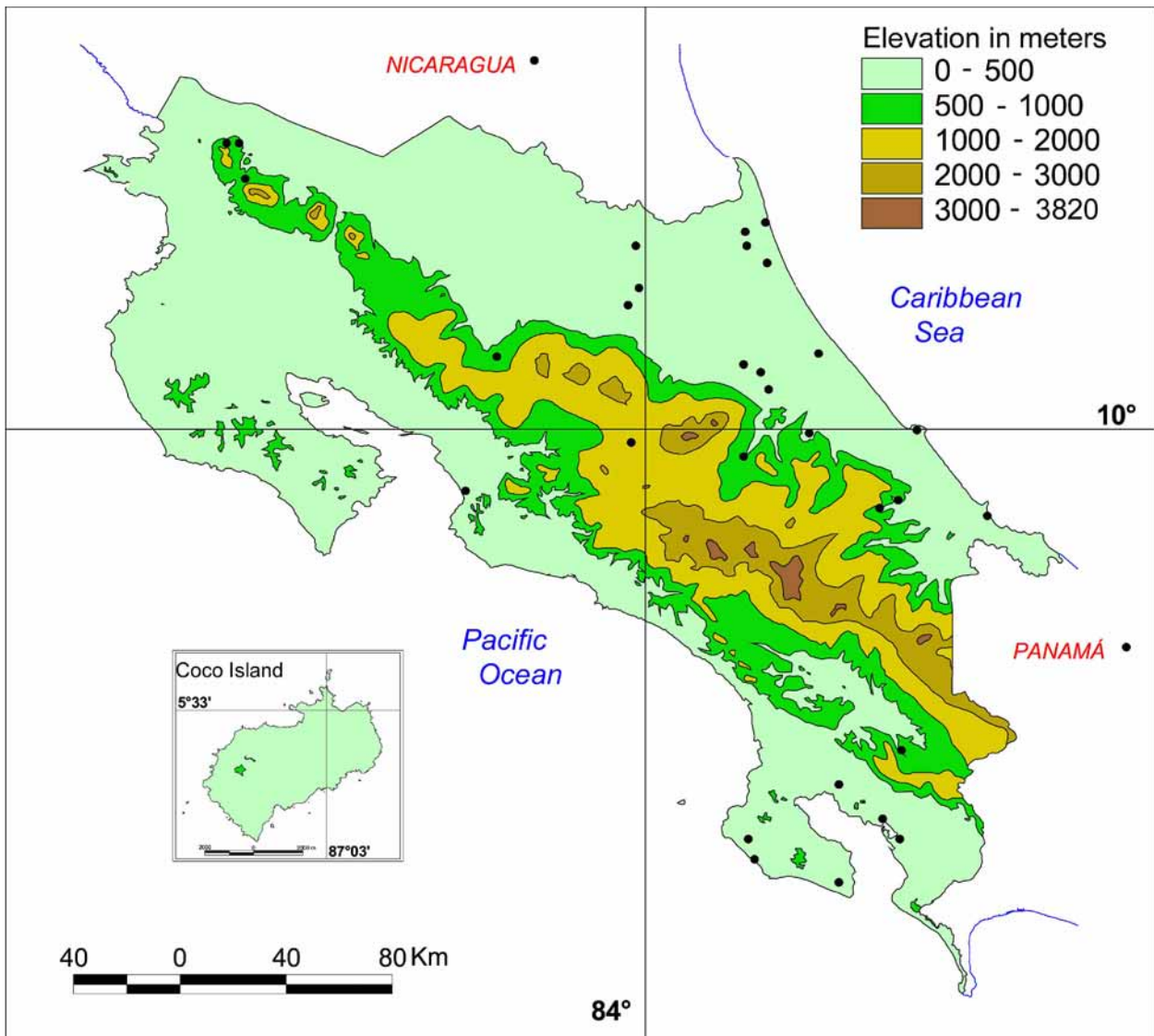


FIGURE 9. Distribution of the species of *Moriosomus* Motschulsky in Costa Rica: *Moriosomus sylvestris* Motschulsky (open circle, ○).

Evolutionary considerations

Given that, until now, there were only two known species of *Moriosomus*, there are no well-supported evolutionary or biogeographic patterns noted for this genus. However, we note potential patterns that may be emerging with the discovery of the third species. The two South American species (*M. motschulskyi* and *M. seticollis*) occur only in the highlands and they are both flightless and relatively rare, whereas the Central American species (*M. sylvestris*) occurs only in the lowlands and lower uplands and specimens are fully winged and broadly distributed. *Moriosomus motschulskyi* and *M. seticollis* share some morphological attributes that are not present in *M. sylvestris*, such as smooth elytral interneurs, sparsely setose intercoxal process, and the presence of a pair of ambulatory setae on sternum VII. Future phylogenetic analyses of *Moriosomus* species and species in closely related genera will reveal whether or not these characters are apomorphies defining a sister-group relationship between the two South American species.

Concluding statement

We predict that additional species of this genus will be discovered in isolated valleys within the higher altitudes of the Andean region from Bolivia to Colombia. Adults can be sought under fallen logs and under the bark of fallen trees. Future discoveries and descriptions of additional species of *Moriosomus* will provide more information regarding the evolutionary and biogeographic history of this Neotropical lineage.

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Literature cited

- Allen, R.T. (1968) A synopsis of the tribe Morionini in the Western Hemisphere with descriptions of two new species (Coleoptera: Carabidae). *Caribbean Journal of Science*, 8(3–4), 141–163.
- Ball, G.E. (1972) Classification of the species of the *Harpalus* subgenus *Glanodes* Casey (Carabidae, Coleoptera). *The Coleopterists Bulletin*, 26, 179–204.
- Bates, H.W. (1882a) Coleoptera, Carabidae, vol. 1, pt. 1, pp. 41–152. In, Godman, F.D. & Salvin, O. (Eds.), *Biologia Centrali-Americana*. Taylor & Francis, London.
- Brullé, G.A. (1835) Leur classification et la description des espèces. In, Audoin, J.V. & Brullé, A. (eds.), *Histoire Naturelle des Insectes 5, Coléoptères II*, 436 pp. Paris.
- Chaudoir, M. de (1880) Essai monographique sur les Morionides. *Bulletin de la Société impériale des Naturalistes de Moscou*, 55(1), 317–384.
- Erwin, T.L. (1973a) Studies of the subtribe Tachyina (Coleoptera: Carabidae: Bembidiini), Part I: A revision of the Neotropical genus *Xystosomus* Schaum. *Smithsonian Contributions to Zoology*, 140, 1–39.
- Erwin, T.L. (1973b) A supplement to the bombardier beetles of North and Middle America: New records for Middle America (Coleoptera: Carabidae). *The Coleopterists Bulletin*, 27(2), 79–82.
- Erwin, T.L. (1974a) Studies of the subtribe Tachyina (Coleoptera: Carabidae: Bembidiini), Part II: A revision of the New World-Australian genus *Pericompsus* LeConte. *Smithsonian Contributions to Zoology*, 162, 1–96.
- Erwin, T.L. (1974b) The ground beetle components of the Panamanian fauna, pp. 124–128. In, Rubinoff, R.W. (1973) *Environmental Monitoring and Baseline Data. Smithsonian Institution Environmental Science Program*. Smithsonian Reports.
- Erwin, T.L. (1982) Small terrestrial ground-beetles of Central America (Carabidae: Bembidiina and Anillina). *Proceedings of the California Academy of Sciences*, 42(19), 455–496.
- Erwin, T.L. (1991). The ground-beetles of Central America (Carabidae) I: Carabinae (in part): Notiophilini, Loricerini, Carabini. *Smithsonian Contributions to Zoology*, 501, 1–30.
- Erwin, T.L. (1994) Arboreal beetles of tropical forests: The Xystosomi group, subtribe Xystosomina (Coleoptera: Carabidae: Bembidiini). Part I. Character analysis, taxonomy, and distribution. *The Canadian Entomologist*, 126(3), 549–666.
- Erwin, T.L. (2000) A new genus and species of Lachnophorini and two new species of Lebiini from Costa Rica (Coleoptera: Carabidae). *The Coleopterists Bulletin*, 54(3), 279–283.
- Erwin, T.L. (2002) The Beetle Family Carabidae of Costa Rica: Twenty-nine new species of Costa Rican *Agra* Fabricius 1801 (Coleoptera: Carabidae, Lebiini, Agrina). *Zootaxa*, 119, 1–68.

- Erwin, T.L. (2004a) The Beetle Family Carabidae of Costa Rica and Panamá: Descriptions of four new genera and six new species with notes on their way of life (Insecta: Coleoptera). *Zootaxa*, 537, 1–18.
- Erwin, T.L. (2004b) The Beetle Family Carabidae of Costa Rica: The genera of the *Cryptobatida* group of subtribe Agrina, tribe Lebiini, with new species and notes on their way of life (Insecta: Coleoptera). *Zootaxa*, 662, 1–54.
- Erwin T.L. (2004c) The Beetle Family Carabidae of Costa Rica: The genus *Epikastea* Liebke of the *Plochionida* group, with new Neotropical species and notes on their way of life (Insecta: Coleoptera, Lebiini, Agrina). *Zootaxa*, 790, 1–20.
- Erwin, T.L. & Johnson, P.J. (2000) Naming species, a new paradigm for crisis management in taxonomy: Rapid journal validation of scientific names enhanced with more complete descriptions on the internet. *The Coleopterists Bulletin*, 54(3), 269–278.
- Erwin, T.L. & Kavanaugh, D.H. (1981). Systematics and zoogeography of *Bembidion* Latreille: I. The *carlhi* and *erasum* groups of western North America (Coleoptera: Carabidae, Bembidiini). *Entomologica Scandinavica*, Supplement 15, 33–72.
- Erwin, T.L., Kavanaugh, D.H. & Moore, W. (2004) Keys to tribes and genera of Costa Rican Carabidae. <http://www.inbio.ac.cr> (last updated April 2004).
- Kavanaugh, D.H. (1979) Studies on the Nebriini (Coleoptera: Carabidae), III. New Nearctic *Nebria* species and subspecies, nomenclatural notes, and lectotype designations. *Proceedings of the California Academy of Sciences*, 42, 87–133.
- Kavanaugh, D.H. & Erwin, T.L. (1991) The tribe Cicindini Břnninger (Coleoptera: Carabidae): comparative morphology, classification, natural history, and evolution. *Proceedings of the Entomological Society of Washington*, 93, 356–389.
- Keleinikova, S.I. (1976) V.I. Motschulsky's types of Coleoptera in the collection of the Zoological Museum MGU. I. Carabidae (in Russian). *Sbornik Trudov Zoologicheskogo Muzeian MGU*, 15, 183–224.
- Latreille, P.A. (1810) Considerations generales su l'orde naturel del animaux composant les classes des crustaces, des archnides, et des insectes; avec un tableau methodique de leurs genres, disposes en famillas, 444pp. Paris.
- Liebherr, J.K. & Will, K.W. (1998) Inferring phylogenetic relationships within Carabidae (Insecta, Coleoptera) from characters of the female reproductive tract. In: G. E. Ball, Casale, A. & Vigna Taglianti, A. (Eds) *Phylogeny and classification of Caraboidea (Coleoptera: Adepaga)*. Museo Regionale di Scienze Naturali, Torino, pp. 107–170.
- Motschulsky, V. de (1855) Voyages. Lettre de M. de Motschulsky à M. Ménériés. *Études Enomologiques*, pt. 4, 8–25.
- Motschulsky, V. de (1864) Énumération des nouvelles espèces de coléoptères rapportés de ses voyages. *Bulletin de al Société des Naturalistes de Moscou* 37, 171–240.
- Straneo, S.L. (1985) Una nuova specie del genere *Moriosomus* Motschulsky, 1864 (Coleoptera, Carabidae). *Giornale italiano di Entomologia* 2, 361–364.
- Will, K.W. (2003) Review and cladistic analysis of the generic-level taxa of Morionini Brullé (Coleoptera: Carabidae). *The Pan-Pacific Entomologist*, 79(3/4)(2004), 212–229.
- Will, K.W. (2006) *Moriosomus*. Version 07 July 2006 (under construction). <http://tolweb.org/Moriosomus/28916/2006.07.07> in The Tree of Life Web Project, <http://tolweb.org>

Appendix

From Motschulsky 1855

“Les chasses dans les forêt-vierges sont bien plus pénibles que chez nous; vous êtes à chaque instant accroché ou déchiré par des plantes épineuses et la chaleur étouffante vous met bientôt hors de combat; aussi ma récolte n’y fut pas très abondante; sous les feuilles sèches, j’ai pris un Carabique noir de la taille de notre *Pseudomaseus nigrita*, mais plus court, qui constitue le passage des *Morio* aux *Campylocnemis*, ayant le facies des premiers et les jambs postérieures arquées des seconds; les antennes sont comprimées et élargies vers l’extrémité, comme chez les *Helluo*, le menton est sans dent au milieu; j’ai nommé le genre et l’espèce: *Moriosomus sylvestris*.”

Translation

“Huntings in the virgin forests are much more painful than on our premises; you are at every moment hung or torn by thorny plants and choking heat puts you soon out of combat; also my harvest was not very abundant there; under dry leaves, I took a black carabid the size of our *Pseudomaseus nigrita*, but shorter, which constitutes a transition from *Morio* to *Campylocnemis*, having the over-all form of the first and the arched posterior legs of the second; the antennae are compressed and widened toward the end, as in *Helluo*, the mentum is without a tooth in the middle; I have named the genus and the species: *Moriosomus sylvestris*.”