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A new genus and sixteen new species of false click beetles
(Coleoptera: Eucnemidae) described from the Heredia Province
of Costa Rica with several additional records from
the Osa Peninsula and Panama

Robert L. Otto

W4806 Chrissie Circle, Shawano, WI 54166, U.S.A.

Jyrki Muona

Finnish Museum of Natural History, Zoology Unit
PO Box 17, University of Helsinki, Finland FIN-00014

Jim Córdoba-Alfaro

Insectopia Insect Museum , BioSur Foundation
Puerto Jiménez, Península de Osa, Costa Rica
jim.cordoba@biosurcorcovado.org

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A new genus and sixteen new species of false click beetles
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Robert L. Otto

W4806 Chrissie Circle, Shawano, WI 54166, U.S.A.
tar1672@yahoo.com

https://orcid.org/0000-0002-5679-4044

Jyrki Muona

Finnish Museum of Natural History, Zoology Unit
PO Box 17, University of Helsinki, Finland FIN-00014
jyrki.muona@helsinki.fi

https://orcid.org/0000-0003-2771-1171

Jim Córdoba-Alfaro

Insectopia Insect Museum, BioSur Foundation
Puerto Jiménez, Peninsula de Osa, Costa Rica
jim.cordoba@biosurcorcovado.org

Abstract. More than 1300 specimens of Eucnemidae collected from Heredia Province in Costa Rica during the 1990s Arthropods of La Selva (ALAS) survey were studied from 2018 through 2022. One **new genus** of false click beetle, *Absensiugum* Otto, Muona and Córdoba-Alfaro, is described. *Nematodes teres* Horn, from the Neartic and Caribbean regions, is transferred to this new genus to form *Absensiugum teres*, **new combination**. Sixteen new species of false click beetle (Coleoptera: Eucnemidae) are described from Costa Rica. These **new species** are: *Adelothyreus brevis*, *Adelothyreus costaricensis*, *Adelothyreus totus*, *Quirsfeldia stethonoides*, *Lacus pectinatus*, *Maelodrus costaricensis*, *Onichodon confluentus*, *Onichodon rufus*, *Isarthrus striatus*, *Absensiugum brunneum*, *Dromaeolus americanus*, *Dromaeolus brunneus*, *Dromaeolus herediensis*, *Dromaeolus holdridgei*, *Deltometopus bicolor* and *Nematodes apicalis*. Three additional records outside of the Heredia Province from the Osa Peninsula and Panama for *Lacus pectinatus* are included in this study. Identification keys are provided for species of *Adelothyreus* Chevrolat, *Onichodon* Newman, *Dromaeolus* Kiesenwetter, *Deltometopus* Bonvouloir and *Nematodes* Berthold in Costa Rica. Diagnostic differences are briefly noted for each species within the Neotropical region. A list of Eucnemidae from Heredia Province is provided.

Key words. Latin America, taxonomy, species discovery, biodiversity, *Adelothyreus*, *Quirsfeldia*, *Lacus*, *Onichodon*, *Isarthrus*, *Absensiugum*, *Dromaeolus*, *Deltometopus*, *Nematodes*.

Resumen. Se estudiaron más de 1300 especímenes de Eucnemidae recolectados de la provincia de Heredia en Costa Rica durante la encuesta de Artrópodos de La Selva (ALAS) de la década de 1990 desde 2018 hasta 2021. Se describe un **nuevo género** de escarabajo de falso clic, *Absensiugum* Otto, Muona y **Córdoba-Alfaro**. *Nematodes teres* Horn, de las regiones Neártica y Caribe, se transfiere a este nuevo género para formar *Absensiugum teres*, **nueva combinación**. Se describen dieciséis nuevas especies de escarabajos de falso clic (Coleoptera: Eucnemidae) de Costa Rica. Estas **nuevas especies** son: *Adelothyreus brevis*, *Adelothyreus costaricensis*, *Adelothyreus totus*, *Quirsfeldia stethonoides*, *Lacus pectinatus*, *Maelodrus costaricensis*, *Onichodon confluentus*, *Onichodon rufus*, *Isarthrus striatus*, *Absensiugum brunneum*, *Dromaeolus americanus*, *Dromaeolus brunneus*, *Dromaeolus herediensis*, *Dromaeolus holdridgei*, *Deltometopus bicolor* and *Nematodes apicalis*. En este estudio se incluyen tres registros adicionales fuera de la Provincia de Heredia de la Península de Osa y Panamá para *Lacus pectinatus*. Se proporcionan claves de identificación para especies de *Adelothyreus* Chevrolat, *Onichodon* Newman, *Dromaeolus* Kiesenwetter, *Deltometopus* Bonvouloir and *Nematodes* Berthold en Costa Rica. Las diferencias de diagnóstico se observan brevemente para cada especie dentro de la región neotropical. Se proporciona una lista de verificación de Eucnemidae de la provincia de Heredia.

Palabras clave. America latina, taxonomía, descubrimiento de especies, biodiversidad, *Adelothyreus*, *Quirsfeldia*, *Lacus*, *Onichodon*, *Isarthrus*, *Absensiugum*, *Dromaeolus*, *Deltometopus*, *Nematodes*.

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Introduction

Costa Rica is a small, tropical Central American country of about 20,000 square miles, representing 0.03% of the world's landmass, but it is home to more than 5% of the world's biodiversity (Obando Acuña 2007). The extraordinary biodiversity of taxa per unit of area found in this small country has been dispersing and mixing through a land bridge between the continental landmasses of North and South America for the last three million years through the Great American Interchange. Vermeij (1991) illustrated various terrestrial and marine biotic interchanges, including the Great American Interchange during the Pliocene Epoch, where lowland rainforest species have radiated from South America into Central America, while at the same time, savanna and upland species radiated southward from North America into Central America. Webb (1991) discussed the Great American Interchange in detail. The formation of the Central American connection between North and South American landmasses was the result of the collision of the Cocos plate against the Caribbean plate, giving rise to a new landmass that is now comprised of Costa Rica and parts of Nicaragua and Panama. The collision of these plates have formed the mountain ranges and volcanic activities within the interior of Costa Rica which allowed isolations of these two coasts to take place. As a result, more than half a million species of invertebrates and vertebrates now inhabit this small area in a diverse topography, climate, and habitat types, dominated by the Caribbean and Pacific coasts (Henderson 2010). A hypothesis as to the response of Eucnemidae has been formulated, with evidence being collected for a future study. Approximately 10 eucnemid genera have radiated from the North American continent south into Central America, whereas 38 eucnemid genera have radiated northward into Central America from the South American continent. Additionally, the Osa landmass was originally a small island formed in the Pacific Ocean approximately 66 million years ago, long before the formation of the Central American landmass. As the Cocos plate continued to collide with the Caribbean plate, the island drifted and collided with the newly formed landmass creating the present day Osa Peninsula in southwestern Costa Rica. These geological events have divided Costa Rica into many different faunal regions that enabled high rates of endemism to take place, especially along the coast lines and the Osa Peninsula.

Costa Rica's openness to allow scientists to conduct their research on its biotic composition have significantly contributed to the expanding understanding of the taxon count, particularly in Coleoptera, Lepidoptera and Hymenoptera. Continued cooperation by Costa Rica to allow researchers to study its biota will further increase our understanding of the biodiversity found within the country and it will go a long way towards better protecting them in the long run for future generations to enjoy.

La Selva Biological Station is one of the most intensively studied and best understood tropical field sites in the world. The station is located in Heredia Province on the eastern slopes and foothills of the central volcanic mountains chain of Costa Rica that give way to the Caribbean coastal plain between the confluence of the Sarapiquí and Puerto Viejo rivers (McDade and Hartshorn 1994). The station preserves 1536 hectares of tropical wet forest (Holdridge 1967) and receives about 4 meters (157 inches) of rain annually with monthly average temperatures ranging 24.7–27.1°C. The resulting condensation produces constant high humidity and strong precipitation all throughout the year. The vascular flora includes nearly two thousand species (one-quarter of the country's total), of which more than four hundred are trees (McDade and Hartshorn 1994). The biological station is involved in ecologically significant research, such as Project ALAS (Arthropods of La Selva), which, from the 1990's to early 2000's, performed a large-scale inventory of the arthropod biodiversity in a tropical lowland rainforest (Coldwell and Longino 2004).

In the late 19th Century, Bernardo Soto established the National Museum in Costa Rica with its mission to provide the country with a place to study and classify cultural artifacts and biological specimens. Anastasio Alfaro was the founding director of the national museum, holding that position for 43 years. His main interests included archeology, history and natural history. Much of the study of biodiversity began at the time the national museum was established and continued to the present day, including the incorporation of the InBio collection that makes up much of their natural history collection within the museum.

Insects represent the most diverse animal group in the world. It is estimated that Costa Rica has approximately 365,000 species of insects, which represents 71% of the wildlife present in the country. Nevertheless, insects also represent the least-understood group with a major lack of biological information (Obando Acuña 2007).

The eucnemid fauna of Costa Rica is poorly known. Much of the documented Mesoamerican faunal composition of Eucnemidae came from Horn (1890), where he described 56 new species and six new genera. This study will be the first of many to document faunal composition of the false click beetle biodiversity present in Costa Rica. One recently described species, *Euryphlegon parallelus* Otto was recorded from Guanacaste and Puntarenas provinces (Otto 2017a) and the other, *Fornax valario* Fisher taken from Chitara, [San José Province] Costa Rica (Fisher 1945). Muona (2021a) recently described two species, *Gastraulacus doyenii* and *Gastraulacus moragai*, from Costa Rica and transferred Barber's *Gastraulacus nevermanni* to his new genus, *Pseudotemnillus* Muona. Additionally, Muona (2021b) described another species, *Temnillus isthmi* from Costa Rica. This study adds 16 new species to the Costa Rican fauna. Current and future research on the composition of eucnemid biodiversity is still ongoing as we continue to collaborate on new records from Costa Rica, new species descriptions and the important roles these beetles have in the tropical ecosystem.

Materials and Methods

Many of the material collected through the ALAS project took place largely in a single province with the use of flight intercept traps placed in several plant communities including primary forests, secondary forests and successional plots. Many of these materials were taken year round at an elevation of 50–150 meters above sea level.

Specimens studied are from the Arthropods of La Selva Project and holotypes and most paratypes will be returned to the Instituto Nacional de Biodiversidad, Santo Domingo de Heredia, Costa Rica (INBIO [or INBC], though the former is more widely used), in care of the Museo Nacional de Costa Rica (MNCR); with selected paratypes retained at the Global Eucnemid Research Project, UW-Madison, Dept. of Entomology, Madison, WI (GERP). Two Panamanian specimens included in this study are in the collection of Jyrki Muona (JMC),

Specimens were examined through a Wild M3C 6.4–40x zoom stereo binocular microscope with 20x oculars under a table lamp. Habitus, antennal and other structural images were taken with a JVC KY-F75U digital camera attached to a Leica® Z16 APO dissecting microscope with apochromatic zoom objective and motor focus drive, using a Synchroscopy Auto-Montage® Pro System and software version 5.01.0005. Image stacks were processed using CombineZP®.

All images were captured as TIFF files during the imaging process. Each image was modified through a paint program and Photoshop Elements 10® software and all were collated into plates. Label data for all types are reported verbatim. Observed metadata are placed between parentheses and brackets for some labels.

Checklist of Eucnemidae collected in Heredia Province

Subfamily Melasinae Fleming, 1821

Tribe Melasini Fleming, 1821

Isorhipis holocericea Horn

Tribe Xylobiini Reitter, 1911

Xylophilus guyanensis Fleutiaux

Tribe Dirhagini Reitter, 1911

Arrhipis subacuta (Guérin-Méneville)

Entomophthalmus americanus Bonvouloir

Entomophthalmus asper Horn

Entomophthalmus minutus Bonvouloir

Rhagomicrus thoracicus (Horn)

Adelothyreus brevis Otto, Muona and Córdoba-Alfaro, **new species**

Adelothyreus comes Horn

Adelothyreus costaricensis Otto, Muona and Córdoba-Alfaro, **new species**

Adelothyreus horni (Fleutiaux)

Adelothyreus totus Otto, Muona and Córdoba-Alfaro, **new species**

Adelorrhagus lateralis Horn

Microrhagus elatus Horn
Microrhagus insidiosus Horn
Microrhagus intrusus Horn
Microrhagus maculicollis Horn
Microrhagus marcidus Horn
Microrhagus repandus Horn
Microrhagus sepositus Horn
Quirselfeldia stethonoides Otto, Muona and Córdoba-Alfaro, **new species**

Subfamily Eucneminae Eschscholtz, 1829

Tribe Eucnemini Eschscholtz, 1829

Idiotarsus estriatus Horn

Subfamily Macraulacinae Fleutiaux, 1923

Tribe Macraulacini Fleutiaux, 1923

Lacus pectinatus Otto, Muona and Córdoba-Alfaro, **new species**
Macraulacus sp.
Diphytaxis excavata Horn
Eurachis elegans Horn
Maelodrus costaricensis Otto, Muona and Córdoba-Alfaro, **new species**
Diapodius bicolor Horn
Somahenecus brevicorne Cobos
Plesiofornax badia Horn
Plesiofornax imperita Horn
Plesiofornax inutilis Horn
Plesiofornax ligniperda Bonvouloir
Plesiofornax longicornis Horn
Plesiofornax pectoralis Horn
Silveriola sublucida (Bonvouloir)
Onichodon confluentus Otto, Muona and Córdoba-Alfaro, **new species**
Onichodon rufus Otto, Muona and Córdoba-Alfaro, **new species**
Fornax adjecta Horn
Fornax affinis Bonvouloir
Fornax carinifrons Horn
Fornax infrequens Bonvouloir
Fornax insita Horn
Fornax petiti Guérin-Méneville
Fornax valario Fisher
Fornax variepennis Bonvouloir
Isarthrus striatus Otto, Muona and Córdoba-Alfaro, **new species**
Cladus maxillaris Bonvouloir
Dyscolotaxia championi Horn
Phaenobolus bicolor Horn
Absensiugum brunneum Otto, Muona and Córdoba-Alfaro, **new genus and species**
Dromaeolus ambiguus Bonvouloir
Dromaeolus americanus Otto, Muona and Córdoba-Alfaro, **new species**
Dromaeolus brunneus Otto, Muona and Córdoba-Alfaro, **new species**
Dromaeolus cinnerescens Bonvouloir
Dromaeolus dilutipes Bonvouloir
Dromaeolus fastidiosus Bonvouloir
Dromaeolus herediensis Otto, Muona and Córdoba-Alfaro, **new species**
Dromaeolus holdridgei Otto, Muona and Córdoba-Alfaro, **new species**
Dromaeolus morens Horn

Dromaeolus ornatulus Horn
Dromaeolus panamensis Fisher
Dromaeolus pusio Horn
Dromaeolus sallei Bonvouloir
Dromaeolus tetricus Horn
Dromaeolus tripartitus Horn
Dromaeolus vanus Horn
Dromaeolus variegatus Bonvouloir
Thambus pusillus Bonvouloir
Deltometopus bicolor Otto, Muona and Córdoba-Alfaro, **new species**
Deltometopus foveolatus (Guérin-Méneville)

Tribe Nematodini Leiler, 1976

Nematodes apicalis **new species**
Nematodes biarti Bonvouloir
Nematodes cuneatus (Guérin-Méneville)
Nematodes cylindricus (Laporte)
Nematodes mannerheimi Bonvouloir

Systematics

Subfamily Melasinae Fleming, 1821

Diagnosis. Form oblong to elongate; antennae sexually dimorphic; antennal sensory pegs concentrated on apices and sides of individual antennomeres; mandibles short, stout; lateral pronotal sides either with a simple ridge or with divided, serrate ridges; hypomeron either simple, without antennal grooves or with notosternal antennal grooves; prothoracic tibiae with single apical spur; tarsomere IV either simple or bilobed; pretarsal claws simple; male prothoracic tarsomere I with or without basal or apical sex combs; male aedeagus either bulbous, wide and with an entire, free median lobe, or highly modified with an enlarged flagellum; female eight sternite partially sclerotized; bursa simple, divided; spermatheca reduced, sclerotized (Muona 1993; Otto 2016).

Tribe Dirhagini Reitter, 1911

Diagnosis. Form cylindrical; mandibles short, without ventral tooth; flagellomeres 1–8 equal, either pectinate or flabellate; pronotum with simple lateral ridge; hypomeron without antennal grooves, nearly parallel-sided; prothoracic sternal peg high and strongly convex behind prothoracic coxae; male prothoracic tarsomere I without sex combs; last visible ventrite strongly produced; tergite VII usually keeled, exposed; aedeagus originally bulbous; median lobe entire, free and originally with both dorsal and ventral basal struts; bursa divided, simple; spermatheca divided, sclerotized (Muona 1993; Otto 2016).

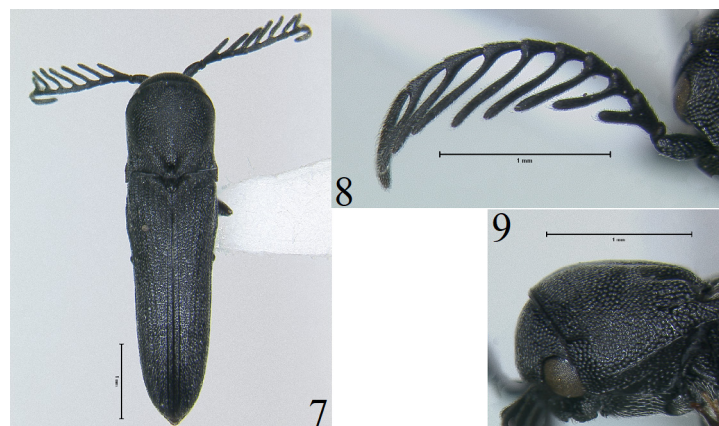
Genus *Adelothyreus* Chevrolat, 1867

Diversity and distribution. The small group consists of 17 species distributed worldwide, that are present in four ecoregions. Three species are known in the Nearctic region. A single species is present in the Southeast Asian region. One species is known from the African continent. One species is present in Madagascar. In the Neotropical region, including the Antilles, 11 species are known. This study adds three more species to that region. In Costa Rica, in addition to the three newly described species, there are several other species present: *Adelothyreus comes* Horn (Figures 1–3), *A. flavosignatus* Bonvouloir (Figures 4–6) and *A. horni* (Fleutiaux) (Figures 7–9). *Adelothyreus flavosignatus* has not been observed in Heredia province, but is present elsewhere in Costa Rica and included in the identification key.

Diagnosis. Apical margin of frontoclypeal region evenly rounded and more than twice as wide as the distance between antennal sockets; apically wide notosternal antennal grooves present; male prothoracic tarsomere I simple, without sex combs; metacoxal plate parallel-sided; last visible ventrite produced, forming a beak; simple



Figures 1–6. Costa Rican *Adelothyreus* species. 1) *Adelothyreus comes*, dorsal habitus. 2) *Adelothyreus comes*, antenna. 3) *Adelothyreus comes*, pronotal lateral habitus. 4) *Adelothyreus flavosignatus*, dorsal habitus. 5) *Adelothyreus flavosignatus*, antenna. 6) *Adelothyreus flavosignatus*, pronotal lateral habitus. (Scale: 1–6 = 1.0 mm).



Figures 7–9. *Adelothyreus horni*. 7) Dorsal habitus. 8) Antenna. 9) Pronotal lateral habitus. (Scale: 7–9 = 1.0 mm).

tarsal claws; lateral surfaces of meso- and metatibiae with setae only; male aedeagus dorsoventrally compressed, with basally attached secondary lateral lobes; median lobe simple, deeply and widely bifurcate apically; lateral lobes simple, longitudinally bilobed; aedeagal flagellum complex; tubular (Muona 1993, 2011).

Adelothyreus are very similar to *Quirsfeldia* Cobos. The group can be distinguished from *Quirsfeldia* by the apical margin of the frontoclypeal region being more than twice as wide as the base. *Quirsfeldia* have apical margin of the frontoclypeal region less than twice as wide as the base.

A key to the species of *Adelothyreus* of Costa Rica

1. Elytron unicolored 2
- Elytron with a yellow-colored vitta *Adelothyreus flavosignatus* Bonvouloir
- 2(1). Flagellomere I serrate 3
- Flagellomere I pectinate *Adelothyreus horni* (Fleutiaux)
- 3(2). Flagellomere II pectinate 4
- Flagellomere II strongly, asymmetrically serrate 5
- 4(3). Anterior lateral pronotal ridge directed posteroventrally
..... *Adelothyreus costaricensis* Otto, Muona and Córdoba-Alfaro, new species
- Anterior lateral pronotal ridge directed posteriorly *Adelothyreus comes* Horn
- 5(3). Anterior lateral pronotal ridge completely connected to posterior lateral pronotal ridge
..... *Adelothyreus totus* Otto, Muona and Córdoba-Alfaro, new species
- Anterior lateral pronotal ridge scarcely elongate, extremely short
..... *Adelothyreus brevis* Otto, Muona and Córdoba-Alfaro, new species

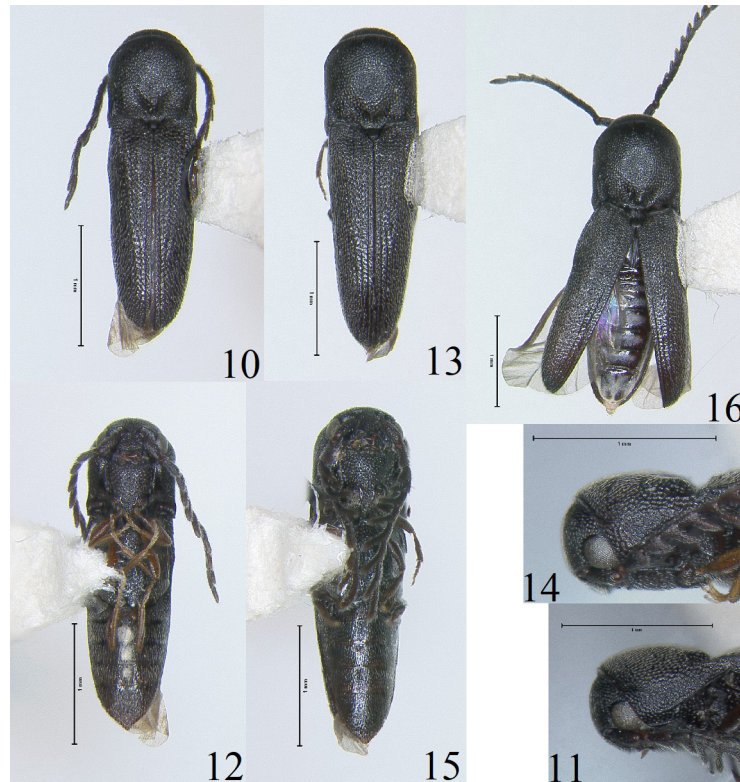
Adelothyreus brevis Otto, Muona and Córdoba-Alfaro, new species

Figures 10–12

Diagnosis. The presence of a very short anterior lateral pronotal ridge will distinguish the new species from all known *Adelothyreus* species present in Costa Rica.

Type material. Male holotype: “COSTA RICA: Heredia; Est.Bio. La Selva, 50–; 150 m 10°26'N 84°01'W; Proy. ALAS, INBio-OET” / “M/06/085; 02 Mayo 1993; Bosque primario” / “**HOLOTYPE**;; *Adelothyreus brevis* ♂; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (red printed label). Holotype to be deposited in INBC.

Description. Male holotype: Length, 2.5 mm. Width, 0.50 mm. Body elongate; uniformly dark black; antennae dark brownish black; legs dark brown; head, pronotum and elytra clothed with short, recumbent yellowish setae (Figure 10). **Head:** Surface densely punctate, somewhat dullish, subspherical; frons convex, without median fovea or carina; apical margin of frontoclypeal region rounded, more than 2.0 times wider than base; mandibles stout, bidentate, densely punctate. **Antenna:** Pectinate from flagellomeres III–VIII, attaining about $\frac{2}{3}$ the length of the body; flagellomere I longer than II; flagellomere II strongly, asymmetrically serrate; flagellomeres III–IV longer than wide, sub-equal, each shorter than V; flagellomeres V–VIII each sub-equal, longer than wide; flagellomere IX longer than VIII; rami on flagellomeres III–VIII arising at apical end, short and about as long as the length of the segment. **Pronotum:** Surface somewhat dullish, closely punctate; longer than wide, with poorly developed hind angles; lateral sides parallel-sided, laterally sinuous above pronotal hind angle, apically arcuate; disc flattened without median groove; anterior lateral pronotal ridge extremely short, directed posteroventrally; posterior lateral pronotal ridge elongate, extending at least $\frac{3}{4}$ the length of pronotum (Figure 11); base sinuous, with circular strong impressions above scutellar shield. **Scutellar shield:** Quadrate, sub-triangular, shallowly punctate, setose and distally rounded. **Elytra:** Striate indistinct; interstices flattened; surfaces shiny, closely punctate to rugose at basal $\frac{1}{2}$, shallowly and closely punctate at apical $\frac{1}{2}$. **Legs:** First tarsomere as long as the combined lengths of the remaining four on meso- and metatarsi; tibiae rounded in cross section; metatarsomeres I–III simple; metatarsomere IV very short, excavate; metatarsomere V short with simple claws. **Venter** (Figure 12): Closely punctate, with short, recumbent yellowish setae; hypomeron with apically widened notosternal antennal grooves; antennal grooves smooth, scarcely punctate apically; metepisterna caudally wide; elytral epipleura punctate; metacoxal plates parallel-sided.



Figures 10–16. Costa Rican *Adelothyreus* species. **10)** *Adelothyreus brevis* **sp. nov.**, dorsal habitus. **11)** *Adelothyreus brevis* **sp. nov.**, pronotal lateral habitus. **12)** *Adelothyreus brevis* **sp. nov.**, ventral habitus. **13)** *Adelothyreus costaricensis* **sp. nov.**, male holotype, dorsal habitus. **14)** *Adelothyreus costaricensis* **sp. nov.**, male holotype, pronotal lateral habitus. **15)** *Adelothyreus costaricensis* **sp. nov.**, male holotype, ventral habitus. **16)** *Adelothyreus costaricensis* **sp. nov.** female allotype, dorsal habitus. (Scale: 10–16 = 1.0 mm)

Distribution. This eucnemid species is known only from its type location in Costa Rica

Biology. The holotype was taken from a primary forest. Larvae and pupae are unknown.

Etymology. The specific epithet is derived from the presence of a very short anterior pronotal lateral ridge.

Adelothyreus costaricensis Otto, Muona and Córdoba-Alfaro, new species

Figures 13–16

Diagnosis. This new species is very similar to *A. comes*. The posteroventrally directed anterior lateral pronotal ridge will distinguish the new species from *A. comes*.

Type material. Male holotype: “COSTA RICA: Heredia; Est.Bio. La Selva, 50–; 150 m 10°26'N 84°01'W; Proy. ALAS, INBio-OET” / “M/01/332; 01 Febrero 1994; Parcelas sucesionales” / “**HOLOTYPE**:: *Adelothyreus; costaricensis* ♂; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (red printed label). **Female allotype:** “COSTA RICA, Heredia; Est.Bio. La Selva, 50–; 150 m, 10°26'N 84°01'W; Proy.ALAS, INBio-OET” / “M/15/121; 02 Junio 1993; Bosque secundario” / “**ALLOTYPE**:: *Adelothyreus; costaricensis* ♀; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (yellow printed label). Holotype and allotype are to be deposited in INBC.

Description. Male holotype: Length, 2.5 mm. Width, 0.75 mm. Body elongate; uniformly dark black; antennae dark brownish black; femur and tibiae dark brownish black; tarsi dark brown; head, pronotum and elytra clothed with short, recumbent yellowish setae (Figure 13). **Head:** Surface densely punctate, somewhat dullish, subspherical; frons convex, without median fovea or carina; apical margin of frontoclypeal region rounded, more than 2.0 times wider than base; mandibles stout, bidentate, densely punctate. **Antenna:** Pectinate from flagellomeres

II–VIII, attaining about $\frac{2}{3}$ the length of the body; flagellomere I longer than II; flagellomeres II–III sub-equal, each shorter than IV; flagellomere IV longer than III, shorter than V; flagellomeres V–VIII each sub-equal, longer than wide; flagellomere IX longer than VIII; ramus on flagellomere II arising along entire length, rami on flagellomeres III–VIII arising at apical end, elongate and about 1.5 times longer than length of segment. **Pronotum:** Surface somewhat dullish, closely punctate; longer than wide, with poorly developed hind angles; lateral sides parallel-sided, apically arcuate; disc convex without median groove; anterior lateral pronotal ridge short, arcuate, directed posteroventrally; posterior lateral pronotal ridge elongate, about $\frac{3}{4}$ the length of the pronotum (Figure 14); base sinuous, with circular strong impressions above scutellar shield. **Scutellar shield:** Short, quadrate, sub-triangular, shallowly punctate, setose and distally rounded. **Elytra:** Very shallow striate indicated; interstices slightly elevated; surfaces shiny, very closely punctate to rugose at basal $\frac{1}{2}$, closely punctate at apical $\frac{1}{2}$. **Legs:** First tarsomere as long as the combined lengths of the remaining four on meso- and metatarsi; tibiae rounded in cross section; metatarsomeres I–III simple; metatarsomere IV very short, excavate; metatarsomere V short with simple claws. **Venter** (Figure 15): Closely punctate, with short, recumbent yellowish setae; hypomeron with apically widened notosternal antennal grooves; antennal grooves smooth, sparsely punctate; metepisterna caudally wide; elytral epipleura punctate; metacoxal plates parallel-sided.

Female allotype (Figure 16): Length, 3.0 mm. Width, 1.0 mm. Antennae serriform, about $\frac{1}{2}$ the length of the body; flagellomere I longer than wide, longer than II; flagellomere II quadrate, serrate, shorter than III; flagellomeres III–VIII sub-equal, transverse, asymmetrically serrate; flagellomere IX longer than VIII.

Distribution. This species is only known from its type location in Costa Rica.

Biology. The holotype was taken from a successional plot of trees. The allotype was taken from a secondary growth forest. Larvae and pupae are unknown.

Etymology. The specific epithet is named for the country of Costa Rica from which the new species was taken.

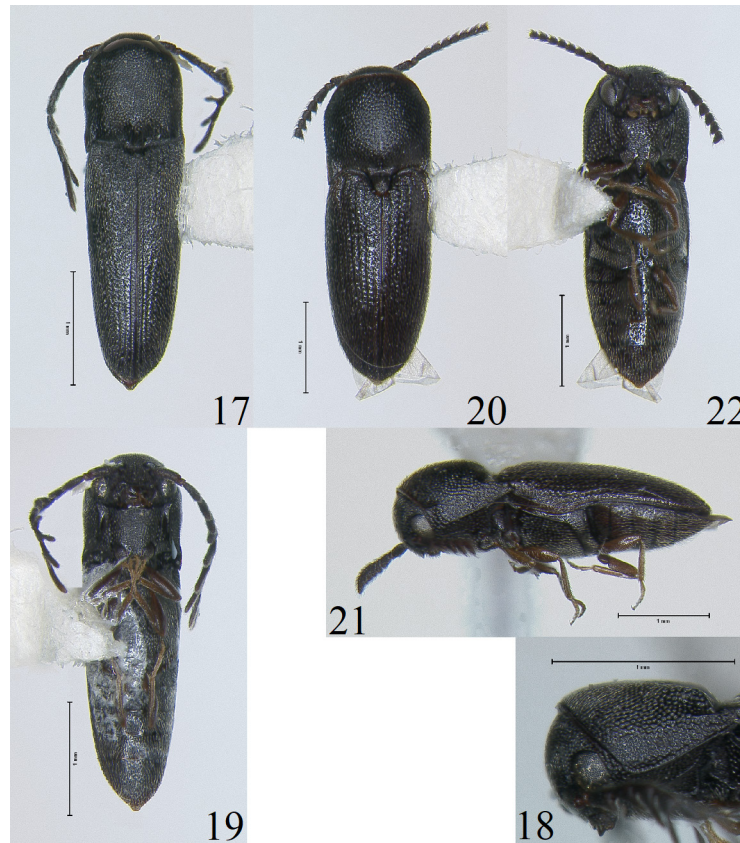
***Adelothyreus totus* Otto, Muona and Córdoba-Alfaro, new species**

Figures 17–19

Diagnosis. A complete lateral pronotal ridge will distinguish the new species from all known *Adelothyreus* species present in Costa Rica.

Type material. Male holotype: “COSTA RICA: Heredia pr.; La Selva Bio. Sta.; 3 km S Pto. Viejo; 10°26'N 84°01'W” / “I.IV.1988; H.A. Hespeneheide” (“I”, “IV” and “8” handwritten) / “**HOLOTYPE**;; *Adelothyreus*; *totus* ♂; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2021” (red printed label). Holotype to be deposited in INBC.

Description. Male holotype: Length, 3.0 mm. Width, 0.75 mm. Body elongate; uniformly dark black; antennae dark brownish black; legs dark brown; head, pronotum and elytra clothed with short, recumbent yellowish setae (Figure 17). **Head:** Surface densely punctate, somewhat dullish, subspherical; frons convex, without median fovea or carina; apical margin of frontoclypeal region rounded, more than 2.0 times wider than base; mandibles stout, bidentate, densely punctate. **Antenna:** Pectinate from flagellomeres III–VIII, attaining about $\frac{3}{4}$ the length of the body; flagellomere I longer than II; flagellomere II strongly, asymmetrically serrate; flagellomere III longer than wide, shorter than IV; flagellomeres IV–VIII each sub-equal, longer than wide; flagellomere IX longer than VIII; rami on flagellomeres III–VIII arising at apical end, elongate and about 2.0 times longer than length of segment. **Pronotum:** Surface somewhat dullish, closely punctate; longer than wide, with poorly developed hind angles; lateral sides parallel-sided, apically arcuate; disc flattened with delicate median groove; anterior lateral pronotal ridge completely connected to the posterior lateral pronotal ridge forming a complete lateral ridge (Figure 18); base sinuous, strongly impressed above scutellar shield. **Scutellar shield:** Short, transverse, shallowly punctate, setose and distally truncated. **Elytra:** Shallow striate indicated at humeri, indistinct elsewhere; interstices flattened; surfaces shiny, closely punctate to rugose at basal $\frac{1}{2}$, shallowly punctate at apical $\frac{1}{2}$. **Legs:** First tarsomere as long as the combined lengths of the remaining four on meso- and metatarsi; tibiae rounded in cross section; metatarsomeres I–III simple; metatarsomere IV very short, excavate; metatarsomere V short with simple claws. **Venter** (Figure 19): Closely punctate, with short, recumbent yellowish setae; hypomeron with apically widened notosternal antennal grooves; antennal grooves apically punctate, basally smooth; metepisterna caudally wide; elytral epipleura punctate; metacoxal plates parallel-sided.



Figures 17–22. Costa Rican Eucnemidae. 17) *Adelothyreus totus* sp. nov., dorsal habitus. 18) *Adelothyreus totus* sp. nov., pronotal lateral habitus. 19) *Adelothyreus totus* sp. nov., ventral habitus. 20) *Quirsfeldia stethonoides* sp. nov., dorsal habitus. 21) *Quirsfeldia stethonoides* sp. nov., pronotal lateral habitus. 22) *Quirsfeldia stethonoides* sp. nov., ventral habitus. (Scale: 17–22 = 1.0 mm)

Distribution. This eucnemid species is only known from its type location in Costa Rica.

Biology. No biological information is known for the new species. Larvae and pupae are unknown.

Etymology. The specific epithet is derived from ‘totus’, a Latin adjectival word for complete due to the presence of a complete lateral pronotal ridge.

Genus *Quirsfeldia* Cobos, 1964

Diversity and distribution. The small group consists of several species with two being present in the Amazonian region of South America, particularly in Brazil and a third species recorded for the first time in Central America. The new Central American species is only known from a single province in Costa Rica.

Diagnosis. Apical margin of frontoclypeal region fairly evenly rounded and less than twice as wide as the distance between antennal sockets; poorly indicated notosternal antennal grooves present, caudally obliterated; elytral apices meeting tightly together; metacoxal plates parallel-sided, medially less than 2.5 times wider than laterally; frons simple; last visible ventrite acutely produced; simple tarsal claws; lateral surfaces of meso- and metatibiae with setae only (Muona 2011).

The genus is very similar to *Adelothyreus* Bonvouloir and can be distinguished by the apical margin of the frontoclypeal region being less than twice as wide as the base. *Adelothyreus* has the apical margin of the frontoclypeal region more than twice as wide as the base.

***Quirsfeldia stethonoides* Otto, Muona and Córdoba-Alfaro, new species**

Figures 20–22

Diagnosis. Generic character features like caudally obliterated notosternal antennal grooves, parallel-sided metacoxal plates and apical margin of the frontoclypeal region being less than 2.0 wider than the base will distinguish the new species from all known species within the tribe in Costa Rica.

Type material. Female holotype: “COSTA RICA: Heredia; Est.Bio. La Selva, 50–; 150 m 10°26'N 84°01'W; Proy. ALAS, INBio-OET” / “M/06/170; 03 Agosto 1993; Bosque primario” / “**HOLOTYPE:** *Quirsfeldia stethonoides* ♀; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (red printed label). Holotype to be deposited in INBC.

Description. Female holotype: Length, 3.0 mm. Width, 1.0 mm. Body elongate; uniformly dark brownish black; antennae dark brownish black; legs brown; head, pronotum and elytra clothed with short, recumbent yellowish setae (Figure 20). **Head:** Surface densely punctate, somewhat dullish, subspherical; frons convex, with delicate median fovea above frontoclypeal region; apical margin of frontoclypeal region rounded, less than 2.0 times wider than base; mandibles stout, bidentate, densely punctate. **Antenna:** Asymmetrically serrate from flagellomeres II–IX, presumably attaining about $\frac{1}{3}$ the length of the body, never beyond pronotal hind angles; flagellomere I longer than II; flagellomere II shorter than I and III, quadrate; flagellomeres III–VII each sub-equal, wider than long; flagellomeres VIII–IX missing on right antenna; flagellomeres VI–IX missing on left antenna. **Pronotum:** Surface somewhat dullish, granulose; slightly longer than wide, with moderate, sharp hind angles; lateral sides parallel-sided at basal $\frac{2}{3}$, arcuate at apical $\frac{1}{3}$; disc convex with short, delicate median groove above scutellar shield; anterior lateral pronotal ridge short, arched, ventrally bent; posterior lateral pronotal ridge elongate, extending almost to caudal end (Figure 21); base sinuous. **Scutellar shield:** Short, sub-triangular, shallowly punctate, with median groove and distally rounded. **Elytra:** Shallow striate indicated; interstices slightly elevated; surfaces shiny, transversely rugose at basal $\frac{1}{2}$, dense, rugose at apical $\frac{1}{2}$. **Legs:** First tarsomere shorter than the combined lengths of the remaining four on meso- and metatarsi; tibiae rounded in cross section; metatarsomeres I–IV simple; metatarsomere IV very short; metatarsomere V elongate with simple claws. **Venter** (Figure 22): Closely punctate, with short, recumbent yellowish setae; hypomeron with caudally obliterated, poorly defined notosternal antennal grooves; metepisterna parallel-sided; elytral epipleura punctate; metacoxal plates parallel-sided.

Distribution. This eucnemid species is only known from its type location in Costa Rica.

Biology. The holotype was taken from a primary forest. Larvae and pupae are unknown.

Etymology. The specific epithet is derived from its similar appearance to the Eucnemine genus, *Stethon* LeConte.

Subfamily Macraulacinae Fleutiaux, 1923

Diagnosis. Form oblong, elongate or obtuse; antennomeres usually sexually dimorphic; mandibles either stout with a basal tooth or slender without teeth; simple lateral pronotal ridge present; hypomeron either simple, with basally closed lateral antennal grooves or with basally open lateral antennal grooves; legs slender; prothoracic tibiae with one apical spur; lateral surfaces of mesothoracic and metathoracic tibiae usually with transverse rows of spines; tarsomere IV often bilobed; tarsal claws either simple or basally toothed; prothoracic tarsomere I usually with basal sex combs in males; male aedeagus with dorsally open basal piece; median lobe simple, with solidly fused slender basal struts; fused to lateral lobes; lateral lobes entire, either with notched or apically deeply and narrowly bifurcate; bursa either simple or divided; spermatheca tripartite, sclerotized, divided (Muona 1993; Otto 2016).

Tribe Macraulacini Fleutiaux, 1923

Diagnosis. Form oblong, elongate or obtuse; flagellomeres usually sexually dimorphic; mandibles either stout with a basal tooth or slender without teeth; simple lateral pronotal ridge present; hypomeron either simple, with basally closed lateral antennal grooves or with basally open lateral antennal grooves; legs slender; prothoracic tibiae with one apical spur; lateral surfaces of mesothoracic and metathoracic tibiae usually with transverse rows of spines; tarsomere IV often bilobed; tarsal claws either simple or basally toothed; prothoracic tarsomere I usually with basal sex combs in males; male aedeagus with dorsally open basal piece; median lobe simple, with solidly fused slender basal struts, fused to lateral lobes; lateral lobes entire, either with notched or apically deeply and

narrowly bifurcate; bursa either simple or divided; spermatheca tripartite, sclerotized, divided (Muona 1993; Otto 2017c).

Genus *Lacus* Bonvouloir, 1871

Diversity and distribution. This group was previously monotypic with the type species, *Lacus laticornis* Bonvouloir being present in Brazil and French Guiana. The new Central American species is known from only two provinces in Costa Rica and two provinces in Panama.

Diagnosis. Apical margin of frontoclypeal region fairly evenly rounded and less than twice as wide as the distance between antennal sockets; well developed, deep, basally closed lateral antennal grooves present; male protarsomere I simple, without basal sex combs; elytral apices dehiscent; metacoxal plates medially 3.0–6.0 times wider than laterally; frons simple; last visible ventrite either rounded or acute; simple tarsal claws; lateral surfaces of meso- and metatibiae with setae and transverse rows of spine combs (Muona 2011).

These diagnostic characteristics, especially the presence of a basally closed lateral antennal grooves and obtuse form will distinguish the group from any genera within the tribe Macraulacini.

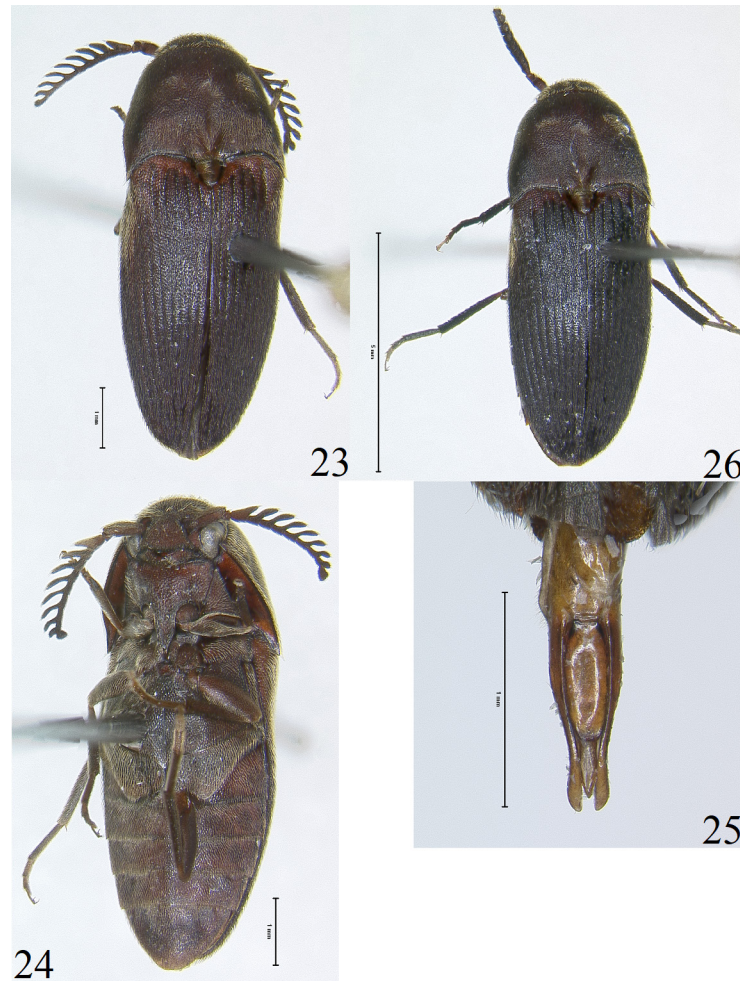
Lacus pectinatus Otto, Muona and Córdoba-Alfaro, new species

Figures 23–26

Diagnosis. The new eucnemid species is distinguished from *L. laticornis* by the presence of broken setal patterns on the pronotum. *Lacus laticornis* have a more intact bands of setal patterns present on the pronotum. Punctate striae are present in the new species, whereas striae in *L. laticornis* is solid.

Type material. Male holotype: “COSTA RICA: Heredia; Est.Bio. La Selva, 50–; 150 m 10°26'N 84°01'W; Proy. ALAS, INBio-OET” / “M/02/065; 15 Abril 1993; Bosque secundario” / “**HOLOTYPE**:: *Lacus pectinatus* ♂; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (red printed label). **Female allotype:** “COSTA RICA, Heredia; Est.Bio. La Selva, 50–; 150 m, 10°26'N 84°01'W; Apr 2000, INBio-OET” / “17 Abril 2000; Bosque secundario; M/19/746” / “**ALLOTYPE**:: *Lacus pectinatus* ♀; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (yellow printed label). Holotype and allotype are to be deposited in INBC.

Paratypes. 6 ♂♂, 3 ♀♀: **COSTA RICA: Heredia Province:** 1 ♂, “COSTA RICA: Heredia; Pr: La Selva Biol. Sta.; 3 km S Pto Viejo; 10°26'N 84°01'W” / “12 FEB 1993; Bosque secundario; M/00/011” / “**PARATYPE**:: *Lacus pectinatus* ♂; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (yellow printed label) (INBC); 1 ♂, “COSTA RICA: Heredia; Est.Bio. La Selva, 50–; 150 m 10°26'N 84°01'W; Proy.ALAS, INBio-OET” / “M/02/017; 02 Marzo 1993; Bosque secundario” / “**PARATYPE**:: *Lacus pectinatus* ♂; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (yellow printed label) (INBC); 1 ♀, “COSTA RICA: Heredia; Pr: La Selva Biol. Sta.; 3 km S Pto Viejo; 10°26'N 84°01'W” / “2 Mayo 1993; Bosque secundario; M/02/081” / “**PARATYPE**:: *Lacus pectinatus* ♀; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (yellow printed label) (INBC); 1 ♂ 1 ♀, “COSTA RICA: Prov. Heredia; Est. Biol. La Selva, 50–; 150, 10°26'N 84°01'W; 09 Marzo 2004, INBio-OET-ALAS transect” (“09 Marzo” handwritten on label) / “09 Marzo 2004; Malaise; M/25/777” / “**PARATYPE**:: *Lacus pectinatus*; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (either ♂ or ♀ printed behind species name on label) [yellow printed label] (INBC); 1 ♂, “COSTA RICA: Prov. Heredia; Est. Biol. La Selva, 50–; 150, 10°26'N 84°01'W; 21 Marzo 2004, INBio-OET-ALAS transect” (“21 Marzo” handwritten on label) / “21 Marzo 2004; Malaise; M/23/785” / “Collection of the Global; Eucnemid Research Project; (Robert L. Otto)” (green framed white label) / “**PARATYPE**:: *Lacus pectinatus* ♂; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (yellow printed label) (GERP); **Puntarenas Province:** 1 ♂, “COSTA RICA. Prov. Puntarenas; Golfito Poue Nal Corcovado Est.; Agujas, Cerro Rincón. 745 m 13 FEB; 2000. A. Azofeifa. Intersección; L S 275500 522000 #56525” / “**PARATYPE**:: *Lacus pectinatus* ♂; Otto, Muona & Córdoba-Alfaro, Det. J. Muona; 2022 (yellow printed label) (INBC); **PANAMA: Colón Province:** 1 ♂, “IBISCA Project Panama; Colon, San Lorenzo NP; 27.3–7.3 2004” (‘27.3–7.3’ handwritten on label; black framed white label) / “IBISCA 2003-05; Morphospec. sort; Jürgen Schmidl; COEUCN 50” (‘50’ handwritten on label; black framed white label) / “Photo PACOEUCN; #146” (‘146’ handwritten on label; black framed pink label) / “**PARATYPE**:: *Lacus pectinatus* ♂; Otto, Muona & Córdoba-Alfaro; Det. J. Muona; 2022” (yellow printed label) (JMC); **Panamá Province:** 1 ♀, “Panama; Canal Zone” / “**PARATYPE**:: *Lacus pectinatus*



Figures 23–26. *Lacus pectinatus* sp. nov. 23) Male holotype, dorsal habitus. 24) Male holotype, ventral habitus. 25) Male aedeagus, dorsal view. 26) Female allotype, dorsal view. (Scale: 23–25 = 1.0 mm; 26 = 5.0 mm)

♀; Otto, Muona & Córdoba-Alfaro; Det. J. Muona; 2022” (yellow printed label) (JMC). Paratypes are to be deposited in INBC, GERP and JMC.

Description. Male holotype: Length, 6.5 mm. Width, 2.0 mm. Body obtuse; uniformly dark brown with infuscate reddish basal margin of elytral humeri, venter reddish-brown; antennae and legs reddish-brown; head, pronotum and elytra clothed with short, recumbent yellowish setae; broken setal patterns present on the pronotum (Figure 23). **Head:** Surface densely punctate, somewhat dullish, subspherical; frons convex, without median carina or fovea above frontoclypeal region; apical margin of frontoclypeal region rounded, about 2 times wider than base; interantennal carina absent; mandibles stout, bidentate, densely punctate. **Antenna:** Pectinate from flagellomeres I–VIII, attaining about $\frac{1}{2}$ the length of the body, never beyond pronotal hind angles; flagellomere I slightly longer than II; flagellomeres II–VIII each sub-equal, slightly longer than wide; rami moderately elongate, arising near apices of flagellomeres I–VIII; flagellomere IX simple, slightly longer than VIII. **Pronotum:** Surface somewhat dullish, densely punctate; slightly transverse, with moderate, sharp hind angles; lateral sides strongly arcuate and narrowing towards craniad; disc convex with pair of shallow circular fovea; base sinuous. **Scutellar shield:** Elongate, sub-triangular, setose, shallowly punctate and distally rounded. **Elytra:** Distinctly, shallowly punctate striate present; interstices slightly elevated; surfaces shiny, transversely rugose at humeri, dense, crowded punctures present elsewhere. **Legs:** First tarsomere as long as the combined lengths of the remaining four on meso- and metatarsi; tibiae rounded in cross section; metatarsomeres I–III simple; metatarsomere IV very short,

excavated, slightly emarginated; metatarsomere V elongate with basally swollen, simple claws. **Venter** (Figure 24): Closely punctate, with elongate, recumbent yellowish setae; hypomeron with basally closed, wide, lateral antennal grooves; metepisterna parallel-sided; elytral epipleura punctate; metacoxal plates medially 3.0–6.0 times wider than laterally. **Aedeagus (paratype)** (Figure 25): Elongate, dorsally flattened, sinuate; median lobe free, short, apically rounded; parameres apically elongate, rounded, longer than median lobe, without lateral tooth; secondary lateral lobe absent; basal piece elongate, apically truncated.

Female allotype (Figure 26): Length, 8.0 mm. Width, 2.5 mm. Antennae filiform, about $\frac{1}{3}$ the length of the body; flagellomere I longer than wide, slightly longer than II; flagellomere II longer than wide, much longer than III; flagellomeres III–VIII quadrate, sub-equal; left flagellomere IX missing; right antenna missing. Lateral side of elytra above epipleura infusate reddish.

Variations. Six paratypes were examined. Several additional included paratypes from the Osa Peninsula and Panama were not examined for variations. Four male paratypes measured 6.0–7.0 mm long and 2.0 mm wide. Two female paratypes measured 5.0–7.0 mm long and 1.5–2.5 mm wide. Two of the male paratypes have the same length and width as the holotype. One male is shorter than and just as wide as the holotype. One male is longer than and just as wide as the holotype. One female is shorter and narrower than the holotype. One female is larger and wider than the holotype. All four males have a more pronounced reddish coloration along the humeri region than the remaining areas of the elytra. The reddish area of the humeri in both females are more infusate and blended with the surrounding dark brown coloration of the elytral region. All paratypes are slightly darker than the holotype.

Distribution. This eucnemid species is known from eight specimens taken from La Selva within the province of Heredia, a single specimen each from the Puntarenas province and two sites in Panama.

Biology. Three specimens were taken from a Malaise trap. Five specimens were taken from a secondary growth forest. Larvae and pupae are unknown.

Etymology. The specific epithet is derived from the presence of pectinate antennae found in male specimens.

Genus *Maelodrus* Fleutiaux, 1928

Diversity and distribution. Five described species and numerous undescribed species are known in the Oceanic region from the Philippines and Indonesia to Samoa. The new Central American species is present within a single province in Costa Rica. A second, undescribed species is present in Peru (Vahtera et al. 2015).

Diagnosis. Apical margin of frontoclypeal region fairly evenly rounded and more than twice as wide as the distance between antennal sockets; vaguely defined, either shallow or deep, basally opened lateral antennal grooves present; male protarsomere I simple, with straight, basal sex combs; elytral apices meeting tightly together; metacoxal plates medially at least 6.0 times wider than laterally; frons simple; last visible ventrite either rounded, emarginated or acute; simple tarsal claws; lateral surfaces of meso- and metatibiae either with setae and transverse rows of spine combs or setae and irregularly placed flat spines (Muona 2011).

These diagnostic characteristics, especially the presence of a vaguely defined lateral antennal groove and elongate form will distinguish the group from any genera within the tribe Macraulacini in Costa Rica.

Maelodrus costaricensis Otto, Muona and Córdoba-Alfaro, new species

Figures 27–29

Diagnosis. This new eucnemid species is distinguished by its elongate bicolored form and vaguely defined lateral antennal grooves from all known eucnemid species present in Costa Rica.

Type material. Male holotype: “COSTA RICA: Heredia; Est.Bio. La Selva, 50–; 150 m 10°26'N 84°01'W; Proy. ALAS, INBio-OET” / “FPM/23/07; Pentaclethra macroloba; 14 Octubre 1994” / “**HOLOTYPE**;; *Maelodrus*; *costaricensis* ♂; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (red printed label). Holotype to be deposited in INBC.

Description. Male holotype: Length, 3.0 mm. Width, 0.75 mm. Body elongate; bicolored with black head, dark brown pronotal disc and elytra, lateral pronotal sides, hypomera and abdomen infusate reddish; antennae



Figures 27–30. Costa Rican macraulacine eucnemids. 27) *Maelodrus costaricensis* sp. nov., dorsal habitus. 28) *Maelodrus costaricensis* sp. nov., lateral habitus. 29) *Maelodrus costaricensis* sp. nov., ventral habitus. 30) *Onichodon confluentus* sp. nov., male holotype, dorsal habitus. (Scale: 27–29 = 1.0 mm; 30 = 5.0 mm)

black; legs reddish-brown; head and elytra clothed with short, recumbent yellowish setae, pronotum with elongate, recumbent yellowish setae (Figures 27–28). **Head:** Surface evenly punctate, somewhat shiny, subspherical; frons convex, without median carina or fovea above frontoclypeal region; apical margin of frontoclypeal region rounded, about 2 times wider than base; interantennal carina absent; mandibles stout, bidentate, densely punctate. **Antenna:** Filiform to weakly serrate from flagellomeres I–IX, attaining about $\frac{3}{4}$ the length of the body; flagellomere I longer than wide, slightly shorter than II; flagellomeres II–VIII each sub-equal, longer than wide; flagellomere IX simple, slightly longer than VIII. **Pronotum:** Surface somewhat dullish, densely punctate; slightly longer than wide, with moderate, sharp hind angles; lateral sides parallel-sided at basal $\frac{2}{3}$, arcuate at apical $\frac{1}{3}$; disc convex without fovea or circular fovea; base sinuous. **Scutellar shield:** Short, sub-triangular, setose, shallowly punctate and distally rounded. **Elytra:** Distinctly, shallowly striate; interstices slightly elevated; surfaces shiny with dense punctures. **Legs:** First tarsomere as long as the combined lengths of the remaining four on meso- and metatarsi; tibiae rounded in cross section; metatarsomeres I–III simple; metatarsomere IV very short, excavated, slightly emarginated; metatarsomere V short with simple claws. **Venter** (Figure 29): Closely punctate, with elongate, recumbent yellowish setae; hypomeron with vaguely defined, lateral antennal grooves; metepisterna parallel-sided; elytral epipleura punctate; metacoxal plates medially 6.0 times wider than laterally.

Distribution. This eucnemid species is known from a holotype specimen taken from a single location within the province of Heredia.

Biology. A single specimen was taken from Pracaxi (*Pentacletha macroloba* (Willdenow) Kuntze; Fabaceae). Larvae and pupae are unknown.

Etymology. The specific epithet is derived from a combination of two words, ‘Costa Rica’ and ‘-ensis’, a Latin adjectival suffix meaning “pertaining to”; from which the new species have been taken.

Genus *Onichodon* Newman, 1838

Diversity and distribution. Six described species are known in this genus. Five species are present in the Nearctic region. One species is present in Fiji. One undescribed species is present in Southeast Asia. Two new Central American species are known only from Heredia province in Costa Rica. Many misplaced species of *Fornax* Laporte present in Central and South America may belong in this group.

Diagnosis. Apical margin of frontoclypeal region feebly trilobed and more or less than twice as wide as the distance between antennal sockets; narrow, well-developed basally open lateral antennal grooves present; male protarsomere I simple, with basal sex combs; metacoxal plates medially 3.0–6.0 times wider than laterally; elytral epipleura evenly punctate; last visible ventrite either rounded or slightly emarginate; tarsal claws basally toothed; lateral surfaces of meso- and metatibiae with setae and transverse rows of spine combs; male aedeagus

dorsoventrally compressed, without secondary lateral lobes; median lobe simple, with moderately and narrowly bifurcate apices; lateral lobes simple, entire; aedeagal flagellum simple.

A key to the species of *Onichodon* in Costa Rica

1. Habitus large, 6.0–12.0 mm long, dark reddish-brown; frons confluent rugose
..... *Onichodon confluentus* Otto, Muona and Córdoba-Alfaro, new species
- Habitus small, 6.0 mm long, reddish; frons with crowded punctures
..... *Onichodon rufus* Otto, Muona and Córdoba-Alfaro, new species

Onichodon confluentus Otto, Muona and Córdoba-Alfaro, new species

Figures 30–32

Diagnosis. The new eucnemid species can be readily distinguished by the presence of confluent surfaces of the frons from any members of *Fornax* and *Onichodon* present in Costa Rica.

Type material. Male holotype: “COSTA RICA: Heredia; Est.Bio. La Selva, 50–; 150 m 10°26′N 84°01′W; Proy. ALAS, INBio-OET” / “M/15/121; 02 Junio 1993; Bosque secundario” / “**HOLOTYPE**:: *Onichodon; confluentus* ♂; Otto, Muona & Córdoba-Alfaro’ Det. R.L. Otto; 2019” (red printed label). **Female allotype:** “COSTA RICA: Prov. Heredia; 16 km SSE La Virgen, 1050–; 1150 m, 10°16′N 84°05′W; 9 Abril 2001; INBio-OET-ALAS transect” (“9 Abril”, “1” were handwritten on label) / “09 Abril 2001; 11/M/01/061; Transect” / “**ALLOTYPE**:: *Onichodon; confluentus* ♀; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (yellow printed label). Holotype and allotype are to be deposited in INBC.

Paratypes. 7 ♂♂: **COSTA RICA:** 1 ♂, “COSTA RICA: Heredia; Est.Bio. La Selva, 50–; 150 m 10°26′N 84°01′W; Proy.ALAS, INBio-OET” / “M/14/061; 02 Abril 1993; Bosque secundario” / “**PARATYPE**:: *Onichodon; confluentus* ♂; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (yellow printed label) (INBC); 1 ♂, “COSTA RICA: Heredia; Est.Bio. La Selva, 50–; 150 m 10°26′N 84°01′W; Proy.ALAS, INBio-OET” / “M/15/094; 03 Mayo 1993; Bosque secundario” / “**PARATYPE**:: *Onichodon; confluentus* ♂; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (yellow printed label) (INBC); 1 ♂, “COSTA RICA: Heredia; Est.Bio. La Selva, 50–; 150 m 10°26′N 84°01′W; Proy.ALAS, INBio-OET” / “M/16/122; 02 Junio 1993; Bosque secundario” / “Collection of the Global; Eucnemid Research Project; (Robert L. Otto)” (green framed white label) / “**PARATYPE**:: *Onichodon; confluentus* ♂; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (yellow printed label) (GERP); 1 ♂, “COSTA RICA: Heredia; Est.Bio. La Selva, 50–; 150 m 10°26′N 84°01′W; Proy.ALAS, INBio-OET” / “M/14/148; 01 Julio 1993; Bosque secundario” / “**PARATYPE**:: *Onichodon; confluentus* ♂; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (yellow printed label) (INBC); 1 ♂, “COSTA RICA: Heredia; Est.Bio. La Selva, 50–; 150 m 10°26′N 84°01′W; Proy.ALAS, INBio-OET” / “M/12/397; 30 Junio 1995; Bosque primario” / “**PARATYPE**:: *Onichodon; confluentus* ♂; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (yellow printed label) (INBC); 1 ♂, “COSTA RICA: Heredia; Est.Bio. La Selva, 50–; 150 m 10°26′N 84°01′W; Proy.ALAS, INBio-OET” / “M/05/655; 31 Mayo 1996; Bosque primario” / “**PARATYPE**:: *Onichodon; confluentus* ♂; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (yellow printed label) (INBC); 1 ♂, “21 Mar 2001; INBio-OET-ALAS transect; COSTA RICA: Prov. Heredia; 16 km SSE La Virgen, 1050–; 1150 m, 10°16′N 84°05′W (“21 Mar” and “1” were handwritten on label) / 21 Marzo 2001; Transect; 11/M/07/067” / “**PARATYPE**:: *Onichodon; confluentus* ♂; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (yellow printed label) (INBC). Paratypes are to be deposited in INBC and GERP.

Description. Male holotype: Length, 8.0 mm. Width, 2.5 mm. Body elongate; dark reddish-brown; antennae and legs dark reddish-brown; head, pronotum and elytra clothed with short, recumbent yellowish setae (Figure 30). **Head:** Surface dullish, subspherical, confluent rugose; frons convex, simple without impression or carina; apical margin of frontoclypeal region weakly trilobed, about 2 times wider than base; mandibles stout, bidentate, densely punctate. **Antenna:** Filiform from flagellomeres I–IX, attaining at least 1/3 the length of the body, just beyond pronotal hind angles; flagellomere I longer than wide, slightly longer than II; flagellomeres II–VIII each longer than wide, sub-equal; flagellomere IX slightly longer than VIII. **Pronotum:** Surface somewhat shiny, with closely spaced punctures; quadrate, with well-developed, sharp hind angles; sides subparallel-sided at basal 1/2, arcuate at apical 1/2, slightly sinuate above pronotal hind angles; disc convex with shallow fovea above scutellar shield; base sinuous, with circular pit on each side above scutellar shield. **Scutellar shield:** Longer than wide,



Figures 31–34. Costa Rican macraulacine eucnemids. **31)** *Onichodon confluentus* sp. nov., male holotype, ventral habitus. **32)** *Onichodon confluentus* sp. nov., female allotype, dorsal habitus. **33)** *Onichodon rufus* sp. nov., dorsal habitus. **34)** *Onichodon rufus* sp. nov., ventral habitus. (Scale: 31–32 = 5.0 mm; 33–34 = 1.0 mm)

sub-triangular, shallowly punctate, setose and distally rounded. **Elytra:** Very shallow striae indicated; interstices slightly elevated; surfaces shiny, transversely rugose at basal $\frac{1}{4}$, closely punctate elsewhere. **Legs:** First tarsomere as long as the combined lengths of the remaining four on meso- and metatarsi; tibiae rounded in cross section; metatarsomeres I–III simple; metatarsomere IV excavated; metatarsomere V elongate with basally toothed claws. **Venter** (Figure 31): Closely punctate, with short, recumbent yellowish setae; hypomeron with basally opened, lateral antennal grooves; metepisterna parallel-sided; elytral epipleura punctate; metacoxal plates medially 3.0–6.0 times wider than laterally.

Female allotype (Figure 32): Length, 12.0 mm. Width, 4.0 mm. Antennae weakly and asymmetrically serriform, about $\frac{1}{3}$ the length of the body; flagellomere I longer than wide, slightly longer than II; flagellomere II slightly longer than wide, shorter than III; flagellomeres III–VIII longer than wide, sub-equal.

Variations. Seven male paratypes measured 6.0–10.5 mm long and 1.5–2.5 mm wide. Two male paratypes are larger than and just as wide as the holotype. The remaining five paratypes are shorter and narrower than the holotype. Pronotal punctures are widely dispersed in one paratype, whereas the remaining six paratypes have exoskeletal structures similar to the holotype.

Distribution. This eucnemid species is known from nine specimens taken from two locations within the province of Heredia.

Biology. Two specimens were taken from a primary forest. Five specimens, including the holotype were taken from a second growth forest. Larvae and pupae are unknown.

Etymology. The specific epithet is named from the presence of confluent surfaces of the frons on the new species.

Onichodon rufus Otto, Muona and Córdoba-Alfaro, new species

Figures 33–34

Diagnosis. The smaller size along with the reddish coloration with its habitus will distinguish the new species from *O. confluentus* new species and any other misplaced members of *Fornax* present in Costa Rica.

Type material. Female holotype: “COSTA RICA: Heredia; pr: La Selva Bio. Sta.; 3 km S Pto. Viejo; 10°26'N 84°01'W” / “25.IV.1990; H.A. Hespenheide” (“25”, “IV” and “0” handwritten on label) / “HOLOTYPE:; *Onichodon; rufus* ♀; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (red printed label). Holotype to be deposited in INBC.

Description. Female holotype: Length, 6.0 mm. Width, 1.5 mm. Body elongate; dark reddish; antennae and legs dark reddish; head, pronotum and elytra clothed with short, recumbent yellowish setae (Figure 33). **Head:** Surface somewhat shiny, subspherical with crowded punctures; frons convex without carina or fovea; interantennal carina present; apical margin of frontoclypeal region weakly trilobed, more than 2 times wider than base;

mandibles stout, bidentate, densely punctate. **Antenna:** Weakly serriform from flagellomeres I–IX, attaining about $\frac{1}{3}$ the length of the body, just beyond pronotal hind angle; flagellomere I longer than wide, longer than II; flagellomeres II–VIII each slightly longer than wide, sub-equal; flagellomere IX slightly longer than VIII. **Pronotum:** Surface somewhat shiny, with deep, crowded punctures; quadrate, with well-developed, sharp hind angles; sides parallel-sided at basal $\frac{2}{3}$, arcuate at apical $\frac{1}{3}$; disc convex, without carina or fovea; base sinuous. **Scutellar shield:** Slightly longer than wide, sub-triangular, shallowly punctate, setose and distally rounded. **Elytra:** Very shallow striae present; interstices slightly elevated; surfaces shiny, transversely rugose through much of the elytra. **Legs:** First tarsomere as long as the combined lengths of the remaining four on meso- and metatarsi; tibiae rounded in cross section; metatarsomeres I–III simple; metatarsomere IV excavated; metatarsomere V short with basally toothed claws. **Venter** (Figure 34): Closely punctate, with short, recumbent yellowish colored setae; hypomeron with basally opened, lateral antennal grooves; metepisterna parallel-sided; elytral epipleura punctate; metacoxal plates medially 3.0–6.0 times wider than laterally.

Distribution. This eucnemid species is known from the holotype taken from La Selva within the province of Heredia.

Biology. No biological information is known for the new species. Larvae and pupae are unknown.

Etymology. The specific epithet is derived from its overall reddish coloration of its habitus.

Genus *Isarthrus* LeConte, 1852

Diversity and distribution. Historically, *Isarthrus* is a small group consisting of two species found in the Nearctic region, north of Mexico. A third species described here, is the first outside the Nearctic region.

Diagnosis. Apical margin of frontoclypeal region feebly trilobed and more than twice as wide as the distance between antennal sockets; well-developed basally open lateral antennal grooves present; male protarsomere I simple, with basal sex combs; metacoxal plates medially 3.0–6.0 times wider than laterally; elytral epipleura evenly punctate; last visible ventrite either rounded or slightly emarginate; tarsal claws simple; lateral surfaces of meso- and metatibiae with setae and transverse rows of spine combs; male aedeagus dorsoventrally compressed, without secondary lateral lobes; median lob simple, with moderately and narrowly bifurcate apices; lateral lobes simple, entire; aedeagal flagellum simple.

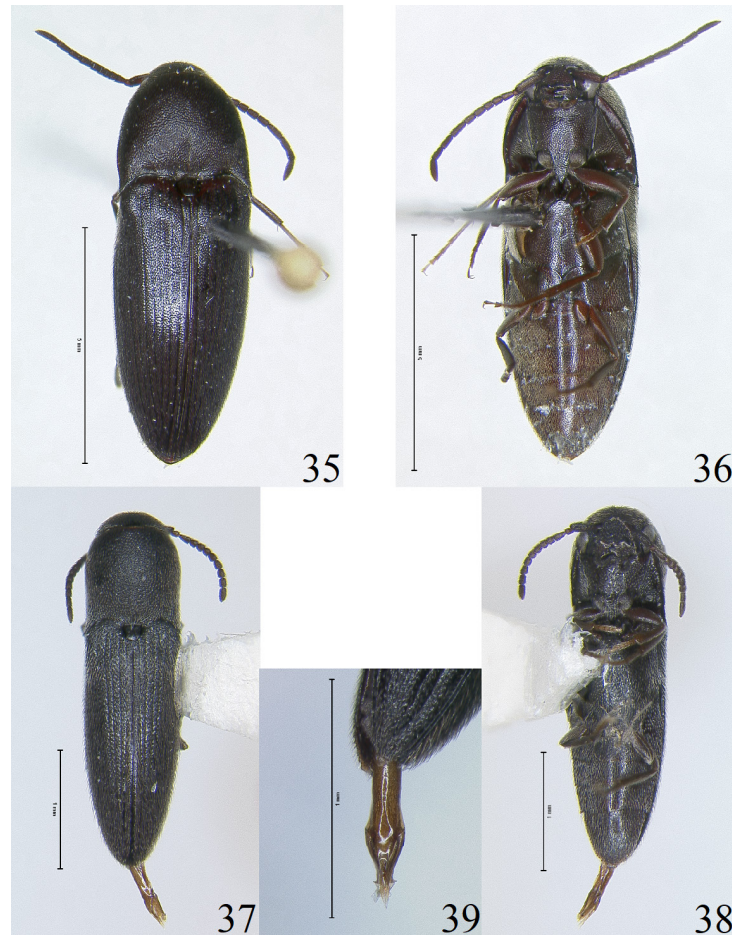
Isarthrus striatus Otto, Muona and Córdoba-Alfaro, new species

Figures 35–36

Diagnosis. The new eucnemid species can be readily distinguished from any macraulacine members of Eucnemidae present in Costa Rica by the presence of an interantennal carina, a wide lateral antennal groove which is widest in the middle, simple tarsal claws and dark colored dorsum with reddish-brown antennae and legs. The new species differs from the Nearctic *Isarthrus calceatus* LeConte by its antennal grooves widest in the middle, striate elytra and shorter flagellomeres II–III. *Isarthrus calceatus* have parallel-sided antennal grooves, poorly developed striae on the elytra, and slightly longer flagellomeres II–III.

Type material. Female holotype: “COSTA RICA: Prov. Heredia; Est.Bio. La Selva, 50–; 150 m 10°26'N 84°01'W; 24 Feb 2004; INBio-OET-ALAS transect” (“24 Feb” handwritten on label) / “24 Febrero 2004; Malaise; M/26/768” / “**HOLOTYPE**;; *Isarthrus; striatus* ♀; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (red printed label). Holotype to be deposited in INBC.

Paratypes. 4 ♀♀: **COSTA RICA:** 1 ♀, “COSTA RICA: Heredia; Pr: La Selva Bio. Sta.; 3 km s. Pto. Viejo; 10°26'N 84°01'W” / “ii–iv.1993, P. Hanson, Malaise Trap” / “**PARATYPE**;; *Isarthrus; striatus* ♀; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (yellow printed label) (INBC); 1 ♀, “COSTA RICA: Heredia; Pr: La Selva Bio. Sta.; 3 km s. Pto. Viejo; 10°26'N 84°01'W” / “iv–v.1993, P. Hanson, Malaise Trap” / “**PARATYPE**;; *Isarthrus; striatus* ♀; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (yellow printed label) (INBC); 1 ♀, “COSTA RICA: Heredia; Est.Bio. La Selva, 50–; 150 m 10°26'N 84°01'W; Proy.ALAS, INBio-OET” / “M/04/111; 01 Junio 1993; Bosque primario” / “**PARATYPE**;; *Isarthrus; striatus* ♀; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (yellow printed label) (INBC); 1 ♀, “COSTA RICA: Heredia; Est.Bio. La Selva, 50–; 150 m 10°26'N 84°01'W; Proy.ALAS, INBio-OET” / “M/10/172; 03 Agosto 1993; Bosque primario” / “Collection of the Global;



Figures 35–39. Costa Rican macraulacine eucnemids. **35)** *Isarthrus striatus* sp. nov., dorsal habitus. **36)** *Isarthrus striatus* sp. nov., ventral habitus. **37)** *Absensiugum brunneum* sp. nov., male holotype, dorsal habitus. **38)** *Absensiugum brunneum* sp. nov., male holotype, ventral habitus. **39)** *Absensiugum brunneum* sp. nov., Male aedeagus, dorsal view. (Scale: 35–36 = 5.0 mm; 37–39 = 1.0 mm)

Eucnemid Research Project; (Robert L. Otto)” (green framed white label) / “**PARATYPE**;; *Isarthrus; striatus* ♀; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (yellow printed label) (GERP). Paratypes are to be deposited in INBC and GERP.

Description. Female holotype: Length, 8.5 mm. Width, 2.5 mm. Body elongate; dark brownish-black; antennae and legs dark reddish-brown; head, pronotum and elytra clothed with short, recumbent yellowish setae (Figure 35). **Head:** Surface somewhat shiny, subspherical with crowded punctures; frons convex with slight circular impression above interantennal carina, poorly developed median carina present; interantennal carina present; apical margin of frontoclypeal region weakly trilobed, more than 2 times wider than base; mandibles stout, bidentate, densely punctate. **Antenna:** Filiform from flagellomeres I–IX, attaining about $\frac{1}{3}$ the length of the body; flagellomere I longer than wide, longer than II; flagellomeres II–III each slightly longer than wide, sub-equal, each shorter than I and IV; flagellomeres IV–V each longer than wide, sub-equal, longer than III, shorter than VI; flagellomeres VI–VIII each longer than wide, sub-equal; flagellomere IX slightly longer than VIII. **Pronotum:** Surface somewhat shiny, with deep, crowded punctures; quadrate, with well-developed, sharp hind angles; sides parallel-sided at basal $\frac{1}{2}$, arcuate at apical $\frac{1}{2}$; disc convex, slightly depressed near base above scutellar shield; base sinuous. **Scutellar shield:** Quadrate, sub-triangular, shallowly punctate, setose and distally rounded. **Elytra:** Very shallow striae present; interstices slightly elevated; surfaces shiny, closely punctate. **Legs:** First tarsomere as long as the combined lengths of the remaining four on meso- and metatarsi; tibiae rounded in cross section;

metatarsomeres I–III simple; metatarsomere IV excavated; metatarsomere V elongate with simple claws. **Venter** (Figure 36): Closely punctate, with short, recumbent silver-colored setae; hypomeron with basally opened, lateral antennal grooves, widest in the middle; metepisterna parallel-sided; elytral epipleura punctate; metacoxal plates medially 3.0–6.0 times wider than laterally.

Variations. Four female paratypes were examined. These paratypes measured 7.0–8.5 mm long and 2.0–2.5 mm wide. One female paratype is as large as and just as wide as the holotype. The remaining three paratypes are shorter and narrower than the holotype. Median carina on the frons are evident in two paratypes and absent in the other two paratypes.

Distribution. This eucnemid species is known from five specimens taken from La Selva within the province of Heredia.

Biology. Two paratypes were taken from a primary forest. Three specimens were taken from a Malaise trap. Larvae and pupae are unknown.

Etymology. The specific epithet is derived from the presence of well-developed striae on the elytra which serves as one of the best feature to distinguish the new species from the Nearctic *I. calceatus*.

***Absensiugum* Otto, Muona and Córdoba-Alfaro, new genus**

Type species. *Absensiugum brunneum* new species, by present designation.

Diversity and distribution. *Absensiugum* new genus is a genus consisting of two species distributed in the Caribbean, Nearctic and Neotropical regions. The new species was found in two locations within a single area in Costa Rica. The second species is distributed in the Caribbean region and southeastern United States.

Description. Male. Body elongate, approximately 3.5 times longer than wide, dorsally convex and ventrally well sclerotized. **Head:** Hypognathous, with short, recumbent setae. Antennae tubular, filiform with 11 antennomeres, setose; scape 3.0 times longer than pedicel; pedicel globular, shorter than flagellomere I; flagellomere I longer than II; flagellomeres II–IV sub-equal in length and rounded in cross section; flagellomeres V–VIII sub-equal in length and rounded in cross section; flagellomere IX longer than VIII. Eyes round, well developed, enlarged, not incised. Frontoclypeal region subtriangular, apically trilobed, about 2.5 times wider than base. Mandibles well developed, stout, bidentate. Maxillary and labial palpi concealed behind mandibles. Labrum concealed. **Pronotum:** Subparallel-sided, convex and setose. Longer than wide, with moderately sized pronotal hind angles. Lateral pronotal ridge entire, straight. Disc convex. Base sinuous. **Scutellar shield:** Setose, short, sub-triangular. **Elytron:** Elongate, convex, setose. Disc with striae indicated as punctate lines. Interstices slightly elevated. Cavities absent near elytral apices. **Legs:** Prothoracic legs shortest, metathoracic legs longest. Protibia apically rounded, setose, with one apical spur. Lateral sides of meso- and metatibiae with setae and transverse row of spine combs. Metatarsi, including claws, as long as tibia. Protarsomere I with straight, basal sex combs. First metatarsi as long as combined length of remaining four. Metatarsi I–III simple. Metatarsus IV excavate-emarginate, as wide as III. Metatarsus V elongate. Pretarsal claws basally toothed. Tarsal formula 5-5-5. **Venter:** Surface with recumbent setae. Prosternal peg basally narrow, elongate. Notosternal suture as long as the hypomeral base. Hypomeron without medially defined antennal ridge, surface smooth along lateral ridge, rest punctate. Epipleura simple, not grooved. Metepisterna parallel-sided. Metacoxal plate medially 3.0–6.0 times wider than laterally. Tarsal grooves absent on meso- and metasterna. Abdomen with 5 visible ventrites, convex medially. Last visible ventrite rounded caudally.

Etymology. The new generic name is a combination of two Latinized words, *absens*, which means absent and *iugum* which means ridge, due to the missing medial antennal ridge of the hypomeron. Gender neuter.

Note. During the course of the study, R. Otto discovered a pair of Costa Rican beetles superficially resembling the Nearctic species, *Dromaeolus teres* (Horn). Upon further examination, these two species were found to share the same morphological attributes, resulting in our decision to create a new group name, *Absensiugum* new genus, for these species. Therefore, we propose to transfer *Nematodes teres* Horn to the new group, hereby recognized as *Absensiugum teres* (Horn) new combination.

***Absensiugum brunneum* Otto, Muona and Córdoba-Alfaro, new species**

Figures 37–40

Diagnosis. The new species differ from *A. teres* by its antennal segments; stouter, quadrate in the new species and longer than wide in *A. teres*. Additionally, habitus coloration will further distinguish the new species from *A. teres*; dark brown in the new species, reddish-brown in *A. teres*.

Type material. Male holotype: “COSTA RICA, Heredia; Est.Bio. La Selva, 50–; 150 m, 10°26'N 84°01'W; Apr 2000, INBio-OET” / “M/01/236; 15 Octubre 1993; Parcelas sucesionales” / “**HOLOTYPE:** *Absensiugum brunneum* ♂; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (red printed label). **Female allotype:** “COSTA RICA, Heredia; Est.Bio. La Selva, 50–; 150 m, 10°26'N 84°01'W; Apr 2000, INBio-OET” / “M/12/390; 04 Abril 1994; Bosque primario” / “**ALLOTYPE:** *Absensiugum brunneum* ♀; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (yellow printed label). Holotype and allotype are to be deposited in INBC.

Description. Male holotype: Length 3.0 mm, width 0.75 mm. Body color uniformly dark brown (Figure 37). **Head:** Subspherical, without carina or fovea on frons; interantennal carina absent; surface dullish; punctures deep, closely spaced; eyes protuberant. **Antennae:** Dark reddish-brown; filiform, about 1/3 of body length; flagellomeres II–IV quadrate, sub-equal; flagellomeres V–VIII each slightly larger than IV, quadrate; flagellomere IX larger than VIII; lateral carina absent on flagellomeres II–VIII. **Pronotum:** Surface dullish, with somewhat elongate, yellow recumbent setae; punctures deep, closely spaced, almost rugose; longer than wide, with moderate, sharp hind angles; sides subparallel, sinuous; disc convex; base sinuous. **Scutellar shield:** Somewhat shiny, setose, punctures deep, close, subtriangular and distally rounded. **Elytron:** Convex, elongate, gradually narrowed from humeri to apices; conjoined tightly at apex; somewhat shiny, with elongate, yellow recumbent setae; length 2.0 mm, width 0.375 mm at humeri; humeri with punctate striae; disc with punctate striae; interstices slightly elevated, transversely rugose; apices without cavities. **Legs:** Femora and tibiae dark brown; tarsi dark reddish brown; surface somewhat shiny; punctures shallow, with yellow recumbent setae. **Venter** (Figure 38): Dark brown; surface somewhat shiny, with elongate, yellow recumbent setae; punctate, except along lateral side of hypomeron. **Aedeagus** (Figure 39): Elongate, dorsally flattened, sinuate, apically narrowed; median lobe free, short, apically rounded; parameres apically elongate, rounded, longer than median lobe, with lateral tooth; secondary lateral lobe absent; basal piece elongate, apically rounded.

Female allotype (Figure 40): Length, 4.0 mm. Width, 1.0 mm. Antennae filiform, about 1/3 the length of the body; flagellomere I longer than wide, longer than II; flagellomere II–IV slightly longer than wide, sub-equal; flagellomeres V–VIII each slightly longer than IV, longer than wide, sub-equal. Antennae reddish-brown. Legs reddish brown. Lateral antennal grooves deeper, surfaces smooth, ridge medially undefined.



Figures 40–43. Cost Rican macraulacine eucnemids. **40)** *Absensiugum brunneum* sp. nov., female allotype, dorsal habitus. **41)** *Dromaeolus ambiguus*, dorsal habitus. **42)** *Dromaeolus cinerescens*, dorsal habitus. **43)** *Dromaeolus dilutipes*, dorsal habitus. (Scale: 40–43 = 1.0 mm)

Distribution. This new eucnemid species is known from two localities at La Selva (successional plot and primary forest) within Costa Rica.

Biology. The holotype was taken from a successional plot. The allotype was taken from a primary forest. Larvae and pupae are unknown.

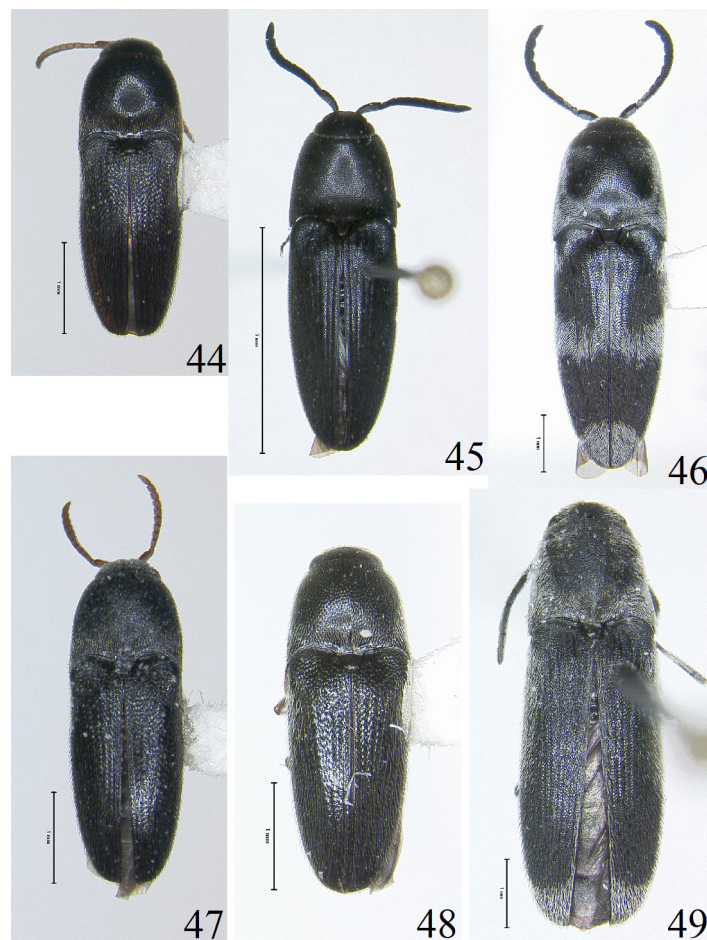
Etymology. The specific epithet is derived from the dark brown coloration of the beetle.

Genus *Dromaeolus* Kiesenwetter, 1858

(=*Melanus* Broun, 1881)

(=*Megathambus* Reitter, 1911)

Diversity and distribution. More than 200 species are presently assigned to *Dromaeolus*. Many species are distributed largely in the tropical and subtropical regions around the globe. The greatest diversity of the group is concentrated in the African, Neotropical and Indo-Malaysian regions. Eight species are known in the Nearctic region. Nine species are distributed in the Palearctic region. In Costa Rica, in addition to four newly described species, there are 13 other species present: *Dromaeolus ambiguus* Bonvouloir (Figure 41), *D. cinerescens* Bonvouloir (Figure 42), *D. dilutipes* Bonvouloir (Figure 43), *D. fastidiosus* Bonvouloir (Figure 44), *D. morens* Horn (Figure 45), *D. ornatulus* Horn (Figure 46), *D. panamensis* Fisher (Figure 47), *D. pusio* Horn (Figure 48), *D. sallei* Bonvouloir (Figure 49), *D. tetricus* Horn (Figure 50), *D. tripartitus* Horn (Figure 51), *D. vanus* Horn (Figure 52)



Figures 44–49. Costa Rican *Dromaeolus* species. 44) *Dromaeolus fastidiosus*, dorsal habitus. 45) *Dromaeolus morens*, dorsal habitus. 46) *Dromaeolus ornatulus*, dorsal habitus. 47) *Dromaeolus panamensis*, dorsal habitus. 48) *Dromaeolus pusio*, dorsal habitus. 49) *Dromaeolus sallei*, dorsal habitus. (Scale: 44, 46–49 = 1.0 mm; 45 = 5.0 mm)



Figures 50–53. Costa Rican *Dromaeolus* species. **50)** *Dromaeolus tetricus*, dorsal habitus. **51)** *Dromaeolus tripartitus*, dorsal habitus. **52)** *Dromaeolus vanus*, dorsal habitus. **53)** *Dromaeolus variegatus*, dorsal habitus. (Scale: 50–53 = 1.0 mm)

and *D. variegatus* Bonvouloir (Figure 53). Five other described Central American species may be present but haven't been collected in Costa Rica yet.

Diagnosis. Apical margin of frontoclypeal region feebly trilobed and more than twice as wide as the distance between antennal sockets; well-developed basally open or basally closed lateral antennal grooves present; male protarsomere I simple with basal sex combs; metacoxal plates medially 1.2–2.5 times wider than laterally; frons simple or with median carina present; last visible ventrite either rounded or truncated; tarsal claws simple; lateral surfaces of meso- and metatibiae either with setae and transverse rows of spine combs or setae and irregularly placed spines; male aedeagus dorsoventrally compressed, with laterally attached secondary lateral lobes; median lobe simple, with moderately and narrowly bifurcate apices; lateral lobes simple, entire; aedeagal flagellum simple (Muona 1993, 2011; Otto 2016).

Note. *Dromaeolus* is paraphyletic, based on plesiomorphic traits (Otto 2017b). Many species presently assigned in the group are misplaced. A revision of the group on a global scale is necessary to stabilize the group, in which the number of true *Dromaeolus* will be much fewer than the current numbers presently assigned to the group once the group is revised.

A key to the species of *Dromaeolus* of Costa Rica

1. Lateral antennal grooves narrow, parallel-sided 2
- Lateral antennal grooves wide, apically wider *Dromaeolus fastidiosus* Bonvouloir
- 2(1). Interantennal carina absent or incomplete 3
- Interantennal carina present and complete 4
- 3(2). Lateral margin of frontoclypeal region carinate *Dromaeolus tetricus* Horn
- Lateral margin of frontoclypeal region not carinate *Dromaeolus vanus* Horn
- 4(2). Median carina present on frontoclypeal region 5
- Median carina absent on frontoclypeal region 8
- 5(4). Elytra without ornate silver-colored setae 6
- Elytra with ornate silver-colored setae 7
- 6(5). Elytral striae present; habitus dullish *Dromaeolus dilutipes* Bonvouloir
- Elytral striae largely absent; habitus shiny *Dromaeolus pusio* Horn
- 7(5). Broader silver-colored band present on elytra; silver-colored setae present at elytral apices
..... *Dromaeolus herediensis* Otto, Muona and Córdoba-Alfaro, new species

- Narrower silver-colored band present on elytra; silver-colored setae at elytral apices absent
 *Dromaeolus holdridgei* Otto, Muona and Córdoba-Alfaro, new species
- 8(4). Elytra without ornate silver-colored setae 9
 — Elytra with ornate silver-colored setae 12
- 9(8). Pronotal surface punctate 10
 — Pronotal surface granulose *Dromaeolus ambiguus* Bonvouloir
- 10(9). Dorsum black 11
 — Dorsum dark brown *Dromaeolus brunneus* Otto, Muona and Córdoba-Alfaro, new species
- 11(10). Habitus small, less than 4.5 mm long *Dromaeolus panamensis* Fisher
 — Habitus large, greater than 4.5 mm long *Dromaeolus morens* Horn
- 12(8). Frons without median carina above frontoclypeal region 13
 — Frons with short median carina above frontoclypeal region *Dromaeolus cinerescens* Bonvouloir
- 13(12). Prosternal suture not deeply grooved 14
 — Prosternal suture deeply grooved *Dromaeolus tripartitus* Horn
- 14(13). Silver-colored setae present at elytral apices 15
 — Silver-colored setae absent at elytral apices
 *Dromaeolus americanus* Otto, Muona and Córdoba-Alfaro, new species
- 15(14). Flagellomere I slightly longer than II 16
 — Flagellomere I as long as II *Dromaeolus ornatulus* Horn
- 16(15). Silver-colored setae present narrowly at humeri, along elytral suture and elytral apices
 *Dromaeolus sallei* Bonvouloir
 — Silver-colored setae present along elytral humeri, extending down along suture from humeri and at elytral apices *Dromaeolus variegatus* Bonvouloir

Dromaeolus americanus Otto, Muona and Córdoba-Alfaro, new species

Figures 54–55

Diagnosis. This new eucnemid species can be readily distinguished from any ornate members of *Dromaeolus* present in Costa Rica by its elytral vittae and smaller size. The elytral vittae are very similar to an Amazonian eucnemid, *D. batesii* Bonvouloir, but *D. americanus* differs by its smaller size.

Type material. Male holotype: “COSTA RICA: Heredia; Est.Bio. La Selva, 50–; 150 m 10°26'N 84°01'W; Proy. ALAS, INBio-OET” / “M/06/198; 01 Septiembre 1993; Bosque primario” / “**HOLOTYPE**; *Dromaeolus*; *americanus* ♂; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (red printed label). Holotype to be deposited in INBC.

Paratype. 1 ♂: COSTA RICA: “COSTA RICA: Heredia; Est.Bio. La Selva, 50–; 150 m 10°26'N 84°01'W; Proy.ALAS, INBio-OET” / “M/01/320; 15 Enero 1994; Parcelas sucesionales” / “**PARATYPE**; *Dromaeolus*; *americanus* ♂; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (yellow printed label). Paratype to be deposited in INBC.

Description. Male holotype: Length, 4.5 mm. Width, 1.0 mm. Body elongate; black; antennae black; femur and tibiae black, tarsi black; head and pronotum clothed with short, recumbent silver-colored setae more apparent along base and lateral sides of pronotum, elytra with silver-colored setae more apparent with comma-shaped vittae at humeri, wide band across the apical ⅓ of each elytron, short, narrow patch along elytral suture just below scutellar shield (Figure 54). **Head:** Surface dullish, subspherical with closely spaced punctures; frons convex, simple with slight circular impression above interantennal carina; interantennal carina present; apical margin of frontoclypeal region weakly trilobed, more than 2 times wider than base; mandibles stout, bidentate, densely punctate. **Antenna:** Filiform from flagellomeres I–IX, attaining nearly ⅓ the length of the body, never passed beyond pronotal hind angles; flagellomere I longer than wide, longer than II; flagellomeres II–VIII each quadrate, sub-equal; flagellomere IX slightly longer than VIII. **Pronotum:** Surface dullish, with evenly dispersed punctures; slightly longer than wide, with well-developed, sharp hind angles; sides arcuate above pronotal hind



Figures 54–57. Costa Rican *Dromaeolus* species. **54)** *Dromaeolus americanus* sp. nov., dorsal habitus. **55)** *Dromaeolus americanus* sp. nov., ventral habitus. **56)** *Dromaeolus brunneus* sp. nov., male holotype, dorsal habitus. **57)** *Dromaeolus brunneus* sp. nov., male holotype, ventral habitus. (Scale: 54–57 = 1.0 mm)

angles; disc convex without shallow median groove or circular fovea; base sinuous, with delicate short median groove. **Scutellar shield:** Quadrate, sub-triangular, shallowly punctate and distally rounded. **Elytra:** Very shallow striae indicated; interstices slightly elevated; surfaces dullish, transversely rugose at basal 1/4, closely punctate elsewhere. **Legs:** First tarsomere longer than the combined lengths of the remaining four on meso- and meta-tarsi; tibiae rounded in cross section; metatarsomeres I–III simple; metatarsomere IV excavated; metatarsomere V short with simple claws. **Venter** (Figure 55): Closely punctate, with short, recumbent silver-colored setae; hypomeron with basally opened, lateral antennal grooves; metepisterna parallel-sided; elytral epipleura punctate; metacoxal plates medially 3.0–6.0 times wider than laterally.

Variation. The male paratype measured 5.0 mm long and 1.0 mm wide. It is slightly longer than and just as wide as the holotype. Interantennal carina is more apparent than the holotype. A circular impression above the interantennal carina is also more apparent than the holotype.

Distribution. This species is known from two specimens taken from La Selva within the province of Heredia.

Biology. The holotype was taken from a primary forest. The paratype was taken from a successional plot. Larvae and pupae are unknown.

Etymology. The specific epithet is named after America, a name first used shortly after Christopher Columbus' voyage to the new world, in which the name derives from Amerigo Vespucci, an Italian explorer who explored the new continents years later.

Dromaeolus brunneus Otto, Muona and Córdoba-Alfaro, new species

Figures 56–58

Diagnosis. The new eucnemid species can be readily distinguished by its elongate form, brown colored dorsum and presence of interantennal carina from any *Dromaeolus* species present in Costa Rica. The new species is very similar to the Nearctic *D. badius* (Melsheimer) and *D. salsus* Bonvouloir. The presence of an interantennal carina and shorter flagellomere II will distinguish the new species from either Nearctic species.

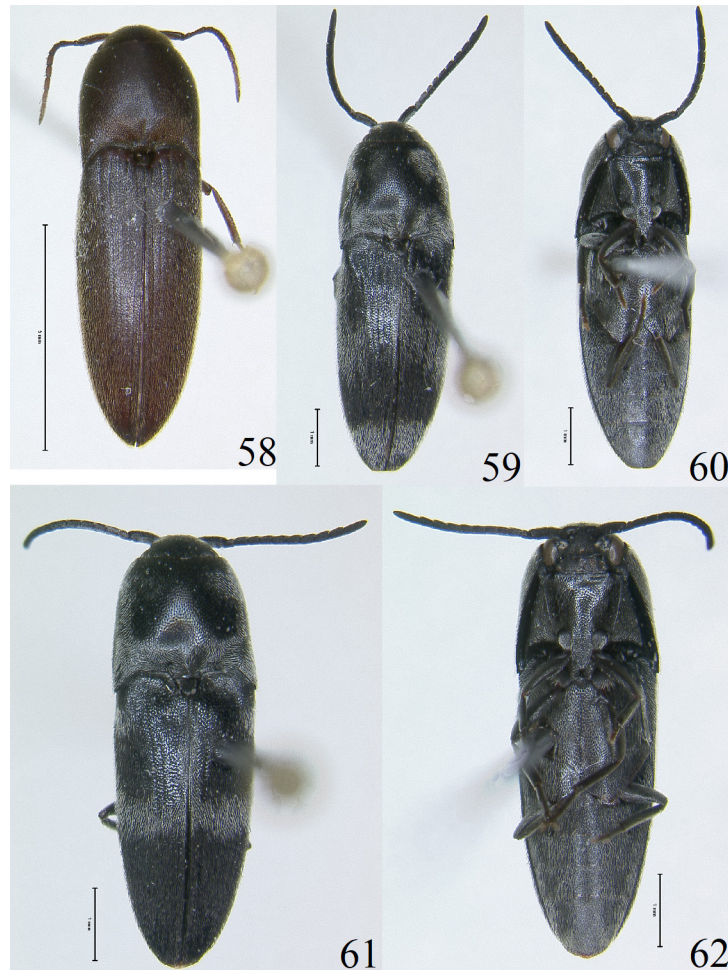
Type material. Male holotype: “COSTA RICA: Heredia; Est.Bio. La Selva, 50–; 150 m 10°26'N 84°01'W; Proy. ALAS, INBio-OET” / “M/01/208; 16 Septiembre 1993; Parcelas sucesionales” / “**HOLOTYPE**:: *Dromaeolus brunneus* ♂; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (red printed label). **Female allotype:** “COSTA RICA: Heredia; Est.Bio. La Selva, 50–; 150 m 10°26'N 84°01'W; Proy.ALAS, INBio-OET” / “M/10/380; 15 Marzo 1994; Bosque primario” / “**ALLOTYPE**:: *Dromaeolus brunneus* ♀; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (yellow printed label). Holotype and allotype are to be deposited in INBC.

Paratypes. 3 ♂♂ 8 ♀♀: **COSTA RICA:** 1 ♀, “COSTA RICA: Heredia; Est.Bio. La Selva, 50–; 150 m 10°26′N 84°01′W; Proy.ALAS, INBio-OET” / “M/13/028; 03 Marzo 1993; Bosque secundario” / “**PARATYPE**;; *Dromaeolus; brunneus* ♀; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (yellow printed label) (INBC); 1 ♀, “COSTA RICA: Heredia; Est.Bio. La Selva, 50–; 150 m 10°26′N 84°01′W; Proy.ALAS, INBio-OET” / “M/10/025; 03 Marzo 1993; Bosque primario” / “**PARATYPE**;; *Dromaeolus; brunneus* ♀; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (yellow printed label) (INBC); 1 ♀, “COSTA RICA: Heredia; Pr: La Selva Bio. Sta.; 3 km S Pto. Viejo; 10°26′N 84°01′W” / “1 Abril 1993; Bosque secundario; M/02/049” / “**PARATYPE**;; *Dromaeolus; brunneus* ♀; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (yellow printed label) (INBC); 1 ♂, 1 ♀, “COSTA RICA: Heredia; Est.Bio. La Selva, 50–; 150 m 10°26′N 84°01′W; Proy.ALAS, INBio-OET” / “M/16/063; 02 Abril 1993; Bosque secundario” / “**PARATYPE**;; *Dromaeolus; brunneus*; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (either ♂ or ♀ typed behind species name on label) [yellow printed label] (2, INBC); 1 ♂, “COSTA RICA: Heredia; Est.Bio. La Selva, 50–; 150 m 10°26′N 84°01′W; Proy.ALAS, INBio-OET” / “M/04/067; 15 Abril 1993; Bosque primario” / “**PARATYPE**;; *Dromaeolus; brunneus* ♂; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (yellow printed label) (INBC); 1 ♀, “COSTA RICA: Heredia; Est.Bio. La Selva, 50–; 150 m 10°26′N 84°01′W; Proy.ALAS, INBio-OET” / “M/10/104; 18 Mayo 1993; Bosque primario” / “Collection of the Global; Eucnemid Research Project; (Robert L. Otto)” (green framed white label) / “**PARATYPE**;; *Dromaeolus; brunneus* ♀; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (yellow printed label) (GERP); 1 ♀, “COSTA RICA: Heredia; Est.Bio. La Selva, 50–; 150 m 10°26′N 84°01′W; Proy.ALAS, INBio-OET” / “M/04/111; 01 Junio 1993; Bosque primario” / “**PARATYPE**;; *Dromaeolus; brunneus* ♀; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (yellow printed label) (INBC); 1 ♂, “COSTA RICA: Heredia; Est.Bio. La Selva, 50–; 150 m 10°26′N 84°01′W; Proy.ALAS, INBio-OET” / “M/11/389; 04 Abril 1994; Bosque secundario” / “**PARATYPE**;; *Dromaeolus; brunneus* ♂; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (yellow printed label) (INBC); 1 ♀, “COSTA RICA: Heredia; Est.Bio. La Selva, 50–; 150 m 10°26′N 84°01′W; Proy.ALAS, INBio-OET” / “M/10/635; 02 Mayo 1996; Bosque primario” / “**PARATYPE**;; *Dromaeolus; brunneus* ♀; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (yellow printed label) (INBC); 1 ♀, “COSTA RICA: Heredia; Est.Bio. La Selva, 50–; 150 m 10°26′N 84°01′W; Apr. 2000, INBio-OET” / “17 Abril 2000; Bosque secundario; M/19/746” / “**PARATYPE**;; *Dromaeolus; brunneus* ♀; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (yellow printed label) (INBC). Paratypes are to be deposited in INBC and GERP.

Description. Male holotype: Length, 6.0 mm. Width, 1.5 mm. Body elongate; dark brown; antennae and legs dark reddish-brown; head, pronotum and elytra clothed with short, recumbent yellowish setae (Figure 56). **Head:** Surface dullish, subspherical, closely punctate; frons convex, simple without impression or carina; apical margin of frontoclypeal region weakly trilobed, about 2 times wider than base; interantennal carina complete; mandibles stout, bidentate, densely punctate. **Antenna:** Filiform from flagellomeres I–IX, attaining up to 1/3 the length of the body, just beyond pronotal hind angles; flagellomere I longer than wide, longer than II; flagellomeres II–III each sub-equal, longer than wide, shorter than IV; IV–VIII each longer than wide, sub-equal; flagellomere IX slightly longer than VIII. **Pronotum:** Surface somewhat dullish, with closely spaced punctures; longer than wide, with well-developed, sharp hind angles; sides arcuate; disc convex without fovea or carina; base sinuous. **Scutellar shield:** Longer than wide, sub-triangular, shallowly punctate, setose and distally rounded. **Elytra:** Very shallow striae indicated at humeri region, indistinct elsewhere; interstices flattened; surfaces shiny, transversely rugose at basal 1/2, closely punctate at apical 1/2. **Legs:** First tarsomere as long as the combined lengths of the remaining four on meso- and metatarsi; tibiae rounded in cross section; metatarsomeres I–III simple; metatarsomere IV excavated; metatarsomere V elongate with simple claws. **Venter** (Figure 57): Closely punctate, with short, recumbent yellowish setae; hypomeron with basally opened, lateral antennal grooves; metepisterna parallel-sided; elytral epipleura punctate; metacoxal plates medially 3.0–6.0 times wider than laterally.

Female allotype (Figure 58): Length, 9.0 mm. Width, 2.0 mm. Short carina extending from interantennal carina down the frontoclypeal region. Flagellomeres filiform, less than 1/3 the length of the body; flagellomere I longer than wide, longer than II; flagellomere II longer than wide, as long as III; flagellomeres IV–VIII longer than wide, sub-equal.

Variations. Three male and eight female paratypes were examined. Males measured 6.0 mm long and 1.5 mm wide. Females measured 6.0–9.0 mm long and 1.5–2.5 mm wide. All male paratypes are just as long as and as



Figures 58–62. Costa Rican *Dromaeolus* species. **58)** *Dromaeolus brunneus* sp. nov., female allotype, dorsal habitus. **59)** *Dromaeolus herediensis* sp. nov., dorsal habitus. **60)** *Dromaeolus herediensis* sp. nov., ventral habitus. **61)** *Dromaeolus holdridgei* sp. nov., dorsal habitus. **62)** *Dromaeolus holdridgei* sp. nov., ventral habitus. (Scale: 59–62 = 1.0 mm; 58 = 5.0 mm)

wide as the holotype. Two female paratypes are just as large and as wide as the allotype. Four female paratypes are shorter than and just as wide as the allotype. The remaining two female paratypes are shorter than and narrower than the allotype. None of the paratype have a short carina extending down the frontoclypeal region from the interantennal carina. Four paratypes out of 11 have the same elytral microsculpture as the holotype. The remaining seven paratypes exhibit transversely rugose surfaces at the basal $\frac{1}{3}$ of the elytra instead of the basal $\frac{1}{2}$.

Distribution. This eucnemid species is known from 13 specimens taken from La Selva within the province of Heredia.

Biology. Six specimens were taken from a primary forest. Six specimens were taken from a second growth forest. One specimen was taken from a successional parcel. Larvae and pupae are unknown.

Etymology. The specific epithet is named from its brown colored dorsum present on the new species.

Dromaeolus herediensis Otto, Muona and Córdoba-Alfaro, new species

Figures 59–60

Diagnosis. The new eucnemid species can be readily distinguished from any ornate members of *Dromaeolus* present in Costa Rica by the presence of interantennal carina, median carina on the frontoclypeal region and

median carina present on the frons except *Dromaeolus holdridgei* **new species**. Broader silver-colored band on the elytra along with the presence of silver-colored setae at elytral apices will distinguish the new species from *D. holdridgei* **new species**. Shiny surface with punctures will further distinguish the new species from *Dromaeolus dilutipes* Bonvouloir.

Type material. Female holotype: “COSTA RICA: Heredia; Est.Bio. La Selva, 50–; 150 m 10°26'N 84°01'W; Proy. ALAS, INBio-OET” / “M/11/026; 03 Marzo 1993; Bosque primario” / “**HOLOTYPE**::; *Dromaeolus; herediensis* ♀; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (red printed label). Holotype to be deposited in INBC.

Paratype. 1 ♀: COSTA RICA: “COSTA RICA: Heredia; Est.Bio. La Selva, 50–; 150 m 10°26'N 84°01'W; Proy.ALAS, INBio-OET” / “M/11/026; 03 Marzo 1993; Bosque primario” / “**PARATYPE**::; *Dromaeolus; herediensis* ♀; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (yellow printed label). Paratype to be deposited in INBC.

Description. Female holotype: Length, 6.0 mm. Width, 1.5 mm. Body elongate; black; antennae black; femur and tibiae black, tarsi dark brownish-black; head and pronotum clothed with short, recumbent silver-colored setae, elytra with silver-colored setae more apparent along lateral sides at basal half, wide band across the middle of each elytron, narrow band along elytral suture terminating at the middle band and patch of silver-colored setae present at elytral apices (Figure 59). **Head:** Surface shiny, subspherical with closely spaced punctures; frons convex with median carina extending down to interantennal carina, above frontoclypeal region; frontoclypeal region with median carina; interantennal carina present, sinuous; apical margin of frontoclypeal region trilobed, more than 2 times wider than base; mandibles stout, bidentate, densely punctate. **Antenna:** Filiform from flagellomeres I–IX, attaining nearly $\frac{1}{3}$ the length of the body, never passed beyond pronotal hind angles; flagellomere I longer than wide, longer than II; flagellomere II quadrate, shorter than III; flagellomere III slightly longer than wide, shorter than IV; IV–VIII each sub-equal, longer than wide; flagellomere IX slightly longer than VIII. **Pronotum:** Surface shiny, with evenly dispersed punctures; slightly longer than wide, with well-developed, sharp hind angles; sides parallel-sided, slightly arcuate near craniad; disc convex without shallow median groove or circular fovea; base sinuous. **Scutellar shield:** Elongate, sub-triangular, shallowly punctate, setose and distally rounded. **Elytra:** Very shallow striae indicated; interstices slightly elevated; surfaces shiny with rugose to deep punctures at humeri, shallower elsewhere. **Legs:** First tarsomere longer than the combined lengths of the remaining four on meso- and metatarsi; tibiae rounded in cross section; metatarsomeres I–III simple; metatarsomere IV excavated; metatarsomere V short with simple claws. **Venter** (Figure 60): Closely punctate, with short, recumbent silver-colored setae; hypomeron with basally opened, lateral antennal grooves; metepisterna parallel-sided; elytral epipleura punctate; metacoxal plates medially 3.0–6.0 times wider than laterally.

Variations. One female paratypes was examined. The female paratype measured 5.5 mm long and 1.5 mm wide. The female paratype is slightly shorter than and just as wide as the holotype. The frontal carina on the frons on the paratype does not extend down towards the interantennal carina. The frontal carina does extend down to the interantennal carina in the holotype.

Distribution. This eucnemid species is known from two specimens taken from La Selva within the province of Heredia.

Biology. Both the holotype and paratype were taken from a primary forest. Larvae and pupae are unknown.

Etymology. The specific epithet is derived from a combination of two words, ‘Heredia’ and ‘-ensis’, a Latin adjectival suffix meaning “pertaining to”; from which the new species have been taken.

Dromaeolus holdridgei Otto, Muona and Córdoba-Alfaro, new species

Figures 61–62

Diagnosis. The new eucnemid species can be readily distinguished from any ornate members of *Dromaeolus* present in Costa Rica by the presence of interantennal carina, very short, median carina on the frontoclypeal region and short, median carina present on the frons except *D. herediensis* **new species**. Narrower silver-colored band on the elytra along with the absence of silver-colored setae at elytral apices will distinguish the new species from *D. herediensis* **new species**.

Type material. Female holotype: “COSTA RICA: Heredia; Est.Bio. La Selva, 50–; 150 m 10°26'N 84°01'W; Proy.ALAS, INBio-OET” / “M/01/136; 01 Julio 1993; Parcelas sucesionales” / “**HOLOTYPE**;; *Dromaeolus holdridgei* ♀; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (red printed label). Holotype to be deposited in INBC.

Description. Female holotype: Length, 6.0 mm. Width, 1.5 mm. Body elongate; black; antennae black; femur and tibiae black, tarsi dark brownish-black; head and pronotum clothed with short, recumbent silver-colored setae more apparent at base and along lateral sides of pronotum, elytra with silver-colored setae more apparent along lateral sides at basal half, narrow band across the middle of each elytron and narrow band along elytral suture terminating at the middle band (Figure 61). **Head:** Surface dullish, subspherical with closely spaced punctures; frons convex with short median carina; frontoclypeal region with short, delicate median carina; interantennal carina present, sinuous; apical margin of frontoclypeal region weakly trilobed, more than 2 times wider than base; mandibles stout, bidentate, densely punctate. **Antenna:** Filiform from flagellomeres I–IX, attaining nearly $\frac{1}{3}$ the length of the body, never passed beyond pronotal hind angles; flagellomere I longer than wide, longer than II; flagellomere II quadrate, shorter than III; flagellomere III slightly longer than wide, shorter than IV; IV–VIII each sub-equal, longer than wide; flagellomere IX slightly longer than VIII. **Pronotum:** Surface shiny, with evenly dispersed punctures; slightly longer than wide, with well-developed, sharp hind angles; sides subparallel-sided, slightly arcuate near craniad; disc convex without shallow median groove or circular fovea; base sinuous. **Scutellar shield:** Elongate, sub-triangular, shallowly punctate, setose and distally rounded. **Elytra:** Very shallow striae indicated; interstices slightly elevated; surfaces shiny with transversely rugose to deep punctures at humeri, shallower punctures elsewhere. **Legs:** First tarsomere longer than the combined lengths of the remaining four on meso- and metatarsi; tibiae rounded in cross section; metatarsomeres I–III simple; metatarsomere IV excavated; metatarsomere V short with simple claws. **Venter** (Figure 62): Closely punctate, with short, recumbent silver-colored setae; hypomeron with basally opened, lateral antennal grooves; metepisterna parallel-sided; elytral epipleura punctate; metacoxal plates medially 3.0–6.0 times wider than laterally.

Distribution. This eucnemid species is known from a single specimen taken from La Selva within the province of Heredia.

Biology. The holotype was taken from a successional plot. Larvae and pupae are unknown.

Etymology. The specific epithet is dedicated in honor of Dr. Leslie Holdridge, an American botanist and climatologist who was the founding member of the La Selva Biological Station established in 1968.

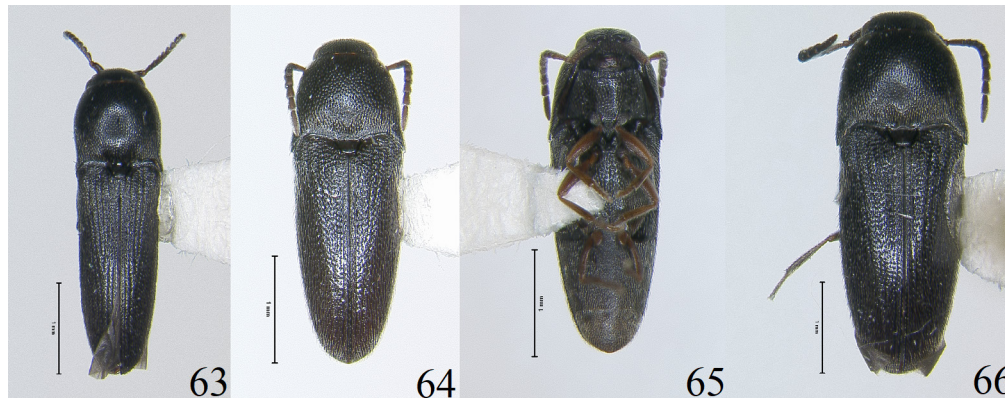
Genus *Deltometopus* Bonvouloir, 1871

Diversity and distribution. *Deltometopus* is a small group consisting of 11 described species distributed in the Neotropical and Nearctic regions. Nine described species are present in the Neotropical region. There are also an indeterminate number of undescribed species present in the region. Currently, two species are present in the Nearctic region.

Diagnosis. Apical margin of frontoclypeal region fairly evenly rounded and more than twice as wide as the distance between antennal sockets; well developed, apically widened, open lateral antennal grooves present; male prothoracic tarsomere I simple, without sex combs; metacoxal plates medially 1.2–2.5 times wider than laterally; frons simple; last visible ventrite either rounded or acute; simple tarsal claws; lateral surfaces of mesothoracic and metathoracic tibiae either with setae only or with setae and irregularly placed spines; male aedeagus dorsoventrally compressed, with laterally attached secondary lateral lobes; median lobe simple, moderately and narrowly bifurcate apically; lateral lobes simple, entire; aedeagal flagellum simple (Muona 1993, 2011).

A key to the species of *Deltometopus* in Costa Rica

1. Habitus cuneiform; sulcus present along lateral margin of pronotum (Figure 63) *Deltometopus foveolatus* Bonvouloir
- Habitus elongate, less cuneiform; sulcus absent along lateral margin of pronotum *Deltometopus bicolor* Otto, Muona and Córdoba-Alfaro, new species



Figures 63–66. Costa Rican *Deltometopus* species. **63)** *Deltometopus foveolatus*, dorsal habitus. **64)** *Deltometopus bicolor* sp. nov., male holotype, dorsal habitus. **65)** *Deltometopus bicolor* sp. nov., male holotype, ventral habitus. **66)** *Deltometopus bicolor* sp. nov., female allotype, dorsal habitus. (Scale: 63–66 = 1.0 mm)

Deltometopus bicolor Otto, Muona and Córdoba-Alfaro, new species

Figures 64–66

Diagnosis. The new eucnemid species is very similar to *D. fastidiosus* Bonvouloir. *Deltometopus bicolor* can be distinguished from *D. fastidiosus* by the presence of interrupted interantennal carina at the base of the frontoclypeal region. *Dromaeolus fastidiosus* have a complete interantennal carina. The new species is further distinguished from *D. foveolatus* by its elongate, less cuneiform habitus and absence of sulcus along lateral margin of the pronotum.

Type material. Male holotype: “COSTA RICA: Heredia; Est.Bio. La Selva, 50–; 150 m 10°26′N 84°01′W; Proy. ALAS, INBio-OET” / “M/13/028; 03 Marzo 1993; Bosque secundario” / “**HOLOTYPE**;; *Deltometopus; bicolor* ♂; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (red printed label). **Female allotype:** “COSTA RICA, Heredia; Est.Bio. La Selva, 50–; 150 m, 10°26′N 84°01′W; Proy.ALAS, INBio-OET” / “M/13/028; 03 Marzo 1993; Bosque secundario” / “**ALLOTYPE**;; *Deltometopus; bicolor* ♀; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (yellow printed label). Holotype and allotype are to be deposited in INBC.

Paratypes. 2 ♂♂, 1 ♀: **COSTA RICA:** 1 ♂, “COSTA RICA: Heredia; Est.Bio. La Selva, 50–; 150 m 10°26′N 84°01′W; Proy.ALAS, INBio-OET” / “M/09/072; 15 Abril 1993; Bosque secundario” / “**PARATYPE**;; *Deltometopus; bicolor* ♂; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (yellow printed label) (INBC); 1 ♂, “COSTA RICA: Heredia; Est.Bio. La Selva, 50–; 150 m 10°26′N 84°01′W; Proy.ALAS, INBio-OET” / “M/11/341; 15 Febrero 1994; Bosque secundario” / “Collection of the Global; Eucnemid Research Project; (Robert L. Otto)” (green framed white label) / “**PARATYPE**;; *Deltometopus; bicolor* ♂; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (yellow printed label) (GERP); 1 ♀, “COSTA RICA: Heredia; Est.Bio. La Selva, 50–; 150 m 10°26′N 84°01′W; Proy.ALAS, INBio-OET” / “M/02/400; 17 Julio 1995; Bosque secundario” / “**PARATYPE**;; *Deltometopus; bicolor* ♀; Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (yellow printed label) (INBC). Paratypes are to be deposited in INBC and GERP.

Description. Male holotype: Length, 2.5 mm. Width, 1.0 mm. Body elongate; dark black; antennae brown; femur and tibiae brown, tarsi brown; head, pronotum and elytra clothed with short, recumbent whitish setae (Figure 64). **Head:** Surface densely punctate, somewhat shiny, subspherical; frons convex, without fovea or ridge; apical margin of frontoclypeal region rounded, more than 2 times wider than base; interantennal carina incomplete; mandibles stout, bidentate, densely punctate. **Antenna:** Serriform from flagellomeres I–VIII, attaining about 1/3 the length of the body, just beyond pronotal hind angles; flagellomere I longer than II; flagellomeres II–III sub-equal, slightly longer than wide; flagellomeres IV–VIII sub-equal, each slightly larger than III, slightly longer than wide; flagellomere IX simple, slightly longer than VIII. **Pronotum:** Surface somewhat shiny, densely punctate; quadrate, with moderate, sharp hind angles; lateral sides sinuous, apically narrowed, arcuate; disc convex without fovea or ridge; base sinuous. **Scutellar shield:** Transverse, sub-triangular, shallowly punctate and distally rounded. **Elytra:** Striae delicately indicated on humeri, indistinct elsewhere; interstices flattened; surfaces shiny,

transversely rugose at basal 1/4, dense, crowded, shallow punctures present elsewhere. **Legs:** First tarsomere as long as the combined lengths of the remaining four on meso- and metatarsi; tibiae rounded in cross section; metatarsomeres I–III simple; metatarsomere IV short, excavate-emarginate; metatarsomere V elongate with simple claws. **Venter** (Figure 65): Closely punctate, with short, recumbent white-colored setae; hypomeron with basally widened, basally opened, lateral antennal grooves; metepisterna parallel-sided; elytral epipleura punctate; metacoxal plates medially 3.0–6.0 times wider than laterally.

Female allotype (Figure 66): Length, 4.0 mm. Width, 1.0 mm. Flagellomeres serriform, about $\frac{1}{3}$ the length of the body; flagellomere I longer than wide, longer than II; flagellomere II–IV sub-equal, quadrate; flagellomeres V–VIII each slightly longer than IV, quadrate, sub-equal. Frons impressed above frontoclypeal region.

Variations. Three paratypes were examined. Two male paratypes measured 3.0 mm long and 1.0 mm wide. One female paratype measured 4.0 mm long and 1.0 mm wide. All paratypes are longer than and just as wide as the holotype. Both male paratypes have a more pronounced impression on the frons just above the frontoclypeal region. Frons on the female paratype are simple, without any indications of impression above the frontoclypeal region. Pedicel and flagellomere I are yellowish in one male paratype. The remaining two paratypes have antennal colorations similar to the holotype. Habitus in all paratypes are just as dark as the holotype. Striae at the humeri are more pronounced in one of the male and female paratypes compared to the holotype. Striae in the other male paratype are similar to the holotype.

Distribution. This eucnemid species is known from five specimens taken from a single location in four different collection events at La Selva within the province of Heredia.

Biology. All specimens in the type series were taken from a second growth forest. Larvae and pupae are unknown.

Etymology. The specific epithet is derived from its black habitus along with dark brown legs and antennae.

Tribe Nematodini Leiler, 1976

Diagnosis. Mandibles short, with ventral secondary tooth, without expanded lateral surfaces; prothoracic tibiae with one apical spur; male prothoracic tarsomere I with basal sex combs; tarsomere IV usually bilobed; lateral sides of mesothoracic and metathoracic tibiae variable, either with setae and simple spines or with setae and transverse rows of spine combs; hypomeron with or without antennal grooves; prothoracic sternal peg high, either truncated or excavated; median lobe without dorsal basal struts, fused with lateral lobes, distinct, with narrowly and deeply bifurcate apex; bursa divided, simple; spermatheca sclerotized, divided and U-shaped (Muona 1993; Otto 2017c).



Figures 67–70. Costa Rican *Nematodes* species. **67)** *Nematodes biarti*, dorsal habitus. **68)** *Nematodes conjunctus*, dorsal habitus. **69)** *Nematodes cuneatus*, dorsal habitus. **70)** *Nematodes cylindricus*, dorsal habitus. (Scale: 67 = 1.0 mm; 68–70 = 5.0 mm)

Genus *Nematodes* Berthold, 1827

Diversity and distribution. *Nematodes* is a moderately large group consisting of 48 species. Five described species are distributed in eastern North America, north of Mexico. Twenty-three species are found in the Neotropical region, including the Caribbean Islands. One species occurs throughout much of Europe and Russia. Two species are distributed along the eastern coastline of the Australian continent. One species is present on the African continent. Nine species are represented in Southeast Asia, including Japan. At least seven undescribed species are known in the Neotropical, Oceanic and Southeast Asian regions. In Costa Rica, in addition to the newly described species, there are 6 other species present: *Nematodes biarti* Bonvouloir (Figure 67), *N. conjunctus* Bonvouloir (Figure 68), *N. cuneatus* (Guérin-Méneville) (Figure 69), *N. cylindricus* (Laporte) (Figure 70), *N. mannerheimi* Bonvouloir (Figure 71) and *N. mexicanus* Chevrolat (Figure 72). Both *Nematodes mexicanus* and *N. conjunctus* have not been observed in the province of Heredia, but are present elsewhere in Costa Rica and therefore are included in the identification key.

Diagnosis. Apical margin of frontoclypeal region feebly trilobed and more than twice as wide as the distance between antennal sockets; antennal grooves absent; male protarsomere I simple with basally curved sex combs; tarsal claws simple; tarsomere IV excavate-emarginate; metacoxal plates medially 3.0–6.0 times wider than laterally; last visible ventrite strongly produced; lateral surfaces of meso- and metatibiae with setae and transverse rows of spine combs; metathoracic episterna parallel-sided; male aedeagus dorsoventrally compressed, with laterally attached secondary lateral lobes; median lobe simple, with moderately and narrowly bifurcate apices; lateral lobes simple, entire; aedeagal flagellum simple (Muona 1993, 2011; Otto 2016).

These diagnostic characteristics, especially the presence of excavate-emarginate tarsomere IV and parallel-sided metathoracic episterna will distinguish the group from any other genera within the tribe Nematodini.

A key to the species of *Nematodes* in Costa Rica

1. Elytral apices without ornate silver-colored setae 2
- Elytral apices with ornate silver-colored setae
..... *Nematodes apicalis* Otto, Muona and Córdoba-Alfaro, new species
- 2(1). Short basal carina absent along antennal depression of hypomeron 3
- Short basal carina present along antennal depression of hypomeron
..... *Nematodes mexicanus* Chevrolat
- 3(2). Elytral striae absent 4
- Elytral striae weakly indicated 5
- 4(3). Flagellomeres II–VII more expanded, slightly longer than wide; habitus black
..... *Nematodes cylindricus* (Laporte)
- Flagellomeres II–VII less expanded, longer than wide; habitus dark brownish-black
..... *Nematodes mannerheimi* Bonvouloir
- 5(3). Flagellomeres II–VII longer than wide 6
- Flagellomeres II–VII quadrate *Nematodes biarti* Bonvouloir
- 6(5). Complete carina present along lateral margin of antennal insertion at base of frontoclypeal region ...
..... *Nematodes conjunctus* Bonvouloir
- Incomplete carina present along lateral margin of antennal insertion at base of frontoclypeal region ...
..... *Nematodes cuneatus* (Guérin-Méneville)

Nematodes apicalis Otto, Muona and Córdoba-Alfaro, new species

Figures 73–74

Diagnosis. The new eucnemid species is distinguished from all known Central American *Nematodes* species by the presence of silver-colored setae on the elytral apices.

Type material. Female holotype: “COSTA RICA: Heredia; Est.Bio. La Selva, 50–; 150 m 10°26'N 84°01'W; Proy. ALAS, INBio-OET” / “M/07/337; 01 Febrero 1994; Bosque primario” / “**HOLOTYPE**;; *Nematodes; apicalis* ♀;



Figures 71–74. Costa Rican *Nematodes* species. 71) *Nematodes mannerheimi*, dorsal habitus. 72) *Nematodes mexicanus*, dorsal habitus. 73) *Nematodes apicalis* sp. nov., dorsal habitus. 74) *Nematodes apicalis* sp. nov., ventral habitus. (Scale: 72–74 = 1.0 mm; 71 = 5.0 mm)

Otto, Muona & Córdoba-Alfaro; Det. R.L. Otto; 2019” (red printed label). Holotype to be deposited in INBC.

Description. Female holotype: Length, 6.0 mm. Width, 1.25 mm. Body elongate; dark black; antennae black with apices of antennomere XI infusate reddish; femur and tibiae black, tarsi dark brownish-black; head, pronotum and elytral humeri and elytral apices clothed with short, recumbent silver-colored setae (Figure 73). **Head:** Surface densely punctate, somewhat dullish, subspherical; frons convex, with slightly depressed median fovea above frontoclypeal region; apical margin of frontoclypeal region rounded, about 2 times wider than base; interantennal carina absent; mandibles stout, bidentate, densely punctate. **Antenna:** Filiform from flagellomeres I–VIII, attaining about $\frac{1}{3}$ the length of the body, never beyond pronotal hind angles; flagellomere I longer than II; flagellomeres II–III sub-equal, quadrate; flagellomere IV larger than III, slightly shorter than V, quadrate; flagellomeres V–VIII each larger than IV, sub-equal, quadrate; flagellomere IX simple, slightly longer than VIII. **Pronotum:** Surface somewhat dullish, densely punctate to rugose; longer than wide, with moderate, sharp hind angles; lateral sides sinuous basally, apically arcuate; disc convex with pair of very shallow circular fovea; base sinuous. **Scutellar shield:** Elongate, sub-triangular, setose, shallowly punctate and distally rounded. **Elytra:** Striae present on humeri and elytral apices, indistinct elsewhere; interstices flattened; surfaces shiny, transversely rugose at basal $\frac{1}{4}$, dense, crowded punctures present elsewhere. **Legs:** First tarsomere as long as the combined lengths of the remaining four on meso- and metatarsi; tibiae rounded in cross section; metatarsomeres I–III simple; metatarsomere IV short, excavate-emarginate; metatarsomere V elongate with simple claws. **Venter** (Figure 74): Closely punctate, with short, recumbent silver-colored setae; hypomeron without antennal grooves; metepisterna parallel-sided; elytral epipleura punctate; metacoxal plates medially 3.0–6.0 times wider than laterally.

Distribution. This eucnemid species is known from a holotype taken from a single location within the province of Heredia.

Biology. The holotype was taken from a primary forest. Larvae and pupae are unknown.

Etymology. The specific epithet is derived from the presence of silver colored setae present on the elytral apices.

Discussion

Even though the La Selva Biological Station is considered one of the most sampled and studied areas in the Neotropics, the descriptions of these 16 new species of false click beetles illustrates how little scientific knowledge of the Costa Rican entomofauna is known, much of which still remains unknown. Much of the work done at La

Selva, especially with Project ALAS, has resulted in many published papers covering different levels of arthropod taxa, from individual groups to revisions and faunal surveys. Project ALAS of La Selva has an outdated website that was maintained by Coldwell and Longino (2004) and has a long list of published papers covering arthropods collected from the biological station up to 2006. Data from Project ALAS gives us a starting point to better understand the biodiversity of Eucnemidae, based on the events these beetles were collected in the 1990's and early 2000's. Similar scientific studies of such magnitude have been done in the past elsewhere around the globe and one such project worth mentioning is the Fauna Hawaiiensis project which the Association for the Advancement of Science and the Royal Society jointly appointed a committee to catalog the wildlife in Hawai'i. The committee hired R.C.L. Perkins to collect arthropods, snails and birds from Hawai'i for identification along with D. Sharp to identify them at the University Museum of Zoology at Cambridge. Perkins kept detailed notes on where each lot were collected and resulted in a series of publications. Sharp (1908) published an account of the false click beetle fauna in Hawaii. More than a century later, Otto (2017b) published a revision of the family as a follow-up from the original study, adding 20 new species, and provided a brief history of the project with summaries of collection events taken place and accounts of the possible extinctions of at least 18 species on the islands. Project ALAS has similar goals to allow tracking of biodiversity compositions over time to see if trends are improving or if we are seeing local extinctions of taxa in the long term.

The false click beetles are one of the most unique and important family of beetles around the world. Eucnemidae as a whole are important indicators of the forest health and overall composition of the diverse structure of the forest system, especially in the tropical region (Muona 1993). With close association with fungi present in dead wood, the family may be important in the regeneration of the forest system.

The importance of this study and future research into this group will hopefully serve as an inspiration for other scientific studies to be conducted for other insect groups in an effort to elucidate and/or quantify the entomofauna within Costa Rica in order to conserve and protect the remaining biodiversity from extinction. Eucnemid research will continue in the future as we gather more information on the biodiversity composition and any new biological information when opportunities are presented in Costa Rica.

Although much of the eucnemid fauna is unknown, especially its developmental stages or natural histories, many opportunities await for new discoveries as we embark on an ambitious project to gather more comprehensive information on the family in Costa Rica. For example, in the Neotropical region specifically, larvae of only two eucnemid species out of hundreds of species present have been described in literature, which includes an unknown *Fornax* species from Brazil (Costa et al. 1988) and *Xylophilus othoides* (Fleutiaux, 1899) also from Brazil (Teixeira and Casari-Chen 1994). Many opportunities to gather unknown biological/developmental information exists that are paramount for a better understanding of their roles in any tropical ecosystems. In addition to unlocking their biological/developmental stages, such information should also include identifying and classifying different plant communities as well as identifying different levels of ecoregions within Costa Rica which will add and enrich information for each species occurring in the country.

All Costa Rican eucnemid species from this project are databased with essential information including altitudinal data (when available) that will allow us to understand more about their biology and distribution within the country, and draw conclusions on their overall abundance in any given period of time. As new data emerges from examining other museum specimens and obtaining new material from future collection events, we will gain greater understanding of the eucnemid fauna in Costa Rica.

The overall biodiversity of the family in a given area can be measured and monitored in the future once a baseline has been established. This study has now established a baseline from which the overall eucnemid biodiversity composition can be studied in the future to ascertain the overall health of the forest system, in order to see if any trends appear at a particular time in the future. This information will be useful for conservation decisions that will enhance and protect the remaining biodiversity of that forest system.

Sampling entomofauna in different regions, at differing altitudes, in different plant communities and different ecoregions within Costa Rica will offer us further information on the composition by seeing similarities and differences from one area to another, as well as any other trends that will allow us to understand the biodiversity within Costa Rica.

The loss of such biodiversity in a tropical ecosystem would be catastrophic in the region if no preventions were to take place, for every species of plant and animal each have an important role in the maintenance of the

forest system (e.g. web of life). Information must be available for everyone to understand and participate in the role of becoming stewards in order to protect the biodiversity contained within Costa Rica for future generations to appreciate. Conservation efforts cannot be done by a small group of people. It takes a whole community to make a difference in protecting the biodiversity composition of the Mesoamerican Rainforest and other plant communities within Costa Rica.

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