



Universitat d'Alacant
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Taxonomía y filogenia de los géneros
Anomala y *Callistethus* de Costa Rica

Valentina Filippini



Tesis

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TESIS DOCTORAL

Taxonomía y filogenia de los géneros
Anomala y *Callistethus* de Costa Rica

- Valentina Filippini -





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Anomala arthuri, foto V. Filippini

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de Costa Rica**

Taxonomy and phylogeny of the genera Anomala and Callistethus in Costa Rica.



Universitat d'Alacant
Universidad de Alicante

Valentina Filippini



Centro Iberoamericano de la Biodiversidad (CIBIO)

Instituto de Investigación

Universidad de Alicante

2015




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Taxonomía y filogenia de los géneros *Anomala* y *Callistethus* de Costa Rica

Memoria presentada por la licenciada Valentina Filippini para optar al título de Doctora en Biología por la Universidad de Alicante



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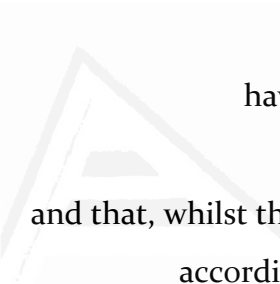
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Alicante, 2015



There is grandeur in this view of life,
with its several powers,
having been originally breathed
into a few forms or into one;
and that, whilst this planet has gone cycling on
according to the fixed law of gravity,
from so simple a beginning
endless forms most beautiful and most wonderful have been,
and are being, evolved.

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Agradecimientos

En primer lugar quiero agradecer a mis directores de tesis, la doctora Estefania Mico y el doctor Eduardo Galante, quienes me ofrecieron su confianza y apoyo para hacer realidad mi deseo de trabajar con un grupo tan complejo, y que no podíamos imaginar donde nos iba a llevar. Ha pasado mucho tiempo y muchas cosas desde ese primero encuentro, y espero que para vosotros como para mí haya valido la pena.

Este trabajo se ha podido llevar a cabo gracias a una beca predoctoral Ministerio de Educación y ha sido financiado por el programa de cooperacion universitaria de la AECID (A/4426/05, A/6788/06, A/019887/08 y A/023060/09) en el marco de cooperacion del CIBIO y el Instituto Nacional de Biodiversidad de Costa Rica (INBio).

Estoy muy agradecida al personal y a los investigadores de las diferentes instituciones donde realicé estancias fundamentales para el desarrollo de esta tesis: en particular a Manuel Zumbado y Ángel Solís del INBio, Costa Rica; Malcolm Kerley del Natural History Museum, Londres; Johannes Frisch y Joachim Willers del Museum für Naturkunde der Humboldt-Universität, Berlín; Antoine Mantilleri y Olivier Montreuil del Muséum National d'Histoire Naturelle, Paris; Gonzalo Giribet y todo el equipo del laboratorio del Museum of Comparative Zoology & Department of Organismic and Evolutionary Biology de la Harvard University, Cambridge.

Muchas gracias a los profesores y personal del CIBIO, por compartir sus conocimientos y ayudas en miles de ocasiones.

Muchísimas gracias a los compañeros y compañeras del CIBIO, por los buenos ratos pasados juntos, la ayuda y el "apoyo moral". A los amigos y amigas de Alicante, de Italia y del resto del mundo, por hacerme sentir en casa en cualquier lado, por "estar ahí" aún no físicamente, cuando lo necesitaba, por las miles de cosas que aprendí gracias a vosotros.

Y por último, gracias a mi familia y a Raúl, por la paciencia, apoyo y amor que me acompañaron en estos años.



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Publicaciones derivadas de esta tesis

Filippini, V., Micó, E., Galante, E., 2013. Redescription of *Anomala eucoma* Bates, 1888 and a description of three new species from Costa Rica (Coleoptera: Scarabaeidae: Rutelinae). *Zootaxa* 3670 (2): 255-273.

Filippini, V., Micó, E., Galante, E., 2014. Description of eight new *Anomala* species from Costa Rica (Coleoptera: Scarabaeidae: Rutelinae). *Journal of Entomology and zoology Studies*, 2(6): 107-122

Filippini, V., Micó, E., Galante, E. *Anomala trapezifera* species-group: a burst of diversity (Coleoptera: Scarabaeidae: Rutelinae). *Annales de la Société entomologique de France*, en revisión.

Filippini, V., Galante, E., Micó, E. The genus *Callistethus* (Coleoptera: Scarabaeidae: Rutelinae) in the Neotropics: new data and new species from Costa Rica. *Arthropod Systematics and Phylogeny* , en revisión.

Filippini, V., Galante, E., Micó, E. Description of six new species of Anomalini from Costa Rica (Coleoptera: Scarabaeidae: Rutelinae). *Zootaxa*, en revisión.

Filippini, V., Galante, E., Micó, E. Description of new small sized *Anomala* species from Costa Rica (Coleoptera: Scarabaeidae: Rutelinae). Para enviar.

Filippini, V., Micó, E., Galante, E. Checklist and identification key of Anomalini (Coleoptera: Scarabaeidae: Rutelinae) of Costa Rica. Para enviar.

Filippini, V., Galante, E., Micó, E., Giribet, G. Phylogeny and community structure of Anomalini (Coleoptera: Scarabaeidae: Rutelinae) of Costa Rica. Para enviar.

Resumen



Abstract

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Resumen

Los objetivos desarrollados en esta tesis doctoral se enmarcan dentro de los estudios dirigidos a contribuir al conocimiento de la diversidad de los Coleopteros Rutelinae neotropicales y su posible utilización como bioindicadores del estado de conservación de los ecosistemas en áreas tropicales.

El objetivo general de esta investigación es contribuir a la clarificación taxonómica de los Anomalinos (Coleoptera: Scarabaeidae: Rutelinae), un grupo muy rico en especies, presentes en todo el mundo, varias de las cuales tienen importancia como plagas agrícolas. El estudio de esta tesis se ha centrado en los dos géneros más diversos en ecosistemas neotropicales que son *Anomala* y *Callistethus*.

El estudio taxonómico se ha llevado a cabo en Costa Rica y se ha basado en especímenes depositados en las colecciones del Instituto Nacional de Biodiversidad (INBio), Costa Rica, y la Colección Entomológica de la Universidad de Alicante (CEUA). Asimismo, se han consultado las especies de este grupo depositadas en las principales colecciones europeas. Se han identificado un total de 78 especies de *Anomala* y 28 especies de *Callistethus*. Como resultado de las investigaciones conducentes a la elaboración de esta tesis doctoral, se han descrito un total de 57 especies nuevas de las cuales 44 son de *Anomala* y 13 de *Callistethus*.

Con este estudio se incrementa en 56 especies el conocimiento del grupo en Costa Rica, y por primera vez se hace un estudio del conjunto de sus especies aportando datos de su distribución. Para facilitar su identificación se ha elaborado una clave dicotómica general para la identificación de todas ellas. Asimismo, se ilustran por primera vez las genitalia masculinas para casi todas las especies, dado que son un importante elemento de diagnóstico que permite una rápida identificación de las especies. Se incluyen datos sobre las distribuciones de cada especie, más detalladas

para las de nueva descripción. Con esta información se pretende paliar en gran medida la falta de conocimiento y de material bibliográfico de identificación para estos grupos en el Neotrópico con el fin de que puedan ser utilizados con mayor frecuencia en estudios de biodiversidad y como bioindicadores en estos ecosistemas tropicales.

Se ha realizado un análisis filogenéticos basados en datos moleculares y morfológicos con el objeto de aclarar la situación taxonómica de los géneros *Anomala* y *Callistethus*, y en particular para determinar la composición de este último. Se ha pretendido aclarar la posición de algunas especies de dudosa asignación, así como identificar caracteres morfológicos con valor diagnóstico, principalmente en el pronoto y en el aparato genital masculino. El estudio realizado ha puesto de manifiesto que el género *Anomala* es en realidad un complejo formado por varios clados, y resulta por tanto parafilético ya que incluye a *Callistethus* y *Anomalorhina*. Por último, se ha analizado la estructura filogenética de las comunidades ecológicas de estos dos géneros con objeto de investigar los mecanismos que dirigen los patrones de diversidad de estos géneros en Costa Rica; el principal resultado es que, en general, hay un filtro ecológico que condiciona la composición de las comunidades limitando la colonización de tipos de ambientes inestables.

Organización de la tesis

Esta memoria de tesis doctoral se ha estructurado en seis capítulos seguidos de unas conclusiones generales.

El **Capítulo 1** presenta una introducción sobre el estado de conocimiento de los Anomalinos en el Neotrópico en cuanto a su problemática taxonómica y diversidad. Se caracteriza el área de estudio y se presentan los objetivos de la tesis.

En el **Capítulo 2** se discute la metodología general empleada en todos los capítulos siguientes, así como el material estudiado y los especímenes tipos consultados en distintos museos.

Los siguientes capítulos abordan la clarificación taxonómica de los géneros *Anomala* y *Callistethus* en Costa Rica:

El **Capítulo 3** incluye seis subcapítulos que siguen la estructura de artículo científico, y que corresponden a descripciones de nuevas especies.

El **Capítulo 4** presenta el listado de especies de Anomalini de Costa Rica y la clave de indentificación general.

En el **Capítulo 5** se presenta un análisis filogenético, con datos morfológicos y moleculares, y se discuten las principales hipótesis que pueden explicar la riqueza de especies de estos géneros en Costa Rica utilizando para ello índices de diversidad y la estructura filogenética de comunidades.

En el **Capítulo 6** se discuten de forma global los resultados obtenidos en los capítulos anteriores.

Finalmente en el apartado dedicado a las **Conclusiones**, se resumen los principales resultados generados en cada uno de los capítulos precedentes.

Abstract

The objectives developed in this thesis are part of a general study aimed at contributing to the knowledge of the diversity of neotropical Coleoptera Rutelinae and its possible use as bioindicators of the conservation status of ecosystems in tropical areas.

Within this framework, the overall objective of this research is to contribute to the taxonomic clarification of Anomalini (Coleoptera: Scarabaeidae: Rutelinae), a group rich in species, worldwide distributed, several of which have importance as agricultural pests. The study of this thesis is centered in the two most diverse genera in tropical ecosystems, that are *Anomala* and *Callistethus*.

The taxonomic study was conducted in Costa Rica and was based on specimens conserved in the collections of Instituto Nacional de Biodiversidad (INBio), Costa Rica, and Colección Entomológica de la Universidad de Alicante (CEUA). Moreover species of this group conserved in the main European collections were consulted. A total of 78 species of *Anomala* and 28 species of *Callistethus* have been identified. As a result of the research leading to the development of this thesis, a total of 57 new species were described, of which 44 belongs to *Anomala* and 13 to *Callistethus*.

With this research the knowledge of this group in Costa Rica is increased with 56 species, and for the first time a study on all its species is conducted, providing their distribution data. For easier identification, a general dichotomous key to identify all species have been developed. Male genitalia are also illustrated for the first time for most species, which are an important diagnostic tool that enable a quick identification. Data on the distributions of each species, more detailed for the newly described species, are included. This information is intended to largely offset the lack of knowledge and bibliographic identification material for these groups in the

Neotropics so that they can be used more frequently in biodiversity studies and as bioindicators and in these tropical ecosystems.

A phylogenetic analysis was performed based on molecular and morphological data in order to clarify the taxonomic status of the genera *Anomala* and *Callistethus*, and in particular for the latter to determine its composition. It has sought to clarify the position of some species of dubious assignment and determine morphological characters that have diagnostic value, particularly in the pronotum and the male genital structures. The study has shown that the genus *Anomala* is actually a complex of several clades, and is thus paraphyletic because it includes *Callistethus* and *Anomalorhina*. Finally we analyzed the phylogenetic structure of ecological communities of these two genera, in order to investigate the mechanisms that influence diversity patterns of these genera in Costa Rica; the main result is that in general there is an ecological filter operating on the composition of communities, limiting the colonization of unstable environments.

Organization of the thesis

The thesis is structured in six chapters followed by general conclusions.

Chapter 1 provides an introduction to the state of knowledge of Anomalini in the Neotropics regarding their taxonomic problems and diversity. The study area is characterized and objectives of the thesis are presented.

In **Chapter 2** the general methodology used in all the following chapters are discussed as well as the material studied and type specimens consulted in museums.

The following chapters address the taxonomic clarification of the genera *Anomala* and *Callistethus* in Costa Rica:

Chapter 3 includes six subsections that follow the structure of scientific paper, which correspond to descriptions of new species.

Chapter 4 presents the checklist of Anomalini species of Costa Rica and the general identification key.

In **Chapter 5**, a phylogenetic analysis, based on morphological and molecular data, is presented and hypotheses are discussed to explain the richness of species of these genera in Costa Rica, by means of diversity indexes and phylogenetic structure of communities.

In **Chapter 6**, the results obtained in the previous chapters are discussed comprehensively.

Finally, in the section devoted to the conclusions, the main results generated in each of the preceding chapters are summarized.

Capítulo 1

Introducción general

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Antecedentes

Los objetivos desarrollados en esta tesis doctoral se enmarcan dentro de los estudios dirigidos a contribuir al conocimiento de la diversidad de los Coleopteros Rutelinae neotropicales y su posible utilización como bioindicadores del estado de conservación los ecosistemas en áreas tropicales. Los Rutelinae, un grupo muy rico en especies, distribuido por todo el mundo, presentan diferencias en biología y requerimientos ecológicos, lo que unido a su abundancia, amplia distribución y facilidad de recolección los convierten en buenos bioindicadores del estado de conservación de los ecosistemas (Morón, 1997). A pesar de esas características, no es frecuente la utilización de los Anomalinos como bioindicadores debido a la gran dificultad de identificación de sus especies como consecuencia del pobre conocimiento taxonómico que se tiene del grupo.

Los problemas taxonómicos de los Anomalinos (Coleoptera: Scarabaeidae: Rutelinae) se pueden resumir en algunas cifras como es el caso de un género con más de 1000 especies (*Anomala*), y 46 géneros con menos de 10 especies.

Los trabajos de taxonomía recientes, a parte de la descripción de nuevas especies, se han centrado en el área Neotropical y abordan la revisión de géneros con un número limitado de especies, como *Epectinaspis* y *Balanogonia* (Paucar-Cabrera 2003) (9 y 2 especies respectivamente), pero a menudo la separación de nuevas entidades taxonómicas se hace a partir de especies antes incluidas en *Anomala* Samouelle 1819 como es el caso de los géneros *Anomalorhina* (Jameson *et al.* 2003), *Pachystethus* (Ramírez-Ponce & Morón 2012a), y el subgénero *Bucaphallanus* (Ramírez-Ponce & Morón 2012b). En la Tabla 1 se presentan los géneros de Anomalini presentes en el continente Americano.

1. Introducción general

La investigación desarrollada a lo largo de esta tesis doctoral, se ha centrado en los géneros *Anomala* y *Callistethus* en Costa Rica por ser los más ricos en especies y los que mayores problemas taxonómicos presentan.

Tabla 1: Géneros de anomalinos presentes en el continente americano

Género	Autoría	Nº especies
<i>Anomala</i>	Samouelle 1819	Aprox. 180
<i>Anomalacra</i>	Casey 1915	1
<i>Anomalorhina</i>	Jameson, Paucar-Cabrera, Solís 2003	2
<i>Balanogonia</i>	Paucar-Cabrera 2003	2
<i>Callirhinus</i>	Blanchard 1851	1
<i>Callistethus</i>	Blanchard 1851	Aprox. 60
<i>Chelilabia</i>	Morón, Nogueira 1998	1
<i>Dilophochila</i>	Bates 1888	6
<i>Epectinaspis</i>	Blanchard 1851	9
<i>Leptohoplia</i>	Saylor 1935	1
<i>Mazahuapertha</i>	Morón, Nogueira 1999	1
<i>Nayarita</i>	Morón, Nogueira 1998	1
<i>Pachystethus</i>	Blanchard 1851	6
<i>Phyllopertha</i>	Stephens 1830	1 (<i>incertae sedis</i>)
<i>Popillia</i>	Serville 1825	1 (introducida)
<i>Rugopertha</i>	Machatschke 1957	1
<i>Strigoderma</i>	Burmeister 1844	c. 40
<i>Yaaxkumukia</i>	Morón, Nogueira 1998	1

El género *Anomala* es el más diverso de la tribu Anomalini. Los principales problemas para su clarificación son la homogeneidad de sus caracteres morfológicos,

la amplia variación en los patrones de pigmentación, el limitado estudio comparativo previo realizado sobre su genitalia, los escasos datos existentes sobre su distribución y biología, así como la existencia de numerosas descripciones originales basadas en pocos individuos o incluso un único ejemplar (Potts, 1977; Morón *et al.*, 1997; Morón & Nogueira, 1998, 2002; Jameson *et al.*, 2003).

Debido a las deficiencias sobre la caracterización morfológica del género, se han creado muchas sinonimias y muchos autores no lo consideran monofilético. (Potts, 1974; Jameson *et al.*, 2003; Paucar-Cabrera, 2003; Morón & Nogueira, 1998).

A esto se añade el problema de la identidad del género *Callistethus* en América, el cual fue descrito con base a una especie asiática, área geográfica donde este género es más diverso. Diversos autores consideran que las especies americanas incluidas en este género en realidad pertenecerían a *Anomala* (Bates, 1888; Blackwelder, 1944; Potts, 1974; Jameson *et al.*, 2003), mientras otros, como Machatschke (1957, 1972), Morón *et al.* (1997), Morón y Nogueira (1998, 2002) Ramírez y Morón (2009) han considerado a este género válido y presente en el continente americano, aunque señalaron que ciertas especies de *Anomala* debieran ser transferidas al género *Callistethus*.

En consecuencia, debido a esta incertidumbre taxonómica y a la escasez de estudios sobre el grupo, la identificación de las especies es imprecisa cometiéndose errores que repercuten negativamente tanto en estudios de biodiversidad como en el control de plagas agrícolas.

Recientemente en el estudio de la morfología genital masculina se ha empezado a analizar las partes membranosas del saco interno, normalmente invaginadas dentro del edeago y por tanto de difícil acceso, en particular se ha realizado este tipo de estudios en trabajos sobre especies europeas (Micó 2001, también incluye genitales femeninas) y en algunas especies asiáticas (Zorn 2007). El estudio del saco interno,

añadido a los caracteres del edeago, se mostrado como una fuente importante de caracteres con validez taxonómica.

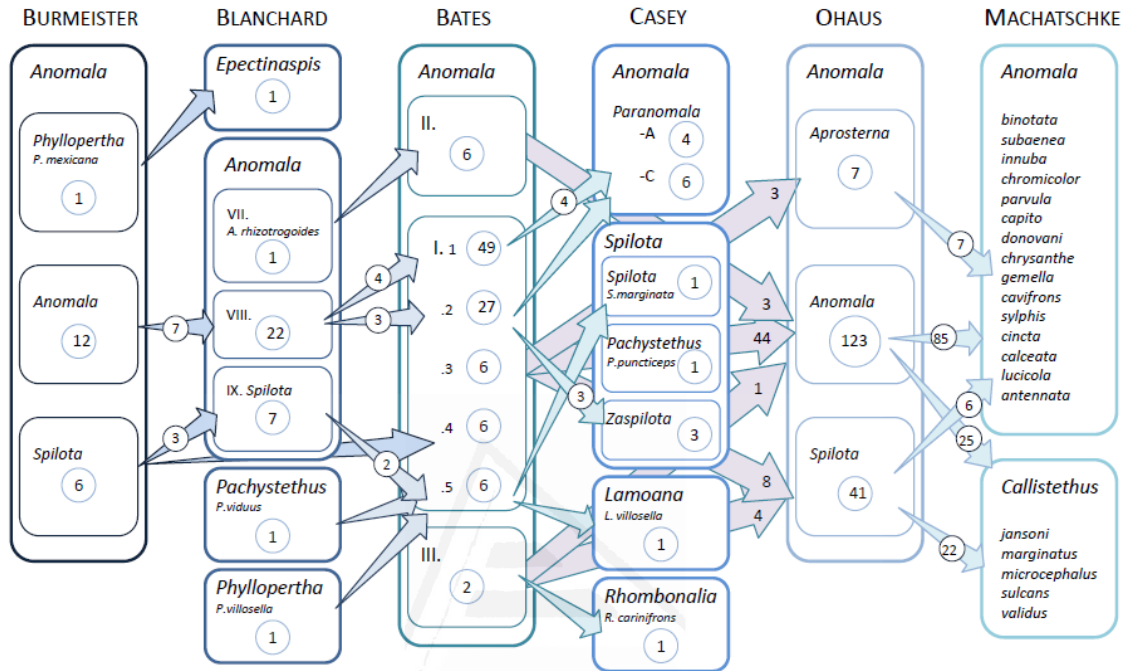
Teniendo en cuenta estos antecedentes y dada la complejidad taxonómica del grupo y la información contradictoria existente en cuanto la validez y relaciones filogenéticas entre especies, se marcó como objetivo general de esta tesis el llevar a cabo una investigación que pudiera contribuir a la clarificación taxonómica de los Anomalinos (Coleoptera: Scarabaeidae: Rutelinae) en zonas tropicales del Neotrópico.

Antecedentes taxonómicos

Debido al elevado número de especies incluidas en *Anomala*, muchos autores propusieron distintas divisiones y tratamientos taxonómicos, basados en características morfológicas. Los principales, por número de especies tratadas o divisiones propuestas, están resumidos en la Tabla 2. Un esquema de comparación enfocado en las especies neotropicales se presenta en la Fig. 1.

Burmeister (1844) tomó en consideración 75 especies de *Anomala* y, tomando en cuenta caracteres de la cabeza, patas, superficie elitral, forma del cuerpo y mesoesternón, distinguió nueve grupos subgénericos, de los cuales 3 están presentes en el Neotrópico: *Phyllopertha* (una especie neotropical: ahora *Epectinaspis mexicana*), *Anomala* (12 especies en el Neotrópico) y *Spilota* (6 especies neotropicales). Este último grupo corresponde al género introducido por Dejean (1833) (con una especie de Java, *S. irrorella* - ahora *Callistethus irrorellus* (Dejean 1833)), y que según Burmeister corresponde a especies que comparten los caracteres de *Anomala*, pero presentan un proceso mesosternal desarrollado (ahora incluidas en *Callistethus*). En su trabajo de 1855 (que incluye 58 especies) mantiene los mismos grupos, excepto el grupo *Phyllopertha* que en este trabajo se considera un género independiente bajo el nombre de *Strigoderma*.

Figura 1: Esquema de comparación entre las diferentes subdivisiones taxonómicas de los principales autores, enfocado en las especies neotropicales. Los números en los recuadros indican el número de especies neotropicales incluidas en cada subdivisión, las flechas indican especies compartidas entre subdivisiones, con su respectivo número, flechas sin número corresponden a una sola especie.



Blanchard (1851), estudiando 125 especies de *Anomala*, realizó 15 divisiones, basadas en características de los tarsos, el labium, el mesoesternón y forma general del cuerpo. Sólo las divisiones VII-IX incluyen especies neotropicales: la séptima incluye una sola especie, *A. rhizotrogoides* Blanchard 1851 de México; la octava 22 especies neotropicales (incluye especies del grupo *Anomala* de Burmeister); la novena (*Spilota*) 7 especies neotropicales (incluye especies del grupo *Spilota* de Burmeister).

En esta obra crea también el género *Callistethus*, con una sola especie de distribución oriental, *C. consularis* (ahora sinonimizado con *C. auronitens* (Hope 1835)).

Bates (1888) estudió 106 especies de *Anomala* de Centroamérica y México, que dividió en tres secciones basadas en caracteres de los tarsos. La primera sección fue a su vez dividida en cinco grupos basados en caracteres del mesoesternón. Los grupos

1.Introducción general

I.1 y I.2 incluyen especies de los grupos *Anomala* de Burmeister y octavo de Blanchard; los grupos I.3 y I.4 especies de *Spilota*, el grupo I.5 incorpora el género *Pachystethus* introducido por Blanchard y especies que éste autor había incluido en el género *Phyllopertha* y grupo *Spilota*. El grupo II incluye a la séptima división de Blanchard.

Casey (1915) estudió especies Norteamericanas y las consideró un grupo complejo a nivel de subtribu, introduciendo varios géneros nuevos para especies antes clasificadas en *Anomala*. El género *Anomala* fue dividido en 3 grupos, el primero de los cuales, *Paranomala*, a su vez consta de 4 secciones, y el género *Spilota* en otros 4 grupos. Sus divisiones se basan en características de los epímeros, clípeo, labrum, mesoesternón, tibias, y forma general del cuerpo; para los grupos de *Anomala* en caracteres de tibias y tarsos, los de *Spilota* en los de las tibias y surco basal del pronoto, y las secciones de *Paranomala* en el pigidio y coloración del pronoto.

Sólo algunos de los géneros incluyen especies con distribución neotropical: *Rhombonalia* (una especie, *A. carinifrons* Bates 1888, incluida en el grupo III de Bates), *Anomala* (*Paranomala*) sección A (4 especies) y C (6 especies) (algunas clasificadas en grupos I.1 y I.2 de Bates); *Spilota* grupos 1 y 2 (una especie cada uno) y grupo 3 (3 especies del grupo I.2 de Bates); *Lamoana* (que incluye *A. villosella* (Blanchard 1851)).

Ohaus 1918 consideró casi 800 especies de distribución mundial divididas en 4 subgéneros, de los cuales 3 presentan especies con distribución neotropical: *Aprosterna* (introducido por Hope (1835) para el género *Mimela*, 7 especies); *Anomala* (123 especies, reúne especies de los grupos I.1, I.2, II, III de Bates); *Spilota* (41 especies, reúne especies de los grupos III, IV, V de Bates). No especifica los caracteres para sus divisiones. El género *Callistethus* está presente, con 4 especies orientales.

Machatschke (1957, 1972) traslada más de un centenar de especies neotropicales, divididas en 5 grupos, al género *Callistethus*, extendiendo entonces su distribución al continente americano. Este se corresponde sólo parcialmente al subgénero *Spilota* de los autores precedentes, aunque se puede suponer que se basa en los mismos caracteres del mesoesternón. Los grupos *jansoni* y *validus* están compuestos por especies incluidas en el subgénero *Anomala* por Ohaus, y los grupos *microcephalus* y *sulcans* por una mezcla de *Anomala* y *Spilota*.

El género *Anomala* está dividido en seis secciones, cada una a su vez compuesta por varios grupos. Especies neotropicales están presentes en la primera sección con 15 grupos. Aquí se reúnen especies de los 3 subgéneros de Ohaus (*Aprosterna* forma el grupo *gemella* y algunas especies de *Spilota* se incluyen en los grupos *chrysanthe* y *lucicola*), y de las secciones I.1, I.2, I.4, I.5 y II de Bates. No especifica los caracteres para sus divisiones.

Potts (1974), reconociendo la artificialidad de las clasificaciones supraespecíficas, y su utilidad en simplificar la identificación, critica este florecer de agrupaciones, según su opinión, sin fundamentos y dictadas por la necesidad de hacer manejable un género tan grande. En su trabajo sobre especies norteamericanas sólo reconoce al género *Anomala*.

Ramírez-Ponce y Morón (2009) mediante un análisis filogenético basado en caracteres morfológicos de 46 especies pertenecientes a 18 géneros, llegan a la conclusión que algunas especies de *Anomala* y *Callistethus* neotropicales constituyen una nueva combinación genérica, que recupera el nombre de *Paranomala* introducido por Casey (1915), y revalidan también el género *Pachystethus* Blanchard.

Teniendo en cuenta todos estos precedentes, en este trabajo de tesis doctoral se ha preferido seguir la clasificación clásica, agrupando las especies neotropicales en los géneros *Anomala* y *Callistethus* (Jameson *et al.*, 2003; Krajcik 2007). Se considera esta

aproximación más prudente, en espera de nuevos estudios más amplios que incluyan las especies tipo de ambos géneros, así como un elevado número de especies de *Anomala* y *Callistethus* con el fin de tener una buena representación de su variabilidad en cada zona de distribución, y empleando también técnicas moleculares.

Grupo de estudio

La distribución de la tribu Anomalini es mundial, exceptuando zonas más frías, si bien la mayoría de sus géneros se encuentran distribuidos en un sólo continente. De todos los géneros de esta tribu, *Anomala* es el más cosmopolita, estando presente en todos los continentes.

Los imagos de Anomalinos tienen hábitos tanto diurnos como nocturnos, y son frecuentemente atraídos por las luces artificiales. Se alimentan de hojas, partes florales y frutas tanto de angiospermas como gimnospermas. Las larvas se desarrollan en el suelo o en madera en descomposición, alimentándose de raíces y materia orgánica. Por sus hábitos alimenticios, algunas especies pueden llegar a convertirse en plagas agrícolas al consumir raíces de diversos cultivos (p.e. *Zea maíz* Linneo, *Saccharum officinarum* Linneo y *Glycine max* Linneo) o bien defoliar plantas ornamentales y frutales, siendo especialmente dañina su acción cuando se introducen en países donde no son originarias (p.e. *Popillia japonica* Newman, *Anomala orientalis* Waterhouse y *Anomala dubia* Scopoli) (Jameson *et al.*, 2003; Morón & Aragón, 2003). Las larvas de algunas especies son un recurso alimenticio en algunos países de Sudamérica (Onore, 1997; Smith & Paucar-Cabrera, 2000).

El tamaño del imago varía entre 5 y 40 mm de longitud, y la coloración presenta un amplio abanico de colores y tonalidades, desde el verde metálico, al parduzco y negro. Las características diagnósticas son: labro situado horizontalmente con respecto al clípeo, antenas con 9 segmentos, protibias normalmente bidentatas, pero

también uni o tridentatas, espolón protibial interno subapical (ausente en *Leptohoplia* y *Mazahuapertha*), protarsomeros no ensanchados o sedosos ventralmente, élitros con borde membranoso, espiráculo terminal no posicionado en la sutura pleural.

Streubel (1839) introdujo la familia Anomalidae, clasificada en los Lamellicornia. Más tarde Blanchard (1851) dentro de los Rutelinae agrupó 14 géneros bajo el nombre Anomalitae. Bates en 1888 clasificó el grupo como una subfamilia de los Rutelidae, clasificación seguida también por Potts (1974). En 1902, Peringuey designó a Anomalini como tribu de los Rutelinae, clasificación mantenida por Casey (1915), Ohaus (1918), Machatschke (1957, 1972) hasta la actualidad. Hay pocas fuentes bibliográficas para la identificación de especies de este grupo. Entre las obras recopilatorias de mayor importancia destacamos los listados de especies de *Coleopterorum Catalogus* (Ohaus, 1918; Machatschke, 1972), *Genera Insectorum* (Machatschke, 1957), Blackwelder (1944) y Krajcik (2007) y las claves en Paucar-Cabrera (2003) y Morón & Ramírez-Ponce (2012).

Diagnosis de los géneros estudiados

***Anomala* SAMOUELLE, 1819**

Sinónimos: *Anisonichus* Dejean 1837, *Anomalepta* Casey 1915, *Anomalopides* Strand 1928, *Anomalopus* Casey 1915, *Aprosterna* Hope 1835, *Bifurcanomala* Kim 1998, *Chejuanomala* Kim 1998, *Chrysoplethisa* Reitter 1903, *Dichomala* Reitter 1903, *Diplomala* Reitter 1903, *Emphalena* Reitter 1903, *Euchlora* MacLeay 1819, *Euchronomala* Reitter 1903, *Euporochlora* Reitter 1903, *Euporomala* Reitter 1903, *Hemispilota* Casey 1915, *Heteroplia* Burmeister 1844, *Hybalonomala* Reitter 1903, *Hybalomorpha* Reitter 1903, *Idiocnema* Faldermann 1835, *Idiocnemina* Reitter 1903, *Iliola* Semenov & Medveded 1949, *Lamoana* Casey 1915, *Oliganomala* Casey 1915, *Orphnomala* Reitter 1903, *Paragematis* Reitter 1903, *Paranomala* Casey 1915,

Psammoscaphus Motschulsky 1835, *Rhinoplia* Burmeister 1844, *Rhombonalia* Casey 1915.

Diagnosis. Longitud corporal comprendida entre 5-30 mm. Borde anterior del clípeo redondeado o recto, labro casi completamente cubierto por el clípeo, sutura fronto-clipeal completa, borde basal del pronoto completo. Ápice antenal formado por tres lamelas. Base del pronoto tan ancha como los élitros. Mesoepímeros recubiertos por los élitros. Élitros generalmente convexos. Pro y mesosterno sin proyecciones visibles, meso y metatibia con 2 espolones terminales. Ápice de la sutura elitral redondeada. Parámetros tubiformes alineados con la pieza basal. Dimorfismo sexual poco acusado.

***Callistethus* BLANCHARD, 1851**

Sinónimos: *Pachystethus* Blanchard 1851, *Spilota* Burmeister 1844, *Hadropopollia* Kraatz 1892, *Poecilosticta* Kraatz 1892, *Spileuchlora* Ohaus 1903, *Zaspilota* Casey 1915.

Diagnosis. Longitud corporal comprendida entre 11-23 mm. Ápice antenal formado por tres lamelas. Clípeo no sinuado. Maxila con seis dientes. Pronoto sin borde posterior. Base del pronoto tan ancha como los élitros. Mesoepímeros cubiertos por los élitros. Élitros generalmente convexos. Ápice de la sutura elitral espiniforme. Espacio intercoxal del mesoesterno amplio y con prominencia visible y dirigida anteriormente hasta las procoxas, meso y metatibia con 2 espolones terminales. Parámetros y placa ventral fusionados. Dimorfismo sexual poco acusado.

El carácter más utilizado para diferenciar *Callistethus* de *Anomala* ha sido la presencia de una proyección mesometasternal bien visible, que debería faltar completamente en *Anomala*. En realidad, por lo menos en las especies neotropicales, se ha encontrado una notable variabilidad en el desarrollo de esta estructura, desde un alargamiento del espacio sin una prominencia visible, hasta varios estadios de desarrollo de la misma, incluidos un desarrollo de la prominencia en un espacio

estrecho entre las coxas. Obviamente esto complica la separación inequívoca de los dos géneros.

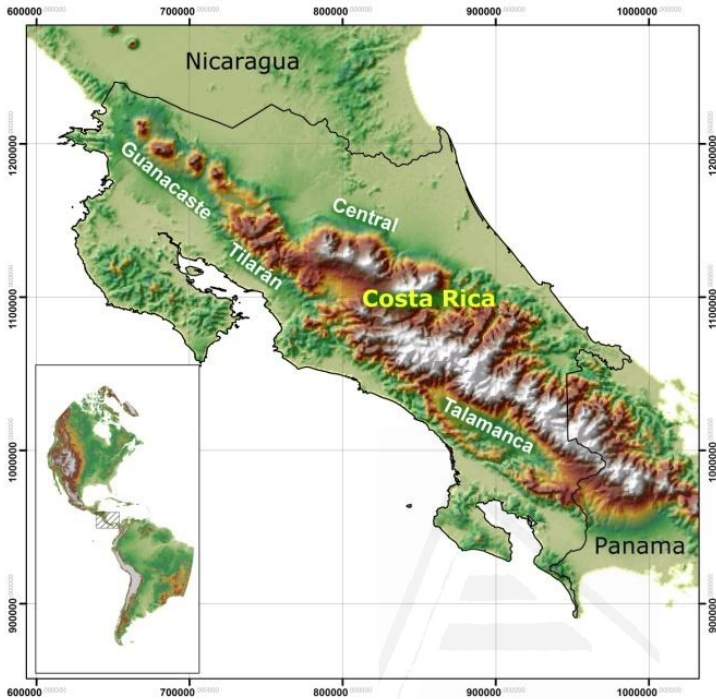
Área de estudio

Costa Rica ocupa el 0,03% de la superficie terrestre y hospeda acerca del 4% de las especies estimadas a nivel mundial, siendo uno de los 35 puntos calientes de biodiversidad mundiales (Zachos & Habel 2011), y se encuentra entre los 20 Países con mayor biodiversidad, listado que encabeza si se considera la densidad de especies (número de especies por área) (Obando 2002). Esto se debe en parte a su posición geográfica en el Neotrópico, la región biogeográfica con mayor biodiversidad (Gaston & Spicer 2004). Su historia geológica como archipiélago en el Mesozoico y puente ístmico en el Mioceno superior ha contribuido a esta riqueza de especies ya que ha actuado como zona de transición entre faunas del norte y sur del continente americano (Kappelle 2001). Por último, encontramos que a esta alta biodiversidad también contribuye la existencia de una gran diversidad de ecosistemas que están relacionados con los diferentes patrones estacionales de lluvias y a la influencia de las dos vertientes costeras (Atlántico-Pacífico) separadas por 4 cadenas montañosas (Cordillera de Guanacaste, Cordillera de Tilarán, Cordillera Central, Cordillera de Talamanca) que atraviesan el país de noroeste a suroeste (Kappelle 2001). Estas características geográficas definen 3 grandes regiones climáticas principales: la Región Tropical Húmeda del Atlántico, la Región Central Intermontana y la Región Tropical del Pacífico (Solano & Villalobos 2001) (Fig. 2).

Siguiendo la clasificación de vegetación del Sistema de Zonas de Vida de Holdridge (1967), en Costa Rica están presentes 12 zonas de vida y 12 zonas de transición, de las cuales las más extensas son bosque tropical húmedo (10.5% del área total del País), bosque premontano húmedo (7.2%) y bosque montano bajo húmedo (5.9%) (Kohlmann *et al.* 2007) (Fig. 3).

1.Introducción general

Figura 2: Mapa de Costa Rica con indicadas las principales cadenas montañosas.



La cobertura forestal de Costa Rica ocupa actualmente el 51% de la superficie del País (FAO 2005), aunque a finales del siglo XX este porcentaje era mucho menor: se estima en un 36% en 1973, 19% en 1983 (Rosero-Bixby & Palloni 1998) y un 29% en 1991 (Sánchez-Azofeifa *et al.* 2001).

Costa Rica constituye un lugar ideal para estudiar ambos taxa, debido tanto a la alta diversidad de especies (casi 200) distribuidas por los diversos ambientes naturales, así como por el elevado porcentaje de endemismos. Por otra parte, la Colección Entomológica de la Universidad de Alicante (CEUA) y la del Instituto Nacional de Biodiversidad de Costa Rica (INBio), atesoran una gran cantidad de especímenes identificados que han constituido en parte la base de este estudio.

Hay que destacar aquí la gran riqueza de especies puesta a disposición del estudio científico por parte del Instituto Nacional de Biodiversidad (INBio) de Costa Rica. La colección del INBio alberga más de 16800 especímenes de Anomálinos (base de datos ATTA, INBio), lo que constituye un gran esfuerzo de muestreo y conservación de especímenes sin cual no se podría haber llevado a cabo esta investigación.

Figura 3: Diferentes tipos de ambientes de Costa Rica. a) Manglares y bosque tropical húmedo (tropical wet forest), Tortuguero, Limón. b) Humedales y bosque tropical húmedo (tropical moist forest), transición a seco (Palo Verde, Guanacaste). c) Bosque tropical seco (P.N. Barra Honda, Guanacaste). d) Bosque tropical húmedo (Cabanga, Alajuela). e) Bosque lluvioso (P.N. Tenorio, Guanacaste). f) Bosque nuboso (S. Ramón, Alajuela)(Fotografías por V.Filippini).



Objetivos

El objetivo general de esta tesis es conocer la riqueza y distribución de los géneros *Anomala* y *Callistethus* en Costa Rica. Para ello se pretende:

1. Clarificar la taxonomía de estos dos géneros, mediante un estudio morfológico de las especies, su identificación mediante revisión de material tipo, la descripción de nuevas especies, y la elaboración una clave dicotómica general para la fauna de este país. La consecución de este objetivo pretende facilitar la identificación de estos géneros y permitir así su inclusión en estudios de biodiversidad.
2. Investigar las posibles pautas evolutivas de estos géneros para explicar su elevada diversidad en Costa Rica, mediante la identificación de grupos de especies, la realización de un análisis filogenético basado tanto en datos morfológicos como moleculares, y el análisis de la estructura filogenética de las comunidades ecológicas, con objeto de elucidar los mecanismos que influyen los patrones de diversidad de estos géneros en Costa Rica.

Tabla 2: Subdivisiones taxonómicas previas de los géneros *Anomala* y *Callistethus*.

Burmeister 1844 (Anisopliidae)	Blanchard 1851 (Rutelinae)	Bates 1888 (Rutelidae Anomalinae)	Casey 1915 (Rutelinae Anomalini)	Ohaus 1918 (Anomalini)	Machatschke 1957/1972 (Rutelinae Anomalini)
Anomala <i>Rhinoplia</i> 2 spp (Oriental)	Anomala Divisio I Tarsi antici et medii, ungue externo fisso. Labium fere planum, palpis margine laterali insertis. Corpus planum. 2 spp (Afrotropical)	Anomala 1. Tarsi quatuor anteriores unguibus fissis, dente superiore in ♂ hand multo brevior.	Rhombanalia 7 spp	Anomala <i>Aprosterna</i> 37 spp (Oriental) + 15 (Afrotropical) + 7 spp (Neotropical)	Anomala 1. Paleártico, Oriental, Australasia 1. <i>vitis</i> (29/31) 2. <i>elaphacerooides</i> (1/1) 3. <i>gracilenta</i> (0/1) 4. <i>pallens</i> (0/2) 5. <i>exolata</i> (17/19) 6. <i>ocitoscotata</i> (2/2) 7. <i>conrugata</i> (2/2) 8. <i>aulax</i> (8/15) 9. <i>varicolor</i> (19/19) 10. <i>rufipes</i> (5/12) 11. <i>ebenina</i> (6/6) 12. <i>holomecena</i> (5/5) 13. <i>aureob</i> (10/10) 14. <i>striolata/rufivenis</i> (4/2) 15. <i>cuprascens</i> (158/158) 16. <i>macrophylla</i> (16/16) 17. <i>holoptera</i> (2/3) 18. <i>lineatopennis</i> (23/28) 19. <i>polychroma</i> (2)/ <i>luminosa</i> (2) 20. <i>hirsutula</i> (4/4) 21. <i>cornuscans</i> (11/11) 22. <i>windathi</i> (20/20) 23. <i>ovalis</i> (4/4) 24. <i>viridisericea</i> (4/4) 25. <i>chalcascens</i> (8/8) 26. <i>antiqua</i> (1/1) 27. <i>viridis</i> (40/40) 28. <i>dasyptiga</i> (15/20) 29. <i>chiroptiga</i> (9/9) 30. <i>bicolor</i> (40/39) 31. <i>xanthopiera</i> (8/8)
Heteroplia 6 spp (Oriental, Afrotropical)	Divisio II <i>Rhinoplia</i> Tarsi antici et medii ungue externo fisso. Labium antice depressum vel excavatum, palpis supeme insertis. Corpus convexum. 12 spp (Afrotropical, Oriental)	1. Mesosternum angustum nec apice prominens. 49 spp	Anomalepta 2 spp	Anomala 46 spp (Paleártico) + 235 (Oriental) + 43 (Australasia) + 95 (Afrotropical) + 123 (Neotropical) + 14 spp (Nearctic)	
Hoplopus 2 spp (Afrotropical)	Divisio III <i>Heteroplia</i> Tarsi antici, ungue externo fiso, medii, simplici. Labium antice depressum vel excavatum, palpis supeme insertis. Corpus convexum. 6 spp (Afrotropical, Oriental)	2. Mesosternum latior, apice plus minusve incrassatum. 27 spp	Anomalaca 1 spp	Euchlora 4 (Paleártico) + 80 (Oriental) + 6 (Australasia) + 2 spp (Afrotropical)	
Phyllopertha 5 spp (Paleártico, Neotropical)	Divisio IV Tarsi omnes, ungue exteme simplid. Labium fere planum, angustum, apice vix emarginatum. Corpus convexum. 2 spp (Afrotropical)	3. Mesosternum latum, apice conicum, porrectum. Elytra margine laterali in ♀ haud dilatato-incrassato. (<i>Spilota</i> , partim, Burm.) 6 spp	Anomala 1. <i>Paranomala</i> a- <i>binotata</i> 10 b- <i>minuta</i> 2 c- <i>flavipennis</i> 29 d- <i>parvula</i> 3 spp	Spilota 1 (Paleártico) + 41 (Oriental) + 2 (Australasia) + 43 (Neotropical) + 2 spp (Nearctic)	
Rhombix 4 spp (Paleártico)	Divisio V <i>Rhombix</i> Tarsi omnes, ungue externo simplici. Labium latum, antice depressum, lateribus cum apice emarginatum. Corpus breve, convexum. 5 spp (Paleártico)	4. Mesosternum valde porrectum. (<i>Spilota</i> , partim, Burm.) 6 spp	2. <i>Oliganomala</i> 1 sp		(Afrotropical) 32. <i>olivacea</i> (2/2) 33. <i>laevigata</i> (9/9) 34. <i>semicinctulata</i> (2/2) 35. <i>basalis</i> (35/40) 36. <i>rubricollis</i> (13/13)

1. Introducción general

Burmeister 1844	Blanchard 1851	Bates 1888	Casey 1915	Ohaus 1918	Machatschke 1957/1972
<i>Anomala</i> 26 spp (Paleártico, Neártico, Neotropical, Oriental, Afrotropical)	Divisio VI <i>Anomala</i> Tarsi antici et medi, ungue extemo fisso. Labium breve, medio dilatatum, apice truncatum. Corpus convexum, sat breve. 11 spp (Paleártico)	5. Mesosternum breviter porrectum, conicum. Elytra margine laterali (praecipue in F) ante medium dilatato- incrassato. Mesostemi epimera juxta humeros acute ascendentiá (Incl. <i>Pachystethus</i> , Blanch.) 6 spp	3. <i>Anomalopus</i> 1 sp		37. <i>welmanni</i> (5/5) 38. <i>paleopyga</i> (5/6) 39. <i>punctipennis</i> (2/2) 40. <i>pallidula</i> (25/26) 41. <i>lutea</i> (21/21) 42. <i>subvittata</i> (1/1) 43. <i>separata</i> (1/1) 44. <i>pu dica</i> (4/4) (Neotropical, Neártico)
<i>Spilota</i> 11 spp (Neotropical, Oriental)	Divisio VII Tarsi antici, ungue extemo lato, fisso; medi, unguibus simplicibus. Labium antico coarctatum, apice truncatum. Corpus ovalum. <i>A. rhizotrogoides</i> (Mexico)	II. Tarsi anteriores unguibus haud apice fissis, dente superiore dorsali setiformi; intermedii unguibus dente pavo vel simplicibus Tibiae posticae breves, subtriangulares. 6 spp	Spilota 1. <i>Spilota</i> 2 spp		45. <i>binotata</i> (20/20) 46. <i>subaenea</i> (3/3) 47. <i>innuba</i> (8/8) 48. <i>chromicolor</i> (1/1) 49. <i>parvula</i> (7/7) 50. <i>capita</i> (2/2) 51. <i>donovani</i> (12/12) 52. <i>chysanthae</i> (2/2) 53. <i>gemella</i> (26/27) 54. <i>cavifrons</i> (1/1) 55. <i>sylphis</i> (6/6) 56. <i>cinata</i> (8/9) 57. <i>calceata</i> (13/13) 58. <i>lucicola</i> (10/10) 59. <i>antennata</i> (25/25) Sin grupo (29/30)
<i>Euchlora</i> 16 spp (Oriental)	Divisio VIII Tarsi antici et medi, ungue extemo fisso. Labium medio paulo dilatatum, apice distincte emarginatum. Mesosternum haud prominens. Corpus ovatum, subconvexum. 29 spp (Neártico, Neotropical)	III. Ungues omnes simplices 2 spp	2. <i>Pachystethus</i> 1 sp		
<i>Aprosterna</i> 3 spp (Oriental)	Divisio IX <i>Spilota</i> Tarsi antici et medi, ungue extemo fisso. Labium medio dilatatum, apice leviter emarginatum. Mesosternum inter coxas valde porrectum. Corpus ovatum medio criter convexum. 10 spp (Neártico, Neotropical)	Species incertae sedis 4 spp.	3. <i>Hemispilota</i> 2 spp		II. (Afrotropical) 1. <i>unicolor</i> (34/34) 2. <i>plebeja</i> (4/4)
	Divisio X Tarsi antici et medi, ungue externofisso; tarsorum anticomum ungue externoincrasso, valde recurvo, profunde fisso. Labium sat latum, apice paulo emarginatum. Mesosternum haud porrectum Corpus latum, subplanum 1 spp (Oriental)		4. <i>Zaspilota</i> 3 spp		III. (Afrotropical) 1. <i>emortualis</i> (10/10) 2. <i>vetula</i> (3/3) IV. (Afrotropical) 1 sp.

1. Introducción general

Burmeister 1844	Blanchard 1851	Bates 1888	Casey 1915	Ohaus 1918	Machatschke 1957/1972
	<p>Divisio XI Tarsi antici et medii ungue externo fisso. Labium elongatum, fere paralielum. Maxillae dentibus medioocris armatae. Mesosternum haud porrectum. Copus breviter ovatum, convexum 1 spp (Oriental)</p>		<p>Lamoana (<i>A. villosella</i>)</p>		<p>V. (Paleártico, Afrotropical) 1. <i>atpiflicis</i> (3/3) 2. <i>calcarata</i> (1/1) Sin grupo (0/20)</p>
	<p>Divisio XII Tarsi antici et medii, unguo exteme fiso. Labium ad insertionem palparum paulo excavatum, apice leviter emarginatum. Mesosternum latum, haud productum. Copus saepius subplanum, antice attenuatum. 19 spp (Oriental)</p>				<p>VI. (Oriental, Australasia) 1. <i>palpada</i> (19/19) 2. <i>walker</i> (4/4) 3. <i>siamensis</i> (3/4) 4. <i>acrominalis</i> (1/1) Sin grupo (107/71)</p>
	<p>Divisio XIII <i>Euchlora</i> Tarsi antici et medii, ungue externo fiso. Labium elongatum, medio paulo dilatatum, apice leviter emarginatum. Mesosternum latum, haud porrectum. Copus ovatum convexum. Elytra vix striata. 21 spp (Oriental)</p>				<p>Callistethus (Oriental, Australasia) 1. <i>aurantiens</i> (9/10) 2. <i>maculatus</i> (25/25) 3. <i>pusillus</i> (2/2) 4. <i>excellens</i> (6/6) 5. <i>glandulicollis</i> (4/7) 6. <i>agnellus</i> (2/2) 7. <i>insignis</i> (4/4) 8. <i>regina</i> (3/3) 9. <i>curtisi</i> (1/1) 10. <i>chloromelus</i> (1/1) 11. <i>armatus</i> (0/3) 12. <i>caliwaerti</i> (3/3) (Neotropical, Neártico)</p>
	<p>Divisio XIV <i>Aprosterna</i> Tarsi antici et medii, ungue externo fiso. Labium sat latum, antice excavatum apice leviter emarginatum. Mesosternum haud porrectum. Copus oblongo-ovatum, parum convexum. 3 spp (Oriental)</p>				<p>13. <i>validus</i> (10/10) 14. <i>marginatus</i> (23/26) 15. <i>microcephalus</i> (10/11) 16. <i>sulcans</i> (8/8) 17. <i>jansoni</i> (2/2) Sin grupo (3/0)</p>
	<p>Divisio XV Tarsi antici et medii ungue extemo fisso. Labium latum, antice excavatum. Mesosternum latum, inter coxas paulo prominens. Copus breve, latum, crassum. 2 spp (Oriental)</p>				<p>TOT: 1076/1109 spp.</p>
<p>TOT: 75 spp.</p>	<p>TOT: 125 spp.</p>	<p>TOT: 106 spp.</p>	<p>TOT: 75 spp.</p>	<p>TOT: 796 spp.</p>	

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Universitat d'Alacant
Universidad de Alicante

Capítulo 2

Materiales y métodos

Universitat d'Alacant
Universidad de Alicante

Ejemplares de estudio

Se estudiaron 1034 ejemplares pertenecientes a 124 especies de la Colección Entomológica de la Universidad de Alicante (CEUA), depositada en el CIBIO, y la colección del Instituto Nacional de Biodiversidad (INBio) de Costa Rica. De ellas, 113 especies pertenecen a los géneros *Anomala* y *Callistethus*, todas ellas de Costa Rica. Además se añadieron especies de otros géneros de Anomalinos: *Anomalorhina*, *Strigoderma*, *Epectinaspis*, *Dilophochila*, además de especies de *Cyclocephala* (Dynastinae) y *Platycoelia* (Rutelino) utilizados como grupo externo para los análisis filogenéticos. (Anexo 1)

Para la asociación de las especies a uno de los dos géneros se hizo referencia al catálogo de Krajcik (2007), a las claves taxonómicas disponibles en la bibliografía y a la presencia de caracteres diagnósticos presentados en el capítulo precedente.

Disección y preparación de especímenes

Los ejemplares usados en la investigación fueron sumergidos en agua caliente durante varios minutos para ablandarlos y poder extraer las piezas bucales (labio, mandíbulas, maxilas, labro) y genitales (edeago y *spiculum gastrale* de los machos).

La extracción de las piezas bucales se realizó con la ayuda de micropinzas, introduciendo sus ápices en la abertura oral para empujar el labio hacia abajo y posteriormente separarlo cuidadosamente de la gula, luego se separan las maxilas y mandíbulas haciendo fuerza en la base de esas piezas, para no correr el riesgo de romper las delicadas estructuras apicales, como las espinas o los palpos. Por último se separa cuidadosamente el labro del clipeo, intentando extraer también la membrana de la epifaringe.

2. Materiales y métodos

Las genitalia y estructuras asociadas se extrajeron ampliando la abertura de la cloaca.

Todas las piezas se sumergieron en un baño de hidróxido de potasio (KOH), para eliminar los restos de tejido muscular, para una mejor conservación y observación de las piezas.

Las estructuras bucales y el *spiculum gastrale* fueron pegados en una pieza de cartulina recortada, en manera que se puedan observar los diversos lados de cada pieza, y montadas en un alfiler entomológico asociándolo con el ejemplar de origen. Esto permite observar y comparar características en éstas estructuras no visibles fácilmente en los ejemplares.

Los edeagos se sumergían en ácido láctico durante algunos días, para que se hicieran translúcidas las estructuras del saco interno, que posteriormente era evaginado inyectando agua por la base del edeago.

Material de referencia

Para verificar la identificación del material y excluir casos de sinonimia en las especies que resultaron nuevas para la ciencia, se consultaron las principales colecciones que conservan material tipo de Anomalinos, durante diferentes estancias de investigación:

Natural History Museum, Londres (febrero 2011);

Museum für Naturkunde der Humboldt Universität, Berlín (donde también se pudo consultar material del Museo de la Martin-Luther-Universität, Halle; septiembre 2011);

Muséum National d'Histoire Naturelle, París (octubre 2011).

El listado de las especies consultadas se proporciona en el Anexo 2.

Análisis filogenético

Selección de caracteres morfológicos

El uso de caracteres morfológicos para reconstrucciones filogenéticas está todavía reconocido en esta “era de la comparación molecular”, en cuanto que aporta una mayor consistencia en los cladogramas obtenidos a partir de datos mixtos, moleculares y morfológicos, y las filogenias con base morfológicas operan como referencia para las reconstrucciones basadas en secuencias, que a veces, por diferentes tasas de evolución entre organismos, dan resultados erróneos (Wiens, 2004; Wortley & Scotland, 2006).

Se consideraron 74 caracteres morfológicos (Anexo 3, resumen en Tabla 1), que intentan abarcar toda la variabilidad interespecifica que se pueda cuantificar de manera objetiva, excluyendo caracteres variables dentro de una misma especie.

Tabla 1: Resumen de caracteres morfológicos utilizados para en análisis filogenético

Cabeza (18)	Perfil anterior, forma y superficie del clípeo, frente, distancia interocular, antena, piezas bucales
Thorax (17)	Forma, superficie, proporciones del pronoto, posición de mesoepímeros, desarrollo del mesoesternón, definición y posición de la sutura mesoesternal
Patas (8)	Número de dientes en las protibias, longitud de espinas portibiales, proporciones de protarsómeros, forma del onichium
Élitros (6)	Proporción, forma, textura de los élitros, presencia y extensión de la lámina cuticular, forma del ápice
Abdomen (3)	Presencia de parches de setas, forma del sexto espiráculo, espesor de la membrana apical
Aparato reproductor masculino (22)	Edeago: características del tecto, presencia y aspecto de la placa ventral, forma de los parámetros; presencia y forma del lóbulo mediano; forma y tamaño del spiculum gastrale. Endofalo: posición y aspecto del canal eyaculador, forma y estructuras del saco interno

Se tomaron como referencia inicial los estudios de Jameson (1997) Paucar-Cabrera (2003), Jameson *et al.*, (2007) y Ramírez & Morón (2009), eligiendo y modificando sucesivamente la definición y separación de los distintos estadios de caracteres, según iba avanzando el estudio de los ejemplares, y se identificaban las pautas de variabilidad dentro de estos dos géneros cercanos.

Durante el estudio morfológico de los ejemplares, resultó notable la variabilidad entre especies de las estructuras del aparato reproductor masculino, sobre todo si lo comparamos con la poca variabilidad observada entre especies congénicas de Europa y Asia. Mediante las disecciones y el incremento paulatino de las especies estudiadas, se observó la existencia de componentes y formas que se repiten en la morfología general de esta estructura. Se implementaron así más caracteres para el edeago y el saco interno, con el fin de representar la diversidad observada. Mientras que el edeago y sus características se utilizan ampliamente en estudios taxonómicos, y sus características se implementan en estudios filogenéticos basados en datos morfológicos, el saco interno es poco utilizado en estudios de coleópteros, y en particular de escarabeidos, no obstante en los estudios donde se utiliza se pone en evidencia su utilidad (Zorn 2007, Wada 2002 para Anomalinos, Morón & Solís 2001, Morón 2006 para Melolontinos). Por este motivo, los caracteres que se refieren a esta estructura fueron difíciles de codificar, ya que no hay precedentes aplicables a la variabilidad encontrada en los ejemplares examinados.

La elaboración de la matriz de caracteres morfológicos se desarrolló con el programa NDE (Nexus Data Editor) versión 0.5.0 (Page, 2001).

De los 74 caracteres morfológicos seleccionados 51 fueron binarios y 23 multiestado, tratados como no ordenados y con el mismo peso. Los caracteres inaplicables se codificaron con el guion medio “-“ y los faltantes con el signo final de interrogación “?”.

Extracción de ADN y secuenciación

Todos los procesos de extracción de ADN, amplificación y secuenciación de fragmentos genéticos se llevaron a cabo en el laboratorio del "Museum of Comparative Zoology & Department of Organismic and Evolutionary Biology", Harvard University, durante la estancia de investigación llevada a cabo entre noviembre 2012 y enero 2013 bajo la guía del prof. Gozalo Giribet.

La metodología empleada se explica en detalle en los capítulos 3.3 y 5.

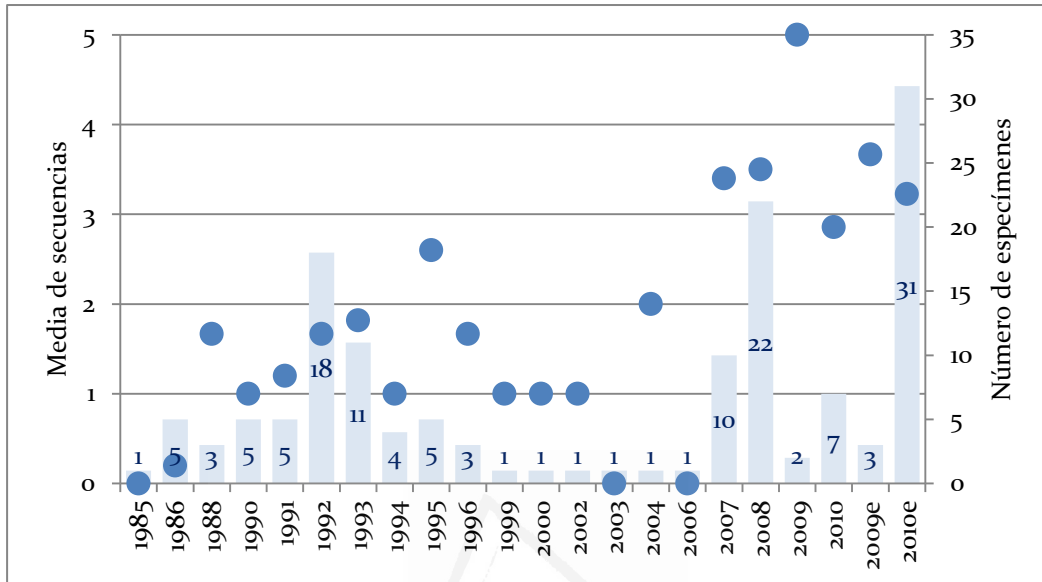
Se realizó la extracción de 141 especímenes, pertenecientes a 111 especies (76 de *Anomala*, 24 de *Callistethus*, el resto de otros géneros de Anomalini, Rutelini y Dynastinae) (Tabla 2). Se disponía de 34 ejemplares colectados recientemente y conservado en etanol y a -20°C, condiciones óptimas para la conservación del ADN, mientras que los demás especímenes estaban conservados en seco y con fecha de colecta entre 2010 y 1985.

Las secuencias objetivo eran partes de dos genes mitocondriales (16S y *cox1*) y 3 fragmentos contiguos de un gen nuclear (28S), en total 5 secuencias. En el gráfico presentado en Fig. 1 se presenta la media de secuencias obtenidas por año de colecta de los especímenes (para tener en cuenta de diferentes números de especímenes por cada año). Se puede apreciar, como cabía esperar, que de los especímenes más antiguos se pudo obtener pocas secuencias, mientras que en los más recientes la media de secuencias obtenidas aumenta, sin grandes diferencias entre especímenes conservados en etanol o en seco.

La calidad inferior del ADN de los especímenes más antiguos se demuestra también por el hecho que para 11 especímenes colectados anteriormente a 1995 el gen *cox1* se pudo amplificar solamente con un segundo par de "primers" (LCO1490-HCO2198, 650 bp), que daban una secuencia más corta respecto al par principal (LCO1490-HCOoutout, 800bp).

2. Materiales y métodos

Figura 1: Media de las secuencias obtenidas por año de colecta (puntos), y número de especímenes disponibles para cada año (barras). 2009e y 2010e hacen referencia a los especímenes conservados en etanol.



Al contrario de lo que se podía esperar para los especímenes conservados en seco desde hace décadas, y la utilización de “primers” universales, las contaminaciones de ADN por organismos que podían haber colonizados el material (como hongos) fue muy baja, con 16 casos, que interesaron secuencias de un solo fragmento génico, no el total del ADN extraído del espécimen.

En total, se obtuvieron secuencias para 106 especímenes correspondientes a 82 especies, de las cuales 54 de *Anomala* y 21 de *Callistethus*, que corresponden respectivamente al 73 y 75% de las especies presentes en Costa Rica. Sin embargo, la necesidad de un número mínimo de secuencias para los análisis filogenéticos ha hecho que el número de especies tratadas en los estudios haya sido menor.

Análisis filogenético

Los análisis cladísticos se desarrollaron con los programas, modelos e impostaciones explicados en los relativos capítulos (3.3 y 5).

Tabla 2: Ejemplares para la extracción de ADN y secuencias obtenidas (casillas azules).

TRIBU	ESPECIE	MEDIO	AÑO	VOUCHER	COI	16S	28S 1	28S 2	28S 3
Anomalini	<i>Anomala_cupricollis</i>	etanol	2010	CEUA00105809					
Anomalini	<i>Anomala_cupricollis</i>	etanol	2010	CEUA00105810					
Anomalini	<i>Anomala_discoidalis</i>	etanol	2009	CEUA00105820					
Anomalini	<i>Anomala_discoidalis</i>	etanol	2009	CEUA00105821					
Anomalini	<i>Anomala_aereiventris</i>	seco	2008	CEUA00105843					
Anomalini	<i>Anomala_aereiventris</i>	seco	1985	INBIOCRI002517713					
Anomalini	<i>Anomala_aglaos</i>	seco	2008	CEUA00106186					
Anomalini	<i>Anomala_aglaos</i>	etanol	2010	CEUA00106232					
Anomalini	<i>Anomala_antica</i>	seco	1992	INBIOCRI000430985					
Anomalini	<i>Anomala_arara</i>	etanol	2010	CEUA00106237					
Anomalini	<i>Anomala_arara</i>	etanol	2010	CEUA00106238					
Anomalini	<i>Anomala_arthuri</i>	seco	1986	INBIOCRI002612731					
Anomalini	<i>Anomala_aspersa</i>	seco	1995	CEUA00106067					
Anomalini	<i>Anomala_atrivillosa</i>	seco	1990	INBIOCRI000290078					
Anomalini	<i>Anomala_balzapambae</i>	seco	2008	CEUA00105805					
Anomalini	<i>Anomala_calligrapha</i>	seco	2007	CEUA00105803					
Anomalini	<i>Anomala_calligrapha</i>	seco	2010	CEUA					
Anomalini	<i>Anomala_chapini</i>	etanol	2010	CEUA00106227					
Anomalini	<i>Anomala_chapini</i>	etanol	2010	CEUA00106228					
Anomalini	<i>Anomala_chiriquina</i>	seco	1990	INBIOCRI000259213					
Anomalini	<i>Anomala_chrysomelina</i>	seco	1994	INBIOCRI001894629					
Anomalini	<i>Anomala_clarivillosa</i>	seco	2008	CEUA00105909					
Anomalini	<i>Anomala_coffea</i>	seco	1992	INBIOCRI000916759					
Anomalini	<i>Anomala_coffea</i>	seco	2008	INBIOCRI003315377					
Anomalini	<i>Anomala_contusa</i>	seco	2008	CEUA00105866					
Anomalini	<i>Anomala_cupreovariolosa</i>	seco	1995	CEUA00106170					

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Anomalini	<i>Anomala_cyclops</i>	seco	1993	CEUA00106196					
Anomalini	<i>Anomala_divisa</i>	seco	1992	CEUA00106198					
Anomalini	<i>Anomala_estrella</i>	seco	1992	CEUA00105806					
Anomalini	<i>Anomala_eucoma</i>	seco	1992	CEUA00105265					
Anomalini	<i>Anomala_eucoma</i>	seco	1992	CEUA00105264					
Anomalini	<i>Anomala_eucoma</i>	seco	1993	CEUA00105267					
Anomalini	<i>Anomala_eucoma</i>	seco	1993	CEUA00105266					
Anomalini	<i>Anomala_eucoma</i>	seco	1993	CEUA00105271					
Anomalini	<i>Anomala_eucoma</i>	seco	1994	CEUA00105270					
Anomalini	<i>Anomala_eulissa</i>	seco	2008	CEUA00106225					
Anomalini	<i>Anomala_eusticta</i>	seco	1995	CEUA00106063					
Anomalini	<i>Anomala_ferrea</i>	seco	1988	INBIOCRI002517845					
Anomalini	<i>Anomala_flavacoma</i>	seco	2006	CEUA00003306					
Anomalini	<i>Anomala_flavacoma</i>	seco	2010	CEUA00105076					
Anomalini	<i>Anomala_foraminosa</i>	seco	1991	INBIOCRI000298660					
Anomalini	<i>Anomala_globulata</i>	seco	2008	CEUA00105885					
Anomalini	<i>Anomala_globulata</i>	seco	2008	CEUA					
Anomalini	<i>Anomala_hiata</i>	seco	1996	CEUA00106069					
Anomalini	<i>Anomala_histrionella</i>	seco	1994	INBIOCRI001966351					
Anomalini	<i>Anomala_hoppi</i>	seco	2008	CEUA00106223					
Anomalini	<i>Anomala_inbio</i>	seco	2008	INBIOCRI004146689					
Anomalini	<i>Anomala_leopardina</i>	seco	1995	CEUA00106061					
Anomalini	<i>Anomala_levicollis</i>	seco	2008	CEUA00105850					
Anomalini	<i>Anomala_longisacculata</i>	etanol	2009	CEUA00106233					
Anomalini	<i>Anomala_megalia</i>	seco	1992	INBIOCRI000988672					
Anomalini	<i>Anomala_megaparamera</i>	seco	1990	CEUA00105268					
Anomalini	<i>Anomala_megaparamera</i>	seco	1990	CEUA00105269					

Anomalini	<i>Anomala_mersa</i>	seco	1999	CEUA00106201					
Anomalini	<i>Anomala_mesosticta</i>	etanol	2010	CEUA00106231					
Anomalini	<i>Anomala_mesosticta</i>	seco	1993	INBIOCRI001957604					
Anomalini	<i>Anomala_nigroflava</i>	seco	2007	CEUA00106190					
Anomalini	<i>Anomala_nitidula</i>	seco	1986	INBIOCRI002517263					
Anomalini	<i>Anomala_obovata</i>	seco	2008	CEUA00106224					
Anomalini	<i>Anomala_ochrogastra</i>	seco	1988	INBIOCRI000916192					
Anomalini	<i>Anomala_ochroptera</i>	seco	1986	INBIOCRI002612658					
Anomalini	<i>Anomala_perspicax</i>	seco	2008	CEUA00105879					
Anomalini	<i>Anomala_perspicax</i>	seco	2008	CEUA00105879					
Anomalini	<i>Anomala_piccolina</i>	seco	1992	INBIOCRI000874947					
Anomalini	<i>Anomala_pinselada</i>	seco	1993	CEUA00106160					
Anomalini	<i>Anomala_praecellens</i>	seco	2007	CEUA00106217					
Anomalini	<i>Anomala_pseudoeucoma</i>	etanol	2010	CEUA00106229					
Anomalini	<i>Anomala_pseudoeucoma</i>	etanol	2010	CEUA					
Anomalini	<i>Anomala_quiche</i>	seco	1993	INBIOCRI001331539					
Anomalini	<i>Anomala_ruatana</i>	seco	1992	INBIOCRI000492834					
Anomalini	<i>Anomala_sejuncta</i>	seco	1988	INBIOCRI002517860					
Anomalini	<i>Anomala_semicincta</i>	etanol	2010	CEUA00106230					
Anomalini	<i>Anomala_semicincta</i>	etanol	2010	CEUA					
Anomalini	<i>Anomala_semilla</i>	seco	2007	CEUA00106175					
Anomalini	<i>Anomala_solisi</i>	seco	2003	INBIOCRI004026000					
Anomalini	<i>Anomala_sp203</i>	seco	1996	INBIOCRI002459941					
Anomalini	<i>Anomala_sp249</i>	seco	2004	INBIOCRI003853316					
Anomalini	<i>Anomala_sp310</i>	seco	1992	INBIOCRI001117054					
Anomalini	<i>Anomala_stillaticia</i>	seco	1992	CEUA00106066					
Anomalini	<i>Anomala_strigodermoides</i>	seco	2010	CEUA00106215					

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Anomalini	<i>Anomala_subaenea</i>	seco	1996	INBIOCRI001118308					
Anomalini	<i>Anomala_subridens</i>	seco	2008	CEUA00105864					
Anomalini	<i>Anomala_subridens</i>	seco	2008	CEUA00105802					
Anomalini	<i>Anomala_subusta</i>	seco	1991	INBIOCRI000533195					
Anomalini	<i>Anomala_subusta</i>	seco	2008	CEUA00105804					
Anomalini	<i>Anomala_tenoriensis</i>	seco	2008	CEUA00105841					
Anomalini	<i>Anomala_testaceipennis</i>	seco	2010	CEUA00106216					
Anomalini	<i>Anomala_testaceipennis</i>	etanol	2010	CEUA00106234					
Anomalini	<i>Anomala_tuberculata</i>	etanol	2010	CEUA00106235					
Anomalini	<i>Anomala_tuberculata</i>	etanol	2010	CEUA00106236					
Anomalini	<i>Anomala_undulata</i>	seco	1992	INBIOCRI000761699					
Anomalini	<i>Anomala_valida</i>	seco	2008	CEUA00003281					
Anomalini	<i>Anomala_vallisneria</i>	seco	1992	CEUA00106071					
Anomalini	<i>Anomala_veraegrucis</i>	seco	1993	INBIOCRI001184220					
Anomalini	<i>Anomala_volsellata</i>	seco	2009	INBIOCRI004191779					
Anomalini	<i>Anomala_vulcanicola</i>	seco	1992	INBIOCRI000407478					
Anomalini	<i>Anomala_zumbadoi</i>	seco	1991	CEUA00106203					
Anomalini	<i>Anomalorhina_turrialbana</i>	seco	2010	CEUA00105807					
Anomalini	<i>Callistethus_carbo</i>	seco	1992	CEUA00105294					
Anomalini	<i>Callistethus_chontalensis</i>	etanol	2010	CEUA00105811					
Anomalini	<i>Callistethus_chontalensis</i>	etanol	2010	CEUA00105812					
Anomalini	<i>Callistethus_flavodorsalis</i>	seco	1991	INBIOCRI000566181					
Anomalini	<i>Callistethus_fuscorubens</i>	seco	1995	CEUA00105284					
Anomalini	<i>Callistethus_granulipygus</i>	etanol	2010	CEUA00105813					
Anomalini	<i>Callistethus_granulipygus</i>	etanol	2010	CEUA					
Anomalini	<i>Callistethus_jordani</i>	seco	1992	INBIOCRI000909339					
Anomalini	<i>Callistethus_lativittis</i>	etanol	2010	CEUA00105814					

Anomalini	<i>Callistethus_lativittis</i>	etanol	2010	CEUA00105815	■	■	■	■	■
Anomalini	<i>Callistethus_levigatus</i>	seco	2007	CEUA00105281	■	■	■	■	■
Anomalini	<i>Callistethus_macroxantholeus</i>	etanol	2010	CEUA00105818	■	■	■	■	■
Anomalini	<i>Callistethus_macroxantholeus</i>	seco	1991	CEUA00105292	■	■	■	■	■
Anomalini	<i>Callistethus_macroxantholeus</i>	seco	1992	CEUA00105293	■	■	■	■	■
Anomalini	<i>Callistethus_microxantholeus</i>	etanol	2010	CEUA00105822	■	■	■	■	■
Anomalini	<i>Callistethus_microxantholeus</i>	etanol	2010	CEUA00105823	■	■	■	■	■
Anomalini	<i>Callistethus_microxantholeus</i>	etanol	2010	CEUA00105819	■	■	■	■	■
Anomalini	<i>Callistethus_mimeloides</i>	etanol	2010	CEUA00105808	■	■	■	■	■
Anomalini	<i>Callistethus_mimeloides</i>	etanol	2010	CEUA	■	■	■	■	■
Anomalini	<i>Callistethus_multiplicatus</i>	seco	2010	CEUA00105283	■	■	■	■	■
Anomalini	<i>Callistethus_multiplicatus</i>	seco	2010	CEUA	■	■	■	■	■
Anomalini	<i>Callistethus_parapulcher</i>	seco	2009	CEUA00105287	■	■	■	■	■
Anomalini	<i>Callistethus_ruteloides</i>	seco	2007	CEUA00106211	■	■	■	■	■
Anomalini	<i>Callistethus_schneideri</i>	etanol	2010	CEUA00105816	■	■	■	■	■
Anomalini	<i>Callistethus_schneideri</i>	etanol	2010	CEUA00105817	■	■	■	■	■
Anomalini	<i>Callistethus_sp304</i>	seco	2007	CEUA00105801	■	■	■	■	■
Anomalini	<i>Callistethus_specularis</i>	seco	2007	CEUA00105278	■	■	■	■	■
Anomalini	<i>Callistethus_stannibracteus</i>	seco	1990	CEUA00105277	■	■	■	■	■
Anomalini	<i>Callistethus_sulcans</i>	seco	1993	INBIOCRI001802492	■	■	■	■	■
Anomalini	<i>Callistethus_valdecostatus</i>	seco	1993	INBIOCRI001926964	■	■	■	■	■
Anomalini	<i>Callistethus_vanpatteni</i>	seco	2007	INBIOCRI004238842	■	■	■	■	■
Anomalini	<i>Callistethus_xiphostethus</i>	seco	1986	INBIOCRI002517477	■	■	■	■	■
Anomalini	<i>Callistethus_yalizo</i>	seco	2008	CEUA00106167	■	■	■	■	■
Anomalini	<i>Epectinaspis_mexicana</i>	seco	2000	CEUA00003695	■	■	■	■	■
Rutelini	<i>Platycoelia_humeralis</i>	seco	2008	CEUA00015920	■	■	■	■	■
Anomalini	<i>Strigoderma_auriventris</i>	seco	1992	INBIOCRI000704210	■	■	■	■	■

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Anomalini	<i>Strigoderma_biolleyi</i>	seco	1986	INBIOCRI004238838					
Anomalini	<i>Strigoderma_nodulosa</i>	seco	1994	INBIOCRI001734718					
Anomalini	<i>Strigoderma_sulcipennis</i>	seco	1993	INBIOCRI001158680					
Anomalini	<i>Yaaxkumukia_conabioi</i>	seco	2002	CEUA00003821					
Cyclocephalini	<i>Cyclocephala_atripes</i>	etanol	2010	CEUA00106239					
Cyclocephalini	<i>Cyclocephala_atripes</i>	etanol	2010	CEUA00106240					
Cyclocephalini	<i>Cyclocephala_erotilina</i>	seco	2007	CEUA00106226					

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Capítulo 3

Descripciones de nuevas especies de *Anomala* y *Callistethus*

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Este capítulo está dividido en diferentes apartados que corresponden a los artículos de descripción de nuevas especies, tal y como fueron elaborados para su publicación.

3.1 - Redescription of *Anomala eucoma* Bates, 1888 and a description of three new species from Costa Rica (Coleoptera: Scarabaeidae: Rutelinae)

[Redescripci3n de *Anomala eucoma* Bates, 1888 y descripci3n de tres nuevas especies de Costa Rica (Coleoptera: Scarabaeidae: Rutelinae)]



Abstract: *Anomala eucoma* Bates, 1888 is redescribed and a lectotype from Guatemala is designated. Three new species from Costa Rica, *A. flavacoma* new species, *A. megaparamera* new species, and *A. pseudoeucoma* new species, are described, and a distribution map is given. The internal sac (endophallus) of the species covered is illustrated, and its use in separating closely related species in this region is discussed. An identification key for morphologically similar species from the Neotropical region is provided.

Key words: aedeagus, distribution, endophallus, identification key, lectotype

Resumen: Se redescrive *Anomala eucoma* Bates, 1888 y se selecciona un lectotipo de Guatemala. Se describen las especies de Costa Rica *A. flavacoma* sp.n., *A. megaparamera* sp. n., y *A. pseudoeucoma* sp. n., con mapas de sus distribuciones. El saco interno de las especies aquí consideradas es ilustrado, y se discute su utilidad para separar especies cercanas. Se proporciona una clave dicotómica para la identificación de especies morfológicamente similares de la región neotropical.

Introduction

The taxonomic complexity of the genus *Anomala* (Coleoptera: Scarabaeidae: Rutelinae: Anomalini) is in part due to its high variability within species, especially in colour patterns, whereas characters used as diagnostic are uniform between species (Morón *et al.* 1997, Morón & Nogueira 2002, Jameson *et al.* 2003). Moreover, most of the descriptions, at least for Neotropical species, are usually based on few specimens and date back a century or so. They include few diagnostic characters, which often turn out to be variable when more specimens are studied, and lead to the synonymization of several species.

With a few exceptions, the genitalia were not described or illustrated in older descriptions, and usually only the aedeagus is illustrated in the few modern publications dealing with this group. Despite several previous encouraging findings on the endophallus of Anomalini (see for example Zorn 2006 for species delimitation and grouping), this suite of characters has only recently been included in taxonomic studies of *Anomala*. Endophallus characters have not been used or illustrated for Neotropical species.

An example of the need for revision and new diagnostic characters is *Anomala eucoma* Bates, 1888, a brown, medium-sized species covered with dense setation. One of the main differences with the similar *A. ampicoma* Bates, 1888, reported in the original description, is the length of the upper branch of the protarsal internal

claw, which is subject to wear and varies among individuals. This makes correct identification difficult if no voucher specimens are available.

In this paper, three more species are described from Costa Rica, which closely resemble *A. eucoma* due to their dense setation and colour pattern, showing the value of internal and external male genitalia for delimitating morphologically uniform species.

Moreover, a recent examination of type specimens of *A. eucoma* (seven specimens in total) from the Natural History Museum (London) and the Muséum National d'Histoire Naturelle (Paris), as well as several specimens from Costa Rica, revealed differences in body size and male reproductive systems between populations, which may indicate incipient species. These are revised in this paper.

The aim of the present paper is to redescribe *A. eucoma* using modern standards, to describe three new species from Costa Rica, and to introduce the description of the endophallus as a diagnostic character in Neotropical species for the first time.

Material and methods

The material cited in this publication is deposited in the following collections:

BMNH—Natural History Museum, London, United Kingdom

CEUA—Colección Entomológica de la Universidad Alicante, Spain

INBIO—Instituto Nacional de Biodiversidad, Costa Rica

MNHN—Muséum National d'Histoire Naturelle, Paris, France

MNHUB—Museum für Naturkunde der Humboldt Universität zu Berlin, Germany

MUCR—Museo de Insectos, Universidad de Costa Rica, Costa Rica

To prepare the endophallus for study, the following procedure was used. The aedeagus was washed in a 10% hot KOH solution for 5–10 minutes and then rinsed in distilled water. It was then kept in lactic acid for a minimum of 48 hours, until the

3.1 Redescription *A. eucoma*

structures of the aedeagus and endophallus became translucent. The endophallus was everted by injecting water from the base of aedeagus with a syringe equipped with a suitable needle, or microforceps (WPI Dumont #5) when the length of the internal sac made the syringe method inefficient. The dissection was transferred to a microvial containing glycerine, which was attached to the insect pin. From 2–12 specimens of each species were dissected.

Line drawings were done with the aid of a camera lucida attached to a stereo microscope (Leica M80). The pencil drawings were then traced with technical ink pens.

All measurements were taken from photographs of the specimens, using Leica Application software. A Leica DFC450 camera mounted on a Leica M205C stereo microscope was used to take the photographs.

The following definitions were used in the description. Body length: from tip of clypeus to pygidium. Body width: measured on widest point of elytra. Clypeus width: measured at half height. Ratio interocular width/width of eye: widths measured at half the height of eyes. Pronotum width: measured at base. Width between mesocoxae: measured at level of apex of trochanters. Metatibia ratio: length measured from below the articulation with femur to tip, on the median axis; width measured at widest point. Protarsal claw: length measured from tip of claw to internal basal angle; height measured perpendicularly to the line of the length measurement, using this as base and the dorsal surface of the claw at the point when it reaches its maximum height as tip (see Fig. 1).

For morphological terminology we followed Zorn (2007) for enumeration of elytral striae; Harris (1979) for surface sculpturing; D'Hotman & Scholtz (1990) and Zorn (2007) for endophallus and aedeagus structures, with the addition for the first time in this publication of the term "inflation" for swollen bumps with a wide base. The term

"diverticle" is used for secondary small sac-like appendages, longer than wide. For additional terminology used for parameres, see Fig. 13.

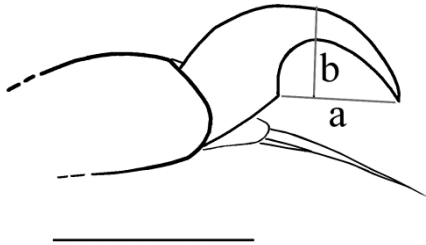


Figure 1: External protarsal claw of *Anomala eucoma* (lectotype): a: length; b: height. Scale = 0.5 mm.

We follow the traditional inclusion of New World species in the genus *Anomala* (Jameson *et al.* 2003) as taxonomic treatment, in contrast to the recent paper by Ramírez-Ponce & Morón (2009), who group them into a new genus *Paranomala*, as a more conservative classification, waiting for a more extensive study at global scale.

Results

Anomala eucoma Bates, 1888

(Fig. 2)

Material examined: Lectotype (here designated): 1♂ "Syn-type / Type / Las Mercedes, 3000 ft. Champion. / *Anomala eucoma* Bates (handwritten) / B.C.A., Col., II(2) *Anomala*" (BMNH). Paralectotypes: 1♂ "Las Mercedes, 3000 ft. Champion. / *Anomala eucoma* Bates (handwritten) / H.W. Bates Biol. Cent. Amer." (MNHN). ♂ "Las Mercedes, 3000 ft. Champion. / *eucoma* Bates (handwritten) / H.W. Bates Biol. Cent. Amer." (MNHN). 1♂ "SYNTYPE / Costa Rica. V.P. (handwritten) / Locality doubtful (handwritten) / B. C. A., Col. II (2) *Anomala*" (BMNH); 1♂ "SYN-TYPE / Costa Rica / Salle Coll. / 1195 / *Anomala eucoma* Bates (handwritten) / *Isonychus* sp. apud Sallé (handwritten) / B. C. A., Col. II (2) *Anomala*" (BMNH). 1♂ "Pantaleon, 1700 ft. Champion / *Anomala eucoma* (handwritten) / B. C. A., Col. II (2) *Anomala*". 1♀ "San Isidro, 1600 ft. Champion / *Anomala eucoma* (handwritten) / B. C. A., Col. II (2) *Anomala*". Additional material: 1♂ "MUSEO DE INSECTOS UNIVERSIDAD DE COSTA RICA, COSTA RICA, PROV. (printed) San José U.C.R. 12-XI-64. G. Fuentes (handwritten) / *Anomala* ? id: Sullivan 86" (MUCR); 1♂ "MUSEO DE INSECTOS UNIVERSIDAD DE COSTA RICA, COSTA RICA, PROV. (printed) San José Univ. de Costa Rica San Pedro, San José. Alt. 1200 m. 10-oct

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1968. P.L. Kazan (handwritten) / *Anomala* sp. Id: D. Corde 1994" (MUCR); 1♂ "Amubri, A.C. Amistad., Prov. Limon, COSTA RICA. 70 m. 4-30 Abr 1994, G. Gallardo, L S 385500_578100 # 2822 / COSTA RICA INBIOCRI001785409"; 1♀ "Amubri, Prov. Limón, COSTA RICA. 70m. 1-22 JUN 1995. G. Gallardo, L S 385000 578100 #5333 / COSTA RICA INBIOCRI002235510"; 1♂ "Amubri, Talamanca., A.C. Amistad, Prov. Limón, COSTA RICA. 70 m . 6-28 Jun 1994, G. Gallardo, L N 385000_578100 #3006 / COSTA RICA INBIOCRI001875336"; 1♀ "Amubri, A.C. Amistad., Prov. Limon, COSTA RICA. 70 m. 2-31 May 1994, G. Gallardo, L N 385000_578100 # 2928 / CEUA00105270"; 1♂ "Amubri, Prov. Limón, COSTA RICA. 70m. 1-22 Oct 1994. G. Gallardo, L S 385500 578000 #3266 / COSTA RICA INBIOCRI002008852"; 1♂ "Amubri, Prov. Limón, COSTA RICA. 70m. 3-9 SET 1994. G.M. Gallardo, L S 385500 578000 #3201 / COSTA RICA INBIOCRI002018611"; 1♂ "Amubri, A.C. Amistad., Prov. Limon, COSTA RICA. 70 m. 4-21 Dec 1993, G. Gallardo, L S 385500_578100 # 2480 / CEUA00105271"; 1♂ "Est. Sirena, P. N. Corcovado, 0 - 100m, Prov. Punt., COSTA RICA. N. Obando, Jun 1990, L- S 270500_508300 / COSTA RICA INBIOCRI000644524"; 1♂ "Est Sirena, Corcovado N. P. , Puntarenas, Prov. COSTA RICA, 0-100m, Jan. 1990, G. Fonseca, L_S_270500_508300 / COSTA RICA INBIOCRI000198374"; 1♂ "Sirena, Corcovado N. P. Puntarenas Province COSTA RICA. 0 - 100m. G. Fonseca, Dic 1989, L- S 270500_508300 / COSTA RICA INBIOCRI000203726"; 1♂ "Est. Sirena, P. N. Corcovado, 0-100m, Prov. Punt., COSTA RICA F. Quesada, Jun 1990, L- S 270500_508300 / COSTA RICA INBIOCRI000376353"; 1♂ "Est. Sirena, P. N. Corcovado, 0 - 100m, Prov. Punt., COSTA RICA, G. Fonseca, Oct 1989, L- S 270500_508300 / COSTA RICA INBIOCRI000446957"; 1♂ "Est. Sirena, 0-100m, P. N. Corcovado, Prov. Puntarenas, Costa Rica, G. Rodriguez, Abr 1992, L- S 270500_508300 / CEUA00105265"; 1♀ "Est. Sirena, 0-100m, P. N. Corcovado, Prov. Punt., COSTA RICA, G. Fonseca, Ene 1992, L- S 270500_508300 / COSTA RICA INBIOCRI000506778"; 1♂ "Est. Sirena, P. N. Corcovado, 0 - 100m, Prov. Punt., COSTA RICA. N. Obando, Jun 1990, L- S 270500_508300 / COSTA RICA INBIOCRI000644521"; 1♀ "Est. Sirena, 0-100m, P. N. Corcovado, Prov. Puntarenas, Costa Rica, Jun 1992, G. Fonseca, L -S 270500_508300 / CEUA00105264"; 1♂ "Est. Sirena, 0-100m, P. N. Corcovado, Prov. Puntarenas, Costa Rica, Jun 1992, G. Fonseca, L -S 270500_508300 / COSTA RICA INBIOCRI000714400"; 1♀ "COSTA RICA. Prov. Puntarenas. P.N. Corcovado, Est. Sirena. 0-100m. 21 FEB 2004. E. Holzer. C. Libre. L_S_270850_509176 #92946 / INB0004129881 INBIOCRI COSTA RICA "; 1♀ "COSTA RICA. Prov. Puntarenas. P.N. Corcovado, Est. Sirena.

0–100m. 21 FEB 2004. E. Holzer. C. Libre. L_S_270850_509176 #92946 / INB0004129887 INBIOCRI COSTA RICA"; 1♂ " COSTA RICA. Prov. Puntarenas. P.N. Corcovado, Est. Sirena.

0–100m. 21 FEB 2004. E. Holzer. C. Libre. L_S_270850_509176 #92946 / INB0004129886 INBIOCRI COSTA RICA"; 1♂ " COSTA RICA. Prov. Puntarenas. P.N. Corcovado, Est. Sirena.

0–100m. 21 FEB 2004. E. Holzer. C. Libre. L_S_270850_509176 #92946 / INB0004129883 INBIOCRI COSTA RICA"; 1 ♂ "Est. Palo Verde, 10m, Ref. Nac. Fauna Silv. R. L. Rodriguez, Prov. Guan., COSTA RICA, D. Acevedo, Jun 1991, L- N 259000_388400 / COSTA RICA INBIOCRI000652257"; 1♂ "Est. Palo Verde, 10m, Ref. Nac. Fauna Silv. R. L. Rodriguez, Prov. Guan., COSTA RICA, D. Acevedo, Jun 1991, L- N 259000_388400 / COSTA RICA INBIOCRI000652258"; 1♂ "Est. Las Pailas, 800m, P. N. Rincon de la Vieja, Prov. Guanacaste, Costa Rica, 1 a 22 jul 1992, D. Garcia, L- N 306300_388600 / COSTA RICA INBIOCRI000713719"; 1♂ "Fca. Jenny, 30 km N de Liberia, P. N. Guanacaste, Prov. Guanacaste, Costa Rica, 20 ago a 12 set 1992, E. Araya, L N 316200_364400 / COSTA RICA INBIOCRI000849675"; 1♂ "Est. Las Pailas, 800 m, P.N. Rincon de la Vieja, Prov. Guan. COSTA RICA. 15 May–11 Jun 1993, K. E. Taylor, L- N 306300_388600 / CEUA00105267"; 1♂ "Finca Jenny, 30 km N de Liberia, P.N. Guanacaste, Prov. Guana, COSTA RICA. 300m. Mar 1991. R. Espinoza, L N 316200_364400 # 1678 / COSTA RICA INBIOCRI001693034"; 1♂ "Fca. Jenny, 300m, 31 Km N. Liberia, Guanacaste Prov. COSTA RICA, Nov 1988 GNP Biodiversity Survey W85 34 27", N10 51 55" / COSTA RICA INBIOCRI002517326"; 1♂ "Estac. Maritza, 600 m, W side Volcan Orosi Guanac. Pr. COSTA RICA. June 1988. Janzen & Hallwachs W85 29`37" .N10 57`39" / COSTA RICA INBIOCRI002517343"; 1♂ "Estac. Maritza, 600 m, W side Volcan Orosi Guanac. Pr. COSTA RICA. June 1988. Janzen & Hallwachs W85 29`37" .N10 57`39" / COSTA RICA INBIOCRI002517348"; 1♀ "Tierras Morenas, 700m, Prov. Guan., COSTA RICA. May 1993. G. Rodriguez. L-N-283950, 424500 / COSTA RICA INBIOCRI001180822"; 1♀ " Tierras Morenas, 700m, Prov. Guan., COSTA RICA. May 1993. G. Rodriguez. L-N-283950, 424500 / COSTA RICA INBIOCRI001180834"; 1♂ "Est. Las Pailas, P.N. Rincón de la Vieja, A.C. Guanacaste, Prov. Guana. COSTA RICA. 800 m. 8–26 May 1994. K.E. Taylor, L N 306300_388600 #2912 / COSTA RICA INBIOCRI001861399"; 1♂ "Est. Las Pailas, P.N. Rincón de la Vieja, A.C. Guanacaste, Prov. Guana. COSTA RICA. 800 m. 8–26 May 1994. K.E. Taylor, L N 306300_388600 #2912 / COSTA RICA INBIOCRI001861400"; 1♀ "Est. Las Pailas, P.N. Rincón de la Vieja, A.C. Guanacaste, Prov. Guana. COSTA RICA. 800 m. 8–26 May 1994. K.E. Taylor, L N 306300_388600 #2912 / COSTA

3.1 Redescription *A. eucoma*

RICA INBIOCR1001861401"; 1♀ "Est. Las Pailas, P.N. Rincón de la Vieja, A.C. Guanacaste, Prov. Guana. COSTA RICA. 800 m. 7–26 May 1994. D. García, L N 306300_388600 #2910 / COSTA RICA INBIOCR1001879319"; 1♀ "Est. Las Pailas, P.N. Rincón de la Vieja, Prov. Guanacaste, Costa Rica. 800 m. 19 Jun– 1 Jul 1993. D. G. García, L N 306300_388600 #2189 / COSTA RICA INBIOCR1001967801"; 1♀ "Est. Las Pailas, P.N. Rincón de la Vieja, Prov. Guana. COSTA RICA. 800 m. 16–24 Ago 1993. D. García, L N 306300_388600 #2268 / CEUA00105266".

Description. Male. Body shape oval. Length 12.15 mm. Width 6.90 mm. Head, pronotum, scutellum, and pygidium dark brown; legs and underside reddish brown; elytra dark brown with two slightly lighter horizontal bands (along anterior margin and on elytral disc). Surface covered with fine, blond setae.

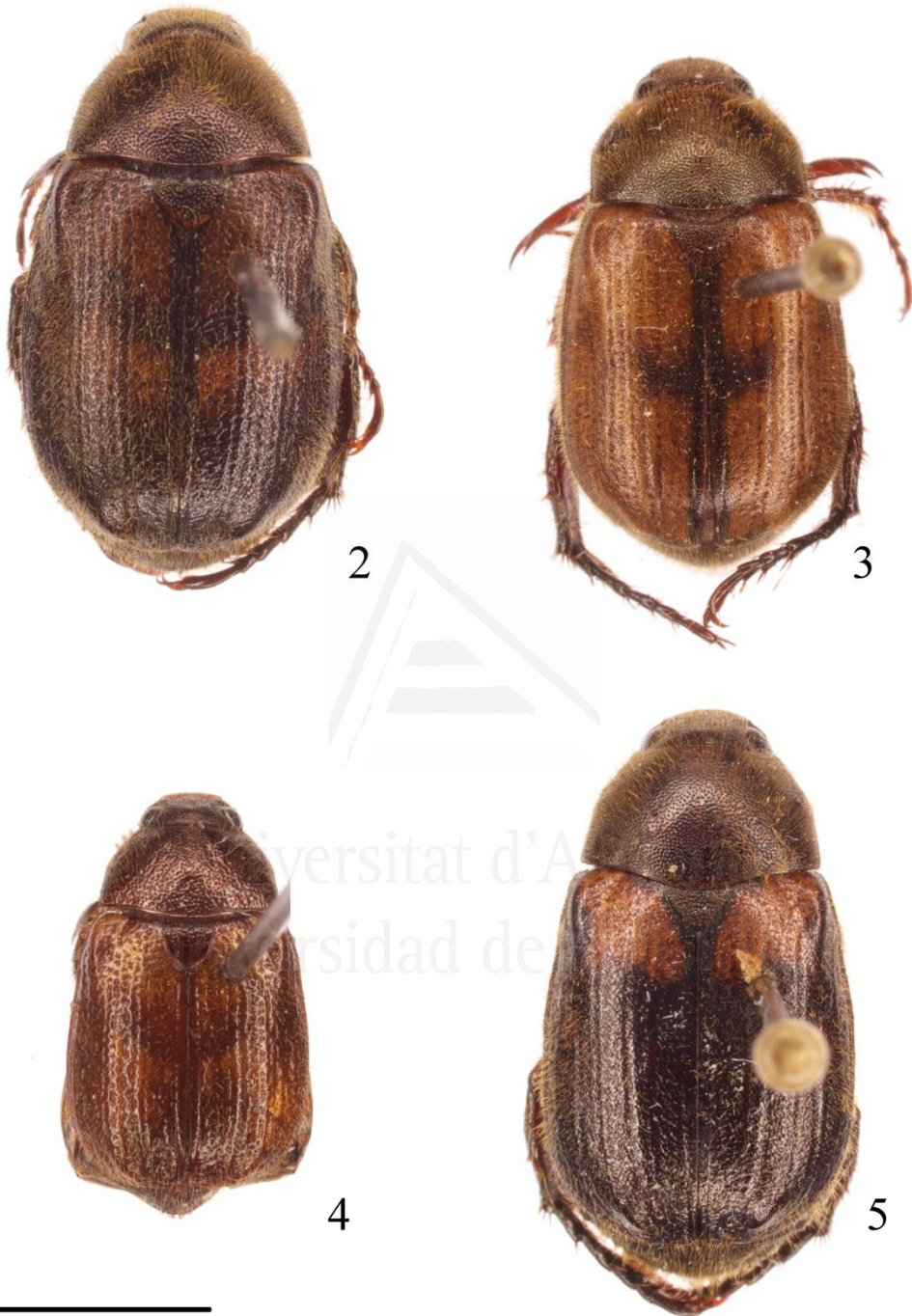
Clypeus trapezoidal, densely punctate-reticulate; ratio width/length 1.91. Anterior angles rounded. Frons densely punctate, flat, with apparent boundary with vertex (due to an abrupt change in inclination of the two surfaces) (Fig. 6a). Ocular canthum long and thin, with rounded apex. Interocular ratio (interocular width/width of eye): 3.15.

Pronotum trapezoidal, width 1.57 times length. Lateral margins forming an obtuse angle at 1/3 of pronotum length. Anterior angles right and sharp, posterior angles obtuse and rounded. Basal margin thin and complete, sinuate. Entire surface with deep punctures.

Scutellum sub-pentagonal in shape, with rounded sides and acute apex, ratio width/length 1.26; sparsely punctate.

Elytra with defined costae and interstices with sparse, large punctures, somewhat obliterated by the numerous and smaller setae-bearing punctures. Lateral margin convex, larger at base, disappearing on apex. Marginal membrane almost complete.

Pygidium finely granulate, with longer setae at hind margins. Triangular in shape. Slightly convex in lateral view. Ratio width/length 1.58.



Figures 2-5: Habitus images. 2: *Anomala eucoma* (paralectotype, Las Mercedes, Guatemala). 3: *A. flavaeucoma* (female paratype, Estación Hitoy Cerere, Costa Rica). 4: *A. megaparamera* (holotype). 5: *A. pseudoeucoma* (holotype). Scale = 5 mm.

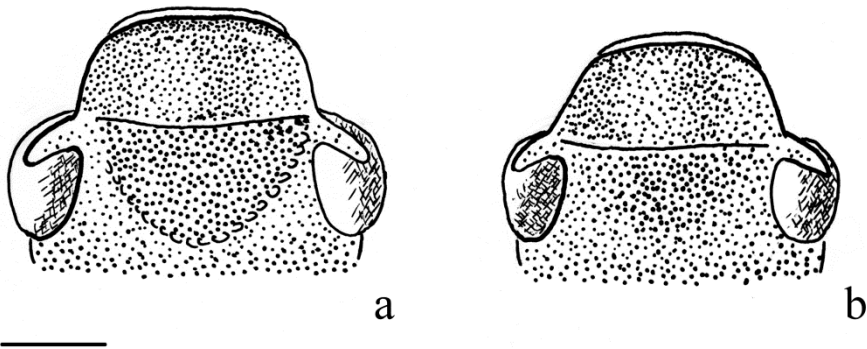
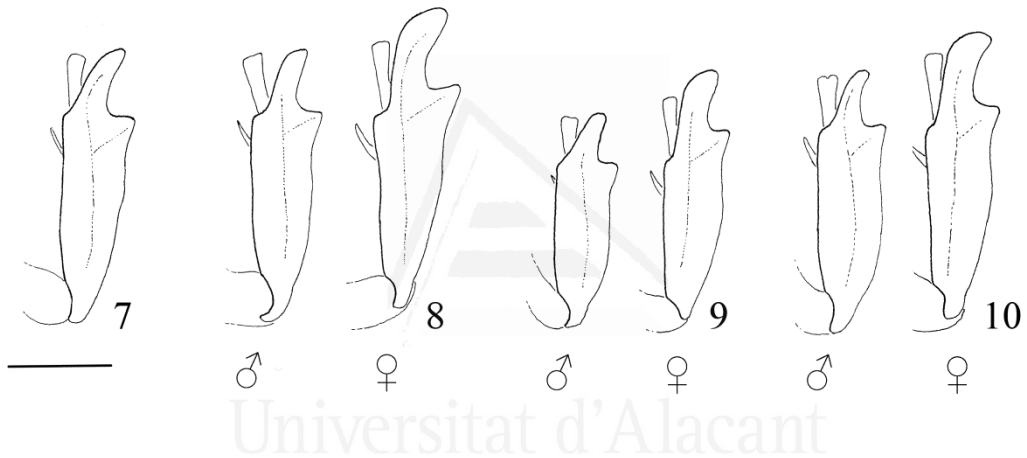


Figure 6: Head of a: *Anomala eucoma* (paralectotype, Las Mercedes, Guatemala) and b: *A. eucoma* (paralectotype, precise locality unknown, Costa Rica). Scale = 1 mm.



Figures 7-10: Shape of protibia in 7: *Anomala eucoma* (paralectotype, Las Mercedes, Guatemala); 8: *A. flavacoma* (♂ holotype, ♀ Hitoy Cerere, Costa Rica); 9: *A. megaparamera* (♂ holotype, ♀ paratype, Cuatro Esquinas, Costa Rica); 10: *A. pseudoeucoma* (♂ holotype, ♀ paratype, Reserva de San Ramón, Costa Rica). Scale = 1 mm.

Metasternal disc sulcated, with setigerous punctures on the entire surface. Space between the mesocoxae narrow, slightly convex, width 0.25 mm. Mesometasternal suture well defined, at base of mesocoxae.

Abdominal sternites with 5–8 irregular transverse rows of setae, concentrated on bottom on sternites 2–4. Surface with elongate punctures that coalesce at sides. Male last sternite strigate, with apical margin well defined and rounded.

Protibia with 2 teeth (Fig. 7), apical tooth long and curved; second tooth at the same level of internal apex of protibia, triangular in shape, acute. Metatibia stout, slightly

narrower subapically. Ratio length/width 2.93. First carina somewhat obliterated by elongated and dense punctures, which become rugose below second carina.

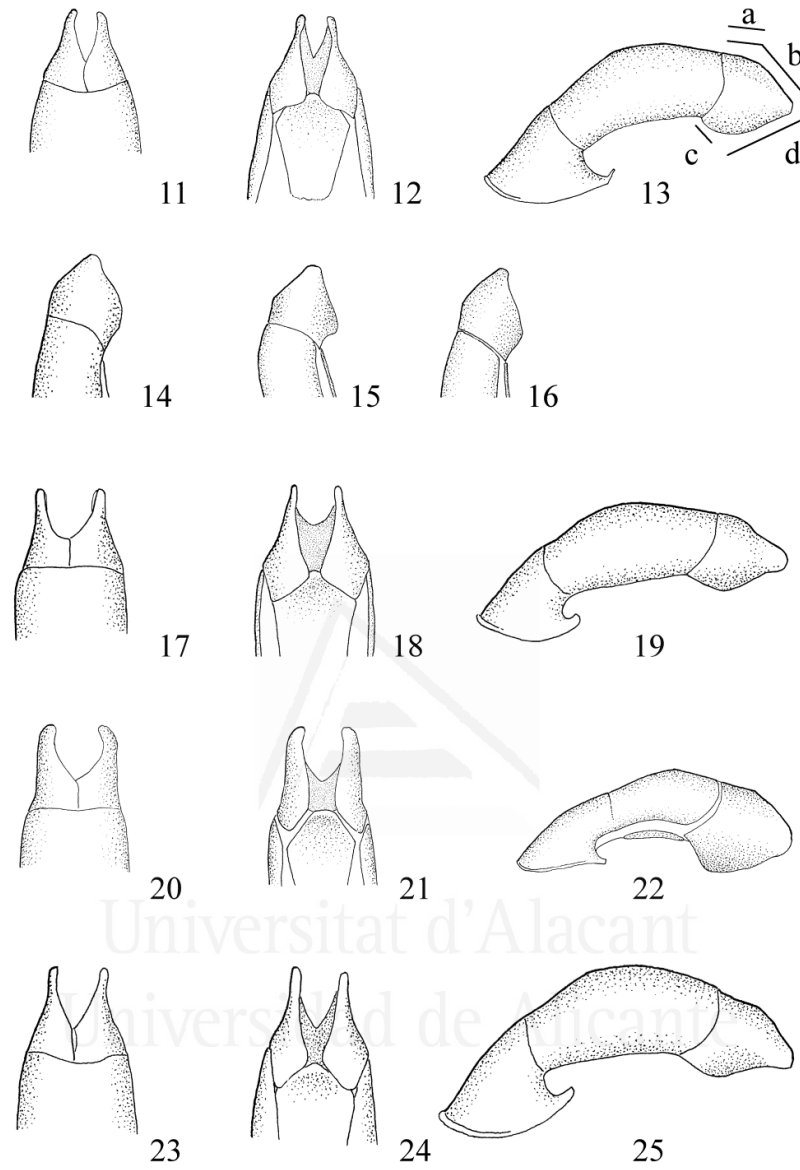
Protarsal claws: external claw strongly curved; ratio length/height: 2.01; internal claw bifurcate, with upper branch slightly shorter and half the width of the lower one. Inferior margin slightly sinuate.

Aedeagus (Figs 11–13): parameres short and wide, with inferior margin slightly sinuate. Endophallus (Fig. 26) with one long sacculus with sclerotized setae in a wide patch on apex; a ring of short but thick setae is present subapically. The rest of surface is covered by microsetation. A smaller diverticle is present at base. Gonopore opening ventrally at basal third.

Female (Costa Rica): Similar to males, Apical tooth of protibia longer and wider than in male. Inferior margin of internal protarsal claw straight. Metatibia wider than in males. Last abdominal sternite with curved margin.

Variation: Body length 8.44–12.62 mm, body width 4.87–6.93 mm. Clypeus w/l: 1.75–2.05. Interocular ratio (interocular width/width of eye): 2.80–3.73. Antenna: ratio funiculus/club 0.66–0.75. Pronotum w/l: 1.54–1.67. Scutellum w/l: 1.21–1.48. Pygidium w/l: 1.53–1.78. Width between mesocoxae: 0.15–0.27 mm. Metatibia w/l: 2.35–3.08. External claw l/h: 1.32–2.01. Colour on head, pronotum, scutellum, and pygidium from greenish to reddish to bronze brown.

Three different populations are present in Costa Rica, with defined geographic ranges (Fig. 33), each presenting subtle differences with the others and the specimens from Las Mercedes, Guatemala. The two paralectotypes from Costa Rica and the specimens from San Pedro (Universidad de Costa Rica, near San José, Central Valley) and Amubri (the Talamanca mountain range) are similar in size (body length 11.45–12.62 mm, width 5.94–6.93 mm; Guatemalan specimens: body length 11.74–12.53 mm, width 6.71–6.90 mm) but are paler in colour; the frons gradually curving towards vertex (Fig. 6b), clypeus trapezoidal with lateral sides straight. This is in contrast to the Las Mercedes specimens, where they are curved, with basal half perpendicular to



Figures 11-26: Aedeagus of *A. eucoma* (paralectotype, Las Mercedes, Guatemala). 11: Dorsal aspect. 12: Ventral aspect. 13: Lateral aspect; **a**: dorsal section: part of the dorsal margin that corresponds to the joint between the two parameres; **b**: dorsal margin: margin of the paramere dorsal with respect to apex; conversely, the ventral part is the ventral margin, which in these species can be divided in **c**: posterior ventral margin; and **d**: anterior ventral margin, in relation to the angle formed by the curvature of the margin. Parameres of Costa Rican specimens showing slight variation among populations. 14: San José, Universidad de Costa Rica. 15: Estación Las Pailas, Guanacaste. 16: Estación Sirena, Parque Nacional Corcovado. 17-19. Aedeagus of *Anomala flavacoma* (paratype, Estación Cabro Muco, Costa Rica). 17: Dorsal aspect. 18: Ventral aspect. 19: Lateral aspect. 20-22. Aedeagus of *Anomala megaparamera* (holotype). 20: Dorsal aspect. 21: Ventral aspect. 22: Lateral aspect. 23-25. Aedeagus of *Anomala pseudoeucoma* (paratype, Hitoy Cerere, Costa Rica). 23: Dorsal aspect. 24: Ventral aspect. 25: Lateral aspect. Scale = 1 mm.

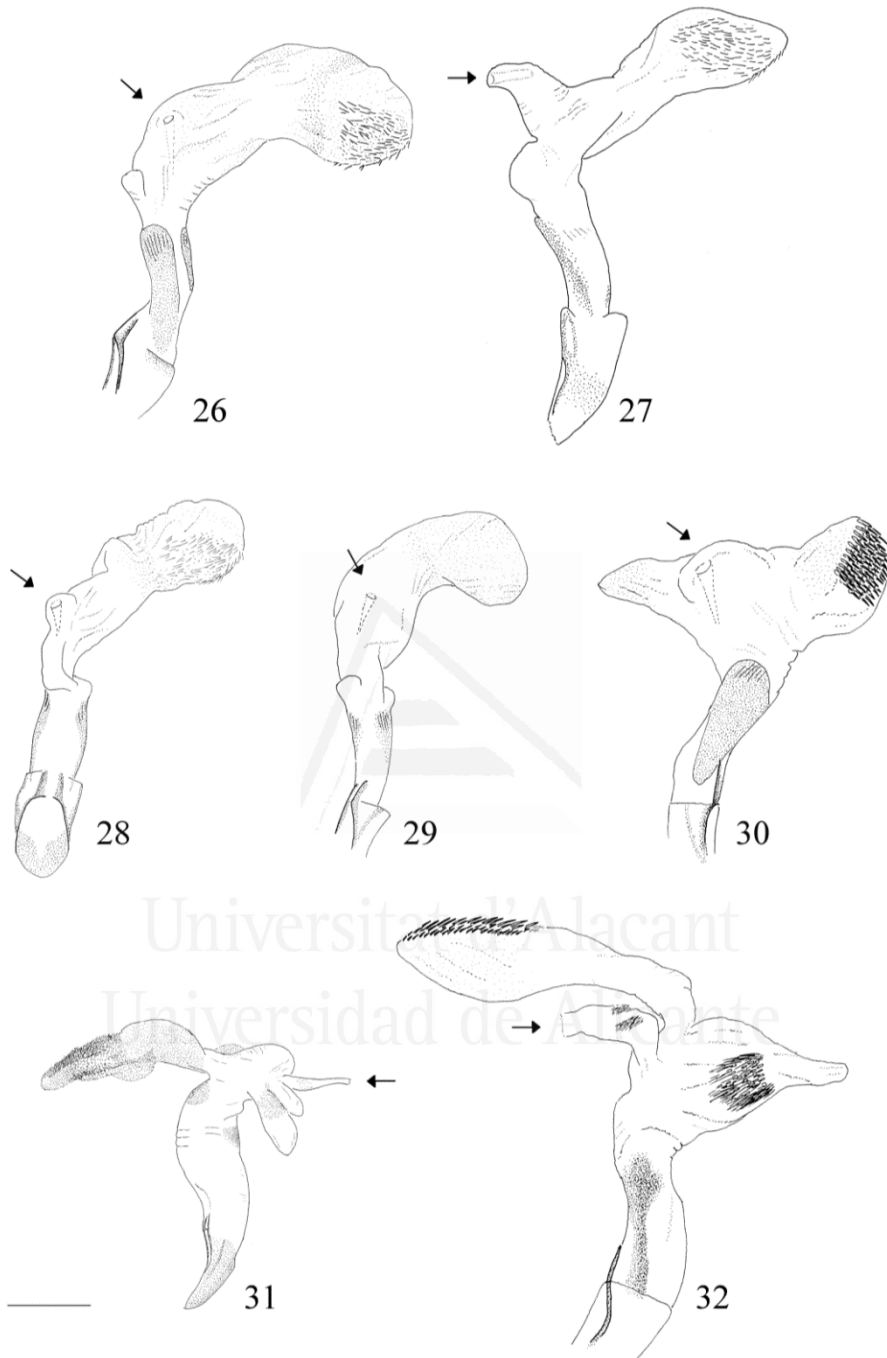


Figure 26-32: Endophallus of *Anomala eucoma* showing variation among populations. 26: Paralectotype, Las Mercedes, Guatemala. 27: San José, Universidad de Costa Rica, Costa Rica. 28: Estación Las Pailas, Guanacaste, Costa Rica. 29: Estación Sirena, Parque Nacional CoCorcovado, Costa Rica. 30: Endophallus of *Anomala flavacoma* (holotype). 31: Endophallus of *Anomala megaparamera* (holotype). 32: Endophallus of *Anomala pseudoeucoma* (holotype). Scale = 1 mm. The arrows show the position of the gonopore.

the base (see Fig. 6). Other differences are: less curved external protarsal claw, metatibia punctate above first carina, which is well defined, slender parameres (Figs. 14) and shorter and narrower endophallus (Fig. 27).

The specimens from the Guanacaste province are smaller in size (body length 9.31–9.96 mm, width 5.05–5.93 mm), with frons gradually curving towards vertex, metatibia punctate above first carina, which is well defined, narrower apical angle of parameres (Fig. 15), thinner setation on endophallus (Fig. 28). The paralectotypes from Pantaleon and San Isidro, Guatemala, are more similar to these specimens in size and genitalia than to the ones from Las Mercedes.

The specimens from the Osa peninsula (P.N. Corcovado) are also smaller in size (body length 8.44–9.90 mm, width 4.87–5.63 mm), with frons gradually curving towards vertex, metatibia punctate above first carina, which is well defined, slender parameres with sinuate ventral margin (Fig. 16), endophallus without patches of sclerotized setae (Fig. 29).

Diagnosis: *Anomala eucoma* is separated from similar species by the combination of the following characters: two dark bands on elytra, parameres pentagonal in shape, with dorsal and ventral margin not strongly sinuate, endophallus with one long sacculus. It can easily be separated from *A. amphicoma*, about the same size and dorsally setose, by the latter having the following characteristics: a metallic green pronotum in most specimens, covered by velvety dense setae; the pronotum is largest at 1/3 of height, with base narrower than elytra; elytra uniformly dark in colour, shorter parameres with sinuate ventral margin, endophallus with two long sacculi. It is differentiated from *A. flavacoma* by size (*A. flavacoma* has an intermediate size between the larger and smaller specimens of *A. eucoma*) and its darker colour, proportionally narrower scutellum, endophallus with one narrow and long sacculus and lack of thick setae, in contrast to the two short sacculi of *A. flavacoma*. It can be distinguished from *A. pseudoeucoma* by the longer and more curved apical tooth in male protibia; more convex intermesocoxal space, shorter parameres, endophallus

with one long sacculus and lack of thick setae, instead of the two sacculi with patches of thick setae of *A. pseudoeucoma*. *Anomala megaparamera* is similar in size and colour to the Osa and Guanacaste populations, but *A. megaparamera* has a proportionally wider pygidium, aedeagus with proportionally larger parameres, endophallus with several inflations and diverticles and copiously covered with setae.

Distribution: Guatemala: Las Mercedes; Costa Rica: Guanacaste and the Talamanca mountain ranges; Central Valley, Parque Nacional Corcovado, in the Osa peninsula (Fig. 33).

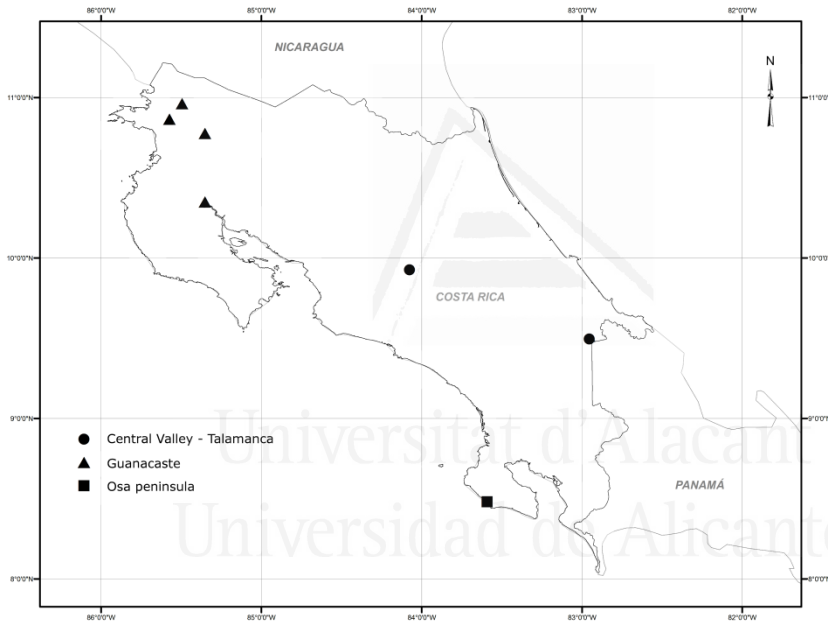


Figure 33: Distribution of *Anomala eucoma* in Costa Rica, with populations differentiated.

Anomala flavacoma Filippini, Micó, & Galante, new species

Fig. 3

Material examined: Holotype: ♂ "Limon, Costa Rica Reserva Hitoy-Cerere Rio Cerere 100 msnm 24 marzo 1987 Angel Solis / 56 / Costa Rica INBIOCRI002517822" (INBIO).

Paratypes (11): 1♂ "Est. Hitoy Cerere, 100m, R. Cerere, Res. Biol. Hitoy Cerere, Prov. Limon, Costa Rica, Nov 1992 G. Carballo L- N / Costa Rica INBIOCRI000926676"; 1♂ "Est. Hitoy

3.1 Redescription *A. eucoma*

Cerere, 100 m, R. Cerere, Res. Biol. Hitoy Cerere, Prov. Limon, COSTA RICA. Abr 1993. G. Carballo. L- N 184200_643300 / Costa Rica INBIOCR1000975444"; 1♀ "Est. Hitoy Cerere, 100m, R. Cerere, Res. Biol. Hitoy Cerere, Prov. Limon, Costa Rica, Nov 1992 G. Carballo L- N / Costa Rica INBIOCR1000926686"; 1♀ "Est. Hitoy Cerere, 100m, R. Cerere, Res. Biol. Hitoy Cerere, Prov. Limon, Costa Rica, Nov 1992 G. Carballo L- N / Costa Rica INBIOCR1000926680"; 1♂ "Cuatro esquinas, P.N. Tortuguero, Prov. Limon COSTA RICA. om. 26 Aug- 6 Set 1989. J. Solano 280000, 590500 / Costa Rica INBIOCR1000020620"; 1♂ "Albergue Heliconias, Bijagua (Costa Rica). 750m 30-1-2006. Luz casa (18:45-22:00). Leg.: Micó, García, Galante. / CEUA00003306"; 1♂ "Volcán Tenorio. Alajuela. Costa Rica. 1160m. 7/4/2008. Leg. J.A. Azofeifa / CEUA00003320"; 1♂ "Estación Cabro Muco, Repr. ICE - Z.P. Miravalles, Guanacaste. Costa Rica. 1000m 12/06/2010. L. Filippini, Moraga. / CEUA00105076"; 1♀ "Estación Cabro Muco, Repr. ICE - Z.P. Miravalles, Guanacaste. Costa Rica. 1000m 12/06/2010. L. Filippini, Moraga. / CEUA00105077"; 1♀ "Dos de Tilarán (San Ramón), Prov. Guana. COSTA RICA. 1100m. MAY 1995. G. Rodriguez. L_N_262600_437500 #5891 / INBIOCR1002337626"; 1♀ "Dos de Tilarán (San Ramón), Prov. Guana. COSTA RICA. 1100m. MAY 1995. G. Rodriguez. L_N_262600_437500 #5891/ INBIOCR1002337602".

Description. Male. Body shape oval. Length 11.21 mm. Width 6.30 mm. Head, pronotum, scutellum, and pygidium dark brown; legs and underside from reddish brown to dark orange; elytra light brown with suture, humerus, and basal half of lateral margins dark brown. The dark stripe on suture broadens mid elytra, forming a small expansion. Surface all covered with fine, blonde setae.

Clypeus trapezoidal, densely punctate-reticulate; ratio width/length 1.88. Anterior angles rounded. Frons densely punctate, flat; vertex with apparent boundary. Ocular canthum long, thin, and rounded at apex. Interocular ratio (interocular width/width of eye): 3.20. Male antenna: ratio funiculus/club 0.76.

Pronotum trapezoidal, width 1.71 times length. Lateral margins forming an obtuse angle at 1/3 of pronotum length. Anterior angles right and sharp, posterior angles obtuse and sharp. Basal margin thin and complete, sinuate. Entire surface with deep punctures.

Scutellum subpentagonal to subtriangular in shape, with rounded sides and acute apex. Ratio width/length 1.38. Sparsely punctate.

Elytra with striae defined by dark punctures. Subsutural interstice with 2–3 rows of sparse punctures, 2nd–4th interstices with one irregular secondary striae. Surface covered with shallow setigerous punctures. Lateral margin convex, larger at base, disappearing on apex. Marginal membrane almost complete.

Pygidium finely granulate, with longer setae at hind margins. Triangular in shape. Slightly convex in lateral view. Ratio width/length 1.69.

Metasternal disc slightly sulcated, densely punctate. Space between the mesocoxae narrow, slightly convex; width 0.22 mm. Mesometasternal suture well defined, at base of mesocoxae.

Abdominal sternites completely covered with dense setae, arranged in about 7–10 irregular rows, with strigate surface. Male last sternite strigate-imbricate, with apical margin well defined and rounded.

Protibia with 2 teeth (Fig 8); apical tooth long and curved; second tooth at the same level of internal apex of protibia, triangular in shape, obtuse. Metatibia stout, slightly narrower subapically. Ratio length/width 2.95. First carina well developed. Surface with elongate punctures above second carina and rugose below. Protarsal claws: external claw strongly curved; ratio length/height: 1.37; internal claw bifurcate, with upper branch slightly shorter and half the width of the lower one. Inferior margin sinuate.

Aedeagus (Figs 17–19): parameres pointed and narrow. Endophallus (Fig. 30) wide, with 2 short sacculi. The wider, ventral one has a strip of thick spines, with defined margins that extend frontally from side to side in a horseshoe shape. The dorsal sacculus is covered with fine setation, slightly thicker than the microsetation that commonly covers the entire surface of endophallus. Median lobe sclerotized.

Female. Similar to male. Scutellum with blunt apex. Internal protarsal claw narrower than in male, inferior margin straight. Protibia (Fig. 8) with apical tooth wider and

longer than in male; second tooth above internal apex. Metatibia wider than in males. Last abdominal sternite with curved margin.

Variation: Dark pigmentation of elytra margin can extend to the tip of elytra; the expansions of sutural dark stripe mid length of elytra can be inconspicuous or form a complete band across the elytra (as in specimens from P.N. Tortuguero, Est. Cabro Muco, Heliconias). Body length 10.86–11.21 mm, body width 6.04–6.30 mm. Clypeus w/l: 1.88–2.04. Interocular ratio (interocular width/width of eye): 3.15–3.32. Pronotum w/l: 1.56–1.71. Scutellum w/l: 1.33–1.49. Pygidium w/l: 1.66–1.77. Width between mesocoxae: 0.19–0.22 mm. Metatibia w/l: 2.68–2.95. External claw l/h: 1.37–1.58.

Diagnosis: *Anomala flavacoma* can be differentiated from similar species using the combination of the following characters: medium size (10–12 mm) elytra light brown, with a dark central spot to a complete medium transversal band; metatibia with oblong punctures above second carina, abdominal sternites with dense setae, endophallus with two short and swollen sacculi.

Slightly smaller and more slender than *A. eucoma* and *A. pseudoeucoma*, it can be distinguished by the much lighter colour of elytra, pronotum, and underside; slender apex of parameres and endophallus that is shorter and wider. The specimens that develop a horizontal dark band on elytra may look similar to the lighter specimens of *A. eucoma*, but in *A. flavacoma* the band is much darker than in *A. eucoma*, and there is just one. Moreover, the puncture on the elytra is shallow and not coalescent in *A. flavacoma*, with clear differentiation between setigerous punctures and striae punctures, the latter being larger and dark coloured; whereas in *A. eucoma* both types of punctures are deep, and coalescent. *A. megaparamera* is much smaller and darker in colour, with a proportionally wider pygidium, wider parameres and proportionally longer and thinner endophallus.

Distribution: Caribbean lowlands of Costa Rica (Fig. 34).

Etymology: from Latin "flava", blonde, and "coma", hair, for its pale colour and setation.

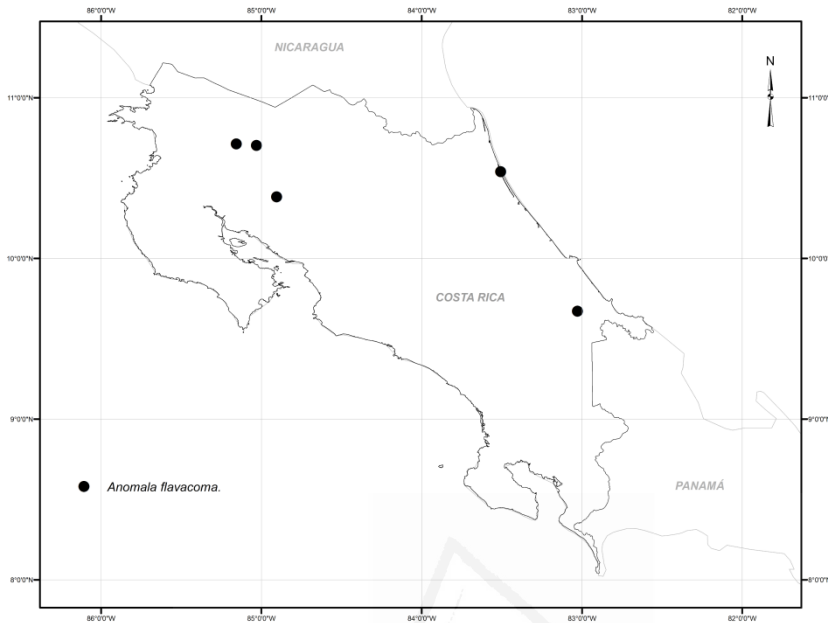


Figure 34: Distribution of *Anomala flavacoma*.

Anomala megaparamera Filippini, Micó, & Galante, new species

Fig. 4

Material examined: Holotype: ♂ "Est. Cuatro Esquinas, P. N. Tortuguero, 0 m, Prov. Limon, COSTA RICA, R. Delgado, Oct 1990, L- N 280000_590500 / COSTA RICA INBIOCR1000285104" (INBIO).

Paratypes (6): 1♂ "Est. Cuatro Esquinas, om, P. N. Tortuguero, Prov. Limon, COSTA RICA. E. Quesada., Jun 1990, L- N 280000_590500 / CEUA00105268"; 1♂ "Cerro Tortuguero, 0–120m P. N. Tortuguero, Prov. Limon, COSTA RICA, R. Delgado, Feb 1992, L- N 285000_588000 / COSTA RICA INBIOCR1000552532"; 1♂ "Est. Cuatro Esquinas, P. N. Tortuguero, om, Prov. Limon, COSTA RICA, E. Quesada, Jul 1990, L- N 280000_590500 / COSTA RICA INBIOCR1000670946"; 1♂ "Cuatro Esquinas, P. N. Tortuguero, Prov. Limon, COSTA RICA. om. 26 Aug – 6 Set 1989, J. Solano, L N 280000_590500 / COSTA RICA INBIOCR1000020633"; 1♀ "Cuatro Esquinas, P. N. Tortuguero, Prov. Limon, COSTA RICA. om, Set 1989. J. Solano, L N 280000_590500 / COSTA RICA INBIOCR1000086333"; 1♀ "Est. Cuatro Esquinas, P. N.

3.1 Redescription *A. eucoma*

Tortuguero, om, Prov. Limon, COSTA RICA, U. Chavarria, Jul 1990, L- N 280000_590500 / CEUA00105269".

Description. Male. Body shape oval. Length 9.03 mm. Width 5.10 mm. Head, pronotum, and scutellum dark reddish brown. Pygidium, legs, and underside reddish brown; elytra light brown with two dark reddish brown horizontal bands, one median and one covering the bottom third. Surface covered with fine, blonde setae.

Clypeus trapezoidal, densely and deeply punctate, with rather coarse punctures; ratio width/length 2.21. Anterior angles rounded. Frons deeply punctate, with a shallow central depression and apparent boundary with vertex. Ocular canthum long, thin, and rounded at apex. Interocular ratio (interocular width/width of eye): 2.93. Antenna: ratio funiculus/club 0.62.

Pronotum trapezoidal, width 1.67 times length. Lateral margins form an obtuse and protruding angle at $1/3$ of pronotum length, with width of pronotum at this level being slightly greater than at base. Anterior angles right and sharp, posterior angles obtuse and rounded. Basal margin thin and complete, sinuate. Whole surface with deep, large, and confluent punctures with sulcus not reaching hind margin. Surface with shallow wrinkles due to confluence of punctures.

Scutellum subpentagonal in shape, with rounded sides and blunt apex. Ratio width/length 1.30. Coarsely punctate.

Elytra with irregular striae. Subsutural interstice with 2 irregular rows of often confluent punctures, following interstices with irregular secondary striae; costae 2–6 not conspicuous. Setigerous punctures coincide with striae punctures, consequently the setae are not very dense. Lateral margin convex, larger at base, disappearing on apex. Marginal membrane almost complete.

Pygidium finely granulate, with longer setae at hind margins. Triangular in shape. Slightly convex in lateral view. Metasternal disc slightly sulcated, covered with sparse setae on the entire surface. Space between the mesocoxae narrow, slightly convex; width 0.21 mm. Mesometasternal suture well defined, at base of mesocoxae.

Abdominal sternites with 2–3 transverse rows of setae in the middle, and denser setae at sides. Punctures large and oval, sometimes fusing in diagonal streaks. Last sternite strigate-imbricate, with apical margin well defined and slightly sinuate.

Protibia with 2 teeth (Fig.9): apical tooth long and almost straight; second tooth at the same level to internal apex of protibia, triangular in shape, obtuse. Metatibia stout, narrower subapically. First carina well developed. Surface rugose.

Protarsal claws: external claw strongly curved; internal claw bifurcate, with upper branch slightly shorter and half as wide as the lower one. Inferior margin sinuate.

Aedeagus (Figs. 20–22) with very wide parameres, and proportionally shorter tectum.

Endophallus (Fig. 31) composed of a long ventral sacculus covered with sclerotized setae and a median posterior inflation; on the opposite side, 2 frontal inflations and 2 dorsal diverticles; gonopore situated dorsally between one inflation and diverticles (ejaculatory duct partially everted in illustration).

Female: similar to males, but the antennal club is shorter than in males. Pronotum usually wider than in males. Apical tooth of protibia (Fig.9) wider and longer than in males; second tooth above internal apex. Upper branch of the internal protarsal claw half the width of the lower one, inferior margin straight. Metatibia stouter than in males. Last abdominal sternite with curved margin.

Variation: Second tooth of protibia at the same level or slightly superior in relation to the internal apex of protibia. Body length 9.02–10.14 mm, body width 5.10–6.18 mm. Clypeus w/l: 1.92–2.21. Interocular ratio (interocular width/width of eye): 2.93–3.52. Antenna: ratio funiculus/club 0.62–0.73. Pronotum w/l: 1.63–1.68. Scutellum w/l: 1.30–1.59. Pygidium w/l: 2.10–2.20. Width between mesocoxae: 0.21–0.25 mm. Metatibia w/l: 2.96–3.07. External claw l/h: 1.43.

Diagnosis: *Anomala megaparamera* is separated from similar species by the combination of the following characters: small size (8–10 mm); presence of depression in frons and irregular wrinkles on pronotum; pronotum wider at 1/3 of

3.1 Redescription *A. eucoma*

length than at base; metatibia surface rugose; parameres nearly as wide as tectum length, and similarly long; endophallus with additional inflations and diverticles.

Similar to the Osa and Guanacaste populations of *A. eucoma*, much smaller than the other species described here, it can be distinguished by the larger and coarser punctation on head, elytra, and sternites; the presence of depressions in frons and pronotum; much wider and longer parameres, and more complex and setose endophallus.

Distribution: Costa Rica, Parque Nacional Tortuguero (Fig. 35).

Etymology: from Greek mega "big" and paramere, referring to the large proportions of parameres in relation to size of aedeagus.

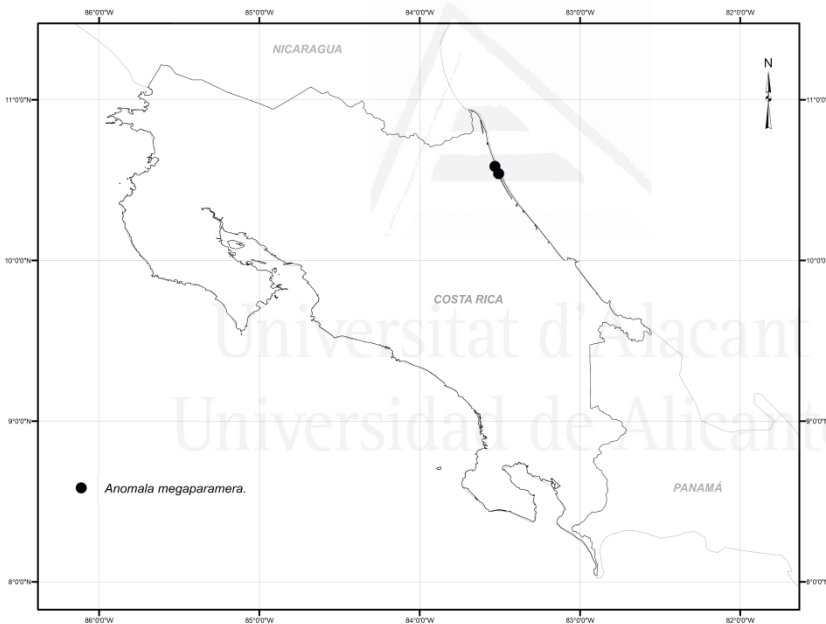


Figure 35: Distribution of *Anomala megaparamera*.

Anomala pseudoeucoma Filippini, Micó, & Galante, new species

Fig. 5

Material examined: Holotype: ♂ "Est. Hitoy Cerere, 100m, R. Cerere, Res. Biol. Hitoy Cerere, Prov. Limón, COSTA RICA, R. Guzman. 12 – 28 Abr 1992. L_N_184600_643400 #1137 / COSTA RICA INBIOCR1000393407" (INBIO).

Paratypes (20): 1♂ "Alajuela, Costa Rica, San Ramon, Rio S. Lorencito, 800m 3 octubre 1986 Col: A. Solis Blanco. / COSTA RICA INBIOCR1002517836"; 1♀ "Alajuela, Costa Rica. Reserva de San Ramón. Río San Lorencito, 850m. 1 abril 1987 Angel Solís / COSTA RICA INBIOCR1002517838"; 1♀ "Alajuela, Costa Rica. Reserva de San Ramón. Río San Lorencito, 850m. 1 abril 1987 Angel Solís / COSTA RICA INBIOCR1002517839"; 1♀ "Alajuela, Costa Rica. Reserva de San Ramón. Río San Lorencito, 850m. 1 abril 1987 Angel Solís / COSTA RICA INBIOCR1002517840"; 2♂ "Albergue Heliconias, Prov. Alajuela, Costa Rica. 11/11/2007 Leg. D. Gutiérrez" CEUA00105078 and CEUA00105079; 1♀ "Albergue Heliconias, Prov. Alajuela, Costa Rica. 31/01/2008 Leg. D. Gutiérrez / CEUA00105081"; 1♂ "Albergue Heliconias, Prov. Alajuela, Costa Rica. 14/09/2007 Leg. D. Gutiérrez / CEUA00105082"; 1♂ "Cerro Tortuguero, 0–100m, P. N. Tortuguero, Prov. Limon, COSTA RICA, R. Delgado, 26 Ene–14 Feb 1992, L- N 285000_588000 / COSTA RICA INBIOCR1000334543"; 1♂ "Cerro Tortuguero, 0–120m, P. N. Tortuguero, Prov. Limon, COSTA RICA, R. Delgado, Set 1991, L- N 285000_588000 / COSTA RICA INBIOCR1000479636"; 1♂ "Cerro Tortuguero, P. N. Tortuguero, 0 – 100m, Prov. Limon, COSTA RICA. J. Solano, May 1990. L- N 285000_588000 / COSTA RICA INBIOCR1000242771"; 1♀ "Cerro Tortuguero, P. N. Tortuguero, Prov. Limon, COSTA RICA. 100 m. Nov 1989. J. Solano, L N 285000_588000 / COSTA RICA INBIOCR1000055767"; 1♂ "Cerro Tortuguero, P. N. Tortuguero, Prov. Limon, COSTA RICA. 100 m. Nov 1989. J. Solano, L N 285000_588000 / COSTA RICA INBIOCR1000141229"; 1♂ "Est. La Casona, 1520 m, Res. Biol. Monteverde, Prov. Punt. COSTA RICA, N. Obando, Oct 1991, L- N 253250_4497001 / COSTA RICA INBIOCR1000632624"; 1♂ "Est. La Casona, 1520 m, Res. Biol. Monteverde, Prov. Punt. COSTA RICA, N. Obando, Oct 1991, L- N 253250_449700 / COSTA RICA INBIOCR1000632689"; 1♂ "Fca. Cafrosa, Est. Las Mellizas, P. N. Amistad, Puntarenas Pr. COSTA RICA, 1300 m. 20 Aug – 4 Set 1989, M. Ramirez & G. Mora, L S 316100_596100 / COSTA RICA INBIOCR1000093803"; 1♀ "Isla Bonita, Prov. Alajuela, Costa Rica. 12/07/2007 Leg. M. Moraga / CEUA00105080"; 1♂ "Limon, Costa Rica Reserva Hitoy–Cerere Rio Cerere 100 msnm 24 marzo 1987 Angel Solis /

3.1 Redescription *A. eucoma*

COSTA RICA INBIOCRI002517319"; 1♂ "San Luis, Monteverde, Prov. Punta, COSTA RICA, 1040 m. nov 1993. Z. Fuentes L- N 250850_449250 #2443 / COSTA RICA INBIOCRI001937988"; 1♂ "R.B. Hitoy Cerere, Valle La Estrella, Prov. Limon, COSTA RICA. 100–200m. 9–14 May 1994, G. Carballo, L N 643400_184600 # 2856 / COSTA RICA INBIOCRI001799052".

Description. Male. Body shape oval. Length 12.16 mm. Width 6.57 mm. Head, pronotum, scutellum, and pygidium dark reddish brown; legs and underside reddish brown; elytra dark brown with a light horizontal band along the anterior margin. The entire surface is covered with fine, blonde setae.

Clypeus trapezoidal, with shallow and large reticulate punctures; ratio width/length 2.04. Anterior angles rounded. Frons densely punctate, flat, gradually curving towards vertex (no boundary clearly visible between the two parts). Ocular canthum long, thin, and rounded at apex. Interocular ratio (interocular width/width of eye): 3.03. Antenna: ratio funiculus/club 0.69.

Pronotum trapezoidal, width 1.58 times length. Lateral margins forming an obtuse angle at 1/3 of pronotum length. Anterior angles right and sharp, posterior angles obtuse and rounded. Basal margin thin and complete but partially obliterated in the middle, sinuate. Entire surface with deep punctures.

Scutellum subpentagonal to subtriangular in shape, with rounded sides, surface finely punctate. Ratio width/length 1.47.

Elytra with striae defined by shallow grooves, surface with punctures coalescent. On light bands, dark spots show the striae-defining punctures and sparse punctures in the interstices. Lateral margin convex, larger at base, disappearing on apex. Marginal membrane almost complete.

Pygidium finely granulate, with all setae equal on size. Triangular in shape. Slightly convex in lateral view. Ratio width/length 1.94.

Metasternal disc slightly sulcated, densely setose. Space between the mesocoxae narrow, slightly convex, width 0.17 mm. Mesometasternal suture well defined at base of mesocoxae.

Abdominal sternites with numerous (5–10) irregular transverse rows of setae, and elongate punctures that fuse at sides. Last sternite strigate, with apical margin well defined and slightly sinuate.

Protibia with 2 teeth (Fig.10), apical tooth long and slightly curved; second tooth at the same level internal apex of protibia, triangular in shape, obtuse. Metatibia stout, slightly narrower subapically. Ratio length/width 3.97. First carina poorly defined by isolated spines. Surface punctate above second carina and rugose below.

Protarsal claws: external claw strongly curved; ratio length/height: 1.82; internal claw bifurcate, with upper branch slightly shorter and more than half the width of the lower one. Inferior margin sinuate.

Aedeagus (Figs. 23–25): parameres with blunt apex, protruding from the strongly sinuate ventral margin. Endophallus (Fig. 32) composed by a long ventral sacculus with a ridge of thick spines on dorsal margin, and a swollen shorter dorsal sacculus with a wide patch of sclerotized setae on left side. Gonopore ventral, between the two sacculi.

Female: similar to male, but the antennal club is slightly shorter than in males. Apical tooth of protibia (Fig. 10) wider and longer than in males; second tooth above internal apex. Internal protarsal claw narrower than in males, inferior margin straight. Metatibia stouter than in males. Last abdominal sternite with curved margin.

Variation: Underside from reddish brown to dark brown; elytra dark brown to bluish black; in some specimens with homogeneous colour (without the basal lighter band), and rarely, with a barely distinguishable median band. In some specimens, particularly the darker ones, the denser and thicker setae give the pronotum a velvety blond appearance. Second tooth of protibia at the same level or slightly above internal apex of protibia. On endophallus, the patch of setae on dorsal sacculus extends further frontally in some specimens.

3.1 Redescription *A. eucoma*

Body length 11.34–12.63 mm, body width 6.57–7.20 mm. Clypeus w/l: 1.81–2.10. Interocular ratio (interocular width/width of eye): 2.94–3.45. Antenna: ratio funiculus/club 0.69–0.71. Pronotum w/l: 1.58–1.65. Scutellum w/l: 1.26–1.47. Pygidium w/l: 1.65–1.94. Width between mesocoxae: 0.16–0.24 mm. Metatibia w/l: 2.79–3.97. External claw l/h: 1.37–1.82.

Diagnosis: *Anomala pseudoeucoma* can be distinguished from the other species described here by its dark and uniform brown colour, median size, frons nearly continuous with apex, first carina of metatibia obliterated, surface of metatibia punctate above second carina, parameres with strongly sinuate inferior margin, and endophallus with two patches of sclerotized spines and setae that can be distinguished even in the inverted endophallus.

This species is very similar to *A. eucoma*, especially in the lighter specimens, *A. pseudoeucoma* can be distinguished by the following characters: shorter and less curved apical tooth in male protibia; large internal claw in males, with inferior border more strongly sinuate; narrower intermesocoxal space, and less convex than in *A. eucoma*. As in the case of *A. eucoma*, the brown and trapezoidal pronotum easily distinguishes this species from *A. amphicoma*. *Anomala flavacoma* is smaller and much lighter in colour, with marked sides of frons with vertex, metatibia with oblong punctures above second carina. *Anomala megaparamera* is much smaller in size, with larger parameres and endophallus with diverticles and setae less sclerotized and more diffuse.

Distribution: widely distributed, with localities recorded in Guanacaste and the Tilarán mountain ranges to the north, the Talamanca Mountain Range near the border with Panama to the south, and Caribbean lowlands. Altitudinal range varies from 0 m to above 1500 m (Fig. 36).

Etymology: from Greek "pseudo-", false, and "eucoma", for its similarity with *A. eucoma*.

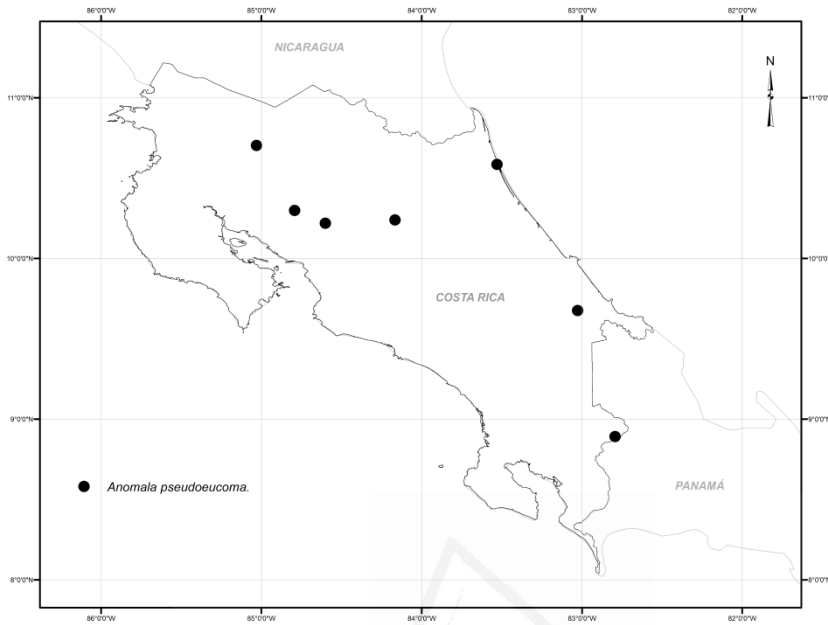


Figure 36: Distribution of *Anomala pseudoeucoma*

Key to dorsally setose *Anomala* species of the Neotropical Region

Only the species with setae on the elytral surface and two protibial teeth are included. Of the additional species included in the key, only *A. amphicoma* probably belongs to the same group of the species described here. *A. semitonsa*, *A. balzapambae*, and especially *A. hispidula* and *A. tindakua* are likely distant phylogenetically.

1. Rounded shape, with widest point mid length of elytra; two transversal bands on elytra: a median transversal wavy band, hind band usually not reaching the posterior margin of elytra 2
- Elongate shape, with widest point at last third of elytra; elytra with uniform colour, or with 1 or more, continuous, transversal bands, the hind band covering the apical third of elytra; when bands are defined by spots, they are arranged in 3 rows..... 3

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2. Median band on elytra continuous, hind band reaching sides, male genitalia illustrated in Fig. 37. Panama, Ecuador *A. semitonsa* Bates, 1888
- Median band on elytra composed of isolated spots, hind band usually not reaching sides, male genitalia illustrated in Fig. 38. Costa Rica, Ecuador *A. balzapambae* Ohaus, 1897
3. Pronotum metallic green, larger at $\frac{1}{3}$ of height than at base, elytra uniform dark brown, total length about 10 mm, male genitalia illustrated in Fig. 39. Panama *A. ampicoma* Bates, 1888
- Pronotum dark brown, largest at base, if a green luster is present then elytra have transversal light bands 4
4. Pronotum almost rectangular, head large, almost as long as pronotum and $\frac{2}{3}$ the width of the pronotum. Elytra light brown dappled with darker spots, concentrated in three transversal bands (post humeral, median, and posterior half of elytra), or expanding until covering almost all surface 5
- Pronotum trapezoidal, head small, about half wide as the pronotum. Elytra with uniform colour or maximum two transversal bands, never a posthumeral band 6
5. Elytra with setae on the entire surface, pronotum of uniform colour or with slightly lighter border in light coloured specimens, pattern on elytra not defined, aedeagus illustrated in Fig. 40. Mexico, Guatemala *A. hispidula* Bates, 1888
- Elytra with setae only on posterior third, border of pronotum always of lighter colour, pattern on elytra well defined, aedeagus in Morón & Nogueira (2002). Mexico *A. tindakua* Morón & Nogueira, 2002

6. Elytra uniformly light brown or with one transversal dark band. Size approximately 11 mm. Costa Rica *A. flavacoma* Filippini, Micó, & Galante
 -. Elytra uniformly dark brown or with two bands, apical third of elytra always dark7
7. Pronotum with irregular surface due to small depressions on sides of median sulcus. Parameres wide, maximum length $\frac{3}{4}$ of tectum length, with blunt and wide apex. Length less than 10.1 mm. Costa Rica *A. megaparamera* Filippini, Micó, & Galante
 -. Pronotum with uniform surface, sometimes a median sulcus is present. Parameres slender, with defined narrow apex; length of parameres not reaching $\frac{3}{4}$ of tectum length. Length 8.4–12.7 mm 8
8. Elytra uniformly dark or with a lighter posthumeral band (rarely a second light band on disc); male protibia upper tooth short (less than $\frac{1}{4}$ of total length) and almost straight; aedeagus with wide apex and strongly sinuate ventral margin. Costa Rica *A. pseudoeucoma* Filippini, Micó, & Galante
 -. Two darker transversal bands are visible on elytra; male protibia upper tooth long (more than $\frac{1}{4}$ of total length) and oblique, parameres with short rounded apex and slightly sinuate ventral margin. Guatemala, Costa Rica..... *A. eucoma* Bates, 1888

Discussion

The differences shown here between the Costa Rican populations and the Guatemalan specimens of *A. eucoma*, even if not strong enough to consider them as separate species, indicate a possible event of speciation in process, which may eventually lead to their separation into four species. In Costa Rica, the three populations of *A. eucoma* already appear isolated in their distribution, although they are often in sympatry with the other closely related species described here. Further

3.1 Redescription *A. eucoma*

studies on the morphology and distribution of the species, with modern sampling from Guatemala and other Central American countries, together with the use of the molecular tools, will be required to determine the status of *A. eucoma* populations in Costa Rica.

The species described here constitute a morphologically homogeneous group, with all their body surface covered by short, blonde setae; generally brown in colour, and elytral patterns made of a light brown ground colour with dark transversal bands. Variability ranges from the complete absence of bands (as in *A. flavacoma*) to forms with almost completely dark elytra (as in *A. pseudoeucoma*). The size and colour may be used as a first screening in the identification of the species concerned here, but due to high intraspecific variability, the male reproductive structures are the only structures able to provide discriminating characters. Other morphological traits, like the shape of clypeus and metatibia, are homogeneous between these species, or highly variable within a species, in which case these characters were not considered for diagnosis. The endophallus and the shape of parameres have no variation in structure within a species, and have clear differences even among species that are externally nearly identical, so they have proved to be good diagnostic characters for Neotropical species.

The endophalli of the species described here are proportionally longer than the ones recorded for oriental (Zorn 2007) and European *Anomala* species (Micó 2001). In addition, the vestigial median lobe, usually expressed as two lateral sclerotized strips, is more developed in these Neotropical species. However, to evaluate the importance of the high diversification of this structure at a taxonomic level, more studies on the endophallus of *Anomala* species should be undertaken, covering the entire distribution range of the genus.

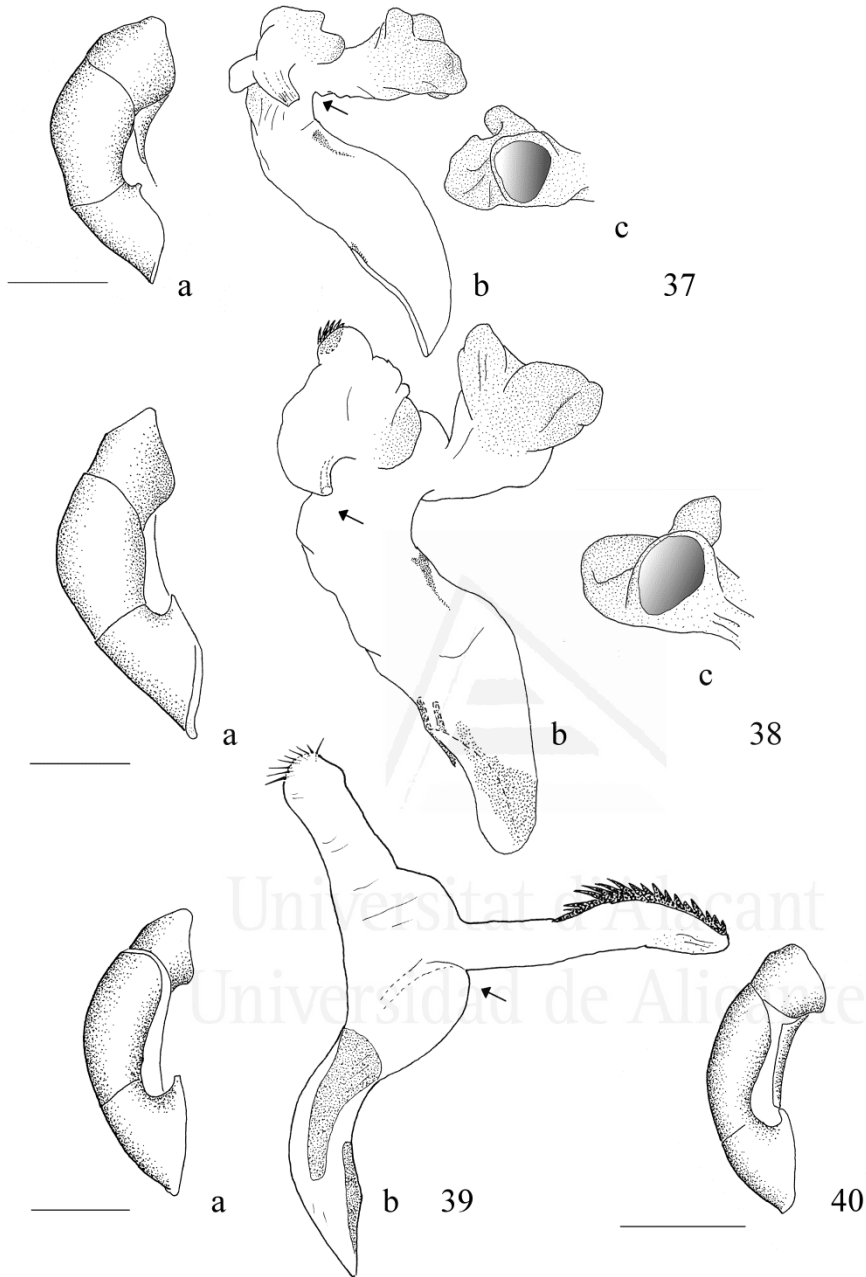


Figure 37-40: 37. **a.** Aedeagus and **b.** endophallus of *Anomala semitonsa* (syntype, Bugaba, Panama, MNHM); **c.** view from the other side of dorsal sacculus of endophallus, with a flat sclerotized plate in evidence. 38. **a.** Aedeagus and **b.** endophallus of *Anomala balzapambae* (holotype, Balzapamba, Ecuador, MNHUB); **c.** view from the other side of dorsal sacculus of endophallus, with a flat sclerotized plate evident. 39. **a.** Aedeagus and **b.** endophallus of *Anomala amphicoma* (Volcán de Chiriqui, Panama, MNHN). 40. Aedeagus of *Anomala hispidula* (syntype, San Geronimo, Guatemala, MNHM). Scale = 1mm.

Acknowledgements

We thank Ángel Solís, from the Instituto Nacional de Biodiversidad, Costa Rica; Humberto Lezama, from the Insect Museum at the University of Costa Rica; Malcolm D. Kerley, from the Natural History Museum, London; and Antoine Mantilleri and Olivier Montreuil, from the Muséum National d'Histoire Naturelle, Paris, for the loan of the specimens.

Financial support was provided by the Agencia Española de Cooperación Internacional para el Desarrollo (AECID) projects A/4426/05, A/6788/06, A/019887/08, A/023060/09, and a PhD grant to V. Filippini from the Spanish Ministry of Education.

The research stay at the Natural History Museum, London received support from the SYNTHESYS Project, which is financed by European Community Research Infrastructure Action under the FP7 "Capacities" Program.

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3.2 - *Anomala trapezifera* species-group: a burst of diversity (Coleoptera: Scarabaeidae: Rutelinae).

[El grupo *Anomala trapezifera*: una explosión de diversidad (Coleoptera: Scarabaeidae: Rutelinae)]

Abstract: The species *Anomala aereiventris* n. sp., *A. aspersa* n. sp., *A. atrivillosa* n. sp., *A. clarivillosa* n. sp., *A. contusa* n. sp., *A. eusticta* n. sp., *A. hiata* n. sp., *A. latifalculata* n. sp., *A. leopardina* n. sp., *A. levicollis* n. sp., *A. longisacculata* n. sp., *A. m-fuscum* n. sp., *A. perspicax* n. sp., *A. piccolina* n. sp., *A. globulata* n. sp., *A. stillaticia* n. sp., *A. subridens* n. sp., *A. subusta* n. sp., *A. tenoriensis* n. sp., *A. tuberculata* n. sp. and *A. vallisneria* n. sp. from Costa Rica are described. These and *A. polygona* Bates, 1888, *A. trapezifera* Bates, 1888 and *A. vulcanicola* Ohaus, 1897 are placed in a new species-group, named after *A. trapezifera*, whose diagnosis is provided. Their distribution patterns are discussed.

Key words: aedeagus, group diversification, species distribution, endophallus, new species.

Filippini V., Micó E., Galante E., *Annales de la Société entomologique de France*, en
revisión

Résumé. Les espèces *Anomala aereiventris* sp. nov., *A. aspersa* sp. nov., *A. atrivillosa* sp. nov., *A. clarivillosa* sp. nov., *A. contusa* sp. nov., *A. eusticta* sp. nov., *A. hiata* sp. nov., *A. latifalculata* sp. nov., *A. leopardina* sp. nov., *A. levicollis* sp. nov., *A. longisacculata* sp. nov., *A. m-fuscum* sp. nov., *A. perspicax* sp. nov., *A. piccolina* sp. nov., *A. globulata* sp. nov., *A. stillaticia* sp. nov., *A. subridens* sp. nov., *A. subusta* sp. nov., *A. tenoriensis* sp. nov., *A. tuberculata* sp. nov. et *A. vallisneria* sp. nov., sont décrits de Costa Rica. Toutes ces espèces, avec *A. polygona* Bates 1888, *A. trapezifera* Bates 1888 et *A. vulcanicola* Ohaus 1897, forment un nouveau groupe d'espèces qui reçoit sa dénomination d'après l'espèce *A. trapezifera*, dont le diagnostic est fourni. Les modèles de distribution des espèces sont discutés.

Introduction

Bates (1888) described both *Anomala polygona* and *Anomala trapezifera* based on one specimen each from Costa Rica; a male for the first species (but described as female by Bates), and a female for the second. Ohaus described both male and female specimens of *Anomala vulcanicola* in 1897, recognizing its similarity with *A. polygona*. Machatschke (1957) included them in the heterogeneous *A. "gemella" group*, for which he did not provide any diagnostic character. *Anomala "gemella" group* included species like *A. antica*, *A. ruatana* and *A. sejuncta*, with tan-colored elytra, and *A. popayana*, with a black transversal band on elytra. However, the species here described share common characters and similar coloration, including an elongated shape, tridentate protibias, irregular punctuation on elytra and a sclerotized structure near the ejaculatory duct opening of the endophallus.

These classical authors studied few specimens, thus species variability could not be easily assessed. Costa Rica is rich in *Anomala* species that share these characters, and 21 of them are described in this publication, thanks to the collecting effort and great amount of accumulated specimens of this genus in the INBio's collections. We

introduce the denomination of *Anomala trapezifera* species-group for these species, and we are confident that this represents a natural group.

Materials and methods

The material cited in this publication is deposited in the following collections:

CEUA Colección Entomológica de la Universidad Alicante, Spain

INBIO Instituto Nacional de Biodiversidad, Costa Rica

MNHN Muséum National d'Histoire Naturelle, Paris, France

MNHUB Museum für Naturkunde der Humboldt Universität zu Berlin, Germany

To prepare the endophallus for study, the following procedure was used. The aedeagus was washed in a 10% hot KOH solution for 5–10 minutes and then rinsed in distilled water. It was then kept in lactic acid for a minimum of 48 hours, until the structures of the aedeagus and endophallus became translucent. The endophallus was everted by injecting water from the base of aedeagus with a syringe equipped with a suitable needle, or microforceps (WPI Dumont #5) when the length of the internal sac made the syringe method inefficient. The dissection was transferred to a microvial containing glycerine, which was attached to the insect pin. From 2–9 specimens of each species were dissected.

Line drawings were done with the aid of a camera lucida attached to a stereo microscope (Leica M80). The pencil drawings were then traced with technical ink pens and edited in GIMP image manipulation program (version 2.8, www.gimp.org).

All measurements were taken from photographs of the specimens, using Leica Application software. A Leica DFC450 camera mounted on a Leica M205C stereo microscope was used to take the photographs.

The following definitions were used in the description. Body length: from tip of clypeus to pygidium. Body width: measured on widest point of elytra. Clypeus width:

3.2 *A. trapezifera* species group

measured at half height. Ratio interocular width/width of eye: widths measured at half the height of eyes. Pronotum width: measured at base. Metatibia ratio: length measured from below the articulation with femur to tip, on the median axis; width measured at widest point.

One new term for structures in the endophallus is introduced here: *ejaculatory sclerite*, for a peculiar structure found in association with the ejaculatory duct (Figures 98–120). It is usually an elongated and thick sclerite, embedded in the endophallus, and kept in place by membranes attached to both sides of the entire length of the sclerite. It may have a similar function as the *trigonum copulatrix* found in the endophallus of *Anisoplia* species (Pilleri 1948).

The collection where the specimens are deposited is listed following the label data, or is incorporated in the collection's code label.

This work is part of a general taxonomical work on *Anomala* in Costa Rica. To exclude cases of synonymy, the type specimens for 173 Neotropical species (about 80% of species cited) have been studied (listed in *Anexo 2*); for the remaining 20% of species, the characters and distribution given in the original descriptions and available literature exclude any correspondence with the species here described.

We follow the traditional inclusion of New World species in the genus *Anomala* (Jameson et al 2003) as taxonomic treatment, in contrast to the recent paper by Ramírez-Ponce & Morón (2009), who group them into a new genus *Paranomala*, as a more conservative classification, waiting for a more extensive study at global scale.

We use the term species group to define a group of species sharing morphological characters, not as a taxonomical category.

Results

Description of *Anomala trapezifera* species-group

Color. Head and pronotal disc brown to bronze or metallic green, ochre bands or maculae sometimes present on clypeus and frons. Pronotum completely dark, dark with ochre margins, or mainly ochre with differing dark patterns; patterns often forming two continuous arches or an "M" shape. Elytra ochre with dark maculae or numerous, small numerous "flecks". Pygidium ochre with sparse, brown "flecks" and 1-3 pairs of maculae usually located at the base and margins; base with or without dark band or median inverted triangle. Venter ochre to dark brown, commonly with dark bands or flecks on abdominal sternites. Legs ochre to brown; if ochre, then with oblong dark maculae, usually near apex, and basal and apical extremities of the femora and tibiae dark.

Head. Clypeus densely punctate-reticulate; shape rectangular or trapezoidal, disc convex or flat; anterior angles rounded; anterior margin straight or sinuate. Frons densely punctate to reticulate, surface slightly concave with triangular or parabolic concavity. Ocular canthus long and narrow, apex rounded.

Pronotum. Shape sub-trapezoidal with or without sinuate lateral margins. Anterior angles acute or quadrate, posterior angles obtuse. Basal margin sinuate, basal bead complete or obliterated in the middle. Surface sculpturing variable (punctures of differing density and size).

Scutellum. Shape sub-triangular.

Elytra. Elytral membrane thin and almost complete (Figure 1). Surface with regular or irregular rows of punctures, first interstice with irregular punctures.

Pygidium. Shape triangular, width greater than length, surface punctate and/or striated.

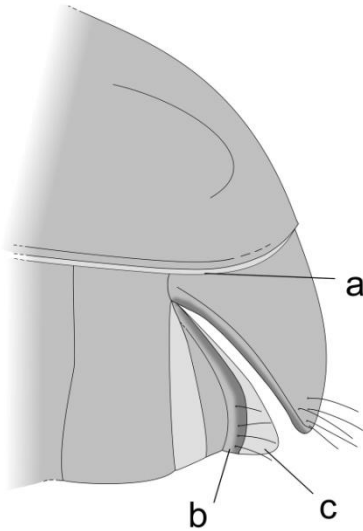


Figure 1: Lateral view of the apex of the abdomen of *Anomala tenoriensis*, holotype. a) elytral membrane, b) subapical bead, c) weakly sclerotized apical portion.

Metasternum. Disc slightly concave, surface with fine, setose punctures; setae long, dense, blonde. Mesocoxae nearly contiguous. Mesometasternal suture well defined, at level of base of mesocoxae.

Legs. Protibia tridentate. Male: apical tooth well developed, narrow, middle tooth triangular in shape, basal tooth triangular, small, and usually obtuse. Female: apical tooth long, with blunt and wide apex, middle tooth triangular in shape, blunt, basal tooth triangular, small, and usually obtuse.

Metatibia slender, fusiform, external carinae well defined; similar in both sexes except some species with male metafemur very narrow, females with metafemur and metatibia wider than males.

Abdominal sternites. Surface sparsely or densely punctate with short and medium blonde setae. Last sternite (male) with apical portion weakly sclerotized and subapex sinuate, beaded, with a row of setae (Figure 1). Last sternite (female) with curved apical margin.

Male genitalia. Aedeagus. Typically asymmetrical, twisted to one side. Tectum appearing stout; typically shorter or similar in size to the basal piece. Ventral plate (lateral view) with apex curved ventrally. Endophallus. Asymmetric and twisted if aedeagus is also asymmetric and twisted. Ejaculatory sclerite near opening of ejaculatory duct with supportive membranes. Median lobe. Two sclerotized lateral plates, normally asymmetric, apex with expansions or triangular folds (some species). Endophalli with different shapes, but with three main structures: one long sacculus, with a small basal expansion where the ejaculatory duct opening is located; two medium short sacculi with irregular shapes, the ejaculatory duct opening located between the sacculi, or on the shorter one, always basal; one very long sacculus with

homogeneous width and one shorter sacculus, with the opening of the ejaculatory duct located between them. Patches of setae, spines, and sclerotized plates are commonly present.

Diagnosis. The species of *Anomala trapezifera* species group are defined by a combination of the following characters: Pronotum dark brown to bronze or metallic green, often with an irregular shaped macula (Figures 26–49). Elytra with ochre background covered by maculae or small numerous flecks (Figures 2–25). Tridentate protibia (Figures 50–73). Aedeagus commonly twisted to one side (Figure 79). Tectum usually shorter than or similar in size to the basal piece (Figure 79). Ventral plate commonly with a curved apex in lateral view (Figure 82). Endophallus with a sclerotized structure near the ejaculatory duct opening (Figures 98–120).

Other species of Neotropical Anomalini that may look similar in color to the ones here described have not been included in this species group because they do not present other defining characters, especially the ones of the male genitalia. For example, species by Morón & Nogueira (2002), even if some have tridentate protibias, or *A. oreas* Ohaus 1897 (with bidentate protibia), have regular maculae on elytra, aedeagus with long tectum, not twisted. *A. oreas* also presents hairy parameres, asymmetrical for having different shapes, characters not shared with any of the specie here treated. Endophallus has been studied for *A. ayjikala* Morón & Nogueira 2002 and *A. picturella* Morón & Nogueira 2002, and do not have an ejaculatory sclerite. This structure has been additionally found only in *A. obovata* Ohaus 1933 and two undescribed species, out of the about 100 species of *Anomala* and *Callistethus* in Costa Rica, and no similar structure is described in the (scarse) literature on *Anomala* endophalli.

Key to *Anomala trapezifera* species-group

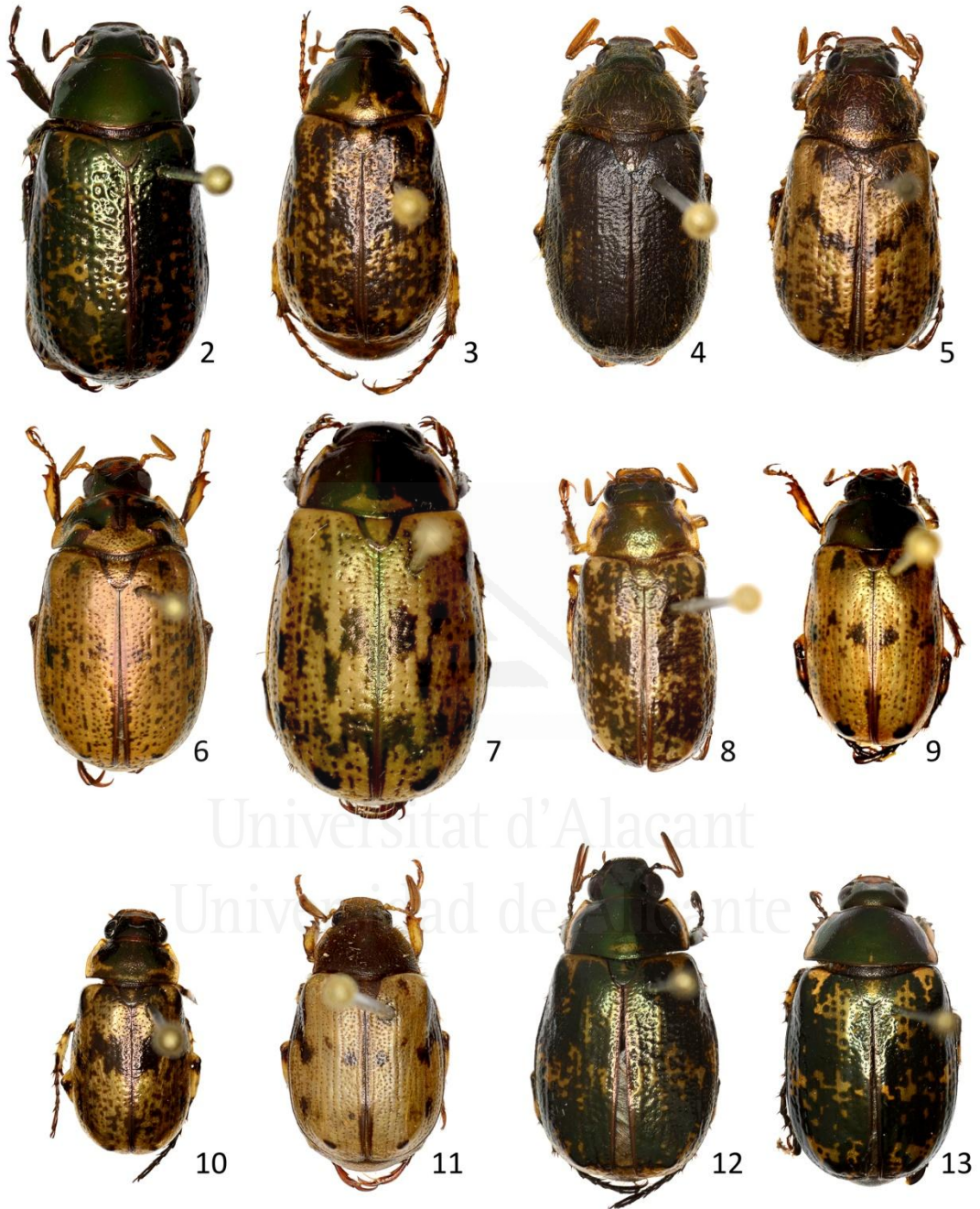
1. Pronotum with deep impressions*Anomala contusa* n. sp.
-. Pronotum with surface evenly convex.....2
2. Presence of setae on pronotum and elytra3
-. Pronotum and elytra glabrous, pronotum may have a row with a few setae5
3. Body length 10.0–11.5 mm, pronotum with dense punctation, elytra with two regular rows of maculae, aedeagus in Figure 83 *Anomala leopardina* n. sp.
-. Body length 12.0–14.0 mm, pronotum with sparse and coarse punctation, elytra irregularly covered with maculae and flecks.....4
4. Light color, pronotum with evident sinuate lateral margins (Figure 29), aedeagus as in Figure 77*Anomala clarivillosa* n. sp.
-. Dark color, pronotum with slightly sinuate lateral margins (Figure 28), aedeagus as in Figure 76.....*Anomala atrivillosa* n. sp.
5. Lateral margins of pronotum sinuate.....6
-.Lateral margins of pronotum regularly convex or angulated.....13
6. Side of pronotum deeply sinuate (it crosses an imaginary line from the apical to basal angles), pronotum almost completely dark in color, aedeagus as in Figure 89 ...
.....*Anomala polygona* Bates, 1888
-. Lateral margins of pronotum weakly sinuate (they do not cross an imaginary line from the apical to basal angles), pronotum with an irregular macula on disc or ochre margins7

7. Pronotum dark with ochre margins, elytra with regular maculae, aedeagus as in Figure 81..... *Anomala hiata* n. sp.
 -. Pronotum with an irregular macula on its disc, elytra with several small flecks8
8. Pronotum with a narrow sinuate spot, elytra with few flecks, length less than 11.5 mm, parameres long with an acute apex and protruding ventral angle in lateral view (Figure 86)*Anomala m-fuscum* n. sp.
 -. Pronotum with larger maculae, elytra with abundant flecks, size 10.2–13.4 mm, different aedeagus9
9. Ventral plate with elongated apical corners, short parameres, less than half of the length of the tectum, with an acute apex pointing downwards in lateral view (Figure 97)..... *Anomala vulcanicola* Ohaus, 1897
 -. Ventral plate with a rounded apex, parameres longer than half of the length of the tectum.....10
10. Ventral plate with its apical side curved in lateral view.....11
 -. Ventral plate with a plain apex12
11. Parameres short with a blunt apex in lateral view (Figure 75).....
*Anomala aspersa* n. sp.
 -. Parameres long with an acute apex in lateral view (Figure 94).....
*Anomala trapezifera* Bates, 1888
12. Parameres long and narrow, dorsal margin curved, ventral angle obtuse (Figure 91)*Anomala subridens* n. sp.
 -. Parameres short and wide, dorsal margin sinuate, ventral angle pointing backwards in lateral view (Figure 96)*Anomala vallisneria* n. sp.

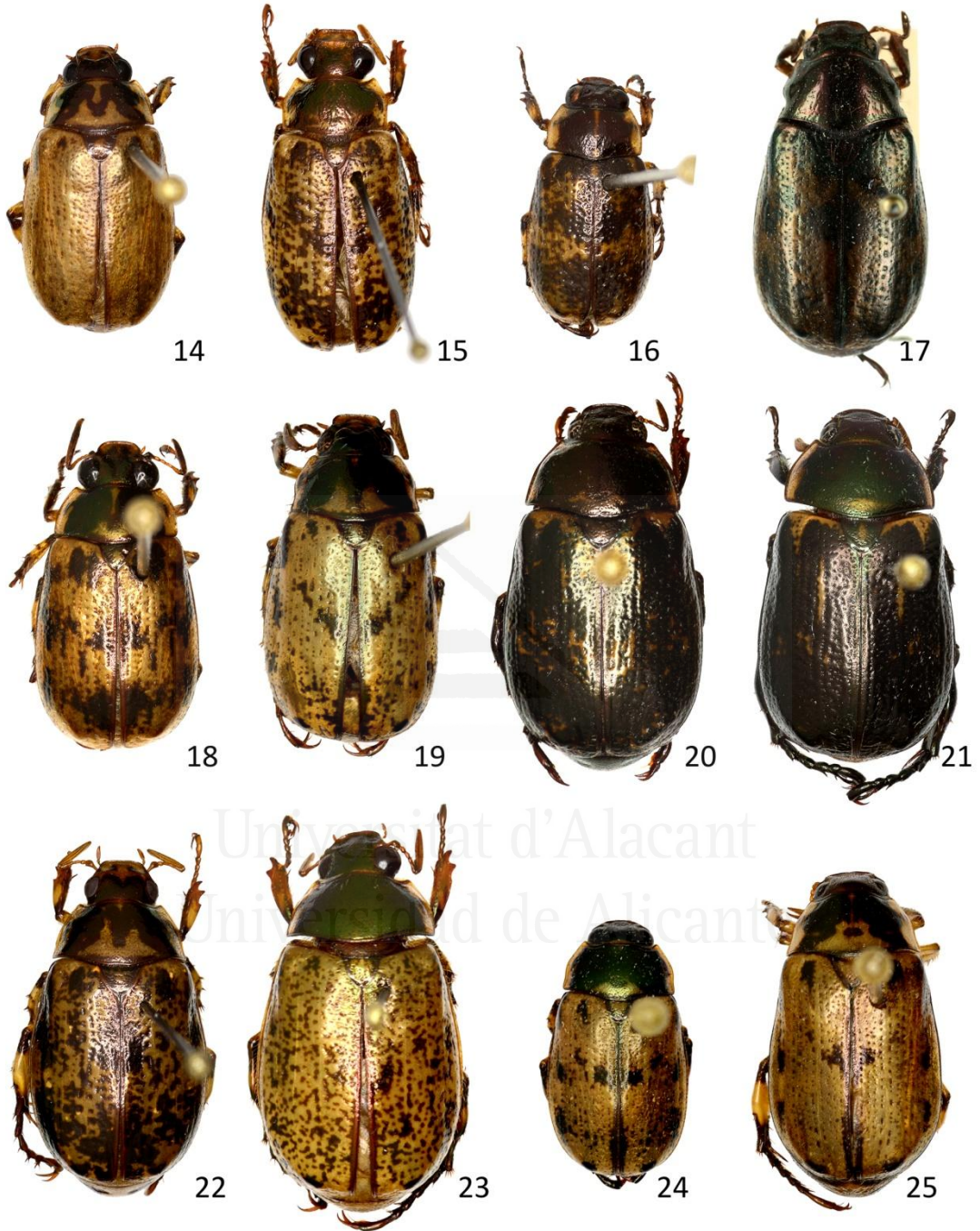
3.2 *A. trapezifera* species group

13. Elytra light colored with sparse flecks, length > 14.1 mm14
-. Elytra light colored and length < 13.5 mm, or dark elytra and length > 14.1 mm16
14. Presence of protuberance on clypeus, aedeagus as in Figure 95
.....*Anomala tuberculata* n. sp.
-. Clypeus with uniform surface15
15. Pronotum with an irregular macula on its disc, large maculae on elytra, aedeagus
as in Figure 79*Anomala eusticta* n. sp.
-. Pronotum completely dark, elytra with small flecks, aedeagus as in Figure 74
.....*Anomala aereiventris* n. sp.
16. Pronotum surface smooth.....17
-. Pronotum surface with evident punctures18
17. Pronotum completely dark, venter homogeneously bronze brown, metallic, basal
tooth of protibia weakly developed, length >13.2 mm, aedeagus as in Figure
74..... *Anomala aereiventris* n. sp.
-. Pronotum with ochre sides, venter brown with yellowish parts, basal tooth of
protibia well developed, length <13.0, aedeagus as in Figure
84.....*Anomala levicollis* n. sp.
18. Male with large eyes (interocular ratio < 1.8), medium size 19
-. Male with small eyes (interocular ratio >2.2), medium and large size20
19. Pronotum with coarse punctures, basal half of lateral margins parallel, elytra with
small irregularly placed flecks, aedeagus as in Figure 87 *Anomala perspicax* n. sp.

- Pronotum with fine punctures, basal half of lateral margins oblique to the base, elytra with large maculae organized in three rows, aedeagus as in Figure 90 *Anomala stillaticia* n. sp.
20. Length > 13.0 mm, width >7 mm, elytra nearly completely dark..... 21
- Length < 12.6 mm, width < 6.8 mm, elytra usually with abundant light flecks..... 22
21. Green pronotum, elongated ochre maculae on elytra, light colored pygidium, aedeagus as in Figure 93 *Anomala tenoriensis* n. sp.
- Brown pronotum, diffuse ochre flecks on elytra, pygidium with large dark maculae, aedeagus as in Figure 92..... *Anomala subusta* n. sp.
22. Basal half of lateral margins of pronotum parallel, length ≤10.0 mm, width < 5.2 mm 23
- Basal half of lateral margins of pronotum oblique to the base, length generally > 11.0 mm, width > 5.9 mm 24
23. Presence of concavity on frons, dark venter, micro-punctuation on elytra surface, male internal protarsal claw wide (upper branch 1/4 the width of the lower one), aedeagus as in Figure 82 *Anomala latifalculata* n. sp.
- Frons with homogeneous surface, light venter, punctuation on elytra surface simple, male internal protarsal claw narrow (upper branch 2/3 the width of the lower one), aedeagus as in Figure 88 *Anomala piccolina* n. sp.
24. Clypeus with a straight apical side, pronotum green with ochre sides, surface homogeneous, aedeagus as in Figure 85 *Anomala longisacculata* n. sp.
- Clypeus with a sinuate apical side, pronotum with an irregular brown macula on disc, surface with wrinkles, aedeagus as in Figure 80..... *Anomala globulata* n. sp.



Figures 2–13. Habitus. 2: *Anomala aereiventris* (Holotype). 3: *A. aspersa* (Holotype). 4: *A. atrivillosa* (Holotype). 5: *A. clarivillosa* (Holotype). 6: *A. contusa* (Holotype). 7: *A. eusticta* (Holotype). 8: *A. globulata* (Holotype). 9: *A. hiata* (Holotype). 10: *A. latifalculata* (Holotype). 11: *A. leopardina* (Holotype). 12: *A. levicollis* (Holotype). 13: *A. longisacculata* (Holotype). Scale = 5 mm.



Figures 14–25. Habitus. 14: *A. m-fuscum* (Holotype). 15: *A. perspicax* (Holotype). 16: *A. piccolina* (Holotype). 17: *A. polygona* (Escazu, Costa Rica). 18: *A. stillaticia* (Holotype). 19: *A. subridens* (Holotype). 20: *A. subusta* (Holotype). 21: *A. tenoriensis* (Holotype). 22: *A. trapezifera* (Parque Nacional Tapantí, Costa Rica). 23: *A. tuberculata* (Holotype). 24: *A. vallisneria* (Paratype, Sector Las Pailas, Costa Rica). 25: *A. vulcanicola* (San Gerardo de Dota, Costa Rica). Scale = 5 mm.

Description of species

Anomala aereiventris Filippini, Micó, Galante, new species

Figure 2, 26, 50, 74, 98, 121.

Material examined. Holotype: ♂ "COSTA RICA. Prov. Cartago. P.N. Tapanti. 1250–1400m. 3–5 JUN 2007. Barries, Cate. Tp. Luz. L_N_190766_560354 #91943/ INB0004098939".

Paratypes (7): 1♂ "Quebrada Segunda, P. N. Tapanti, 1250m, Prov. Cartago, Costa Rica, Oct 1992, G. Mora, L- N 194000_560000/ INBIOCR1000910796"; 1♀ "P.N. Tapanti, Prov. Carta, COSTA RICA. 1480m, Nov 1992, G. Mora, L-N 187500_560200 #1554/ INBIOCR1001716957"; 1♂ "La Esperanza 2300m. Prov. Cartago Costa Rica 29/08/2008 Leg. A. García, M.Zumbado/ CEUA00105842"; 1♂ "La Esperanza 2300m. Prov. Cartago Costa Rica 30/08/2008 Leg. A. García, M.Zumbado/ CEUA00105843"; 1♂ "Est. Zurqui, 1600m, P. N. Braulio Carrillo, 500 m antes del Tunel, Prov. S. Jose, COSTA RICA, G. Maass, May 1991, L- N 226800_535200/ INBIOCR1000478018"; 1♀ "R. Dos Amigos, 1450 m, P. N. Tapanti, Prov. Cartago, Costa Rica, 28 set 1992, A. Solis L-N 187600,560250/ INBIOCR1000849194"; 1♂ "San Jose Costa Rica P.N. Braulio Carrillo. Est. Zurqui Tunel 1500m 15 octubre 1985 A.M. Chacon & M.M. Chavarria/ INBIOCR1002517713".

Description. Holotype. Male: Body shape slender, elongated. Length 13.88 mm. Width 7.41 mm. (Figure 2).

Color. Clypeus, head and pronotum metallic green (Figure 26). Scutellum dark brown. Elytra metallic greenish black with sparse ochre flecks; pygidium bronze brown; venter and legs bronze brown, with last sternite apical and basal membrane ochre.

Head. Clypeus trapezoidal, with straight anterior margin; ratio width/length 2.24. Frons with a triangular concavity. Ratio interocular width/width of eye 2.62. Length of antennal club: 1.79 mm.

Pronotum. Width 1.68 times length. Lateral margins angulated at 1/3 of pronotum length. Basal bead obliterated in the middle. Surface smooth, with sparse fine punctures (Figure 26).

Scutellum with sparse fine punctures.

Elytra with sparse punctures arranged in irregular rows. First interstice with one irregular row of punctures.

Pygidium rugose, with long setae on margins.

Legs. Protibia (Figure 50) with long apical tooth; middle tooth at same level as the internal apex; basal tooth at $2/5$ of internal length. Protarsal claws: internal claw bifurcate, with its upper branch the same length as and half the width of the lower one. Inferior margin sinuate. Metafemur ratio length/width 3.43. Metatibia punctate, slightly rugose below second external carina. Width 0.94 mm.

Abdominal sternites with oblong punctures, dense on sides and sparse on the median part; one row of sparse setae per sternite. Last sternite punctate, subapical bead sinuate and complete, apical portion medially wider than basal part of sternite.

Male genitalia. Aedeagus (Figure 74) slightly twisted to the left. Parameres long, with blunt protruding apex in lateral view. Ventral plate with curved apex in lateral view. Endophallus in Figure 98. Two sacculi, a wider dorsal one with microsetation on its apical portion and an inflation covered with setae on dorsal side; a ventral one, thin and slightly longer, with the ejaculatory duct opening at the base on the dorsal side. Three sclerotized circular plates at the base of the endophallus.

Female: antennal club slightly shorter compared to males; first tooth of protibia longer and wider, middle tooth above internal apex (Figure 50); internal protarsal claw thinner than in males, inferior margin curved.

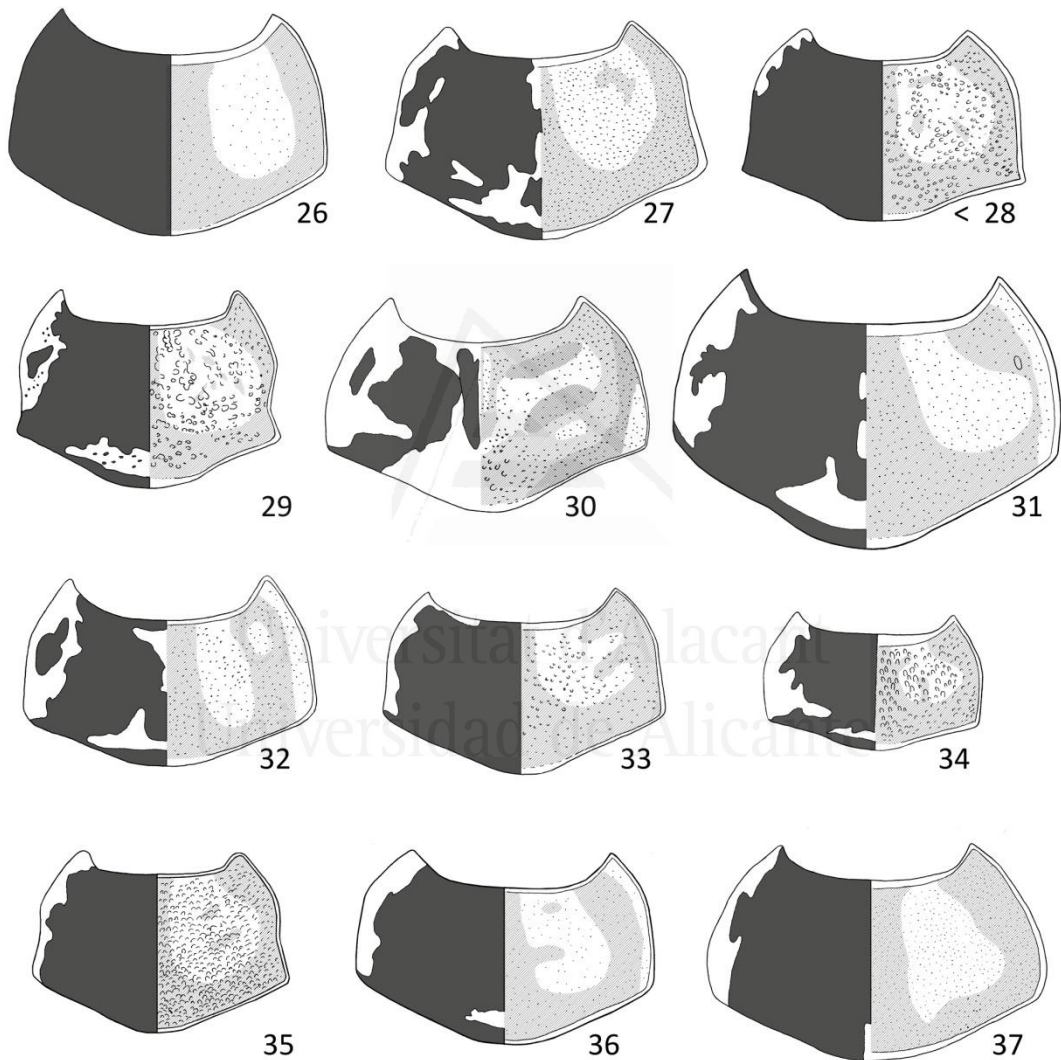
Variation: clypeus, head, pronotum, scutellum from metallic green to coppery green; elytra from ochre with dark flecks to nearly completely dark; pygidium from ochre with dark sides and median band, to completely purplish black; venter and legs reddish to blackish brown, density of setation variable; basal circular plates on the endophallus absent in other specimens.

Body length 13.27–14.75 mm, body width 7.34–8.36 mm. Clypeus w/l: 2.21–2.57. Interocular ratio (interocular width/width of eye): 2.17–2.89. Male antennal club:

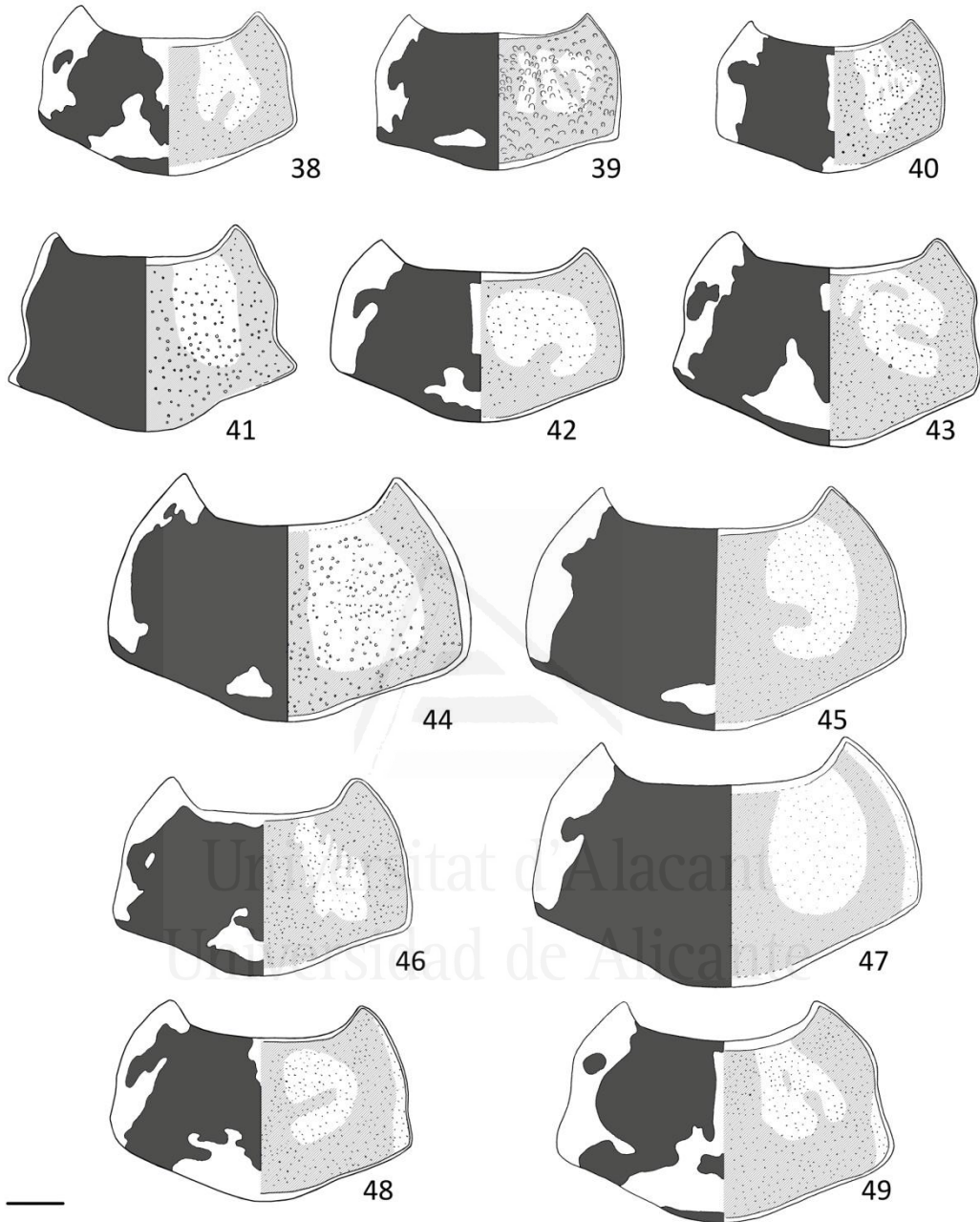
3.2 *A. trapezifera* species group

1.55–1.86 mm; female antennal club: 1.48 mm.

Diagnosis: large size, dark color with metallic luster, trapezoidal pronotum completely dark, surface with fine punctures, basal tooth of protibia in males barely developed, parameres with squared apex in lateral view, endophallus with two long sacculi.



Figures 26–37. Pronotum, with detail of pigmentation (left) and surface punctation (right). 26: *Anomala aereiventris* (Holotype). 27: *A. aspersa* (Holotype). 28: *A. atrivillosa* (Holotype). 29: *A. clarivillosa* (Holotype). 30: *A. contusa* (Holotype). 31: *A. eusticta* (Holotype). 32: *A. globulata* (Holotype). 33: *A. hiata* (Holotype). 34: *A. latifalculata* (Holotype). 35: *A. leopardina* (Holotype). 36: *A. levicollis* (Holotype). 37: *A. longisacculata* (Holotype). Scale = 1mm.



Figures 38–49. Pronotum, with detail of pigmentation (left) and surface punctation (right). 38: *Anomala m-fuscum* (Holotype). 39: *A. perspicax* (Holotype). 40: *A. piccolina* (Holotype). 41: *A. polygona* (Holotype). 42: *A. stillaticia* (Holotype). 43: *A. subridens* (Holotype). 44: *A. subusta* (Holotype). 45: *A. tenoriensis* (Holotype). 46: *A. trapezifera* (Reserva Tapantí, Costa Rica). 47: *A. tuberculata* (Holotype). 48: *A. vallisneria* (Holotype). 49: *A. vulcanicola* (San Gerardo de Dota, Costa Rica). Scale = 1mm.

3.2 *A. trapezifera* species group

Similar to *A. eusticta*, it is differentiated by its smaller size, dark pronotum, small flecks on elytra, and the shape of the male genitalia. Similar to *A. tuberculata*, it is differentiated by its flat clypeus, dark and smoother pronotum, and the shape of the male genitalia.

Distribution: a few localities in the Central and Northern Talamanca mountain ranges, from 1250 to 2300 m (Figure 121).

Etymology: from the Latin adjective "*aereus, a, um*", bronzed, and the adjective derived from the noun "*venter, tris*", venter, for the color of its abdominal sternites.

Anomala aspersa Filippini, Micó, Galante, new species

Figure 3, 27, 51, 75, 99, 122.

Material examined. Holotype: ♂ "COSTA RICA. Prov. Cartago. Paraíso. R.F. Río Macho. Villa Mills. 3000m. 22 DEC 1995. A. Solis. L_S_390000_495000 #93637/ INBIOCRI001147712". Paratypes (7): 1♀ "Est. Cuerici, 4.6 Km al E. de Villa Mills, Prov. San Jose, COSTA RICA. 2600m. 24-28 NOV 1995. A. Picado, L_S_389400_499600 #6429/ INBIOCRI002362410"; 1♀ "Est. Cuerici, Send. El Carbon, 5 Km al E. de Villa Mills, Prov. San Jose, COSTA RICA. 2600m. 28 NOV 1995. A. Picado, L_S_389550_500050 #6426/ INBIOCRI002365349"; 2♂♂ 1♀ "Est. Cuerici, 4.6 Km al E. de Villa Mills, Prov. San Jose, COSTA RICA. 2600m. 22-25 NOV 1995. A. M. Maroto, de Luz L_S_389400_499600 #6458" INBIOCRI002367655, CEUA00106067 and CEUA00106068; 1♂ "Est. Cuerici, 4.6 Km al E. de Villa Mills, Sendero al Mirador, Prov. San Jose, COSTA RICA. 2640m. 21-24 OCT 1995. A. Picado, de Luz L_S_389700_499600 #6314/ INBIOCRI002389254"; 1♀ "COSTA RICA, Prov. Cartago, Reserva Río Macho. Est. Ojo de Agua. 2960m. 24-26 FEB 1998. E. Alfaro. Tp. Luz L_S_396300_483500 #49903/ INBIOCRI002603491".

Description. Holotype. Male: Body shape slender, elongated. Length 12.70 mm. Width 7.14 mm. (Figure 3)

Color. Head and clypeus bronze brown; pronotal disc with a bronze brown irregular macula and ochre sides (pattern shown in Figure 27). Scutellum ochre with brown margins. Elytra ochre with dense irregular brown maculae and flecks on the entire

surface; pygidium ochre with a brown basal margin and a pair of lateral small maculae near its apex; abdominal sternites dark brown, sternum light brown with abundant long setae, legs ochre with tarsi, extremities and maculae on femura and coxae reddish brown.

Head. Clypeus trapezoidal, with straight or sinuate anterior margin; ratio width/length 3.37. Frons with a shallow parabolic concavity. Ratio interocular width/width of eye 3.63. Length of antennal club: 1.50 mm. Pronotum. Width 1.80 times length. Lateral margins sinuate. Basal bead complete. Surface with dense fine punctures connected by shallow wrinkles (Figure 27).

Scutellum with dense punctures.

Elytra with sparse punctures arranged in irregular rows. First interstice with irregular dense punctures. Micro-punctation on the entire surface.

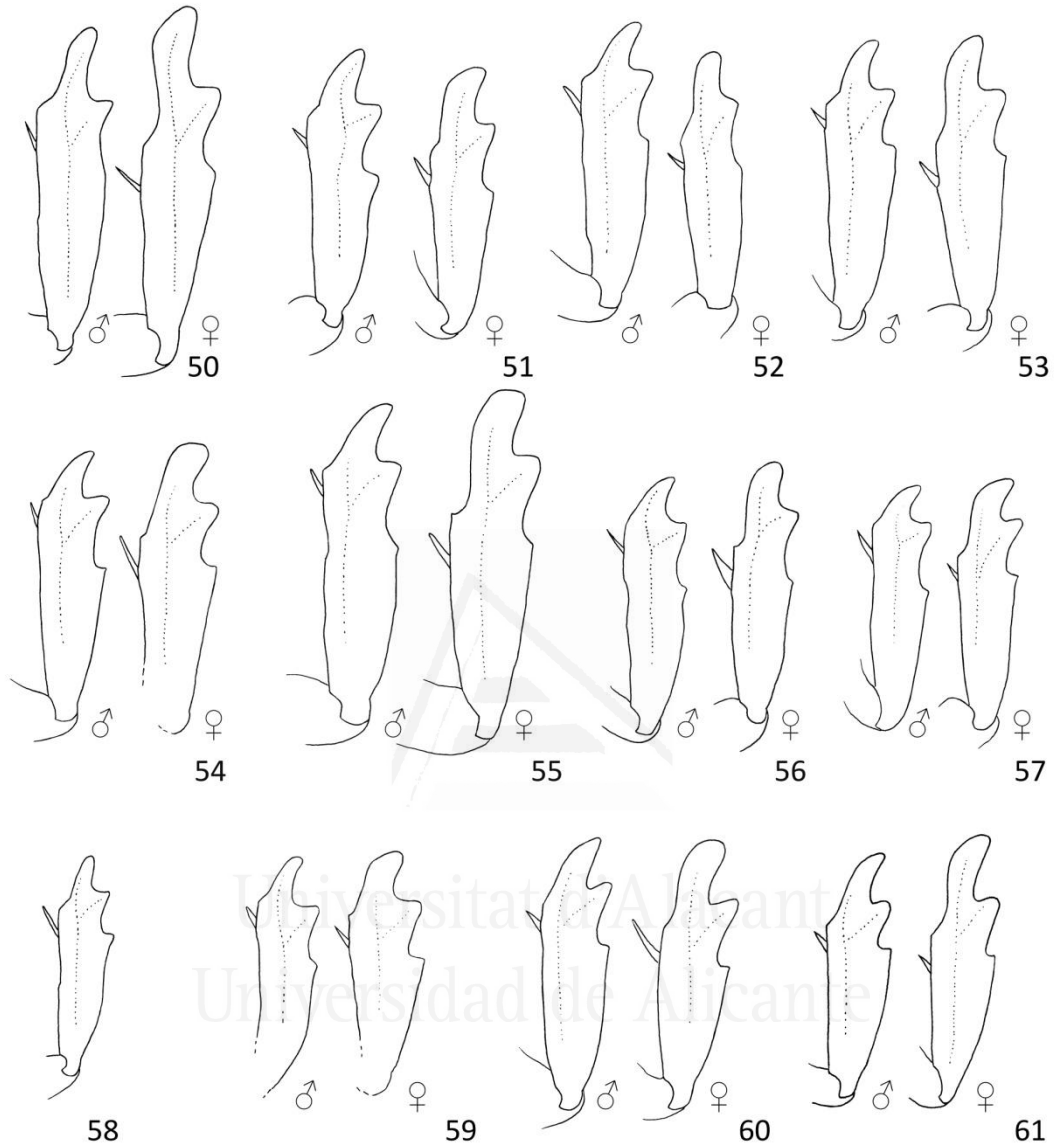
Pygidium with dense coarse punctures and long setae on margins; surface rugose.

Legs. Protibia (Figure 51): long apical tooth; middle tooth slightly above the internal apex; basal tooth at $1/2$ of internal length. Protarsal claws: internal claw bifurcate, with upper branch the same length as and $2/3$ the width of the lower one, inferior margin slightly curved. Metafemur ratio length/width 3.77. Metatibia rugose, first external carina well defined, width 0.82 mm.

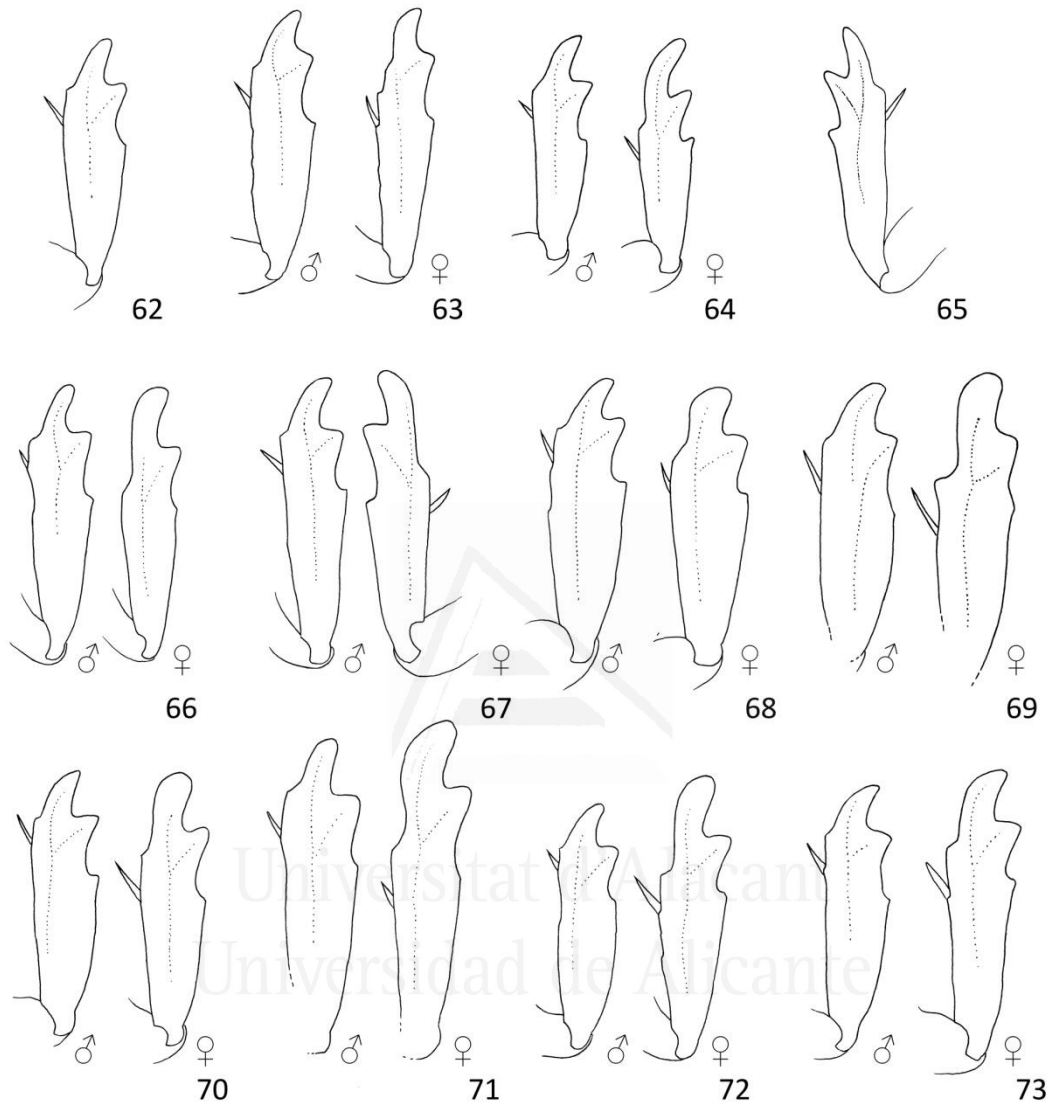
Abdominal sternites with dense oblong coalescent punctures in 1–4 irregular rows, secondary small punctures giving an irregular surface; one row of sparse setae per sternite. Last sternite punctate, subapical bead slightly sinuate and complete, apical portion narrow.

Male genitalia. Aedeagus (Figure 75) slightly twisted to the left. Parameres wide, with a blunt apex and slightly sinuate ventral margin in lateral view. Ventral plate with a curved apex in lateral view. Endophallus in Figure 99. One swollen long sacculus, covered in microsetation and a ventral patch of long setae. Ejaculatory duct opening ventral, with inflations at sides.

3.2 *A. trapezifera* species group



Figures 50–61. Shape of protibia in 50: *A. aereiventris* (male: paratype, la Esperanza, Costa Rica; female: paratype, Parque Nacional Tapantí, Costa Rica). 51: *A. aspersa* (male: holotype; female: paratype, Estación Cuerici, Costa Rica). 52: *Anomala atrivillosa* (male: paratype, Estación Barva, Costa Rica; female: paratype, Estación Barva, Costa Rica). 53: *A. clarivillosa* (male: paratype, La Esperanza, Costa Rica; female: paratype, La Esperanza, Costa Rica). 54: *A. contusa* (male: holotype; female: paratype, Volcán Tenorio, Costa Rica). 55: *A. eusticta* (male: holotype; female: paratype, Derrumbe Estación Cacao, Costa Rica). 56: *A. globulata* (male: paratype, Refugio Forestal Río Macho, Costa Rica; female: paratype, La Esperanza, Costa Rica). 57: *A. hiata* (male: holotype; female: paratype, Estación Pittier, Costa Rica). 58: *A. latifalculata* (male: holotype). 59: *A. leopardina* (male: holotype; female: paratype, Finca Cafrosa, Costa Rica). 60: *A. levicollis* (male: paratype, Parque Nacional Volcán Tenorio, Costa Rica; female: paratype, Quebrada Segunda, Costa Rica). 61: *A. longisacculata* (male: holotype; female: paratype, El Copal, Costa Rica). Scale = 1mm..



Figures 62–73. Shape of protibia in 62: *Anomala m-fuscum* (male: holotype). 63: *A. perspicax* (male: holotype; female: paratype, La Esperanza, Costa Rica). 64: *A. piccolina* (male: holotype; female: paratype, Estación Altamira, Costa Rica). 65: *A. polygona* (Holotype). 66: *A. stillaticia* (male: holotype; female: paratype, Quebrada Segunda, Costa Rica). 67: *A. subridens* (male: holotype; female: paratype, Esperanza del Guarco, Costa Rica). 68: *A. subusta* (male: paratype, Estación Cacao, Costa Rica; female: paratype, Estación Cacao, Costa Rica). 69: *A. tenoriensis* (male: holotype; female: paratype, Parque Nacional Volcán Tenorio, Costa Rica). 70: *A. trapezifera* (male and female: Parque Nacional Tapantí, Costa Rica). 71: *A. tuberculata* (male: holotype; female: paratype, Parque Nacional Volcán Tenorio, Costa Rica). 72: *A. vallisneria* (male: holotype; female: paratype, Río Grande de Orosi, Costa Rica). 73: *A. vulcanicola* (male: San Gerardo de Dota, Costa Rica; female: Estación Cuerici, Costa Rica). Scale = 1mm.

3.2 *A. trapezifera* species group

Female: similar to male; antennal club shorter; first tooth of protibia wider; middle tooth above internal apex (Figure 51).

Variation: extension of the macula on the pronotum variable, density of flecks on elytra variable, from mainly light colored to nearly completely brown; abdominal sternites from ochre with brown apical margins to uniformly dark brown. Body length 11.93–12.80 mm, body width 6.29–7.14 mm. Clypeus w/l: 2.37–3.37. Interocular ratio (interocular width/width of eye): 3.49–3.73. Male antennal club: 1.41–1.50 mm; female antennal club: 1.27–1.28 mm. Pronotum w/l: 1.67–1.80. Metafemur l/w: 2.77–3.85. Metatibia width: 0.82–0.91 mm.

Diagnosis: medium size, small eyes, pronotum with sinuate lateral margins, surface with dense punctures and wrinkles, male protibia stout, parameres wide with a blunt apex in lateral view, endophallus with one swollen sacculus.

It is distinguished from *A. subridens* by smaller male eyes, shorter male antenna, less sinuate lateral margins on the pronotum, and the male genitalia. It is differentiated from *A. trapezifera* by its smaller male eyes, shorter male antenna, narrower metafemur in males, and the shape of the male genitalia. It is separated from *A. vallisneria* by its wider clypeus, smaller male eyes, darker abdominal sternites, and the male genitalia. It is distinguished from *A. vulcanicola* by smaller and more diffuse flecks on the elytra, darker abdominal sternites, and the male genitalia.

Distribution: Talamanca mountain range, from 2600 to 3000 m (Figure 122).

Etymology: from the Latin past participle "*aspersus, a, um*" sprayed, for its elytral pattern, rich in small flecks.

Anomala atrivillosa Filippini, Micó, Galante, new species

Figures 4, 28, 52, 76, 100, 123

Material examined. Holotype: ♂ "Estac. Barva, Braulio Carrillo, N. P. 2500 m. Heredia, COSTA RICA. Apr 1990. A. Fernandez, L N 233400_523200/INBIOCR1000178001".

Paratypes (6): 2♂♂ "Est. Barva, P. N. Braulio Carrillo, 2500m, Prov. Here., COSTA RICA, A. Fernandez, Jun 1990, L- N 233400_523200" INBIOCR1000221965 and INBIOCR1000121099; 3♂♂ "Est. Barva, P. N. Braulio Carrillo, 2500m, Prov. Here., COSTA RICA, B. Apu & G. Varela, Jul 1990 L- N 233200_523100" CEUA00106059, CEUA00106060 and INBIOCR1000385671; 1♀ "Estac. Barva, Braulio Carrillo, N. P. 2500 m. Heredia COSTA RICA. Feb 1990. A. Fernandez, L N 233400_523200/ INBIOCR1000121099".

Description. Holotype. Male: Body shape elongated, expanded at apical third of elytra. Length 12.56 mm. Width 6.43 mm. (Figure 4).

Color. Head, clypeus and pronotum dark bronze brown, anterior part of sides of the pronotum ochre (Figure 28). Scutellum and elytra dark brown, a row of few ochre flecks on sides of elytra. Pygidium dark brown with a ochre macula on the apex; venter reddish brown; coxae ochre with dark maculae, trochanters, tibiae and tarsi reddish brown. Frons, pronotum and scutellum covered with long fine blonde setae, elytra with less dense setae along the main rows of punctures.

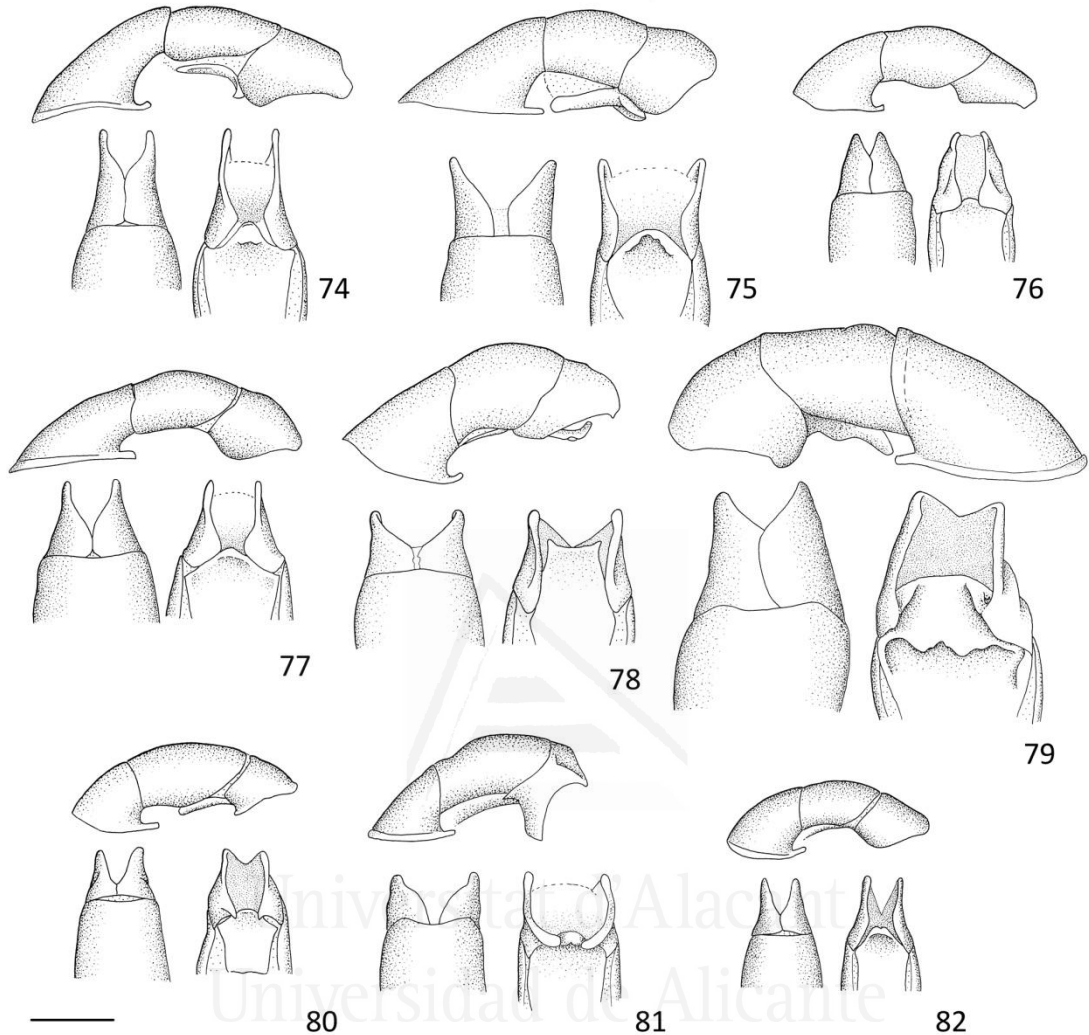
Head. Clypeus nearly rectangular, with anterior margin straight, surface concave near suture with frons; ratio width/length 2.60. Ratio interocular width/width of eye 3.15. Length of antennal club: 2.09 mm.

Pronotum. Width 1.70 times length. Lateral margins sinuate, maximum width at 1/3 of pronotum height, but not much wider than basal margin, parallel on basal third. Basal bead obliterated in the middle. Surface irregular with dense round punctures, with a shallow, irregular depression, mainly on the sides and median axis (Figure 28). Scutellum with sparse punctures.

Elytra. Surface with irregular rows of large and deep punctures, often coalescent. First interstice with 2–3 irregular rows. Fine small punctures in the background, general aspect of surface irregular.

Pygidium. Surface rugose, with dense coalescent punctures, long setae on the entire surface.

Legs. Protibia (Figure 52) with long apical tooth; middle tooth slightly above the internal apex of protibia; basal tooth at 1/3 of internal length.



Figures 74–82. Shape of aedeagus, lateral view (top), dorsal view (bottom left), ventral view (bottom right). 74: *Anomala aereiventris* (Holotype). 75: *A. aspersa* (Holotype). 76: *A. atrivillosa* (Holotype). 77: *A. clarivillosa* (Holotype). 78: *A. contusa* (Holotype). 79: *A. eusticta* (Holotype). 80: *A. globulata* (Holotype). 81: *A. hiata* (Holotype). 82: *A. latifalculata* (Holotype). Scale = 1mm.

Protarsal claws: internal claw thin, bifurcate, with upper branch shorter and $\frac{1}{3}$ the width of the lower one, space between the branches very narrow. Inferior margin slightly curved. Metafemur ratio length/width 3.47. Metatibia with elongated, rugose punctures, width 0.86 mm.

Abdominal sternites with 4–6 rows of shallow oblong punctures and one row of setae per sternite. Last sternite with dense shallow punctures, subapical bead sinuate, thin and complete, apical portion narrow.

Male genitalia. Aedeagus in Figure 76. Parameres with squared apex in lateral view. Endophallus in Figure 100. One long dorsal sacculus with microsetation and a patch of long setae on right side. Ejaculatory duct opening frontal on a basal ventral inflation.

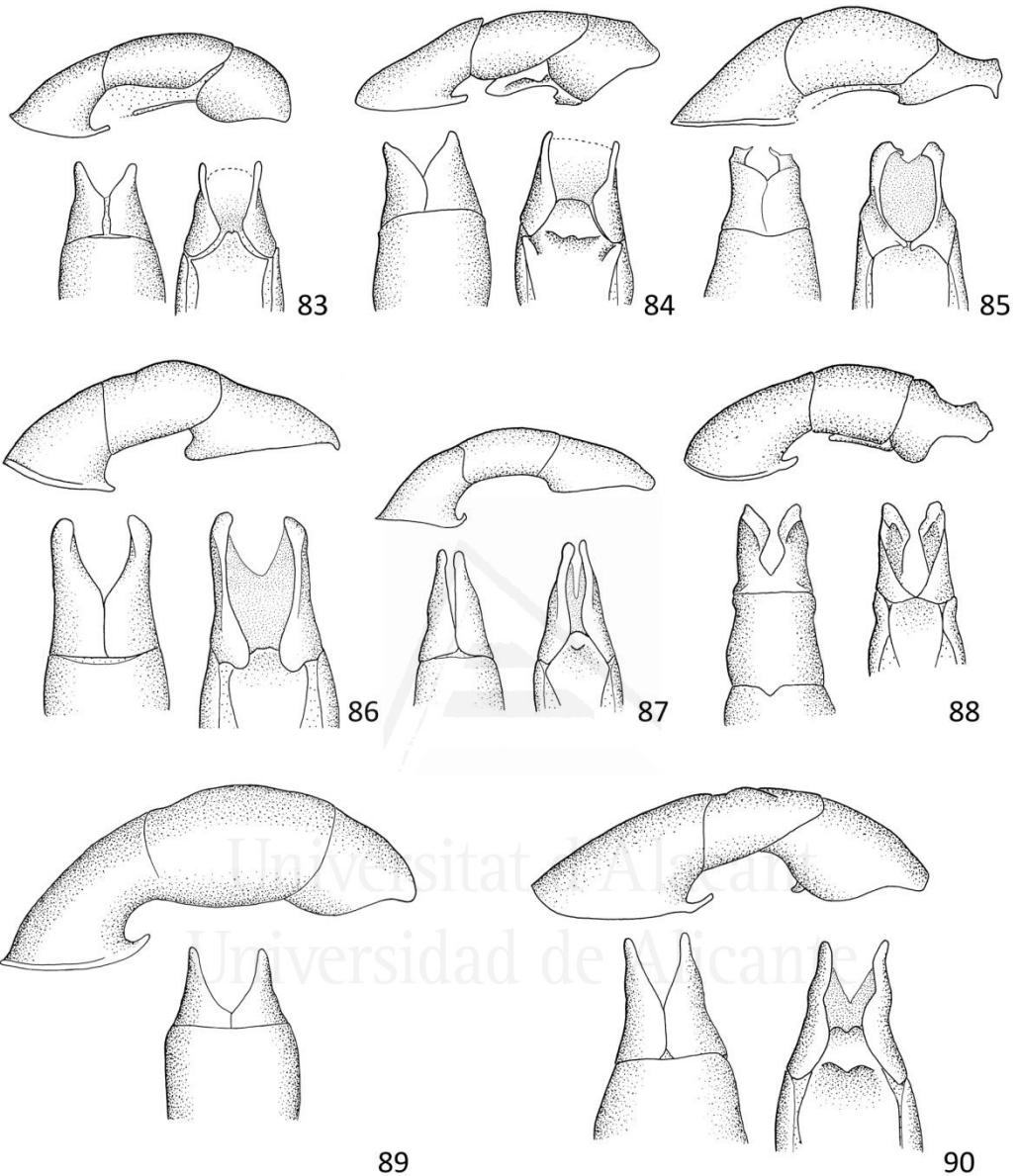
Female: antennal club shorter compared to males; metafemur wider than in males; first tooth of protibia wider and longer in relation to males (Figure 52); protarsal claws similar to males, bifurcation on internal claw wider and upper branch longer than the lower one; last abdominal sternite with curved apical margin.

Variation: clypeus from entirely brown, to brown with ochre apex and maculae; ochre flecks can be present on lateral sides of pronotum, disc of scutellum, sparse on elytra except for on the median band; pygidium from ochre with dark brown maculae on sides, to entirely brown except for the apex; venter dark to reddish brown, with ochre maculae and bands; coxae and femura yellowish to reddish with dark maculae, trochanters, tibiae and tarsi dark to reddish brown, with yellowish maculae. Body length 12.16–12.96 mm, body width 6.43–7.00 mm. Clypeus w/l: 2.20–2.60. Interocular ratio (interocular width/width of eye): 2.43–3.15. Male antennal club: 1.87–2.09 mm. Pronotum w/l: 1.55–1.70. Metafemur l/w: 3.47–4.13. Metatibia width: 0.81–0.94 mm.

Diagnosis: medium size, dark color, whole surface covered with sparse setae, pronotum with sinuate lateral margins, surface with dense round punctures and an irregular surface, anterior angles of pronotum obtuse, parameres with a squared apex in lateral view, endophallus with one sacculus with a long thin patch of setae.

Very similar to *A. clarivillosa*, it is differentiated by its darker color, the shape of its pronotum and the male genitalia.

Distribution: *A. atrivillosa* is known from one locality in the Braulio Carrillo National Park, in the Central mountain range, 2500 m (Figure 123).



Figures 83–90. Shape of aedeagus, lateral view (top), dorsal view (bottom left), ventral view (bottom right). 83: *Anomala leopardina* (Holotype). 84: *A. levicollis* (Holotype). 85: *A. longisacculata* (Holotype). 86: *A. m-fuscum* (Holotype). 87: *A. perspicax* (Holotype). 88: *A. piccolina* (Holotype). 89: *A. polygona* (Escazu, Costa Rica). 90: *A. stillaticia* (Holotype). Scale = 1mm.

Etymology: from the Latin adjectives "*ater, atra, atrum*" dark, and "*villosus, a, um*" villose, for its dark color and presence of setae.

Anomala clarivillosa Filippini, Micó, Galante, new species

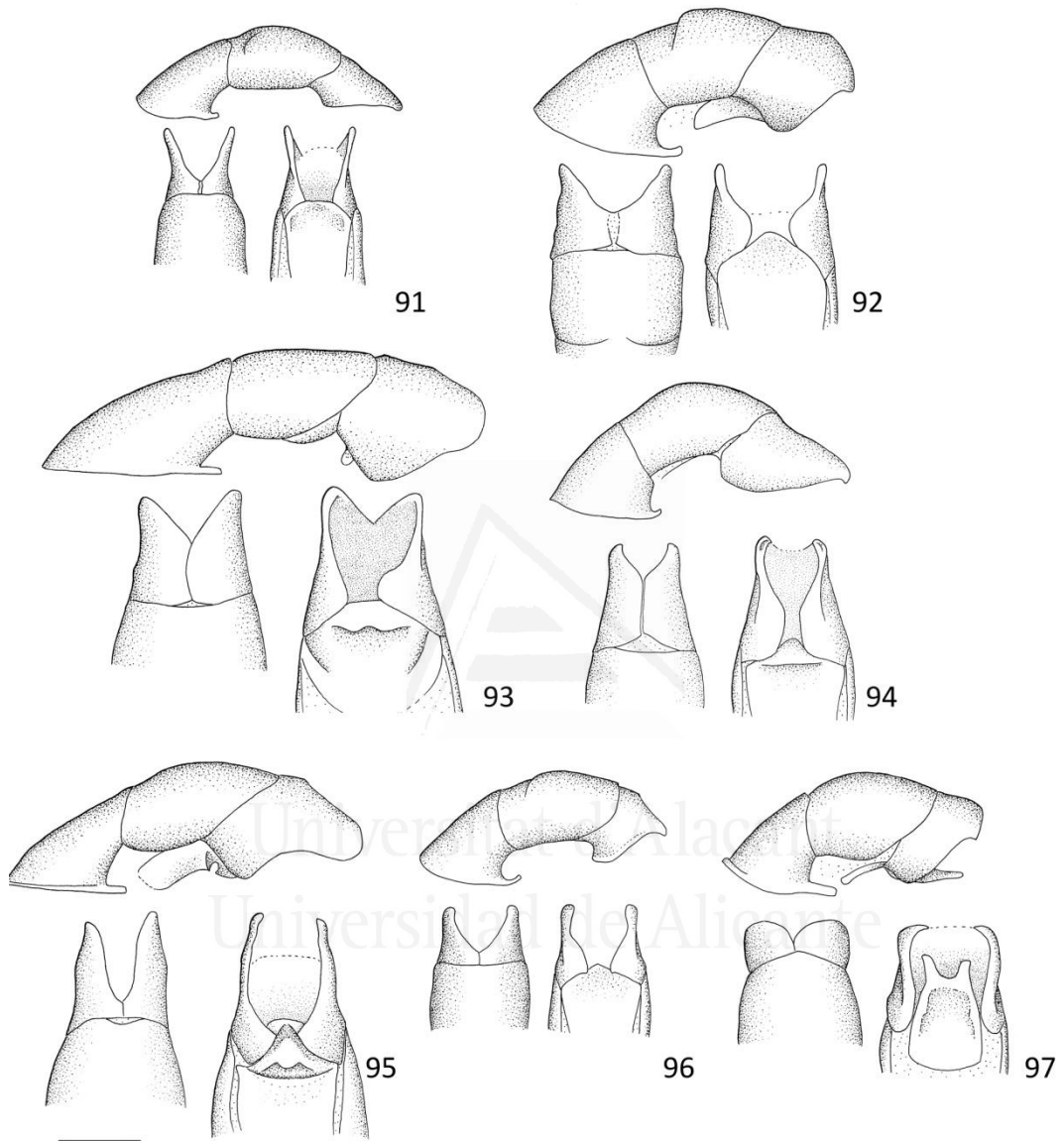
Figures 5, 29, 53, 77, 101, 123.

Material examined. Holotype: ♂ "La Esperanza 2300m. Prov. Cartago. Costa Rica. 30/08/2008 Leg. A. García, M. Zumbado./ CEUA00105904".

Paratypes (9): 1♂ "La Esperanza 2300m. Prov. Cartago. Costa Rica. 30/08/2008 Leg. A. García, M. Zumbado./ CEUA00105905"; 2♂♂ 1♀ "La Esperanza 2300m. Prov. Cartago. Costa Rica. 29/08/2008 Leg. A. García, M. Zumbado." CEUA00105906, CEUA00105907 and CEUA00105908; 1♂ COSTA RICA. Prov. Cartago. P.N. Tapantí. La Esperanza del Guarco. 2334m. 5 MAY 2008. A. García, M.A. Zumbado. Tp. Luz 2. L_N_188418_552219 #93739/ CEUA00105909"; 1♂ "COSTA RICA. Prov. Cartago. P.N. Tapantí. Macizo de la Muerte. La Esperanza del Guarco. 2300m. 1 AGO 2008. M.A. Zumbado, A. García. Tp. Luz 2. L_N_188418_552219 #94550/ CEUA00105910"; 1♀ "COSTA RICA. Prov. Cartago, R.F. Río Macho, Macizo de la Muerte, Estac. Esperanza del Guarco, 2600m, 13 OCT 2001, R. Tenorio, T. de Luz. L_N_185600_550000 #655887/ INB0003396663"; 1♂ "COSTA RICA. Prov. Cartago, El Guarco, R.F. Río Macho, Est. La Esperanza del Guarco, 2700m, 22 - 27 ENE 2002, R. G. Tenorio, Luces ambiente L_N_185600_550000 #66624/ INB0003422351"; 1♀ "Cartago. Costa Rica Río Macho. 2Km de Interamericana Sur 12 set de 1988. 2600m. A. Solis/ INBIOCRI002517404".

Description. Holotype. Male: Body shape elongated, expanded at apical third of elytra. Length 12.35 mm. Width 6.23 mm. (Figure 5).

Color. Clypeus and tarsi orangey brown; clypeus with two reddish basal maculae. Head, pronotal disc, venter reddish brown, with bronze metallic luster; lateral and bottom margins of the pronotum ochre, shape of the discal macula in Figure 29. Scutellum reddish brown with lighter disc. Elytra ochre with several irregular brown maculae: one on each side of the scutellum, on a median wavy band, one on the apical calli, two per side along the lateral margins; several small flecks are present on punctures. Pygidium ochre with several dark maculae concentrated on basal half, with small flecks on punctures; legs yellowish with reddish brown maculae, femura nearly entirely reddish brown.



Figures 91–97. Shape of aedeagus lateral view (top), dorsal view (bottom left), ventral view (bottom right). 91: *Anomala subridens* (Holotype). 92: *A. subusta* (Holotype). 93: *A. tenoriensis* (Holotype). 94: *A. trapezifera* (Parque Nacional Tapantí, Costa Rica). 95: *A. tuberculata* (Holotype). 96: *A. vallisneria* (Paratype, Sector Las Pailas, Costa Rica). 97: *A. vulcanicola* (San Gerardo de Dota, Costa Rica). Scale = 1mm.

Frons, pronotum and scutellum covered with long fine blonde setae, elytra with less dense setae along the main rows of punctures.

Head. Clypeus nearly rectangular, with sinuate anterior margin; ratio width/length 2.60. Ratio interocular width/width of eye 3.15. Length of antennal club: 1.78 mm.

Pronotum. Width 1.47 times length. Lateral margins deeply sinuate, maximum width slightly above the midpoint, protruding strongly in relation to basal angles. Basal bead obliterated in the middle. Surface with deep oblong punctures and shallow oblong impressions at sides (Figure 29).

Scutellum with sparse punctures and setae.

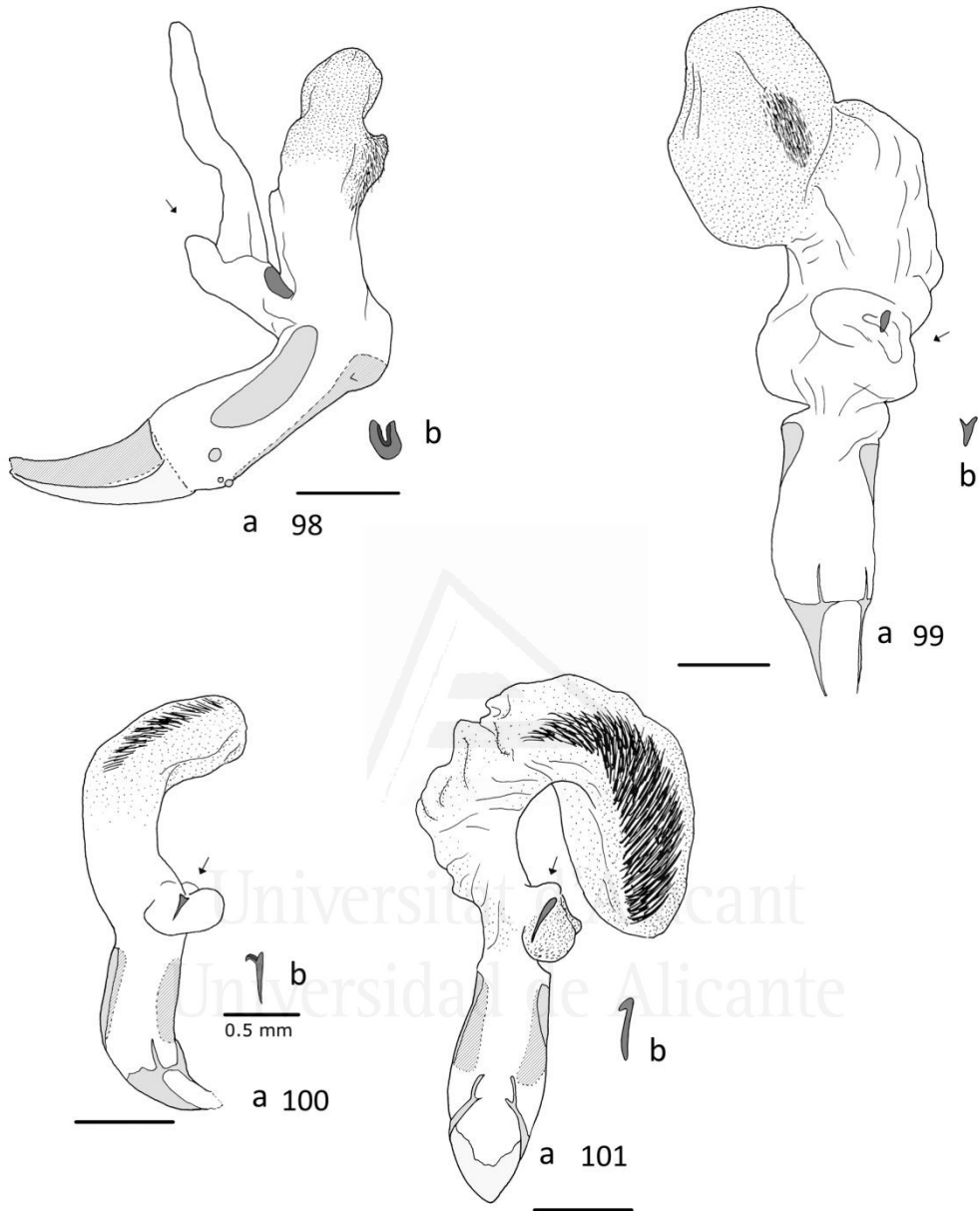
Elytra. Surface with regular rows of widely spaced punctures, often coalescent. First interstice with two irregular rows.

Pygidium. Surface with deep oblong coalescent punctures, with long setae on the entire surface.

Legs. Protibia (Figure 53) with long apical tooth; middle tooth slightly above the internal apex of the protibia; basal tooth at $\frac{1}{3}$ of internal length. Protarsal claws: thin internal claw, bifurcate, with upper branch slightly shorter and $\frac{2}{3}$ the width of the lower one. Inferior margin slightly curved. Mesocoxae narrow, as wide as mesotibiae; metafemur very narrow, ratio length/width 4.29. Metatibia with elongated, rugose punctures, width 0.90 mm.

Abdominal sternites. Sternites I–IV with very dense fine punctures, V with sparse larger punctures; only the sternite II is covered with dense short setae, the others have sparse setae, mainly on the sides. Posterior margin of the sternites II and III sinuate. Last sternite punctate, with subapical bead sinuate with a wide central curve, thin and complete, apical portion wide.

Male genitalia. Aedeagus in Figure 77. Parameres with blunt apex in lateral view, inferior margin sinuate. Endophallus in Figure 101. One long and wide sacculus with microsetation and a wide patch of long setae on the right side. Ejaculatory duct opening frontal on a basal, left-sided inflation, covered with microsetation.



Figures 98–101. Endophallus: a) whole, b) detail of ejaculatory sclerite. 98: *Anomala aereiventris* (Holotype). 99: *A. aspersa* (Holotype). 100: *Anomala atrivillosa* (Paratype, Estación Barva, Costa Rica). 101: *A. clarivillosa* (Paratype, La Esperanza del Guarco, Costa Rica). Scale = 1mm.

Female: antennal club shorter compared to males; metafemur wider than in males; first tooth of protibia wider and longer than males (Figure 53); protarsal claws similar to males, bifurcation on internal claw wider; last abdominal sternite with apical margin curved.

Variation: head and pronotum with green or bronze luster, extension of maculae and flecks on elytra variable. Body length 12.31–13.96 mm, body width 6.23–6.88 mm. Clypeus w/l: 2.30–2.66. Interocular ratio (interocular width/width of eye): 2.43–3.55. Male antennal club: 1.64–1.79 mm; female antennal club: 1.34–1.49 mm. Pronotum w/l: 1.47–1.68. Metafemur l/w: 3.21–3.52 (female) 4.29–4.74 (male). Metatibia width: 0.82–0.91 mm.

Diagnosis: medium size, light color, whole surface covered with sparse setae, pronotum with deeply sinuate lateral margins, surface with oblong punctures, anterior angles of pronotum acute, parameres with blunt apex in lateral view, endophallus with one wide sacculus with a wide patch of setae.

Very similar to *A. atrivillosa*, it is differentiated by its lighter color, the shape of its pronotum and the male genitalia.

Distribution: it is known from one locality in the Tapantí National Park on the Talamanca mountain range, from 2300 to 2700 m (Figure 123).

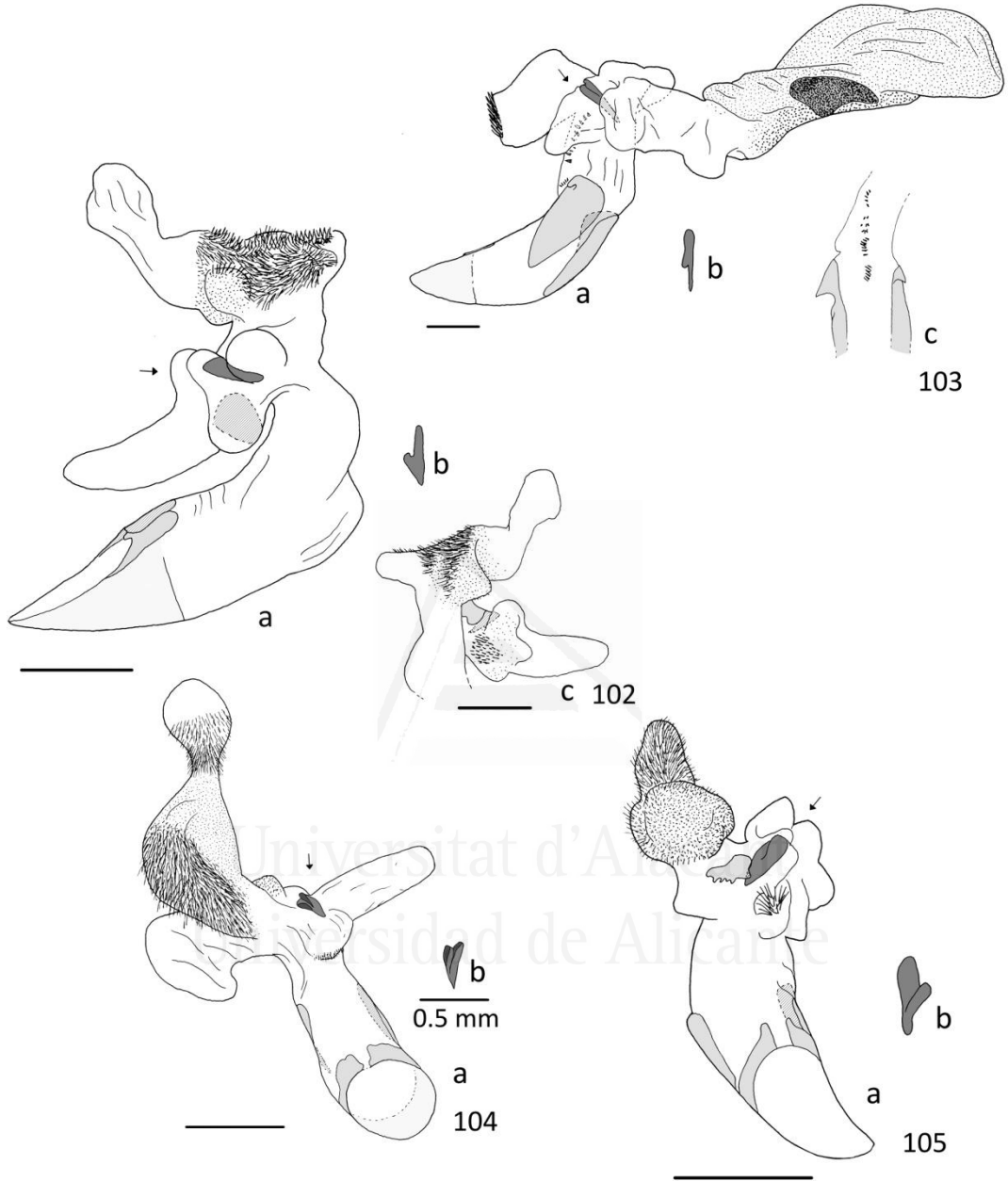
Etymology: from the Latin adjectives "*clarus, a, um*" light, and "*villosus, a, um*" villose, for its light color and presence of setae.

Anomala contusa Filippini, Micó, Galante, new species

Figure 6, 30, 54, 78, 102, 124.

Material examined. Holotype: ♂ "Volcán Tenorio 1300m. Prov. Guanacaste. Costa Rica. 31/08/2008 Leg. J.A. Azofeifa/ CEUA00105854".

Paratypes (8): 1♂ "Estación Zurquí. P.N. B. Carrillo (Costa Rica) 1550m 22-9-06. Luz de mercurio. Leg.: Micó, García, Galante./ CEUA0019662"; 2♂♂ "Volcán Tenorio 1300m. Prov. Guanacaste. Costa Rica. 31/08/2008 Leg. J.A. Azofeifa" CEUA00105865 and CEUA00105871; 1♂



Figures 102–105. Endophallus: a) whole, b) detail of ejaculatory sclerite. 102: *Anomala contusa* (Holotype) c) view of the other side. 103: *A. eusticta* (Paratype, Estación La Casona) c) detail of ventral portion. 104: *A. globulata* (Holotype and Paratype, reserva Forestal Río Macho, Costa Rica). 105: *A. hiata* (Paratype, Estación Pittier). Scale = 1mm.

"Volcán Tenorio 1300m. Prov. Guanacaste. Costa Rica. 30/09/2008 Leg. J.A.Azofeifa/ CEUA00105866"; 3 ♀♀ "Volcán Tenorio 1300m. Prov. Guanacaste. Costa Rica. 30/08/2008 Leg. J.A.Azofeifa" CEUA00105867, CEUA00105868 and CEUA00105869; 1 ♂ "Volcán Tenorio 1300m. Prov. Guanacaste. Costa Rica. 01/09/2008 Leg. J.A.Azofeifa/ CEUA00105870".

Description. Holotype. Male: Body shape oval. Length 12.12 mm. Width 6.86 mm. (Figure 6).

Color. Clypeus ochre with two symmetric dark copper maculae at sides of disc; frons dark copper with a small ochre triangle next to suture with clypeus; pronotum ochre with large symmetric blackish coppery maculae (pattern in Figure 30); scutellum ochre with blackish edges; elytra ochre with dark punctures, some slightly larger maculae on the calli, median band and sides; pygidium ochre with two pairs of blackish maculae on sides and several sparse flecks; sternum dark reddish brown, ventral sternites ochre with dark punctures and dark bands on the apical margin of sternites II–IV and basal half of sternite V; legs light ochre, with the tarsi, apex and base of femura reddish brown.

Head. Clypeus trapezoidal, anterior margin very slightly sinuate, ratio width/length 2.42. Frons with a small triangular concavity. Ratio interocular width/width of eye 3.24. Length of antennal club: 1.59 mm.

Pronotum. Width 1.90 times length. Lateral margins regularly convex. Surface sculptured, with two deep rectangular imprints, obliquely placed at sides of a median sulcus, and two expanded swellings towards posterior margin; covered with large and deep punctures (Figure 30). Basal bead obliterated in the middle.

Scutellum surface with sparse punctures concentrated on the margins.

Elytra with irregular rows of deep punctures, often coalescing, and widely spaced between groups of coalesced punctures. First interstice with 2–3 rows of sparse punctures.

Pygidium with sparse deep punctures and long setae on apex.

Legs. Protibia (Figure 54) with long apical tooth; middle tooth at the same level as the internal apex; basal tooth at 2/5 of protibia length. Protarsal claws: internal claw

3.2 *A. trapezifera* species group

with upper branch similar in length to and slightly narrower than the lower one; inferior margin slightly sinuate. Metafemur ratio length/width 3.67. Metatibia with strong swelling, covered with sparse fine punctures, slightly rugose below the second external carina. Width 1.05 mm.

Abdominal sternites with 3–6 rows of sparse punctures, one row of sparse setae per sternite. Last sternite densely punctate, with subapical bead sinuate, thin and complete, apical portion higher than basal part of sternite.

Male genitalia. Aedeagus in Figure 78. Parameres stout, with apex pointing downwards in lateral view. Ventral plate with straight apex and protruding apical angles. Endophallus (Figure 102) composed by two sacculi with irregular shapes, one on the front-left, with long setae and microsetation at its base, the apex swollen. The other one on the ventral-right side, with several inflations at the base where the ejaculatory duct opening is located, and a patch of short thick setae and a sclerotized plate on its internal side.

Females: antennal club slightly shorter compared to males; first tooth of protibia wider, basal tooth nearer to the second, internal apex lower in position than in males (Figure 54); protarsal claws similar to males, internal claw with longer upper branch and inferior margin curved; last abdominal sternite with curved apical margin.

Variation: clypeus from dark copper to ochre with two maculae; ochre triangle on frons absent in specimens with a dark clypeus; middle tooth of protibia at the same level as, or slightly above the internal apex; large dark maculae on the pygidium variable in number and size; extension of dark bands on ventral sternites variable, but always with dark maculae at sides. Body length 12.12–13.59 mm, body width 6.86–7.62 mm. Clypeus w/l: 1.97–2.42. Interocular ratio (interocular width/width of eye): 2.88–3.52. Male antennal club: 1.58–1.65 mm; female antennal club: 1.25–1.28 mm. Pronotum w/l: 1.81–1.92. Metafemur l/w: 3.03–3.67. Metatibia width: 1.05–1.17 mm.

Diagnosis: medium sized, pronotum with regularly convex lateral margins and deep impressions, elytra with numerous scattered flecks, parameres stout, with apex

pointing downwards in lateral view, ventral plate with straight apex and protruding apical angles, endophallus with two short sacculi.

It is similar to *Anomala picturella* Morón & Nogueira 2002 and *A. terronoides* Morón & Nogueira 2002 from Mexico, which also present tridentate protibiae and deep impressions on the pronotum, but these are different in each species, with *A. contusa* the only one that has a median sulcus; elytra patterns are more regular in Mexican species, which present isolated defined maculae, fewer in number and larger in size than the flecks on *A. contusa*. The parameres of *A. picturella* and *A. terronoides* are much more slender, the ventral plate has an acute and curved apex in lateral view; the endophallus of *A. picturella* is sac shaped with no ejaculatory sclerite.

Distribution: it is known from a few localities in the Guanacaste, Central and Coastal mountain ranges, from 1300 to 1550 m (Figure 124).

Etymology: from the past participle of Latin verb "*contundo* ", bruised, because of the markings on the pronotum.

Anomala eusticta Filippini, Micó, Galante, new species

Figure 7, 31, 55, 79, 103, 125.

Material examined. Holotype: ♂ "Est. La Casona, R.B. Monteverde, Prov. Punta, COSTA RICA. 1520m. 3-24 ABR 1995. A. Azofeifa, L_N_253900_449300 #5288/ INBIOCR1002453183".

Paratypes (10): 1♀ "Derrumbe, Est. Cacao, lado oeste del V. Cacao, Prov. Guanacaste, Costa Rica, III Curso Parataxon., May 1992, L- N 323700_376700/ INBIOCR1000423420"; 1♂ "Est. La Casona, 1520m, Res. Biol. Monteverde, Prov. Puntarenas, Costa Rica, K. Flores, Mar 1992 L-N 253250_449700/ INBIOCR1000788709"; 1♂ "Est. La Casona, 1520 m, Res. Biol. Monteverde, Prov. Punt., COSTA RICA. Abr 1991, N. Obando. L- N 253250_449700/ CEUA00106064"; 1♂ "Est. La Casona, 1520 m, Res. Biol. Monteverde, Prov. Punt., COSTA RICA. Mar 1991, N. Obando, L- N 253250_449700/ INBIOCR1001320027"; 1♂ "Estacion La Casona, R. B. Monteverde, Prov. Punta., COSTA RICA. 1520m. Jun 1991. N. Obando, L N 253250_449700 #1714/ INBIOCR1001694171"; 3♂♂ 2♀♀ "Est. La Casona, R.B. Monteverde, Prov. Punta., COSTA

3.2 *A. trapezifera* species group

RICA. 1520m. 3–24 ABR 1995. A. Azofeifa, L_N_253900_449300 #5288" INBIOCRI002453046, INBIOCRI002453178, INBIOCRI002453180, INBIOCRI002453179 and CEUA00106063.

Description. Holotype. Male: Body shape oval, expanded at the apical third of elytra. Length 14.76 mm. Width 8.78 mm. (Figure 7).

Color. Head, clypeus and pronotum metallic dark green, pronotum with ochre edges (pattern in Figure 31) and a thin median band; scutellum ochre with metallic green lateral margins; elytra ochre with numerous blackish flecks and larger maculae concentrated on two sinuate transversal bands and on the calli, the entire surface with a metallic green to bronze hue. Pygidium ochre with four pairs of dark brown maculae on sides. Sternum greenish brown, abdominal sternites ochre with brown apical margins; femura ochre, tibiae and tarsi reddish with metallic green luster, and lighter maculae on tibiae.

Head. Clypeus trapezoidal, with straight anterior margin; ratio width/length 2.33. Frons with sparse shallow punctures, concave in a small zone next to the suture with the clypeus, and with a short impression medially near vertex. Ratio interocular width/width of eye 2.54. Length of antennal club: 1.62 mm.

Pronotum. Width 1.75 times length. Lateral margins homogeneously convex. Basal bead obliterated in the middle. Surface with dense fine punctures (Figure 31).

Scutellum surface with sparse punctures concentrated near its margins.

Elytra with irregular rows of large and deep punctures, surface irregular, with very small shallow punctures that give an irregular appearance. First interstice with one row of punctures, which branches to 2–3 at its base.

Pygidium with sparse oblong deep punctures, coalescent; surface rugose; with long setae on apex.

Legs. Protibia (Figure 55) with apical tooth quite short; middle tooth at the same level as the internal apex; basal tooth between $1/3$ and $2/5$ of internal length. Protarsal claws: internal claw widely bifurcate, with upper branch as long as and $2/3$ the width of the lower one; inferior margin sinuate, with a sharp angle. Metafemur

ratio length/width 3.1. Metatibia with sparse fine punctures, rugose below second external carina. Width 1.34 mm.

Abdominal sternites with sparse oblong punctures, denser on sternite II and one row of sparse setae per sternite. Last sternite narrow, with subapical bead sinuate and complete, apical portion as wide as sternite; surface with dense shallow punctures.

Male genitalia. Aedeagus (Figure 79) twisted to the left. Parameres wide, with blunt apex in lateral view. Ventral plate with a wide apical portion curved in lateral view, with bilobed margin, lateral membranes folded. Endophallus in Figure 103. Dorsal sacculus long and wide, covered with dense microsetation, thicker on posterior side, with a fold covered densely in spines on the ventral side, at half the length. Ventral sacculus shorter, with an elongated patch of thick spines at the apex. Ejaculatory duct opening frontal, between the sacculi, with inflations at sides. A row of spines runs ventrally on the portion between the median lobes and the bifurcation of the sacculi. Median lobes with triangular folds at the apex.

Female: antennal club shorter compared to males; teeth of protibia wider, internal apex lower in position than in males (Figure 55); protarsal claws similar to males, upper branch wider in relation to males, inferior margin curved; metatibia stout; last abdominal sternite with its apical margin curved.

Variation: green margins on the scutellum of variable width; maculae on elytra concentrated in two or three sinuate transversal bands; pygidium with 3–4 pairs of maculae; sternum from reddish to green to light brown; tibiae and tarsi reddish to metallic green. Body length 14.76–15.81 mm, body width 8.35–9.35 mm. Clypeus w/l: 1.97–2.33. Interocular ratio (interocular width/width of eye): 2.45–2.60. Male antennal club: 1.54–1.62 mm. Pronotum w/l: 1.75–1.85. Metafemur l/w: 2.90–3.14. Metatibia width: 1.28–1.34 mm.

Diagnosis: large size, lateral margins of pronotum convex, surface with fine punctures, elytra light in color with regular maculae and metallic luster, parameres

3.2 *A. trapezifera* species group

with blunt apex in lateral view, ventral plate with apex curved in lateral view, endophallus with one long and one short sacculi, median lobes with triangular folds. Similar to *A. aereiventris* and *A. tuberculata*, it is differentiated by its larger size, flat clypeus, a lighter pattern on the pronotum, large maculae on the elytra and the shape of the male genitalia.

Distribution: a few localities in the Guanacaste and Tilarán mountain ranges, from 1300 to 1520 m (Figure 125).

Etymology: from the Greek "eú, eû" well, and adjective "stiktós" spotted, for the regular maculae on the elytra.

Anomala globulata Filippini, Micó, Galante, new species

Figure 8, 32, 56, 80, 104, 126.

Material examined. Holotype: ♂ "COSTA RICA. Prov. Cartago, P.N. Tapantí - Macizo de La Muerte, Send. Quebrada las Piedras, 2650m, 21–22 JUN 2002, R. González, Luces ambiente, L_N_186100_550100 #70064/ INB0003500676"

Paratypes (6): 2♂♂ "COSTA RICA. Prov. Cartago, R.F. Río Macho, Alred. Estación la Esperanza, 2650m, 26–29 MAY 2002, R. González, Luz ambiente, L_N_185600_550000 #69624" INB0003489989 and INB0003489988; 1♂ "Fila El Alto, Camino entre Legua y San Francisco, Prov. San J. COSTA RICA. 2000m. 22–26 MAY 1995. A. Solís, M. M. Chavarria, L_N_188500_524000 #5461/ INBIOCRI002319885"; 1♂ 1♀ "Esperanza del Guarco. Cartago, Costa Rica. 2300m. 5/6/2008. Leg. A. García, M. Zumbado" CEUA00105886 and CEUA00105884; 1♀ "COSTA RICA. Prov. Cartago. P.N. Tapanti Macizo de la Muerte. La Esperanza del Guarco. 2300m. 6 MAY 2008. M. A. Zumbado, A. García. Tp. de luz 1. L_N_188418_552219 #93862/ CEUA00105885".

Description. Holotype. Male: Body shape slender, elongated. Length 11.68 mm. Width 5.92 mm. (Figure 8).

Color. Clypeus ochre with two darker rectangular basal maculae; head brown, with ochre margin, with clypeus expanding in a triangle in the middle, and a ochre macula at the base of the head; pronotal disc ochre, with a wide brown "M" shaped macula,

and two elongated brown maculae on the sides (pattern shown in Figure 32). Scutellum brown with a ochre central circular macula. Elytra ochre with several irregular brown maculae concentrated in three bands: one along the elytra bases, one median and one along $2/3$ of length; pygidium ochre with brown irregular maculae, coalescing, and smaller flecks on punctures; abdominal sternites brown with ochre sides and light apical margins, sternum and legs ochre, with tarsi and extremities of femura reddish brown.

Head. Clypeus rectangular, with sinuate anterior margin; ratio width/length 2.98. Frons with a triangular concavity. Ratio interocular width/width of eye 3.56. Length of antennal club: 1.67 mm. Pronotum. Width 1.89 times length. Lateral margins angulated at $1/3$ of pronotum height; anterior angles wide and slightly curved upwards. Basal bead obliterated in the middle. Surface with rounded punctures connected by small longitudinal wrinkles and short setae on anterior part of disc; two symmetric shallow imprints on disc, interior to lateral fossae (Figure 32).

Scutellum with coarse punctures and sparse long setae.

Elytra with sparse punctures arranged in irregular rows. First interstice with irregular dense punctures.

Pygidium with coarse coalescent punctures and long setae on margins; surface rugose punctate.

Legs. Protibia (Figure 56) with short and wide apical tooth; middle tooth below internal apex; basal tooth at nearly $1/2$ of internal length. Protarsal claws: internal claw bifurcate, with upper branch the same length as and half the width of the lower one. Inferior margin slightly curved. Space between branches narrow. Metafemur narrow, ratio width/length 4.61. Metatibia rugose. First external carina absent, a row of sparse setae in place. Ratio length/width 0.71 mm.

Abdominal sternites with 2–5 irregular rows of punctures, concentrated in the basal and apical part of each sternite, coalescent at sides; 2–5 rows of dense setae on sternite II, one row of sparse setae on sternites III–V. Last sternite with sparse

3.2 *A. trapezifera* species group

punctures, rugose, subapical bead sinuate and poorly defined, apical portion medially as wide as basal portion of sternite.

Male genitalia. Aedeagus (Figure 8o) slightly twisted to the right. Parameres with a blunt apex and concave anterior ventral margin in lateral view. Ventral angle acute. Endophallus in Figure 104. One long sacculus on the right, with expanded apex, globular, subapically covered with long setae; median portion covered with long setae and microsetation; a large inflation dorsally at base. On the left, a short glabrous sacculus. Frontal ejaculatory duct opening, among sacculi and a ventral inflation.

Female: similar to male, with shorter antennal club, first tooth of protibia with rounded apex (Figure 56) and stouter metafemur.

Variation: extension of maculae on the pronotum and elytra variable; pygidium from ochre with sparse dark maculae to nearly entirely dark; abdominal sternites from reddish to dark brown. Body length 11.29–12.60 mm, body width 5.65–6.09 mm. Clypeus w/l: 2.72–2.98. Interocular ratio (interocular width/width of eye): 3.09–3.96. Male antennal club: 1.67–1.81 mm; female antennal club: 1.06 mm (n=2). Pronotum w/l: 1.82–2.05. Metafemur l/w: 3.40–3.56 (female); 4.33–4.61 (male). Metatibia width: 0.68–0.82 mm.

Diagnosis: medium size, clypeus with sinuate anterior margin, pronotum with angulated lateral margins and irregular surface, parameres with acute ventral angle in lateral view, endophallus with two sacculi, one with a globular apex.

Distribution: Northern Talamanca mountain range, from 2000 to 2650 m (Figure 126).

Etymology: adjective from Latin adjective "*globulatus*, -a, -um", ball shaped, for the globular structure in its internal sac.

Anomala hiata Filippini, Micó, Galante, new species

Figure 9, 33, 57, 81, 105, 122.

Material examined. Holotype: ♂ "Est. Pittier, Prov. Punta., COSTA RICA. 1670m. 23 ENE-2 FEB 1995. E. Nunez, L_S_330900_577400 #5401/ INBIOCR1002238414".

Paratypes (3): 1♂ 1♀ "Est. Pittier, Puntarenas, Costa Rica. 1670m. 4-22 ENE 1996. E. Navarro, de Luz L_S_330900_577400 #6816" INBIOCR1002390301 and INBIOCR1002390299; 1♂ "Est. Pittier, Send. Rio Gemelo. Puntarenas, Costa Rica. 1670m. 16 MAR 1996. A. M. Maroto, de Luz L_S_330900_577400 #7240/ CEUA00106069".

Description. Holotype. Male: Body shape slender, elongated. Length 10.61 mm. Width 5.81 mm. (Figure 9).

Color. Clypeus ochre with two reddish dark maculae at the sides of the disc; head dark brown with a reddish small macula on the suture with clypeus; pronotal disc dark brown, with ochre sides (Figure 33); head and pronotum with a dark green luster. Scutellum reddish brown with a ochre macula on the disc; elytra ochre with dark maculae on calli, one pair of dark maculae along the basal margin and several on a median transversal sinuate band, small maculae on punctures; pygidium ochre with two pairs of maculae at the sides: the basal pair large and the ones along the lateral margin smaller; sternum brown, abdominal sternites ochre with a darker apical margin expanding medially on the sternites II-IV, basal on the sternite V, coxae ochre, femura and tarsi reddish brown with lighter reddish maculae.

Head. Clypeus trapezoidal, with straight anterior margins; ratio width/length 2.10. Frons with shallow triangular concavity. Ratio interocular width/width of eye 2.47. Length of antennal club: 1.47 mm.

Pronotum. Width 1.78 times length. Lateral margins slightly sinuate. Basal bead obliterated in the middle. Surface with dense rounded punctures, two oblong shallow impressions at the sides (Figure 33).

Scutellum with sparse punctures along the sides.

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Elytra with sparse punctures arranged in irregular rows. First interstice with irregular sparse punctures.

Pygidium with dense punctures and long setae on its margins; surface rugose.

Legs. Protibia (Figure 57) with long apical tooth; middle tooth at the same level as the internal apex; basal tooth at $2/5$ of the internal length. Protarsal claws: internal claw bifurcate, with upper branch slightly shorter and $2/3$ the width of the lower one. Inferior margin sinuate. Metafemur ratio length/width 3.40. Metatibia with sparse punctures, rugose below second external carina. First external carina defined by spines. Width 0.93 mm.

Abdominal sternites with sparse oblong punctures; one row of sparse setae per sternite. Last sternite with sparse punctures, subapical bead sinuate and complete, apical portion wider than sternite.

Male genitalia. Aedeagus in Figure 81. Parameres with apex bilobed in lateral view, with a wide and concave space between the two lobes. Ventral margin with curved apex. Endophallus (Figure 105) composed of one sacculus with irregular shapes on the left, with long setae and microsetation at the apex, swollen in the middle and with a narrow apex. On the right side irregular inflations where the ejaculatory duct opening is located, a patch of setae on the ventral side and a sclerotized frontal plate, near the sacculus.

Female: antennal club shorter compared to males; first tooth of protibia wider, middle tooth above the internal apex (Figure 57); internal protarsal claw thinner, inferior margin curved; metatibia stouter and rugose; last abdominal sternite with apical margin curved.

Variation: clypeus from reddish brown to ochre with two maculae; head and pronotum with bronze or green luster; scutellum uniformly dark in color or with a ochre macula on the disc; elytra with maculae on one or two median bands; last sternite dark on female; coxae entirely ochre or with darker maculae. Body length 10.15–10.61 mm, body width 5.58–6.26 mm. Clypeus w/l: 2.07–2.23. Interocular ratio

(interocular width/width of eye): 2.38–2.77. Male antennal club: 1.40–1.47 mm; female antennal club: 1.10 mm. Pronotum w/l: 1.78–1.83. Metafemur l/w: 2.96–3.40. Metatibia width: 0.90–0.93 mm.

Diagnosis: medium size, pronotum with slightly sinuate lateral margins, almost completely dark, surface with dense large punctures, elytra with large maculae, parameres with wide and bilobed apex in lateral view, endophallus with one short sacculus.

Distribution: one locality in the southern Talamanca mountain range, 1670 m (Figure 122).

Etymology: from the Latin past participle "*hiatus, a, um*", widely opened, for the shape of its parameres.

Anomala latifalculata Filippini, Micó, Galante, new species

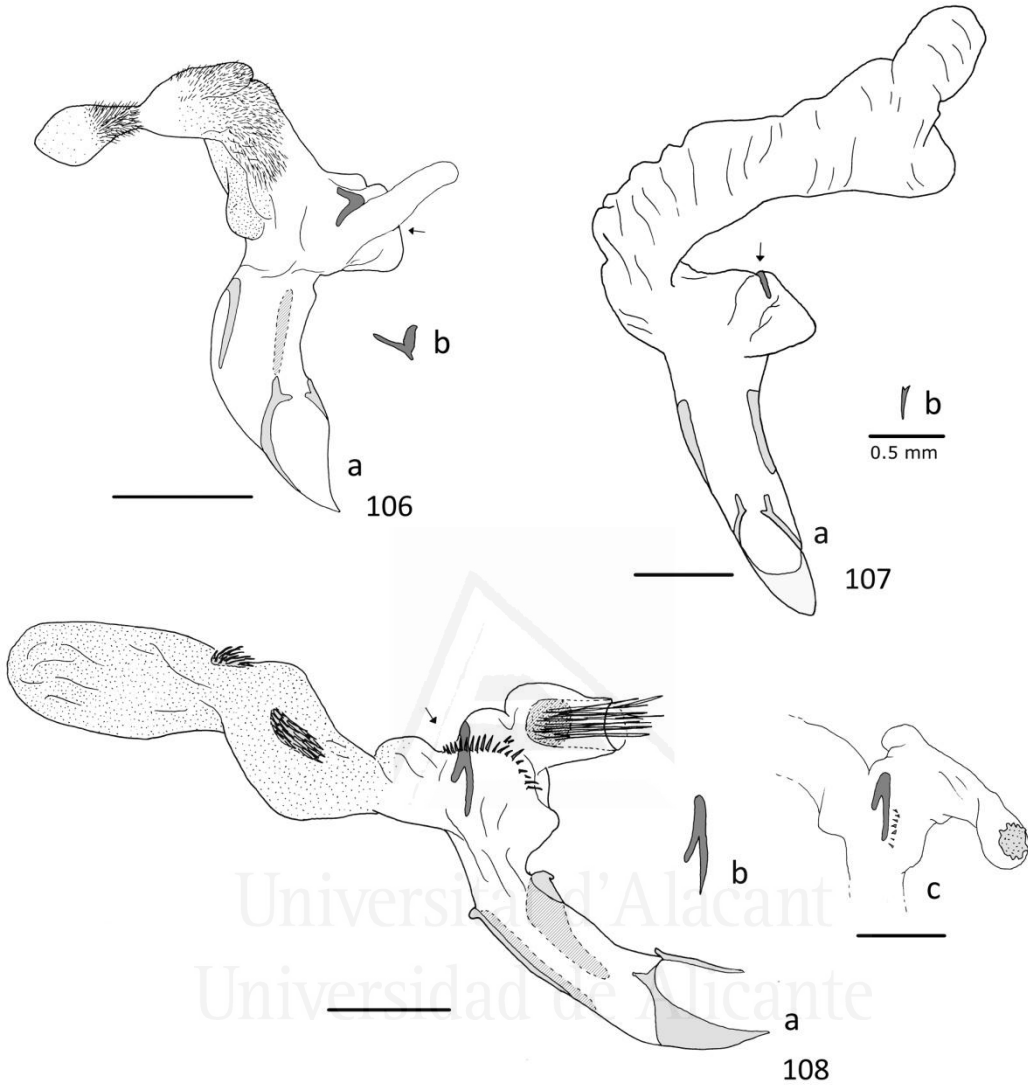
Figure 10, 34, 58, 82, 106, 127.

Material examined. Holotype: ♂ "COSTA RICA. Prov. Cartago. La Unión. Z.P. C. Carpintera. Campo Esc. Istarú. 1750m. 19 JUL 2008. J. Azofeifa, B. Hernández, M. Moraga, M. Zumbado. Luz Mercurio. L_N_208125_539750 #94434/ INB0004158455".

Paratype (1): 1♂ "COSTA RICA. Prov. Cartago. La Unión. Z.P. C. Carpintera. Campo Esc. Istarú. 1750m. 19 JUL 2008. J. Azofeifa, B. Hernández, M. Moraga, M. Zumbado. Luz Mercurio. L_N_208125_539750 #94434/ INB0004158428".

Description. Holotype. Male: Body shape slender, elongated. Length 9.29 mm. Width 4.76 mm. (Figure 10).

Color. Clypeus ochre with two dark brown maculae at the side of the disc; head dark brown with a wide triangular macula on the suture with the clypeus, as wide as the suture; pronotal disc dark brown with bronze to green luster and ochre sides (pattern shown in Figure 34); elytra ochre with several irregular brown maculae concentrated in two bands: one along the elytra base and one median, and numerous sparse punctures on 2/3 of its length; the pygidium is ochre or ochre with small dark flecks, three pairs of larger maculae on the sides and a dark basal band; venter dark brown,



Figures 106–108. Endophallus: a) whole, b) detail of ejaculatory sclerite. 106: *Anomala latifalculata* (Holotype and paratype, Campo Istarú). 107: *A. leopardina* (Paratype, Buenos Aires, Costa Rica). 108: *A. levicollis* (Paratype, Estación La Casona) c) detail of left sacculus without spines (common state). Scale = 1mm.

lighter on the sides and apex, legs ochre with tarsi, extremities of femura and a median macula on coxae and femura dark brown.

Head. Clypeus large, rectangular, with a curved anterior margin; ratio width/length 2.57. Frons with a deep parabolic concavity. Eyes large, ratio interocular width/width of eye 2.88. Length of antennal club: 1.09 mm.

Pronotum. Width 1.81 times length. Lateral margins angulated at $\frac{1}{3}$ of pronotum height, basal portion with parallel lateral margins. Lateral margins regularly convex, anterior angles curved upwards. Basal bead obliterated in the middle. Surface with deep punctures connected by small longitudinal wrinkles and short setae on the anterior part of disc; two symmetric shallow imprints on disc, interior in relation to lateral fossae (Figure 34).

Scutellum with sparse punctures.

Elytra with sparse punctures arranged in irregular rows. First interstice with irregular sparse punctures. Micro-punctation on the entire surface, giving an irregular appearance. Pygidium with oblong punctures and long setae on its margins; surface rugose punctate.

Legs. Protibia (Figure 58) with short apical tooth; middle tooth above internal apex; basal tooth at $\frac{1}{3}$ of internal length. Protarsal claws: internal claw wide and bifurcate, with its upper branch slightly shorter and $\frac{1}{4}$ the width of the lower one. Inferior margin slightly sinuate. Metafemur ratio length/width 3.96. Metatibia nearly smooth above the second external carina, rugose below. First external carina absent, a row with a few setae in its place. Width 0.71 mm.

Abdominal sternites with 3–4 rows of deeply impressed punctures; one row of sparse setae per sternite. Last sternite with sparse punctures, subapical bead sinuate and poorly defined, apical portion medially as wide as sternite.

Male genitalia. Aedeagus (Figure 82) slightly twisted to the left. Parameres with blunt point in lateral view and slightly sinuate ventral margin. Apex of ventral plate curved in lateral view. Endophallus in Figure 106. One long sacculus to the right, with an expanded apex and subapical portion covered with long setae; median portion covered with long setae and microsetation. On the left, an inflation with a long diverticle. Ejaculatory duct opening on the left side.

Female: unknown.

3.2 *A. trapezifera* species group

Variation: head and pronotum with green or bronze luster; larger and more numerous maculae on apical third of elytra; dark maculae on the pygidium expanding until they join together. Body length 10.03 mm, body width 5.18 mm.

Clypeus w/l: 2.67. Interocular ratio (interocular width/width of eye): 2.80. Antennal club: 1.14 mm. Metafemur l/w: 4.10. Metatibia width: 0.74 mm.

Diagnosis: small size, frons with a deep parabolic concavity, pronotum lateral margins parallel on the basal part, surface with large deep punctures and setae, male internal protarsal claw wide, parameres with a blunt point in lateral view, endophallus with thin median plates, a long sacculus, with a subapical ring of setae.

It is differentiated from *Anomala piccolina* by having darker venter, deeper concavity on the frons, a wider clypeus, micro-punctation on elytra surface and the shape of the male genitalia. It is differentiated from *A. perspicax* by being smaller in size, having smaller male eyes, a wide male internal protarsal claw, and the shape of the male genitalia.

Distribution: it is known from one locality in Zona Protectora Cerro de la Carpintera, Cartago province, 1750 m (Figure 127).

Etymology: from the Latin adjective "*latus, a, um*", wide, and an adjective indicating possession from the noun "*falcula, ae*", a small sickle, for its wide internal protarsal claw.

Anomala leopardina Filippini, Micó, Galante, new species

Figure 11, 35, 59, 83, 107, 123.

Material examined. Holotype: ♂ "COSTA RICA, Prov. Puntarenas, Finca Cafrosa, 1 Km NE. de la Escuela Progreso. 1180m. 23 NOV 1995. M. Chinchilla. de Luz L_S_318500_595500 #8267/ INBIOCR1002470471".

Paratypes (5): 1♀ "COSTA RICA, Prov. Puntarenas, Coto Brus, Estación Pittier. 1670m. 9-22 ENE 2000. R. González. de Luz L_S_330030_578645 #56791/ INB000311201"; 1♂ "COSTA RICA. Prov. Puntarenas, Buenos Aires, Camino a Olan. 1425m. 15 al 19 FEB 1999. R. A. Zuniga. Luz. L_S_358631_550525 #63429/ INB0003337380"; 1♂ 1♀ "COSTA RICA, Prov. Puntarenas, Finca

Cafrosa, 1 Km NE. de la Escuela Progreso. 1180m. 23 NOV 1995. M. Chinchilla. de Luz L_S_318500_595500 #8267" CEUA00106061 and INBIOCRI002470481; 1♀ "PUNTARENAS COSTA RICA Las Mellizas 22 nov 1987 COL: A. SOLIS B./ CEUA00106062".

Description. Holotype. Male: Body shape elongated, oval, pronotum narrower than elytra. Length 10.54 mm. Width 6.16 mm. (Figure 11).

Color. Clypeus reddish orange with two darker maculae, head, pronotum and the scutellum dark brown, lateral margins of the pronotum orangey yellow (Figure 35); elytra ochre with dark maculae on a median transversal sinuate band, on the calli, a pair on the sides of the scutellum, and a pair on the sides between the median band and apical calli; pygidium ochre with a dark brown band on basal margin, and brown maculae on lateral fossae; venter and legs ochre, with tarsi and apical part of femura reddish. Frons and pronotum covered with dense fine blonde setae.

Head. Clypeus nearly rectangular, with its anterior margin curved or slightly sinuate, ratio width/length 2.34. Ratio interocular width/width of eye 3.45. Length of antennal club 1.79 mm.

Pronotum. Width 1.61 times length. Lateral margins sinuate, maximum width at 1/3 of pronotum height, on dorsal view as wide as or slightly narrower than the basal margin. Basal bead complete. Surface densely punctate (Figure 35).

Scutellum. Surface with sparse punctures, denser on sides.

Elytra. Surface with regular rows of rounded punctures. First interstice with two irregular rows. **Pygidium.** Surface with dense coalescent punctures, rugose, with long setae on apex.

Legs. A small protuberance between the mesocoxae. Protibia (Figure 59) with long apical tooth; middle tooth below the internal apex of the protibia; basal tooth at nearly 1/2 of internal length. Protarsal claws: internal claw thin, bifurcate, with upper branch as long as and 1/2 the width of the lower one. Inferior margin slightly sinuate. Metafemur ratio length/width 3.61. Metatibia wide basally, covered with dense small punctures, rugose below first external carina. Ratio length/width 0.85 mm.

3.2 *A. trapezifera* species group

Abdominal sternites covered with dense oblong punctures, and 2–3 rows (sternite II) or one row (sternites III–V) of setae per sternite. Last sternite with dense shallow punctures, subapical bead sinuate, thin and complete, apical portion as high as 3/4 of basal part of last sternite.

Male genitalia. Aedeagus in Figure 83. Tectum longer than basal piece. Parameres with curved dorsal margin, acute apex pointing downwards in lateral view. Endophallus in Figure 107. One long lateral sacculus with bifurcated apex, glabrous. Ejaculatory duct opening frontal on a basal, left-sided inflation.

Female: Teeth of protibia wider than males (Figure 59); protarsal claws similar to males, upper branch longer than the lower one, inferior margin straight; last abdominal sternite with apical margin curved.

Variation: clypeus, head, the pronotum and scutellum reddish to dark brown; dark maculae on elytra on one or two transversal sinuate bands; a dark brown band on the pygidium of variable width, usually expanding in the middle. Body length 9.97–11.54 mm, body width 6.15–6.25 mm. Clypeus w/l: 2.27–2.64. Interocular ratio (interocular width/width of eye): 2.90–3.53. Male antennal club: 1.71–2.04 mm; female antennal club: 1.12–1.17 mm. Pronotum w/l: 1.55–1.65. Metafemur l/w: 2.92–3.70. Metatibia width: 0.85–1.02 mm.

Diagnosis: medium size, whole surface covered with sparse setae, pronotum with sinuate lateral margins and very dense punctures, elytra with defined dark maculae, parameres with acute apex pointing downwards in lateral view, endophallus with one glabrous sacculus bifurcating at apex.

Distribution: it is distributed in the southern part of the Tamanca mountain range, from 1180 to 1670 m (Figure 123).

Etymology: Latin adjective meaning “of a leopard”, for the rounded dark maculae on the elytra.

***Anomala levicollis* Filippini, Micó, Galante, new species**

Figure 12, 36, 60, 84, 108, 128.

Material examined. Holotype: ♂ "COSTA RICA. Prov. Alajuela. Guatuso. P.N. Volcán Tenorio. Punto 4: Cerro Montezuma. 1510m. 4 JUL 2008. J. A. Azofeifa. Tp. de Luz 2. L_N_2971750_424050 #94274/ CEUA00105851".

Paratypes (17): 1♂ "Volcán Tenorio. Alajuela. Costa Rica. 1160m. 7/4/2008. Leg. J.A. Azofeifa/ CEUA00105845"; 1♂ "La Esperanza 2300m. Prov. Cartago Costa Rica 30/08/2008 Leg. A. García, M.Zumbado/ CEUA00105844"; 2♂♂ 1♀ "Volcán Tenorio 1160m. Prov. Guanacaste. Costa Rica. 31/08/2008. Leg. J.A. Azofeifa" CEUA00105847, CEUA00105848 and CEUA00105846; 1♀ "COSTA RICA. Prov. Alajuela. Guatuso. P.N. V. Tenorio. Punto 3: Los Pelados. Falda Norte Cerro Montezuma. 1300m. 5 JUN 2008. J. A. Azofeifa. Tp. de Luz 2. L_N_297410_424680 #93856/ CEUA00105849"; 1♂ "COSTA RICA. Prov. Alajuela. Guatuso. P.N. V. Tenorio. Punto 2: Falda N Cerro Montezuma. 1160m. 6 MAY 2008. J. A. Azofeifa. Tp. de Luz 1. L_N_297500_425050 #93745/ CEUA00105850"; 1♂ "Estac. Cacao, 1000–1400m, SW side Volcan Cacao, Guanac. Pr. COSTA RICA Malaise Tp, 1988–1989, GNP Biodiv. Survey. L_N_323300_375700 #22/ INBIOCR1000103717"; 1♀ "R. San Lorenzo, 1050m, R. F. Cord. Guanacaste (Tenorio), Prov. Guan. COSTA RICA. C. Alvarado, Jul 1991, L- N 287800_427600/ INBIOCR1000365225"; 1♂ "Rio San Lorenzo, 1050 m, Tierras Morenas, Z. P. Tenorio, Prov. Guanacaste, Costa Rica, C. Alvarado, Abr 1992, L- N 287800_427600/ INBIOCR1000415243"; 1♂ "Est. La Casona, 1520m, Res. Biol. Monteverde, Prov. Punt. COSTA RICA, N. Obando, Set 1991, L- N 253250_449700/ INBIOCR1000510194"; 1♀ "Quebrada Segunda, Ref. Nac. Fauna Silv. Tapanti, 1250m, Prov. Cartago, Costa Rica, G. Mora, Abr 1992, L- N 194000_560000/ INBIOCR1000535975"; 1♂ "Rio San Lorenzo, 1050m, Tierras Morenas, Z. P. Tenorio, Prov. Guanacaste, Costa Rica, Nov 1992 G. Rodriguez L N 287800_427600/ INBIOCR1000949598"; 1♂ "Est. La Casona, 1520 m, Res. Biol. Monteverde, Prov. Punt., COSTA RICA. Ago 1991, N. Obando, L N 253250,449700/ INBIOCR1001357769"; 1♂ "Est. La Casona, R.B. Monteverde, Prov. Punta, COSTA RICA. 1520 m. Mar 1994, N. Obando. L N 253250_449700 # 2819/ INBIOCR1001780596"; 1♂ "Volcán Tenorio 1160m. Prov. Guanacaste. Costa Rica. 01/09/2008. Leg. J.A. Azofeifa/ CEUA00105852"; 1♀ "COSTA RICA. Prov. Alajuela. Guatuso. P.N. Volcán Tenorio. Punto 4: Cerro Montezuma. 1510m. 6 MAY 2008. J. A. Azofeifa. Tp. de Luz 2. L_N_2971750_424050 #94176/ CEUA00105853".

Description. Holotype. Male: Body shape slender, elongated. Length 12.41 mm. Width 7.08 mm. (Figure 12).

Color. Clypeus and head dark metallic green; pronotal disc metallic dark green, with ochre sides and median part of basal margin (pattern shown in Figure 36). Scutellum dark green with central ochre macula. Elytra metallic green with ochre basal and apical stripes, and ochre coalescent maculae on two median bands; pygidium ochre with four pairs of blackish maculae at sides and black apical margin; venter dark brown with lighter flecks on sternum and ochre sides on abdominal sternites, coxae ochre with a brown macula, femura dark brown with a lighter macula on the first external carina, tarsi reddish brown.

Head. Clypeus trapezoidal, with straight anterior margin; ratio width/length 2.22. Frons with a triangular concavity. Ratio interocular width/width of eye 2.26. Length of antennal club: 1.90 mm.

Pronotum. Width 1.82 times length. Lateral margins angulated at $\frac{1}{3}$ of pronotum length. Basal bead complete. Surface with sparse small shallow punctures, smooth and shiny appearance (Figure 36).

Scutellum with punctures coalescing in horizontal rows.

Elytra with coarse punctures arranged in irregular rows, coalescing. First interstice with irregular dense punctures. Pygidium with deep punctures and long setae on margins; surface rugose punctate.

Legs. Protibia (Figure 60) with apical tooth long; middle tooth above the internal apex; basal tooth at $\frac{1}{3}$ of internal length. Protarsal claws: internal claw bifurcate, with upper branch slightly shorter than and half the width of the lower one. Space between branches wide. Inferior margin sinuate, forming a sharp angle at $\frac{1}{3}$ from tip. Metafemur ratio length/width 3.38. Metatibia nearly smooth above the second external carina, rugose below. First external carina absent, a row with a few spines in its place. Ratio length/width 0.90 mm.

Abdominal sternites with sparse punctures; one row of sparse setae per sternite. Last sternite with sparse punctures, subapical bead sinuate and shallow, apical portion medially as wide as basal portion of sternite.

Male genitalia. Aedeagus (Figure 84) twisted to the left. Parameres with protruding apex in lateral view and sinuate ventral margin. Ventral plate with a wide apical portion curved in lateral view, with a bilobed margin, and ridges at the sides. Endophallus in Figure 108. Sacculus on the right long and wide, covered with dense microsetation, two patches of dense spines at half the length, on ventral and frontal sides. Sacculus on the left shorter, with a sclerotized plate at the apex. It bears very long spines that detach very easily, and most of the specimens (holotype included) lack these spines (Figure 108b). Ejaculatory duct opening frontal, between the sacculi, with inflations on the sides. A row of spines runs ventrally at the base. Median lobes with triangular folds at the apex.

Female: antennal club shorter than males; first tooth of protibia wider than in males, second and third teeth above internal apex (Figure 60); internal protarsal claw with thinner inferior branch and curved inferior margin; last abdominal sternite with apical margin curved.

Variation: body with green or bronze luster; basal ochre macula on the pronotum absent in some specimens; maculae on elytra variable; venter from ochre to blackish brown, abdominal sternites from ochre with dark apical bands to dark brown with ochre sides. One specimen (INBIOCRI000103717) is especially light in color, with a ochre clypeus with two green maculae, a pronotum with a median ochre band, ochre elytra with numerous reddish brown maculae, venter ochre with darker brown maculae in the same pattern as other specimens. Body length 11.02–12.97 mm, body width 6.26–7.08 mm. Clypeus w/l: 2.22–2.47. Interocular ratio (interocular width/width of eye): 1.81–3.2. Male antennal club: 1.75–2.26 mm; female antennal club: 1.14–1.16 mm. Pronotum w/l: 1.76–1.83. Metafemur l/w: 3.28–3.81. Metatibia width: 0.76–1.03 mm.

Diagnosis: medium size, dark color, pronotum trapezoidal, lateral margins angulated, surface smooth, parameres with protruding apex in lateral view, ventral plate with curved apex in lateral view, endophallus with one long sacculus and one that is short, median lobes with triangular folds at the apex.

It is differentiated from *Anomala longisacculata* by its longer male antenna, smoother surface of the pronotum, whose lateral margins are angulated, and the shape of the male genitalia. It is differentiated from *A. trapezifera* by its darker color, smaller size, smoother surface of the pronotum, a wider metafemur in males, and the shape of the male genitalia.

Distribution: widely distributed in the Guanacaste, Tilarán and Talamanca mountain ranges, from 1000 to 1520 m (Figure 128).

Etymology: from the Latin adjectives "*levatus, a, um*", smooth, polished, and "*collis, i*", necked, for the smooth appearance of the pronotum.

Anomala longisacculata Filippini, Micó, Galante, new species

Figure 13, 37, 61, 85, 109, 126.

Material examined. Holotype: ♂ "La Montura Prov. San José Costa Rica 08/12/2007 Leg. M. Moraga/ CEUA00105873".

Paratypes (15): 1♂ "La Montura Prov. San José Costa Rica 07/11/2007 Leg. M. Moraga/ CEUA00105872"; 1♀ "Quebrada González, P.N. Braulio Carrillo (Costa Rica) 550m 21-9-06 T.luz 17:00–21:00 Leg.: Micó, García, Galante/ CEUA00019641"; 1♂ "Est. Pitilla, 700 m, 9 km S Sta. Cecilia, Prov. Guan. COSTA RICA, II curso Parataxon., May 1990, L N 330200_380200/ INBIOCRI000293147"; 1♂ "Sector Cerro Cocori, Fca. de E. Rojas, 150m, Prov. Limon, COSTA RICA, E. Rojas, Oct 1991, L- N 286000_567500/ INBIOCRI000618273"; 1♂ "La Montura Prov. San José Costa Rica 08/12/2007 Leg. M. Moraga/ CEUA00105874"; 1♀ "Albergue Heliconias. Prov. Alajuela Costa Rica 31/01/2008 Leg. D. Gutierrez/ CEUA00105875"; 1♀ "La Montura Prov. San José Costa Rica 12/06/2007 Leg. M. Moraga/ CEUA00105876"; 1♀ "El Copal. Prov. Cartago. Costa Rica. 16/06/2007 Leg. M. Moraga/ CEUA00105877"; 1♀ "El Copal. Prov. Cartago. Costa Rica. 14/07/2007 Leg. M. Moraga/ CEUA00105878"; 1♂ 1♀ "Cabanga, finca J.Martínez. P.

Alajuela. 480m, Costa Rica. 10/II/2010 trampa 1. L. M. Zumbado, J.A.Azofeifa." CEUA00105912 and CEUA00105911; 1♂ 2♀♀ "Cabanga, finca J.Robles. Prov. Alajuela. 480m, Costa Rica. 10/II/2010 trampa 2. L. M. Zumbado, J.A.Azofeifa." CEUA00105915, CEUA00105913 and CEUA00105914; 1♀ "Pitilla. Send. Orosilito. P.N. Guanacaste (Costa Rica) 1150m 5-10-06 T. luz 16:30-6:00. Leg.: Micó, García, Galante/ CEUA00019643".

Description. Holotype. Male: Body shape slender, oval. Length 11.91 mm. Width 6.79 mm. (Figure 13).

Color. Clypeus ochre with two dark green basal maculae at the side of the disc; head dark green, with a ochre median triangle and two lateral small maculae at the suture with the clypeus; pronotal disc metallic dark green, with ochre sides and a short basal median line (pattern shown in Figure 37). Scutellum ochre with dark sides. Elytra ochre with large irregular greenish black maculae concentrated mainly in two transversal bands; pygidium ochre with a dark brown basal triangle and two pairs of maculae at the sides; venter ochre, with sides of abdominal sternites dark brown, legs ochre, with tarsi and extremities of femura dark brown.

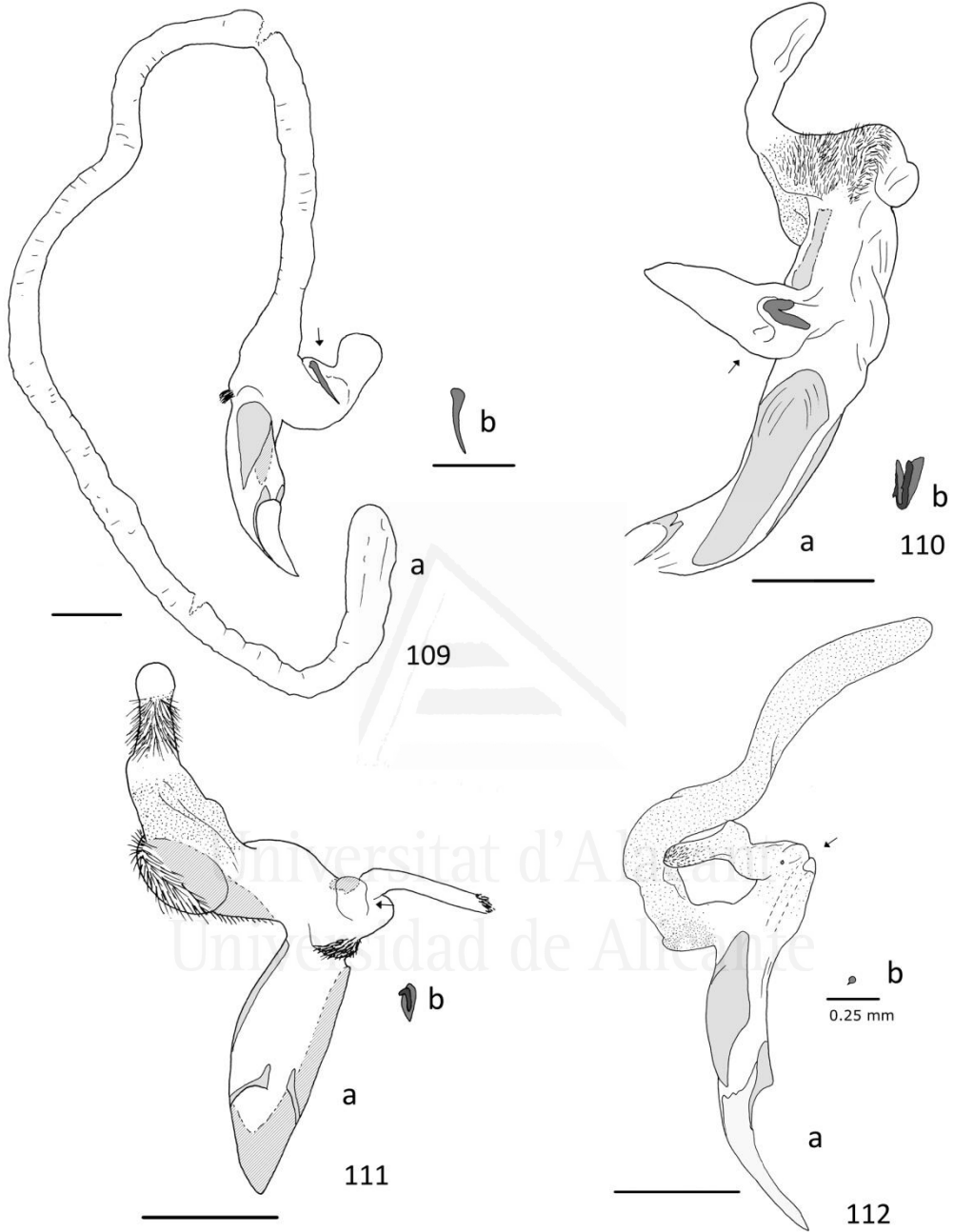
Head. Clypeus trapezoidal, with straight anterior margin; ratio width/length 2.31. Frons with a deep triangular concavity. Ratio interocular width/width of eye 2.83. Length of antennal club: 1.04 mm. Pronotum. Width 1.83 times length. Lateral margins regularly convex. Basal bead complete. Surface with dense rounded punctures and a row of a few long setae on the sides and basal third; surface irregular, with shallow imprints on the disc, medially and on the sides (Figure 37).

Scutellum with sparse punctures.

Elytra with sparse punctures arranged in irregular rows. First interstice with irregular dense punctures.

Pygidium with dense coarse punctures and long setae on margins; surface rugose punctate.

Legs. Protibia (Figure 61) with long apical tooth; middle tooth above internal apex; basal tooth at 1/5 of internal length. Protarsal claws: internal claw bifurcate, with upper branch of the same length as and half the width of the lower one; inferior



Figures 109–112. Endophallus: a) whole, b) detail of ejaculatory sclerite. 109: *Anomala longisacculata* (Paratype, Cabanga, finca J.Martínez). 110: *A. m-fuscum* (Paratype, Esperanza del Guarco, Costa Rica). 111: *A. perspicax* (Paratype, Buenos Aires, Costa Rica). 112: *A. piccolina* (Holotype). Scale = 1mm.

margin slightly sinuate. Metafemur ratio length/width 2.82. Metatibia rugose. Width 1.03 mm. Abdominal sternites with dense punctures; one row of sparse setae per sternite. Last sternite with sparse punctures, subapical bead sinuate and complete, apical portion narrow, wider medially.

Male genitalia. Aedeagus (Figure 85) twisted to the left. Parameres with squared apex in lateral view, inferior angle protruding, and sinuate inferior margin. Endophallus (Figure 109) with extremely long dorsal sacculus, glabrous, slightly wider at the apex, with a small patch of setae at its base. A short ventral sacculus, with a frontal ejaculatory duct opening. The dorsal sacculus at rest is located, completely inverted and folded, inside the muscular sheath of the ejaculatory duct.

Female: antennal club similar in length to males; protibia similar to male, first tooth slightly wider (Figure 61); internal protarsal claw similar to males, inferior margin straight.

Variation: clypeus and apical part of frons can be entirely ochre; median ochre line on pronotum usually absent, or can be longer, reaching anterior margin; elytra from nearly entirely dark to mainly ochre with dense but sparse flecks; elytra with bronze, green or no metallic luster; pygidium with one or two pairs of lateral maculae; impressions on pronotum variable in number and place, in some specimens a shallow median sulcus is present instead; total length of the endophallus of the specimen depicted approximately 25 mm. Body length 10.20–12.16 mm, body width 6.06–6.79 mm. Clypeus w/l: 2.04–2.65. Interocular ratio (interocular width/width of eye): 2.78–2.99. Antennal club: 0.91–1.04 mm. Pronotum w/l: 1.76–1.85. Metafemur l/w: 2.77–3.17. Metatibia width: 0.94–1.03 mm.

Diagnosis: medium size, dark color, pronotum trapezoidal, lateral margins convex, surface with fine punctures, basal tooth on male protibia near the second, well developed, parameres with squared apex in lateral view, inferior angle protruding, endophallus extremely long.

3.2 *A. trapezifera* species group

It is differentiated from *Anomala levicollis* by its shorter male antenna, punctures on surface of the pronotum, convex lateral margins of the pronotum, and the shape of the male genitalia. It is differentiated from *A. trapezifera* by its shorter male antenna, a darker pronotum, wider metafemur in males, and the shape of the male genitalia.

Distribution: widely distributed in the Guacaste, Central, Talamanca mountain ranges and the Tortuguero conservation area on the Caribbean coast, from 10 to 1150 m (Figure 126).

Etymology: from the Latin adjective "*longus, a, um*", long, and the adjective indicating possession from noun "*sacculus, i*", little sack, for its extremely long internal sac.

Anomala m-fuscum Filippini, Micó, Galante, new species

Figure 14, 38, 62, 86, 110, 129.

Material examined. Holotype: ♂ "R. Grande de Orosi, desde Puente R. Dos Amigos hasta la Represa, Prov. Cartago, RICA. 1800m. 22 AGO-15 SET 1995. R. Delgado, Interseccion L_N_186600_562000 #6234/ INBIOCRI002467325"

Paratypes (4): 1♂ "Esperanza del Guarco. Cartago, Costa Rica. 2300m. 5/5/2008. Leg. A. García, M. Zumbado/ CEUA00105903"; 1♂ "R. Grande de Orosi, desde Puente R. Dos Amigos hasta la Represa, Prov. Carta, COSTA RICA. 1400-1800m. MAR 1995. R. Delgado. L_N_186600_562000 #44187/ INBIOCRI002255351"; 1♂ "COSTA RICA Prov. Cartago P.N. Tapantí- Macizo de la Muerte. La Esperanza del Guarco. 2300m. 1 JUN 2008. M.A. Zumbado, A. García. Tp. Luz 1. L_N_188418_552219 #94241/CEUA00106213"; 1♂ "COSTA RICA Prov. Cartago P.N. Tapantí- Macizo de la Muerte. La Esperanza del Guarco. 2300m. 2 JUL 2008. M.A. Zumbado, A. García. Tp. Luz 1. L_N_188418_552219 #94276/CEUA00106214".

Description. Holotype. Male: Body shape slender, elongated. Length 11.10 mm. Width 5.98 mm. (Figure 14).

Color. Clypeus ochre with two reddish maculae at sides of the disc; head reddish brown, with a ochre median triangle and two lateral small maculae at suture with clypeus; pronotal disc ochre, with a reddish brown "M" shaped macula (pattern

shown in Figure 38), head and pronotum with bronze luster; scutellum with reddish brown margins and ochre disc; elytra ochre with bronze maculae on humeral calli and a pair along the basal margin, sparse brownish flecks on punctures; pygidium ochre with two pairs of maculae at the sides, one very large that is near the base and one of elongated maculae along the margins towards the apex; sternum light brown, abdominal sternites ochre with darker apical margin, sternite V mostly dark, legs ochre with tarsi, extremities of femura and one macula on the coxae reddish brown.

Head. Clypeus trapezoidal, with a straight anterior margin, convex on the disc; ratio width/length 2.24. Frons with a triangular concavity. Ratio interocular width/width of eye 2.48. Length of antennal club: 1.40 mm.

Pronotum. Width 1.84 times length. Lateral margins slightly sinuate. Basal bead obliterated in the middle. Surface with shallow sparse punctures, shallow transversal imprints on sides. Posterior margin obliterated in the middle (Figure 38).

Scutellum with sparse punctures.

Elytra with sparse punctures arranged in irregular rows. First interstice with numerous irregular sparse punctures.

Pygidium with coarse punctures and long setae on margins.

Legs. Protibia (Figure 62) with long apical tooth; middle tooth at same level as the internal apex; basal tooth at $1/3$ of internal length. Protarsal claws: internal claw bifurcate, with the upper branch slightly shorter than and $2/3$ the width of the lower one, inferior margin sinuate. Metafemur ratio length/width 4.33. Metatibia with sparse punctures, slightly rugose below the second external carina, first external carina absent, a row with a few spines, width 0.84 mm.

Abdominal sternites with oblong punctures; one row of sparse setae per sternite. Last sternite with sparse punctures, subapical bead sinuate and complete, apical portion wider than sternite.

Male genitalia. Aedeagus in Figure 86. Parameres long, slender with acute apex in lateral view. Endophallus in Figure 110. One sacculus on the left with irregular shapes,

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apex swollen, base large and covered with long setae. A shorter conical sacculus on the right side. Between the sacculi a stripe-like sclerotized plate. Ejaculatory duct opening on the left, on the shorter sacculus.

Female: unknown.

Variation: head and pronotum with bronze or green luster, pronotal disc macula entire or formed by more isolated maculae (INBIOCR100255351); elytra with darker maculae only along the basal margin (holotype) or also along the lateral margin (INBIOCR100255352), or more diffuse forming a transversal median band (CEUA00105903). Body length 10.43–11.36 mm, body width 5.83–6.06 mm. Clypeus w/l: 2.22–2.42. Interocular ratio (interocular width/width of eye): 2.45–2.73. Male antennal club: 1.40–1.59 mm. Pronotum w/l: 1.80–1.84. Metafemur l/w: 3.77–4.06. Metatibia width: 0.80–1.84 mm.

Diagnosis: medium size, pronotum with sinuate lateral margins, with a thin dark pattern, surface with shallow sparse punctures, light colored elytra, parameres long, slender with acute apex in lateral view, endophallus with two short sacculi.

Distribution: Northern Talamanca mountain range, from 1400 to 2300 m (Figure 129).

Etymology: from the Latin letter "M", and qualifying adjective "*fuscus*, -a, -um", brown, referring to the dark pattern in form of an "M" on the pronotum. To be treated as a noun in apposition.

Anomala perspicax Filippini, Micó, Galante, new species

Figure 15, 39, 63, 87, 111, 127.

Material examined. Holotype: ♂ "La Esperanza 2300m. Prov. Cartago. Costa Rica. 30/06/2008 Leg. A. García, M. Zumbado./ CEUA00105879".

Paratypes (6): 1♂ "COSTA RICA. Prov. Puntarenas, R.I. Ujarrás-Salitre-Cabagra, Buenos Aires, 2990m, 19 SEP 2003, M. Alfaro, Tp. Luz, L_S_369282_539197 #75710/ INB0003787797"; 3♀♀ "COSTA RICA. Prov. Cartago. P.N. Tapantí Macizo de la Muerte. La Esperanza del Guarco.

2300m. 6 MAY 2008. M. A. Zumbado, A. García. Tp. Luz 2. L_N_188418_552219 #94177" CEUA00105880, CEUA00105882 and CEUA00105883; 1♀ "COSTA RICA. Prov. Cartago. P.N. Tapantí Macizo de la Muerte. La Esperanza del Guarco. 2300m. 31 MAY 2008. M. A. Zumbado, A. García. Tp. de Luz 1. L_N_188418_552219 #93861/ CEUA00105881"; 1♂ "COSTA RICA. Prov. Cartago. P.N. Tapantí Macizo de la Muerte. La Esperanza del Guarco. 2334m. 5 MAY 2008. A. García, M. A. Zumbado. Tp. de Luz 2. L_N_188418_552219 #93739/ CEUA00105887".

Description. Holotype. Male: Body shape slender, elongated. Length 12.45 mm. Width 5.92 mm. (Figure 15).

Color. Clypeus ochre with two dark brown maculae at the side of the disc; head reddish dark brown with a wide triangular macula on the suture with the clypeus, as large as the suture; pronotal disc dark brown with a green luster and ochre sides (pattern shown in Figure 39). Elytra ochre with several irregular brown maculae concentrated in three bands: one along the elytra base, one median and one on 2/3 of the length; pygidium ochre with two pairs of large dark maculae at sides and a dark basal band; venter brown with lighter bands on basal half of abdominal sternites, legs ochre with tarsi, extremities of femura and a median macula on coxae and femura dark brown.

Head. Clypeus large, rectangular, with sinuate anterior margin; ratio width/length 2.64. Frons with a deep parabolic concavity. Eyes large, ratio interocular width/width of eye 1.84. Length of antennal club: 1.84 mm.

Pronotum. Width 1.69 times length. Lateral margins angulated at 1/3 of pronotum height, lateral margins on basal portion parallel. Basal bead nearly complete. Surface with deep punctures connected by small longitudinal wrinkles (Figure 39).

Scutellum with sparse punctures.

Elytra with sparse punctures arranged in irregular rows. First interstice with irregular sparse punctuation. Micro-punctuation on the entire surface, giving an irregular appearance.

Pygidium with oblong punctures and long setae on margins; surface rugose.

Legs. Protibia (Figure 63) with short apical tooth; middle tooth above internal apex; basal tooth at $\frac{1}{3}$ of internal length. Protarsal claws: internal claw bifurcate, with the upper branch slightly shorter and $\frac{2}{3}$ the width of the lower one. Inferior margin slightly sinuate. Metafemur ratio length/width 3.77. Metatibia punctate to rugose punctate. First external carina absent, a row of sparse setae in place; width 0.87 mm.

Abdominal sternites with 3–4 rows of deeply impressed punctures; surface slightly rugose; one row of sparse setae per sternite. Last sternite with oblong punctures, subapical bead slightly sinuate and poorly defined, apical portion narrow.

Male genitalia. Aedeagus in Figure 87. Parameres long and slender in lateral view. Ventral plate with curved apex in lateral view. Endophallus in Figure 111. One long sacculus to the right, with expanded apex, and a subapical ring of long setae; median portion covered with microsetation; inflation at base covered with long setae. On the left, an inflation with a long apical diverticle with sclerotized setae on the tip; a patch of setae on the posterior side. Ejaculatory duct opening on the left side.

Female: Antennal club shorter and eyes smaller compared to males; first tooth of protibia slightly wider (Figure 63); protarsal claws similar to males, internal claw narrower, upper branch as long as the inferior one; last abdominal sternite with a curved apical margin.

Variation: head and pronotum with green or bronze luster; one male (INB0003787797) with a row of a few setae on the anterior part of the pronotum. Body length 12.04–13.39 mm, body width 5.88–6.47 mm. Clypeus w/l: 2.32–2.82. Interocular ratio (interocular width/width of eye): 1.84 (male); 2.48–2.87 (female). Male antennal club: 1.73–1.84 mm; female antennal club: 1.26–1.34 mm. Pronotum w/l: 1.68–1.72. Metafemur l/w: 2.92–3.77. Metatibia width: 0.86–1.00 mm.

Diagnosis: medium size, frons with a deep parabolic concavity, lateral margins of pronotum angulated, surface with deep punctures, males with large eyes and a long antennal club, parameres long and slender in lateral view, the endophallus has a long sacculus, with a subapical ring of setae.

It is differentiated from *Anomala piccolina* by its larger size, darker venter, deeper concavity on frons, micro-punctation on elytra surface, and the different shape of the male genitalia. It is differentiated from *A. latifalculata* by its larger size, wider male eyes, narrower male internal protarsal claw, and the different shape of the male genitalia.

Distribution: Talamanca mountain range, from 2300 to 3000 m (Figure 127).

Etymology: from the Latin adjective "*perspicax*", sharp sighted, perspicacious, due to its long antennal clubs and large eyes of the male.

Anomala piccolina Filippini, Micó, Galante, new species

Figure 16, 40, 64, 88, 112, 121.

Material examined. Holotype: ♂ "Est. Biol. Las Alturas 1500m, Coto Brus, Prov. Puntarenas, Costa Rica, Ago 1992, M. Ramirez y E. Sancho L-S 322500_591300/INBIOCRI000874987".

Paratypes (3): 1♀ "COSTA RICA. Prov. Puntarenas, P. Int. La Amistad, Estac. Altamira, Send. Gigantes, 1300 - 1400m, 8 SEP 2001. R. G. Tenorio, Libre L_S_331300_571500 #64778/INB0003378870"; 2♂♂ "Est. Biol. Las Alturas 1500m, Coto Brus, Prov. Puntarenas, Costa Rica, Ago 1992, M. Ramirez y E. Sancho L-S 322500_591300" CEUA00106065 and INBIOCRI000874944.

Description. Holotype. Male: Body shape slender, elongated. Length 9.42 mm. Width 5.00 mm. (Figure 16).

Color. Clypeus and head dark reddish brown; pronotal disc dark brown with sides and central vertical band ochre (pattern shown in Figure 40). Elytra ochre with several irregular brown maculae concentrated in three bands: one along the elytra base, one median and one on 2/3 of the length; pygidium ochre with small dark flecks; venter brownish, ochre on the sides, legs ochre with tarsi and apical part of femura dark brown.

Head. Clypeus rectangular, with a curved anterior margin; ratio width/length 2.44. Eyes very large, ratio interocular width/width of eye 1.97. Length of antennal club:

3.2 *A. trapezifera* species group

1.32 mm. Pronotum. Width 1.74 times length. Lateral margins angulated at $\frac{1}{3}$ of lateral height, parallel on basal portion. Basal bead obliterated in the middle. Surface with deep punctures connected by small longitudinal wrinkles (Figure 40).

Scutellum with sparse punctures.

Elytra with sparse punctures arranged in irregular rows. Row on first interstice bifurcating at base.

Pygidium with oblong punctures and long setae on the entire surface.

Legs. Protibia (Figure 64) with long apical tooth; middle tooth at the same level as internal apex; basal tooth at $\frac{2}{5}$ of internal length. Protarsal claws: internal claw bifurcate, with its upper branch slightly shorter and $\frac{2}{3}$ the width of the lower one. Inferior margin slightly sinuate. Metafemur ratio length/width 3.08. Metatibia rugose punctate. Width 0.75 mm. First external carina defined by deep and pigmented punctures.

Abdominal sternites with 3–4 rows of sparse oblong punctures; surface slightly rugose; one row of sparse setae per sternite. Last sternite with oblong punctures, with subapical bead sinuate and complete, apical portion as wide as the subapical bead.

Male genitalia. Aedeagus (Figure 88) twisted to the right. Parameres with sinuate dorsal and ventral margins in lateral view, apex expanded and sharp. Endophallus in Figure 112, with two sacculi: a very long dorsal one, covered in microsetation, denser at the base; a shorter ventral one, with setae at the apex. Ejaculatory duct opening frontal on the ventral side. Ejaculatory sclerite vestigial. Lateral lobes heavily sclerotized and convex shaped.

Female: antennal club shorter compared to males; first tooth of protibia longer and wider, internal apex lower in position than in males (Figure 64); metatibia stouter compared to males; protarsal claws similar to males, internal claw narrower, upper branch as long as the inferior one; last abdominal sternite with curved apical margin.

Variation: body length 8.80–9.67 mm, body width 4.53–5.14 mm. Clypeus w/l: 2.22–2.84. Interocular ratio (interocular width/width of eye): 1.72–2.21. Male antennal club:

1.23–1.32 mm; female antennal club: 1.06 mm. Pronotum w/l: 1.63–1.79. Metafemur l/w: 2.69–3.23. Metatibia width: 0.69–0.76 mm.

Diagnosis: small size, lateral margins of pronotum angulated, surface with deep rounded punctures, parameres with squared apex and sinuate margins in lateral view, endophallus with convex median plates, two long sacculi, reduced ejaculatory sclerite.

It is differentiated from *Anomala latifalculata* by having lighter venter, no concavity on frons, narrower clypeus, punctation on elytra surface simple, and the shape of the male genitalia. It is differentiated from *A. perspicax* by its smaller size, lighter venter, no concavity on frons, simple punctation on elytra surface, and the shape of the male genitalia.

Distribution: Southern part of the Talamanca mountain range, from 1300 to 1500 m (Figure 121).

Etymology: from the Italian adjective "*piccolo, a*", small, for the reduced size of this species, treated here as a noun in apposition.

Anomala polygona Bates, 1888

Figure 17, 41, 65, 89.

Material examined. Holotype: ♂ "Costa Rica/ *Anomala polygona* Bates/ H.W.Bates Biol. Centr. Amer." MNHN.

Additional material: 1♂ "Escazu Costa Rica/ *Aprosterna polygona* Bts/ Coll. Ohaus Mus. Berlin/ Cum typo comparatum" MNHUB.

1♀ " COSTA RICA. Prov. Limón, P.I. L. A., Send.Circular, 2450m, 27–29 MAR 2003, R. González, D.Rubí, R. Delgado, M. Alfaro, Tp. Luz Mercurio, L_S_340258_577465 #74176/ INB0003724484"

Overview: length: 12–13 mm. Habitus in Figure 17. Clypeus, head, pronotum and scutellum metallic green or dark bronze, pronotum with uniform color or a lighter band on the sides (Figure 41); elytra ochre ochre with irregular maculae at base, on a median transversal line and near the apex, several small flecks on the entire surface;

3.2 *A. trapezifera* species group

pygidium reddish ochre with small dark flecks; venter and legs reddish brown. Clypeus trapezoidal with a slightly sinuate anterior margin. Pronotum (Figure 41) with strongly sinuate lateral margins, surface with coarse punctures, a few long setae. Scutellum with sparse long setae. Protibia on Figure 65. Metafemur and metatibia slender. Aedeagus (Figure 89) symmetric, parameres with a blunt point and slightly sinuate ventral margin.

Diagnosis: the most recognizable features are the deeply sinuate pronotal lateral margins and the dark colored pronotum.

Notes: no recently collected male specimens corresponding to this species were found. The female specimen from the INBio collection shares the shape of the pronotum, its general coloring and the presence of setae on the scutellum and pronotum with the type material, but male specimens are required to confirm this identification.

Anomala stillaticia Filippini, Micó, Galante, new species

Figure 18, 42, 66, 90, 113, 125.

Material examined. Holotype: ♂ "La Catarata, Prov. Carta., COSTA RICA. 1700m. AGO 1994. G. Mora, Desconocido L_N_560300_190900 #3183/ INBIOCRI002037919".

Paratypes (3): 1♀ "Quebrada Segunda., P. N. Tapanti, A. C. Amistad, Prov. Carta, COSTA RICA. 1150 m. Jun 1994, G. Mora, L N 194000_559800 # 3009/ INBIOCRI001907330"; 1♂ "R. Grande de Orosi, desde Administracion hasta Sendero La Pava, Prov. Cartago, COSTA RICA. 1150–1600m. DIC 1995. G. Mora, Interseccion L_N_192500_560400 #648/ INBIOCRI002392030"; 1♂ "Quebrada Segunda, P. N. Tapanti, 1250m, Prov. Cartago, Costa Rica, Jul 1992, G. Mora, L- N 194000_560000/ CEUA00106066".

Description. Holotype. Male: Body shape slender, elongated. Length 11.90 mm. Width 6.54 mm. (Figure 18).

Color. Clypeus ochre with two reddish elongated maculae at the sides of the disc; head reddish brown with bronze green luster; pronotal disc ochre, with a reddish brown wide "M" shaped macula (pattern shown in Figure 42), with green luster.

Scutellum reddish brown with elongated ochre macula. Elytra ochre with large reddish brown maculae on three transversal bands: basal, median and on the apical third, maculae on median band arranged in a wavy line; pygidium ochre with three pairs of small maculae at sides; sternum light brown, abdominal sternites ochre with a darker apical margin, legs ochre with tarsi and extremities of femura reddish brown.

Head. Clypeus trapezoidal, with straight anterior margin; ratio width/length 2.04. Frons with a triangular concavity. Ratio interocular width/width of eye 1.50. Length of antennal club: 1.97 mm.

Pronotum. Width 1.91 times length. Lateral margins regularly convex. Basal bead obliterated in the middle. Surface with sparse punctures, connected by small shallow wrinkles, and a row of a few long setae on the sides (Figure 42).

Scutellum with sparse punctures on disc.

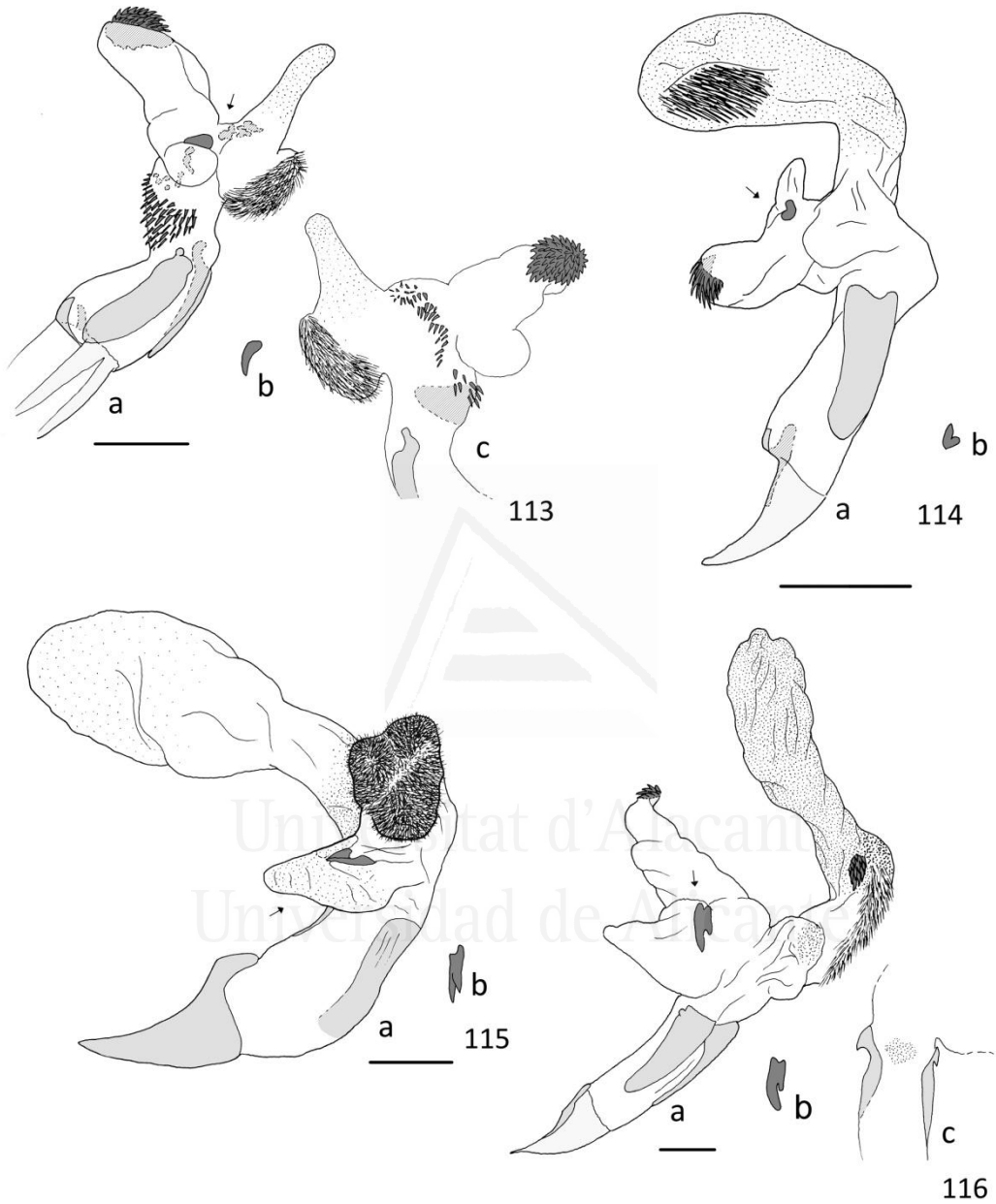
Elytra with sparse punctures arranged in irregular rows. First interstice wide with dense irregular punctures concentrated in a median band. Micro-punctation on the entire surface giving an irregular appearance.

Pygidium with dense coarse punctures and long setae on margins; surface rugose.

Legs. Protibia (Figure 66) with long apical tooth; middle tooth at the same level as internal apex; basal tooth at $1/3$ of internal length. Protarsal claws: internal claw bifurcate, with the upper branch the same length as, and $2/5$ the width of the lower one. Straight inferior margin. Metafemur ratio length/width 3.44. Metatibia smooth, slightly rugose below the second external carina. First external carina defined. Width 0.86 mm.

Abdominal sternites with coarse punctures; one row of sparse setae per sternite. Last sternite with sparse punctures, subapical bead sinuate and complete, apical portion medially as wide as the last sternite.

Male genitalia. Aedeagus (Figure 90) twisted to the left. Parameres long with protruding apex in lateral view.



Figures 113–116. Endophallus: a) whole, b) detail of ejaculatory sclerite. 113: *Anomala stillaticia* (Paratype, Río Grande de Orosi, Costa Rica) c) view of the other side. 114: *A. subridens* (Holotype). 115: *A. subusta* (Holotype). 116: *A. tenoriensis* (Holotype) c) detail of ventral portion. Scale = 1mm.

Ventral plate with a large apical portion curved in lateral view.

Endophallus (Figure 113) with a fringe of thick spines at the base, which continues ventrally toward the apex as sparse spines. Two sacculi at the apex, a thin dorsal one covered with microsetation, with a large inflation at the base, covered with long setae; a wider ventral sacculus, ending with a dense cluster of thick setae; ejaculatory duct opening located at the base on the left side, among frontal inflations. Median lobes with triangular folds at the apex.

Female: antennal club shorter than in males, but longer than in females of other species; smaller eyes; first tooth of protibia wider, middle tooth above the internal apex (Figure 66); internal protarsal claw similar to males, upper branch longer than the inferior one; metafemur stouter; last abdominal sternite with curved apical margin.

Variation: pronotal disc dark brown with ochre margins in the female specimen; size and number of dark maculae on elytra and pygidium variable; venter from reddish to dark brown; dark apical margin on abdominal sternites can extend medially to the entire width of the sternite. Body length 11.45–11.90 mm, body width 6.37–6.56 mm. Clypeus w/l: 2.03–2.26. Interocular ratio (interocular width/width of eye): 1.50–1.58 (male); 2.31 (female). Male antennal club: 1.97–2.02 mm; female antennal club: 1.40 mm. Pronotum w/l: 1.90–1.99. Metafemur l/w: 3.44–3.95 (male) 2.96 (female). Metatibia width: 0.86–0.97 mm.

Diagnosis: medium size, male with large eyes and long antennal clubs, lateral margins of pronotum convex, surface with sparse punctures, elytra with large maculae, parameres long with protruding apex in lateral view, ventral plate with curved apex in lateral view, endophallus with two short sacculi and abundance of spines and setation.

Distribution: a few localities in the northern part of the Talamanca mountain range, from 1150 to 1250 m (Figure 125).

Etymology: from the Latin adjective "*stillaticius*, -a, -um", dripping, for the elytral pattern, resembling a dark dripping band.

***Anomala subridens* Filippini, Micó, Galante, new species**

Figure 19, 43, 67, 91, 114, 130.

Material examined. Holotype: ♂ "COSTA RICA. Prov. Cartago, R.F. Río Macho, Calle hasta Límite con Pina, 2700m, 9 - 14 OCT 2002, R. González Tenorio, Luz normal, L_N_185700_550400 #71781/ INB0003546311".

Paratypes (16): 1♂ COSTA RICA. Prov. Cartago, El Guarco, San Isidro, Est. Esperanza. 2600m. 14 al 21 MAR 2001. R. González. Luz. L_N_185285_550117 #63507/ INB0003340288"; 1♂ COSTA RICA. Prov. Cartago, R.F. Río Macho, Calle hasta Límite con Pina, 2700m, 25-30 AGO 2002, R. González Tenorio, Luz ambiente, L_N_185700_550400 #71384/ INB0003535819"; 1♂ COSTA RICA. Prov. Cartago, R.F. Río Macho, Calle hasta Límite con Pina, 2700m, 9 - 14 OCT 2002, R. González Tenorio, Luz normal, L_N_185700_550400 #71781/ INB0003546276"; 1♀ COSTA RICA. Prov. Cartago, R.F. Río Macho, Calle hasta Límite con Pina, 2700m, 16-21 NOV 2002, R. González Tenorio, Luz normal, L_N_185700_550400 #72156/ INB000353609"; 1♀ COSTA RICA. Prov. Cartago, R.F. Río Macho, Send. Límite con Parcelas UNA, 2550m, 13-24 NOV 2002, R. González Tenorio, Tp. Intersección, L_N_185550_549600 #72166/ INB000353868"; 1♂ Est. Cuerici, 4.6 Km al E. de Villa Mills, Prov. San Jose, COSTA RICA. 2600m. 21-26 SET 1995. A. Picado, de Luz. L_S_389400_499600 #6307/ INBIOCR1002435185"; 1♀ "Esperanza del Guarco. Cartago, Costa Rica. 2300m. 5/6/2008. Leg. A. García, M. Zumbado/ CEUA00105856"; 4♂♂ "La Esperanza 2300m. Prov. Cartago. Costa Rica. 29/09/2008 Leg. A. García, M. Zumbado." CEUA00105857, CEUA00105858, CEUA00105859 and CEUA00105862; 2♂♂ "La Esperanza 2300m. Prov. Cartago. Costa Rica. 30/08/2008 Leg. A. García, M. Zumbado." CEUA00105860 and CEUA00105864; 1♂ 1♀ "La Esperanza 2300m. Prov. Cartago. Costa Rica. 28/09/2008 Leg. A. García, M. Zumbado." CEUA00105863 and CEUA00105861; 1♂ COSTA RICA. Prov. Cartago, El Guarco, R.F. Río Macho, Est. La Esperanza del Guarco, 2700m, 22 - 27 ENE 2002, R. G. Tenorio, Luces ambiente L_N_185600_550000 #66624/ INB0003422347".

Description. Holotype. Male: Body shape slender, elongated. Length 12.63 mm. Width 6.57 mm. (Figure 19).

Color. Clypeus ochre ochre with two large greenish brown basal maculae; head metallic green with a lighter macula medially on the suture with the clypeus; pronotal disc ochre, with a dark metallic green wide "M" shaped macula (pattern shown in Figure 43). Scutellum ochre with green margins. Elytra ochre with pairs of irregular brown maculae on the calli, along the basal and lateral margins, and on the disc forming a V shape, and several small dark flecks on the entire surface; pygidium ochre with three pairs of small dark maculae on the sides, several small flecks on punctures, mainly at the base; venter dark brown with ochre maculae at the sides of abdominal sternites, legs ochre with tarsi, extremities and maculae on femura and coxae reddish brown.

Head. Clypeus rectangular, with blunt anterior angles and a sinuate anterior margin, convex on the disc; ratio width/length 2.43. Frons with a triangular concavity. Ratio interocular width/width of eye 2.91. Length of antennal club: 2.02 mm.

Pronotum. Width 1.73 times length. Lateral margins sinuate. Basal bead complete. Surface with dense fine punctures; irregular shallow imprints on the disc (Figure 43). Scutellum convex, with coarse punctures.

Elytra with sparse punctures arranged in irregular rows. First interstice with irregular sparse punctures.

Pygidium with dense oblong punctures and long setae on margins; surface slightly rugose.

Legs. Protibia (Figure 67) with apical tooth long; middle tooth at the same level as the internal apex; basal tooth at $1/3$ of internal length. Protarsal claws: internal claw bifurcate, with the upper branch the same length as and $2/3$ the width of the lower one. Inferior margin slightly curved. Metafemur ratio length/width 4.76. Metatibia rugose. First external carina well defined. Width 0.77 mm.

Abdominal sternites with dense small shallow punctures in 4–5 irregular rows; one row of sparse setae on the sternites III–V, several rows on the sternite II. Last sternite punctate, subapical bead slightly sinuate and complete, apical portion narrow.

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Male genitalia. Aedeagus (Figure 91) slightly twisted to the left. Parameres slender, with acute apex in lateral view. Endophallus (Figure 114) composed by two sacculi, one dorsal, large, covered with microsetation and a patch of long spines on one side; the other ventral, with a patch of short thick setae on the apex. Ejaculatory duct opening frontal, at base of the shorter sacculus.

Female: antennal club shorter compared to males; first tooth of protibia wider than in males, middle tooth above the internal apex (Figure 67).

Variation: pronotum from green with ochre lateral margins and central part of the basal margin, to ochre with an "M" shaped macula; density of maculae on the elytra variable; abdominal sternites from completely dark to brown with several lighter maculae on the entire width. Body length 12.04–13.53 mm, body width 6.26–7.51 mm. Clypeus w/l: 2.28–2.76. Interocular ratio (interocular width/width of eye): 2.51–2.98. Male antennal club: 1.63–2.09 mm; female antennal club: 1.40 mm. Pronotum w/l: 1.68–1.74. Metafemur l/w: 2.92–3.00 (female) 3.95–4.76 (male). Metatibia width: 0.77–0.91 mm.

Diagnosis: medium size, pronotum with sinuate lateral margins, surface with fine punctures, male metafemur narrow, parameres slender, with an acute apex in lateral view, endophallus with one short sacculus and one long.

It is distinguished from *A. aspersa* by larger male eyes, longer male antenna, more sinuate pronotum lateral margins, and the male genitalia. It is distinguished from *A. trapezifera* by the shorter male antenna, more sinuate pronotum lateral margins, and the shape of the male genitalia. It is separated from *A. vallisneria* by its longer male antenna, more sinuate pronotum margins, darker abdomen, and the male genitalia. It is distinguished from *A. vulcanicola* by its narrower pronotum, smaller and more diffuse flecks on the elytra, its darker abdomen, and the male genitalia.

Distribution: Northern Talamanca mountain range, from 2300 to 2700 m (Figure 130).

Etymology: from the Latin present participle "*subridens*" smiling, from the central macula on the elytra resembling a smile.

***Anomala subusta* Filippini, Micó, Galante, new species**

Figure 20, 44, 68, 92, 115, 131.

Material examined. Holotype: ♂ "Est. Cacao, 1000–1400m, Lado SO Vol. Cacao, P. N. G., Prov. Guan, COSTA RICA, Elfin Rainforest 91, May 1991, L- N 323300_375700/ INBIOCR1000531839".

Paratypes (22): 3♂♂ 2♀♀ "Est. Cacao, 1000–1400m, Lado SO Vol. Cacao, P. N. G., Prov. Guan, COSTA RICA, Elfin Rainforest 91, May 1991, L- N 323300_375700" INBIOCR1000533195, INBIOCR1000533196, INBIOCR1000531838, INBIOCR1000531837 and INBIOCR1000533192; 1♂ "COSTA RICA. Prov. Cartago, Transecto Irazú - Braulio Carrillo, Camp. N° 1, 1760m, 2–4 JUN 2004, W. Porras, M. Zumbado, Libre, L_N_226940_549456 #77262/ INB0003850383"; 1♂ "Volcán Tenorio. Alajuela. Costa Rica. 1160m. 6/4/2008. Leg. R. González/ CEUA00105824"; 1♂ "COSTA RICA. Prov. Alajuela. Guatuso. P.N. Volcán Tenorio. Punto 3: Los Pelados Falda N Cerro Montezuma. 1300m. 3 JUL 2008. J. A. Azofeifa. Tp luz 1. L_N_297410_424680 #94265/ CEUA00105825"; 1♂ "COSTA RICA. Prov. Alajuela. Guatuso. P.N. Volcán Tenorio. Punto 4: Cerro Montezuma. 1510m. 4 JUL 2008. J. A. Azofeifa. Tp. Luz 2. L_N_297175_424050 #94274/ CEUA00105826"; 3♂♂ 1♀ "COSTA RICA. Prov. Cartago. Paraíso. P.N.Tapantí. Torre Muestreo. 1600m. 31 MAY 2008. R. Gonzalez. Tp. Luz 1. L_N_189292_560783 #94242" CEUA00105827, CEUA00105828, CEUA00105829 and CEUA00105831; 1♂ "COSTA RICA. Prov. Alajuela. Guatuso. P.N. Volcán Tenorio. Punto 4: Cerro Montezuma. 1510m. 3 JUL 2008. J. A. Azofeifa. Tp Luz 1. L_N_297175_424050 #942730/ CEUA00105830"; 1♂ 1♀ "COSTA RICA. Prov. Alajuela. Guatuso. P.N. Volcán Tenorio. Punto 4: Cerro Montezuma. 1510m. 28 JUN 2008. J. A. Azofeifa. Tp. Luz. L_N_297175_424050 #94187" INB0004154055 and INB0004154069; 1♀ "COSTA RICA Prov. Alajuela. Guatuso. P.N. Volcán Tenorio. Punto 2: Falda N Cerro Montezuma. 1160m. 4 Jun 2008. J. A. Azofeifa. Tp. de Luz 2. L_N_297500_425050 #93853/ CEUA00105804"; 1♂ 1♀ "COSTA RICA. Prov. Cartago. Paraíso. P.N.Tapantí. Torre Muestreo. 1600m. 2 JUN 2008. R. Gonzalez. Tp. Luz 1. L_N_189292_560783 #93858" CEUA00105835 and CEUA00105832; 1♀ "COSTA RICA. Prov. Alajuela. Guatuso. P.N. Volcán Tenorio. Punto 4: Cerro Montezuma.

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1510m. 4 JUN 2008. J. A. Azofeifa. Tp. Luz 2. L_N_297175_424050 #94240/ CEUA00105833"; 1♀ "La Esperanza 2300m. Prov. Cartago. Costa Rica 30/08/2008 Leg. A. García, M. Zumbado/ CEUA00105834"; 1♀ "Estación La Casona, Prov. Puntarenas, COSTA RICA, 1520 m. agos 1993, N. G. Obando, L N 253250_449700 #2295/ INBIOCR1001912044".

Description. Holotype. Male: Body shape elongated, expanded at the apical third of elytra. Length 14.16 mm. Width 8.38 mm. (Figure 20).

Color. Head and clypeus reddish brown. Pronotum blackish brown with ochre edges (pattern on Figure 44). Scutellum blackish brown. Elytra blackish brown with ochre basal edge and maculae on median transversal band. Pygidium ochre with a median vertical dark band, largest at the base, and two small dark maculae on the sides. Venter brown, abdominal sternites brown to ochre with dark brown apical margins; legs reddish brown with ochre femura.

Head. Clypeus trapezoidal, with anterior margin straight, densely but shallowly punctate; ratio width/length 2.40. Frons with dense and shallow punctures. Ratio interocular width/width of eye 2.92. Length of antennal club: 1.54 mm.

Pronotum. Width 1.84 times length. Lateral margins homogeneously convex. Basal bead complete. Surface with dense round punctures (Figure 44).

Scutellum with sparse punctures concentrated on its disc.

Elytra. Surface with irregular rows of large deep punctures, often coalescent. First interstice with 2–3 irregular rows of smaller punctures.

Pygidium. Surface with small punctures, with shallow vertical wrinkles connecting pairs of punctures and with long setae on apex.

Legs. Protibia (Figure 68) with short apical tooth; middle tooth slightly above the internal apex; basal tooth at $\frac{1}{3}$ of the internal length. Protarsal claws: internal claw bifurcate, with upper branch as long as and $\frac{2}{3}$ the width of the lower one; inferior margin slightly sinuate. Metafemur ratio length/width 3.21. Metatibia swelling on basal third, covered with sparse punctures, rugose below second external carina. Width 1.40 mm.

Abdominal sternites with 4–6 rows of shallow oblong punctures and one row of sparse setae per sternite. Last sternite punctate, subapical bead sinuate with wide central curvature and complete, apical portion wider than sternite.

Male genitalia. Aedeagus in Figure 92. Parameres stout, with apex pointing downwards in lateral view, ventral margin with well defined angle. Endophallus in Figure 115. One long sacculus on the right, swollen at the apex, with microsetation at the base and apex. A shorter, tapering sacculus on the left, with microsetation at the apex, and a large inflation covered with setae frontally at the base. Ejaculatory duct opening at half the length of the shorter sacculus, on the frontal surface, facing the apex of the sacculus.

Female: antennal club shorter compared to males; first tooth of protibia wider (Figure 68); protarsal claws similar to males, upper branch longer than the lower one and wider than in males; last abdominal sternite with curved apical margin.

Variation: clypeus dark brown to ochre with two darker basal maculae; pronotum from ochre with an irregular macula to entirely dark; elytra from ochre with numerous blackish maculae to almost completely blackish brown, but with a ochre basal edge and maculae on the median transversal band; middle tooth of protibia slightly above or at the same level as the internal apex; pygidium from ochre with two pairs of dark brown maculae on the sides, one large along the basal margin and one flattened along the apical sides, or with a median vertical dark band and two small dark maculae on the sides, to completely dark; femura and tarsi from dark to reddish brown with lighter maculae. Body length 13.09–14.16 mm, body width 7.07–8.38 mm. Clypeus w/l: 2.13–2.40. Interocular ratio (interocular width/width of eye): 2.91–3.30. Male antennal club: 1.32–1.54 mm; female antennal club: 1.23 mm (n=2). Pronotum w/l: 1.74–1.85. Metafemur l/w: 2.89–3.27. Metatibia width: 1.02–1.40 mm.

Diagnosis: large size, dark color, trapezoidal pronotum with convex lateral margins, protibia stout in both sexes, surface with large punctures, parameres stout, with the

apex pointing downwards in lateral view, endophallus with one long sacculus and one that is short.

Similar to *A. tenoriensis*, it is differentiated by its brown pronotum, diffuse ochre flecks on the elytra, a pygidium with large dark maculae, and the shape of the male genitalia.

Distribution: widely distributed in the Guanacaste, Tilarán, Central and northern Talamanca mountain ranges, from 1000 to 2300 m (Figure 131).

Etymology: from the past participle of Latin verb "*suburo* " slightly burned, for its irregular dark pigmentation.

Anomala tenoriensis Filippini, Micó, Galante, new species

Figure 21, 45, 69, 93, 116, 122.

Material examined. Holotype: ♂ "COSTA RICA. Prov. Alajuela. Guatuso. P.N. Volcán Tenorio. Punto 1: Catarata Río Buenavista. 800m. 25-26 MAY 2009. J. A. Azofeifa. Tp. Luz Mercurio. L_N_298380_427850 #97190/ INB0004219250".

Paratypes (7): 1♂ "COSTA RICA. Prov. Alajuela. Guatuso. Sitio Catarata Río Buenavista. 700-800m. 23 MAR 2007. J. A. Azofeifa. Tp. Luz. L_N_298474_428857 #91074/ INB0004075900"; 1♂ 2♀♀ "COSTA RICA. Prov. Alajuela. Guatuso. P.N. Volcán Tenorio. Punto 1: Catarata Río Buenavista. 800m. 5 MAY 2008. J. A. Azofeifa. Tp luz 2. L_N_298380_427850 #93735" CEUA00105836, CEUA00105837 and CEUA00105840; 1♀ "Volcán Tenorio 700m. Estación El Pilón. Guanacaste Costa Rica 21/06/2009 Leg. E. Galante/ CEUA00105838"; 1♀ "COSTA RICA. Prov. Alajuela. Guatuso. P.N. Volcán Tenorio. Punto 1: Catarata Río Buenavista. 800m. 4 JUL 2008. J. A. Azofeifa. Tp. de Luz 1. L_N_298380_427850 #93847/ CEUA00105839"; 1♂ "COSTA RICA. Prov. Alajuela. Guatuso. P.N. Volcán Tenorio. Punto 1: Catarata Río Buenavista. 800m. 7 MAY 2008. J. A. Azofeifa. Tp luz 1. L_N_298380_427850 #93736/ CEUA00105841".

Description. Holotype. Male: Body shape oval. Length 13.62 mm. Width 8.62 mm. (Figure 21).

Color. Clypeus metallic green; head brownish green; pronotal disc metallic green, with ochre sides and a subapical ochre macula (Figure 45). Scutellum metallic green

with a ochre macula on the disc. Elytra blackish brown with a ochre basal edge, two longitudinal linear ochre maculae on the basal half and sparse ochre flecks; pygidium light ochre with two small blackish maculae along its lateral margins; sternum brownish to ochre, abdominal sternites ochre with dark apical margins, coxae ochre on the basal half and brown apically, expanding to an oval macula towards the apex, femura and tarsi greenish brown.

Head. Clypeus trapezoidal, with straight anterior margin; ratio width/length 2.08. Frons flat. Ratio interocular width/width of eye 2.63. Length of antennal club: 1.72 mm.

Pronotum. Width 1.86 times length. Lateral margins regularly convex. Basal bead obliterated in the middle. Surface with dense rounded punctures (Figure 45).

Scutellum with dense punctures.

Elytra with sparse punctures arranged in irregular rows. First interstice with 2–3 irregular rows of punctures. Pygidium punctate, with long setae on its margins.

Legs. Protibia (Figure 69) with short apical tooth; middle tooth at the same level of the internal apex; basal tooth at $1/3$ of internal length. Protarsal claws: internal claw bifurcate, with the upper branch the same length as and $2/3$ the width of the lower one. Inferior margin sinuate. Metafemur ratio length/width 2.89. Metatibia robust, with fine small punctures, nearly smooth in appearance, slightly rugose below the second external carina. Width 1.47 mm.

Abdominal sternites with sparse punctures; one row of sparse setae per sternite. Last sternite punctate, subapical bead sinuate and complete, apical portion medially wider than sternite.

Male genitalia. Aedeagus (Figure 93) twisted to the left. Parameres wide, with blunt apex in lateral view. Ventral plate with a wide apical portion curved in lateral view, with bilobed margin, and ridges at its sides. Endophallus in Figure 116. Sacculus on the right long and wide, covered with dense microsetation on most of its surface and with long setae on the dorsal part of the basal portion, one patch of dense spines at

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half the length, on the internal side. A dorsal inflation at the base, with microsetation at the apex. Sacculus on the right shorter, with a patch of spines at apex. Ejaculatory duct opening opens frontally, between the sacculi, with inflations on the side. A patch of microsetation basally among the apex of the median lobes. Median lobes with asymmetric triangular folds at the apex.

Female: antennal club shorter respect to males; first tooth of protibia wider than in males, middle tooth above the internal apex (Figure 69); internal protarsal claw thinner than in males, inferior margin curved.

Variation: head and clypeus reddish brown to green, light basal macula on the pronotum absent in darker specimens, light maculae on the elytra variable in density, always arranged in longitudinal lines on the basal half, and in elongated maculae on a median transversal band; pygidium with one or two pairs (the second pair basal) of dark maculae; coxae from ochre and brown to completely brown. Body length 13.26–16.01 mm, body width 7.80–8.98 mm. Clypeus w/l: 2.08–2.41. Interocular ratio (interocular width/width of eye): 2.63–3.01. Male antennal club: 1.65–1.74 mm; female antennal club: 1.38–1.43 mm. Pronotum w/l: 1.76–1.86. Metafemur l/w: 2.50–2.89. Metatibia width: 1.34–1.56 mm.

Diagnosis: large size, dark color, a pronotum with convex lateral margins, surface with fine punctures, basal tooth of protibia weakly developed, parameres stout, with a blunt apex in lateral view, endophallus with one long sacculus and one short. Similar to *A. subusta*, it is differentiated by its green pronotum, elongated ochre maculae on elytra, light colored pygidium, and the shape of the male genitalia.

Distribution: a few localities in the Tenorio National Park, Guanacaste mountain range, from 700 to 800 m (Figure 122).

Etymology: toponymic adjective coined from the Tenorio National Park in northern Costa Rica, where this species has been found.

***Anomala trapezifera* Bates, 1888**

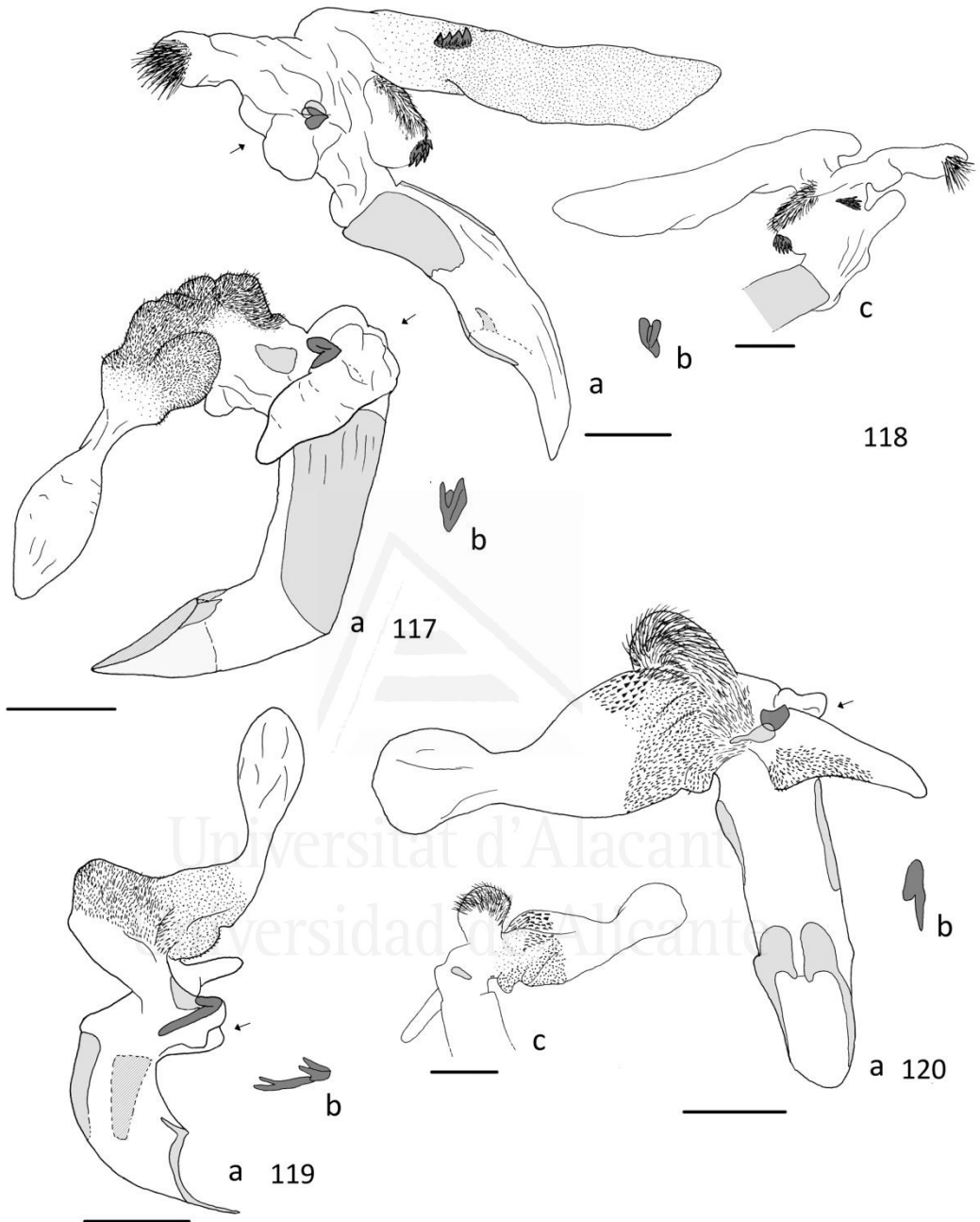
Figure 22, 46, 70, 94, 117, 132.

Material examined. Holotype: ♀ "Costa Rica/ ♀/ *Anomala trapezifera* Bates/ H.W. Bates Biol. Cent. Amer./ Type/ Mus. Paris" MNHN.

Additional material: 1♀ "Tapantí. Cartago, Costa Rica. 1600m. 6/2/2008. Leg. R. González/ CEUA00105896"; 1♀ "Cartago. Costa Rica Reserva Tapanti. 1500m. Rio Grande de Orosi 9 de junio de 1988 A. Chacon/ INBIOCR1002517704"; 1♂ "Fila Matama, 1680m, Limon, Limon Prov. COSTA RICA. Apr 1989, A. Chacon & G. Herrera, L- N 197000_630500/ INBIOCR1000025346"; 1♂ "COSTA RICA. Prov. Cartago. Paraíso. P.N. Tapanti. Torre Muestreo. 1600m. 31 MAY 2008. R. Gonzalez. Tp de Luz 1. L_N_189292_560783 #94242/ CEUA00105897"; 1♂ 1♀ "COSTA RICA. Prov. Cartago. Paraíso. P.N. Tapanti. Torre Muestreo. 1600m. 2 JUN 2008. R. Gonzalez. Tenorio. Tp de Luz 1. L_N_189292_560783 #93858" CEUA00105898 and CEUA00105902; 1♀ "Tapantí 1600m Prov. Cartago Costa Rica 30/08/2008 Leg. R. González/ CEUA00105899"; 1♀ "La Esperanza 2300m. Prov. Cartago. Costa Rica. 29/08/2008 leg. A. García, M.Zumbado/ CEUA00105802"; 1♀ "COSTA RICA. Prov. Cartago.P.N. Tapanti. Torre Muestreo. 1600m. 5 MAY 2008. B. Hernandez. Tp de Luz 2. L_N_189292_560783 #94182/ CEUA00105900"; 1♀ "Tapantí 1600m Prov. Cartago Costa Rica 28/08/2008 Leg. R. González/ CEUA00105901".

Measurements: Body length 12.92–13.44 mm, width 6.61–7.11. Clypeus ratio width/length 2.12–2.58. Ratio interocular width/width of eye 2.91–3.33. Length of antennal club: 1.21–1.40 (female) 1.62–1.63 (male). Pronotum w/l 1.72–1.76 (female) 1.83–1.88 (male). Metafemur ratio length/width 3.40–3.68 (female) 4.05–4.11 (male). Metatibia width 0.96–1.10 mm.

Overview: habitus in Figure 22. Clypeus from reddish yellow with two dark maculae to completely dark in color. Head and pronotal pattern bronze or metallic green (Figure 46). Frons with a ochre triangle on suture. Elytra ochre with several small dark flecks. Pygidium ochre with one (big) to three (small) pairs of dark maculae, an inverted dark basal triangle may be present with small maculae. Sternum brown, abdominal sternites ochre with dark flecks, especially on the sides. Legs ochre with dark extremities, tarsi reddish. Clypeus trapezoidal with a straight anterior margin.



Figures 117–120. Endophallus: a) whole, b) detail of ejaculatory sclerite. 117: *Anomala trapezifera* (Fila Matama, Costa Rica). 118: *A. tuberculata* (Paratype, Albergue Heliconias, Costa Rica) c) view of the other side. 119: *A. vallisneria* (Paratype, Sector Las Pailas, Costa Rica). 120: *A. vulcanicola* (San Gerardo de Dota, Costa Rica) c) view of the other side. Scale = 1mm unless otherwise specified.

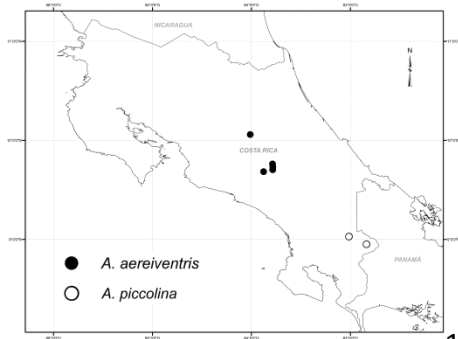
Pronotum with very slightly sinuate lateral margins, surface with deep punctures (Figure 46), connected by small longitudinal wrinkles, one or two pairs of long setae on the surface of the pronotum and scutellum. Elytra with regular rows of punctures, first interstices with a band of dense irregular punctures. Pygidium with dense rounded punctures. Protibiae in Figure 70. Aedeagus slightly twisted to the left (Figure 94). Parameres long and slender, with apex acute, pointing downwards in lateral view. Ventral plate with apex curved in lateral view. Endophallus (Figure 117) composed by two sacculi with irregular shapes, one on the front-left, with long setae and microsetation at its base, the apex swollen. The other one on the ventral-right side, with several inflations at the base where the ejaculatory duct opening is located, and a sclerotized plate on the internal side.

Diagnosis: medium size, pronotum trapezoidal, lateral margins angulated, surface with deep punctures, parameres long with acute apex pointing downwards in lateral view, endophallus with one long sacculus and one short.

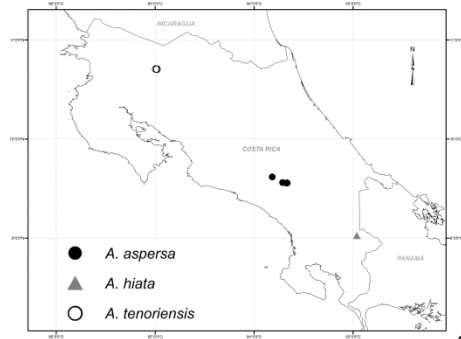
It is differentiated from *A. levicollis* by its lighter color, larger size, punctate surface of the pronotum, narrower metafemur in males, and the shape of the male genitalia. It is separated from *A. longisacculata* by its longer male antenna, lighter pronotum, narrower metafemur in males, and the shape of the male genitalia. It is distinguished from *A. aspersa* by its larger male eyes, longer male antenna, wider metafemur in males, and the shape of the male genitalia. It is differentiated from *A. subridens* by its longer male antenna, less sinuate pronotum lateral margins, and the shape of the male genitalia. It is differentiated from *A. vallisneria* by its larger size, darker color, narrower clypeus, smaller male eyes, larger basal tooth on the protibia, and the shape of the male genitalia. It is separated from *A. vulcanicola* by its darker color, less sinuate pronotum lateral margins, larger and more apical basal tooth on the protibia, and the shape of the male genitalia.

Distribution: Talamanca mountain range, from 1600 to 1680 m (Figure 132).

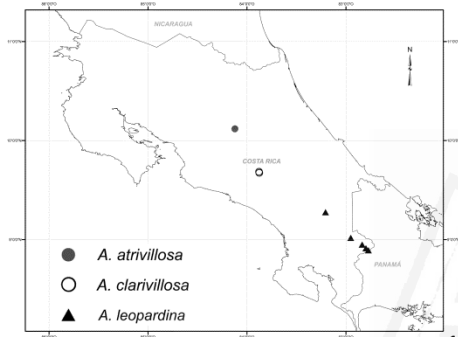
3.2 *A. trapezifera* species group



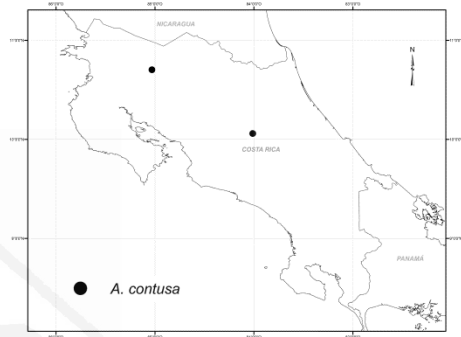
121



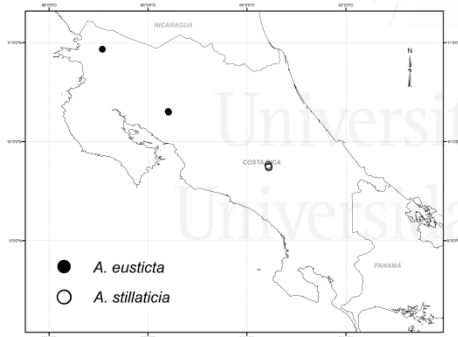
122



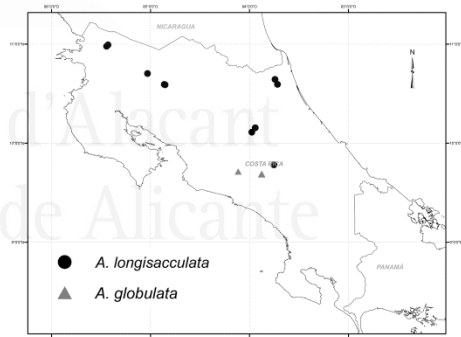
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126

Figures 121–126. Distribution of 121: *A. aereiventris* and *A. piccolina*. 122: *A. tenoriensis*, *A. aspersa* and *A. hiata*. 123: *Anomala atrivillosa*, *A. clarivillosa* and *A. leopardina*. 124: *A. contusa*. 125: *A. eusticta* and *A. stillaticia*. 126: *A. longisacculata* and *A. globulata*.

Anomala tuberculata Filippini, Micó, Galante, new species

Figure 23, 47, 71, 95, 118, 132.

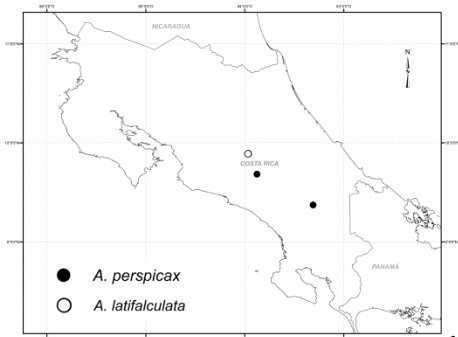
Material examined. Holotype: ♂ "Isla Bonita. Prov. Alajuela. Costa Rica. 08/11/2007 Leg. M. Moraga/ CEUA00105892".

Paratypes (7): 1♂ "Isla Bonita, Prov. Alajuela, Costa Rica. 06/11/2007 Leg. M. Moraga/ CEUA00105888"; 1♂ "COSTA RICA. Prov. Alajuela. Upala. P.N. Volcán Tenorio. Alb. Heliconias. Send. a Laguna Danta. 900m. 12 SEPT 2007. J. D. Gutierrez. Tp. Luz 2. L_N_299100_424000 #92292/ CEUA00105889"; 1♀ "COSTA RICA. Prov. Alajuela. Sarapiquí. Isla Bonita. 900m. 11 AGO 2007. A. Garcia, M. Moraga. Tp. Luz 1. L_N_246700_518375 #92267/ CEUA00105890"; 1♀ "La Montura. Prov. San José. Costa Rica. 06/11/2007 Leg. M. Moraga/ CEUA00105891"; 1♂ "La Montura. Prov. San José. Costa Rica. 07/11/2007 Leg. M. Moraga/ CEUA00105892"; 1♂ "COSTA RICA. Prov. Alajuela. Guatuso. P.N. Volcán Tenorio. Punto 3; Los Pelados. Falda N Cerro Montezuma. 1300m. 3 JUL 2008. J. A. Azofeifa. Tp. Luz 1. L_N_297410_42680 #94265/ CEUA00105895"; 1♀ "Volcán Tenorio 1160m. Prov. Cartago. Costa Rica. 30/09/2008. Leg. J.A. Azofeifa/ CEUA00105895".

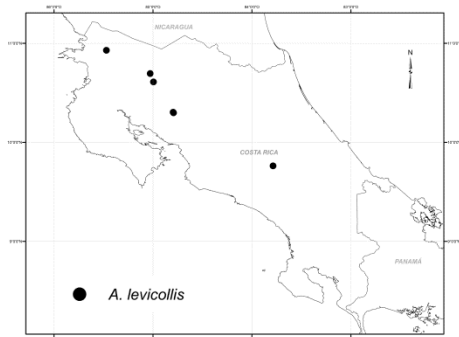
Description. Holotype. Male: Body shape oval, expanded at the apical third of elytra. Length 14.70 mm. Width 7.98 mm. (Figure 23).

Color. Head, clypeus, pronotum and scutellum metallic dark green, sides of the pronotum (pattern in Figure 47) and central macula of the scutellum ochre; elytra ochre with diffuse blackish flecks, some larger maculae on calli and the basal margin, the entire surface with a metallic green to bronze hue; pygidium ochre with two pairs of symmetric dark brown maculae on the sides and brown sides of the basal margin; venter reddish brown; legs reddish brown, with lighter maculae on femura and tibiae. Head. Clypeus trapezoidal, anterior margin nearly straight, with a small protuberance in the middle, next to the suture with the frons; ratio width/length 2.75. Frons with a triangular concavity. Ratio interocular width/width of eye 2.38. Length of antennal club: 1.81 mm.

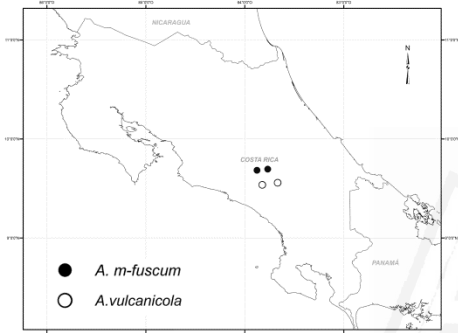
3.2 *A. trapezifera* species group



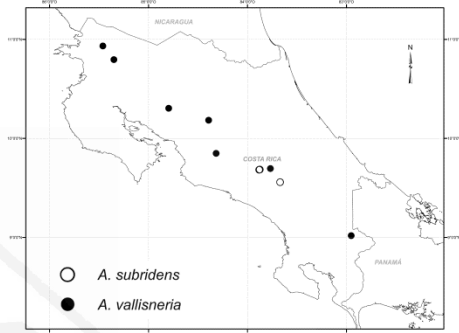
127



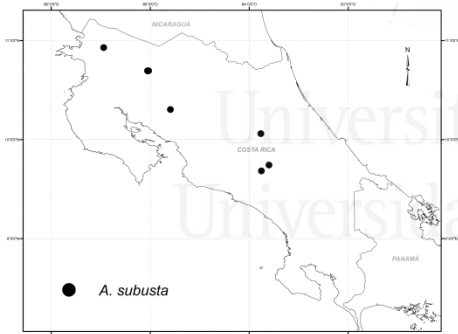
128



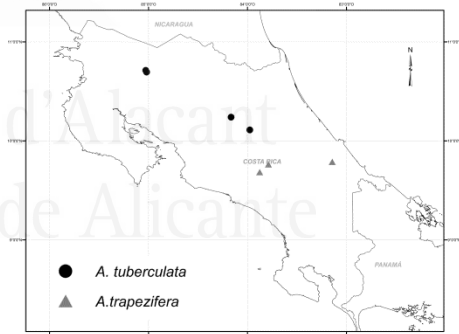
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131



132

Figure 127–132. Distribution of 127: *A. perspicax* and *A. latifalculata*. 128: *A. levicollis*. 129: *A. m-fuscum* and *A. vulcanicola*. 130: *A. subridens* and *A. vallisneria*. 131: *A. subusta*. 132: *A. tuberculata* and *A. trapezifera*.

Pronotum. Width 1.85 times length. Lateral margins homogeneously convex. Basal bead obliterated in the middle. Surface with fine punctures and polished appearance (Figure 47).

Scutellum surface with sparse punctures concentrated near its margins.

Elytra with very irregular rows of large deep colored punctures, often coalescent, clearer along the first and part of the second costae and sides. The first costa is particularly evident as a light colored band, with no maculae until $2/3$. First and second interstices with irregular punctation.

Pygidium with sparse oblong deep punctures, coalescent; surface rugose punctate; with long setae on the apex and sides.

Legs. Protibia (Figure 71) with a short apical tooth; middle tooth at the same level as or slightly above the internal apex; basal tooth at $1/3$, scarcely developed. Protarsal claws: internal claw widely bifurcate, with upper branch as long as and $2/3$ the width of the lower one; inferior margin nearly straight. Metafemur ratio length/width 2.85. Metatibia with sparse fine punctures, rugose below the second external carina. Width 1.15 mm. First external carina absent, substituted by a row of a few thick setae.

Abdominal sternites with 3–5 rows of deep oblong punctures, denser on the sternite II and apical half of sternites III–V, 1–2 rows of sparse setae per sternite. Last sternite punctate, subapical bead sinuate and complete, its apical portion medially wider than the sternite.

Male genitalia. Aedeagus (Figure 95) slightly twisted to the left. Parameres with a blunt apex and strongly sinuate ventral margin in lateral view. Ventral plate with the apex curved in lateral view and a transversal subapical ridge. Endophallus in Figure 118. Sacculus on the left long and wide, covered with dense microsetation, one dorsal patch of large spines at half the length. Sacculus on the right shorter, with long setae at the apex. Several inflations at the base of the sacculi, one dorsal large and covered with setae, with a patch of spines on the apex. Another patch of spines is present dorsally, at the base of the sacculi. The ejaculatory duct opening opens on the right, below the shorter sacculus.

Female: antennal club shorter compared to males; protibia slender, first tooth wider, internal apex lower in position than in males (Figure 71); metatibia stout but with

3.2 *A. trapezifera* species group

subapical narrowing well defined; protarsal claws similar to males, internal claw narrower than in males; last abdominal sternite with apical margin curved.

Variation: head, clypeus, pronotum and scutellum metallic dark green or bronze; lateral margins of pronotum homogeneously convex or angulated at almost half of their length; pygidium with 2–3 pairs of maculae; venter reddish to greenish brown. Body length 14.23–15.18 mm, body width 7.71–8.44 mm. Clypeus w/l: 2.30–2.76. Interocular ratio (interocular width/width of eye): 2.38–2.88. Male antennal club: 1.81–1.94 mm; female antennal club: 1.44–1.54 mm. Pronotum w/l: 1.76–1.85. Metafemur l/w: 2.21–2.34 (female); 2.85–3.45 (male). Metatibia width: 0.77–1.36 mm.

Diagnosis: large size, light color, frons with a small protuberance, smooth pronotum surface, parameres with protruding blunt apex in lateral view, endophallus with one long sacculus and one that is short.

Similar to *A. aereiventris*, it is differentiated by the protuberance on its frons, pronotum with ochre sides, and the shape of the male genitalia. Similar to *A. eusticta*, it is differentiated by its smaller size, protuberance on the frons, its darker pronotum, small flecks on the elytra, and the shape of the male genitalia.

Distribution: Guanacaste and Central mountain ranges, from 900 to 1300 m (Figure 132).

Etymology: an adjective indicating possession from the Latin "*tuberculum*," bump, for the protuberance on frons.

Anomala vallisneria Filippini, Micó, Galante, new species

Figure 24, 48, 72, 96, 119, 130.

Material examined. Holotype: ♂ "Est. La Casona, R.B. Monteverde, Prov. Punta, COSTA RICA. 1520 m. Mar 1994, N. Obando. L N 253250_449700 # 2819/ INBIOCR1001780597".

Paratypes (16): 3♂♂ 2♀♀ "ALAJUELA, COSTA RICA Zarcero, 1700 m 23-V-87 COL: A. SOLIS B." CEUA00106070, INBIOCR1002517395, INBIOCR1002517397, INBIOCR1002517398 and INBIOCR1002517401; 1♀ "Derrumbe, Est. Cacao, lado oeste del V. Cacao, Prov. Guanacaste,

Costa Rica, III Curso Parataxon., May 1992, L- N 323700_376700/ CEUA00106071"; 1♂ "Est. La Casona, Monteverde, Prov. Punta, COSTA RICA. 1520m. 27 MAR–24 ABR 1995. K. Martinez, L_N_253900_449300 #4427/ INBIOCRI002182027"; 2♀♀ R. Grande de Orosi, desde Puente R. Dos Amigos hasta la Represa, Prov. Carta, COSTA RICA. 1400–1800m. MAR 1995. R. Delgado. L_N_186600_562000 #4418" INBIOCRI002253276 and INBIOCRI002253287; 1♂ "COSTA RICA, Prov. Puntarenas, Coto Brus, Estación Pittier. 1670m. 20 ENE 2000. R. González. de Luz L_S_330030_578645 #56802/ INB0003111558"; 1♂ 1♀ "Sector Sendero Volcan, 3,5 Km SSW del Volcan Rincon de la Vieja, Prov.Guana, COSTA RICA. 1100m. 9–10 Jun 1994. D. Garcia, L_N_308407_388816 #3046" INBIOCRI002130711 and INBIOCRI002130712; 4♂♂ "COSTA RICA. Guanacaste. Sector Las Pailas, Copelares. P. N. Guanacaste, 1600 m. 6–26 Jun 1994, K. Taylor, L N_203500_501800 # 3066" INBIOCRI002460977, INBIOCRI002460986, INBIOCRI002460978 and INBIOCRI002460985.

Description. Holotype. Male: Body shape slender, elongated. Length 11.48 mm. Width 6.66 mm. (Figure 24).

Color. Clypeus ochre with two greenish brown large basal maculae and metallic green luster; head dark metallic green; pronotal disc ochre, with a dark metallic green wide "M" shaped macula (pattern shown in Figure 48); scutellum ochre; elytra ochre with three pairs of irregular brown maculae on a median band, a brown macula on the apical and basal calli, and several small dark flecks on the entire surface; pygidium ochre with two pairs of brown maculae; abdominal sternites ochre with brown apical margins, sternum brown with a green luster, legs ochre with tarsi and extremities of femura reddish brown.

Head. Clypeus trapezoidal, with a straight anterior margin; ratio width/length 2.08. Frons with a triangular concavity. Ratio interocular width/width of eye 2.47. Length of antennal club: 1.55 mm. Pronotum. Width 1.75 times length. Lateral margins very slightly sinuate towards base. Basal bead complete. Surface with dense fine punctures; two pairs of shallow diagonal imprints on disc (Figure 48).

Scutellum convex, with coarse punctures.

3.2 *A. trapezifera* species group

Elytra with sparse punctures arranged in irregular rows. First interstice with irregular sparse punctures.

Pygidium with dense oblong punctures and long setae on margins; surface slightly rugose.

Legs. Protibia (Figure 72) with long apical tooth; middle tooth at same level as the internal apex; basal tooth at $1/3$ of internal length. Protarsal claws: internal claw bifurcate, with the upper branch the same length as and $2/3$ the width of the lower one. Inferior margin slightly sinuate. Metafemur ratio length/width 3.49. Metatibia with fine punctures, rugose below the second external carina. First external carina absent, a row of 2–3 thick setae in place. Width 1.05 mm.

Abdominal sternites striated, with 5–6 irregular rows of punctures; one row of sparse setae on each sternite. Last sternite rugose, subapical bead deeply sinuate and poorly defined, apical portion medially wider than the sternite.

Male genitalia. Aedeagus in Figure 96. Parameres with elongated acute apex, sinuate ventral margin with acute ventral angle pointing backwards in lateral view. Endophallus in Figure 119. A long sacculus irregularly shaped, base and apex swollen, a wide ring of short and microsetae at base. A long diverticle on left side. Ejaculatory duct opening ventral, with inflations at sides.

Female: antennal club shorter compared to males; first tooth of protibia wider than in males, middle tooth above the internal apex (Figure 72); last abdominal sternite with its apical margin curved.

Variation: pronotum from uniformly green/bronze with a ochre border, to ochre with a stylized "M" figure formed by irregular maculae. Extension of maculae on the elytra variable: from nearly absent to dense and concentrated in three bands and on the apical calli; pygidium from ochre to reddish brown, four maculae always present; abdominal sternites with a dark apical margin variable in thickness and extension, or even absent, last sternite ochre or dark brown with ochre margins. Impressions on the pronotum variable. Body length 10.16–11.98 mm, body width 5.57–6.66 mm.

Clypeus w/l: 2.06–2.24. Interocular ratio (interocular width/width of eye): 2.47–2.88. Male antennal club: 1.33–1.55 mm; female antennal club: 1.23 mm. Pronotum w/l: 1.75–1.84. Metafemur l/w: 2.71–3.55. Metatibia width: 1.00–1.12 mm.

Diagnosis: medium size, pronotum with slightly sinuate lateral margins, surface with fine punctures, parameres with an elongated acute apex and a sinuate ventral margin in lateral view, endophallus with one short sacculus and one that is long. It is distinguished from *A. aspersa* by its narrower clypeus, larger male eyes, lighter abdominal sternites, and the male genitalia. It is separated from *A. subridens* by its shorter male antenna, less sinuate pronotum lateral margins, lighter abdomen, and the male genitalia. It is differentiated from *A. trapezifera* by its smaller size, lighter color, wider clypeus, larger male eyes, smaller basal tooth on protibia, and the shape of the male genitalia. It is distinguished from *A. vulcanicola* by the smaller and more diffuse flecks on the elytra, and the male genitalia.

Distribution: widely distributed in the four main mountain ranges, from 1100 to 1800 m (Figure 130).

Etymology: this species is dedicated to professors and university fellows that shared academic formation with the author V.F. at the "A. Vallisneri" Interdepartmental Center of the University of Padua. To be treated as a Latin first declension adjective.

Anomala vulcanicola Ohaus, 1897

Figure 25, 49, 73, 97, 120, 129.

Material examined. Holotype: ♂ "Chiriqui/ Typus!/ Aprosterna vulcanicola Ohs./ Coll. Ohaus Mus. Berlin" MNHUB.

Paratypes: 1♂ "Chiriqui/ Cotypus!/ Aprosterna vulcanicola Ohs./ Coll. Ohaus Mus. Berlin" MNHUB; 2♀♀ "Costa Rica P. Biolley/ ♀/ Cotypus!/ Aprosterna vulcanicola Ohs./ Coll. Ohaus Mus. Berlin" MNHUB; 1♂ "Chiriqui/ ♂/ Det. Dr. Ohaus *A. vulcanicola* cotyp. Ohaus/ Paratypus" MNHUB.

Additional material: 3♂♂ 1♀ "San Gerardo de Dota, 2000–2500m, Prov. San Jose, Costa Rica, Curso Tachinidae y Syrphidae, 22–26 feb 1992, L- S 387400_482700"

INBIOCR1000407451, INBIOCR1000407453, INBIOCR1000407478 and INBIOCR1000407689; 1♀ "Est. Cuerici, Sendero al Mirador, 4.6 Km al E. de Villa Mills, San Jose, Costa Rica. 2640m. 19–20 ABR 1996. B. Gamboa, de Luz L_S_389700_499600 #7048/ INBIOCR1002371927".

Measurements: body length 11.42–13.28 mm, width 6.70–7.40. Habitus in Figure 25. Clypeus ratio width/length 2.16–2.37. Ratio interocular width/width of eye 2.87–3.43. Length of antennal club: 1.21–1.25 (female) 1.41–1.60 (male). Pronotum w/l 1.80–1.83. Metafemur ratio length/width 2.95 (female) 3.52–3.62 (male). Metatibia width 0.92–1.11 mm.

Overview: clypeus ochre to metallic green to brown; head metallic green to brown; pronotum with a dark brown irregular "M" shaped macula (Figure 49); elytra with dark maculae on the calli and on a median band, usually not numerous; pygidium ochre with one pair of basal maculae and in some specimens a second smaller pair on the sides. Venter ochre to light brown, central part of the metasternum dark brown; legs ochre, tibiae with dark extremities. Clypeus nearly rectangular with blunt anterior angles. Pronotum with sinuate lateral margins, surface with dense punctation (Figure 49). Elytra with regular lines of punctures and shallow secondary punctures on the entire surface. Pygidium striated. Protibiae in Figure 73. Aedeagus in Figure 97. Parameres short and wide, with sinuate ventral margin, acute apex bent downwards in lateral view. Ventral plate concave, ending in two prolongations. Endophallus (Figure 120) composed by two sacculi with irregular shapes, one on the left, with a swollen apex, a large ring of micro spines at the base, wider on the frontal side, and long setae on a basal inflation. The other one is on the right side, with a patch of short thick setae ventrally. Between the sacculi, a big frontal inflation covered with long setae. Ejaculatory duct opening frontal, between the sacculi; a sclerotized plate near the ejaculatory duct opening and another one dorsally, basal.

Diagnosis: medium size, pronotum with sinuate lateral margins, surface with fine punctures, parameres short and wide, with a sinuate ventral margin in lateral view, endophallus with one short and one long sacculi.

It is distinguished from *A. aspersa* by larger maculae on the elytra, lighter abdominal sternites, and the male genitalia. It is separated from *A. subridens* by its wider pronotum, larger maculae on elytra, lighter abdomen, and the male genitalia. It is differentiated from *A. trapezifera* by its lighter color, more sinuate pronotum lateral margins, smaller and more basal basal tooth on protibia, and the shape of the male genitalia. It is distinguished from *A. vallisneria* by the larger maculae on the elytra, and the male genitalia.

Distribution: northern Talamanca mountain range, from 2000 to 2640 m (Figure 131).

Distribution patterns

Most of the species, with the data available, show a narrow distribution and are known in a few localities that are geographically close. Only eight species (*A. aereiventris*, *A. contusa*, *A. eusticta*, *A. levicollis*, *A. longisacculata*, *A. subusta*, *A. tuberculata*, *A. vallisneria*) are distributed in more than one mountain range. Moreover, as regards altitude, distributions are narrow: for 15 species the difference in altitude between the highest and lowest distribution records is equal to or less than 500 m, and for five species (*A. levicollis*, *A. m-fuscum*, *A. globulata*, *A. vallisneria*, *A. vulcanicola*) it is between 500 and 1000 m. This difference in altitude between the highest and lowest distribution records is only greater than 1000 m for three species (*A. aereiventris*, *A. longisacculata*, *A. subusta*). A wide geographical range is not always associated with a wide altitudinal range (Table 1).

3.2 *A. trapezifera* species group

Table 1: Summary of altitudinal range and distribution on main mountain ranges of the species here treated, based on 212 specimens from CEUA and INBIO collections.

SPECIES	ALTITUDINAL RANGE	DISTRIBUTION
<i>A. aereiventris</i>	1250-2300	Central, Talamanca
<i>A. aspersa</i>	2600-3000	Talamanca
<i>A. atrivillosa</i>	2500	Central
<i>A. clarivillosa</i>	2300-2700	Talamanca
<i>A. contusa</i>	1300-1550	Guanacaste, Central, Costa
<i>A. eusticta</i>	1300-1520	Guanacaste, Tilarán
<i>A. globulata</i>	2000-2650	Talamanca
<i>A. hiata</i>	1670	Talamanca
<i>A. latifalculata</i>	1750	Central
<i>A. leopardina</i>	1180-1670	Talamanca
<i>A. levicollis</i>	1000-1520	Guanacaste, Tilarán, Talamanca
<i>A. longisacculata</i>	10-1150	Guanacaste, Central, Talamanca, Caribbean lowlands
<i>A. m-fuscum</i>	1400-2300	Talamanca
<i>A. perspicax</i>	2300-2500	Talamanca
<i>A. piccolina</i>	1300-1500	Talamanca
<i>A. stillaticia</i>	1150-1250	Talamanca
<i>A. subridens</i>	2300-2700	Talamanca
<i>A. subusta</i>	1000-2300	Guanacaste, Tilarán, Central, Talamanca, Costa
<i>A. tenoriensis</i>	700-800	Guanacaste
<i>A. trapezifera</i>	1600-1680	Talamanca
<i>A. tuberculata</i>	900-1300	Guanacaste, Central
<i>A. vallisneria</i>	1100-1800	Guanacaste, Tilarán, Central, Talamanca, Costa
<i>A. vulcanicola</i>	2000-2640	Talamanca

The richest habitat is the tropical evergreen broad-leaved lower-montane forest, where 15 species can be found, ten of which are limited to this habitat. Ten species are present in the altimontane forest, seven of which are exclusive; five species can be found in sub-montane forest, of which only *A. tenoriensis* is exclusive. *A. longisacculata* is the only species recorded for the tropical evergreen and semi-deciduous lowland forest. Three species (*A. levicollis*, *A. longisacculata*, *A.*

tuberculata) are distributed in both sub-montane and lower-montane forest. *A. subusta* spans from sub-montane to altimontane forest. *A. aereiventris* and *A. m-fuscum* are found in lower-, upper- and altimontane forest.

Discussion

The species described here do not exhaust the diversity of this species-group in Costa Rica, let alone Central America. Unfortunately no additional data is available about these or related species present in nearby countries.

The similarity of the species and the presence of synapomorphies (tridentate protibia, twisted aedeagus, folds in the ventral plate, ejaculatory sclerite) suggest that the *A. trapezifera* species-group is a natural group with strong definition, whose relation to the rest of *Anomala* species will be addressed in a future work based on molecular data. The most related species is *Anomala obovata* Ohaus 1933 (unpublished molecular data), which also presents the peculiar characters of male genitalia such as the lateral and apical ridges on the ventral plate, apical folds on the median lobes and the ejaculatory sclerite.

The narrow distributions both in extension and altitudinal range of the majority of the species suggest an ecological specialization of these species. The high diversity in male genital structures, against uniformity in color and external morphology, suggest that reproductive isolation play a major role in species definition, and the presence of abundant and different sclerotized structures in the endophallus hints at a possible role of sexual selection in speciation. The influence of these factors on the high diversity of *Anomala* in Costa Rica will be addressed in a future work with a phylogenetic background.

In the case of *A. levicollis*, the long and fragile spines on the male endophallus have been found inside the female copulatory sac, a few of which were still piercing the

3.2 *A. trapezifera* species group

membrane of the apical part of the copulatory sac, but the function and effects of this have not been investigated. However, "armed" male genitalia have been proved to be related to sexual conflict in other Coleoptera (Crudgington & Siva-Jothy 2000) and trigger an evolutionary arms race between the sexes (Rönn *et al.* 2007).

The study of female genitalia, which have not been dissected for the other species here described, can be a fertile field for future research, exploring for example the presence of species specific genital traits in females, divergent evolution matching that seen in male genitalia, and coevolution between female and male genitalia. Studies dealing with these themes are still scarce (Simmons 2013), and the array of shapes and structures found in male genitalia among the closely related species treated here add interest and more research possibilities.

This group of species is closely linked to montane forests, with only one species (*A. longisacculata*) found in the lowlands, and ten species found above 2000 m.a.s.l. This is in contrast to what has been found for other Rutelinae genera and also for other scarab subfamilies (García-López *et al.* 2012) that have higher diversity at medium altitudes (500–800 m) and low richness at high altitudes. The common pattern of small distribution ranges and high turnover of species among different localities is shared with other Rutelinae genera and other scarab families (García-López *et al.* 2013).

Acknowledgements

We thank Mr. Ángel Solís, from the Instituto Nacional de Biodiversidad, Costa Rica for the loan of specimens; Dr. Johannes Frisch and Mr. Joachim Willers from the Museum für Naturkunde der Humboldt-Universität, Berlin and Mr. Antoine Mantilleri and Dr. Olivier Montreuil, from the Muséum National d'Histoire Naturelle, Paris for assistance with type material consultation. We also thank Dr. Miguel A. Alonso Zarazaga for his tips on nomenclature.

Financial support was provided by the Agencia Española de Cooperación Internacional para el Desarrollo (AECID) projects A/4426/05, A/6788/06, A/019887/08, A/023060/09 and a PhD grant to V. Filippini from the Spanish Ministry of Education.

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3.3 - The genus *Callistethus* (Coleoptera: Scarabaeidae: Rutelinae) in the Neotropics: new data and new species from Costa Rica.

[El género *Callistethus* (Coleoptera: Scarabaeidae: Rutelinae) en el neotrópico: nuevos datos y nuevas especies de Costa Rica]

Abstract: The species *Callistethus carbo* sp.n., *C. flavodorsalis* sp.n., *C. fuscorubens* sp.n., *C. lativittis* sp.n., *C. levigatus* sp.n., *C. macroxantholeus* sp.n., *C. microxantholeus* sp.n., *C. multiplicatus* sp.n., *C. parapulcher* sp.n., *C. pseudocollaris* sp.n. and *C. stannibractea* sp.n. from Costa Rica are described. The synonymy of *Callistethus kolbei* (Ohaus, 1897) with *Callistethus specularis* (Bates, 1888) is proposed. A phylogenetic analysis based on the genes 16S, COI and 28S is carried out for Costa Rican species and diagnostic morphological features for the genus are tested on it for phylogenetic signal. An identification key for *Callistethus* species of Costa Rica is provided. The distribution patterns of *Callistethus* species in Costa Rica are discussed.

Keywords: Aedeagus, distribution, endophallus, identification key, morphology, molecular analysis, phylogeny.

Filippini V., Galante E., Micó E., *Arthropod Systematics and Phylogeny*, en revisión

Resumen: Se describen las especies *Callistethus carbo* sp.n., *C. flavodorsalis* sp.n., *C. fusciorubens* sp.n., *C. lativittis* sp.n., *C. levigatus* sp.n., *C. macroxantholeus* sp.n., *C. microxantholeus* sp.n., *C. multiplicatus* sp.n., *C. parapulcher* sp.n., *C. pseudocollaris* sp.n. y *C. stannibractea* sp.n. de Costa Rica. Se propone una nueva sinonimia de *Callistethus kolbei* (Ohaus, 1897) con *Callistethus specularis* (Bates, 1888). Se realiza un análisis filogenético basado en los genes 16S, COI y 28S con especies de Costa Rica y sobre el árbol resultante se comprueba la señal filogenética de los caracteres morfológicos diagnósticos del género. Se proporciona una clave para las especies de *Callistethus* de Costa Rica. Se discuten los patrones de distribución del género en Costa Rica.

Introduction

The tribe Anomalini (Coleoptera: Scarabaeidae: Rutelinae) is a heterogeneous group composed by 65 genera, 70% of which have less than 10 species (Krajcik 2007). The most speciose genus in the tribe is *Anomala* Samouelle, with more than 1000 species distributed worldwide. In the Neotropics 15 genera are present, of which 4 can be found in Costa Rica: *Anomala*, *Anomalorhina*, *Callistethus* and *Strigoderma*.

Based on the checklist by Krajcik (2007), the genus *Callistethus* Blanchard comprises 142 species distributed in Asia (85 species) and America (57 species), although their real diversity is probably much higher. The life history of this genus is similar to that of other Anomalini and Rutelini genera: larvae feed on roots and organic material, adults on leaves, floral parts and fruits of angiosperms and gymnosperms. Adults of some species are readily attracted to light at night, while others are diurnal and are found on flowers and foliage. Adult body length ranges from 11 to 23 mm. (Jameson *et al.* 2003).

The diagnostic features for *Callistethus* are a mesosternal process that is produced beyond the apex of the mesocoxae (often produced to the procoxae), concealed

mesepimeron, clypeus not reflexed, maxilla with six teeth (Jameson *et al.* 2003), pronotum without bead on the posterior margin, sutural apex of elytron spiniform, and male genitalia with parameres and aedeagal ventral plate fused (Morón & Ramírez-Ponce 2012). The nearest genera in America are thought to be *Anomala* and *Yaaxkumukia* Morón & Nogueira (Mexico), which share the features of mesoepimeron, clypeus and maxilla; *Yaaxkumukia* also shares the features of pronotum and the presence of a mesosternal process.

The monophyly of the genus *Callistethus* and its definition in relation to the genus *Anomala* have been widely questioned, but no consensus has been reached (Jameson *et al.* 2003). The genus assignment for Neotropical species used by modern authors follows the lists from Machatschke (1957, 1972) and Krajcik (2007).

Bates (1888), Blackwelder (1944) and Potts (1974) considered *Callistethus* as a synonym of *Anomala* when working on Neotropical Anomalini. Morón & Nogueira (2002) considered the taxon valid, but with reservations. They suggested that a study including more Neotropical species could possibly identify a natural Neotropical group separated from *Callistethus* and *Anomala*. Jameson *et al.* (2003) saw a sign of the probable paraphyly of the genus in these contrasting treatments. Ramírez-Ponce & Morón (2009) grouped together species of *Anomala* and *Callistethus* (with short mesosternal process – more or less at same level of apex of mesocoxae–, as *C. cupricollis* (Chevrolat, 1834) and *C. marginicollis* (Bates, 1888)) in a new genus, revalidating the name *Paranomala* Casey, 1915, and considered *Callistethus* a valid genus for the Neotropics, which includes only species with long (reaching procoxae) and acute mesosternal process (also in Morón & Ramírez-Ponce 2012). Table 1 presents an overview of the different taxonomical treatments by these authors for the species considered here.

The diagnostic features that separate *Callistethus* from *Anomala* are: mesosternal process produced beyond the apex of the mesocoxae, consequently with a wider

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Table 1. Overview of the taxonomical treatment for the species of *Callistethus* considered here, from the present publication and the main past lists including Neotropical species. The genus used for the species list follows Krajcik (2007). The symbol '-' is used for species absent in the corresponding publication. Note: the species *C. schneideri* is absent in Blackwelder (1944) and *C. fulvopiceus* and *C. nicoyus* are absent in Ohaus (1918).

(KRAJCIK 2007)	FILIPPINI et al.	MORÓN & RAMÍREZ-PONCE 2012	RAMÍREZ-PONCE & MORÓN 2009	MACHATSCHKE 1957, 1972	OHAUS 1918 BLACKWELDER 1944	BATES 1888
<i>C. cupricollis</i>	ANOMALA	PARANOMALA	PARANOMALA	CALLISTETHUS	ANOMALA	ANOMALA
<i>C. validus</i>				validus group		I.2
<i>C. megalis</i>						
<i>A. praecellens</i>				ANOMALA binotata gr.		
<i>C. chontalensis</i>	CALLISTETHUS	undefined		CALLISTETHUS		-
<i>C. schneideri</i>				marginatus group	- (B)	-
<i>C. granulipygus</i>						ANOMALA
<i>C. valdecostatus</i>						I.3
<i>C. vanpatteni</i>						
<i>C. calonotus</i>		CALLISTETHUS	CALLISTETHUS			
<i>C. chlorotoides</i>						ANOMALA
<i>C. specularis</i>						I.4
<i>A. chrysanthe</i>				ANOMALA		
<i>A. jordani</i>				chrysanthe group		-
<i>A. xiphostetha</i>				ANOMALA		
<i>A. phosphora</i>				no group		
<i>A. lepida</i>						
<i>A. mimeloides</i>						-
<i>A. xantholea</i>		'Xochicotlia' Undescribed genus	PARANOMALA	ANOMALA lucicola gr.		ANOMALA
<i>A. micans</i>						I.5
<i>C. jansoni</i>	ANOMALA	PARANOMALA		CALLISTETHUS jansoni gr.		-
<i>C. fulvopiceus</i>				CALLISTETHUS microcephalus gr.	- (O)	-
<i>C. bioolleyi</i>	<i>Incertae sedis</i>	undefined		CALLISTETHUS sulcans gr.		-
<i>C. buchwaldianus</i>						-
<i>C. nicoyus</i>					- (O)	-
<i>C. sulcans</i>						ANOMALA I.2

space between the mesocoxae, pronotum without bead on the posterior margin, sutural apex of elytron spiniform, male genitalia with parameres and aedeagal ventral plate fused. The same pool of features is also present in oriental species of *Callistethus* (Ramírez-Ponce & Morón 2009), including the type species for the genus, *C. auronitens* (Hope, 1835) (except for the ventral plate of the aedeagus,

reduced to a narrow strip in this species and separated from the parameres; personal observation). We therefore agree with the previous authors on the validity of the genus *Callistethus* in the Neotropics, and its testing was not object of the present work.

There are however different interpretations regarding the level of development of the mesosternal structure required to include one species in the genus *Callistethus*: while for Jameson *et al.* (2003) it seems to include the species with short mesosternal process (for most of which the process is at level of apex of mesocoxae, not beyond it), for Ramírez-Ponce & Morón (2009) and Morón & Ramírez-Ponce (2012) only species with mesosternal process reaching procoxae are included.

Apart from these different interpretations, the current classification still does not reflect this definition, due to the lack of any comprehensive revision. Some species of *Anomala* present a well developed mesosternal process and would therefore be better placed in *Callistethus*, as is the case of *A. lepida* (Burmeister, 1844), reported by Morón & Nogueira (2002), and species currently in *Callistethus* that have a poorly developed mesosternal process should be placed in *Anomala*.

However, the assignment is still unclear for species with short mesosternal process and pronotum with bead on the posterior margin, parameres not fused with ventral plate (as in *validus* group sensu Machatschke 1957); for species with short mesosternal process, pronotum with bead on the posterior margin, parameres fused with ventral plate (as *C. biolleyi* (Ohaus, 1902), *C. buchwaldianus* (Ohaus, 1908), *C. nicoyus* (Ohaus, 1928) and *C. sulcans* (Bates, 1888)); for species with short mesosternal process, pronotum without bead on the posterior margin, parameres usually fused with ventral plate (as *C. chontalensis* (Bates, 1888), *C. schneideri* (Ohaus, 1905), *C. granulipygus* (Bates, 1888)); all these do not fit clearly in any definition given in Morón & Ramírez-Ponce (2012).

3.3 *Callistethus*

Due to these uncertainties, in this paper we will follow the classification found in Krajcik (2007), even if not updated, as starting point to verify the different interpretations.

In this paper we do a phylogenetic analysis of *Callistethus* and *Anomala* species from Costa Rica, based on sequences of one nuclear (a fragment of 28S) and two mitochondrial (16S and COI) genes, and we test the phylogenetic signal of diagnostic characters on the resulting trees.

Other phylogenetic works on Anomalini are scarce: based on morphological characters Paucar-Cabrera (2003) on *Epectinaspis* and Ramírez-Ponce & Morón (2009) on *Anomala*; based on molecular data only broader studies not focused on Anomalini (García-López *et al.* 2013; Ahrens *et al.* 2014). We also describe 11 new species from the revision of the genus *Callistethus* from Costa Rica and propose a new synonym and new combinations.

Material and methods

Specimens examined

A total of 29 species of *Callistethus* have been studied: the 11 new species here described and 18 species present in Costa Rica (through specimens in CEUA and INBio collection, and type material) and 7 species of *Anomala* (through specimens in CEUA and INBio collection).

Type material for 39 additional species of *Callistethus* not present in Costa Rica were consulted for identification and to avoid possible synonymy (list in Anexo 2).

Distribution data for the Costa Rican species have been compiled through locality labels associated with re-examined specimens and INBio's ATTA Database (<http://>

atta.inbio.ac.cr) for species described prior to this work, and for which correct separation was verified personally.

Endophallus preparation procedure

The aedeagus was washed in a 10% hot KOH solution for 5–10 minutes and then rinsed in distilled water. It was then kept in lactic acid for a minimum of 48 hours, until the structures of the aedeagus and endophallus became translucent. The endophallus was then softened in warm water and everted injecting water from the base of the aedeagus with a syringe equipped with a suitable needle, or with microforceps (WPI Dumont #5) when the length of the internal sac made the syringe method inefficient. The dissection was transferred to a microvial containing glycerine, which was attached to the insect pin.

Line drawings

Line drawings were done with the aid of a camera lucida attached to a stereo microscope (Leica M80). The pencil drawings were then traced with technical ink pens. The sacculi are drawn more separated from each other than their natural position to allow a clearer illustration of shapes and structures in the drawings of the endophallus of some species, when their shape or proximity would hide some portions; these cases are indicated in the caption of the corresponding illustration.

Feature standards

Measurements taken are as explained in Filippini *et al.* (2013). When measurements among specimens differed by less than 0.03 units they were not included in the 'Variation' paragraph of descriptions. Width of space between the mesocoxae was measured at level of apex of trochanters. Enumeration of elytral striae was as

illustrated and discussed in Zorn (2007). Endophallus and aedeagus terminology follows Filippini *et al.* (2013). Surface sculpturing terminology follows Harris (1979).

Molecular-based phylogenetic analysis

The 36 Anomalini specimens from Costa Rica, belonging to 28 species, used for the analysis were conserved either dried or fixed in 100% ethanol and stored at -80°C . Collection data are provided in Table 2. As outgroup a species belonging to another Anomalini genus was selected, *Anomalorhina turrialbana* (Ohaus, 1928), also present in Costa Rica, in order to facilitate analysis convergence. Regarding the risk of *Anomalorhina* being an aberrant clade of *Anomala*, this should not affect our aim focused on the genus *Callistethus*.

DNA was extracted from entire or grounded metafemora using the DNeasy Blood and Tissue Kit (Qiagen, Hilden, Germany) following the manufacturer's protocol. Two mitochondrial (cytochrome c oxidase subunit I, 658–814 bp; 16S rRNA, 518 bp) and one nuclear (a continuous ca. 2267 bp section of 28S rRNA) genes were amplified and sequenced using primers 16Sa and 16Sb for 16S, LCO1490 and HCOoutout or HCO2190 for COI. Partial 28S rRNA was amplified in three fragments, using the primers 28Srd1a-28Srd4b for the first fragment, 28Sa-28Srd5b for the second fragment and 28Srd4.8a-28Srd7b1 for the third fragment. PCRs were carried out in 25 μl reaction volumes according to standard protocols for GoTaq® DNA Polymerase (Promega, Madison, WI, USA). The PCR product was purified through enzymatic reaction with ExoSAP-IT (USB Corp., Cleveland, OH, USA). Sequencing was performed with the Big Dye® Terminator v3.1 Cycle Sequencing Kit (AppliedBiosystems, Foster City, CA, USA). Chromatograms obtained from the automatic sequencer were read and sequences assembled using the sequence editing software Sequencher™ 4.7 (Gene Codes Corporation, Ann Arbor, MI, USA) and annealed in Geneious 6.0.5 (Biomatters Ltd., Auckland, New Zealand). The sequence identity for each PCR product was checked using the basic local alignment search

tool (BLAST). The sequences have been deposited in GenBank under the accession numbers shown in Table 2.

First we used PartitionFinder 1.1.1 (Lanfear *et al.* 2012) to determine the best-fitting partition and substitution models for the phylogenetic analysis. Alternative partitions and models were also tested with a stepping-stone analysis in MrBayes 3.1.1 (Ronquist & Huelsenbeck 2003). The best-fitting partition and substitution models chosen for Bayesian analysis were 16S + COI 1st codon position (GTR+I+G), COI 3rd codon position (HKY+G) and 28S + COI 2nd codon position (GTR+I). We analysed the concatenated data set (3831 bp) in MrBayes 3.1.1 (Ronquist & Huelsenbeck 2003), with unlinked gamma shape and branch lengths, and variable rate prior for each partition. We ran two independent runs with 4 chains each for seven million generations, sampling every 500 generations. AWTY (Wilgenbusch *et al.* 2004) and Tracer 1.6 (Rambaut *et al.* 2013) were used to assess convergence. Posterior probabilities are given as statistical branch support.

The best-fitting partition and substitution models for Maximum likelihood was 16S (HKY+I+G), COI 1st codon position (HKY+I+G), COI 2nd codon position (TrN+I+G), COI 3rd codon position (F81), 28S (GTR+I+G). Tree searches were conducted in GARLI (Zwickl 2006), running eighth independent searches.

Bootstrap values were calculated in PAUP* 4.0 (Swofford 1998) from 100 trees built in GARLI. Mr Bayes and Garli were run through CIPRES Science Gateway (Miller *et al.* 2010).

Phylogenetic signal of morphological characters

Morphological characters were adapted from the literature (Morón & Ramírez-Ponce 2012), and additional characters were implemented from the dissection and morphological study of the specimens.

Table 2. Collection data and GenBank accession numbers for specimens used in phylogenetic analysis. Medium D: dry specimen; E: ethanol.

Species	Medium	Voucher	Locality (Costa Rica)	Date	28S	COI	16S
<i>Anomala eucoma</i>	D	CEUA00105271	Amubri, A.C. Amistad, Limón	4-21-Dec-1993	KF737953	KF738020	KF737989
<i>Callistethus stannibractea</i>	D	CEUA00105277	Estación Barva, P.N. Braulio Carrillo, Heredia	feb-90	KF737954	KF738021	
<i>Callistethus specularis</i>	D	CEUA00105278	Isla Bonita, Alajuela	9-Sep-2007	KF737955	KF738022	KF737990
<i>Callistethus levigatus</i>	D	CEUA00105281	Volcán Tenorio, Alajuela	3-Jun-2008	KF737956	KF738023	KF737991
<i>Callistethus sp.304</i>	D	CEUA00105801	Cerro Bitárika, Limón	11-Aug-2007	KF737957	KF738024	KF737992
<i>Callistethus multiplicatus</i>	D	CEUA00105283	Cabanga, finca J.Martínez, Alajuela	20-Jul-2010	KF737958	KF738025	KF757331
<i>Callistethus fuscrobens</i>	D	CEUA00105284	Estación Altamira, Cerro Biolley, Puntarenas	23-30-Oct-1995	KF737959	KF738026	KF737993
<i>Callistethus parapulcher</i>	D	CEUA00105287	Alto Jalisco, Buenos Aires, Puntarenas	22-26-Feb-2009	KF737960	KF738027	KF737994
<i>Callistethus carbo</i>	D	CEUA00105294	Río San Lorenzo, Z.P. Tenorio, Guanacaste	23-Mar-21-Apr-1992	KF737961	KF738028	KF737995
<i>Callistethus macroxantholeus</i>	D	CEUA00105293	Sector Cerro Cocori, Limón	apr-92	KF737962	KF738029	
<i>Anomala subridens</i>	D	CEUA00105802	La Esperanza, Cartago	29-Aug-2008	KF737963	KF738030	KF737996
<i>Anomala calligrapha</i>	D	CEUA00105803	Albergue Heliconias, Alajuela	13-Sep-2007	KF737964		KF737997
<i>Anomala subusta</i>	D	CEUA105804	Volcán Tenorio, Alajuela	04-Jun-2008	KF737965	KF738031	KF737998
<i>Callistethus jordani</i>	D	INBIOCRI000909339	Estación Biológica Las Alturas, Coto Brus, Puntarenas	23-Mar-2-May-1992	KF737966	KF738032	
<i>Callistethus valdecostatus</i>	D	INBIOCRI001926964	Alto de las Moras, Buenos Aires, Puntarenas	24-mar-93	KF737967	KF738033	KF737999
<i>Callistethus megalis</i>	D	INBIOCRI000988672	Manzanillo, Limón	22-Oct-11-Nov-1992	KF737968	KF738034	KF738000
<i>Callistethus validus</i>	D	CEUA00003281	Horquetas	12-feb-06	KF737969	KF738035	KF738001
<i>Anomala balzapambae</i>	D	CEUA00105805	Volcán Tenorio, Alajuela	20-Jun-2009	KF737970	KF738036	KF738002
<i>Anomala estrella</i>	D	CEUA00105806	Los Almendros, P. N. Guanacaste, Guanacaste	28-Mar-24-Apr-1992	KF737971	KF738037	KF738003
<i>Anomalorhina turrialbana</i>	D	CEUA00105807	Cabanga, finca J.Martínez, Alajuela	13-apr-10	KF737972	KF738038	KF738004
<i>Callistethus mimeloides</i>	E	CEUA00105808	Catarata Río Buenavista, P.N. Volcán Tenorio, Alajuela	14-apr-10	KF737973		KF738005
<i>Callistethus cupricollis</i>	E	CEUA00105809	Cabanga, finca J.Robles, Alajuela	15-apr-10	KF737974	KF738039	KF738006
<i>Callistethus cupricollis</i>	E	CEUA00105810	Cabanga, finca J.Martínez, Alajuela	15-apr-10	KF737975	KF738040	KF738007
<i>Callistethus chontalensis</i>	E	CEUA00105811	Catarata Río Buenavista, P.N. Volcán Tenorio, Alajuela	15-apr-10	KF737976	KF738041	KF738008
<i>Callistethus chontalensis</i>	E	CEUA00105812	Cabanga, finca J.Robles, Alajuela	15-apr-10	KF737977	KF738042	KF738009

Species	Medium	Voucher	Locality (Costa Rica)	Date	28S	COI	16S
<i>Callistethus granulipygus</i>	E	CEUA00105813	Cabanga, finca J. Robles, Alajuela	15-apr-10	KF737978	KF738043	KF738010
<i>Callistethus lativittis</i>	E	CEUA00105814	Cabanga, finca J. Martínez, Alajuela	15-apr-10	KF737979	KF738044	KF738011
<i>Callistethus lativittis</i>	E	CEUA00105815	Cabanga, finca J. Robles, Alajuela	14-apr-10	KF737980	KF738045	KF738012
<i>Callistethus schneideri</i>	E	CEUA00105816	Catarata Río Buenavista, P.N. Volcán Tenorio, Alajuela	13-apr-10	KF737981	KF738046	KF738013
<i>Callistethus schneideri</i>	E	CEUA00105817	Catarata Río Buenavista, P.N. Volcán Tenorio, Alajuela	13-apr-10	KF737982	KF738047	KF738014
<i>Callistethus macroxantholeus</i>	E	CEUA00105818	Catarata Río Buenavista, P.N. Volcán Tenorio, Alajuela	14-apr-10	KF737983	KF738048	KF73801
<i>Callistethus microxantholeus</i>	E	CEUA00105819	Cabanga, finca J. Robles, Alajuela	12-feb-10	KF737984	KF738049	KF7575332
<i>Anomala discoidalis</i>	E	CEUA00105820	Cabanga, finca J. Robles, Alajuela	19-Oct-2009	KF737985		KF738016
<i>Anomala discoidalis</i>	E	CEUA00105821	Cabanga, finca J. Robles, Alajuela	19-Oct-2009	KF737986	KF738050	KF738017
<i>Callistethus microxantholeus</i>	E	CEUA00105822	Cabanga, finca J. Robles, Alajuela	11-feb-10	KF737987	KF738051	KF738018
<i>Callistethus microxantholeus</i>	E	CEUA00105823	Cabanga, finca J. Robles, Alajuela	11-feb-10	KF737988	KF738052	KF738019

Characters like 'pronotum with incomplete anterior margin' and 'epipleural fold wide' (Morón & Ramírez-Ponce 2012) were not included for lack of definition that would make the coding subjective. The characters and character states analyzed are the following:

1. Interocular distance (based on a dorsal view): [0] narrow, 2–4 eye diameters (Fig. 1A); [1] wide, > 4 eye diameters (Fig. 1B).
2. Presence of basal bead on the posterior margin of pronotum: [0] present (Fig. 1A); [1] absent (Fig. 1B).
3. Shape of the posterior margin of pronotum in correspondence of scutellum: [0] convex (Fig. 1A); [1] straight or slightly concave (Fig. 1B).
4. Distance between mesocoxae: [0] narrow, about 1/4 the height of coxae or less; [1] wide, half the height of coxae; [2] very large, similar to the height of coxae.
5. Development of mesosternal process: [0] not developed, area between mesocoxae flat or slightly convex; [1] reaching apex of mesocoxae, apex connected to mesoventrite; [2] produced beyond mesocoxae for at least half the height of coxae, with apex separated from level of mesoventrite.
6. Definition of mesometasternal suture: [0] well defined; [1] poorly defined or absent.
7. Position of mesometasternal suture: [0] at the same level as posterior margin of mesotrochanter; [1] at the same level as anterior margin of mesotrochanter.
8. Shape of apex of elytral suture: [0] curved; [1] spiniform.
9. Fusion of parameres to aedeagal ventral plate: [0] absent; [1] present.

The scorings of these characters for species of interest are listed in Table 3.

Characters 1, 3, 6 and 7 were added for different states of characters being present in the species studied from Costa Rica and in the type species of the genus.

Characters 4 and 5 are treated as multistate to account for the variability seen in these structures.

Phylogenetic signal of morphological characters of male genitalia was calculated with the *K* statistics (Blomberg *et al.* 2003), using the R packages *picante* (Kembel *et al.* 2010). *K* values closer to zero correspond to a random, i.e. highly homoplasious, pattern of evolution, while *K* values greater than 1 indicate low homoplasy and thus strong phylogenetic signal.

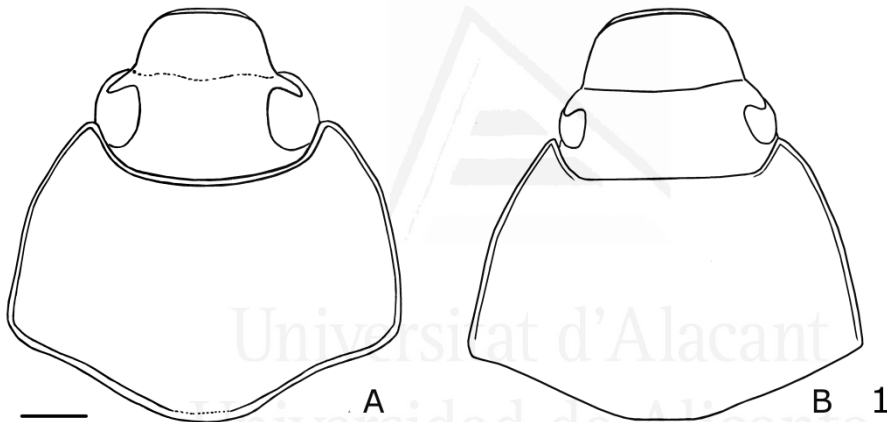


Figure 1: Head and pronotum in dorsal view of (A): *Anomala arara* (male, Estación Cabro Muco, Costa Rica); (B): *Callistethus flavodorsalis* (male, Finca Cafrosa, Costa Rica). Scale = 1 mm.

Abbreviations

BMNH Natural History Museum, London, United Kingdom; **CEUA** Colección Entomológica de la Universidad Alicante, Spain; **INBIOCRI** Instituto Nacional de Biodiversidad, Costa Rica; **MNHN** Muséum National d'Histoire Naturelle, Paris, France; **MNHUB** Museum für Naturkunde der Humboldt-Universität zu Berlin, Germany.

3.3 *Callistethus*

Table 3. Character scoring for the species treated.

Species	1	2	3	4	5	6	7	8	9
<i>Anomala balzapambae</i>	0	0	0	0	0	0	0	0	0
<i>Anomala calligrapha</i>	0	0	0	0	0	0	0	0	0
<i>Anomala discoidalis</i>	0	0	0	0	0	0	0	0	0
<i>Anomala estrella</i>	0	0	0	0	0	0	0	0	0
<i>Anomala eucoma</i>	0	0	0	0	0	0	0	0	0
<i>Anomala subridens</i>	0	0	0	0	0	0	0	0	0
<i>Anomala subusta</i>	0	0	0	0	0	0	0	0	0
<i>Anomalorhina turrialbana</i>	0	1	0	0	0	0	0	0	0
<i>Callistethus antis</i>	0	0	0	2	0	0	1	?	0
<i>Callistethus bimaculatus</i>	0	0	0	1	0	1	0	?	?
<i>Callistethus biolleyi</i>	0	0	1	0	0	0	0	1	1
<i>Callistethus buchwaldianus</i>	0	0	0	0	1	0	0	?	1
<i>Callistethus calonotus</i>	1	1	1	2	2	1	1	0	1
<i>Callistethus carbo</i>	1	1	1	1	1	1	1	1	1
<i>Callistethus chlorotoides</i>	1	1	1	2	2	1	1	1	1
<i>Callistethus chontalensis</i>	0	1	1	0	1	0	1	0	1
<i>Callistethus cicatricosus</i>	0	0	0	1	0	0	0	?	0
<i>Callistethus cupricollis</i>	0	0	0	0	1	1	0	0	0
<i>Callistethus eckhardti</i>	0	0	0	1	1	1	1	?	0
<i>Callistethus flavodorsalis</i>	1	1	1	2	2	1	1	0	0
<i>Callistethus fulvopiceus</i>	0	0	0	1	0	0	0	?	?
<i>Callistethus fuscorubens</i>	0	1	1	1	1	1	1	0	1
<i>Callistethus granulipygus</i>	0	1	1	1	1	1	1	0	1
<i>Callistethus jansoni</i>	0	0	0	0	0	0	0	?	0
<i>Callistethus jordani</i>	1	1	1	1	2	1	1	0	0
<i>Callistethus lativittis</i>	0	1	1	1	1	1	1	0	1
<i>Callistethus lepidus</i>	1	1	1	2	2	1	1	?	1
<i>Callistethus levigatus</i>	1	1	1	2	2	1	1	0	0
<i>Callistethus macroxantholeus</i>	1	1	1	1	1	1	0	1	0
<i>Callistethus megalius</i>	0	0	1	1	0	1	1	0	0
<i>Callistethus microxantholeus</i>	1	1	1	1	1	1	0	1	0
<i>Callistethus mimeloides</i>	0	1	1	2	2	1	1	0	1
<i>Callistethus multiplicatus</i>	1	1	1	2	2	1	1	1	1
<i>Callistethus nicoyus</i>	0	0	0	0	1	0	0	1	1
<i>Callistethus ochrogastrus</i>	0	0	0	0	0	0	0	0	0
<i>Callistethus panamensis</i>	0	0	0	1	0	1	1	?	0

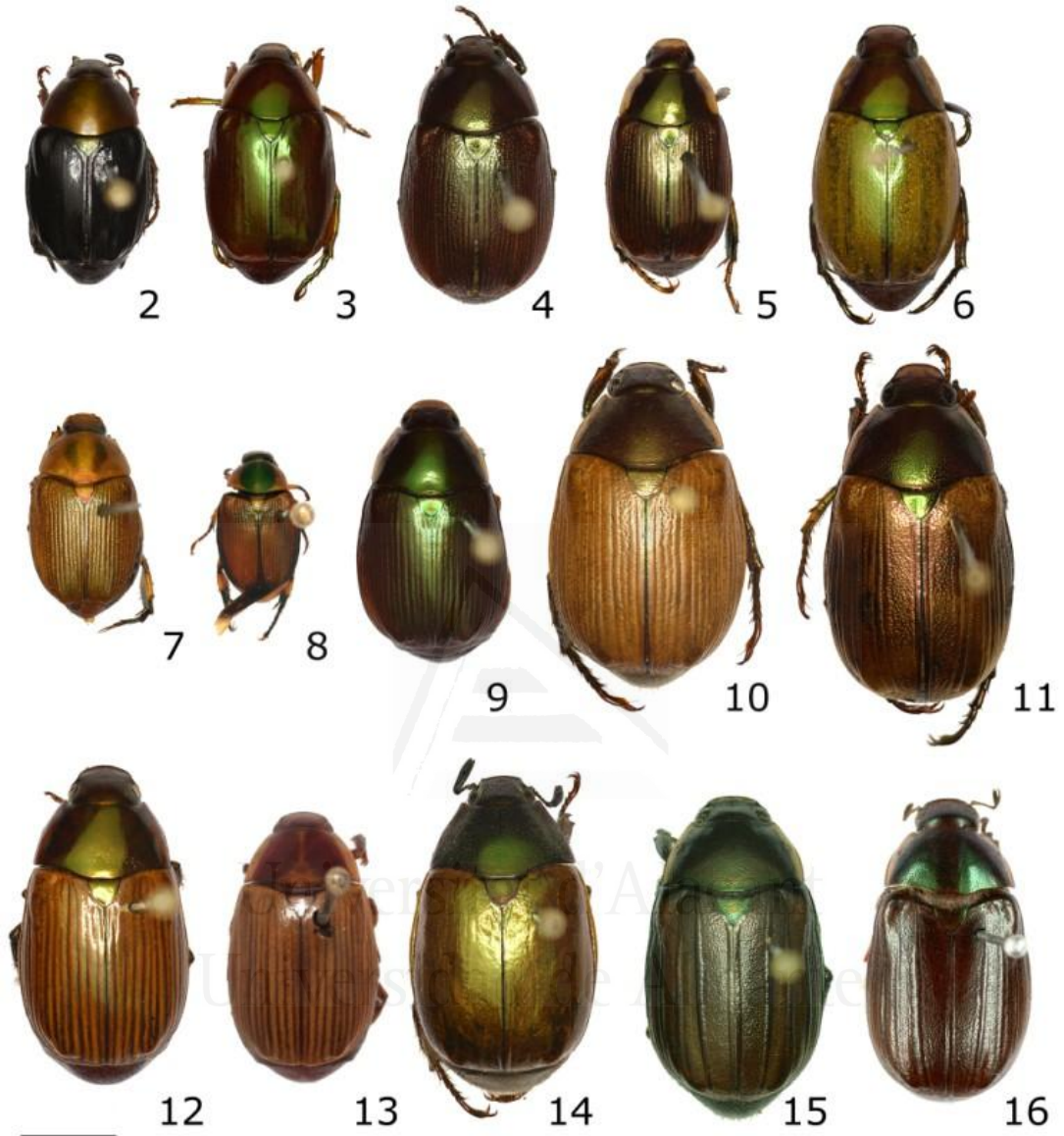
Species	1	2	3	4	5	6	7	8	9
<i>Callistethus parapulcher</i>	0	1	1	1	2	1	1	0	1
<i>Callistethus plagiatus</i>	0	0	0	1	1	1	0	?	?
<i>Callistethus pseudocollaris</i>	1	1	1	2	2	0	1	0	1
<i>Callistethus pupillatus</i>	0	0	0	0	0	0	0	?	0
<i>Callistethus schneideri</i>	0	1	1	0	1	1	1	0	1
<i>Callistethus sp142</i>	0	0	0	2	2	1	1	0	0
<i>Callistethus sp205</i>	0	1	1	1	1	0	1	0	1
<i>Callistethus sp304</i>	1	1	1	1	2	1	1	1	1
<i>Callistethus specularis</i>	1	1	1	2	2	1	1	0	1
<i>Callistethus stannibracteus</i>	1	1	1	1	2	1	1	0	0
<i>Callistethus sulcans</i>	0	0	0	0	1	0	0	1	1
<i>Callistethus valdecostatus</i>	0	1	1	0	1	1	1	0	1
<i>Callistethus validus</i>	0	0	0	0	0	1	0	0	0
<i>Callistethus vanpatteni</i>	0	1	1	1	1	0	1	0	1
<i>Callistethus xantholeus</i>	1	1	1	1	1	0	0	?	0
<i>Callistethus xiphostethus</i>	1	1	1	2	2	1	1	0	0

Taxonomy

Callistethus carbo sp.n.

Description. Male holotype: **Body shape:** Length 11.81 mm; width 6.74 mm. Oval, stout. Elytral disc flattened. **Colouration:** Head, pronotum and scutellum metallic green with bronze luster; scutellum darker. Elytra glossy bluish black, pygidium black. Venter greenish dark brown, legs dark reddish brown (Fig. 2). **Head:** Clypeus trapezoidal, nearly rectangular; ratio width/length 2.09. Clypeus surface punctate-reticulate with confluent punctures. Frons punctate-reticulate. Vertex punctate. Ocular canthus wide and stout; apex large and rounded. Eyes elongated, interocular ratio (interocular width/width of eye) 4.53. Antennae: ratio funiculus/club 0.64. **Pronotum:** Basal width 1.75 x length; in dorsal view broadest at its base. Lateral margins rounded, angulated at 1/3 of length from anterior. Anterior angles acute and sharp; posterior angles obtuse and rounded. Posterior margin without basal bead,

convex, forming a nearly straight line above the scutellum. Surface punctate, with a pair of linear depressions forming a 45° angle, from posterior margin towards lateral margins, without reaching them. **Scutellum**: Shape subpentagonal, sharp apex, with sparse punctures on entire surface; ratio width/length 1.36. **Elytra**: Surface with costae defined by rows of shallow and sparse punctures. First interstice with 2–3 secondary striae, following interstices with 1 stria. The surface appears fairly smooth to the naked eye. Apex of elytral suture spiniform. Lateral margin convex and complete, tapering gradually from the base to the apical third. Marginal membrane narrow, extending along the apical half. **Pygidium**: Strigate-imbricate. Medium-length to long setae at margins. Triangular shape, with acute apex. Slightly convex in lateral view. Ratio width/length 1.42. **Metasternum**: Disc slightly sulcate, densely punctate and densely covered with medium-length setae, reaching half of trochanters height, except on the median sulcus. Mesosternal process short, reaching the anterior margin of mesocoxae, width at base 1/2 of femur height, narrowing towards the apex to 1/2 the width at base; in lateral view blunt, rounded; width at base 0.56 (Fig. 17). Mesometasternal suture absent, metasternal sulcus reaching base of trochanters. **Abdominal sternites**: With sparse oblong punctures coalescing at sides; 1–2 rows of medium-length setae per sternite, denser at sides. Last exposed sternite and apical margin with sparse punctures, apical margin at midline 1/3 as long as total length of last sternite; basal suture of the apical bead sinuate, well defined. Sixth abdominal spiracle flat. **Protibia**: With 2 teeth (Fig. 29), slender; apical tooth narrow, long, curved. Proximal tooth triangular, acute, pointing upwards, slightly above the internal apex of protibia. **Metatibia**: stout, fusiform but with negligible subapical constriction. Ratio length/width 2.53. First carina defined by punctures. Surface with dense deep oblong punctures, nearly glabrous. **Claws of fore leg**: External claw curved; ratio length/height: 1.53; internal claw bifurcate, upper branch slightly shorter than and less than 1/2 as wide as the lower one. Inferior margin slightly sinuate.



Figures 2–16: Habitus. **2:** *Callistethus carbo* (Holotype). **3:** *C. flavodorsalis* (Holotype). **4:** *C. fuscorubens* (Holotype). **5:** *C. lativittis* (Holotype). **6:** *C. levigatus* (Holotype). **7:** *C. macroxantholeus* (Holotype). **8:** *C. microxantholeus* (Paratype, Est. Pitilla). **9:** *C. multiplicatus* (Holotype). **10:** *C. parapulcher* (Holotype). **11:** *C. pseudocollaris* (Holotype). **12:** *C. specularis* (Rio San Lorenzo). **13:** *C. kolbei* (Holotype). **14:** *C. stannibractea* (Holotype). **15:** *C. valdecostatus* (Estación Biológica Las Alturas, Puntarenas, INBIO). **16:** *C. marginicollis* (cotype, Mexico, MNHUB). Scale = 5 mm.

Male genitalia: Aedeagus (Fig. 41). Parameres slender, slightly sinuate frontally, with a rounded apex in lateral view, ventral part membranous; dorsally flattened. Ventral plate fused with parameres in the proximal half. Endophallus (Fig. 53). Swollen dorsally, with a thin dorsal sacculus with aligned patches of thick sclerotised setae along all length; ejaculatory duct opening frontal, right above the tip of median lobe. Median lobe strongly sclerotised, apex pointed.

Female: antennal club shorter than in male; apical tooth of protibia (Fig. 29) longer and wider; basal tooth above internal apex. First carina of metatibia well defined. Lower branch of internal foreleg claw thinner than in male, inferior margin straight. Last exposed sternite with oblong punctures, apical smooth margin narrower than in male.

Variation: body length 11.81–12.50 mm; width 6.74–7.31 mm. Clypeus w/l 1.94–2.09. Interocular ratio 4.05–4.74. Male antennae, ratio funiculus/club 0.64–0.93. Pronotum w/l 1.69–1.75. Scutellum w/l 1.35–1.37. Pygidium w/l 1.42–1.53. Width of mesosternal process at base 0.52–0.56 mm. Metatibia w/l 2.53–2.73. Bronze luster on pronotum can be absent; scutellum from dark green to blackish; pygidium purple black to deep black.

Differential diagnosis. *C. carbo* is separated from similar species by the combination of the following features: medium size, the combination of green pronotum and black elytra, the membranous ventral portion of parameres, the pointed median lobe and endophallus with narrow sacculus.

Derivatio nominis. From the Latin noun 'carbo, -onis', coal, treated here as a noun in apposition, for the shiny black colour of elytra, like anthracite coal.

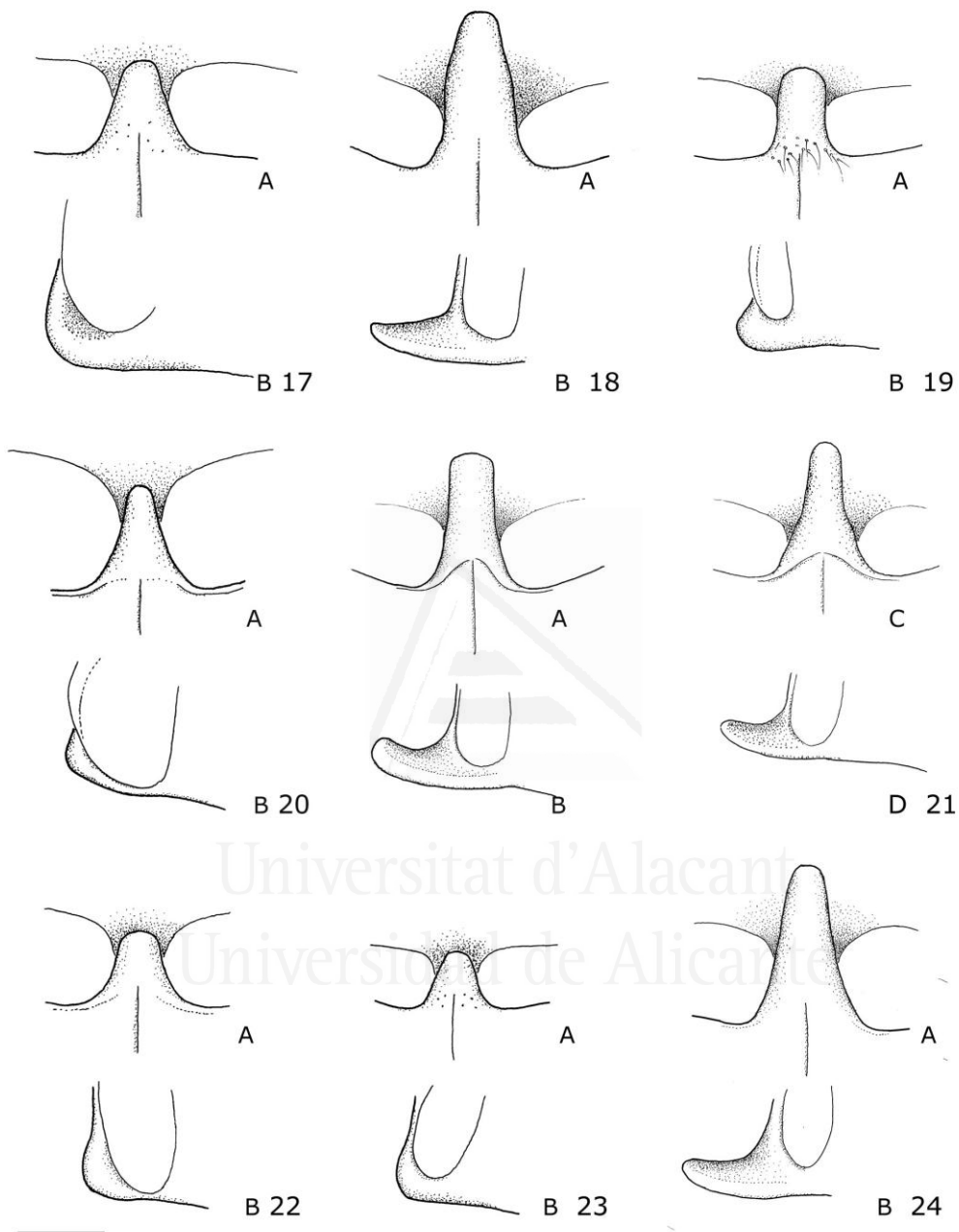
Distribution. *C. carbo* is only known from the Z.P. Tenorio, Prov. Guanacaste (Fig. 97).

Material. HOLOTYPE: ♂ 'Río San Lorenzo, 1050m, Tierras Morenas, Z.P. Tenorio, Prov. Guanacaste Costa Rica. Abr 1992 F. Quesada L-N 287800,427600', 'INBIOCR1000930505'. – PARATYPES (4): 2♂ 'Río San Lorenzo, 1050m, Tierras Morenas, Z.P. Tenorio, Prov. Guanacaste Costa Rica. Abr 1992 F. Quesada L-N 287800,427600', 'INBIOCR1000930501' and

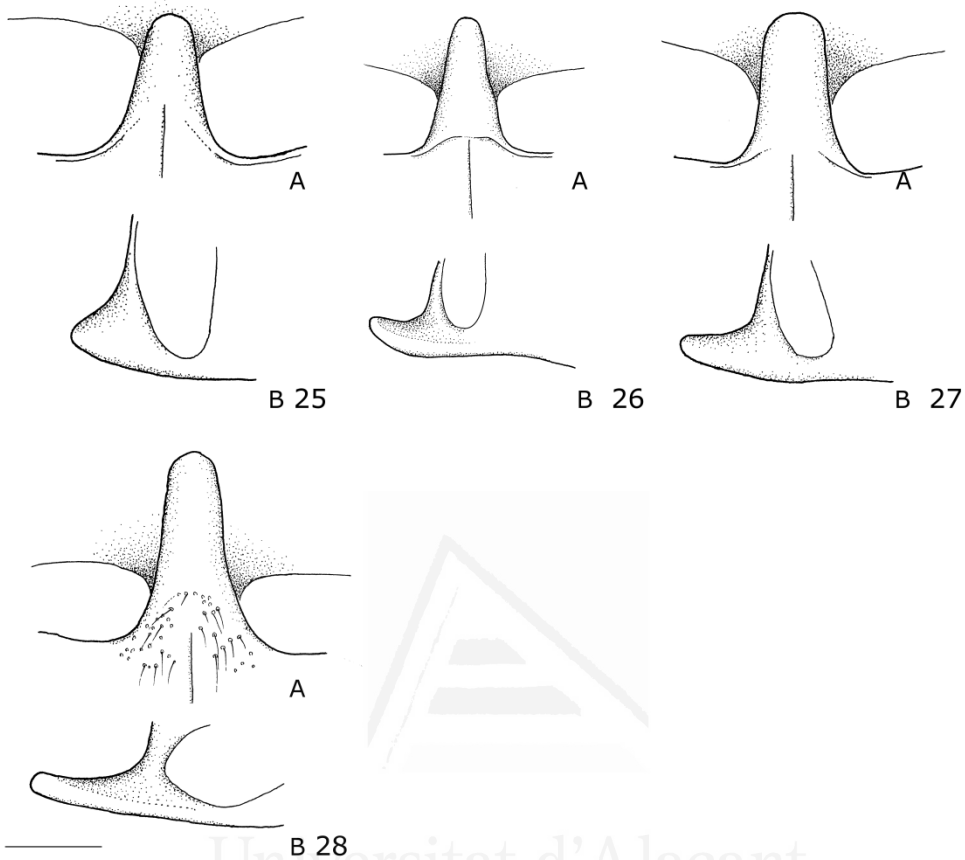
'INBIOCRI000930510'; 1♀ 'Río San Lorenzo, 1050m, Tierras Morenas, Z.P. Tenorio, Prov. Guanacaste Costa Rica. Abr 1992 F. Quesada L-N 287800,427600', 'INBIOCRI000930506'; 1♂ 'Río San Lorenzo, 1050m, Tierras Morenas, Z.P. Tenorio, Prov. Guanacaste Costa Rica. A. Marin 23 mar a 21 abr 1992 L-N 287800,427600', 'CEUA00105294'.

Callistethus flavodorsalis sp.n.

Description. Male holotype: **Body shape:** Length 15.05 mm; width 7.98 mm. Oval, slender. Elytral disc convex. **Colouration:** Head, pronotum, scutellum and pygidium metallic green, light green on clypeus. Margins of pronotum ochre, with green luster. Elytra yellow with green metallic luster. Venter, legs and antennae metallic dark green (Fig. 3). **Head:** Big in relation to pronotum. Clypeus nearly rectangular, ratio width/length 1.92. Clypeus surface densely and deeply punctate, surface reticulate. Frons with slightly less dense punctures. Vertex with sparse punctures. Ocular canthus short and wide; apex rounded. Eyes very small, interocular ratio (interocular width/width of eye) 5.95. Antennae: ratio funiculus/club 0.88. **Pronotum:** Basal width 1.76 x length; in dorsal view broadest at its base. Lateral margins rounded, angulated at nearly 1/2 of length from anterior. Anterior angles acute and sharp; posterior angles obtuse and rounded. Posterior margin without basal bead, sinuate, forming a straight line above the scutellum. Surface with small, shallow, sparse punctures. **Scutellum:** Shape subpentagonal, blunt apex, with fine and sparse punctation on entire surface; ratio width/length 1.43. **Elytra:** Surface with costae clearly defined by rows of shallow punctures. Interstices with 3–4 (first interstice) or 1 (second–fifth interstices) rows of sparse shallow punctures. Small horizontal wrinkles are present between second interstice and third costa, at half the length of elytra surface. Apex of elytral suture rounded. Lateral margin convex, tapering gradually from base to apical third, disappearing on apex. Marginal membrane narrow and nearly complete. **Pygidium:** Coriarius-striated. Short sparse setae on margins. Triangular shape, with rounded apex. Nearly straight in lateral view.



Figures 17–25. Mesosternal process, (A) ventral view, anterior ↑; (B) lateral view, anterior ←, dorsal at top. 17: *Callistethus carbo* (Holotype). 18: *C. flavodorsalis* (Holotype). 19: *C. fuscorubens* (Holotype). 20: *C. lativittis* (Holotype). 21: *C. levigatus*, showing the extent of variability; (A,B) Holotype; (C,D) Paratype, Río San Lorenzo. 22: *C. macroxantholeus* (Holotype). 23: *C. microxantholeus* (Paratype, Amubri). 24: *C. multiplicatus* (Holotype).



Figures 25–28: Mesosternal process, (A) ventral view, anterior ↑; (B) lateral view, anterior ←, dorsal at top. 25: *C. parapulcher* (Holotype). *C. pseudocollaris* (Holotype). 27: *C. specularis* (Isla Bonita). 28: *C. stannibractea* (Holotype). Scale = 1 mm.

Ratio width/length 1.41. **Metasternum:** Disc slightly concave, smooth; glabrous centrally, with coarse setigerous punctures on sides, bearing short blonde setae. Mesosternal process long, reaching the base of procoxae, width at basal $2/3$ as wide as femur height, narrowing moderately towards the apex to $2/3$ the width at base; in lateral view slightly curved upwards, tapering towards apex; width at base 0.88 mm (Fig. 18). Mesometasternal suture absent, metasternal sulcus reaching apex of trochanters. **Abdominal sternites:** With sparse shallow punctures, at side forming 1–2 rows near anterior margin and 3–4 rows near posterior one, with a smooth stripe between them; 1 row of short blonde setae per sternite, a little denser on sides (on 2–

3 rows). Last exposed sternite with sparse shallow punctures, apical margin nearly smooth, at midline $\frac{1}{3}$ as long as total length; basal suture of the apical bead sinuate, well defined. Sixth abdominal spiracle tuberculiform. **Protibia:** With 2 teeth (Fig. 30), stout; apical tooth with wide base, narrowing at apex, quite short (laterally not reaching the level of the basal tooth), oblique in relation to the vertical axis of protibia, nearly quadrate. Proximal tooth small, protruding slightly from the lateral margin, positioned below the internal apex of protibia. **Metatibia:** Quite stout, fusiform. Ratio length/width 3.70. Both carinae well defined. Surface sparsely punctuate, nearly glabrous. **Claws of fore leg:** External claw curved; ratio length/height:1.63; internal claw bifurcate, with branches strongly diverging, upper branch slightly shorter and less than $\frac{1}{2}$ as wide as the lower one. Inferior margin sinuate. **Male genitalia:** Aedeagus (Fig. 42). Very long parameres, with sharp apex and sinuate ventral margin. Ventral plate reduced to a couple of small plates. Endophallus (Fig. 54). Globular shape, with frontal wide ejaculatory duct opening. Dorsally a short sacculus with folded apex. Median lobe sclerotised.

Female: protibia (Fig. 30) with apical tooth longer and wider, basal tooth above the internal apex. Foreleg claw: lower branch of internal claw much narrower than in male, similar in width to upper branch; inferior margin straight. Apical smooth margin of last exposed sternite narrower than in male.

Variation: body length 14.02–15.92 mm; width 7.42–8.93 mm. Clypeus w/l 1.83–1.97. Interocular ratio 5.62–5.95. Male antennae, ratio funiculus/club 0.84–0.90. Pronotum w/l 1.75–1.78. Scutellum w/l 1.32–1.56. Pygidium w/l 1.41–1.53. Width of mesosternal process at base 0.70–0.88 mm. Metatibia w/l 3.31–3.76. External foreleg claw l/h 1.63–1.69. Abdominal sternites and apical part of legs light green in some specimens.

Differential diagnosis. It is distinguished by the the combination of the following features: combination of greenish yellow elytra and green pronotum, narrow and long parameres, reduced ventral plate, globose endophallus with a small sacculus at

base. *C. chrysanthe* and *C. jansoni*, also with light elytra, have a much larger size. *C. mimeloides* is entirely yellow.

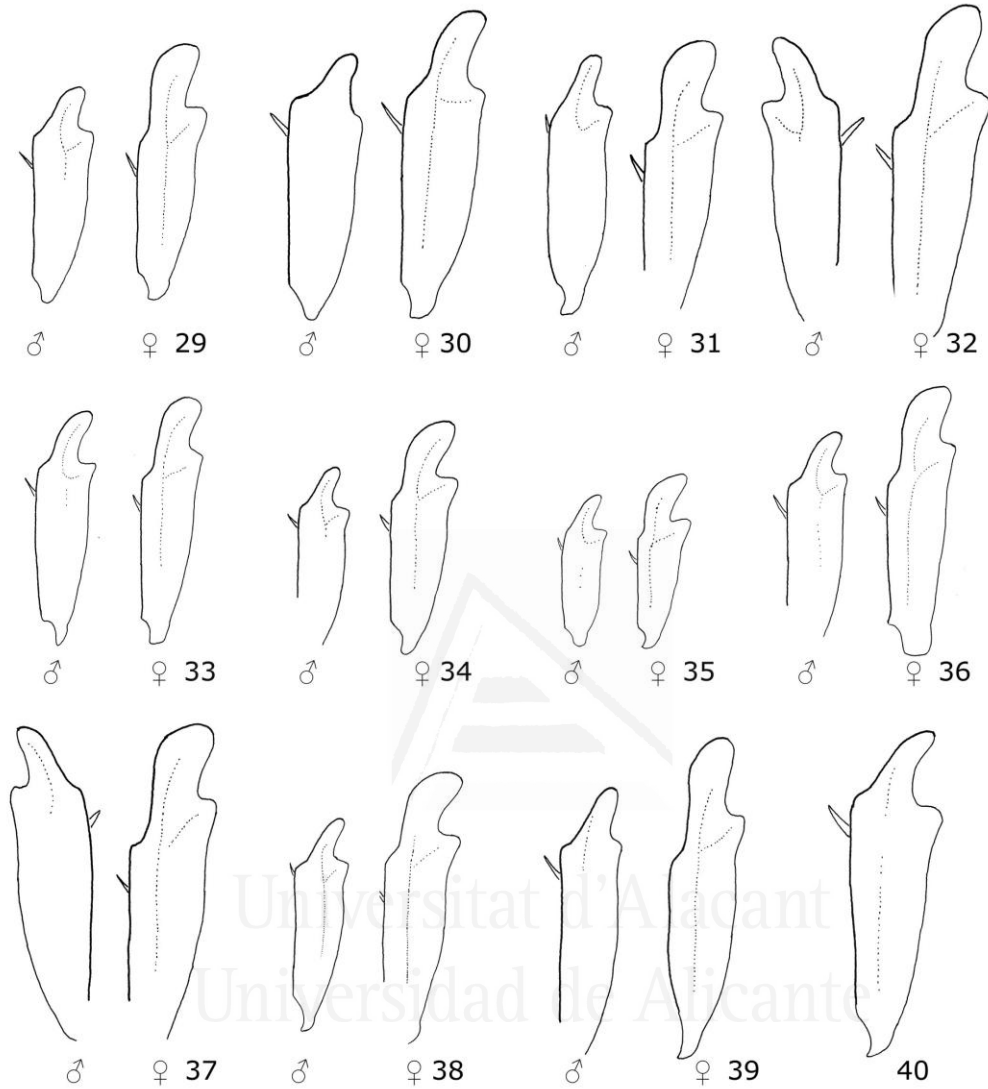
Derivatio nominis. From the Latin adjective 'flavus, -a, -um', yellow, and adjective indicating possession from noun 'dorsum, -i', back, for the yellowish colour of elytra.

Distribution. *C. flavodorsalis* is known from two localities in the southern part of the Talamanca mountain range, Pacific slope, near the boundary with Panama. (Fig. 98).

Material. HOLOTYPE: ♂ 'Fca. Cafrosa, Est. Las Mellizas, P.N. Amistad, 1300 m, Prov. Punt. COSTA RICA. M. Ramirez & G. Mora, Oct 1989. L-S-316100-596100', 'INBIOCR1000478886'. – PARATYPES (7): 1♀ 'Est. Biol. Las Alturas, 1500m, Coto Brus, Prov. Puntarenas, Costa Rica. M.A. Zumbado, Oct 1991 L-S 322500.591300', 'INBIOCR1000376991'; 4♂ 'Fca. Cafrosa, Est. Las Mellizas, P.N. Amistad, 1300 m, Prov. Punt. COSTA RICA. M. Ramirez & G. Mora, Oct 1989. L-S-316100-596100', 'INBIOCR1000478885', 'CEUA00105279', 'INBIOCR1000478896' and 'INBIOCR1000478900'; 2♂ 'Est. Biol. Las Alturas, 1500m, Coto Brus, Prov. Puntarenas, Costa Rica. M.A. Zumbado, Oct 1991 L-S 322500,591300', 'CEUA00105280' and 'INBIOCR1000632447'.

Callistethus fuscrobens sp.n.

Description. Male holotype: **Body shape:** Length 14.21 mm; width 8.12 mm. Oval, stout. Elytral disc convex. **Colouration:** Head, pronotum and scutellum metallic dark green, dark reddish brown under the stereoscope. Pronotum with ochre margins. Elytra dark reddish brown, with greenish hue. Pygidium reddish brown. Venter and legs greenish to reddish dark brown (Fig. 4). **Head:** Clypeus trapezoidal, ratio width/length 1.78. Clypeus surface densely punctate-reticulate. Frons densely punctate, with secondary small punctures on disc, often with a central depression, next to suture with clypeus. Vertex densely punctate as frons. Ocular canthus long and thin; apex rounded. Eyes rounded, interocular ratio (interocular width/width of eye) 3.09. Antennae: ratio funiculus/club 0.76. **Pronotum:** Basal width 1.77 x length; in dorsal view broadest at its base. Lateral margins rounded, angulated at 1/3 of length from anterior. Anterior angles quadrate and rounded; posterior angles obtuse



Figures 29–40. Shape of protibia in dorsal view. Right protibia is shown if not otherwise specified. **29:** *C. carbo*, male: Paratype, Río San Lorenzo; female: Paratype, Río San Lorenzo. **30:** *Callistethus flavodorsalis*, male: Holotype; female: Paratype, Est. Biol. Las Alturas. **31:** *C. fuscorubens*, male: Holotype; female: Paratype, San Vito Las Cruces. **32:** *C. lativittis*, male: Holotype; female: Paratype, Sect. San Ramon de Dos Rios. **33:** *C. levigatus*, male: Holotype, left protibia; female: Paratype, Río San Lorenzo. **34:** *C. macroxantholeus*, male: Holotype; female: Paratype, Estación Pitilla. **35:** *C. microxantholeus*, male: Holotype; female: Paratype, Rancho Quemado. **36:** *C. multiplicatus*, male: Holotype; female: Paratype, Estación Pitilla. **37:** *C. parapulcher*, male: Holotype, right protibia; female: Paratype, Estación Santa Elena. **38:** *C. pseudocollaris*, male: Holotype; female: Paratype, Coto Brus. **39:** *C. specularis*, male: Isla Bonita; female: Río San Lorenzo. **40:** *C. stannibractea* (Holotype). Scale = 1 mm.

and rounded. Posterior margin without basal bead, sinuate, forming a nearly straight line above the scutellum. Surface with sparse punctures. **Scutellum**: Shape subpentagonal, blunt apex, with sparse punctures; ratio width/length 1.28. **Elytra**: Surface with costae defined by dense and sulcate rows of punctures. Apical part of second costa with a secondary stria. First interstice with 4–5 secondary striae, the external ones being fairly regular, the median ones irregular; second interstice with 2 secondary striae, coalescing on base of elytra; following interstices with 1 secondary stria. Apex of elytral suture rounded. Lateral margin convex, tapering gradually from base to apical third, disappearing on apex. Marginal membrane narrow and nearly complete. **Pygidium**: Granulose-imbricate. Short setae on disc, longer on margins. Triangular shape, with rounded apex. Nearly quadrate in lateral view. Ratio width/length 1.55. **Metasternum**: Disc slightly concave, with sparse medium-length setae, very dense on sides. Mesosternal process short, reaching the anterior margin of mesocoxae; with setae at base; width at base $\frac{1}{2}$ of femur height, uniform width along all the length; in lateral view narrowing at apex; width at base 0.62 mm (Fig. 19). Mesometasternal suture absent, metasternal sulcus reaching base of process. **Abdominal sternites**: With oblong punctures, sparse in the middle and dense on sides; 1–2 rows of medium-length blonde setae per sternite, denser on sides. Last exposed sternite with sparse oblong punctures, apical margin nearly smooth, at midline $\frac{1}{3}$ as long as total length of last sternite; basal suture of the apical bead sinuate, well defined. Sixth abdominal spiracle flat. **Protibia**: With 2 teeth (Fig. 31), slender; apical tooth short, curved, with uniform width. Proximal tooth small, acute, slightly above the internal apex of protibia. **Metatibia**: Fusiform. Ratio length/width 2.96. First carina made by row of punctures. Surface sparsely punctuate, setose. **Claws of fore leg**: External claw strongly curved; ratio length/height: 1.51; internal claw deeply bifurcate, upper branch of same length as and more than $\frac{1}{2}$ as wide as the lower one. Inferior margin slightly sinuate. **Male genitalia**: Aedeagus (Fig. 43). Parameres nearly tubular, in lateral view with a squared shape, anterior margin

slightly sinuate; parameres fused to ventral plate. Endophallus (Fig. 55). With 2 long sacculi: a longer dorsal one, thin, with an inflation near their base that bears sclerotised setae; a ventral shorter and wider one, bearing the wide ejaculatory duct opening laterally and with a large pointed sclerotised plate at the apex. Median lobe sclerotised.

Female: apical tooth of protibia (Fig. 31) longer and wider, expanded at apex; basal tooth above internal apex. Upper branch of internal foreleg claw longer than lower one; lower branch thinner than in male and with inferior margin straight. Last exposed sternite punctate, apical smooth margin narrower than in male.

Variation: body length 14.21–15.79 mm; width 8.12–9.58 mm. Clypeus w/l 1.72–1.94. Interocular ratio 3.09–3.40. Pronotum w/l 1.69–1.80. Scutellum w/l 1.28–1.43. Pygidium w/l 1.55–1.76. Width of mesosternal process at base 0.54–0.62 mm. Metatibia w/l 2.93–3.19. External foreleg claw l/h 1.38–1.51. Venter and femurs from ochre to copper to greenish dark brown. Rest of legs usually darker, reddish brown. Scutellum subtriangular to subpentagonal.

Differential diagnosis. *C. fuscorubens* can be separated from other dark coloured species of *Callistethus* by the combination of the following features: pattern of punctation on elytra, mesosternal process with uniform width, parameres nearly squared in lateral view, pointed ventrally, endophallus with a large sclerotised plate. In detail, it can be separated from *C. granulipygus* (Bates, 1888), also present in Costa Rica, as the latter is smaller with a shorter mesosternal process. It is separated from *C. kulzeri* (Frey 1968) (Perú) by having well developed costae on the elytra, and almost no mesosternal process. *C. ladino* (Ohaus, 1902) and *C. rosenbergi* (Ohaus, 1902) (both in Colombia) are the two most similar species, but they both have narrower first interstices, with more or less regular striae, a shorter mesosternum, and differences in the aedeagus: in *C. ladino* (Fig. 65) the parameres are much shorter and squared in lateral view (anterior margin slightly bilobed, but symmetric), slightly wider on the apex than on the base; in *C. rosenbergi* (Fig. 66) the parameres have a

sinuous apex, but the upper lobe is curved and protruding, and the ventral margin is shorter than in *C. fusciorubens*.

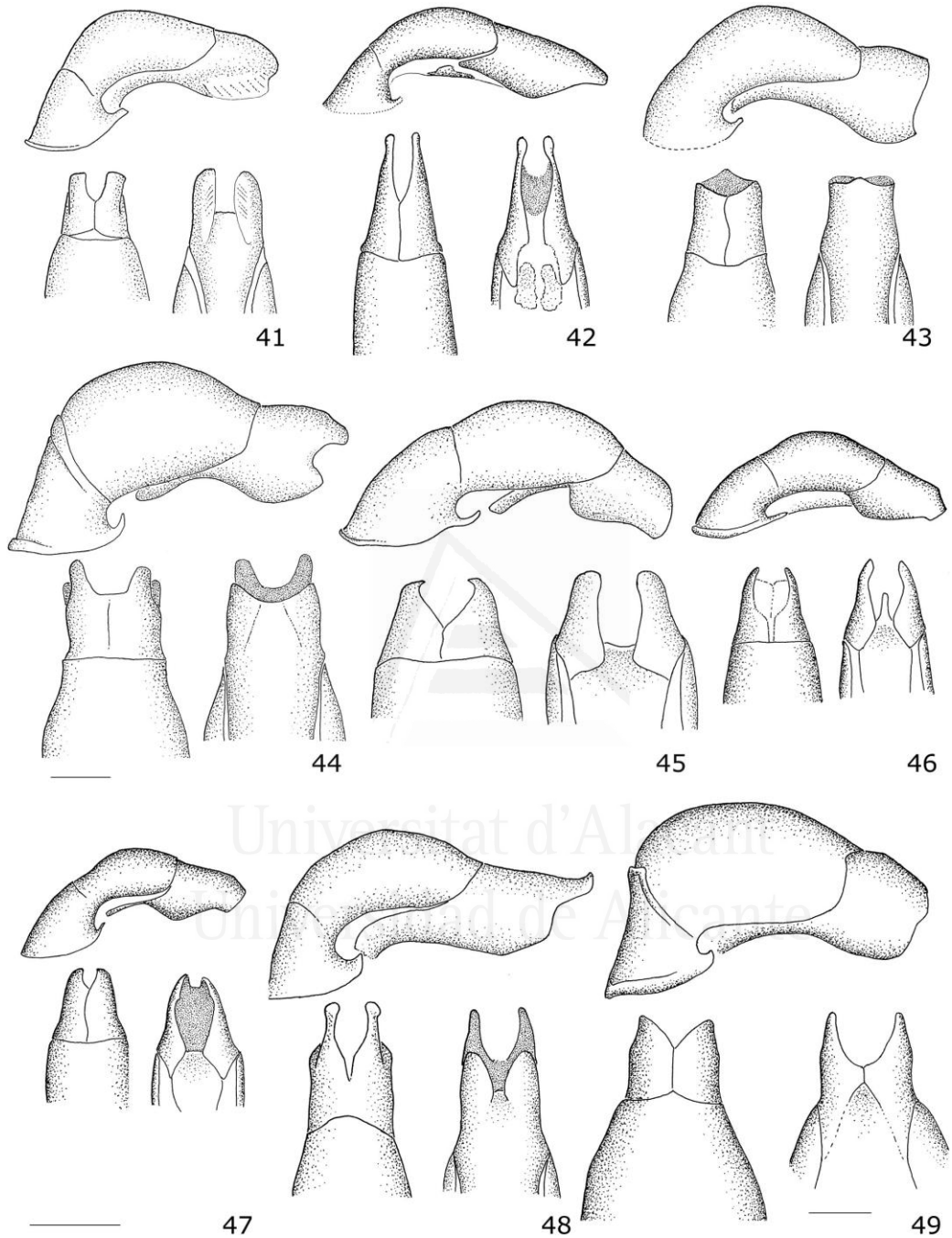
Derivatio nominis. from Latin adjectives 'fuscus, -a, -um', brown, dark; and 'rubens, -entis', reddish, for the dark reddish brown colour of elytra.

Distribution. *C. fusciorubens* is widely distributed in the main mountain ranges, the Nicoya and Osa peninsulas, and the Caribbean lowlands, ranging from 0 to 3500 m a.s.l. (Fig. 99).

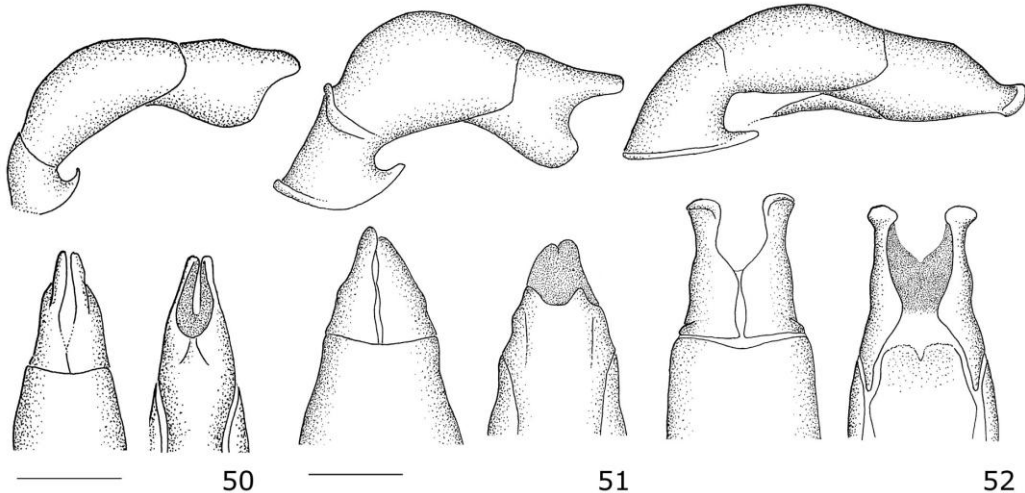
Material. HOLOTYPE: ♂ 'La Escuadra, P. N. Amistad, Puntarenas, Prov. COSTA RICA. 1340 m.14 April 1989, M. Ramirez & G. Mora, L S 326700_581200', 'INBIOCR1000010139'. - PARATYPES (4): 1♀ 'COSTA RICA. Prov. Puntarenas, San Vito Las Cruces. 20 NOV 1988. A. Solis', 'INB0003316029'; 1♂ 'COSTA RICA. Prov. Puntarenas, San Vito Las Cruces. 20 NOV 1988. A. Solis', 'INB0003316037'; 1♀ 'Rancho Quemado, Peninsula de Osa, 200m. Prov, Punt., COSTA RICA, F. Quesada, Dic 1991, L- S 292500_511000', 'INBIOCR1000483196'; 1♂ 'Est. Altamira, Buenos Aires PILA ACLA, Cerro Biolley, Prov. Punta, COSTA RICA. 1300-1450m. 23-30 OCT 1995. R.Villalobos, L_S_331700_572100 #6347', 'CEUA00105284'.

Callistethus lativittis sp.n.

Description. Male holotype: **Body shape:** Length 17.47 mm; width 9.61 mm. Oval, stout. Elytral disc convex. **Colouration:** Head, pronotum, scutellum and pygidium metallic green. Pronotum with ochre margins. Elytra light brown, with bronze and green luster. Metasternum greenish yellow, abdominal sternites bronze brown, legs yellowish green to metallic green on extremities, tarsi brownish green (Fig. 5). **Head:** Clypeus trapezoidal, ratio width/length 1.83. Clypeus surface densely punctate-reticulate. Frons punctate-reticulate, with secondary small punctures on disc. Vertex less densely punctate than frons. Ocular canthus long and thin; apex acute. Eyes rounded, interocular ratio (interocular width/width of eye) 3.05. Antennae: ratio funiculus/club 0.77. **Pronotum:** Basal width 1.79 x length; in dorsal view broadest at its base. Lateral margins rounded, angulated at 1/3 of length from anterior. Anterior angles quadrate and sharp; posterior angles obtuse and rounded. Posterior margin



Figures 41-49. Aedeagus, lateral view (top; base at left bottom), dorsal view (bottom left), ventral view (bottom right). **41:** *Callistethus carbo* (Holotype). **42:** *C. flavodorsalis* (Holotype). **43:** *C. fusciorubens* (Holotype). **44:** *C. lativittis* (Paratype, Dos de Tilaran). **45:** *C. levigatus* (Paratype, Est. La Casona). **46:** *C. macroxantholeus* (Paratype, Sector Cerro Cocori). **47:** *C. microxantholeus* (Paratype, Est. Pitilla). **48:** *C. multiplicatus* (Holotype). **49:** *C. parapulcher* (Paratype, Est. Pittier). Scale = 1 mm.



Figures 50–52. Aedeagus, lateral view (top; base at left bottom), dorsal view (bottom left), ventral view (bottom right). **50:** *C. pseudocollaris* (Holotype). **51:** *C. specularis* (Costa Rica- Pittier- BMNH). **52:** *C. stannibractea* (Holotype). Scale = 1 mm.

without basal bead, sinuate, forming a nearly straight line above the scutellum. Surface with sparse punctures. **Scutellum:** Shape subtriangular, blunt apex, with sparse punctures on sides, leaving a smooth stripe along the median longitudinal axis; ratio width/length 1.33. **Elytra:** Surface with costae defined by dense and sulcate rows of punctures. First interstice wide, with irregular punctures; second–fifth interstices with 1 secondary stria, bifurcating at base of elytra for second (into 2 rows) and third (irregular punctures) interstices. Apex of elytral suture rounded. Lateral margin convex, thin along all length, disappearing on apex. Marginal membrane narrow and nearly complete. **Pygidium:** Surface strigate-imbricate. Short setae on disc, longer on margins. Triangular shape, with rounded apex. Convex in lateral view. Ratio width/length 1.58. **Metasternum:** Disc slightly sulcate, nearly glabrous on disc and densely punctate on sides, with long setae. Mesosternal process short, reaching the anterior margin of mesocoxae; width at base $1/2$ of femur height, narrowing towards the apex to $2/5$ the width at base; in lateral view nearly square; width at base 0.71 mm (Fig. 20). Mesometasternal suture absent, but with a clear change in colour between the metasternum (dark green) and mesosternal process (yellow), metasternal sulcus reaching base of process. **Abdominal sternites:** With sparse

3.3 *Callistethus*

shallow oblong punctures; 1–2 rows of sparse medium-length blonde setae per sternite. Last exposed sternite and apical margin with sparse punctures, apical margin at midline $2/5$ as long as total length of last sternite; basal suture of the apical bead nearly straight, well defined. Sixth abdominal spiracle flat. **Protibia:** With 2 teeth (Fig. 32), slender; apical tooth less than $1/4$ of total length, curved, narrower at apex. Proximal tooth small, acute, at same height as or slightly below the internal apex of protibia. **Metatibia:** Fusiform. Ratio length/width 3.08. First carina made by row of punctures. Surface punctuate above second carina, rugose below; glabrous. **Claws of fore leg:** External claw strongly curved; ratio length/height: 1.44; internal claw deeply bifurcate, with branches diverging, upper branch longer and more than $1/2$ as wide as the lower one. Inferior margin nearly straight, forming a protruding angle at base. **Male genitalia:** Aedeagus (Fig. 44). Parameres apically deeply sinuate, forming 2 lobes in lateral view; ventral margin curved. Tectum wide. Ventral plate fused to parameres. Basal part with thick margins at the base and apex. Endophallus (Fig. 56). With 2 sacculi: the dorsal one long and narrowing at the apex, with a round ventral flattened inflation near the base, bearing a row of large sclerotised spines with an indented top on its margin, and thick small spines on its ventral side; the ventral sacculus with 2 diverticles at apex, one bearing a flat oval sclerotised plate; ejaculatory duct opening on left side of the shorter sacculus, above 2 small lobes. Medial lobe sclerotised.

Female: apical tooth of protibia (Fig. 32) longer and wider, expanded at apex; basal tooth above internal apex. Lower branch of internal foreleg claw thinner than in male and with inferior margin straight.

Variation: body length 17.47–18.08 mm; width 9.61–10.74 mm. Clypeus w/l 1.82–1.91. Interocular ratio 3.05–3.27. Male club longer than in females. Antennae, ratio funiculus/club 0.77–0.87. Pronotum w/l 1.72–1.79. Scutellum w/l 1.33–1.51. Pygidium w/l 1.56–1.66. Width of mesosternal process at base 0.59–0.71 mm. Metatibia w/l 2.75–3.08. External foreleg claw l/h 1.27–1.44. Pygidium has a bronze luster in some

specimens. Elytra ochre to light brown. Venter and legs from ochre to bronze brownish to metallic green. Scutellum subtriangular to subpentagonal.

Differential diagnosis. This species is easily distinguished from similar species by the combination of the following features: wide first interstice and the bronze luster on elytra, mesosternal process tapering at apex to less than 1/2 of base width, parameres bilobed, complex endophallus with sclerotised plates and indented spines.

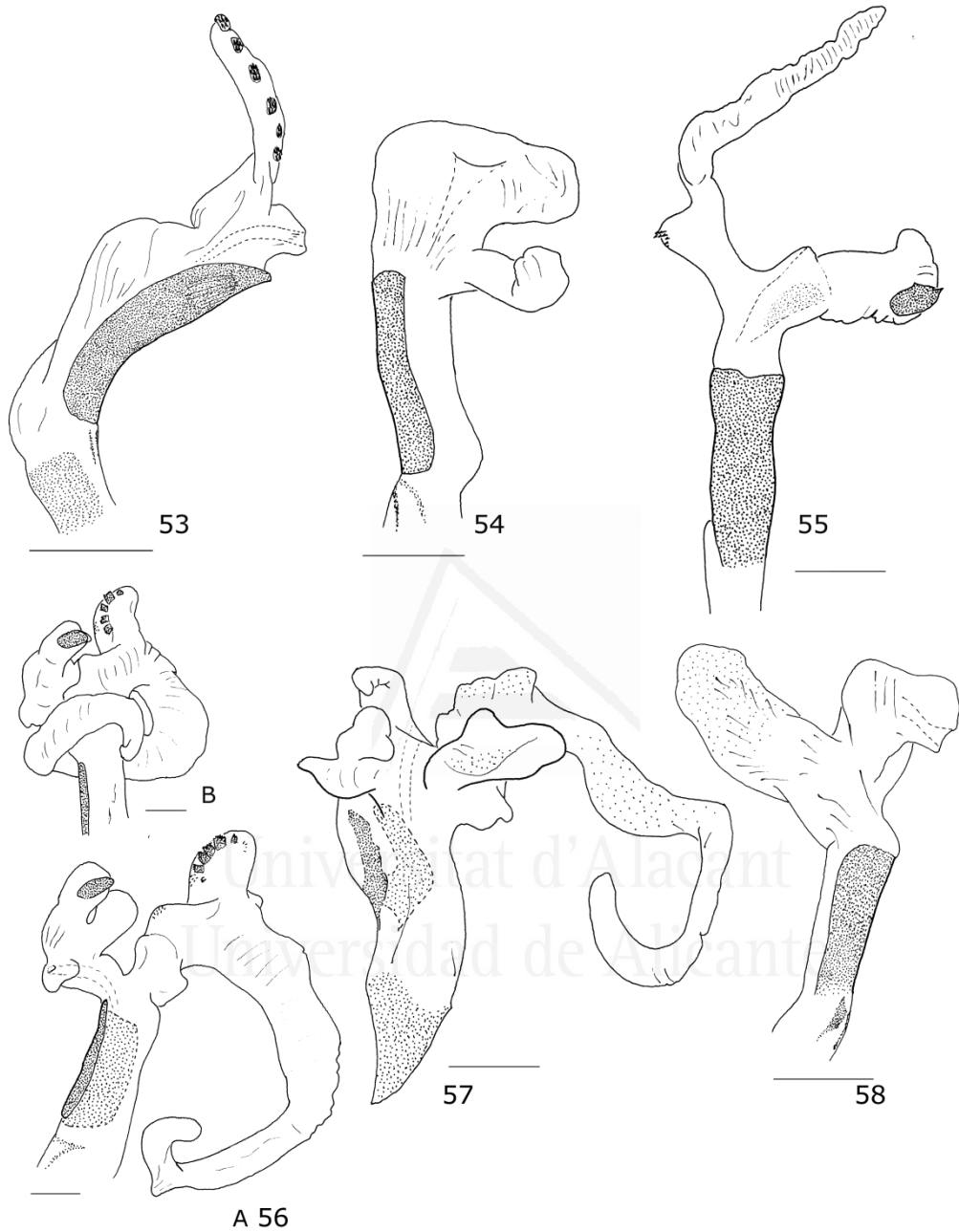
Derivatio nominis. From the Latin adjective 'latus, -a, -um', wide; and adjective indicating possession from noun 'vitta, -ae', band, for the wide and finely punctate first interstice on the elytra.

Distribution. *C. lativittis* is found in the Tilarán and Talamanca mountain ranges, from 100 to 1500 m a.s.l. (Fig. 100).

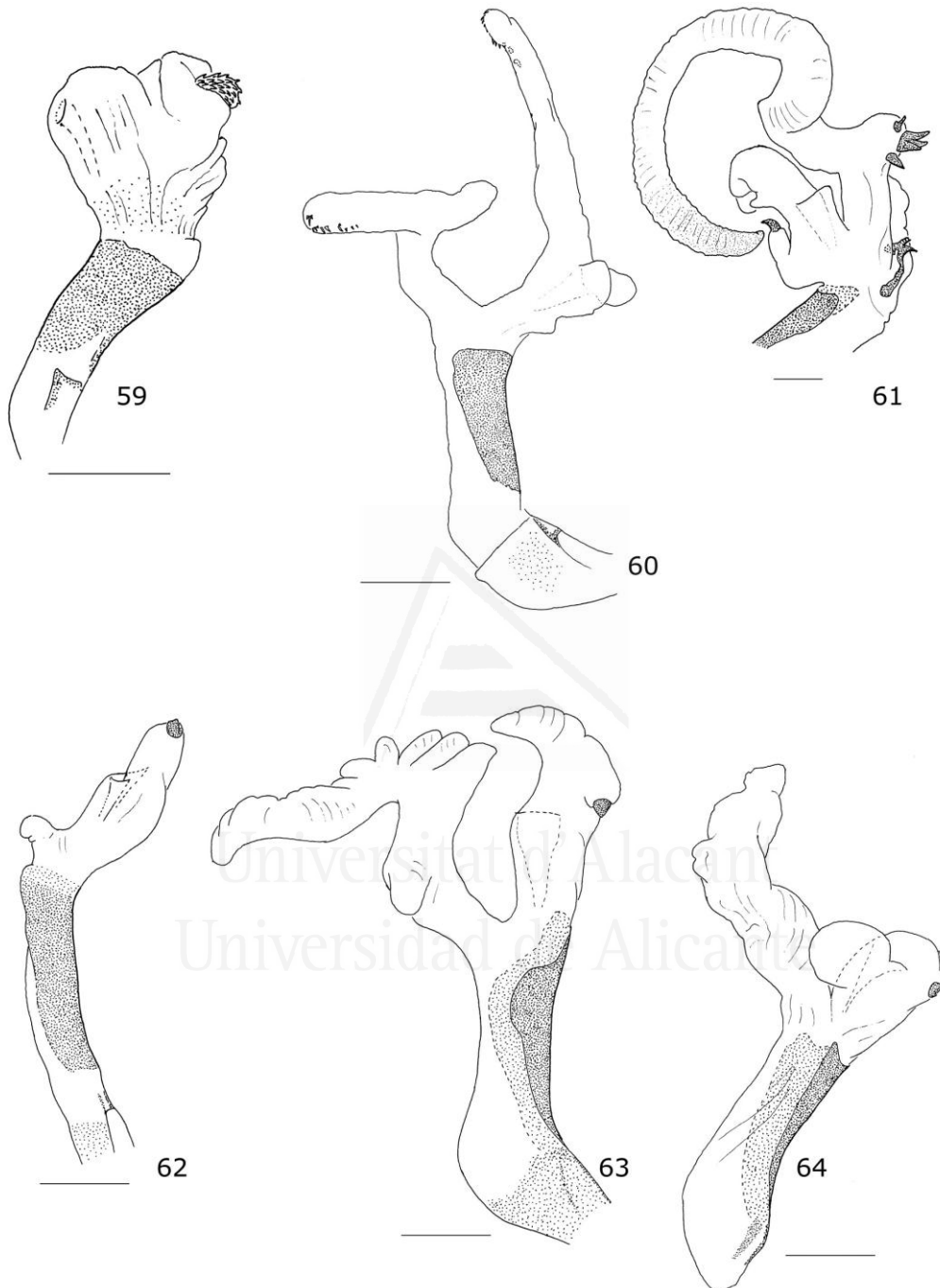
Material. HOLOTYPE: ♂ 'Rio San Lorenzo, Z.P. Tenorio A.C.A. Tilaran, Prov. Guana, COSTA RICA. 1050 m. May 1994, G. Rodriguez, L N 427600_287800 # 2933', 'INBIOCRI001873737'. – PARATYPES (5): 1♀ 'Sect. San Ramon de Dos Rios, Prov. Alaju, COSTA RICA. 620m. 18 MAR–13 ABR 1995. F. A. Quesada, L_N_318100_381900 #5274', 'INBIOCRI002246434'; 1♂ 'Dos de Tilaran (San Ramon), Prov. Guana, COSTA RICA. 1100m. MAY 1995. G. Rodriguez, L_N_262600_437500 #5891', 'INBIOCRI002337541'; 1♂ 'Albergue Heliconias, Bijagua (Costa Rica). 750m 31-1-2006. T. luz (17:15–21:00). Leg.: Micó, García, Galante.', 'Rutelinae *Callistethus* sp.138 Det. Alejandra García', 'CEUA00003273'; 1♀ 'Albergue Heliconias, Bijagua (Costa Rica). 750m 30-1-2006. T. luz (18:45–22:00). Leg.: Micó, García, Galante.', 'Rutelinae *Callistethus* sp.138 Det. Alejandra García', 'CEUA00003313'; 1♀ 'Estación Cabro Muco, Repr. ICE - Z.P. Miravalles, Guanacaste. Costa Rica. 1000m 12/06/2010. L. Filippini, Moraga.', 'CEUA00105285'.

Callistethus levigatus sp.n.

Description. Male holotype: **Body shape:** Length 12.63 mm; width 7.02 mm. Oval, slender. Elytral disc convex. **Colouration:** metallic green, clearer on clypeus and legs. Margins of pronotum ochre, with green luster (Fig. 6). **Head:** Clypeus trapezoidal, ratio width/length 1.88. Clypeus surface densely punctate, with confluent punctures.



Figures 53–58. Endophasus. **53:** *Callistethus carbo* (Paratype, Río S. Lorenzo). **54:** *C. flavodorsalis* (Paratype, Fca. Cafrosa). **55:** *C. fuscorubens* (Paratype, Est. Altamira). **56:** *Callistethus lativittis* (Paratype, Albergue Heliconias), **(A)** sacculi artificially separated; **(B)** natural position. **57:** *C. levigatus* (Holotype). **58:** *C. macroxantholeus* (Paratype, Río San Lorencito). Scale = 1 mm.



Figures 59–64. Endophallus. **59:** *C. microxantholeus* (Paratype, Est. Pitilla). **60:** *C. multiplicatus* (Paratype, Sector Cerro Cocori). **61:** *C. parapulcher* (Paratype, Est. Pittier). **62:** *C. pseudocollaris* (Holotype). **63:** *C. specularis* (Quebrada Segunda), sacculi artificially separated. **64:** *C. stannibractea* (Paratype, Est. Barva). Scale = 1 mm.

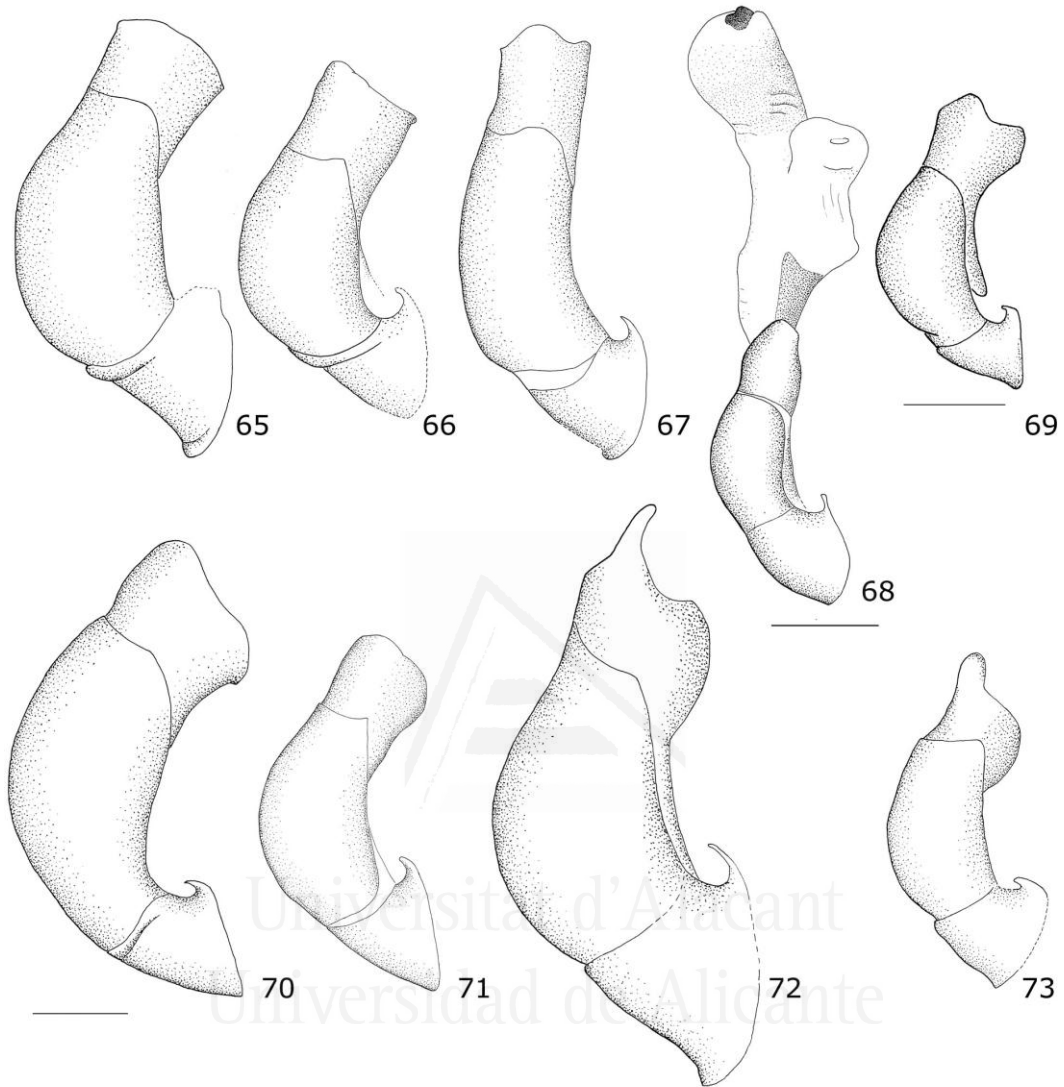
Frons sparsely punctate. Vertex slightly less densely punctate than frons. Ocular canthus short, wide at base, sharpening at apex. Eyes small and oblong, interocular ratio (interocular width/width of eye) 3.88. Antennae: ratio funiculus/club 0.70. **Pronotum:** Basal width 1.70 x length; in dorsal view broadest at its base. Lateral margins rounded, angulated at $\frac{2}{5}$ of length from anterior. Anterior angles quadrate and rounded; posterior angles obtuse and rounded. Posterior margin without basal bead, sinuate, forming a straight line above the scutellum. Surface with small, shallow, sparse punctures. **Scutellum:** Shape subpentagonal, blunt apex, nearly smooth, with very fine and sparse punctation on surface; ratio width/length 1.20. **Elytra:** Surface with costae defined by rows of shallow punctures. Interstices with 3–4 (first interstice) or 1 (second –fifth interstices) rows of sparse shallow punctures. Small horizontal wrinkles are present between second interstice and third costa, almost along entire length. All punctures on pronotum and elytra are very shallow, giving a smooth appearance to the naked eye. Apex of elytral suture rounded. Lateral margin convex and uniform, disappearing at the apex. Marginal membrane narrow and nearly complete. **Pygidium:** Striated, with medium-length sparse setae on margins. Triangular shape, with rounded apex. Nearly straight in lateral view, rounded at apex. Ratio width/length 1.60. **Metasternum:** Disc concave, smooth and glabrous, setigerous punctures on sides, bearing short blonde setae. Mesosternal process long, reaching the base of procoxae; width $\frac{2}{3}$ of femur height, uniform width along all the length; in lateral view slightly curved upwards, tapering towards the apex; width at base 0.67 mm (Fig. 21A,B). Mesometasternal suture well marked, reaching the apex of trochanters. Metasternal sulcus reaching mesometasternal suture. **Abdominal sternites:** With sparse shallow punctures; 1 (in the middle) to 3 (at the sides) rows of short blonde setae per sternite, borne by oblong punctures, always on apical half of sternites. Last exposed sternite with sparse shallow punctures, apical margin smooth, at midline $\frac{1}{2}$ as long as total length of last sternite; basal suture of the apical bead sinuate, well defined. Sixth abdominal

spiracle flat. **Protibia:** With 2 teeth (Fig. 33), slender; apical tooth long, with uniform width, oblique in relation to the vertical axis of protibia, curved at apex. Proximal tooth small, acute, at same height as the internal apex of protibia. **Metatibia:** Quite stout, fusiform. Ratio length/width 3.27. First carina defined by punctures. Surface sparsely punctuate, with elongate punctures below second carina, nearly glabrous. **Claws of fore leg:** External claw strongly curved; internal claw bifurcate, upper branch slightly shorter and more than 1/2 as wide as the lower one. Inferior margin sinuate. **Male genitalia:** Aedeagus (Fig. 45). Parameres with wide apex pointing downwards in lateral view, ventral margin sinuate. Wide tectum. Ventral plate separated from parameres. Endophallus (Fig. 57). Developed dorsally in relation to medial lobe, leaving a bulge in the frontal part. Frontal sacculus ending in a central pointed inflation, folded dorsally, and 2 diverticles pointed laterally; ejaculatory duct opening at base of right diverticle. Dorsally, a long narrowing sacculus, and on its left side, a short sacculus with lateral inflation. Fine setation is present on these 2 dorsal sacculi. Median lobe horseshoe shaped.

Female: Pygidium densely imbricate-striated. Mesosternal process thinning considerably on apical half. Protibia (Fig. 33): apical tooth wider, basal tooth above the internal apex. Foreleg claw: lower branch of internal claw similar in width to upper branch; inferior margin straight. Last exposed sternite finely punctate, apical smooth margin narrower than in male.

Variation: body length 12.63–13.12 mm; width 6.93–7.10 mm. Clypeus w/l 1.76–1.88. Interocular ratio 3.88–4.89. Pronotum w/l 1.67–1.70. Scutellum w/l 1.20–1.25. Pygidium w/l 1.60–1.68. Metatibia w/l 3.16–3.41. External foreleg claw l/h 1.32–1.47. Metasternum variable, from uniform width to tapering at apex (Fig. 21).

Differential diagnosis. This species is distinguished by the combination of the following features: medium size, homogeneous green colour, smooth surface of elytra, parameres with wide apex pointing ventrally, endophallus with median lobe horseshoe shaped, sacculi and diverticles developing dorsally. It resembles *C. collaris*,



Figures 65–73. Aedeagus of *Callistethus* species not present in Costa Rica, lateral view (base at bottom). **65:** *C. ladino* (type, Colombia, MNHUB). **66:** *C. rosenbergi* (type, Colombia, MNHUB). **67:** *C. lepidus* (Guatemala, MNHUB). **68:** *C. xantholeus* (Mexico, INECOL). **69:** *C. collaris* (Holotype). **70:** *C. cayapo* (type, Brazil, MNHUB). **71:** *C. levii* (Ecuador, MNHUB). **72:** *C. pulcher* (Colombia, MNHUB). **73:** *C. marginicollis* (cotype, Mexico, MNHUB). Scale = 1 mm.

C. multiplicatus and *C. pseudocollaris*, but the smooth surface of the elytra clearly distinguishes it. The elytra surface of *C. lepidus* is smooth but has a lighter colour, larger size and a slender aedeagus (Fig. 67).

Derivatio nominis. From the Latin adjective 'levigatus, -a, -um', polished, for the smooth surface of the pronotum and elytra.

Distribution. *C. levigatus* is found on the Pacific slope of the Tilarán and Talamanca mountain ranges, from 1000 to 1500 m a.s.l. (Fig. 98).

Material. HOLOTYPE: ♂ 'Quebrada Segunda, P. N. Tapanti, 1250m, Prov. Cartago, Costa Rica, Jul 1992, G. Mora, L- N 194000_560000', 'INBIOCR1000712086'. – PARATYPES (4): 1♀ 'Rio San Lorenzo, 1050 m, Tierras Morenas, Z. P. Tenorio, Prov. Guanacaste, Costa Rica, C. Alvarado, Abr 1992, L- N 287800_427600', 'INBIOCR1000415209'; 1♂ 'Est. La Casona, Res. Biol. Monteverde, 1520m, Prov. Punt. COSTA RICA, N. Obando, Set 1990, L- N 253250_449700', '60', 'INBIOCR1000269243'; 1♀ 'Est. La Casona, 1520 m, Res. Biol. Monteverde, Prov. Punt., COSTA RICA. May 1991, N. Obando. L-N 253250,449700', 'INBIOCR1001325937'. 1♂ 'COSTA RICA Prov. Alajuela. Guatuso. P.N. Volcán Tenorio. Punto 2: Falda N Cerro Montezuma. 1160m. 3 Jun 2008. J. A. Azofeifa. Tp de Luz 2. L_N_297500_425050 #93851', 'CEUA00105281'.

Callistethus macroxantholeus sp.n.

Description. Male holotype: **Body shape:** Length 10.80 mm; width 5.99 mm. Oval, stout. Elytral disc flattened. **Colouration:** Head and scutellum yellow with green luster. Pronotum yellow with green luster and a couple of metallic green vertical bands on disc. Elytra yellowish brown. Pygidium yellow with green luster, lateral sides metallic green. Venter and legs yellow with green luster on sternum and bronze on sternites; tarsi and apical part of metatibiae darker, reddish or green (Fig. 7).

Head: Clypeus rounded; ratio width/length 1.91. Clypeus surface with confluent punctures. Frons with sparse setae, surface punctate-reticulate. Vertex punctate. Ocular canthus long, stout at the base and acute at the apex. Eyes elongated, interocular ratio (interocular width/width of eye) 4.15. Antennae: ratio funiculus/club 0.64. **Pronotum:** Basal width 1.66 x length; in dorsal view broadest at its base. Lateral margins rounded, angulated at 1/3 of length from anterior. Anterior angles quadrate and sharp; posterior angles obtuse and rounded. Posterior margin without basal bead, sinuate, forming a nearly straight line above the scutellum. Surface punctate,

with sparse setae near anterior margin. **Scutellum**: Shape subpentagonal, sharp apex, with fairly dense punctures on entire surface; ratio width/length 1.26. **Elytra**: Surface with 14 costae (excluding lateral margin), defined by dense and sulcate rows of punctures. On second costae a secondary stria is present at the base; the sixth and ninth striae bifurcate at base. Very fine secondary punctures on entire surface. Apex of elytral suture spiniform. Lateral margin convex, tapering gradually from the base to apical third, where it disappears. Marginal membrane narrow, extending along the apical half. **Pygidium**: From oblong punctation to coarsely strigate-imbricate, more or less densely. Long setae at margins. Triangular shape, with rounded apex. Nearly straight in lateral view. Ratio width/length 1.45. **Metasternum**: Disc slightly sulcate, densely punctate, with medium-length setae denser at sides. Mesosternal process short and stout, reaching the anterior margin of mesocoxae, width at base $\frac{1}{2}$ of femur height, slightly narrower at apex; in lateral view blunt, with dorsal part nearly vertical; width at base 0.49 mm (Fig. 22). Mesometasternal suture poorly defined, reaching half of trochanters height. Metasternal sulcus reaching mesometasternal suture. **Abdominal sternites**: With sparse oblong punctures coalescing at sides, 1–2 rows of sparse setae per sternite, denser at sides. Last exposed sternite and apical margin with sparse punctures, apical margin at midline $\frac{1}{2}$ as long as total length of last sternite; basal suture of the apical bead obliterated at centre, curved. Sixth abdominal spiracle flat. **Protibia**: With 2 teeth (Fig. 34), apical tooth narrow, long, curved. Proximal tooth triangular, acute, at same height as or slightly inferior to the internal apex of protibia. **Metatibia**: Stout, fusiform but with subapical constriction negligible. Ratio length/width 2.64. First carina defined by punctures. Surface with oblong punctures, rugose below second carina, nearly glabrous. **Claws of fore leg**: External claw curved; ratio length/height: 1.57; internal claw bifurcate, upper branch slightly shorter than and $\frac{2}{3}$ as wide as the lower one. Inferior margin slightly sinuate. **Male genitalia**: Aedeagus (Fig. 46). Parameres slender with squared apex in lateral view; ventral margin sinuate. Ventral plate not fused with parameres, ending

with a narrow long apex. Endophallus (Fig. 58). With 2 wide sacculi, the ventral one shorter and with ejaculatory duct opening at apex; the dorsal one with microsetae. Median lobe sclerotised.

Female: apical tooth of protibia (Fig. 34) longer and wider; basal tooth above internal apex. Upper branch of internal foreleg claw longer than the lower one, inferior margin straight. Last exposed sternite finely punctate, apical smooth margin narrower than in male.

Variation: body length 9.62–12.33 mm; width 5.81–6.70 mm. Clypeus w/l 1.91–2.04. Interocular ratio 3.88–4.32. Male antennae, ratio funiculus/club 0.57–0.64. Pronotum w/l 1.59–1.72. Scutellum w/l 1.16–1.26. Pygidium w/l 1.40–1.46. Width of mesosternal process at base 0.47–0.59 mm. Metatibia w/l 2.61–2.65. External foreleg claw l/h 1.52–1.60. Head and scutellum from yellow to metallic green; a bronze luster may be present. Pronotum with green or bronze luster. Elytra from yellowish to reddish brown. Pygidium with green or bronze luster. Venter and legs from yellow to reddish brown with green or bronze luster. In males posterior half of the body narrows gradually.

Differential diagnosis. Similar to *C. xantholeus* and *C. microxantholeus*, but larger in size, pronotum with more curved sides, narrower apex of parameres and endophallus with 2 long sacculi and no sclerotised setae, in contrast to the globose structure of *C. microxantholeus* and the different sized sacculi of *C. xantholeus* (Fig. 68), one of which bears a patch of sclerotised setae.

Derivatio nominis. From the Greek prefix 'macro-', big, and 'xantholeus', referring to the species *A. xantholea* Bates, 1888.

Distribution. *C. macroxantholeus* distribution almost coincides with that of *C. microxantholeus*, being distributed on both slopes of the Tilarán, Central and Talamanca mountain ranges, Caribbean lowlands and Osa peninsula, but with a narrower altitudinal range, from 700 to 1400 m a.s.l. (Fig. 97).

3.3 *Callistethus*

Material. HOLOTYPE: ♂ 'Est. Pitilla, 700m, 9 km S Sta. Cecilia, P. N. Guanacaste, Prov. Guan., COSTA RICA. 19 May –3 Jun 1993. C. Moraga, L N 330200_380200', 'INBIOCRI001315235'. – PARATYPES (10): 1♀ 'P.N.Guanacaste Sector Mengo 15 mayo 1988 Col: D. Janzen', 'INBIOCRI001102734'; 1♂ 'Rio San Lorenzo, 1050 m, Tierras Morenas, Z. P. Tenorio, Prov. Guanacaste, Costa Rica, Abr 1992 F. Quesada L- N 287800_427600', 'INBIOCRI000930545'; 2♀ 'Rio San Lorenzo, 1050 m, Tierras Morenas, Z. P. Tenorio, Prov. Guanacaste, Costa Rica, Abr 1992 F. Quesada L- N 287800_427600', 'INBIOCRI000930543' and 'INBIOCRI000930553'; 1♀ 'Est. Cacao, 1000–1400m, Lado suroeste del Volcan Cacao, Prov. Guan., COSTA RICA, II curso Parataxon., Jun 1990, L- N 323300_375700', 'INBIOCRI000248848'; 1♀ 'Est. Cacao, 1000–1400m, Lado SO Vol. Cacao, P. N. Guan., Prov. Guanacaste, Costa Rica, R. Vargas 21 a 28 may 1992, L- N 323300_375700', 'INBIOCRI000411910'; 1♂ 'Sector Cerro Cocori, Fca. de E. Rojas, 150 m, Prov. Limon, Costa Rica, E. Rojas, Abr 1992, L- N 286000_567500', 'CEUA00105293'; 1♀ 'R. San Lorencito, 900m, R. F. San Ramón, 5 km N de Colonia Palmareña, Prov. Alaju., COSTA RICA. 13–18 Jun 1993. I Curso Scarabeidae. L_N 244500_470700 #2125', 'INBIOCRI001364690'; 1♂ 'Estac. Pitilla, 700m, 9km S Santa Cecilia, Guanac., Pr. COSTA RICA. 21 Mar–21 Abr 1989, GNP Biod. Sur. L N 330200,380200', '160', 'INBIOCRI002517220'; 1♀ 'Est. Pitilla, 700 m, 9 km S Sta. Cecilia, P. N. Guanacaste, Prov. Guan. COSTA RICA R. W. Flowers, 13 May 1991, L- N 330200_380200', 'CEUA00105292'.

Callistethus microxantholeus sp.n.

Description: Male holotype: **Body shape:** Length 7.02 mm; width 4.22 mm. Oval stout. Elytral disc flattened. **Colouration:** Head and scutellum from yellow to light green. Pronotum yellow with a couple of metallic green vertical bands on disc. Elytra reddish brown. Pygidium yellow with green luster. Venter yellow with green luster; antennae blackish, legs yellow with coppery green tarsi (Fig. 8). **Head:** Clypeus nearly rectangular; ratio width/length 2.18. Clypeus surface with confluent punctures. Frons with sparse setae, surface punctate-reticulate. Vertex with less dense punctures. Ocular canthus long and wide; apex rounded. Eyes elongated, interocular ratio (interocular width/width of eye) 4.89. Antennae: ratio funiculus/club 0.67. **Pronotum:** Basal width 1.59 x length; in dorsal view broadest at its base. Lateral

margins rounded, angulated at $1/4$ of length from anterior. Anterior angles acute and sharp; posterior angles obtuse and rounded. Posterior margin without basal bead, sinuate, forming a nearly straight line above the scutellum. Surface with large, deep punctures, with sparse setae near anterior margin. **Scutellum**: Shape subpentagonal, blunt apex, with sparse punctures on entire surface; ratio width/length 1.07. **Elytra**: Surface with 14 costae (excluding lateral margin), defined by dense and sulcate rows of punctures. Apex of elytral suture spiniform. Lateral margin convex, tapering gradually from base to apical third, disappearing on apex. Marginal membrane narrow and extending along the apical half. **Pygidium**: Coarsely strigate-imbricate, with sparse setae, longer at margins. Triangular shape, with rounded apex. Slightly convex in lateral view. Ratio width/length 1.52. **Metasternum**: Disc slightly concave, coarsely punctate. Short to medium-length setae on entire surface, denser at sides. Mesosternal process short and stout, reaching the anterior margin of mesocoxae, width at base $1/2$ of femur height, narrowing lightly towards the apex; in lateral view blunt, with dorsal part nearly vertical; width at base 0.33 mm (Fig. 23). Mesometasternal suture poorly defined, reaching half of the trochanter height. Metasternal sulcus reaching mesometasternal suture. **Abdominal sternites**: With 1–2 rows of sparse setae. Last exposed sternite with large punctures on entire surface; apical margin sparsely punctate, at midline $1/2$ as long as total length of last sternite; basal suture of the apical bead poorly defined, curved. Sixth abdominal spiracle flat. **Protibia**: With 2 teeth (Fig. 35), slender, apical tooth narrow, long, curved. Proximal tooth triangular, acute, at same height as the internal apex of protibia. **Metatibia**: Stout, fusiform but with subapical constriction negligible. Ratio length/width 2.35. First carina defined by large punctures. Surface with large punctures, nearly glabrous. **Claws of fore leg**: External claw strongly curved; ratio length/height: 1.51; internal claw bifurcate, with branches strongly diverging, upper branch as long as and $2/3$ as wide as the lower one. Inferior margin slightly sinuate. **Male genitalia**: Aedeagus (Fig. 47). Parameres slender with wide squared apex in lateral view; ventral margin

sinuate. Endophallus (Fig. 59). With globular shape, with fine setae at base and a ridge of thick sclerotised setae on top, ventrally; ejaculatory duct opening dorsal. Median lobe sclerotised.

Female: antennal club shorter than in male. Apical tooth of protibia (Fig. 35) longer and wider; basal tooth above internal apex. Inferior margin of internal foreleg claw straight. Last exposed sternite punctate, apical smooth margin narrower than in male.

Variation: body length 7.02–8.58 mm; width 4.20–5.04 mm. Clypeus w/l 1.90–2.18. Interocular ratio 4.32–5.16. Male antennae, ratio funiculus/club 0.54–0.77. Pronotum w/l 1.51–1.59. Scutellum w/l 1.05–1.16. Pygidium w/l 1.27–1.52. Width of mesosternal process at base 0.37–0.50 mm. Metatibia w/l 2.35–2.73. External foreleg claw l/h 1.36–1.51. Pronotum with a couple of vertical bands on disc or 1 large macula. Elytra variable: from yellow to reddish brown, to bright metallic green; the metallic green colour turns gradually to black in dead specimens, but it only affects elytra. Venter from yellow with green luster to reddish brown and dark metallic green.

Differential diagnosis. Similar to *C. xantholeus* and *C. macroxantholeus*, but smaller in size, with nearly straight sides of pronotum, longer parameres in relation to tectum, and globose endophallus, in contrast with the elongated and bifurcated structures of the latter species (Figs. 58, 68).

Derivatio nominis. From the Greek prefix 'micro-', small, and 'xantholeus', referring to the species *A. xantholea* Bates, 1888.

Distribution. *C. microxantholeus* is widely distributed on both slopes of the Tilarán, Central and Talamanca mountain ranges, Caribbean lowlands and Osa peninsula, below 1500 m a.s.l. (Fig. 101).

Material. HOLOTYPE: ♂ 'Heredia. Costa Rica Pto. Viejo. Finca La Selva 9 setiembre 1986 M.M.Chavarria-Diaz', '63', '63', 'INBIOCRI002517193'. – PARATYPES (16): 2♂ 'Est. Magsasay, P. N. Braulio Carrillo, 200 m, Prov. Here, COSTA RICA R. Aguilar, Oct 1990, L- N 264600_531100', '152', 'INBIOCRI000235712' and 'INBIOCRI000235713'; 1♂ 'Sector Cerro Cocori, Fca. de E. Rojas. 150 m, Prov. Limon, COSTA RICA, E. Rojas, Dic 1991, L N 286000,567500',

'INBIOCR1000550223'; 1♂ 'Est. Magsasay, 200 m, P. N. Braulio Carrillo, Prov. Here., COSTA RICA. May 1991. A. Fernandez, L- N 264600_531000', 'INBIOCR1001376210'; 1♂ 'Heredia. Costa Rica Puerto Viejo Sarapiquí. Finca La Selva. 35m. 30 abril 1987 M. M. Chavarria Diaz', '152', 'INBIOCR1002517222'; 1♂ 'Amubri, 70m, Talamanca, Prov. Limon, Costa Rica, 1 a 22 jul 1992, G. Gallardo, L-S 385500_578050', 'INBIOCR1000757517'; 1♀ 'Rancho Quemado, 200m, Peninsula de Osa, Prov. Puntarenas, Costa Rica, Ago 1992, M. Segura, L S 292500_511000', 'INBIOCR1000963755'; 2♀ 'Sector Cerro Cocori, Fca de E. Rojas, 150 M, Prov. Limon, COSTA RICA. Mar 1993. E. Rojas, L N 286000_567500', 'INBIOCR1001384952' and 'INBIOCR1001385120'; 2♂ 'Est. Pitilla, 700m, 9 km S Sta. Cecilia, P. N. Guanacaste, Prov. Guan., COSTA RICA. 18 abr a 19 may 1993, P. Rios, L- N 330200_380200', 'INBIOCR1001397208' and 'INBIOCR1001397241'; 1♂ 'Est. Pitilla, 700m, 9 km S Sta. Cecilia, P. N. Guanacaste, Prov. Guan., COSTA RICA. 19 May -3 Jun 1993. C. Moraga, L N 330200_380200', 'INBIOCR1001315179'; 1♂ 'Volcán Tenorio. Guanacaste. Costa Rica. 700m 03/VIII/2009 ex larva F L. 20/VI/2009 L. Filippini, Galante, Marcos.', 'CEUA00105288'; 1♀ 'Cabanga, finca J.Robles. Alajuela, Costa Rica. 500m. 10/II/2010 trampa 2 L. M. Zumbado, J.A.Azofeifa.', 'CEUA00105289'; 1♂ 'Cabanga, finca J.Robles. Alajuela, Costa Rica. 500m 12/II/2010. Trampa 2 L. M. Zumbado, J.A.Azofeifa.', 'CEUA00105290'; 1♂ 'P.N. Volcán Tenorio. Catarata Río Buenavista. P. Alajuela, Costa Rica. 780m 15/12/2009. L. M. Zumbado, J.A.Azofeifa.', 'CEUA00105291'.

Callistethus multiplicatus sp.n.

Description. Male holotype: **Body shape:** Length 13.86 mm; width 7.75 mm. Oval, slender. Elytral disc convex. **Colouration:** Pronotum metallic green with ochre margins. Elytra metallic green. Rest of body metallic green to yellowish green, lighter on clypeus, legs and mesosternal process (Fig. 9). **Head:** Clypeus nearly rounded, ratio width/length 1.95. Clypeus surface densely punctate, surface reticulate. Frons with less dense punctures than clypeus, longitudinally sulcate on disc. Vertex slightly less densely punctate than frons. Ocular canthus short, wide at base, sharpening at apex. Eyes small and oblong, interocular ratio (interocular width/width of eye) 4.84. Antennae: ratio funiculus/club 0.76. **Pronotum:** Basal width 1.79 x length; in dorsal view broadest at its base. Lateral margins rounded, angulated at 2/5 of length from

anterior. Anterior angles quadrate and rounded; posterior angles obtuse and rounded. Posterior margin without basal bead, sinuate on sides, forming a straight line above the scutellum. Entire surface with sparse punctures. **Scutellum**: Shape subpentagonal, blunt apex, with a few shallow punctures on disc; ratio width/length 1.36. **Elytra**: Surface with 14–15 costae (excluding lateral margin), defined by dense and sulcate rows of punctures. Second and third rows (corresponding to first interstice) slightly irregular. Entire surface with very small and fine background punctures. Apex of elytral suture rounded. Lateral margin convex, tapering gradually from base to apical third, disappearing on apex. Marginal membrane narrow and nearly complete. **Pygidium**: Striate in wavy lines, due to confluence on oblong punctures. Short setae on disc, longer on margins. Triangular shape, with rounded apex. Nearly straight in lateral view. Ratio width/length 1.62. **Metasternum**: Disc slightly concave, glabrous, with fine and small punctures. Setigerous punctures on sides, bearing short blonde setae. Mesosternal process long, reaching the base of procoxae; width at base nearly as wide as femur height, narrowing at apex to $\frac{1}{3}$ the width at base; in lateral view curved upwards, very thin at the apex; width at base 0.86 mm (Fig. 24). Mesometasternal suture absent, metasternal sulcus reaching the apex of trochanters. **Abdominal sternites**: With oblong punctures, sparse in the middle and dense on sides; 1 row of short setae per sternite at centre, dense at sides. Last exposed sternite with sparse oblong punctures, apical margin finely punctate, at midline $\frac{1}{3}$ as long as total length of last sternite; basal suture of the apical bead sinuate, well defined. Sixth abdominal spiracle flat. **Protibia**: With 2 teeth (Fig. 36), slender; apical tooth short, curved, with uniform width. Proximal tooth small, nearly quadrate, at same height of the internal apex of protibia. **Metatibia**: Quite stout, fusiform. Ratio length/width 3.16. First carina defined by punctures. Surface sparsely punctuate, glabrous. **Claws of fore leg**: External claw strongly curved; internal claw deeply bifurcate, with branches strongly diverging, upper branch slightly shorter and more than half the width of the lower one. Inferior margin slightly sinuate. **Male**

genitalia: Aedeagus (Fig. 48). Parameres long, with protruding thin apex slightly turned upwards in lateral view, dorsally widened; ventral margin sinuate, nearly at a right angle. Ventral plate fused to parameres. Endophallus (Fig. 60). A dorsal T-shaped sacculus, with one of the extremes with sclerotised setae in a row. A ventral long and thin sacculus, with a row of sclerotised setae on apex, and 2 lobes placed ventrally at about 1/3 of length, ejaculatory duct opening between them. Medial lobe sclerotised.

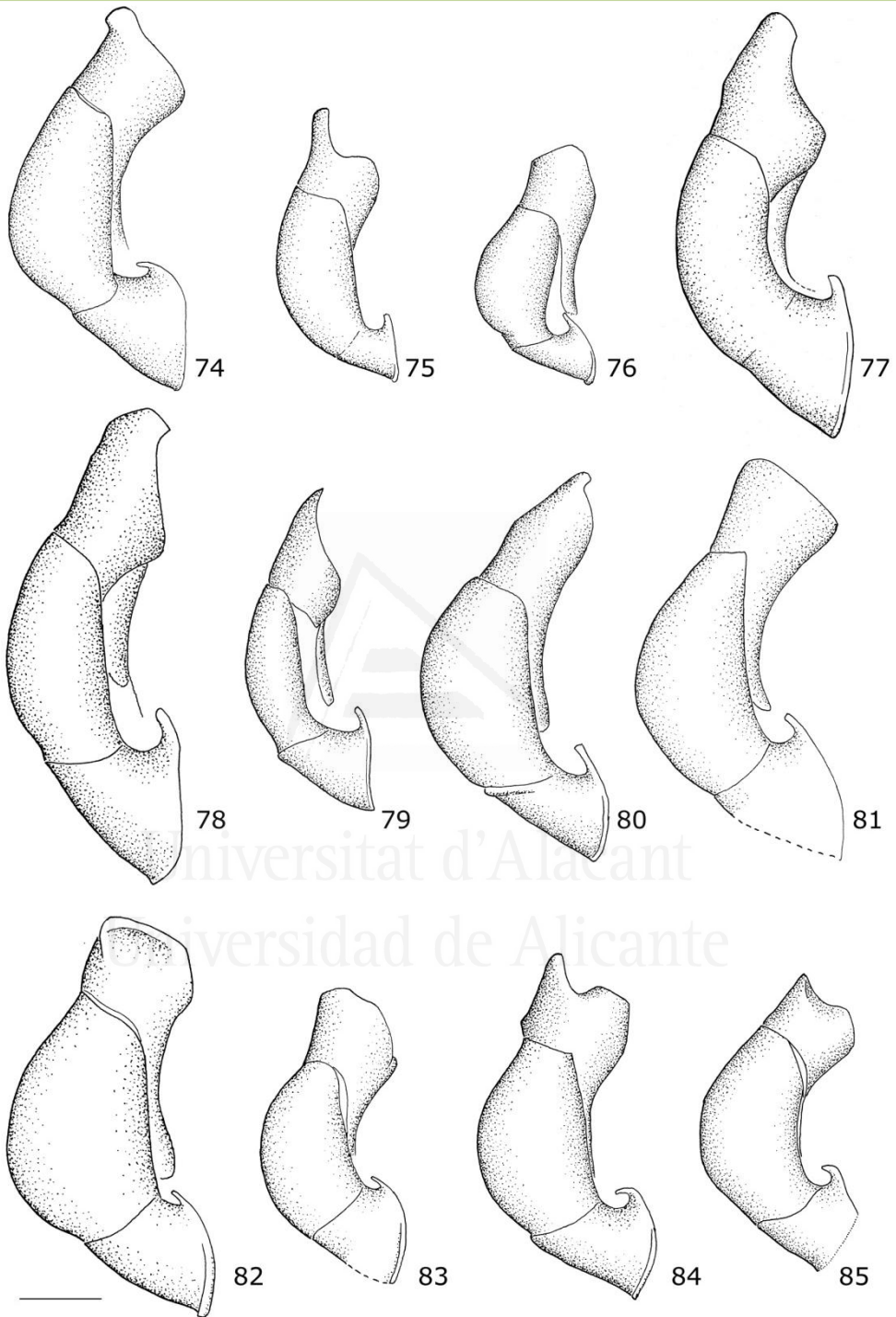
Female: protibia (Fig. 36) with apical tooth longer and wider, expanded at apex; basal tooth above the internal apex. Upper branch of internal foreleg claw longer than lower one; inferior margin straight. Last exposed sternite punctate, apical smooth margin narrower than in male, curved.

Variation: body length 13.45–13.86 mm; width 7.07–7.75 mm. Clypeus w/l 1.88–1.95. Interocular ratio 4.84–5.45. Pronotum w/l 1.76–1.86. Scutellum w/l 1.28–1.45. Pygidium w/l 1.56–1.71. Width of mesosternal process at base 0.69–0.86 mm. Metatibia w/l 3.09–3.29. Elytra metallic green to brownish green.

Differential diagnosis. This species can be differentiated from similar ones by the combination of the following features: homogeneous green colour, elytra with regular sulcated striae, parameres with thin apex bending dorsally, endophallus with 2 long sacculi, one of which is T shaped. It is very similar to *C. collaris* and *C. pseudocollaris*, and is distinguished by the shape of male genitalia, with parameres with thin apex bending dorsally, whereas *C. collaris* has a bilobed apex (Fig. 69), and *C. pseudocollaris* a blunt apex (Fig. 50). The endophallus is composed of 2 long sacculi, instead of a short one in *C. pseudocollaris* (Fig. 62).

Derivatio nominis. From the Latin adjective 'multiplicatus, -a, -um', multiplied, for the high number of species belonging to the *C. collaris* sp. complex

Distribution. *C. multiplicatus* is widely distributed on the Caribbean slopes of the Tilarán and Central mountain ranges, and the Caribbean lowlands, from 0 to 800 m a.s.l. (Fig. 102).



Figures 74–85. Aedeagus of *Callistethus* species, lateral view (base at bottom). **74:** *C. mimeloides* (La Montura, San José, CEUA). **75:** *C. calonotus* (Alto de las Moras, Puntarenas, INBIO). **76:** *C. chlorotoides* (Estación Hitoy Cerere, Limón, INBIO). **77:** *C. chrysanthe* (type, Costa Rica, MNHN). **78:** *C. jordani* (Estación Cacao, Guanacaste, INBIO). **79:** *C. xiphostethus* (Los Angeles, Heredia, INBIO). **80:** *C. schneideri* (Albergue Heliconias, Alajuela, CEUA). **81:** *C. chontalensis* (Cerro Bitárkara, Limón, CEUA). **82:** *C. valdecostatus* (Alto de las Moras, Puntarenas, INBIO). **83:** *C. granulipygus* (Rancho Quemado, Puntarenas, INBIO). **84:** *C. vanpatteni* (Cinco esquinas de Carrizal, Alajuela, INBIO). **85:** *C. sp304* from Cerro Bitárkara. Scale = 1 mm.

Material. HOLOTYPE: ♂ 'Sector Cerro Cocori, Fca. de E. Rojas, 150 m, Prov. Limon, Costa Rica, E. Rojas, 31 ene – 21 feb 1992, L- N 286000_567500', 'INBIOCRI000774896'. – Paratypes (7): 1♀ 'Estación Pitilla, 700m, 9km S Santa Cecilia, Guanac. Pr. COSTA RICA. FEB 1989. GNP Biodiversity Survey. 330200,380200', 'INBIOCRI000104897'; 2♂ 'Sector Cerro Cocori, Fca. de E. Rojas, 150 m, Prov. Limon, Costa Rica. Mar 1992. E. Rojas L- N 286000,567500', 'INBIOCRI001331162' and 'INBIOCRI001331163'; 1♂ 'Manzanillo, 0–100m, RNFS Gandoca y Manzanillo, Prov. Limon, Costa Rica, 9 set a 13 oct 1992, K. Taylor, L- S 398100_610600', 'INBIOCRI000937526'; 1♂ 'Limon. Costa Rica Pacuarito Las Brisas 20 julio 1986 M.M. Chavarria Diaz', '?', '5', '5', 'INBIOCRI002517475'; 1♂ 'Cuatro Esquinas, P. N. Tortuguero, Prov. Limon, COSTA RICA. om, Set 1989. J. Solano, L N 280000_590500', '5', 'INBIOCRI000086335'; 1♀ 'Cerro Tortuguero, 0–120 m, P.N. Tortuguero, Prov. Limon, COSTA RICA. Mar 1993, R. Delgado. L N 285000_588000', 'INBIOCRI001353063'.

Callistethus parapulcher sp.n.

Description. Male holotype: **Body shape:** Length 17.21 mm; width 10.47 mm. Oval, stout. Elytral disc convex. **Colouration:** Head, pronotum and scutellum greenish brown. Pronotum with ochre margins. Elytra light reddish brown. Pygidium dark brown. Abdominal sternites dark green and brown. Sternum and legs yellow to greenish. Tibiae and tarsi darker, metallic green (Fig. 10). **Head:** Clypeus trapezoidal, ratio width/length 1.65. Clypeus surface densely punctate-reticulate. Frons punctate-reticulate, with larger punctures than in clypeus and with secondary small punctuation; sometimes slightly concave on disc. Vertex with same punctation as frons. Ocular canthus long and narrow, apex rounded. Eyes rounded, interocular ratio (interocular width/width of eye) 2.78. Antennae: ratio funiculus/club 0.61. **Pronotum:** Basal width 1.88 x length; in dorsal view broadest at its base. Lateral margins rounded, apex of curvature at 1/3 of length from anterior. Anterior angles acute and rounded; posterior angles obtuse and rounded. Posterior margin without basal bead, sinuate, forming a nearly straight line above the scutellum. Surface with dense punctures and densely covered with short blonde setae (not evident to the

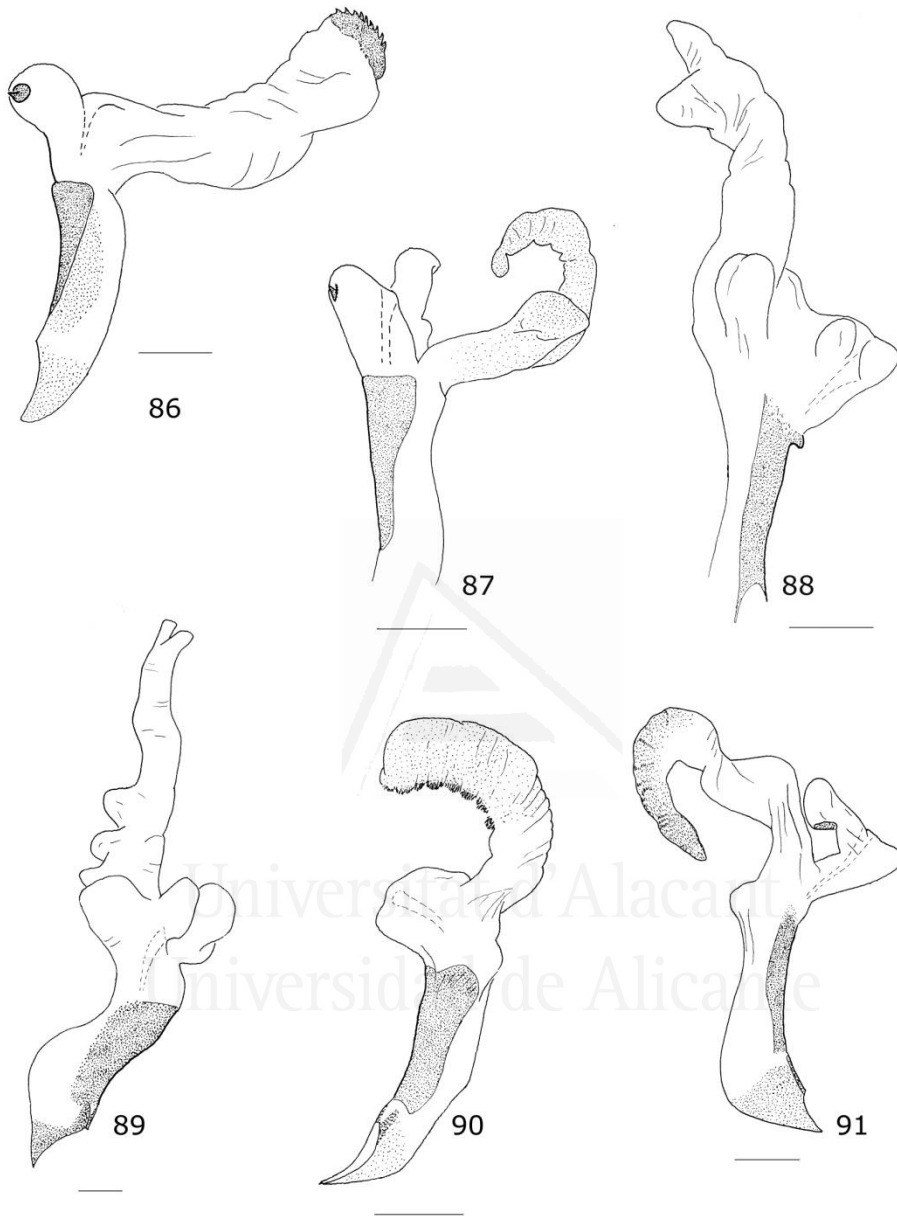
naked eye). **Scutellum**: Shape subtriangular, blunt apex, with sparse punctures, denser at sides; ratio width/length 1.45. **Elytra**: Surface with 14 costae (excluding lateral margin), defined by dense and sulcate rows of punctures. Second and third striae (defining third costa) somewhat irregular, blending into irregular punctures at the base of the elytra. Apex of elytral suture rounded. Lateral margin convex, tapering gradually from base to apical third, disappearing at the apex. Marginal membrane nearly complete. Whole surface covered with microsetae (not evident to the naked eye). **Pygidium**: Strigate-imbricate. Dense short setae on disc, longer on margins. Triangular shape, with rounded apex, with a couple of large deep fossae at sides. Nearly straight in lateral view. Ratio width/length 1.64. **Metasternum**: Disc slightly concave, with sparse medium-length setae, very dense on sides. Mesosternal process short, reaching the anterior margin of mesocoxae; width at base $\frac{2}{3}$ of femur height, narrowing at apex to $\frac{1}{3}$ or less of femur height; in lateral view with a blunt apex; width at base 0.79 mm (Fig. 25). Mesometasternal suture absent, metasternal sulcus reaching the apex of trochanters. **Abdominal sternites**: With dense punctures, oblong on apical half; 1–2 rows of medium-length setae per sternite, denser on sides. Last exposed sternite with dense punctures, apical margin finely punctate, at midline $\frac{1}{4}$ as long as total length of last sternite; basal suture of the apical bead doubled and sinuate, partially obliterated at middle; apically also sinuate. Sixth abdominal spiracle flat. **Protibia**: With 2 teeth (Fig. 37), slender; apical tooth short, curved, acute. Proximal tooth small, quadrate, at same height of internal apex of protibia. **Metatibia**: Slender, fusiform. Ratio length/width 3.33. First carina made by row of punctures. Surface densely punctuate above second carina, rugose below, glabrous. **Claws of fore leg**: External claw strongly curved; ratio length/height: 1.41; internal claw thin, deeply bifurcate, with branches strongly diverging, upper branch of same length, nearly as wide as the lower one. Inferior margin straight. **Male genitalia**: Aedeagus (Fig. 49). Parameres short, nearly squared in lateral view; frontal margin slightly sinuated. Ventral plate fused to parameres, but with suture visible.

Tectum wide. Basal part with thick margins at the base and apex. Endophallus (Fig. 61). With 2 sacculi: the ventral one short and wide, with ventrally folded apex; at base a long diverticle that end in a thick sclerotised claw-like spine. Dorsal sacculus long, laterally inflated at the base, with a bump near the base bearing 4–5 thick spines (the median fused at base); rest of the sacculus thin and curved in a spiral, with thin setae near the apex; dorsally at the base a long thin sclerotised plate with 2 curved spines at the apex, the spines are partially retracted if the endophallus is not fully inflated. Median lobe sclerotised.

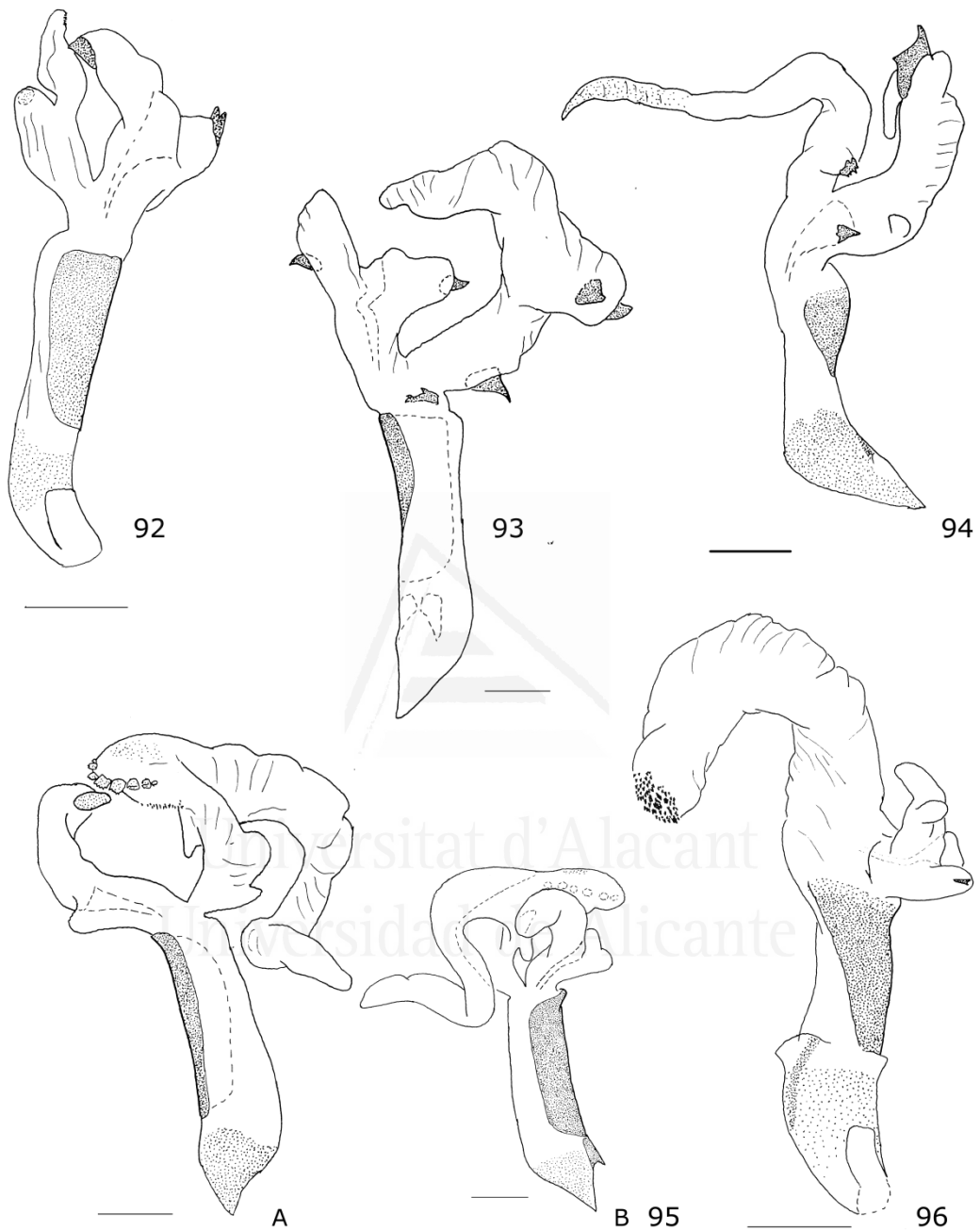
Female: fossae on pygidium not as evident as in male. Apical tooth of protibia (Fig. 37) longer and wider; basal tooth above internal apex.

Variation: body length 17.21–18.39 mm; width 10.41–10.98 mm. Clypeus w/l 1.65–1.85. Interocular ratio 2.60–2.78. Male antennae, ratio funiculus/club 0.61–0.69. Club length slightly longer in male. Pronotum w/l 1.81–2.04. Scutellum w/l 1.38–1.45. Pygidium w/l 1.47–1.64. Width of mesosternal process at base 0.73–0.79 mm. Metatibia w/l 3.19–3.40. External foreleg claw l/h 1.41–1.63. Head, pronotum and scutellum metallic dark green to greenish brown. Pygidium greenish to coppery brown. Mesosternal process variable in width from 1/2 to 2/3 of width of femurs. First carina on metatibiae well defined in some females.

Differential diagnosis. *C. parapulcher* can be distinguished from similar species by the combination of the following features: light brown elytra; presence of setae on the pronotum; pointed mesosternal process in lateral view, wide in ventral view; parameres nearly squared, endophallus with several spines in three different places. In Costa Rica the most similar species is *C. schneideri*, which also presents setation on the body, but the latter is slightly bigger, with darker elytra and a slender shape, the mesosternal process is narrower in ventral view and blunt in lateral view, and genitalia are different (Figs. 80, 92). The presence of setation and the shape of the genitalia distinguish this species from other similar ones, such as *C. cayapo* (Ohaus, 1902) (Brazil), which has pointed parameres, with a sinuate ventral margin (Fig. 70),



Figures 86–91. Endopallus of *Callistethus* species. 86: *C. mimeloides* (Orosilito, Guanacaste, CEUA). 87: *C. calonotus* (Alto de las Moras, Puntarenas, INBIO). 88: *C. chlorotoides* (Reserva Biológica Hitoy Cerere, Limón, INBIO). 89: *C. jordani* (Estación Cacao, Guanacaste, INBIO). 90: *C. xiphostethus* (Los Angeles, Heredia, INBIO). 91: *C. schneideri* (Albergue Heliconias, Alajuela, CEUA). Scale = 1 mm.



Figures 92–96. Endophallus of *Callistethus* species. **92:** *C. chontalensis* (El Copal, Cartago, CEUA). **93:** *C. valdecostatus* (Las Alturas, Puntarenas, INBIO), number and shape of sclerites is variable. **94:** *C. granulipygus* (Estación Quebrada Bonita, Puntarenas, INBIO). **95:** *C. vanpatteni* (Cinco esquinas de Carrizal, Alajuela, INBIO), (A,B) both sides. **96:** *C. sp304* from Cerro Bitárkara. Scale = 1 mm.

and also has more irregular striae on elytra, or *C. levii* (Blanchard, 1851) (Ecuador), smaller in size and with slender aedeagus (Fig. 71), and *C. pulcher* (Blanchard, 1851) (Colombia), which has parameres with a sharp point (Fig. 72).

Derivatio nominis. From the Greek prefix 'para-', side by side, and 'pulcher', referring to the species *C. pulcher* (Blanchard, 1851), to which it is very similar.

Distribution. *C. parapulcher* is distributed in the Tilarán, Central and Talamanca mountain ranges, from 300 to 1800 m a.s.l. (Fig. 103).

Material. HOLOTYPE: ♂ 'Estacion Almirante, 1 Km. S del Cerro Biolley, Sendero Gigantes del Bosque, Puntarenas, Costa Rica. 1300-1450m. 20-23 NOV 1995. M. Moraga, de Luz L_S_331700_572100', 'INBIOCR1002381386'. – PARATYPES (12): 1♀ 'Estacion Pitilla, 9 km S. Santa Cecilia, P. N. Guanacaste, Prov. Guana, Costa Rica, 700 m. 19-22 Jun 1993, G. Carballo, L N 330200_380200 # 2199', 'INBIOCR1001837034'; 2♂ 'Est. Pittier, PILA-ACLA, Prov. Punta, COSTA RICA. 1670m. 5-18 ENE 1995. L. Angulo, L N 330900 577400 #4669', 'INBIOCR1002199232' and 'INBIOCR1002199233'; 1♀ 'Est. Altamira, Buenos Aires, A. C. Amistad, Prov. Punta, COSTA RICA. 1150-1400 m. Dic 1994, M. Segura, L S 331700_572100 # 3377', 'INBIOCR1002091974'; 1♂ 'Est. Pittier, PILA-ACLA, Prov. Punta, COSTA RICA. 1670m. 6-18 ENE 1995. A. Azofeifa, L N 330900 577400 #44830', 'INBIOCR1002205729'; 1♂ 'COSTA RICA. Prov. Puntarenas. Buenos Aires. Alto Jalisco. 900-1000m. 22-26 FEB 2009. E. Ulate, J. A. Azofeifa, M. Moraga. Tp. Luz Mercurio. L_S_327533_523213 #95832', 'CEUA00105287'; 1♀ 'COSTA RICA. Prov. Puntarenas. Buenos Aires. Alto Jalisco. 900-1000m. 22-26 FEB 2009. E. Ulate, J. A. Azofeifa, M. Moraga. Tp. Luz Mercurio. L_S_327533_523213 #95832', 'INB0004197431'; 1♀ 'Fca. Cafrosa, Est. Las Mellizas, P. N. Amistad, 1300m, Puntarenas COSTA RICA Feb 1990. M. Ramirez, L- S 316100_596100', 'INBIOCR1000209842'; 1♂ 'Puntarenas, Costa Rica San Vito, Las Cruces 20 nov 1988 Col: A. Solis', 'INBIOCR1002517067'; 1♀ 'Est. Santa Elena, Viejo, Santa Elena, Las Nubes, Prov. San J, COSTA RICA. 1210m. 20-24 NOV 1995. B. Gamboa, de Luz L_S_371750_507800 #6432', 'INBIOCR1002357497'; 1♂ 'Est. Santa Elena, Viejo, Santa Elena, Las Nubes, Prov. San J, COSTA RICA. 1210m. 20-24 NOV 1995. B. Gamboa, de Luz L_S_371750_507800 #6432', 'INBIOCR1002357500'; 1♀ 'La Amistad, Sect. Altamira, Buenos Aires, Prov. Punta, COSTA RICA. 1200m. 21 Feb-10 Mar 1994, R. Delgado, L S 572100_331700 # 2691', 'CEUA00105286'.

Callistethus pseudocollaris sp.n.

Description. Male holotype: **Body shape:** Length 12.64 mm; width 6.66 mm. Oval, slender. Elytral disc convex. **Colouration:** Pronotum metallic green with ochre margins. Elytra brownish green. Rest of body brownish green to yellowish green, lighter on clypeus, legs and mesosternal process (Fig. 11). **Head:** Clypeus trapezoidal, ratio width/length 1.96. Clypeus surface densely punctate, surface with confluent punctures. Frons with sparse punctures, not differentiated from rest of head surface. Ocular canthus short, wide at base, sharpening at apex. Eyes small and oblong, interocular ratio (interocular width/width of eye) 4.79. Antennae: ratio funiculus/club 0.73. **Pronotum:** Basal width 1.81 x length; in dorsal view broadest at its base. Lateral margins rounded, angulated at 2/5 of length from anterior. Anterior angles quadrate and quite sharp; posterior angles obtuse and quite sharp. Posterior margin without basal bead, sinuate on sides, forming a straight line above the scutellum. Surface with shallow sparse punctures. **Scutellum:** Shape subpentagonal, blunt apex, with a few shallow punctures on disc; ratio width/length 1.22. **Elytra:** Surface with 14 costae (excluding lateral margin), defined by dense and sulcate rows of punctures. Second and third rows (corresponding to first interstice) with more separated punctures. Apex of elytral suture rounded. Lateral margin convex, tapering gradually from base to apical third, disappearing on apex. Marginal membrane narrow and nearly complete. **Pygidium:** Punctate-striate in wavy lines, due to confluence of oblong punctures, with sparse short setae on disc, longer on margins. Triangular shape, with rounded apex. Nearly straight in lateral view. Ratio width/length 1.43. **Metasternum:** Disc slightly concave, with sparse short setae on disc, dense at sides. Mesosternal process long, reaching the base of procoxae; width at base nearly as wide as coxae, narrowing at apex to 1/3 the width at base; in lateral view narrowing and curved upwards at apex; width at base 0.72 mm (Fig. 26). Mesometasternal suture shallow, reaching apex of trochanters. Metasternal sulcus reaching mesometasternal suture. **Abdominal sternites:** With oblong punctures,

sparse in the middle and dense on sides; 1 row of short setae per sternite at centre, dense at sides. Last exposed sternite with sparse shallow punctures, apical margin sparsely punctate, at midline $2/5$ as long as total length of last sternite; basal suture of the apical bead curved, partially obliterated in the middle. Sixth abdominal spiracle flat. **Protibia:** With 2 teeth (Fig. 38), slender; apical tooth oblique in relation to vertical axis of protibia, nearly quadrate, with uniform width. Proximal tooth acute, at same height of the internal apex of protibia. **Metatibia:** Stout, fusiform, glabrous. Ratio length/width 2.64. First carina defined by punctures. Surface sparsely punctuate, with elongate punctures below second carina. **Claws of fore leg:** External claw strongly curved; internal claw deeply bifurcate, with branches strongly diverging, upper branch of same length and more than $1/2$ as wide as the lower one. Inferior margin slightly sinuate. **Male genitalia:** Aedeagus (Fig. 50). Parameres long with protruding wide apex in lateral view; ventral margin angulated and slightly sinuate. Parameres fused with ventral plate. Endophallus (Fig. 62). One short sacculus with a ridged sclerotised plate on apex, ejaculatory duct opening wide, dorsal. A small diverticle at base, dorsal. Median lobe sclerotised, with a weakly sclerotised band on top.

Female: similar to male, protibia (Fig. 38) with apical tooth longer and wider, expanded at apex; basal tooth above the internal apex. Branch of internal foreleg claw similar in width. Last exposed sternite with oblong punctures, apical smooth margin narrower than in male.

Variation: body length 12.64–14.78 mm; width 6.66–7.65 mm. Clypeus w/l 1.84–2.12. Interocular ratio 4.79–6.14. Female antennae, ratio funiculus/club 0.85–0.89. Pronotum w/l 1.73–1.81. Scutellum w/l 1.18–1.36. Pygidium w/l 1.32–1.51. Width of mesosternal process at base 0.72–0.85 mm. Female metatibia w/l 3.14–3.82. Elytra metallic green to brownish green.

Differential diagnosis. *C. pseudocollaris* differs from similar species by the combination of the following features: homogeneous green colour, elytra with

regular sulcated striae, parameres with wide apex, and endophallus with one short sacculus bearing a sclerotised plate on apex. It is very similar to *C. collaris* and *C. multiplicatus*, and is distinguished by the shape of the male genitalia, with parameres that are long in relation to the tectum, with ventral margin sinuate and a blunt apex, whereas *C. collaris* has a bilobed apex (Fig. 69) and *C. multiplicatus* a thin apex bending dorsally (Fig. 48). The endophallus consists of one short sacculus, instead of the two long ones of *C. multiplicatus* (Fig. 60).

Derivatio nominis. From the Greek prefix 'pseudo-', false, and 'collaris', for its resemblance with *C. collaris* (Burmeister, 1844).

Distribution. *C. pseudocollaris* is distributed on the Pacific slopes of the Tilarán and Talamanca mountain ranges, from 1500 to 1700 m a.s.l. (Fig. 102).

Material. HOLOTYPE: ♂ 'Est. La Casona, 1520m, Res. Biol. Monteverde, Prov. Puntarenas, Costa Rica, Jul 1992, N. Obando, L- N 253250_449700', 'INBIOCR1000691543'. – PARATYPES (2): 1♀ 'COSTA RICA, Prov. Puntarenas, A.C.L.A.P, P.I.L.A, Coto Brus, Send Cerro Pittier Estación. 1750m. 29–30 DIC 1998. M. Moraga. Sombrereta L_S_331250_577150 #51998', 'INBIO0003313790'; 1♀ 'La Escuadra, 1600–1900m Parque Internac. La Amistad, Prov. Punt., COSTA RICA, M. Zumbado, Ene 1992, L -S 326700_581200', 'INBIOCR1000489689'.

Callistethus specularis (Bates, 1888)

Callistethus kolbei (Ohaus, 1897) Stettiner Entomologische Zeitung 58: 398. **syn. nov.** (Fig. 13).

Remarks. Ohaus (1897) described *Anomala kolbei* (now *Callistethus kolbei* sensu Machatschke 1957) based on a female specimen from Costa Rica. He indicated that this species is similar to *C. calonotus* (Bates, 1888), but with a reddish colour.

At the Museum für Naturkunde in Berlin, one of the authors (V.F) studied the type of *C. kolbei*, noting its resemblance with *C. specularis* (Bates, 1888), except for its smaller size and reddish colour. The specimen bears a handwritten label 'A. kolbei type Ohaus' and coincides with the description: reddish brown colour, glossy, with yellow clypeus, sides of pronotum, basal triangle on pronotum (that is the basal

widening of a thin median stripe that runs along all the length of the pronotum), and metasternal process, except that it was a male. We are confident that this is the actual type of *C. kolbei*, and the error of Ohaus in sex determination was due to wear on the protibial teeth of the specimen, which were therefore not as sharp as males usually show in *Anomalini*.

According to these results, the edeagus of *C. kolbei* coincided in size (despite the smaller body size of the specimen) and shape to that of *C. specularis*. We therefore propose a new synonymy of *C. kolbei* with *C. specularis*.

The reddish colour of *C. kolbei* type is due to the lack of the metallic green luster that is present on all the surface of common *C. specularis* specimens. Among more than 100 specimens of *C. specularis* conserved in the collection of INBio, Costa Rica, there is one from Cariblanco, Alajuela that has a dark reddish colour, but this is ascribed to inadequate conservation conditions of the private collection where it was previously stored (Á. Solís, personal communication). *C. specularis* also was described on a single specimen, that was also illustrated in Bates work (1888). A second specimen in BMNH collection that bears a "typus" label must be considered mislabelled.

Redescription. male holotype: **Body shape:** Length 17.17 mm; width 9.23 mm. Oval, slender. Elytral disc slightly convex. **Colouration:** Head, pronotum and scutellum shiny light green, pronotum with yellowish lateral margins, blended with the main colour by a metallic green luster when seen in natural light. Elytra light brown with metallic green luster, and darker green brownish lines following the rows of punctures. Pygidium, venter, antennae and legs brownish green, with metallic green luster. Mesosternal process yellow, with metallic green luster (Fig. 12). **Head:** Clypeus trapezoidal, ratio width/length 1.98. Clypeus surface densely punctate, with shallow punctures. Frons with less dense punctures, equally shallow. Vertex only slightly less punctate. Ocular canthus subtriangular, with base width $\frac{2}{3}$ of the length; apex rounded. Eyes elongates, interocular ratio (interocular width/width of eye) 4.60. Antennae: ratio funiculus/club 0.78. **Pronotum:** Basal width 1.92 x length; in dorsal

view broadest at its base. Lateral margins rounded, almost parallel in basal $2/3$, curved and convergent in anterior third. Anterior angles nearly right-angled and rounded; posterior angles obtuse and rounded. Posterior margin without basal bead, sinuate on sides, forming a straight line above the scutellum. Surface with fine, shallow and sparse punctation. **Scutellum**: Shape subpentagonal, sharp apex, with fine and scattered punctures. Ratio width/length 1.36. **Elytra**: Surface with 12 rows of regular punctures, well defined but not deep, leaving the overall surface of ridges flat. The rows are green brownish pigmented, and therefore emphasised. The second row is duplicated at the base; fifth and eighth rows (corresponding to second and third interstices) with slightly more separated punctures, irregular and widened at the beginning. Apex of elytral suture rounded. Lateral margin convex and wide in basal $1/4$, thinner until the $3/4$, and disappearing at the apex. Marginal membrane narrow, extending along almost the complete margin. **Pygidium**: Coriarius-striated. Covered on entire surface with sparse short blonde setae, longer at margins. Triangular shape, with rounded apex. Nearly straight in lateral view, convex at the apex. Ratio width/length 1.54. **Metasternum**: Disc slightly concave and smooth. Glabrous centrally, with dense setigerous punctures on sides bearing medium-length blonde setae. Mesosternal process long, reaching the procoxae, width $3/4$ of coxal height, uniform width along all the length, with rounded apex; in lateral view slightly curved upwards, and narrowed at the apex; width at base 0.86 mm (Fig. 27). Mesometasternal suture obliterated in the middle, at base of mesosternal process. Metasternal sulcus reaching mesometasternal suture. **Abdominal sternites**: Irregularly punctate; punctures denser, deeper and oblong on the sides; presence of short and sparse setae mainly on the sides, arranged in up to 5 rows. Last exposed sternite with shallow sparse punctures, apical margin sparsely punctate, at midline $1/3$ as long as total length of last sternite; basal suture of the apical bead sinuate, partially obliterated in the middle and substituted by a row of punctures. Sixth abdominal spiracle flat. **Protibia**: With 2 teeth (Fig. 39), quite narrow, apical tooth

short and blunt, oblique in relation to the vertical axis of the protibia, quadrate. Proximal tooth small and blunt, at the same height as the internal apex of the protibia. **Metatibia:** Slender, slightly fusiform, glabrous except for carina. Ratio length/width 3.83. Both carinae well defined. Surface sparsely punctate. **Claws of fore leg:** External claw strongly curved; ratio length/height: 1.43; internal claw bifurcate, with branches strongly diverging, upper branch of the same length and more than 1/2 as wide as the lower one. Inferior margin straight. **Male genitalia:** Aedeagus (Fig. 51). Parameres fused to ventral plate; apically deeply sinuate, forming a bilobed apex in lateral view, with wide inferior lobe. Tectum stout, widening from front to rear. Endophallus (Fig. 63). With 2 long sacculi. Ventral sacculus with the ejaculatory duct opening on the left side halfway along its length, situated on the interior of a wide fold; on the opposite side a sclerotised conical spur. Dorsal sacculus longer and with a ridge of small diverticles in the central part; a wide inflation present near the base. Median lobe sclerotised.

Female: protibia (Fig. 39) wider than in male, apical tooth wider and longer than in male, basal tooth above internal apex. Lower branch of the internal foreleg claw narrower than in male. Last exposed sternite punctate, apical smooth margin narrower than in male.

Variation: body length 16.68–18.04 mm; width 8.77–9.23 mm. Clypeus w/l 1.76–2.04. Interocular ratio 4.60–5.01. Male antennae, ratio funiculus/club 0.70–0.85. Pronotum w/l 1.83–1.98. Scutellum w/l 1.29–1.44. Pygidium w/l 1.46–1.54. Width of mesosternal process at base 0.86–1.08 mm. Metatibia w/l 3.75–3.92. External foreleg claw l/h 1.22–1.43. There is an appreciable variability in the degree of the upward bending and thickness of the mesosternal process seen in lateral view. Scutellum pentagonal to subtriangular.

Differential diagnosis. *C. specularis* can be distinguished from other Neotropical *Callistethus* species by the combination of the following features: elytra light brown with green luster, regular flat elytra striation with pigmented striae, parameres

deeply sinuate frontally, a row of diverticles on dorsal sacculi of endophallus. The most similar species in colour are *C. chrysanthe* and *C. jordani*, but these are larger, with subtle punctation on elytra, not striated, and different male genitalia (Figs. 77, 78, 89).

Distribution. *C. specularis* is widely distributed in Costa Rica, occurring in all the principal mountain ranges from 800 to 2000 m a.s.l. (Fig. 104).

Material. Holotype for monotypy: 1♂ 'Type', 'Sp. figured', 'Costa Rica. Van Patten.', 'Anomala specularis Bates', 'B. C. A., Col., II(2) Anomala', 'HOLOTYPE Callistethus specularis (Bates 1888) Labelled by V. Filippini 2012' (BMNH). – *Callistethus kolbei* holotype: 1♂ 'Costa Rica (handwritten)', '23', 'A. Kolbei type Ohaus (handwritten) /Type', '39547', 'HOLOTYPUS Callistethus kolbei Ohaus, 1897 labelled by MNHUB 2011', 'Callistethus specularis det. V. Filippini ix.2011'. – Additional material (5): 1♂ 'Anomala specularis Bates', 'Costa Rica. (Pittier) 97-183. L99 La Palma 1100m 9.96', 'Typus', 'London' (BMNH). 1♂ 'Rio San Lorenzo, 1050 m, Tierras Morenas, Z. P. Tenorio, Prov. Guanacaste, Costa Rica, Abr 1992 F. Quesada L- N 287800, 427600', 'RUTELINAE Callistethus specularis (Bates 1888) Det. V. Filippini 2013', 'INBIOCR1000930532'. 1♂ 'Rio San Lorenzo, 1050 m, Tierras Morenas, Z. P. Tenorio, Prov. Guanacaste, Costa Rica. A. Marin 28 mar a 21 abr 1992 L- N 287800, 427600', 'RUTELINAE Callistethus specularis (Bates 1888) Det. V. Filippini 2013', 'INBIOCR1000416015'. 1♀ 'Rio San Lorenzo, 1050 m, Tierras Morenas, Z. P. Tenorio, Prov. Guanacaste, Costa Rica, Abr 1992 F. Quesada L- N 287800, 427600', 'RUTELINAE Callistethus specularis (Bates 1888) Det. V. Filippini 2013', 'INBIOCR1000930529'. 1♂ 'Isla Bonita, Prov. Alajuela, Costa Rica. T. luz 2. 9 sep 2007 Leg. A. García', 'RUTELINAE Anomala sp.37 Det. Alejandra García', 'RUTELINAE Callistethus specularis (Bates 1888) Det. V. Filippini 2013', 'CEUA00105278'.

Callistethus stannibractea sp.n.

Description. Male holotype: **Body shape:** Length 16.91 mm; width 10.35 mm. Oval, stout. Elytral disc convex. **Colouration:** Head and pronotum metallic green, with margins of pronotum and central part of clypeus yellow brownish with green luster. Scutellum shiny bronze green. Elytra yellowish light green with metallic luster. Pygidium coppery golden. Venter bronze; antennae, mouth parts and prosternum

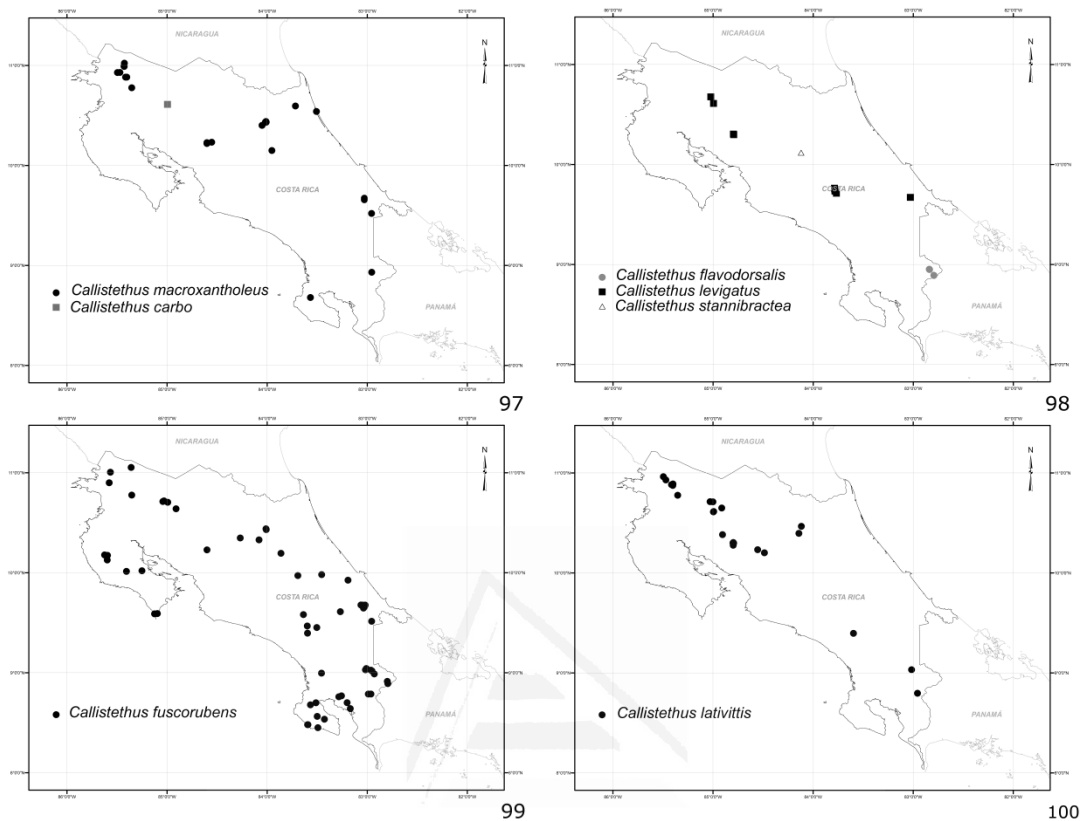
blackish bronze; legs coppery (Fig. 14). **Head:** Clypeus nearly rectangular, ratio width/length 1.76. Clypeus surface densely and deeply punctate, surface with confluent punctures. Frons with less dense large punctures, like those of the clypeus, and very fine and dense shallow punctures on background. Vertex without larger punctures. Ocular canthus short and wide; apex rounded. Interocular ratio (interocular width/width of eye) 4.49. Antennae: ratio funiculus/club 0.65. **Pronotum:** Basal width 1.77 x length; in dorsal view broadest at its base. Lateral margins rounded, angulated at nearly 1/2 of length from anterior. Anterior angles acute and rounded; posterior angles obtuse and rounded. Posterior margin without basal bead, sinuate, forming a nearly straight line above the scutellum. Surface with large, deep, sparse punctures, and very fine, shallow and dense punctures on background, as on frons. Lateral fossae obliterated. **Scutellum:** Shape subpentagonal, blunt apex, with fine and dense punctation on disc; ratio width/length 1.20. **Elytra:** Surface with costae defined by rows of shallow punctures, fairly continuous and sulcated in first and second costae. Interstices with 1 (second–fifth interstices) or 3 (first interstice) rows of sparse shallow punctures. Small horizontal wrinkles present between second interstice and third costa, in the apical half of the elytra surface. Background surface irregular. Apex of elytral suture rounded. Lateral margin convex, tapering gradually from base to apical third, disappearing on the apex. Marginal membrane narrow and extending along the apical half. **Pygidium:** Finely coriarious-striated, densely covered with medium-length blonde setae, longer at margins. Triangular shape, with rounded apex. Nearly straight in lateral view. **Metasternum:** Disc slightly concave, very finely punctate. Glabrous centrally, with dense setigerous punctures on sides, bearing medium-length blonde setae. Mesosternal process long, but not reaching the procoxae; width at base 3/4 of coxal height, narrowing towards the apex to 1/2 the width at base; in lateral view slightly curved upwards at the apex, thin; width at base 0.91 mm (Fig. 28). Mesometasternal suture marked by separate punctures, angulated at the apex where

it reaches the apex of trochanters. Metasternal sulcus reaching mesometasternal suture. **Abdominal sternites:** With 2–5 irregular rows of setigerous punctures, more abundant on sides; setae of medium length, blonde colour, dense on sides. Last exposed sternite with shallow dense small punctures on entire surface, apical margin punctate, at midline $\frac{2}{5}$ as long as total length of last sternite; basal suture of the apical bead sinuate, obliterated on the sides, due to denser punctures. Sixth abdominal spiracle tuberculiform. **Protibia:** With 2 teeth (Fig. 40), widening gradually from base to lower tooth; apical tooth narrow, long, oblique in relation to the vertical axis of protibia, curved at the apex. Proximal tooth triangular, with wide base, blunt, slightly below the internal apex. **Metatibia:** Slender, nearly conical, subapical constriction negligible. Ratio length/width 4.90. First carina defined by large punctures. Surface sparsely punctate. **Claws of fore leg:** External claw curved; internal claw bifurcate, with branches strongly diverging, upper branch slightly shorter and more than $\frac{1}{2}$ as wide as the lower one. Inferior margin straight. **Male genitalia:** Aedeagus (Fig. 52). Parameres long, with thickened apex; ventral margin angulated. Ventral plate separated from parameres, and not well defined on top. Tectum with constant width. Endophallus (Fig. 64). A ventral sacculus with a dorsal large diverticle, ejaculatory duct opening situated frontally between both; a sclerotised circular plate with a central spine on right side of the sacculus. A long swollen dorsal sacculus. Median lobe sclerotised.

Female: unknown.

Variation: body length 16.71–16.94 mm; width 9.54–10.35 mm. Clypeus w/l 1.74–1.79. Interocular ratio 3.86–4.49. Male antennae, ratio funiculus/club 0.58–0.65. Pronotum w/l 1.72–1.77. Pygidium w/l 1.71–1.75. Width of mesosternal process at base 0.69–1.02 mm. Metatibia w/l 4.21–4.90. External foreleg claw l/h 1.76–1.80. The yellowish borders of pronotum are more extended in one specimen (INBIOCRI000164337), giving the green part of the disc an 'M' form.

3.3 *Callistethus*



Figures 97–100. Distribution of *Callistethus* species in Costa Rica. **97:** *C. carbo* and *C. macroxantholeus*. **98:** *C. flavodorsalis*, *C. levigatus* and *C. stannibractea*. **99:** *C. fuscrobens*. **100:** *C. lativittis*.

Differential diagnosis. The large size, colour, abundant ventral setation and particular elytra surface readily separate this species from all congeners. The most similar species in size and colour are *C. chrysanthe* and *C. jordani*, but in these elytra punctation is more evident and regular, and not so green in colour. Also the parameres with thick apex are unique to *C. stannibractea*, whereas are thin and less protruding in *C. chrysanthe* (Fig. 77) and *C. jordani* (Fig. 78).

Derivatio nominis. From the Latin noun 'stanni bractea, -ae', tinfoil, treated here as a noun in apposition, for the irregular and metallic surface of elytra, that looks like it is wrapped in a yellowish green tinfoil.

Distribution. *C. stannibractea* is known from only one locality in the Braulio Carrillo National Park, Heredia. (Fig. 98).

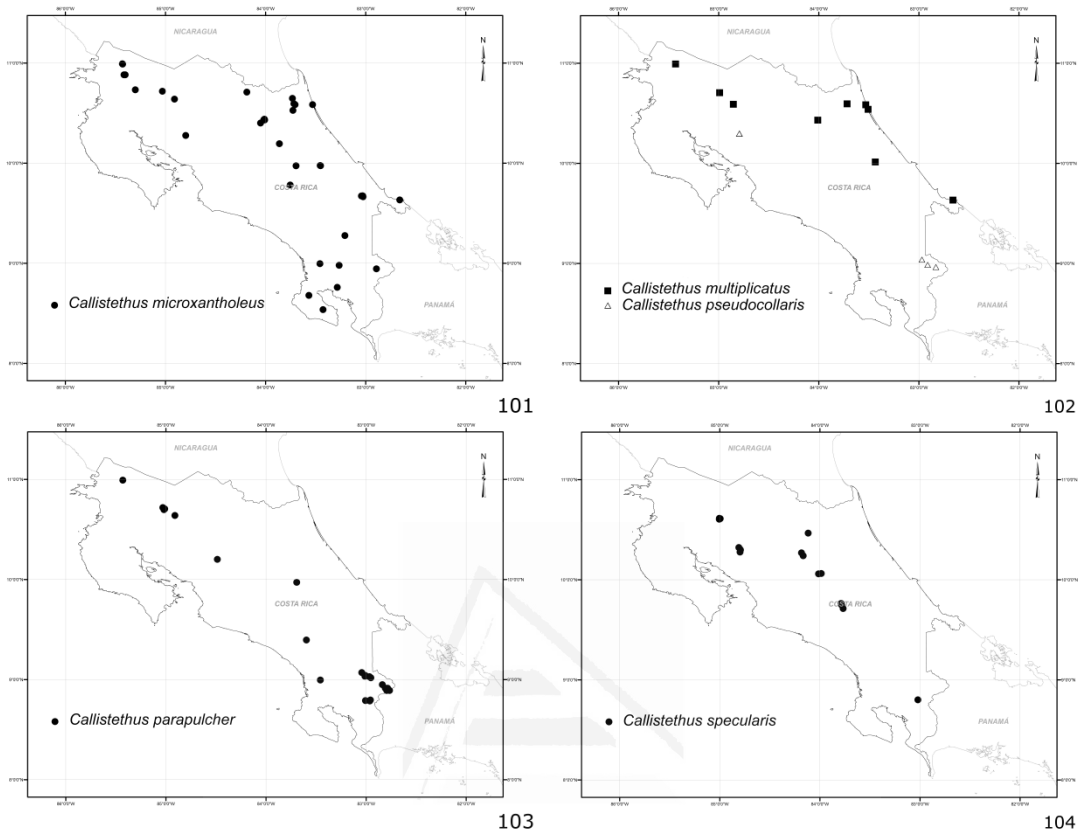
Material. HOLOTYPE: ♂ 'Estac. Barva, BraulioCarrillo N.P., Pr. Heredia. COSTA RICA. 2500m. April 1989 M. Zumbado & A. Fernandez', '156', 'INBIOCRI002517469'. – PARATYPES (3): 1♂ 'Estac. Barva. Braulio Carrillo, N.P. 2500 m. Heredia COSTA RICA. Feb 1990. A. Fernandez 233400-523200', 'CEUA00105277'; 1♂ 'Estac. Barva. Braulio Carrillo, N.P. 2500 m. Heredia COSTA RICA. Mar 1990. G. Rivera 233400-523200', 'INBIOCRI000164337'; 1♂ 'Estac. Barva, BraulioCarrillo N.P., Pr. Heredia. COSTA RICA. 2500m. April 1989 M. Zumbado & A. Fernandez', '156', 'INBIOCRI002517467'.

Callistethus valdecostatus stat.nov. (Bates, 1888)

Remarks. *C. valdecostatus* (Fig. 15) is here elevated to the status of valid species, and not a subspecies of *C. marginicollis* (Bates, 1888) (Fig. 16) (as originally stated by Bates 1888 and listed in Krajcik 2007), due to the clear differences in the aedeagus between the two species: the parameres in *C. valdecostatus* are squared frontally (Fig. 82), whereas in *C. marginicollis* the apex is pointed, with sinuate ventral margin (Fig. 73). Moreover, the elytral costae on *C. valdecostatus* are more evident.

Material. *C. marginicollis*: 1♂ 'Misantla Mex.[ico] Höge', 'Cotype', 'Spilota marginicollis H. Bts.', 'Coll. Ohaus | Mus. Berlin'. *C. valdecostatus*: 1♀ '♀', 'Chiriqui', 'Cotype', 'S. marginicollis | v. valdecostata | 1a H. Bates', 'Coll. Ohaus | Mus. Berlin'; 1♂ 'Chiriqui', 'S. marginicollis | v. valdecostata H. Bates', 'Coll. Ohaus | Mus. Berlin'. – Additional material (3): 1♂ 'Est. Biol. Las Alturas 1500 m, Coto Brus, Prov. Puntarenas, Costa Rica, F. Araya, 23 mar a 2 may 1992, L-S 322500_591300', 'INBIOCRI000915883'; 1♂ 'COSTA RICA. Prov. Puntarenas. Buenos Aires. R.I. Boruca-Térraba. Alto de las Moras. 800-1000m. 24 MAR 1993. E. Phillips, S. Rojas, M. Solis. L_S_326800_533800 #1977', 'INBIOCRI001926965'; 1♀ 'COSTA RICA. Prov. Puntarenas. Buenos Aires. R.I. Boruca-Térraba. Alto de las Moras. 800-1000m. 24 MAR 1993. E. Phillips, S. Rojas, M. Solis. L_S_326800_533800 #1977', 'INBIOCRI001926964'.

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Figures 101–104. Distribution of *Callistethus* species in Costa Rica. **101:** *C. microxantholeus*. **102:** *C. pseudocollaris* and *C. multiplicatus*. **103:** *C. parapulcher*. **104:** *C. specularis*.

Distribution patterns

The largest diversity of *Callistethus* in Costa Rica (21 species) is found on the slopes of the main mountain ranges (Guanacaste, Tilarán, Central, Talamanca), approximately between 700 and 1700 m a.s.l. Ten species (*C. chlorotoides*, *C. mimeloides*, *C. chontalensis*, *C. granulipygus*, *C. schneideri*, *C. multiplicatus*, *C. fuscorubens*, *C. lativittis*, *C. parapulcher*, *C. microxantholeus*) were also found at low altitudes (0–700 m a.s.l.), both in Caribbean or Pacific lowlands. Only four species were registered at altitudes above 1800 m a.s.l. These were *C. fuscorubens* (up to 3500 m a.s.l.), *C. specularis* (up to 2000 m.s.l.), *C. stannibractea* (2500 m a.s.l) and *C. xiphostethus* (up

to 2400 m a.s.l). All of them, with the exception of *C. stannibractea*, have a wide distribution area and altitudinal range.

Almost all of the species have a wide distribution area, and are found along at least two of the four main mountain ranges and are also commonly present in Caribbean lowlands and Pacific peninsulas. The only species with a narrow distribution range are *C. carbo* (Fig. 101), *C. stannibractea* (Fig. 98) and *C. calonotus* (one locality each, the Tilarán, Central and Coastal Mountain ranges respectively), *C. valdecostatus* (south Talamanca and Coastal) and *C. flavodorsalis* (Fig. 98) (south Talamanca).

The richest habitat is the tropical evergreen broad-leaved lowland and montane forest, where all the species can be found, with the exception of *C. stannibractea*, whose distribution range is limited to the tropical evergreen broad-leaved altimontane forest. The tropical semi-deciduous lowland forest follows in diversity richness, however only 11 species are present in this ecosystem.

The majority of *Callistethus* species in Costa Rica show wide climatic tolerance, as demonstrated by wide altitudinal ranges, and good dispersion ability, with wide distribution areas. This is partly in contrast to other Rutelinae and other scarab families, where the opposite scenario of smaller distribution ranges and high turnover of species among different localities is more common (García-López *et al.* 2013).

The highest richness is found between 700 and 1700 m, a result in line with findings for other insect taxa (dung beetles and butterflies), as this range presents a higher variety of habitats, and is a transitional-zone for many groups of animals (Kohlmann *et al.* 2007).

The number of species registered at lower altitudes (0–700 m) is fairly high, as found for other Rutelinae genera and also for other scarab subfamilies (García-López *et al.* 2012), despite the fact that in these areas the forest is fragmented and subject to the

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impact of agro-productive land use, which may limit the presence of more species. However, these results are based on the INBio collection, which generally makes more sampling effort in preserved areas (Kohlmann *et al.* 2007), so that the perturbation effects could be minimized. The lower richness at higher altitudes is a common pattern in tropical scarab beetles (García-López *et al.* 2012).

Regarding species with a narrow distributional range, the distribution near the border with Panama suggests a wider southern distribution for *C. calonotus* (originally described for northern Panama), *C. valdecostatus* and *C. flavodorsalis*, whereas *C. carbo* and *C. stannibractea* probably have a truly restricted distribution that could be due to ecological factors or influence from deforestations from the 1950s to the late 1970s (Rosero-Bixby & Palloni 1998).

Key to Costa Rican species of *Callistethus*

The species *C. nicoyus* and *C. sulcans*, considered *incertae sedis* (see section 5 below) are not included.

1. Slender oval body, body surface convex, usually with metallic green colour or luster; wide interocular space (more than 3.8 x the width of eye), with small and elongated eyes; mesosternal process long (produced anteriorly beyond top of mesocoxae for $>2/3$ x height of mesocoxae) and with apex separated from level of mesoventrite..... 2
- 1'. Mesosternal process short (produced anteriorly beyond top of mesocoxae for $<1/2$ x height of mesocoxae), laterally seen as a bump, apex connected to mesoventrite ...13
2. Elytra surface with regular and sulcate striae, normally 14 per side 3
- 2'. Elytra surface nearly smooth, or with intercostal spaces with shallow irregular punctures, never forming sulcate striae.....7

3. Elytra of same colour as pronotum, body length <16.0 mm4
- 3'. Elytra of lighter colour than pronotum, body length >16.0 mm.....*C. specularis* (Bates, 1888)
4. Elytra and pronotum yellow; aedeagus Fig. 74, endophallus Fig. 86 *C. mimeloides* (Ohaus, 1902)
- 4'. Elytra and pronotum green5
5. Body length >14.0 mm; ochre margins of pronotum concealed by metallic green luster; bright light green colour with reddish reflex; aedeagus Fig. 75, endophallus Fig. 87*C. calonotus* (Bates, 1888)
- 5'. Body length <14.0 mm; ochre margins of pronotum wide end evident; dark to brownish metallic green colour6
6. Apex of parameres wide and straight*C. pseudocollaris* sp.n.
- 6'. Apex of parameres narrow and bending upwards*C. multiplicatus* sp.n.
7. Elytra of same colour as pronotum, green or purple blackish8
- 7'. Elytra of lighter colour than pronotum, yellowish or light green9
8. Elytral surface completely smooth; ventral side brownish, without metallic luster; aedeagus Fig. 76, endophallus Fig. 88*C. chlorotoides* (Bates, 1888)
- 8'. Elytral surface with very shallow punctures, costae visible; ventral side with green metallic luster*C. levigatus* sp.n.
9. Body length >20 mm10
- 9'. Body length <17 mm11

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- 10.** Costae on elytra defined by sulcated rows of punctures; aedeagus Fig. 77
.....*C. chrysanthe* (Bates, 1888)
- 10'.** Costae poorly defined, not sulcated; aedeagus Fig. 78, endophallus Fig. 89
.....*C. jordani* (Ohaus, 1902)
- 11.** Elytral surface irregular, with small wrinkles, punctation not clear at bare sight.
Body length >16.5 mm*C. stannibractea* sp.n.
- 11'.** Elytral surface regular, with clearly visible costae and punctate interstices. Body
length <16 mm**12**
- 12.** Body length 12–13 mm; deep punctures on elytra; ventral side yellow reddish in
colour, or only partially with green luster (not on abdominal sternites or legs); flat
sixth spiracle; aedeagus Fig. 79, endophallus Fig. 90*C. xiphostethus* (Bates, 1888)
- 12'.** Body length 14–15 mm; shallow punctures on elytra; ventral side completely dark
metallic green; tuberculiform sixth spiracle*C. flavodorsalis* sp.n.
- 13.** Stout body, wider at 2/3 of elytra length, body surface convex, brown colour but in
some species a metallic luster is present; eyes large and rounded, as in *Anomala*
species, interocular space <3.5 x width of eye; elytra with defined costae and punctate
interstices; mesosternal process short (produced anteriorly beyond top of mesocoxae
for <1/2 x height of mesocoxae), laterally seen as a bump, apex not free **14**
- 13'.** Body diamond shaped, pronotum long and with anterior margin narrow, end of
body narrowing steadily from elytra midlength; body dorsally flattened; wide
interocular space (>3.8 x width of eye), eyes small and elongated; elytra regularly
striated or nearly smooth; mesosternal process short (produced anteriorly beyond
top of mesocoxae for <1/2 x height of mesocoxae), laterally seen as a bump, apex not
free **21**

14. Elytra light brown, lighter colour than pronotum15
- 14'. Elytra dark brown, similar in tone to pronotum17
15. Elytra with bronze luster; first interstice on elytra wide and with dense punctures, pronotum glabrous*C. lativittis* sp.n.
- 15'. Elytra without metallic luster; first interstice on elytra narrow, with 1–2 rows of punctures, pronotum covered with setae16
16. Oval shape, mesosternal process pointed in lateral view, large and slightly tapering at apex in ventral view, parameres with squared apex*C. parapulcher* sp.n.
- 16'. Elongated shape, mesosternal process blunt in lateral view, tapering strongly just above base in ventral view, parameres with acute apex; aedeagus Fig. 80, endophallus Fig. 91*C. schneideri* (Ohaus, 1905)
17. Pronotum with homogeneous colour, no ochre margins; aedeagus Fig. 81, endophallus Fig. 92*C. chontalensis* (Bates, 1888)
- 17'. Pronotum with ochre margins18
18. Elytral surface with protruding costae, interstices flat with dense irregular punctures; aedeagus Fig. 82, endophallus Fig. 93*C. valdecostatus* (Bates, 1888)
- 18'. Costae not protruding in relation to rest of elytral surface, interstices with rows of punctures19
19. Mesosternal process long, slightly beyond mesocoxae. First interstice of elytra with four rows of punctures; other interstices with irregular rows of punctures, flat*C. fuscorubens* sp.n.

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- 19'**. Mesosternal process short, not beyond mesocoxae. First interstice of elytra with three rows of punctures; other interstices with regular rows of punctures forming sulcate striae**20**
- 20**. Secondary small sparse puncture on all elytra surface; aedeagus Fig. 83, endophallus Fig. 94*C. granulipygus* (Bates, 1888)
- 20'**. No secondary punctures on elytra, background surface smooth; aedeagus Fig. 84, endophallus Fig. 95*C. vanpatteni* (Bates, 1888)
- 21**. Elytra clearly striated, of variable colour**22**
- 21'**. Elytra nearly smooth, with very shallow rows of punctures, colour black *C. carbo* sp.n.
- 22**. Body length >9.50 mm. Pygidium yellow with green sides. Head small in relation to pronotum (head width <0.45 x pronotum width)*C. macroxantholeus* sp.n.
- 22'**. Body length <8.60 mm. Pygidium entirely yellow. Head width >0.55 x pronotum width *C. microxantholeus* sp.n.

Phylogeny and character evolution

The trees obtained with the Bayesian analysis (Fig. 105A) and with the Maximum Likelihood analysis (Fig. 105B) differ in the position of *C. microxantholeus*, *C. carbo* and the clade *C. jordani* + *C. stannibractea* (not supported in the ML) and the resolution for *C. specularis* and *C. multiplicatus*.

Species from the *C. validus* group (*C. cupricollis*, *C. megalius*, *C. validus*) group together with *Anomala* species, while all the other *Callistethus* species form a monophyletic group (*Callistethus* s.str. from now on). The clades within *Callistethus* s.str. are not coincident with morphological features: species with brownish colors,

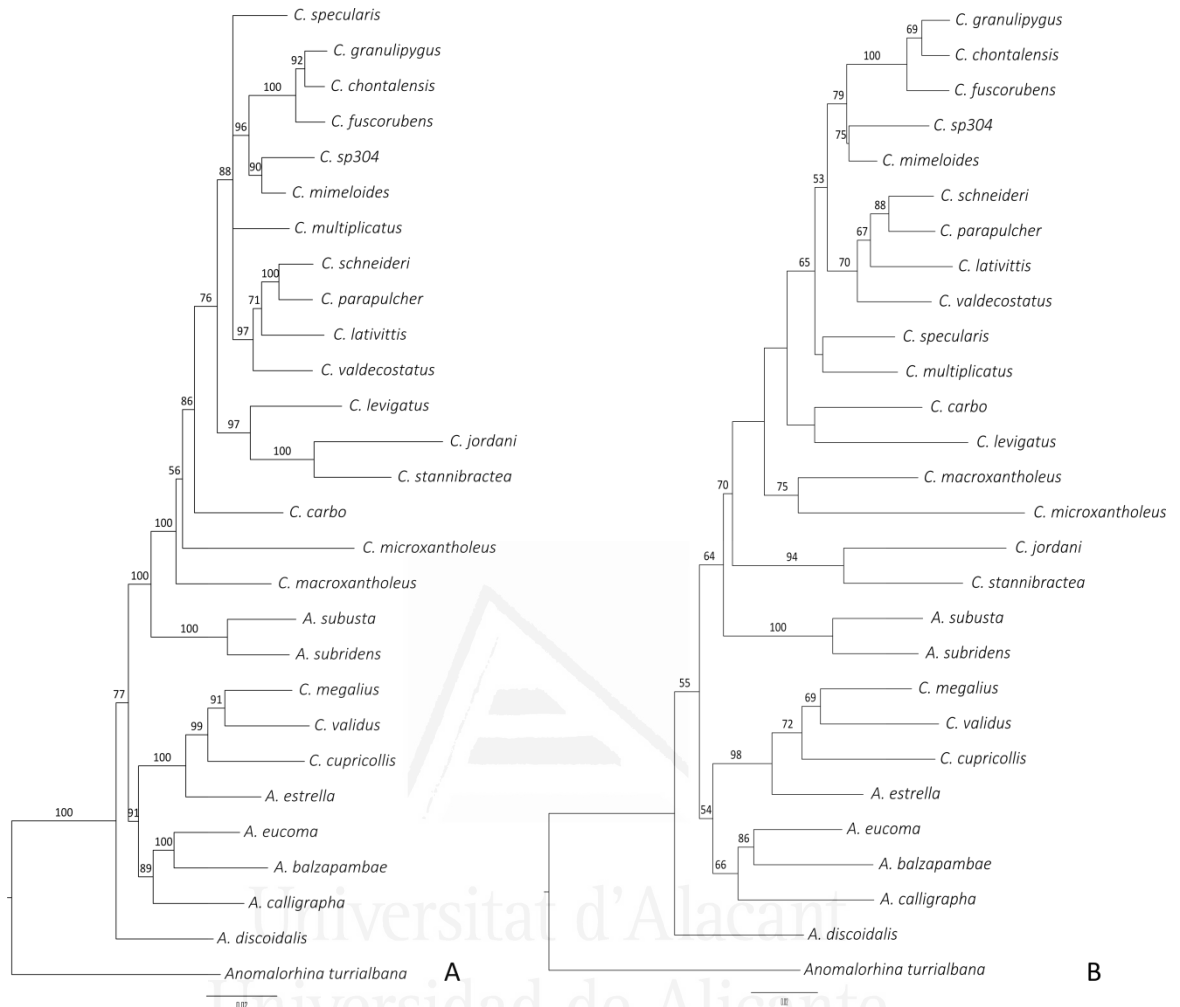


Figure 105. Trees obtained from (A) Bayesian analysis, (B) Maximum Likelihood. Numbers represent percentage posterior probabilities from the Bayesian analysis in (A), bootstrap values in (B). Genera abbreviations: A. = *Anomala*; C. = *Callistethus*.

big eyes and short mesosternal process form 2 clades (*C. granulipygus* + *C. chontalensis* + *C. fuscorubens* pp=100(B)/100(ML) and *C. schneideri* + *C. parapulcher* + *C. lativittis* + *C. valdecostatus* pp=97/70), mixed with medium sized species with small eye, metallic colors and long mesosternal process (*C. specularis*, *C. mimeloides*, *C. multiplicatus*). Species with short mesosternal process and flattened elytra (*C. carbo*, *C. macroxantholeus* and *C. microxantholeus*) are found at base but do not form a clade. The uncertain position of *C. multiplicatus* must be reassessed, as

morphologically it is closer to other species of the *collaris* complex (*C. sp304*), and *C. mimeloides*, who are strongly paired (pp=90/75). The pairment of *C. jordani* and *C. stannibractea* (pp=100/94) is not surprising due to their similarities: big size, light colour, small eyes, long mesosternal process.

The genus *Anomala* results paraphyletic, with the clade *A. subridens* + *A. subusta* forming the sister group of *Callistethus*, and *A. discoidalis* being sister to all other ingroup taxa. However, the complicated systematics of *Anomala* is not an object of the present work.

The *K* statistics for the morphological characters analyzed are presented in Table 4, characters have been associated with ML tree in Fig. 106. The analysis has been conducted on both tree topologies, with similar results. Six of the characters have strong phylogenetic signal, with statistical support. The interocular distance (character 1) shows a weak phylogenetic signal, approaching a value of *K* close to 1, probably due to the fact that both states are present inside the *Callistethus* s.str. clade, while characters on the intercoxal distance (character 4) and the shape of apical suture of elytra (character 8) do not have phylogenetic signal, probably due to state distribution inconsistent with the tree.

The characters with strong phylogenetic signal provide states that are suitable as diagnostic features for the genus *Callistethus*: 2[1]. Posterior margin of the pronotum without bead (*K*=5.28); 3[1]. Posterior margin of the pronotum straight or slightly concave above the scutellum (*K*=3.62); 5[1,2]. Mesosternal process reaching at least apex of mesocoxae (*K*=2.55); 6[1] and 7[1]. Mesometasternal suture poorly defined or absent (*K*=1.44) and at the same level of anterior margin of trochanters (*K*=3.11); 9[1]. Fusion of the parameres to the aedeagal ventral plate (*K*=3.00).

The level of development of the mesosternal process then is not a discriminatory feature: both species with short and long mesosternal process are to be considered

Table 4. Values of *K* statistics and associated *p* value calculated on the two tree topologies (Bayesian, Fig. 2A, and Maximum Likelihood, Fig. 2B). *K* values closer to zero correspond to a random, i.e. highly homoplasious, pattern of evolution, while *K* values greater than 1 indicate low homoplasy and thus strong phylogenetic signal.

Characters	Bayesian		ML	
	K	p	K	p
1. interocular distance	0.9071399	0.007	0.8833322	0.01
2. posterior margin of pronotum	5.2837439	0.001	4.0408277	0.001
3. shape of posterior margin of pronotum	3.6167561	0.001	3.3997172	0.001
4. distance between mesocoxae	0.8168402	0.098	0.6763212	0.203
5. development of mesosternal process	2.5155903	0.001	2.1363155	0.001
6. definition of mesosternal suture	1.4367777	0.026	1.0989112	0.041
7. position of mesosternal suture	3.11286	0.001	3.2256791	0.001
8. shape of apex of elytral suture	0.5660773	0.138	0.5849185	0.154
9. fusion of parameres to ventral plate	3.0029691	0.001	3.3469446	0.001

belonging to the genus *Callistethus*, in contrast to the conclusions of Morón & Ramírez-Ponce (2012).

The presence of a mesosternal process is shared also with some species of the *C. validus* group (represented by *C. cupricollis*, *C. megalis*, *C. validus* in the trees), which, however, do not present the other diagnostic features. On the contrary, the length of the process is variable within the *Callistethus* clade, which includes also species with short processes.

According to these diagnostic features, the following Neotropical species that previously belonged to *Anomala* are herewith moved into *Callistethus*: *C. jordani* (Ohaus, 1902) **comb.n.**, *C. mimeloides* (Ohaus, 1902) **comb.n.**, *C. xantholeus* (Bates, 1888) **comb.n.** (Mexico), *C. lepidus* (Burmeister, 1844) **comb.n.** (Guatemala).

A. jansoni **comb.n.** Ohaus, 1897, *A. fulvopiceus* **comb.n.** Ohaus, 1928 and *A. ochrogastra* Bates 1888, **comb.n.** before included in *Callistethus*, do not present this set of features, and are therefore moved to the genus *Anomala*.

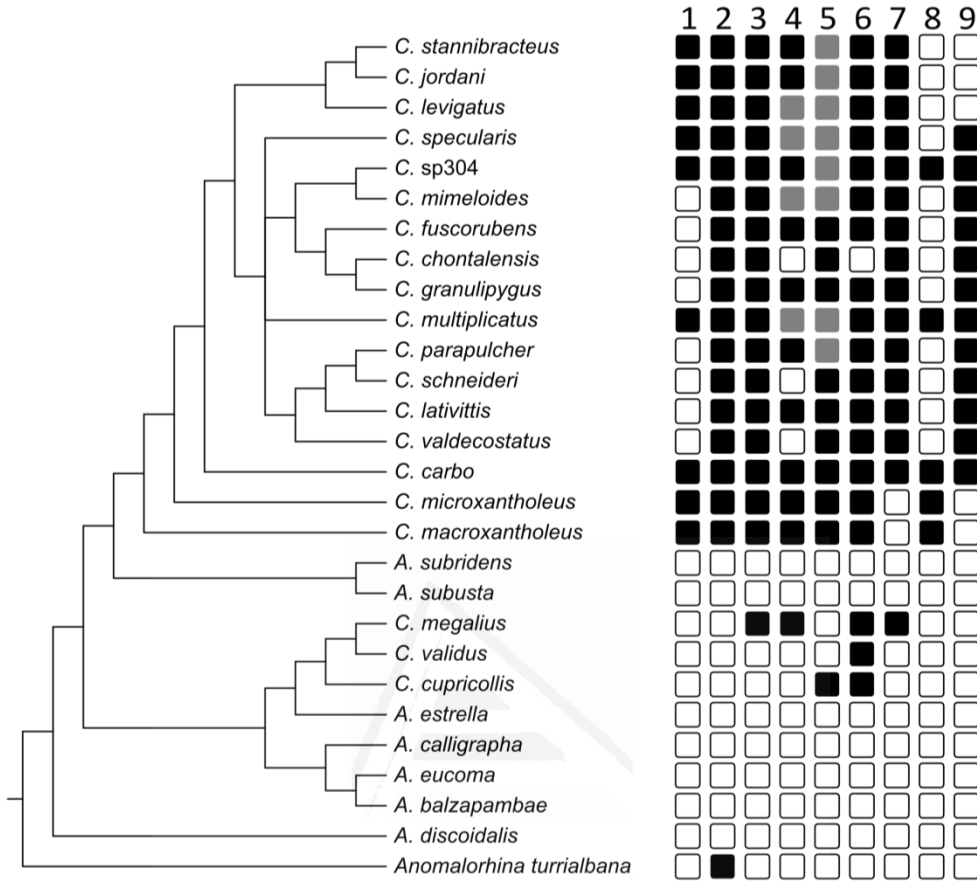


Figure 106. Morphological characters analyzed for phylogenetic signal mapped beside ML tree. Character states 0: white box; 1: black box; 2: grey box. Genera abbreviations: A. = *Anomala*; C. = *Callistethus*.

The species of the *C. validus* group (sensu Machatschke 1957), with short mesosternal process, pronotum with bead on the posterior margin, parameres not fused with ventral plate are placed in *Anomala*, waiting for a comprehensive revision of this genus that will elucidate its actual paraphyly: *A. antis* Ohaus, 1902 **comb.n.**, *A. bimaculata* Blanchard, 1851 **comb.n.**, *A. cicatricosa* (Perty, 1832) **comb.n.**, *A. cupricollis* Chevrolat, 1834 **comb.n.**, *A. eckhardti* Ohaus, 1897 **comb.n.**, *A. megalia* Bates, 1888 **comb.n.**, *A. panamensis* Ohaus, 1902 **comb.n.**, *A. plagiata* Nonfried, 1894 **comb.n.**, *A. pupillata* Burmeister, 1844 **comb.n.**, *A. valida* Burmeister, 1844 **comb.n.**.

The species *C. biolleyi*, *C. buchwaldianus*, *C. nicoyus*, *C. sulcans* with short and narrow mesosternal process, parameres fused with ventral plate, but pronotum with bead on the posterior margin and mesometasternal suture usually well defined, are considered *incertae sedis*, until a phylogenetic study involving these species resolves their status.

C. pseudocollaris and *C. multiplicatus* closely resemble *C. collaris*, and are mainly differentiated from it by the very different shapes of the aedeagus and endophallus. They are supposed to be part of a larger species complex, as from personal experience revising specimens in various European museums, most of the specimens determined as *C. collaris* show a high variety of aedeagus shapes, depending on the locality of the collection. The aedeagus of the type specimen from the Entomological Collection of Martin-Luther-Universität (Halle, Germany) is illustrated in Fig. 69. There is at least one additional species belonging to this species complex in Costa Rica, of which one male from Cerro Bitárkara, Prov. Limón (listed as *C. sp304* on phylogenetic tree) is known, whose aedeagus and endophallus are illustrated in Figs. 85 and 96 respectively.

After the description of the new species presented here, the genus *Callistethus* includes 23 species in Costa Rica.

This is almost double the previously known diversity, but this richness remains far from that of the most closely related genus *Anomala*. However, species numbers cannot be directly compared as with the current state of knowledge (Fig. 2) *Callistethus* is subordinate in *Anomala* and thus most likely either *Anomala* has to be split in several genera or *Callistethus* be included in *Anomala* with increasing phylogenetic knowledge. The genus *Callistethus* is a diversified and speciose taxon in the Neotropics, still evolutionarily active as suggested by the presence of species complexes with uniform external morphology (i.e. *C. collaris* species complex), but with strong differences in male genitalia.

Acknowledgements

We thank Ángel Solís, from the Instituto Nacional de Biodiversidad, Costa Rica; Malcolm D. Kerley, from the Natural History Museum, London; Johannes Frisch and J. Willers from the Museum für Naturkunde der Humboldt-Universität, Berlin; Karla Schneider from the Institut für Zoologie der Martin-Luther-Universität, Halle; Antoine Mantilleri and Olivier Montreuil, from the Muséum National d'Histoire Naturelle, Paris; Miguel Ángel Morón, from the Instituto de Ecología, Xalapa, México for the loan of the specimen; we also thank Jesús Ordóñez, University of Alicante, for the photographs; Miguel A. Alonso Zarazaga for nomenclature tips, and the staff of the laboratory of the Museum of Comparative Zoology & Department of Organismic and Evolutionary Biology, Harvard University, especially to Gonzalo Giribet, Rosa M. Fernández García, Erin McIntyre and Vanessa González, for their invaluable help with the molecular part. Financial support was provided by the Agencia Española de Cooperación Internacional para el Desarrollo (AECID) projects A/4426/05, A/6788/06, A/019887/08, A/023060/09 and a PhD grant to V. Filippini from the Spanish Ministry of Education. The research stay at the Natural History Museum, London received support from the SYNTHESYS Project <http://www.synthesys.info/> that is financed by European Community Research Infrastructure Action under the FP7 'Capacities' Program.

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3.3 *Callistethus*

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3.4 - Description of six new species of Anomalini from Costa Rica (Coleoptera: Scarabaeidae: Rutelinae).

[Descripción de seis nuevas especies de Anomalini de Costa Rica (Coleoptera: Scarabaeidae: Rutelinae)]



Universitat d'Alacant
Universidad de Alicante

Abstract. Four new species of *Anomala* and two new species of *Callistethus* from Costa Rica are described: *A. aglaos* new species, *A. estrella* new species, *A. inbio* new species, *A. pincelada* new species, *C. ruteloides* new species, *C. yalizo* new species, and a distribution map of each is given. The male genitalia (aedeagus and endophallus) of the species described and similar species are illustrated.

Key words: aedeagus, Costa Rica, endophallus, new species, species distribution.

Filippini V., Micó E., Galante E. *Zootaxa*, en revisión

3.4 Six Anomalini species

Resumen. Se describen cuatro especies nuevas de *Anomala* y dos de *Callistethus* de Costa Rica.: *A. aglaos* n.sp., *A. estrella* n.sp., *A. inbio* n.sp., *A. pincelada* n.sp., *C. ruteloides* n.sp., *C. yalizo* n.sp., y se proporciona el mapa de distribución de cada especie. Se ilustran las genitalias masculinas (edeago y endofalo) de las especies descritas y de las similares.

Introduction

The subfamily Rutelinae is recognized as an useful tool for biodiversity and ecology studies in the Neotropics (García-López *et al.* 2010; Morón 1997), and especially the tribe Anomalini for its abundance and diversity (Morón 1997).

However, the lack of taxonomical studies and identification tools makes it difficult to implement this group at its full potential, and the presence of undetermined species, especially of *Anomala* and *Callistethus* genera, in diversity studies is common (see for example Deloya *et al.* 1995; García-López *et al.* 2013). The diversity of Anomalini in Costa Rica is high, with more than 100 species of *Anomala* and more than 20 of *Callistethus* (Instituto Nacional de Biodiversidad 2001). After consultation of type material and literature most of previous undetermined species resulted to be new to science. In this paper we describe four new species of *Anomala* and two new species of *Callistethus*. This work is meant to be part of a general taxonomical work on Anomalini in Costa Rica that will facilitate the use of this group in future diversity studies (Filippini *et al.* 2013, 2014).

Material and methods

The type specimens for 184 Neotropical species (about 80% of species described) have been studied (listed in *Anexo 2*), and available literature has been consulted for the rest, to exclude cases of synonymy.

The material cited in this publication is deposited in the following collections:

CEUA Colección Entomológica de la Universidad Alicante, Spain

INBIOCRI Instituto Nacional de Biodiversidad, Costa Rica

MLUH Martin-Luther-Universität, Halle, Germany

MNHN Muséum National d'Histoire Naturelle, Paris, France

MNHUB Museum für Naturkunde der Humboldt Universität zu Berlin, Germany

MUCR Museo de insectos, Universidad de Costa Rica, Costa Rica

The type specimens of the species here described are deposited mainly at INBIOCRI and CEUA collections; the collection is specified by the numerical code label listed for each specimen in the "Material examined" section or it's specified at the end of the locality data label, for specimens not provided of numerical code.

To prepare the endophallus for study, the following procedure was used. The aedeagus was washed in a 10% hot KOH solution for 5–10 minutes and then rinsed in distilled water. It was then kept in lactic acid for a minimum of 48 hours, until the structures of the aedeagus and endophallus became translucent. The endophallus was everted by injecting water from the base of aedeagus with a syringe equipped with a suitable needle, or microforceps (WPI Dumont #5) when the length of the internal sac made the syringe method inefficient. The dissection was transferred to a microvial containing glycerine, which was attached to the insect pin. From 3–6 specimens of each species were dissected.

Line drawings were traced in GIMP image manipulation program (version 2.8, www.gimp.org). Original drawings were done with the aid of a camera lucida attached to a stereo microscope (Leica M80) for endophalli, or from photographs for aedeagi (taken with a Leica DFC450 camera mounted on a Leica M205C stereo microscope).

3.4 Six *Anomalini* species

All measurements were taken from photographs of the specimens, using Leica Application software. A Leica DFC450 camera mounted on a Leica M205C stereo microscope was used to take the photographs.

The following definitions were used in the description. Body length: from tip of clypeus to tip of pygidium (visible part in dorsal view). Body width: measured on widest point of elytra. Clypeus width: measured at half height. Ratio interocular width/width of eye: widths measured at half the height of eyes. Pronotum width: measured at base. Metatibia ratio: length measured from below the articulation with femur to tip, on the median axis; width measured at widest point. Clypeus thickness in frontal view: thick if more or equal to 0.30 mm; thin if less than 0.30 mm. Position of basal tooth in relation to internal apex of protibia: "above" means it is distal, nearer the tarsus than the internal apex; "below" means it is proximal, nearer the femur than the internal apex.

We follow the traditional taxonomical inclusion of New World species in the genus *Anomala* (Jameson *et al.* 2003), in contrast to the recent paper by Ramírez-Ponce and Morón (2009), who group them into a new genus *Paranomala*, as a more conservative classification, waiting for a more extensive study at global scale.

Results

Anomala aglaos new species, Filippini, Galante & Micó

Figure 1

Material examined. Holotype: ♂ "La Montura, Prov. San José, Costa Rica 07/11/2007 Leg. M. Moraga / CEUA00106184" deposited at INBIOCRI..

Paratypes (6): 1♂ "Isla Bonita, Prov. Alajuela, Costa Rica. 11/06/2007 Leg. M. Moraga / CEUA00106183"; 1♂ "COSTA RICA Prov. San José. P.N. Braulio Carrillo. Sitio La Montura. 1100m. 13 JUN 2007. A. García, M. Moraga, M.A. Zumbado. Tp. Luz 1. L_N_232500_539125

#92217 / CEUA00106185"; 1♀"COSTA RICA. Prov. Alajuela. Guatuso. P.N. Volcán Tenorio. Punto 1: Catarata Río Buenavista. 800m. 5 JUN 2008. J. A. Azofeifa. Tp de Luz 2. L_N_298380_427850 #93849 / CEUA00106186"; 1♀"COSTA RICA Prov. San José. P.N. Braulio Carrillo. Sitio La Montura. 1100m. 12 JUL 2007. A. García, M. Moraga. Tp. Luz 2. L_N_232500_539125 #92245 / CEUA00106187"; 1♀"La Montura Prov. San José Costa Rica 13/06/2007 Det. D. Briceño" INBIOCRI; 1♀"Isla Bonita, Prov. Alajuela, Costa Rica. 6/11/2007 Leg. A. García, M. Moraga / CEUA00106189".

Holotype male: Body shape elongated. Length 17.5 mm. Width 9.7 mm.

Color. Head, pronotum and scutellum metallic green. Elytra metallic green with branched ochre lines along apical portion of costae and coppery luster. Pygidium bronze. Legs metallic green with coppery luster. Venter dark metallic green, abdominal sternites copper.

Clypeus trapezoidal, surface densely punctate, convex. Anterior margin slightly sinuate, clypeus thickness frontally thick. Ratio width/length 2.5. Frons punctate, less densely than clypeus, flat. Ocular canthum long, thin, with rounded apex. Interocular ratio (interocular width/width of eye): 3.0. Antenna: ratio funiculus/club 0.7.

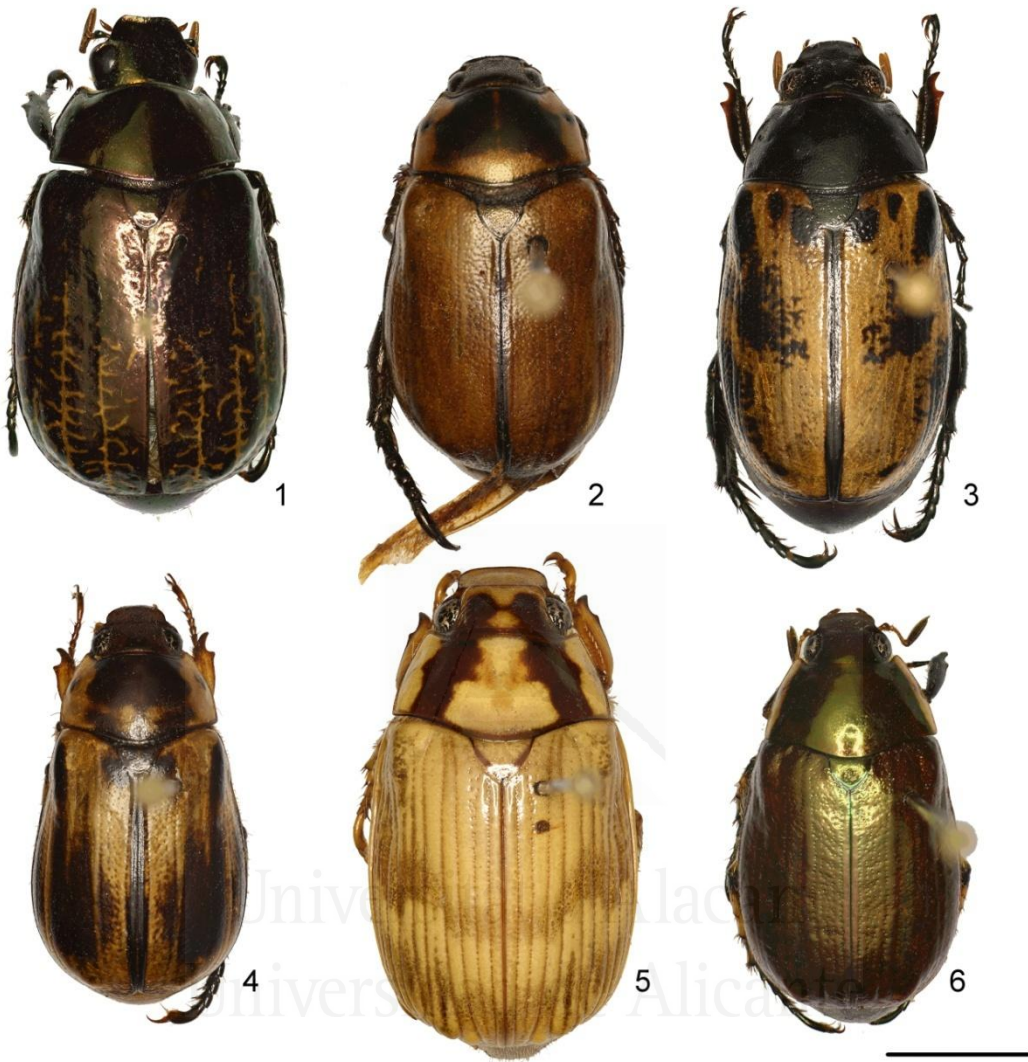
Pronotum subtrapezoidal. Ratio width/length 1.9. Lateral margins sinuate. Anterior angles acute, sharp, posterior angles obtuse, blunt. Basal margin sinuate, subapical bead obliterated in the middle. Surface with fine punctures.

Scutellum. Shape subtriangular, with rounded sides and blunt apex. Ratio width/length 1.4.

Elytra with costae defined by irregular rows of sparse punctures. Interstices with sparse shallow punctures, surface slightly irregular.

Pygidium sparsely punctate with long setae at hind margin. Ratio width/length 1.5.

Space between the mesocoxae narrow, flat. Mesometasternal suture well defined, at base of mesocoxae. Abdominal sternites with 1–2 rows of setae (2–3 rows on sternite II) and 6–8 rows of punctures per sternite. Last sternite punctate, with subapical bead thin and sinuate, apical membrane narrow.



Figures 1–6. Habitus. 1: *Anomala aglaos* (holotype). 2: *A. estrella* (holotype). 3: *A. inbio* (holotype). 4: *A. pincelada* (holotype). 5: *Callistethus ruteloides* (holotype). 6: *C. yalizo* (holotype). Scale = 5mm.

Protibia (Figure 7) bidentate, apical tooth long and curved, basal tooth at same level as internal apex of protibia, triangular in shape, acute. Metatibia slender, fusiform. Ratio length/width 3.2. First external carina obliterated. Surface punctate above second external carina and rugose below. Protarsal claws: internal claw bifurcate, with upper branch of same length and $2/3$ the width of the lower one, inferior margin sinuate.

Aedeagus (Figure 13): parameres big and stout in a lateral view, but narrow dorsally. Ventral plate with curved apex in a lateral view. Endophallus (Figure 19) with two long sacculi, one ending with a pair of thick long claws, with a long diverticle in between, and with a patch of sclerotized spines medially; the other one with swollen base, where ejaculatory sclerite and duct opening are located, and a ridged plate of thick spines at apex. Median lobes asymmetric, one with a triangular fold near apex.

Variation. Ochre lines on elytra of variable length; elytra with green or copper luster. Female. Similar to male, protibia (Figure 7) with longer and wider apical tooth; basal tooth above internal apex; internal protarsal claw narrower with curved inferior margin; last sternite with curved apex.

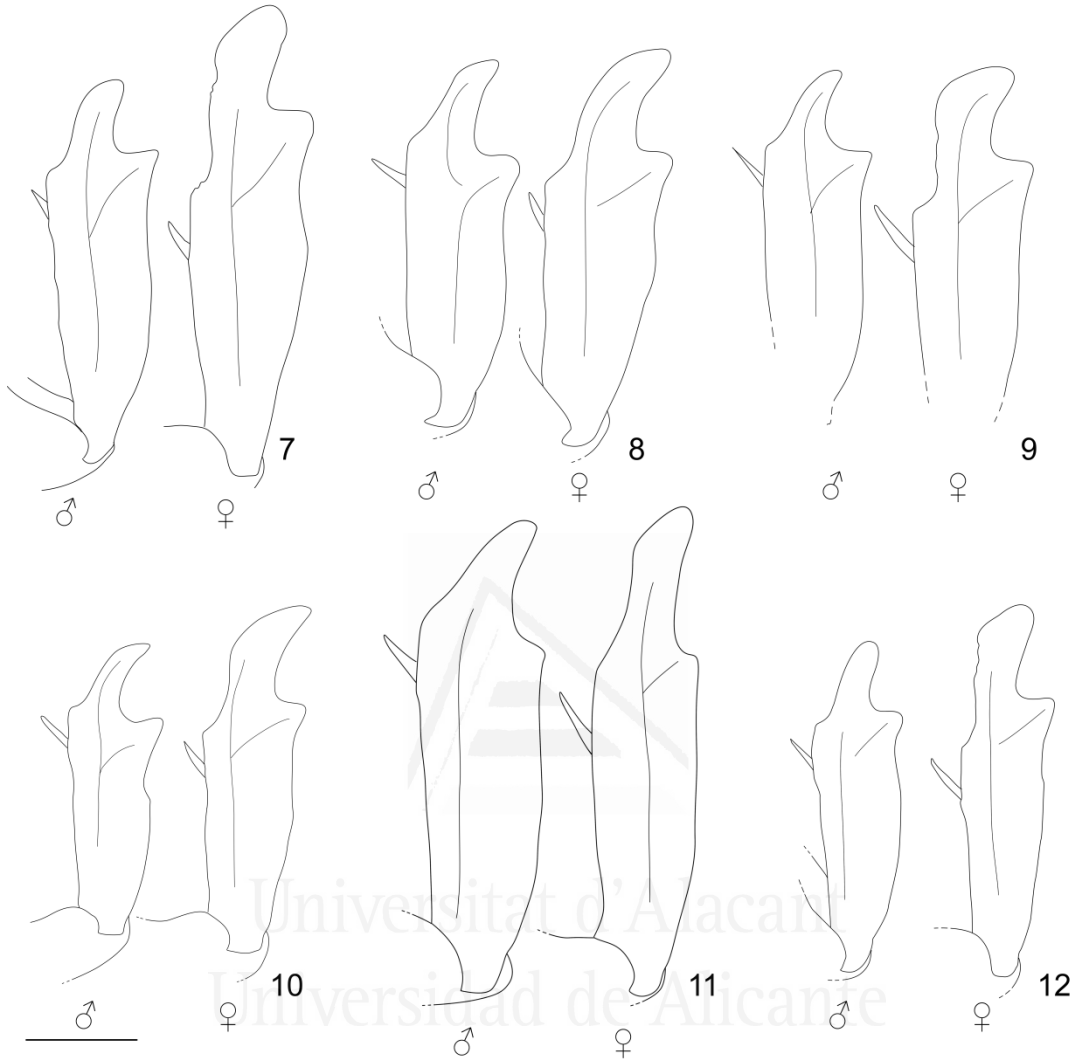
Body length 17.5–18.8 mm, body width 9.7–10.2 mm. Clypeus w/l: 2.3–2.7. Interocular ratio (interocular width/width of eye): 3.0–3.4. Antenna: ratio funiculus/club 0.7–0.9. Pronotum w/l: 1.8–1.9. Scutellum w/l: 1.4–1.6. Pygidium w/l: 1.5–1.6. Metatibia l/w: 2.9–3.5.

Diagnosis: Large size, elongated shape, metallic green color with branched ochre lines on apical portion of elytra, irregular elytral surface, parameres big and stout, endophallus with a pair of long claws.

This species is closely related to *A. obovata* Ohaus, 1933, because of the slightly bigger size, oblong shape and dark green color, but *A. obovata* lack the ochre lines on elytra, its elytral surface is strongly irregular for large and deep coalescing punctures, it has slender parameres (Figure 27, endophallus with a sacculus with a large patch of dense setae on basal portion, instead of claws (Figure 28).

Etymology: from the Greek adjective *aglaós*, splendid, beautiful, treated as a noun in apposition, for the nice and elegant aspect of this species.

Distribution: Guanacaste and Central mountain ranges, from 800 to 1100 m (Figure 34).



Figures 7–12. Shape of protibia in 7: *Anomala aglaos* (male: holotype; female: paratype, Isla Bonita, Costa Rica). 8: *A. estrella* (male: holotype; female: paratype, Los Almendros, Costa Rica). 9: *A. inbio* (male: holotype; female: paratype, Reserva Biológica Hitoy Cerere, Costa Rica). 10: *A. pincelada* (male: paratype, Santa Rosa National Park, Costa Rica; female: paratype, Tierras Morenas, Costa Rica). 11: *Callistethus ruteloides* (male: holotype; female: paratype, El Copal, Cartago). 12: Shape of protibia of *Callistethus yalizo* (male: paratype, Esperanza del Guarco, Cartago; female: paratype, Quebrada Segunda, Cartago). Scale = 1mm.

Anomala estrella new species, Filippini, Galante & Micó

Figure 2

Material examined. Holotype: ♂"Est. La Casona, 1520m, Res. Biol. Monteverde, Prov. Puntarenas, Costa Rica, N. Obando, Mar 1992 L-N 253250,449700 / INBIOCR1000898153".

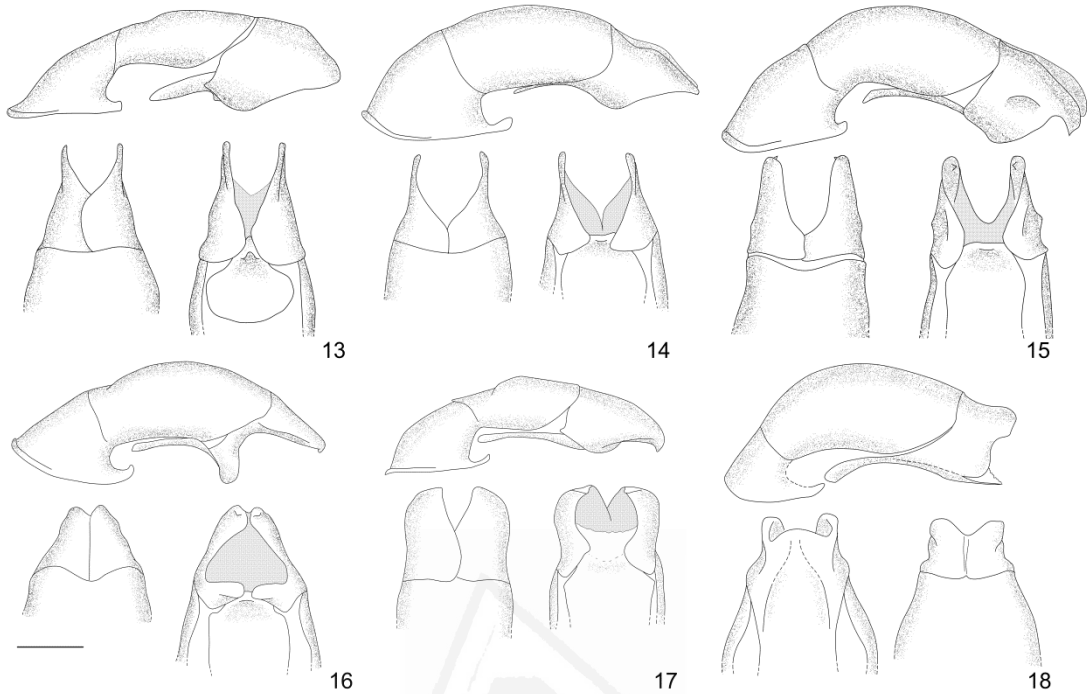
Paratypes (8): 1♀"Estac. Maritza, 600 m. W side Volcan Orosi Guanac. Pr. COSTA RICA. 17 May 1988. Janzen & Hallwachs W85 29 37", N10 57 39" / INBIOCR1002517167"; 1♂"San Jose. Costa Rica Hda. Tiquires. 1500m Rio Tiquires 28 marzo 1988 Col.A.Solis / CEUA00106164"; 2♀"Est. La Casona, 1520m, Res. Biol. Monteverde, Prov. Puntarenas, Costa Rica, N. Obando, Mar 1992 L-N 253250,449700" / INBIOCR1000898149 and INBIOCR1000898152; 1♂"Est. Las Pailas, 800 m, P.N. Rincon de la Vieja, Prov. Guan., COSTA RICA. 6 ene a 13 abr 1993, J. Sihezlar, G. Rodriguez, L- N 306300_388600 / INBIOCR1001331532"; 1♀"Est. Las Pailas, 800 m, P.N. Rincon de la Vieja, Prov. Guan., COSTA RICA. 10 a 27 Mar 1993, K. Taylor, L- N 306300_388600 / INBIOCR1001355780"; 1♂"Est. Maritza, 600 m, lado O Vol. Orosi, Prov. Guan. COSTA RICA. R. Blanco, Abr 1990, L- N 326900_373000 / INBIOCR1000238024"; 1♀"Los Almendros, P. N. Guanacaste, Prov. Guanacaste, Costa Rica, 28 mar a 24 abr 1992, M. Reyes, L- N 334800_369800 / CEUA00105806".

Holotype male: Body shape elongated. Length 14.9 mm. Width 8.4 mm.

Color. Head dark brown. Pronotum orange ochre with one large irregular dark brown macula on disc, not reaching basal margin, and a small macula on lateral foveae, green luster, and a weak lighter longitudinal line. Scutellum light brown with lighter center. Elytra orange ochre. Pygidium ochre. Legs reddish brown; protibiae with darker margins, metafemura ochre, metatibiae and metatarsi dark brown with green luster. Venter, sternum reddish brown with darker margins, abdominal sternites ochre.

Clypeus trapezoidal, surface densely punctate-reticulate, flat. Anterior margin straight, clypeus thickness frontally thin. Ratio width/length 2.3. Frons densely punctate, flat. Ocular canthum long, thin, with rounded apex. Interocular ratio (interocular width/width of eye): 2.9.

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Figures 13–18. Shape of aedeagus, lateral view (top), dorsal view (bottom left), ventral view (bottom right). 13: *Anomala aglaos* (paratype, Isla Bonita, Costa Rica). 14: *A. estrella* (holotype). 15: *A. inbio* (holotype). 16: *A. pincelada* (holotype). 17: *Callistethus ruteloides* (holotype). 18: *C. yalizo* (Cerro Chompipe, Heredia). Scale = 1mm.

Pronotum subtrapezoidal. Ratio width/length 1.7. Lateral margins angulated at $1/3$ of pronotum length. Anterior angles acute, sharp, posterior angles obtuse, blunt. Basal margin sinuate, subapical bead complete. Surface densely punctate.

Scutellum. Shape subtriangular, with rounded sides, acute apex. Ratio width/length 1.5. Surface densely punctate.

Elytra with costae defined by regular rows of punctures. Subsutural interstice with 3–5 rows of punctures, 2nd–4th interstices with 1–2 irregular rows of punctures. Surface covered with secondary punctures.

Pygidium finely granulated with long setae at hind margin. Ratio width/length 1.4.

Space between the mesocoxae narrow, flat. Mesometasternal suture well defined, at base of mesocoxae. Abdominal sternites with 1 row of sparse setae and 5–6 rows of

punctures per sternite. Last sternite punctate, with subapical bead narrow and sinuate, apical membrane narrow.

Protibia (Figure 8) bidentate, apical tooth long and curved, basal tooth below internal apex of protibia, triangular in shape, acute. Metatibia stout, slightly narrower subapically. Ratio length/width 2.6. First external carina obliterated, surface densely punctate above second external carina, rugose below. Protarsal claws: internal claw bifurcate, with upper branch of same length and $\frac{2}{3}$ the width of the lower one, inferior margin sinuate.

Aedeagus (Figure 14): parameres with sinuate dorsal and ventral margins, apex acute in a lateral view. Endophallus (Figure 20) with one long sacculus with wide apex, covered with setae in its middle part, and with a strip of long and short thick spines at apex. Ejaculatory duct opening ventrally on an inflation.

Variation. Macula on pronotum with variable extension it can fuse with maculae on foveae, forming a star-like shaped macula, or reach the posterior margin; elytra from ochre to reddish. Female. Similar to male, protibia (Figure 8) with longer and wider apical tooth; basal tooth above internal apex; internal protarsal claw with curved inferior margin.

Body length 14.4–16.1 mm, body width 7.9–9.6 mm. Clypeus w/l: 2.2–2.3. Interocular ratio (interocular width/width of eye): 2.5–3.0. Antenna: ratio funiculus/club 0.6–0.7. Scutellum w/l: 1.2–1.5. Pygidium w/l: 1.4–1.6. Metatibia l/w: 2.5–2.8.

Diagnosis: large size, irregular dark macula on pronotum, elytra ochre, parameres with sinuate dorsal and ventral margins in lateral view, endophallus with a strip of long and short thick spines at apex.

Similar species is *A. jansoni* Ohaus, 1897, of similar size but with two small maculae on pronotum and parameres with long, narrow and curved apex (Figure 29) (Monte Rotondo, Costa Rica; MNHUB); *A. antica* Ohaus, 1897, *A. luciae* Blanchard, 1851 and *A. quiche* Ohaus, 1897 are smaller, with one small and pentagonal macula on pronotum (*A. antica*), pronotum with sinuate lateral margins (*A. quiche*), maculae on

3.4 Six *Anomalini* species

elytra (*A. luciae* and *A. quiche*), and differences in the parameres: *A. antica* has a long thin apex (Figure 30), *A. luciae* exhibits lobes on anterior portion of inferior margins (Figure 31) and *A. quiche* has wide rounded parameres, and the ventral plate curved at apex in a lateral view (Figure 32).

Etymology: from Spanish noun *estrella*, star, treated here as a noun in apposition, for the star-shaped macula on pronotum.

Distribution: Guanacaste and Tilarán mountain ranges, from 280 to 1520 m (Figure 34).

Anomala inbio new species, Filippini, Galante & Micó

Figure 3

Material examined. Holotype: ♂"COSTA RICA, Prov. Limon, Est. Hitoy Cerere, 100m. 21 MAR-7 ABR 1998. E. Rojas. Tp. Luz L_N_184600_643400 #49943 / INBIOCRI002415599".

Paratypes (10): 1♂"COSTA RICA. Prov. Limón, R.B. Hitoy Cerere, Estación Hitoy Cerere, 100m, 21 MAR 2003, B. Gamboa, Tp. de Luz, L_N_184120_643471 #73276 / INB0003703490";

1♂"COSTA RICA. Prov. Limón. R.B. Hitoy Cerere. Send. Tepezcuintle. 0-100m. 25 MAR 2008.

A. Solis, C. Hernández. Libre. L_N_184300_643300 #93807 / CEUA00106172"; 2♂"COSTA RICA. Prov. Heredia. Sarapiquí. Est. Biol. La Tirimbina. Mirador. 167m. 23-24 ABR 2009. C.

Hernández, D. Díaz. Tp. Luz. L_N_266268_523359 #96599" / INB0004211777 and INB0004211778; 1♂"Est. Hitoy Cerere, 100 m, R. Cerere, Res. Biol. Hitoy Cerere, Prov. Limon,

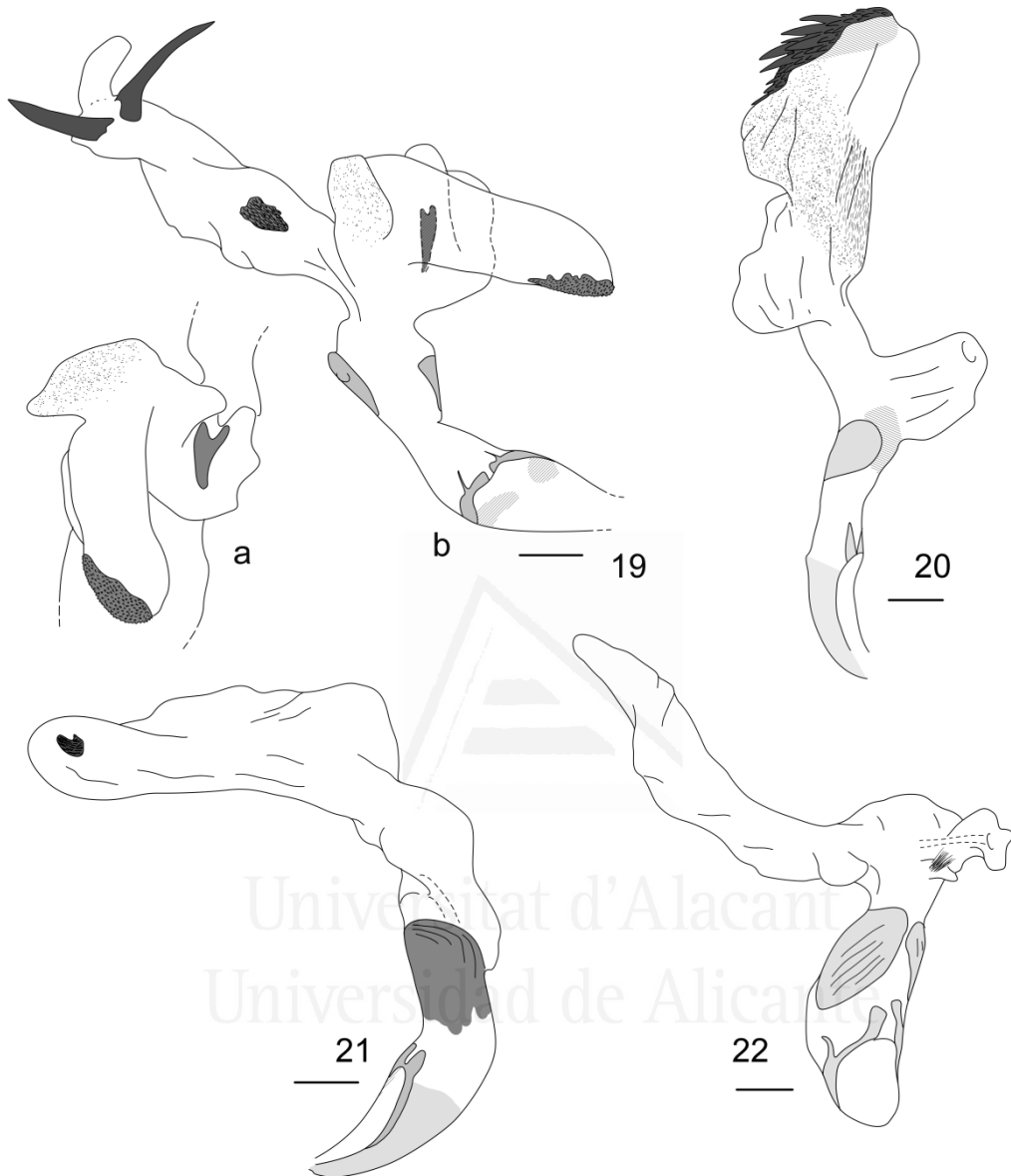
COSTA RICA. Abr 1993. G. Carballo. L- N 184200_643300 / INBIOCRI000975461"; 3♂2♀"R.B.

Hitoy Cerere, Valle La Estrella, Prov. Limon, COSTA RICA. 100-200m. 4-20 Abr 1994, G. Carballo, L N 643400_184600 # 2855" / INBIOCRI001802267, INBIOCRI001802285,

INBIOCRI001802287, INBIOCRI001802301 and CEUA00106173.

Holotype male: Body shape elongated. Length 16.8 mm. Width 8.6 mm.

Color. Head, pronotum, scutellum, pygidium, legs and venter black. Elytra ochre with irregular black maculae: 3 pairs along basal margin, one median, one on sides towards apex, these latter with small flecks near edges.



Figures 19–22. Endophallus of 19: *Anomala aglaos*, (a) particular in frontal view, (b) lateral view (paratype, Isla Bonita, Costa Rica). 20: *A. estrella* (paratype, hacienda Tiquires, Costa Rica). 21: *A. inbio* (holotype). 22: *A. pincelada* (paratype, Cuajiniquil, Costa Rica). Scale = 1mm.

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Clypeus trapezoidal, surface densely punctate-reticulate, flat. Anterior margin straight, clypeus thickness frontally thin. Ratio width/length 2.2. Frons densely punctate, flat. Ocular canthum long, narrow, with rounded apex. Interocular ratio (interocular width/width of eye): 2.7. Antenna: ratio funiculus/club 0.7.

Pronotum subtrapezoidal. Ratio width/length 1.8. Lateral margins regularly convex. Anterior angles right, blunt, posterior angles obtuse, blunt. Basal margin sinuate, subapical bead complete. Surface densely punctate.

Scutellum. Shape subpentagonal, with rounded sides and acute apex. Ratio width/length 1.3. Surface sparsely punctate.

Elytra with costae defined by regular rows of punctures. Subsutural interstice with 2–3 rows of punctures, 2nd–4th interstices with 1–2 irregular secondary striae.

Pygidium finely strigate, with long setae at hind margin. Ratio width/length 1.8.

Space between the mesocoxae narrow, slightly convex. Mesometasternal suture well defined, at base of mesocoxae. Abdominal sternites with 1 rows of setae (3–5 rows on sternite II) and 3–5 rows of punctures per sternite. Last sternite strigate, with subapical bead thick and sinuate, apical membrane wide.

Protibia (Figure 9) bidentate, apical tooth long and curved, basal tooth at the same level as internal apex of protibia, triangular in shape, sharp, acute. Metatibia stout, fusiform. Ratio length/width 3.1. First external carina constituted by a row of sparse setae, surface punctate above second external carina, and rugose below. Protarsal claws: internal claw bifurcate, with upper branch of same length and $\frac{2}{3}$ the width of the lower one, inferior margin sinuate.

Aedeagus (Figure 15): parameres stout, with protruding narrow apex ending sharply. Ventral angle nearly quadrate, blunt. Endophallus (Figure 21) with one long sacculus with a small patch of sclerotized spines near apex; ejaculatory duct opening ventrally at base; median lobes heavily sclerotized.

Variation. Extension of dark maculae on elytra variable. Female. Similar to male, protibia (Figure 9) with longer and wider apical tooth; basal tooth above internal

apex; internal protarsal claw narrower with curved inferior margin; last sternite with curved apex.

Body length 15.7–17.6 mm, body width 8.6–9.3 mm. Clypeus w/l: 2.00–2.2. Interocular ratio (interocular width/width of eye): 2.5–2.7. Antenna: ratio funiculus/club 0.7–0.8. Pronotum w/l: 1.7–1.8. Scutellum w/l: 1.2–1.6. Pygidium w/l: 1.7–1.9. Metatibia l/w: 2.8–3.1.

Diagnosis: large size, black pronotum and irregular maculae on elytra, parameres stout, with protruding narrow apex ending sharply.

The most similar species are *A. inconstans* and *A. pincelada*, but they are smaller, have ochre margins on pronotum, a different pattern of maculae on elytra, and different aedeagus: *A. pincelada* has a bifurcated apex of parameres (Figure 16), *A. inconstans* has parameres with a frontal lobe-like expansion on anterior part of ventral margin (Figure 33).

Etymology: this specie is dedicated to INBio, Instituto Nacional de Biodiversidad in Costa Rica, for its efforts in increasing the knowledge of Costa Rican biodiversity. It has to be treated as a noun in apposition.

Distribution: Caribbean lowlands, from 0 to 167 m (Figure 35).

Anomala pincelada new species, Filippini, Galante & Micó

Figure 4

Material examined. Holotype: ♂"Fca. Jenny, 30 km N de Liberia, P.N. Guanacaste, Prov. Guan., COSTA RICA. 18-25 Abr 1993, E. Araya, L- N 316200_364400 / INBIOCR1001167801".

Paratypes (9): 1♂"3 Km este de Cuajiniquil, 300m, Prov. Guanacaste, Costa Rica, 25 jun 1992, III curso Parataxon. L-N 325600_355200 / INBIOCR1000863924"; 1♂"Santa Rosa National Park Guanacaste Prov. COSTA RICA. 9-11 May 1980 DH Janzen & W Hallwachs / INBIOCR100116980"; 1♂1♀"Fca. Jenny, 30 km N de Liberia, P.N. Guanacaste, Prov. Guan., COSTA RICA. 9-14 May 1993. E. Araya, L-N 316200_364400" INBIOCR1001183402 and INBIOCR1001183321; 1♀"Tierras Morenas, Rio San Lorenzo, Tenorio, Prov. Guana, COSTA RICA, 1050m. May 1993. G. Rodriguez, L S 283950_424500 # 2118 / INBIOCR1001180936";

3.4 Six Anomalini species

1♂ "Sector Las Pailas, P. N. Guanacaste, A. C. Guanacaste, Prov. Guana, COSTA RICA. 800 m. 6-26 Jun 1994, K. Taylor, L N 309500_389500 # 3063 / INBIOCRI001909257"; 2♀ "Finca Jenny, 30 km N de Liberia, P.N. Guanacaste, Prov. Guan., COSTA RICA. 18-25 Abr 1993, E. Araya, L N 316200_364400" INBIOCRI001167798 and CEUA00106161; 1♂ "Est. Murcielago, 8 km S.O. de Cuajiniquil, Prov. Guana, COSTA RICA. 100m. 16 Jun- 4 Jul 1993. F. Quesada, L N 320300_347200 # 2177 / CEUA00106160".

Holotype male: Body shape elongated. Length 13.2 mm. Width 7.9 mm.

Color. Head reddish brown. Pronotum ochre with an irregular median brown macula and small maculae on lateral foveae. Scutellum dark brown. Elytra ochre with a dark brown macula at each side of scutellum, and dark stripes on apical third of first interstice, from basal to apical calli and near lateral margins. Pygidium ochre. Legs ochre with base and apex of tibiae dark brown; pro- and mesotarsi reddish brown, metatarsi dark brown. Venter ochre.

Clypeus trapezoidal, with anterior angles widely curved; surface densely punctate-reticulate, flat. Anterior margin straight, clypeus thickness frontally thin. Ratio width/length 2.1. Frons densely punctate, flat. Ocular canthum long, thin, with acute apex. Interocular ratio (interocular width/width of eye): 2.6. Antenna: ratio funiculus/club 0.8.

Pronotum subtrapezoidal, ratio width/length 1.7, lateral margins regularly convex. Anterior angles quadrate and blunt. Posterior angles obtuse and blunt. Basal margin sinuate, subapical bead complete. Surface with fine dense punctures.

Scutellum. Shape subtriangular, with rounded sides and blunt apex. Ratio width/length 1.4. Surface densely punctate.

Elytra with costae defined by regular rows of punctures, subsutural interstices with 2-3 rows of punctures; maximum width towards apex.

Pygidium with coalescing punctures and long setae at hind margin. Ratio width/length 1.6.

Space between the mesocoxae narrow, flat. Mesometasternal suture well defined, at base of mesocoxae. Abdominal sternites with 1 row of setae and 2-3 rows of sparse,

fine punctures per sternite. Last sternite punctate with subapical bead narrow and sinuate, wide apical membrane.

Protibia (Figure 10) tridentate, apical tooth long and curved, middle tooth below internal apex of protibia, triangular in shape, acute. Metatibia stout, fusiform, ratio length/width 3.0. First external carina constituted by a row of sparse setae, surface punctate above second external carina and rugose below. Protarsal claws: internal claw bifurcate, with upper branch of same length and half the width of the lower one. Inferior margin making a sharp angle near base.

Aedeagus (Figure 16): parameres deeply and widely sinuate anteriorly in a lateral view, becoming nearly bifurcated. Endophallus (Figure 22) with one long lateral sacculus tapering at apex, ejaculatory duct opening on the other side, at base; one small diverticle with long spines ventrally at base.

Variation. Macula on pronotal disc of different size, from a subpentagonal macula not reaching posterior margin, to covering most of the surface, leaving ochre sides; a median narrow faint lighter band may be present; maculae on elytra of variable extension; metatibia from ochre to reddish with darker apex. Female. Similar to male, protibia (Figure 10) with longer and wider apical tooth; internal protarsal claw with curved inferior margin.

Body length 13.2–16.1 mm, body width 7.9–9.2 mm. Clypeus w/l: 2.0–2.3. Interocular ratio (interocular width/width of eye): 2.5–2.9. Antenna: ratio funiculus/club 0.7–0.8. Pronotum w/l: 1.7–1.8. Scutellum w/l: 1.4–1.6. Pygidium w/l: 1.5–1.6. Metatibia l/w: 2.5–3.0.

Diagnosis: externally nearly identical to *A. inconstans* Burmeister, 1844 (Colombia, MLUH), it is separated from it by the shape of male genitalia, which has bifurcated apex of parameres, whereas *A. inconstans* has parameres with thin and curved apex, blunt and wide ventral angle, and a frontal lobe-like expansion on anterior part of ventral margin (Figure 33). Specimens from Mexico, Paraguay, Guatemala and

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Venezuela from **MNHUB** collection, also similar to *A. inconstans*, all show different aedeagi, so these species are part of a large and widely distributed species complex.

Etymology: from Spanish noun *pincelada*, brush stroke, for the elytral pattern; to be treated as a noun in apposition.

Distribution: Guanacaste mountain range, from 200 to 600 m (Figure 35).

Callistethus ruteloides new species, Filippini, Galante & Micó

Figure 5

Type Material. Holotype: ♂ "Quebrada Segunda, P. N. Tapanti, 1250 m, Prov. Cartago, Costa Rica, G. Mora, May 1992 L-N 194000_560000 / INBIOCRI000959028"

Paratypes (5): 1♂ "Est. Biol. Las Alturas, 1500m, Coto Brus, Prov. Puntarenas, Costa Rica. M. Ramirez. Mar 1992 L-S 322500, 591300 / INBIOCRI000987456"; 1♀ "Tapantí (Costa Rica) 1300m 29-9-06 T. luz 17:00-23:00 Leg.: Micó, García, Galante / CEUA00019649"; 1♀ "El Copal, Prov. Cartago, Costa Rica. 17/06/2007 Leg. M. Moraga / CEUA00106211"; 1♀ "COSTA RICA. Prov. Alajuela. Upala. P.N. Volcán Tenorio. Alb. Heliconias. Send. a Laguna Danta. 900m. 16 JUN 2007. J. D. Gutiérrez. Tp. Luz 2. L_N_299100_424000 #92208 / CEUA00106212"; 1♀ "Q. Segunda, P.N. Tapantí, Prov. Carta, COSTA RICA. 1300m. Set 1993. G. Mora, L N 194000_559800 #2326 / INBIOCRI001669692"; 1♂ "PANAMA - CHIRIQUI Santa Clara env. 1546 m 08°51'42,2"N; 082°44'36,5"W 17.6.-4.7.06; V.Malý lgt. P 7 / coll. Vladislav Malý Česká Rep. Praha" Vladislav Malý Česká personal collection.

Holotype male: Body shape oval. Length 17.5 mm. Width 9.8 mm.

Color. Head pale ochre with a sinuate brown macula on frons. Pronotum pale ochre with 2 lateral brown bands. Scutellum pale ochre with reddish margins. Elytra pale ochre with 2 transversal sinuate beige bands, one median and one apical. Pygidium and legs ochre. Venter orange-ochre.

Head big, almost 2/3 of the width of pronotum. Clypeus rectangular, with anterior angles widely curved. Ratio width/length 2.1; surface densely punctate-reticulate, convex; anterior margin straight, nearly as long as frons. Frons punctate, less densely than clypeus, flat. Ocular canthum long, thin, with rounded apex. Interocular ratio

(interocular width/width of eye): 3.0. Antenna: ratio funiculus/club 0.6. Mandibles with apex curved ventrally, maxillae with second and third tooth fused together. Labium and labrum quadrilobulated.

Pronotum trapezoidal. Width 1.9 times length. Lateral margins curved. Anterior angles quadrate, with blunt vertex; posterior angles obtuse, blunt. Basal margin narrow, sinuate and obliterated in the middle. Surface with fine and dense punctures. Scutellum. Shape subtriangular, surface sparsely punctate; ratio width/length 1.6.

Elytra with striae defined by regular rows of punctures. Marginal membrane very narrow.

Pygidium strigate. In lateral view slightly convex. Triangular in shape; with short setae on disc, long setae at hind margin.

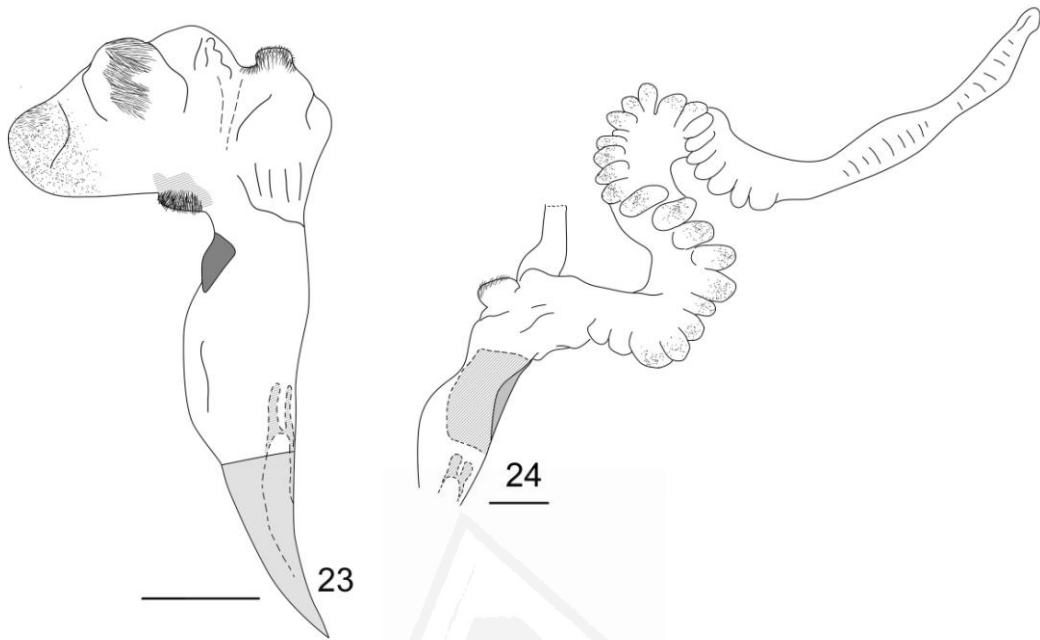
Mesosternal process long, with tapering apex in ventral view; width at base: 1.0 mm (Figure 25). Mesometasternal suture at about half the length of the process.

Abdominal sternites with 1–3 rows of setae, denser at sides, and 4–6 rows of punctures per sternite. Last sternite strigate, with apical margin thick and sinuate, and wide apical membrane.

Legs. Protibia bidentate (Figure 11), apical tooth long and straight, basal tooth below internal apex of protibia, triangular in shape, obtuse. Metatibia slender, slightly narrower subapically. Ratio length/width 4.1. First external carina well developed. Surface rugose. Basal protarsomere of same length as II–IV; tarsomeres stout in general. Protarsal claws: external claw curved, internal claw bifurcate, upper branch of same length and $\frac{2}{3}$ the width of the lower one, inferior margin sinuate.

Aedeagus (Figure 17): parameres with a narrow and acute apex in a lateral view, pointing downwards, flattened dorso-ventrally; apical portion of ventral plate membranous. Endophallus (Figure 23) short, with patches of short and long setae in different positions. Ejaculatory duct opening frontal.

Variation. Background color from pale ochre to orange; transversal bands on elytra more or less evident. Female. Similar to male, antennal club shorter than in male;



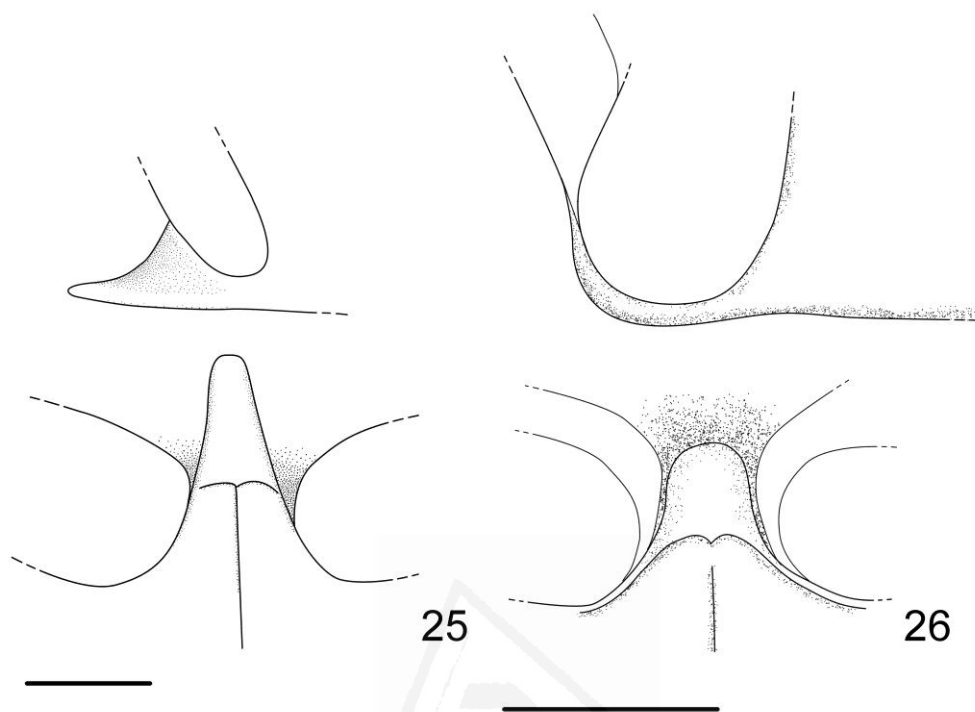
Figures 23–24. Endophallus of 23: *Callistethus ruteloides* (holotype). 24: *C. yalizo* (holotype). Scale = 1mm.

protibia with longer and wider apical tooth (Figure 11); internal protarsal claw narrower with curved inferior margin; last sternite with slightly sinuate apex.

Body length 17.5–20.1 mm, body width 9.8–11.4 mm. Clypeus w/l: 1.9–2.1. Interocular ratio (interocular width/width of eye): 3.2–4.2. Pronotum w/l: 1.8–1.9. Scutellum w/l: 1.5–1.6. Pygidium w/l: 1.5–1.6. Metatibia w/l: 3.8–4.1. Width of mesosternal process at base: 1.0–1.2 mm.

Diagnosis: Big size, pale ochre color with darker bands on pronotum and elytra, long clypeus, big head, pronotum short, long mesosternal process, parameres flattened dorsoventrally.

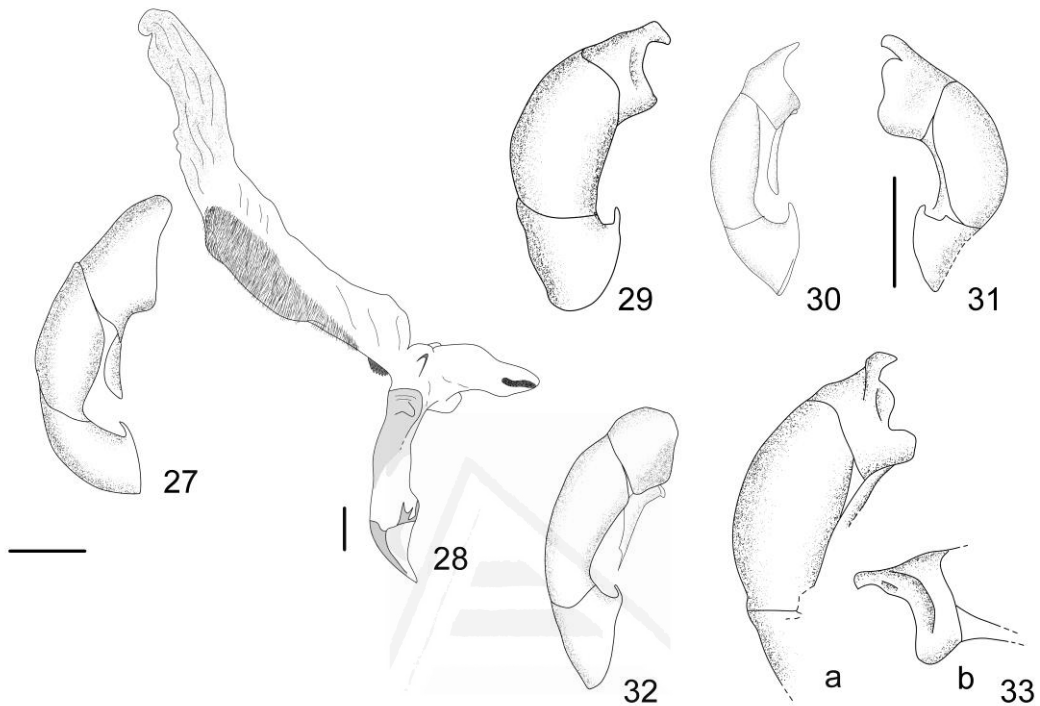
Etymology: from the name of genus *Rutela* and suffix -oides, for its general resemblance with species of the Rutelini tribe.



Figures 25–26. Mesometasternal process in 25: *Callistethus ruteloides* (holotype). 26: *C. yalizo* (paratype, Río Grande de Orosí, Cartago). Scale = 1 mm.

Distribution: Guanacaste and Talamanca mountain ranges and Northern Panama from 900 to 1600 m, (Figure 36).

Note: This species is placed in the genus *Callistethus* with reserve, as it has some distinct features not found in other *Callistethus* species. It probably can be placed in a different genus, but the lack, to our knowledge, of similar species, would make a proper description and diagnosis of the new genus difficult. Singular characters are: long clypeus (nearly as long as frons), big head ($2/3$ of pronotum width), mandibles with apex curved ventrally, maxillae with second and third tooth fused together, labrum and labium quadrilobulated, short pronotum, short and stout tarsomeres, mesometasternal suture high, nearly at half the length of the mesosternal process, aedeagus with parameres flattened dorsoventrally.



Figures 27–33. 27: Aedeagus of *Anomala obovata*, lateral view (Quebrada Kuisa, Costa Rica, INBIO). 28: Endophallus of *A. obovata* (Cerro Chompipe, Costa Rica, INBIO). 29: Aedeagus of *A. jansoni*, lateral view (Monte Rotondo, Costa Rica, type, MNHUB). 30: Aedeagus of *A. antica*, lateral view (Estación Palo Verde, Costa Rica, INBIO). 31: Aedeagus of *A. luciae*, lateral view (Santa Lucia, Antilles, lectotype, MNHN). 32: Aedeagus of *A. quiche*, lateral view (Estación Maritza, Costa Rica, INBIO). 33: Aedeagus of *A. inconstans*, (a) lateral view, (b) other side of parameres (Bogotá, Colombia, type, MLUH). Scale = 1mm.

Callistethus yalizo new species, Filippini, Galante & Micó

Figure 6

Type Material. Holotype: ♂ "P.N. Tapanti, La Represa, A. C. Amistad, Prov. Carta, COSTA RICA. 1650 m. 23 Mar 1994, G. Mora, A. Solis, E. Ulate, L N 185900_563360 # 2783 / INBIOCRI001964129"

Paratypes (8): 1♂ "R. Grande de Orosi, desde Puente R. Dos Amigos hasta la Represa, Prov. Carta, COSTA RICA. 1400-1800m. MAR 1995. R. Delgado. L_N_186600_562000 #4418 / INBIOCR1002253282"; 1♂ "Costa Rica, Cartago Prov., Tapanti N. Pk. Dam area, vi-4-1997 RW Hamilton / RWHC" INBIO; 1♂ "Cerro Chompipe, Res. Biol. Chompipe, Prov. Here, COSTA RICA, J. F. Corrales, 7 Abr 1991, L- N 230000_528000 / INBIOCR1000183743"; 1♀ "Quebrada Segunda, P. N. Tapanti, 1250M, Prov. Cartago, Costa Rica, Mar 1992, R. Vargas, L-N 194000,560000 / INBIOCR1000894947"; 1♂ "Esperanza del Guarco, Cartago, Costa Rica. 2300 m 5/6/2008 Leg. A. García, M.Zumbado / CEUA00106167"; 1♀ "COSTA RICA. Prov. Cartago. P.N. Tapanti. La Esperanza del Guarco. 2334m. 5 MAY 2008. A. García, M.A. Zumbado. Tp. Luz 2. L_N_188418_552219 #93739 / CEUA00106168"; 1♂ "V. Platanar P.N. Juan Castro Blanco (Costa Rica) 1800m 29-1-2006. T. luz (18:30-21:00). Leg.: Micó, García, Galante / CEUA00003201"; 1♂ "MUSEO DE INSECTOS UNIVERSIDAD DE COSTA RICA. COSTA RICA, PROV. Cartago. Río Macho, Orosí. 4 may. 1973. E. Monge." MUCR.

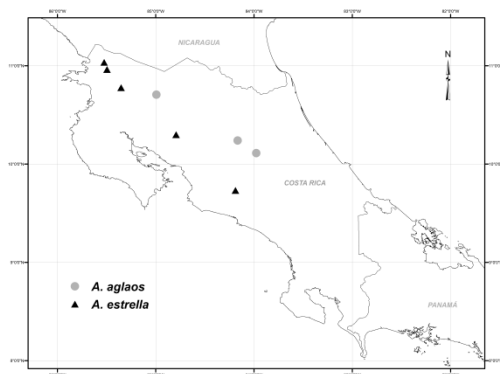
Holotype male: Body shape oval. Length 15.1 mm; width 8.6 mm.

Color. Head, pronotum and scutellum metallic green. Margins of pronotum yellow, with green/bronze luster. Elytra and pygidium metallic green with brown luster. Metasternum metallic green, legs (including coxae) and lateral sternites yellow, with green base and apex, protibiae and tarsi metallic green, claws reddish. Abdominal sternites reddish brown with green/bronze luster. Antennae reddish with dark brown clubs.

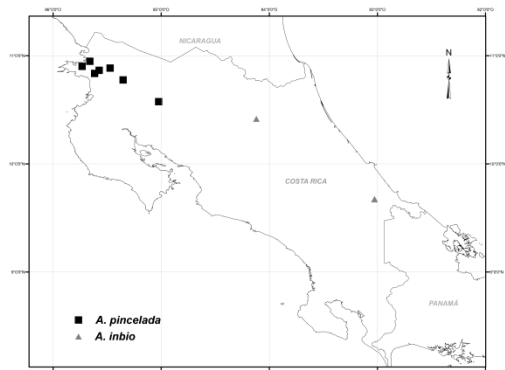
Clypeus nearly rectangular, ratio width/length 2.3; surface granulate; anterior margin slightly sinuate. Frons with dense coarse punctures, rest of head with sparse fine punctures. Ocular canthus long, tapering towards apex; apex acute. Eyes small, interocular ratio (interocular width/width of eye) 3.0. Antenna: ratio funiculus/club 0.6.

Pronotum. Width 1.8 times length; in dorsal view broadest at its base. Lateral margins rounded. Anterior angles quadrate, with rounded vertex; posterior angles obtuse, with rounded vertex. Basal margin without subapical sulcus, sinuate. Whole surface with small, shallow, sparse punctures.

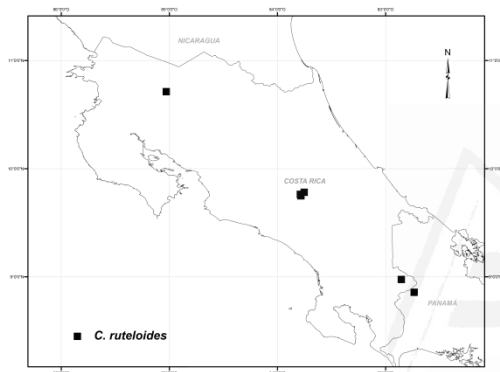
3.4 Six Anomalini species



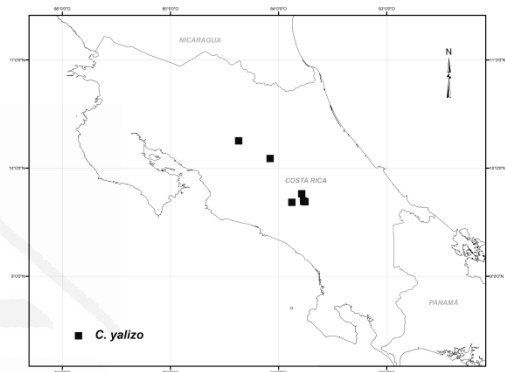
34



35



36



37

Figures 34-37. Distribution of 34: *Anomala aglaos* and *A. estrella*. 35: *A. inbio* and *A. pinclada*. 36: *Callistethus ruteloides*. 37: *C. yalizo*.

Scutellum. Shape subpentagonal, with a median sulcus and sparse deep punctation on the entire surface; ratio width/length 1.5.

Elytra. Surface with costae defined by rows of shallow punctures. Interstices with 3–4 (first interstice) or 1–2 (second–fifth interstices) rows of sparse shallow punctures.

Pygidium granulate with a shallow median sulcus, with short setae on disc and longer setae on margins. Ratio width/length 1.6.

Mesosternal process short, not going beyond anterior margin of mesocoxae, uniformly wide (half as wide as metafemura) with rounded apex; width at base: 0.6 mm (Figures 26). Mesometasternal suture well defined.

Abdominal sternites with sparse shallow punctures, at side forming 6–7 rows of punctures. Short blonde setae arranged in one row per sternite, denser on sides (on

2–3 rows). Last sternite with sparse shallow punctures, apical margin height $\frac{2}{3}$ of basal portion, surface smooth; apical membrane narrow. Sixth abdominal spiracle convex.

Legs. Protibia bidentate (Figure 12), apical tooth long, oblique in relation to the vertical axis of protibia, nearly straight. Basal tooth obtuse, blunt, positioned at same level of the internal apex of protibia. Metatibia very thin, slightly narrower subapically. Ratio length/width 5.1. Both external carinae well defined. Surface punctuate. Protarsal claws: external claw curved; internal claw bifurcate, with branches strongly diverging, upper branch of same length and $\frac{2}{3}$ the width of the lower one, inferior margin sinuate.

Aedeagus (Figures 18). Parameres nearly bilobed in a lateral view, ventral plate partially fused with parameres. Endophallus (Figure 24): with one long sinuate sacculus, presenting a row of small globoid diverticles in its basal half, partially covered with setae; ejaculatory duct opening ventrally at base, at whose side a small diverticle covered in long setae is present.

Variation: Elytra from reddish with green luster to metallic green. Abdominal sternites from ochre to dark brown with green or bronze luster. Female: Similar to male. Antennal club slightly shorter than in male. Eyes smaller than in male. Protibia (Figure 12): apical tooth longer and wider, basal tooth above the internal apex. Protarsal claw: internal claw narrower than in male, bifurcation narrower, inferior margin curved. Margin of last sternite narrower than in male.

Body length 15.1–16.2 mm; width 8.6–9.5 mm. Clypeus w/l: 2.2–2.3. Interocular ratio: 3.0–3.1 (male), 3.5–4.2 (female). Antenna: ratio funiculus/club: 0.6–0.8. Pronotum w/l: 1.8–1.9. Scutellum w/l: 1.3–1.5. Pygidium w/l: 1.5–1.7. Width of mesosternal process at base: 0.4–0.6 mm. Metatibia w/l: 4.6–5.4.

Diagnosis: metallic green color; elytra with shallow punctures that give an irregular aspect; short mesosternal process; parameres nearly bilobed in a lateral view, ventral plate partially fused with parameres.

3.4 Six *Anomalini* species

Etymology: from the Greek verb *yalízo*, to be green like glass, treated as a noun in apposition, for the green shining color of this species.

Distribution: Central and Talamanca mountain ranges, from 200 to 2300 m (Figure 37).

Acknowledgements

We thank Mr. Ángel Solís, from the Instituto Nacional de Biodiversidad, Costa Rica for the loan of specimens; Johannes Frisch and J. Willers from the Museum für Naturkunde der Humboldt-Universität, Berlin; Karla Schneider from the Institut für Zoologie der Martin-Luther-Universität, Halle; Antoine Mantilleri and Olivier Montreuil, from the Muséum National d'Histoire Naturelle, Paris for assistance with type material consultation. We also thank Dr. Miguel A. Alonso Zarazaga for his tips on nomenclature.

We thank the Convenio INBio-MINAE to carry out the National Biodiversity Inventory of Costa Rica.

Financial support was provided by the Agencia Española de Cooperación Internacional para el Desarrollo (AECID) projects A/4426/05, A/6788/06, A/019887/08, A/023060/09 and a PhD grant to V. Filippini from the Spanish Ministry of Education.

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3.5 - Description of eight new *Anomala* species from Costa Rica (Coleoptera: Scarabaeidae: Rutelinae).

[Descripción de ocho nuevas especies de *Anomala* de Costa Rica (Coleoptera: Scarabaeidae: Rutelinae)]



Abstract: Eight new species of *Anomala* from Costa Rica are described: *A. arthuri* new species, *A. cupreovariolosa* new species, *A. ferrea* new species, *A. nigroflava* new species, *A. semilla* new species, *A. solisi* new species, *A. volsellata* new species, *A. zumbadoi* new species and a distribution map of each is given. The male genitalia (aedeagus and endophallus) of the species covered are illustrated.

Keywords: aedeagus, species distribution, endophallus, new species.

Filippini V., Micó E., Galante E. 2014, *Journal of Entomology and zoology Studies*, 2(6): 107-122

Introduction

The genus *Anomala* Samouelle is one of the largest of the animal kingdom, with more than 1000 species described and shows a worldwide distribution (Jameson *et al.* 2003). However, only about 200 of these are described for the New World, a number that is more indicative of the lack of taxonomic study in this region than of the lack of biodiversity.

The size of this genus has been rightly cited by Jameson and collaborators (2003) as one of the main reasons for the lack of taxonomic revision of *Anomala*, but the taxonomic study of species at a local level, with the description of new species, is revealing important information for identifying and characterizing natural groups of species (Zorn 2007, Ramírez-Ponce and Morón 2012), which hopefully will be helpful in elucidating the structure of this huge genus.

The species described in this work are morphologically heterogeneous, showing part of the variability that is grouped under the genus *Anomala*, and their relative relations have not been investigated.

Materials and methods

The material cited in this publication is deposited in the following collections:

CEUA Colección Entomológica de la Universidad Alicante, Spain

INBIO Instituto Nacional de Biodiversidad, Costa Rica

MNHUB Museum für Naturkunde der Humboldt Universität zu Berlin, Germany

MUCR Museo de insectos, Universidad de Costa Rica, Costa Rica

To prepare the endophallus for study, the following procedure was used: the aedeagus was washed in a 10% hot KOH solution for 5–10 minutes and then rinsed in distilled water. It was then kept in lactic acid for a minimum of 48 hours until the

structures of the aedeagus and endophallus became translucent. The endophallus was everted by injecting water from the base of aedeagus with a syringe equipped with a suitable needle or microforceps (WPI Dumont #5) when the length of the internal sac made the syringe method inefficient. The dissection was transferred to a microvial containing glycerin, which was attached to the insect pin. From 3 to 6 specimens of each species were dissected.

Line drawings were traced in GIMP image manipulation program (version 2.8, www.gimp.org). Original drawings were done with the aid of a camera lucida attached to a stereo microscope (Leica M80) for endophalli or from photographs for aedeagi (taken with a Leica DFC450 camera mounted on a Leica M205C stereo microscope).

All measurements were taken from photographs of the specimens, using Leica Application software. A Leica DFC450 camera mounted on a Leica M205C stereo microscope was used to take the photographs.

The following definitions were used in the description: body length: from tip of clypeus to pygidium. Body width: measured at widest point of elytra. Clypeus width: measured at half height. Ratio interocular width/width of eye: widths measured at half the height of eyes. Pronotum width: measured at base. Metatibia ratio: length measured from below the articulation with femur to tip, on the median axis; width measured at widest point.

Clypeus thickness in frontal view: thick if more or equal to 0.3 mm; thin if less than 0.3 mm.

We follow the traditional taxonomic inclusion of the New World species in the genus *Anomala* (Jameson *et al.* 2003), in contrast to the recent paper by Ramírez-Ponce and Morón (2009) who group them into a new genus *Paranomala*, as a more conservative classification, waiting for a more extensive study at global scale.

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This work is meant to be part of a general taxonomical work on *Anomala* in Costa Rica. To exclude cases of synonymy, the type specimens for 173 Neotropical species (about 80% of species cited) have been studied (listed in *Anexo 2*), and available literature has been consulted for the rest.

Results

Anomala arthuri sp.n. Filippini, Galante & Micó

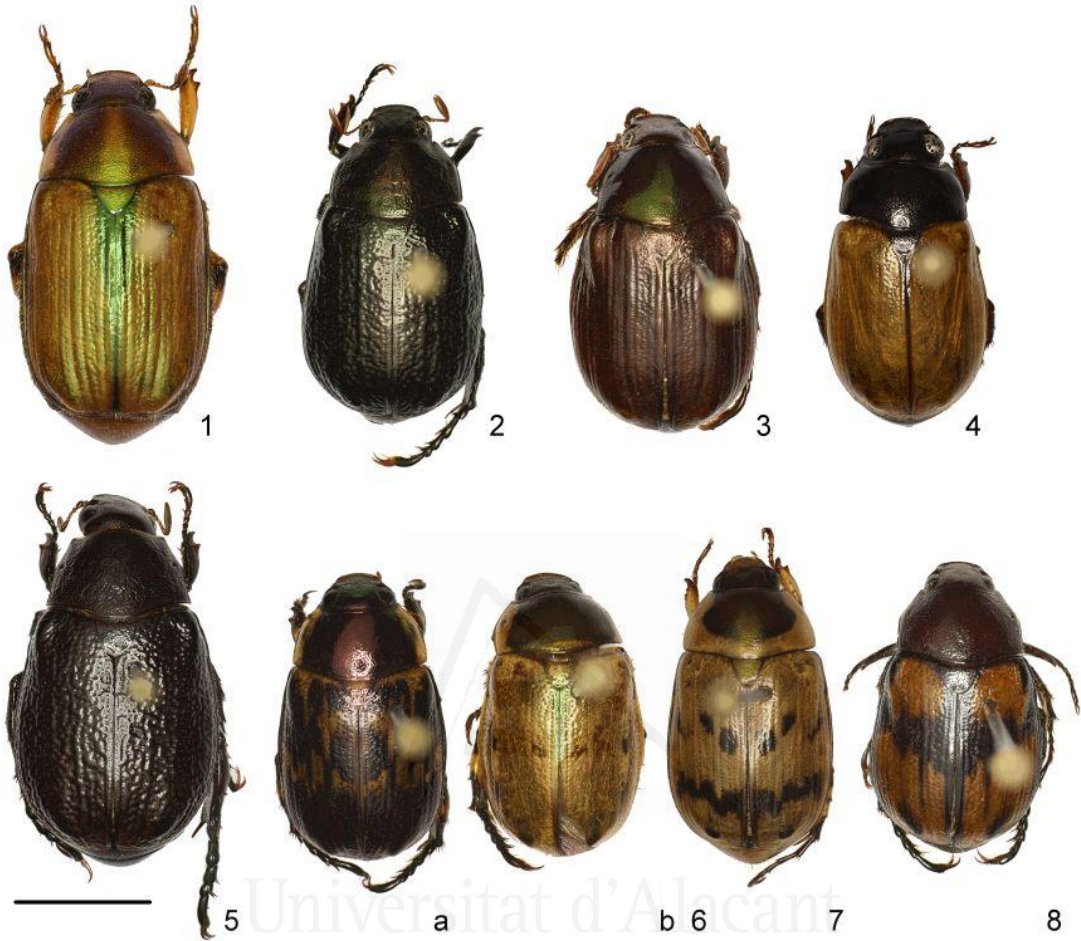
Material examined. Holotype: ♂ "Est. Maritza, 600m, lado O Vol. Orosi, Prov. Guan. COSTA RICA R. Blanco, May 1990, L- N 326900_373000 / INBIOCR1000264744".

Paratypes (6): 2♂ 2♀ "Est. Maritza, 600m, lado O Vol. Orosi, Prov. Guan. COSTA RICA R. Blanco, May 1990, L- N 326900_373000" / INBIOCR1000264750, INBIOCR1000264752, CEUA00106166 and INBIOCR1000264745; 1♂ "La Maritza, Hda. Orosi Gste. Pr. Costa Rica 550 m. 25 May 1986 W. Hallwachs, D.H. Janzen / CEUA00106165"; 1♀ "La Maritza. Hda. Orosi Gste. Pr. Costa Rica 550m. 2-5 June 1986 W. Hallwachs, D.H. Janzen / INBIOCR1002754779".

Holotype male: Body shape elongated. Length 13.3 mm. Width 7.1 mm.

Color. (Fig. 1). Head metallic green, clypeus light green. Pronotum metallic green with sides and median longitudinal band ochre with green luster. Scutellum, elytra and venter ochre with green luster, elytral suture metallic green. Pygidium ochre with green luster and green basal corners. Legs ochre with green luster, apex of pro- and mesotibia brownish, metatibia with green base and apical third. Pro- and mesotarsi brownish, metatarsi metallic green with bronze luster. Abdominal sternites light green.

Clypeus trapezoidal, surface densely punctate-reticulate, flat. Anterior margin straight, clypeus thickness frontally thin. Ratio width/length 1.9. Frons densely punctate, flat. Ocular canthum long, thin, and with rounded apex. Interocular ratio (interocular width/width of eye): 3.0. Antenna: ratio funiculus/club 0.7.

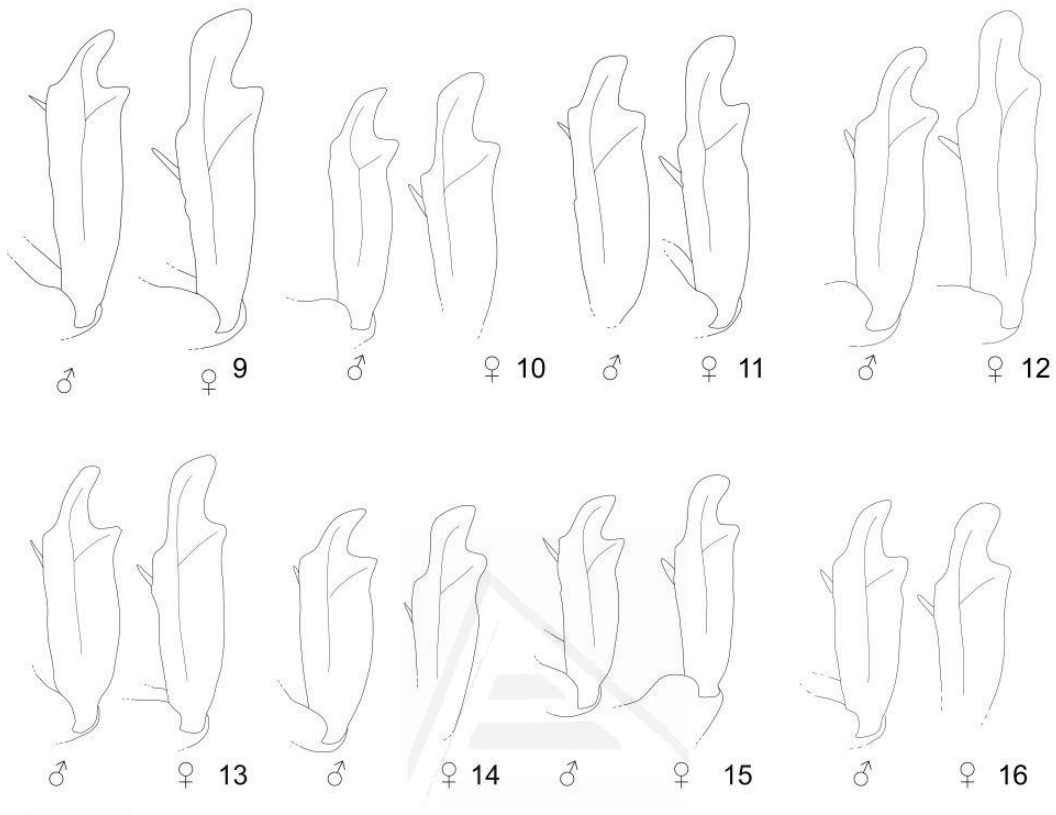


Figures 1-8: Habitus. 1: *Anomala arthuri* (holotype). 2: *A. cupreovariolosa* (holotype). 3: *A. ferrea* (holotype). 4: *A. nigroflava* (holotype). 5: *A. semilla* (holotype). 6: *A. solisi* A: male (holotype), B: female (paratype, Sector San Ramón, Alajuela). 7: *A. volsellata* (holotype). 8: *A. zumbadoi* (holotype). Scale = 5mm.

Pronotum subtrapezoidal. Ratio width/length 1.7. Lateral margins angulated at $1/3$ of pronotum length. Anterior angles acute, sharp, posterior angles obtuse, blunt. Basal margin sinuate, subapical bead obliterated in the middle. Surface with deep dense punctures.

Scutellum subpentagonal, with rounded sides and acute apex. Ratio width/length 1.4. Surface sparsely punctate.

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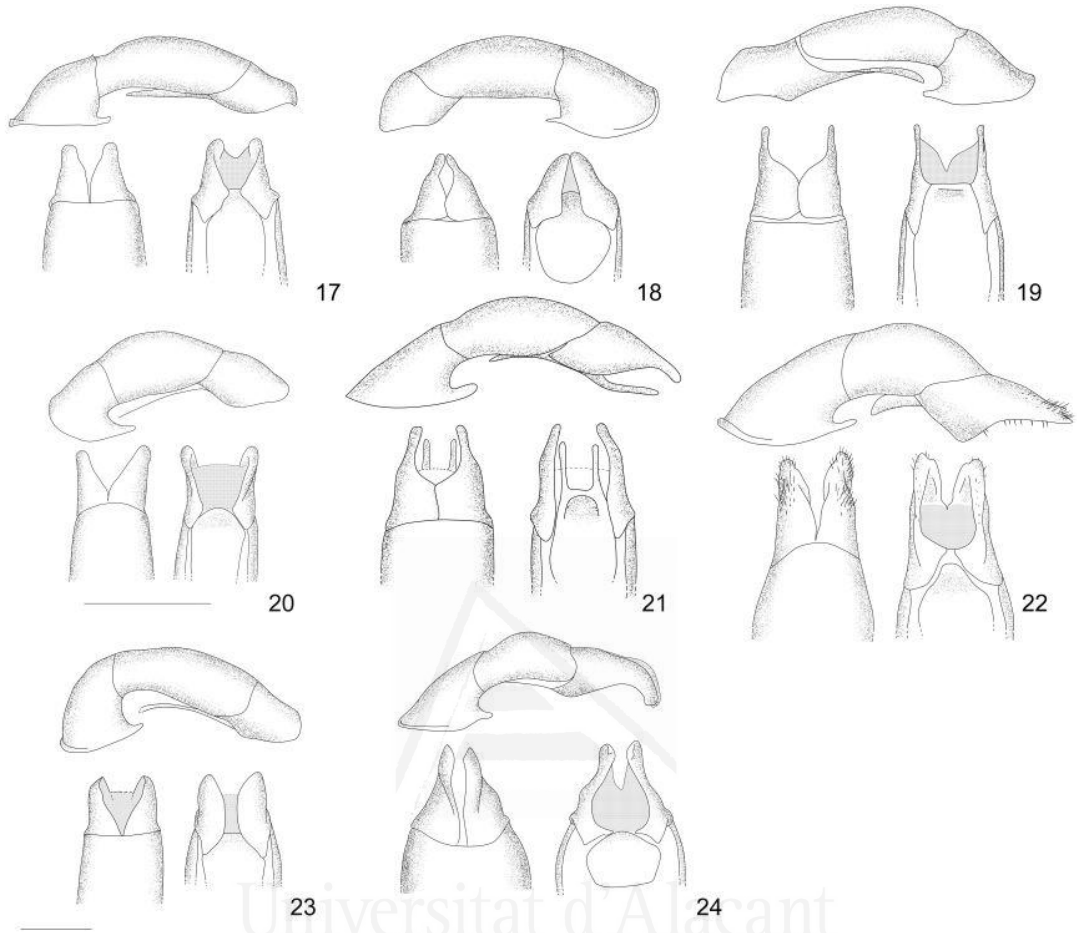


Figures 9-16: Shape of protibia in 9: *Anomala arthuri* (male: paratype, La Maritza, Costa Rica; female: paratype, La Maritza, Costa Rica). 10: *A. cupreovariolosa* (male: holotype; female: paratype, Zona Protectora Las Tablas, Costa Rica). 11: *A. ferrea* (male: holotype; female: paratype, San Vito Las Cruces, Costa Rica). 12: *A. nigroflava* (male: holotype; female: paratype, Estación El Tigre, Costa Rica). 13: *A. semilla* (male: holotype; female: paratype, Albergue Heliconias, Costa Rica). 14: *A. solisi* (male: holotype; female: paratype, sector San Ramon, Costa Rica). 15: *A. volsellata* (male: holotype; female: paratype, Estación Bijagual, Costa Rica). 16: *A. zumbadoi* (male: paratype, Boca del Río Esquinas, Costa Rica; female: paratype, Rancho Quemado, Costa Rica). Scale = 1mm.

Elytra with costae defined by regular rows of punctures. Subsutural interstice with 1–2 rows of punctures, 2nd–4th interstices with 1 irregular secondary stria. Surface covered with secondary punctures.

Pygidium strigate with short setae on disc, long setae at hind margin. Ratio width/length 1.4.

Space between the mesocoxae narrow, slightly convex. Mesometasternal suture obliterated in the middle, at base of mesocoxae. Abdominal sternites with 1–2 rows of



Figures 17-24: Shape of aedeagus, lateral view (top), dorsal view (bottom left), ventral view (bottom right). 17: *Anomala arthuri* (holotype). 18: *A. cupreovariolosa* (paratype, San Vito Las Cruces, Costa Rica). 19: *A. ferrea* (paratype, San Vito Las Cruces, Costa Rica). 20: *A. nigroflava* (holotype). 21: *A. semilla* (holotype). 22: *A. solisi* (holotype). 23: *A. volsellata* (paratype, Las Quebraditas, Costa Rica). 24: *A. zumbadoi* (holotype). Scale = 1mm.

setae and 5–7 rows of punctures per sternite. Last sternite punctate with subapical bead thin and sinuate, apical membrane narrow.

Protibia (Fig. 9) bidentate, apical tooth short and curved, proximal tooth at same level as internal apex of protibia, triangular in shape, sharp, acute. Metatibia stout, slightly narrower subapically. Ratio length/width 2.9. First external carina obliterated, surface punctate above second external carina and rugose below.

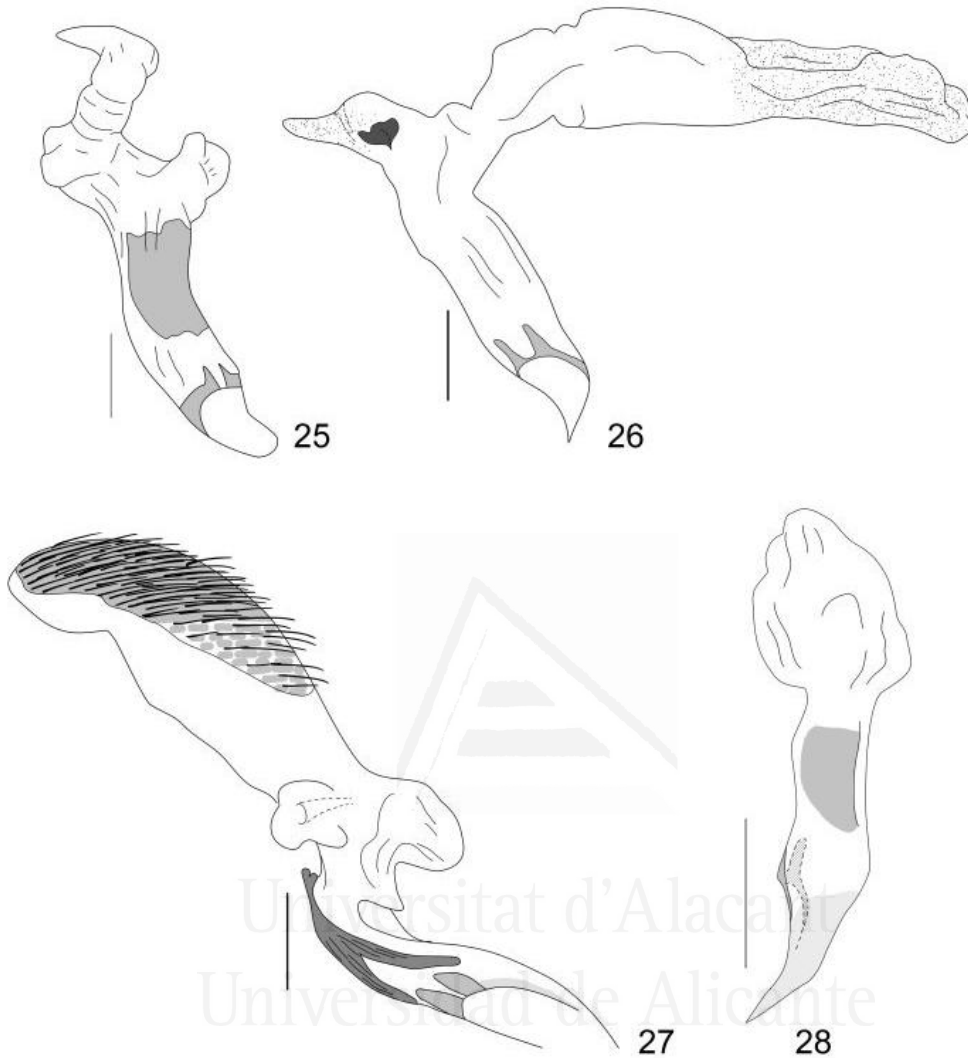
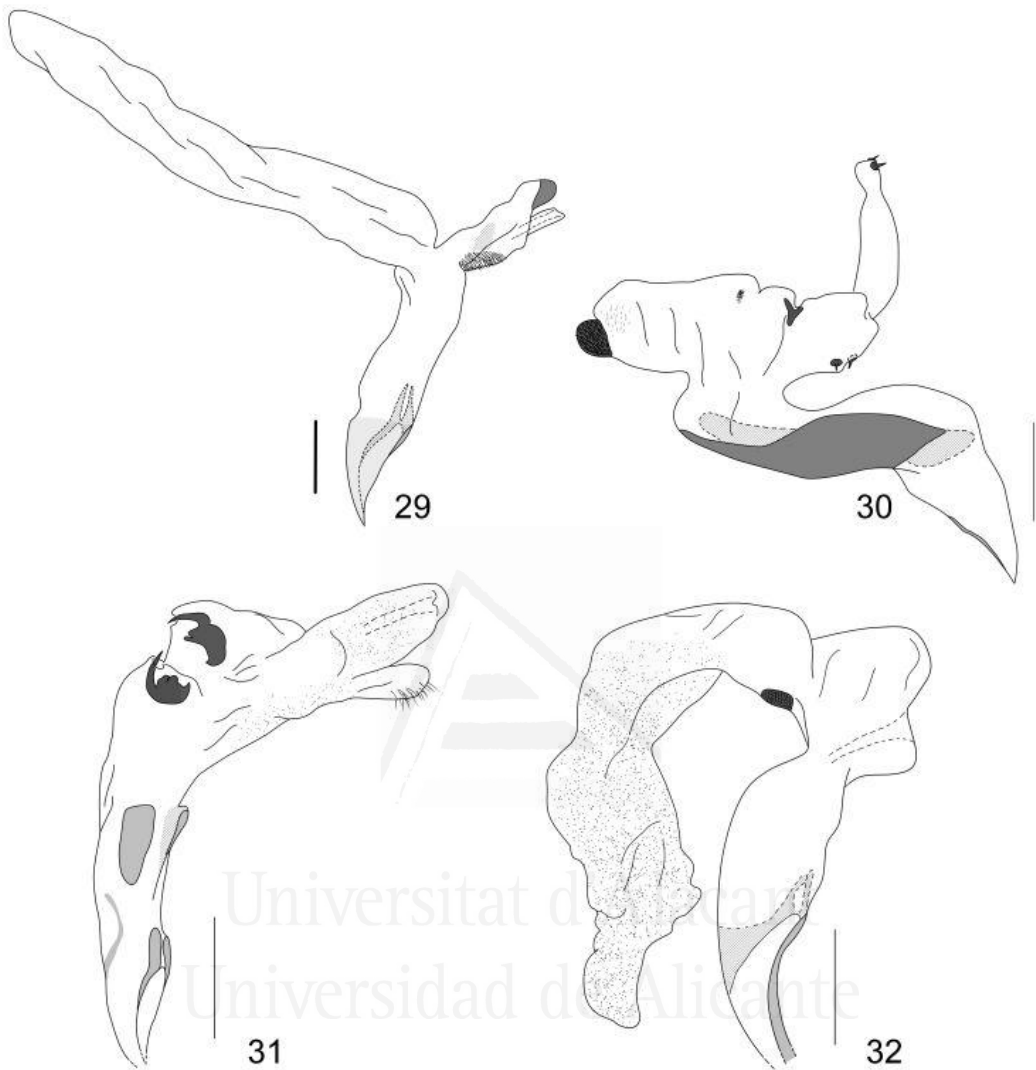


Figure 25-28: Endophallus of 25: *Anomala arthuri* (holotype). 26: *A. cupreovariolosa* (Zona Protectora Las Tablas, Costa Rica). 27: *A. ferrea* (holotype). 28: *A. nigroflava* (holotype). Scale = 1mm.

Protarsal claws: internal claw bifurcate, with upper branch slightly shorter and $\frac{2}{3}$ the width of the lower one. Inferior margin sinuate.

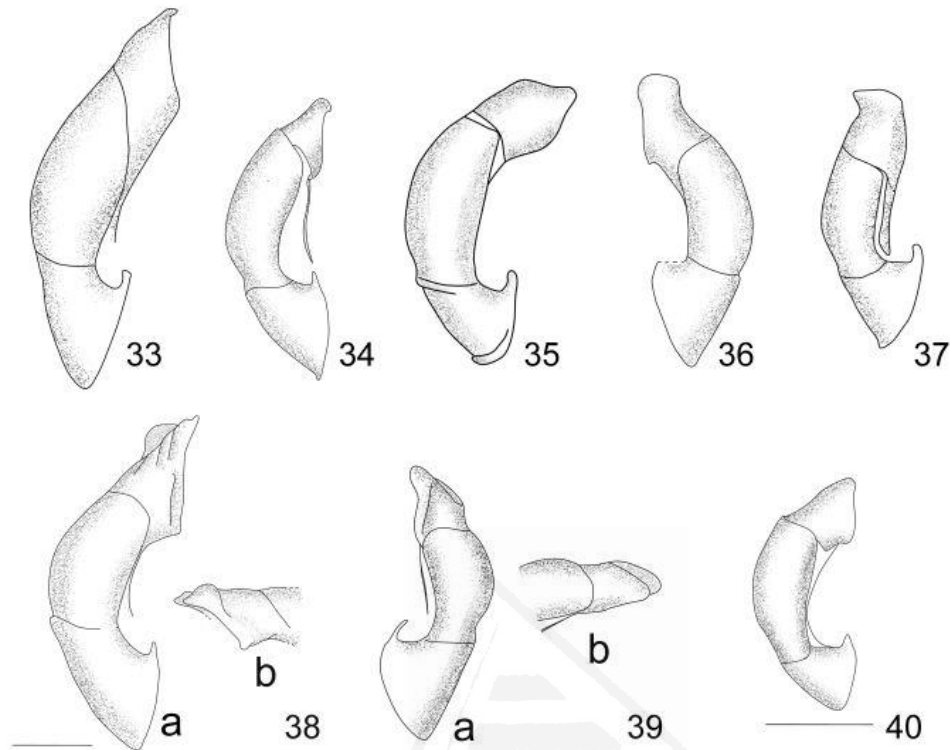
Genitalia. Aedeagus (Fig. 17): parameres with acute apex pointing downwards in a lateral view, ventral margin curved. Endophallus (Fig. 25) with a coiled sacculus tapering at apex; ejaculatory duct opening on a lateral inflation.

Variation. Ochre median band on pronotum of variable width; elytra with green or bronze luster; venter from ochre to metallic green. Body length 13.3–14.3 mm, body



Figures 29-32: Endophallus of 29: *A. semilla* (Albergue Heliconias, Costa Rica). 30: *A. solisi* (paratype, Estación Pitilla, Costa Rica). 31: *A. volsellata* (paratype, Las Quebraditas, Costa Rica). 32: *A. zumbadoi* (holotype). Scale = 1mm.

width 7.1–7.6 mm. Clypeus w/l: 1.9–2.2. Interocular ratio (interocular width/width of eye): 2.9–3.3. Antenna: ratio funiculus/club 0.7–0.8. Pronotum w/l: 1.6–1.7. Scutellum w/l: 1.4–1.5. Metatibia l/w: 2.5–2.9. Females: similar to males, pronotum with more curved lateral margins; protibia (Fig. 9) with longer and wider apical tooth; internal protarsal claw with curved inferior margin; last sternite with curved apex.



Figures 33-40: Shape of aedeagus, lateral view. 33: *A. arara* (Estación Cabro Muco, Costa Rica, CEUA). 34: *A. semicineta* (Albergue Heliconias, Costa Rica, CEUA). 35: *A. variolosa* (Colombia, type, MNHUB). 36: *A. cincta* (Los Tuxtlas, Mexico, CEUA). 37: *A. testaceipennis* (Boca Tapada, Costa Rica, INBIO). 38: *A. oreas*, a. lateral view, b. other side of parameres (Río Yurumangui, Colombia, MNHUB). 39: *A. clathrata*, a. lateral view, b. other side of parameres (Cerro Bitárkara, Costa Rica, CEUA). 40: *A. popayana* (Estación Hitoy Cerere, Costa Rica, INBIO).

Diagnosis: medium size, green head, bands on pronotum and elytral suture, rest of body light green or ochre with green or bronze luster; costae defined and interstices with rows of punctures; parameres with acute apex pointing downwards in a lateral view, ventral margin curved; endophallus coiled.

It is related to *A. arara* Ohaus 1897 and *A. semicineta* Bates 1888, both present in Costa Rica, but it is easily separated from them by color (*A. arara* has head and pronotum entirely green, *A. semicineta* dorsally is nearly completely green except for apical part of elytra) and aedeagus (Figs. 33 and 34 respectively)

Etymology: this species is dedicated to my grandfather, Arturo Filippini, who first taught me the wonders of nature (V.F.)

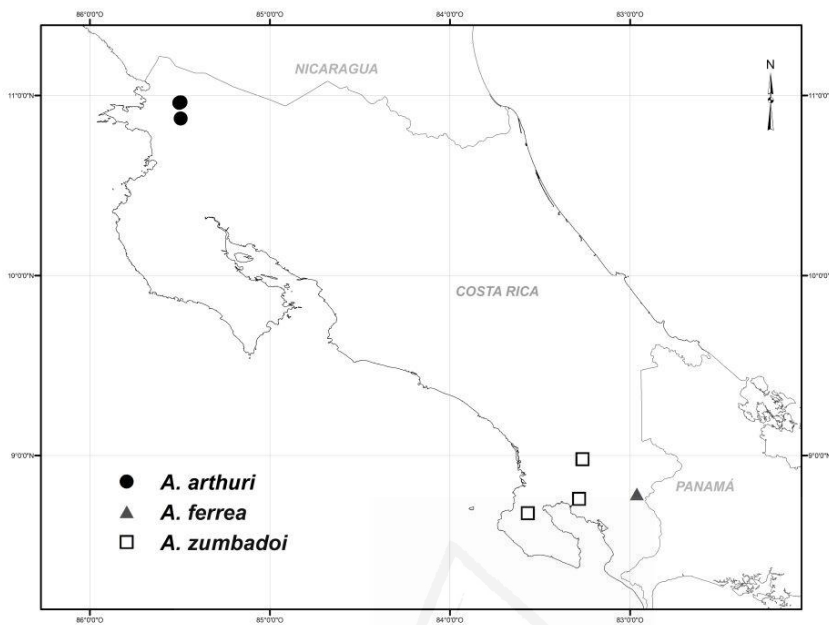


Figure 41: Distribution of *Anomala arthuri*, *A. ferrea* and *A. zumbadoi*.

Distribution: Guanacaste mountain range, from 550 to 600 m (Fig. 41).

Anomala cupreovariolosa sp.n. Filippini, Galante & Micó

Material examined. Holotype: ♂ "Puntarenas. Costa Rica. San Vito Las Cruces. 20 NOV 1988. A. Solis / INBIOCR1002517681".

Paratypes (8): 1♀ "COSTA RICA, Prov. Puntarenas, Coto Brus, Sabalito, Z. P. Las Tablas, Est. Las Alturas. 1600m. 16 MAY 1999. I. A. Chacón. Manual, L_S_323100_591500 #55283 / INB0003316144"; 1♂ 1♀ "Zona Protectora Las Tablas, Prov. Punta, COSTA RICA. 1380m. 21 SET 1995. M. Chinchilla, de Luz L_S_319300_594700 #6296" / CEUA00106170 and INBIOCR1002341975; 2♂ "Puntarenas. Costa Rica. San Vito Las Cruces. 20 NOV 1988. A. Solis" / INBIOCR1002517682 and INBIOCR1002517683; 1♂ "Est. Biol. Las Alturas 1500 m, Coto Brus, Prov. Puntarenas, Costa Rica, F. Araya, 23 mar a 2 may 1992, L- S 322500_591300 / CEUA00106171"; 1♂ "Estacion Biologica Las Alturas, Coto Brus, Prov. Punta, COSTA RICA. 1500m. Abr 1992. M. Ramirez, L S 322500_591300 #1184 / INBIOCR1001717589"; 1♂ "COSTA

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RICA, Prov. Puntarenas, Est. Biologica Las Alturas, Send. a Cerro Echandi. 1580m. 28 FEB 1998. B. Gamboa. Tp. Luz. L_S_322900_591050 #49700 / INBIOCR1002601796".

Holotype male: Body shape oval. Length 12.3 mm. Width 7.4 mm.

Color. (Fig. 2). Head and pronotum black with bronze and green luster. Scutellum and elytra black. Pygidium reddish black. Legs and venter brownish black.

Clypeus trapezoidal, surface densely punctate-reticulate, convex. Anterior margin straight, clypeus thickness frontally thin. Ratio width/length 2.2. Frons densely punctate, flat. Ocular canthum long, thin, with rounded apex. Interocular ratio (interocular width/width of eye): 3.1. Antenna: ratio funiculus/club 0.7.

Pronotum subtrapezoidal. Ratio width/length 1.6. Lateral margins angulated at $\frac{1}{3}$ of pronotum length. Anterior angles right and sharp, posterior angles obtuse and blunt. Basal margin sinuate, subapical bead obliterated in the middle. Surface with coalescing punctures, irregular.

Scutellum. Shape subtriangular, with rounded sides and blunt apex. Ratio width/length 1.5. Surface sparsely punctate.

Elytra with costae defined by irregular rows of coarse punctures. Interstices with dense irregular coalescing punctures. Surface covered with secondary punctures that with coarse main punctation give an irregular appearance.

Pygidium with coalescing punctures and long setae at hind margin.

Space between the mesocoxae narrow, slightly convex. Mesometasternal suture well defined, at base of mesocoxae. Abdominal sternites with 1–3 rows of setae, denser on second sternite, and 3–7 rows of punctures per sternite. Last sternite punctate, with subapical bead thin and sinuate, apical membrane wide.

Protibia (Fig. 10) bidentate, apical tooth long and curved, proximal tooth at same level as internal apex of protibia, triangular in shape, sharp. Metatibia stout, fusiform. Ratio length/width 2.8. First external carina well developed. Surface punctate above second external carina, and rugose below. Protarsal claws: external claw strongly curved, internal claw bifurcate, with upper branch of same length and $\frac{2}{3}$ the width of the lower one, inferior margin sinuate.

Genitalia. Aedeagus (Fig. 18): parameres with blunt apex on lateral view, ventral margin slightly sinuate. Endophallus (Fig. 26) with one long sacculus with setae at apex, and a shorter sacculus on the other side, where ejaculatory duct opening is located, with tapering apex and a sclerotized ridged plate.

Variation. Pronotum with green or bronze luster; elytra from reddish brown to black, green luster may be present; venter from reddish to greenish and brownish black. Body length 12.3–13.7 mm, body width 7.2–7.9 mm. Clypeus w/l: 2.2–2.4. Interocular ratio (interocular width/width of eye): 3.1–3.6. Antenna: ratio funiculus/club 0.7–0.8. Scutellum w/l: 1.2–1.5. Pygidium w/l: 1.6–1.7. Metatibia l/w: 2.6–2.8. Females: similar to males, protibia (Fig. 10) with wider apical tooth; proximal tooth above internal apex; internal protarsal claw narrower with curved inferior margin; last sternite with curved apex.

Diagnosis: medium size, dark color with metallic luster, irregular elytral surface, parameres wide with blunt apex and slightly sinuate ventral margin.

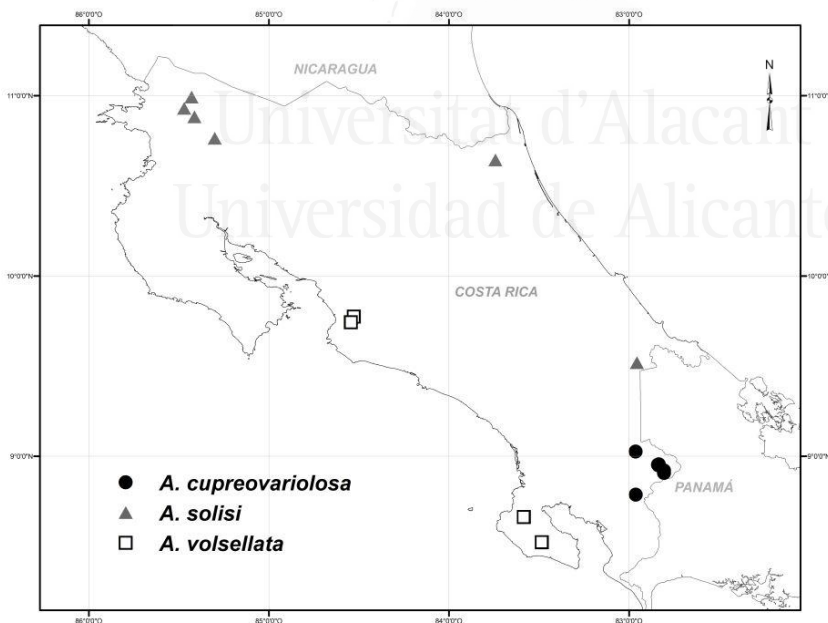


Figure 42; Distribution of *A. cupreovariolosa*, *A. solisi* and *A. volsellata*.

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Similar to *A. variolosa* Ohaus 1928 and *A. semilla* sp.n., it can be differentiated by the presence of metallic luster, smaller size in respect to *A. variolosa*, and shape of male genitalia: *A. variolosa* has parameres with squared apex and strongly sinuate ventral margin (Fig. 35), *A. semilla* has long and slender parameres (Fig. 21).

Etymology: from Latin adjective *cupreus*, -a, -um, coppery, and *variolosa*, for its metallic luster and irregular elytral surface as in *A. variolosa*.

Distribution: Coastal and Talamanca mountain range, from 1180 to 1670 m (Fig. 42).

Anomala ferrea sp.n. Filippini, Galante & Micó

Material examined. Holotype: ♂ "Puntarenas. Costa Rica. San Vito Las Cruces. 20 NOV 1988. Col. A. Solis / INBIOCRI002517845".

Paratypes (6): 1♂ 5♀ "Puntarenas. Costa Rica. San Vito Las Cruces. 20 NOV 1988. Col. A. Solis" / INBIOCRI002517848, INBIOCRI002517847, INBIOCRI002517843, INBIOCRI002517850, INBIOCRI002517844 and CEUA00106169.

Holotype male: Body shape oval. Length 12.12 mm. Width 7.13 mm.

Color. (Fig. 3). Head and pronotum dark metallic green. Scutellum, elytra, pygidium, legs and venter dark reddish brown.

Clypeus rectangular, with anterior angles widely curved, surface densely punctate-reticulate, flat. Anterior margin straight, clypeus thickness frontally thin. Ratio width/length 2.0. Frons densely punctate, flat. Ocular canthum long, thin, with acute apex. Interocular ratio (interocular width/width of eye): 3.3.

Pronotum subtrapezoidal. Ratio width/length 1.5. Lateral margins sinuate. Anterior angles right, blunt, posterior angles obtuse, blunt. Basal margin sinuate, subapical bead obliterated in the middle. Surface with sparse fine punctures.

Scutellum. Shape subtriangular, with rounded sides and acute apex. Ratio width/length 1.4. Surface densely punctate.

Elytra with evident costae, defined by regular rows of punctures. Subsutural interstice with 2 rows of punctures, 2nd–4th interstices with 1 irregular secondary stria. Surface covered with secondary punctures.

Pygidium strigate with long setae at hind margin. Ratio width/length 1.6.

Space between the mesocoxae wide. Mesometasternal suture well defined, at base of mesocoxae. Abdominal sternites with 1–3 rows of setae and 5–7 rows of fine punctures per sternite. Last sternite strigate, with subapical bead thick and sinuate, apical membrane narrow.

Protibia (Fig. 11) bidentate, apical tooth short and curved, proximal tooth below internal apex of protibia, triangular in shape, obtuse. Metatibia slender, fusiform. Ratio length/width 2.9. First external carina constituted by a row of sparse setae. Surface punctate. Protarsal claws: internal claw bifurcate, with upper branch slightly shorter and $2/3$ the width of the lower one, inferior margin showing a sharp angle near base.

Genitalia. Aedeagus (Fig. 19): parameres with angulated dorsal margin in lateral view, narrow apex and sharp ventral angle in a lateral view. Endophallus (Fig. 27) with a heavily sclerotized median lobe, ending in a bilobed projection; endophallus developing dorsally, with a wide sacculus with a large patch of long and somewhat sparse sclerotized spines; bases for attachment of spines are small rectangular lightly sclerotized plates; ejaculatory duct opening lateral at base.

Variation. Head and pronotum from reddish brown to metallic green; elytra from reddish to greenish black; pygidium and venter from reddish to greenish dark brown. Body length 12.1–13.5 mm, body width 7.0–7.8 mm. Clypeus w/l: 2.0–2.1. Interocular ratio (interocular width/width of eye): 2.9–3.5. Antenna: ratio funiculus/club 0.6–0.7. Scutellum w/l: 1.4–1.5. Metatibia l/w: 2.7–3.5. Females: similar to males, antennal club shorter, protibia (Fig. 11) with longer and wider apical tooth; internal protarsal claw narrower, with curved inferior margin; last sternite with curved apex.

Diagnosis: medium size, pronotum dark metallic green, elytra dark reddish brown, elytra with defined costae, subsutural interstices with 2 rows of punctures, parameres with angulated dorsal margin in lateral view, narrow apex and sharp ventral angle in

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a lateral view, median lobe heavily sclerotized, ending in a bilobed projection, endophallus with a large patch of long and sclerotized spines.

Similar to dark forms of *A. cincta* Say 1835 and *A. testaceipennis* Blanchard 1851, it can be differentiated by the brownish color of elytra, more evident costae, subsutural interstice on elytra narrower than in *A. cincta*, and different male genitalia, with both *A. cincta* and *A. testaceipennis* having shorter parameres with the apex squared in a lateral view (Figs 36 and 37 respectively).

Etymology: from Latin adjective *ferreus*, -a, -um, iron, for its dark glossy color.

Distribution: one locality in the southern part of Coastal mountain range, 1200 m (Fig. 41).

Anomala nigroflava sp.n. Filippini, Galante & Micó

Material examined. Holotype: ♂ "Rio Rincon, Prov. Punta, COSTA RICA. om. 10 MAY 1995. M. Moraga, de Luz L N 280450 517500 #4635 / INBIOCRI002169259".

Paratypes (5): 1♂ 1♀ "COSTA RICA. Prov. Puntarenas. Golfito. Jiménez. Est. El Tigre, Area Administrativa. 47m. 8-9 NOV 2007. J. A. Azofeifa. Tp. Luz. L_S_277800_529600 #92860" / INB0004127874 and CEUA00106191; 1♂ "COSTA RICA. Prov. Puntarenas. Golfito. Jiménez. Est. El Tigre, Area Administrativa. 47m. 28-29 NOV 2007. J. A. Azofeifa. Tp. Luz. L_S_277800_529600 #92870 / CEUA00106190"; 1♀ "Est. Esquinas, om, Peninsula de Osa., Prov. Punt., COSTA RICA Ene 1993, M. Segura, L S 301400,542200 / INBIOCRI001303744"; 1♀ "Rio Rincon, Prov. Punta, COSTA RICA. om. 10 MAY 1995. M. Moraga, de Luz L N 280450 517500 #4635 / INBIOCRI002169264".

Holotype male: Body shape oval. Length 11.58 mm. Width 6.2 mm.

Color. (Fig. 4). Head, pronotum and scutellum blackish brown. Elytra light brown with suture reddish brown. Pygidium, venter and legs from reddish brown to dark orange.

Clypeus rectangular, with anterior angles widely curved, surface densely punctate-reticulate, convex. Anterior margin slightly sinuate, clypeus thickness frontally thick. Ratio width/length 2.2. Frons densely punctate, flat. Ocular canthum long, thin, with

rounded apex. Interocular ratio (interocular width/width of eye): 2.3. Antenna: ratio funiculus/club 0.7.

Pronotum trapezoidal. Ratio width/length 1.9. Lateral margins angulated at 1/2 of pronotum length. Anterior angles quadrate, sharp, posterior angles obtuse, blunt. Basal margin sinuate, subapical bead obliterated in the middle. Surface with deep dense punctures.

Scutellum. Shape subtriangular, with rounded sides, and acute apex. Ratio width/length 1.4. Surface sparsely punctate.

Elytra with striae defined by regular rows of punctures. Subsutural interstice with 2–3 rows of sparse punctures, 2nd–4th interstices with 1 irregular secondary stria.

Pygidium finely granulated with long setae at hind margins. Ratio width/length 1.8.

Space between the mesocoxae narrow, flat. Mesometasternal suture well defined, at base of mesocoxae. Abdominal sternites with 1 rows of setae and 5–7 rows of punctures per sternite. Last sternite strigate, with subapical bead thick and sinuate, apical membrane narrow.

Protibia (Fig. 12) bidentate, apical tooth long and curved, proximal tooth above internal apex of protibia, triangular in shape, acute. Metatibia slightly narrower subapically. Ratio length/width 3.1. First external carina constituted by a row of sparse setae. Surface punctate above second external carina and rugose below. Protarsal claws: external claw strongly curved, internal claw bifurcate, with upper branch of same length and 2/3 the width of the lower one, inferior margin sinuate.

Genitalia. Aedeagus (Fig. 20): parameres with blunt point in a lateral view, slightly sinuate ventral margin. Endophallus (Fig. 28) globular, median lobe as two weakly sclerotized plates.

Variation. Venter and legs from orange to reddish brown. Body length 11.5–12.7 mm, body width 5.9–7.1 mm. Clypeus w/l: 2.0–2.2. Interocular ratio (interocular width/width of eye): 2.3–2.7. Antenna: ratio funiculus/club 0.7–0.9. Pronotum w/l: 1.8–1.9. Scutellum w/l: 1.4–1.6. Pygidium w/l: 1.6–1.9. Metatibia l/w: 2.9–3.0. Females:

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similar to males, protibia (Fig. 12) with wider teeth; internal protarsal claw narrower with curved inferior margin; last sternite with curved apex.

Diagnosis: medium size, pronotum completely black, elytra ochre.

Another species with black pronotum and light colored elytra is *A. hoepfneri* Bates 1888, but it's bigger, with reddish brown head and thorax, pronotum with light colored and slightly sinuate lateral margins, denser punctuation on elytra, a dark wide band on elytral suture and maculae on calli.

Etymology: from Latin adjectives *nigrus*, -a, -um, black, and *flavus*, -a, -um, yellow, for the combination of black pronotum and ochre elytra.

Distribution: Osa peninsula and southern Puntarenas province lowlands, from 0 to 47 m (Fig. 43).

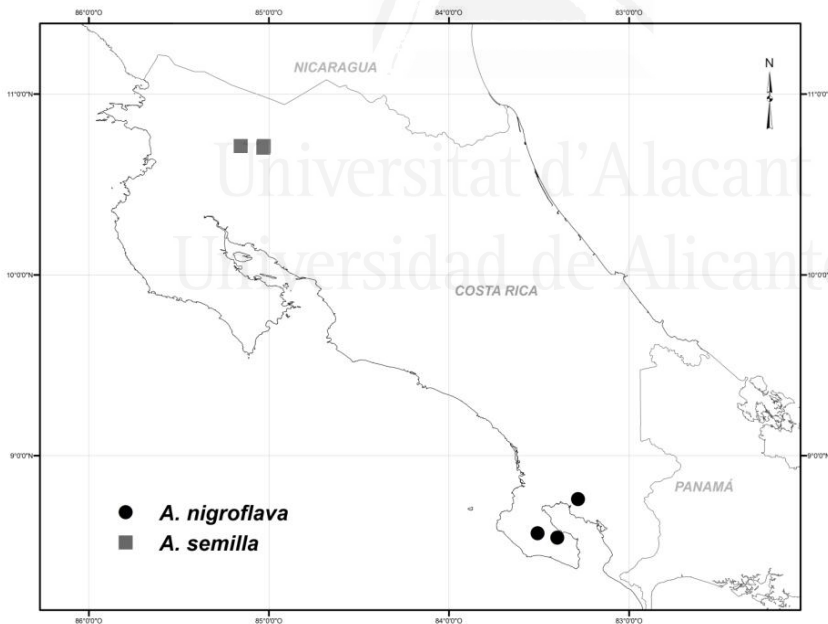


Figure 43: Distribution of *A. nigroflava* and *A. semilla*.

Anomala semilla sp.n. Filippini, Galante & Micó

Material examined. Holotype: ♂ "COSTA RICA. Prov. Alajuela. Upala. P.N. Volcán Tenorio. Alb. Heliconias. Send. a Laguna Danta. 900m. 15 JUN 2007. J. D. Gutiérrez. Tp. Luz 1. L_N_299100_424000 #92206 / CEUA00106176".

Paratypes (8): 1♂ "Albergue Heliconias, Prov. Alajuela, Costa Rica. 15/06/2007 Leg. D. Gutiérrez / CEUA00106174"; 1♂ "COSTA RICA. Prov. Alajuela. Upala. P.N. Volcán Tenorio. Alb. Heliconias. Send. a Laguna Danta. 900m. 15 JUN 2007. J. D. Gutiérrez. Tp. Luz 1. L_N_299100_424000 #92206 / CEUA00106175"; 1♀ "COSTA RICA. Prov. Alajuela. Upala. P.N. Volcán Tenorio. Alb. Heliconias. Send. a Laguna Danta. 900m. 15 JUL 2007. J. D. Gutiérrez. Tp. Luz 1. L_N_299100_424000 #92233 / CEUA00106177"; 1♂ 4♀ "Estación Cabro Muco. Repr. ICE-Z.P. Miravalles. Guanacaste, Costa Rica. 1000 m 12/06/2010 L. V.Filippini, M.Moraga" / CEUA00106178, CEUA00106181, CEUA00106182 and 2 INBIO.

Holotype male: Body shape oval. Length 13.61 mm. Width 7.89 mm.

Color. (Fig. 5). Entire body blackish brown.

Clypeus trapezoidal, surface densely punctate-reticulate, flat. Anterior margin straight, clypeus thickness frontally thin. Ratio width/length 2.4. Frons densely punctate, flat. Ocular canthum short, thin, with rounded apex. Interocular ratio (interocular width/width of eye): 4.0. Antenna: ratio funiculus/club 0.7.

Pronotum trapezoidal. Ratio width/length 1.5. Lateral margins sinuate. Anterior angles right, sharp, posterior angles obtuse, sharp. Basal margin sinuate, subapical bead obliterated in the middle. Surface rugose.

Scutellum. Shape subpentagonal, with rounded sides and blunt apex. Ratio width/length 1.4. Surface densely punctate.

Elytra with irregular rows of coalescing punctures. Surface covered with secondary punctures, irregular.

Pygidium finely strigate, with long setae at hind margin. Ratio width/length 1.7.

Mesometasternal suture well defined, at base of mesocoxae. Abdominal sternites with 1–3 rows of setae (denser on second sternite) and 4–7 rows of punctures per

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sternite. Last sternite strigate, with subapical bead thin and sinuate, apical membrane wide.

Protibia (Fig. 13) bidentate, apical tooth long and curved, proximal tooth at same level as internal apex of protibia, triangular in shape, sharp, acute. Metatibia stout, slightly narrower subapically. Ratio length/width 2.4. First external carina constituted by a row of sparse setae. Surface rugose. Protarsal claws: internal claw bifurcate, with upper branch of same length and $\frac{2}{3}$ the width of the lower one, branches widely open, inferior margin sinuate.

Genitalia. Aedeagus (Fig. 21): parameres long with narrow apex, ventral margin strongly sinuate in a lateral view. Ventral plate with two long and narrow projections at apical sides. Endophallus (Fig. 29) with one long dorsal sacculus, and a shorter ventral sacculus, where ejaculatory duct opening is located, with a sclerotized flattened plate at apex and a patch of sclerotized setae at base.

Variation. Color from reddish to blackish brown. Body length 12.2–13.7 mm, body width 7.2–7.9 mm. Clypeus w/l: 2.2–2.4. Interocular ratio (interocular width/width of eye): 3.5–4.0. Antenna: ratio funiculus/club 0.7–0.8. Pronotum w/l: 1.5–1.6. Scutellum w/l: 1.4–1.5. Pygidium w/l: 1.5–1.7. Metatibia l/w: 2.2–2.7. Females: similar to males, protibia (Fig. 13) with longer and wider apical tooth; internal protarsal claw with curved inferior margin; last sternite with curved apex.

Diagnosis: medium size, blackish or reddish brown color, lateral margins of pronotum weakly curved, irregular elytral surface, parameres long with narrow apex, ventral plate with two long and narrow projections at apical sides.

Similar to *A. variolosa* and *A. cupreovariolosa*, it can be differentiated by the complete absence of metallic luster, smaller size respect to *A. variolosa*, less curved lateral margins of pronotum, and shape of male genitalia, with longer and slender parameres and presence of projections on ventral plate (Fig. 21 vs. Figs. 18, 35).

Etymology: from Spanish noun *semilla*, seed, used as a noun in apposition, for its rounded shape and irregular surface that resemble a seed.

Distribution: Guanacaste mountain range, from 900 to 1000 m (Fig. 43).

Anomala solisi sp.n. Filippini, Galante & Micó

Material examined. Holotype: ♂ "Amubri, 70m, Talamanca, Prov. Limon, Costa Rica, 1 a 22 jul 1992, G. Gallardo, L-S 385500_578050 / INBIOCR1000751373".

Paratypes (11): 1♀ "COSTA RICA. Prov. Guanacaste. P.N. Rincón de la Vieja. Hda. Santa Maria. 839m. 21 MAY 2003. Cate, Barries, Uhler. Tp. Luz. L_N_304918_394213 #86772 / CEUA00106163"; 1♀ "Sector San Ramon, Prov. Alaju, COSTA RICA. 620 m. 13-28 Mar 1994, K. Taylor, L N 318100_381900 # 2763 / INB001711642"; 1♀ "Rio Sardinas, R.N.F.S. Barra del Colorado, Prov. Limon, COSTA RICA. 10m. 6-14 Abr 1994, F. Araya, L N 291500_564700 # 2854 / INBIOCR1001794815"; 2♂ "Estac. Pitilla, 700m, 9 km S Sta. Cecilia, Guanacaste, COSTA RICA, Mar 1990, P. Rios, C. Moraga & R. Blanco, L- N 330200_380200" / INBIOCR1000195592 and INBIOCR1000195830; 1♂ "Est. Cacao, 1000-1400m, Lado suroeste del Volcan Cacao, Prov. Guan., COSTA RICA, II curso Parataxon., Jun 1990, L- N 323300_375700 / INBIOCR1000255275"; 1♂ "Est. Cacao, 1000-1400m, Lado SO Vol. Cacao, P. N. Guan. Prov. Guanacaste, Costa Rica, R. Guzman, 21 a 28 may 1992, L- N 323300_375700 / CEUA00106162"; 1♂ "Rio Sardinas, 10 m, R.N.F.S. Barra del Colorado, Prov. Limon, Costa Rica, Set 1992, F. Araya, L N 291500_564700 / INBIOCR1000819517"; 1♂ 1♀ "Estac. Pitilla, 700m, 9 Km S. Santa Cecilia, Guanac. Pr. COSTA RICA Jun 1988 GNP Biodiversity Survey W85 25'40" ,N10 59'26" " / INBIOCR1002517383 and INBIOCR1002517690; 1♂ "Est. Pitilla, 700 m, 9 km S Sta. Cecilia, Prov. Guan, COSTA RICA C. Moraga, Abr 1991, L- N 330200_380200 / INBIOCR1000693146".

Holotype male: Body shape oval. Length 10.4 mm. Width 6.6 mm.

Color. (Fig. 6a). Head brown with bronze luster, anterior margin of clypeus lighter. Pronotum brown with bronze luster and ochre sides. Scutellum ochre with dark margins. Elytra dark brown with ochre elongated maculae arranged on sub-basal, median and apical transversal bands. Pygidium ochre with brown flecks. Legs mottled in ochre and brown. Venter dark brown with ochre maculae, bronze luster. Clypeus trapezoidal, surface densely punctate-reticulate, flat. Anterior margin straight, clypeus thickness frontally thin. Ratio width/length 2.0. Frons densely punctate with a triangular concavity. Ocular canthum long, thin, with rounded apex.

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Interocular ratio (interocular width/width of eye): 2.5. Antenna: ratio funiculus/club 0.6.

Pronotum subtrapezoidal, ratio width/length 1.9, lateral margins regularly convex. Anterior angles right and sharp, posterior angles obtuse and blunt. Basal margin sinuate, subapical bead complete. Surface densely punctate.

Scutellum subtriangular, with rounded sides and blunt apex. Ratio width/length 1.4. Surface sparsely punctate, slightly convex and with a subapical sulcus.

Elytra with costae defined by regular rows of punctures. Subsutural interstice with 2–3 rows of punctures, 2nd–4th interstices with 1–2 rows of punctures. Surface covered with secondary punctures.

Pygidium coarsely punctate with long setae at hind margin. Ratio width/length 2.1.

Space between the mesocoxae narrow, slightly convex. Mesometasternal suture well defined, at base of mesocoxae. Abdominal sternites with 1 row of setae and 3–5 rows of punctures per sternite. Last sternite strigate, with subapical bead thick and sinuate and wide apical membrane.

Protibia (Fig. 14) bidentate, apical tooth short and curved, proximal tooth at same level as internal apex of protibia, triangular in shape, sharp, acute. Metatibia stout, fusiform. Ratio length/width 2.6. First external carina constituted by a row of sparse setae, surface punctate-rugose above second external carina and rugose below. Protarsal claws: internal claw bifurcate, with upper branch of same length and half the width of the lower one, inferior margin sinuate.

Genitalia. Aedeagus (Fig. 22): parameres with indented apex and strongly sinuate ventral margin; hairy at apex. Endophallus (Fig. 30): median lobes heavily sclerotized, endophallus developing dorsally, T-shaped, with a flattened plate of sclerotized spines on one extreme, and a long diverticle on the other one; ejaculatory sclerite and ejaculatory opening in the middle; presence of wide based spines at apex of diverticle and posterior extremity of endophallus; a small patch of setae is present medially on a side and sparse setae are present near apical plate.

Variation. Head and pronotum with bronze or green luster; elytra from nearly completely ochre with sparse brown maculae, to mainly brown with few light maculae (Fig. 6a and 6b); green or bronze luster can be present. Isolated spines on endophallus are present in groups of two-four, and can be present also at base of diverticle and frontally above apex of median lobe. Body length 10.3–11.5 mm, body width 6.2–7.4 mm. Clypeus w/l: 2.0–2.1. Interocular ratio (interocular width/width of eye): 2.5–3.0. Pronotum w/l: 1.8–1.9. Scutellum w/l: 1.4–1.5. Pygidium w/l: 1.8–2.1. Metatibia l/w: 2.4–2.8. Females: similar to males, protibia (Fig. 14) with longer and wider apical tooth; proximal tooth above internal apex; internal protarsal claw narrower with curved inferior margin; last sternite with curved apex.

Diagnosis: very similar to *A. oreas* Ohaus 1897, it is differentiated by the slightly smaller size and symmetrical parameres, whereas in *A. oreas* (Colombia, MNHUB) the left paramere is wider and curved internally and downwards (Fig. 38); the right paramere is similar to those of *A. solisi*, but with different proportions.

Etymology: we are pleased to dedicate this species to Ángel Solís, curator of the beetle collection at INBio, for his kind help with the consultation of the scarab collection and his efforts in its expansion.

Distribution: Guanacaste mountain range and Caribbean lowlands, from 10 to 850 m (Fig. 42).

Anomala volsellata sp.n. Filippini, Galante & Micó

Material examined. Holotype: ♂ "COSTA RICA. Prov. Puntarenas. Osa. R.F. Golfo Dulce. Cerro Brujo. 612m. 24-25 ENE 2009. J. A. Azofeifa, A. Chamorro. Tp. Luz Mercurio. L_S_290700_509100 #95674 / INB0004191779". Paratypes (6): ♂ "COSTA RICA. Prov. Puntarenas, Golfito, P. N. Corcovado, Cerro Rincón, Las Quebraditas, 500m, 1 MAY 2002, A. Azofeifa, A. Solis, Tp. Luz, L_S_275200_520100 #70567 / CEUA00106205"; ♀ "COSTA RICA. Prov. Puntarenas. Osa. R.F. Golfo Dulce. Cerro Brujo. 612m. 24-25 ENE 2009. J. A. Azofeifa, A. Chamorro. Tp. Luz Mercurio. L_S_290700_509100 #95674 / INB0004191843"; ♂ "Estac. Carara, 200m R. B. Carara, Puntarenas COSTA RICA. Mar. 1990, R. Zuñiga, L N 195250_478700 /

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INBIOCRI000168281"; 2♀ "Est. Bijagual, 600 m. N de Bijagualito, Prov. San J, COSTA RICA. 500m. ABR 1995. J. C. Saborio, L_N_191800_476800 #4826" / INBIOCRI002190664 and CEUA00106206; 1 F# "MUSEO DE INSECTOS UNIVERSIDAD DE COSTA RICA. COSTA RICA, PROV. San José, 16 km N Quepos. 19-11-66 G. Fuentes" MUCR.

Holotype male: Body shape oval. Length 11.33 mm. Width 6.21 mm.

Color. (Fig. 7). Head reddish brown, with lighter clypeus. Pronotum ochre with an inverted pentagonal reddish brown macula on disc, not reaching posterior margin. Scutellum ochre with darker margins. Elytra ochre with dark brown maculae on apical calli, and on 2 transversal bands. Pygidium ochre with dark brown pairs of maculae at sides and on basal margin. Legs ochre, tibiae with dark brown base, apex and external carinae, metatibiae with brown apical third; tarsi reddish brown. Venter ochre with dark brown median metasternal disc, abdominal sternites reddish brown.

Clypeus trapezoidal, with anterior angles widely curved, surface densely punctate-reticulate, convex. Anterior margin straight, clypeus thickness frontally thin. Ratio width/length 2.0. Frons densely punctate, with a small circular concavity near suture with clypeus. Ocular canthum long, thin, with acute apex. Interocular ratio (interocular width/width of eye): 2.8. Antenna: ratio funiculus/club 0.7.

Pronotum subtrapezoidal. Ratio width/length 1.8. Lateral margins regularly convex. Anterior angles quadrate, sharp, posterior angles obtuse, blunt. Basal margin absent. Surface densely punctate.

Scutellum. Shape subtriangular, with rounded sides and acute apex. Ratio width/length 1.5. Surface sparsely punctate.

Elytra with costae defined by regular rows of punctures. Subsutural interstice with 2 rows of punctures, 2nd–4th interstices with 1 secondary stria. Surface covered with secondary punctures.

Pygidium strigate with long setae at hind margin. Ratio width/length 1.9.

Space between the mesocoxae narrow, slightly convex. Mesometasternal suture obliterated in the middle, at base of mesocoxae. Abdominal sternites with 1 row of

setae and 3–6 rows of punctures per sternite. Last sternite punctate, with subapical bead thin and sinuate, apical membrane wide.

Protibia (Fig. 15) bidentate, apical tooth long and curved, proximal tooth below internal apex of protibia, triangular in shape, acute. Metatibia stout, slightly narrower subapically. Ratio length/width 3.0. First external carina well developed. Surface punctate above second external carina, punctate-rugose below. Protarsal claws: external claw strongly curved, internal claw bifurcate, with upper branch of same length and half the width of the lower one, inferior margin showing a sharp angle near base.

Genitalia. Aedeagus (Fig. 23): parameres short, with a blunt apex in a lateral view. Endophallus (Fig. 31): one elongated sacculus, with ejaculatory duct opening frontally at apex, a subapical diverticle covered in long setae; dorsally at median point a pair of facing curved claws, lodged inside membranes at rest, but that can potentially be everted.

Variation. Pronotum from reddish brown to green; size and number of maculae on elytra variable, abdominal sternites from reddish brown to ochre with dark brown sides and last sternite. Body length 10.4–11.6 mm, body width 5.7–6.4 mm. Interocular ratio (interocular width/width of eye): 2.8–3.3. Pronotum w/l: 1.7–1.9. Scutellum w/l: 1.2–1.5. Pygidium w/l: 1.7–1.9. Metatibia l/w: 2.9–3.3. Females: are similar to males, protibia (Fig. 15) with wider apical tooth; proximal tooth above internal apex; internal protarsal claw narrower with curved inferior margin; last sternite with curved apex.

Diagnosis: medium size, rounded shape, elytra with rounded maculae arranged in bands, parameres short, with a blunt apex in a lateral view, endophallus with a pair of claws.

The shape and elytral pattern relate this species to *A. semitonsa* Bates 1888 and *A. balzapambae* Ohaus 1897, but these latter species are covered in setae, and have different shaped male genitalia (illustrated in Filippini *et al.* 2013)

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Etymology: adjective from noun *volsella*, -ae, tongs, claws, for the peculiar structure in the endophallus.

Distribution: Coastal mountain range and Osa peninsula, from 200 to about 600 m (Fig. 42).

Anomala zumbadoi sp.n. Filippini, Galante & Micó

Material examined. Holotype: ♂ "Rancho Quemado, Peninsula de Osa, 200m. Prov, Punt., COSTA RICA, F. Quesada, Dic 1991, L- S 292500_511000 / INBIOCR1000483151".

Paratypes (8): 1♀ "Rancho Quemado, Peninsula de Osa, 200m. Prov, Punt., COSTA RICA, F. Quesada, Dic 1991, L- S 292500_511000 / INBIOCR1000483150"; 1♂ "Rancho Quemado, 200m, Peninsula de Osa, Prov. Puntarenas, Costa Rica, Nov 1992, R. Aguilar, M. Segura y F Quesada L-S 292500, 511000 / INBIOCR1000938231"; 1♂ "COSTA RICA. Prov. Puntarenas. Pen. de Osa. P.N. Piedras Blancas. Est. Esquinas. Boca del Río Esquinas. 200m. DEC 1993. M. Segura, J. Quesada. L_S_301400_542200 #2537 / CEUA00106203"; 1♂ 1♀ "Rancho Quemado, 200m, Peninsula de Osa, Prov. Puntarenas, Costa Rica, Nov 1992, R. Aguilar, M. Segura y F Quesada L-S 292500, 511000" / INBIOCR1000938230 and INBIOCR1000938232; 2♀ "Rancho Quemado, Peninsula de Osa, 200m. Prov, Punt., COSTA RICA, F. Quesada, Dic 1991, L- S 292500_511000" / INBIOCR1000483153 and INBIOCR1000483154; 1♀ "Rancho Quemado, Peninsula de Osa, 200m, Prov. Punt., Costa Rica, F. Quesada, Dic 1991. L_S_292500_511000 #990 / CEUA00106204".

Holotype male: Body shape oval. Length 11.0 mm. Width 6.5 mm.

Color. (Fig. 8). Head and pronotum reddish brown. Scutellum reddish brown with darker margins. Elytra ochre with black suture, lateral margins, maculae on apical calli and a black wavy median transversal band. Pygidium, legs, venter dark reddish brown.

Clypeus rectangular, surface densely punctate-reticulate, flat. Anterior margin straight, clypeus thickness frontally thin. Ratio width/length 2.1. Frons densely punctate, flat. Ocular canthum long, stout, with rounded apex. Interocular ratio (interocular width/width of eye): 3.3. Antenna: ratio funiculus/club 0.7.

Pronotum subtrapezoidal. Ratio width/length 1.5. Lateral margins angulated at $\frac{1}{3}$ of pronotum length. Anterior angles acute, posterior angles obtuse, blunt. Basal margin sinuate, subapical bead obliterated in the middle. Surface with deep dense punctures.

Scutellum with rounded sides and blunt apex. Ratio width/length 1.4.

Elytra with costae defined by regular rows of punctures. Subsutural interstice with 2–3 rows of punctures, 2nd–4th interstices with 1 secondary stria. Surface covered with secondary punctures.

Pygidium finely strigate with short setae on disc, long setae at hind margin.

Space between the mesocoxae narrow, slightly convex. Mesometasternal suture well defined, at base of mesocoxae. Abdominal sternites with 1 row of setae and 3–5 rows of punctures per sternite. Last sternite strigate, with subapical bead thin and curved, apical membrane narrow.

Protibia (Fig. 16) bidentate, apical tooth long and curved, proximal tooth at same level as internal apex of protibia, triangular in shape, obtuse. Metatibia stout, fusiform. Ratio length/width 2.4. First external carina constituted by a row of sparse setae. Surface rugose. Protarsal claws: internal claw bifurcate, with upper branch of same length and $\frac{2}{3}$ the width of the lower one. Inferior margin sinuate.

Genitalia. Aedeagus (Fig. 24): parameres long, with narrow and curved apex pointing downwards in a lateral view. Endophallus (Fig. 32) with one long sacculus, covered with microsetation, curved backwards; one small patch of spines dorsally at base; ejaculatory duct opening ventrally at base. Median lobe absent.

Variation. Head and pronotum from reddish to blackish brown; black transversal band on elytra of variable width, additional black longitudinal stripes may be present on costae, of variable length. Body length 10.7–12.8 mm, body width 6.4–7.0 mm. Clypeus w/l: 2.1–2.5. Interocular ratio (interocular width/width of eye): 2.8–3.4. Antenna: ratio funiculus/club 0.6–0.8. Pronotum w/l: 1.5–1.6. Scutellum w/l: 1.4–1.5. Pygidium w/l: 1.9–2.0. Metatibia l/w: 2.2–2.5. Females: similar to males, protibia (Fig.

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16) with wider apical tooth, internal protarsal claw narrower with curved inferior margin, last sternite with curved apex.

Diagnosis: medium size, pronotum reddish brown, elytra with a black wavy median transversal band, parameres long, with narrow and curved apex pointing downwards in a lateral view.

Related to *A. chapini* Robinson 1948, *A. clathrata* Ohaus 1930 and *A. popayana* Ohaus 1897, which share the elytral pattern, but these species are bigger, *A. chapini* and *A. clathrata* have darker pronotum and venter, elytra with narrower and often interrupted transversal band, long and well marked dark strips on costae. *A. clathrata* has shorter and wider parameres (Fig. 39); *A. popayana* have black, less punctated pronotum with steeper lateral margins, parameres with short squared apex in lateral view (Fig. 40).

Etymology: we are pleased to dedicate this species to Manuel Zumbado, coordinator of the Biodiversity Unit at INBio, for its invaluable help during our joint researches in Costa Rica.

Distribution: Coastal mountain range and Osa peninsula, from 200 to 300 m (Fig. 41).

Acknowledgements

We thank Mr. Ángel Solís, from the Instituto Nacional de Biodiversidad, Costa Rica for the loan of specimens; Johannes Frisch and Joachim Willers from the Museum für Naturkunde der Humboldt-Universität, Berlin for assistance with type material consultation. We also thank Dr. Miguel A. Alonso Zarazaga for his tips on nomenclature.

Financial support was provided by the Agencia Española de Cooperación Internacional para el Desarrollo (AECID) projects A/4426/05, A/6788/06, A/019887/08, A/023060/09 and a PhD grant to V. Filippini from the Spanish Ministry of Education.

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Universitat d'Alacant
Universidad de Alicante

3.6 - Description of new small sized *Anomala* species from Costa Rica (Coleoptera: Scarabaeidae: Rutelinae).

[Descripción de nuevas especies de pequeño tamaño de *Anomala* de Costa Rica (Coleoptera: Scarabaeidae: Rutelinae)]



Universitat d'Alacant

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Abstract. Eight new species of *Anomala* from Costa Rica are described: *Anomala coffea* new species, *A. cyclops* new species, *A. divisa* new species, *A. mersa* new species, *A. mesosticta* new species, *A. robiginosa* new species, *A. strigodermoides* new species, *A. unilineata* new species. The distribution map and male genitalia (aedeagus and endophallus) of each species are illustrated.

Key words: aedeagus, species distribution, endophallus, new species.

Waiting to be sent for publishing

Introduction

In this paper we describe eight new species of *Anomala* from Costa Rica: *Anomala coffea* sp.n., *A. cyclops* sp.n., *A. divisa* sp.n., *A. mersa* sp.n., *A. mesosticta* sp.n., *A. robiginosa* sp.n., *A. strigodermoides* sp.n., *A. unilineata* sp.n..

The diversity of this genus in Costa Rica is ever increasing (Filippini *et al.* 2013, 2014) and the study of male genitalia is revealing important for species definitions, and the recognition of several complex of species with pairs or more species externally indistinguishable, but with clearly distinct male genitalia (as in *A. pincelada* - *A. incostans* group, *A. solisi* - *A. oreas*, *A. robiginosa* sp.n. - *A. sticticoptera*).

Material and methods

The material cited in this publication is deposited in the following collections:

CEUA Colección Entomológica de la Universidad Alicante, Spain

INBIO Instituto Nacional de Biodiversidad, Costa Rica

MNHUB Museum für Naturkunde der Humboldt Universität zu Berlin, Germany

To prepare the endophallus for study, the following procedure was used. The aedeagus was washed in a 10% hot KOH solution for 5–10 minutes and then rinsed in distilled water. It was then kept in lactic acid for a minimum of 48 hours, until the structures of the aedeagus and endophallus became translucent. The endophallus was everted by injecting water from the base of aedeagus with a syringe equipped with a suitable needle, or microforceps (WPI Dumont #5) when the length of the internal sac made the syringe method inefficient. The dissection was transferred to a microvial containing glycerine, which was attached to the insect pin. From 3–6 specimens of each species were dissected.

Line drawings were traced in GIMP image manipulation program (version 2.8, www.gimp.org). Original drawings were done with the aid of a camera lucida attached to a stereo microscope (Leica M80) for endophalli, or from photographs for aedeagi (taken with a Leica DFC450 camera mounted on a Leica M205C stereo microscope).

All measurements were taken from photographs of the specimens, using Leica Application software. A Leica DFC450 camera mounted on a Leica M205C stereo microscope was used to take the photographs.

The following definitions were used in the description. Body length: from tip of clypeus to pygidium. Body width: measured on widest point of elytra. Clypeus width: measured at half height. Ratio interocular width/width of eye: widths measured at half the height of eyes. Pronotum width: measured at base. Metatibia ratio: length measured from below the articulation with femur to tip, on the median axis; width measured at widest point.

Clypeus thickness in frontal view: thick if more or equal to 0.30 mm; thin if less than 0.30 mm.

We follow the traditional inclusion of New World species in the genus *Anomala* (Jameson *et al.* 2003) as taxonomic treatment, in contrast to the recent paper by Ramírez-Ponce and Morón (2009), who group them into a new genus *Paranomala*, as a more conservative classification, waiting for a more extensive study at global scale.

This work is meant to be part of a general taxonomical work on *Anomala* in Costa Rica. To exclude cases of synonymy, the type specimens for 173 Neotropical species (about 80% of species cited) have been studied (listed in *Anexo 2*), and available literature has been consulted for the rest.

Description of species

Anomala coffea sp.n. Filippini, Galante & Micó

Material examined. Holotype: ♂ "Est. Pitilla, 700 m, 9 km S Sta. Cecilia, P. N. Guanacaste, Prov. Guanacaste, Costa Rica, C. Moraga 8 a 24 ago 1991, L- N 330200,380200 / INBIOCR1000409517".

Paratypes (6): 1♀ "Estac. Pitilla, 700m, 9 Km S. Santa Cecilia, Guanac. Pr. COSTA RICA Jul 1988 GNP Biodiversity Survey W85 25 40", N10 59 26" / INB0003315377"; 1♂ "Est. Pitilla, 700 m, 9 km S Sta. Cecilia, P. N. Guanacaste, Prov. Guan. COSTA RICA, Tp Malaise, 1990. L N 330200,380200 / INBIOCR1000304012"; 1♂ "Est. Pitilla, 700 m, 9 km S Sta. Cecilia, P. N. Guanacaste, Prov. Guanacaste, Costa Rica, C. Moraga, 2 a 15 may 1992, L N 330200,380200 / INBIOCR1000405396"; 1♂ "Est. Pitilla, 700m, 9 km S Sta. Cecilia, P. N. Guanacaste, Prov. Guanacaste, Costa Rica, K. Taylor, 31 mar - 29 abr 1992, L- N 330200,380200 / INBIOCR1000523773"; 1♀ "Est. Pitilla, 700 m, 9 km S Sta. Cecilia, P. N. Guanacaste, Prov. Guan. COSTA RICA, C. Moraga, 6-28 Ene 1992, L- N 330200,380200 / CEUA00106195"; 1♂ "Est. Pitilla, 700m, 9km S Sta. Cecilia, P.N. Guanacaste, Prov. Guanacaste, Costa Rica, 22 oct a 2 nov 1992, C. Moraga L-N 330200,380200 / CEUA00106194".

Male: Body shape oval. Length 8.99 mm. Width 5.19 mm.

Color. Fig. 1. Head and pronotum dark brown. Scutellum reddish brown. Elytra dark brown, but lighter than pronotum. Pygidium ochre. Legs orange on femurs, reddish brown on tibiae and tarsi. Venter orange on sternum, abdominal sternites ochre.

Clypeus trapezoidal, short, surface densely punctate-reticulate, convex. Anterior margin curved, frontally thick. Ratio width/length 2.50. Frons sparsely punctate, flat. Ocular canthum long, thin, with rounded apex. Interocular ratio (interocular width/width of eye): 2.84. Antenna: ratio funiculus/club 0.74.

Pronotum subtrapezoidal. Ratio width/length 1.69. Lateral margins angulated at 1/3 of pronotum length. Anterior angles acute, sharp, posterior angles obtuse, blunt. Basal margin sinuate, subapical bead obliterated in the middle. Surface with deep, dense punctures.

Scutellum. Shape subtriangular, with rounded sides, and acute apex. Ratio width/length 1.19. Surface sparsely punctate.

Elytra with costae defined by regular rows of punctures. Subsutural interstice with 1–2 rows of sparse punctures, 2nd–4th interstices with 1 irregular secondary stria.

Pygidium sparsely punctate with long setae at hind margins. Ratio width/length 1.77.

Space between the mesocoxae narrow, flat. Mesometasternal suture well defined, at base of mesocoxae. Abdominal sternites with 1 row of setae, and 4–5 rows of punctures per sternite. Last sternite strigate, with subapical bead thin and sinuate, apical membrane thin.

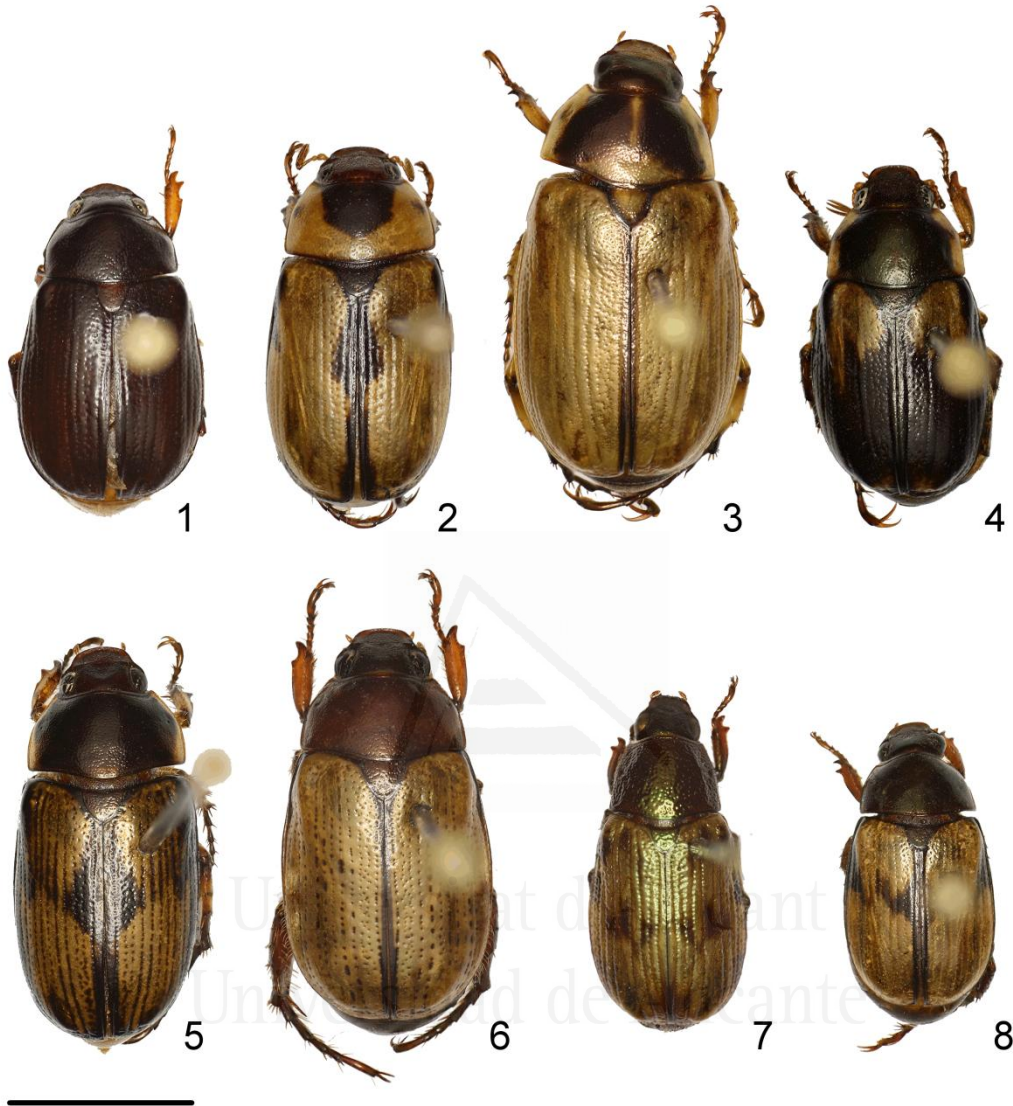
Protibia (Fig. 9) tridentate, apical tooth long and curved, middle tooth above internal apex of protibia, triangular in shape, acute, basal tooth sharp. Metatibia stout, fusiform. Ratio length/width 2.81. First external carina constituted by a row of sparse setae, surface punctate. Protarsal claws: external claw strongly curved, internal claw bifurcate, with upper branch slightly shorter and $\frac{2}{3}$ the width of the lower one, inferior margin curved.

Male genitalia. Aedeagus (Fig. 17): parameres slender, with squared protruding apex in lateral view, slightly sinuate ventral margin. Endophallus (Fig. 25) with one long glabrous sacculus. Ejaculatory duct opening frontally on a ventral inflation.

Female. Similar to male, protibia (Fig. 9) with wider teeth; last sternite with curved apex.

Variation. Dorsal surface from dark reddish brown to dark brown; pygidium and venter from orange to ochre. Body length 8.99–10.17 mm, body width 5.19–5.76 mm. Clypeus w/l: 2.50–2.93. Interocular ratio (interocular width/width of eye): 2.84–3.19. Antenna: ratio funiculus/club 0.73–0.79. Pronotum w/l: 1.69–1.72. Scutellum w/l: 1.13–1.33. Pygidium w/l: 1.68–1.82. Metatibia l/w: 2.60–2.81.

Diagnosis: small size, homogeneously dark brown color, elytra with defined costae and interstices with rows of punctures, protibia tridentate.



Figures 1–8. Habitus. 1: *Anomala coffea* (holotype). 2: *A. cyclops* (holotype). 3: *A. divisa* (holotype). 4: *A. mersa* (holotype). 5: *A. mesosticta* (holotype). 6: *A. robiginosa* (holotype). 7: *A. strigodermoides* (holotype). 8: *A. unilineata* (holotype). Scale = 5mm.

The small size and brown color may resemble the species of *Anomala* (*Bucaphallanus*) Ramírez-Ponce and Morón 2012 subgenus, but *A. coffea* doesn't share any diagnostic character of it, and has more defined punctation on elytra.

Etymology: from the scientific name of coffee plants, to be treated as a noun in apposition, for its resemblance in shape and color to toasted coffee beans, one of most famous Costa Rican products.

Distribution: Guanacaste mountain range, 700 m (Fig. 34).

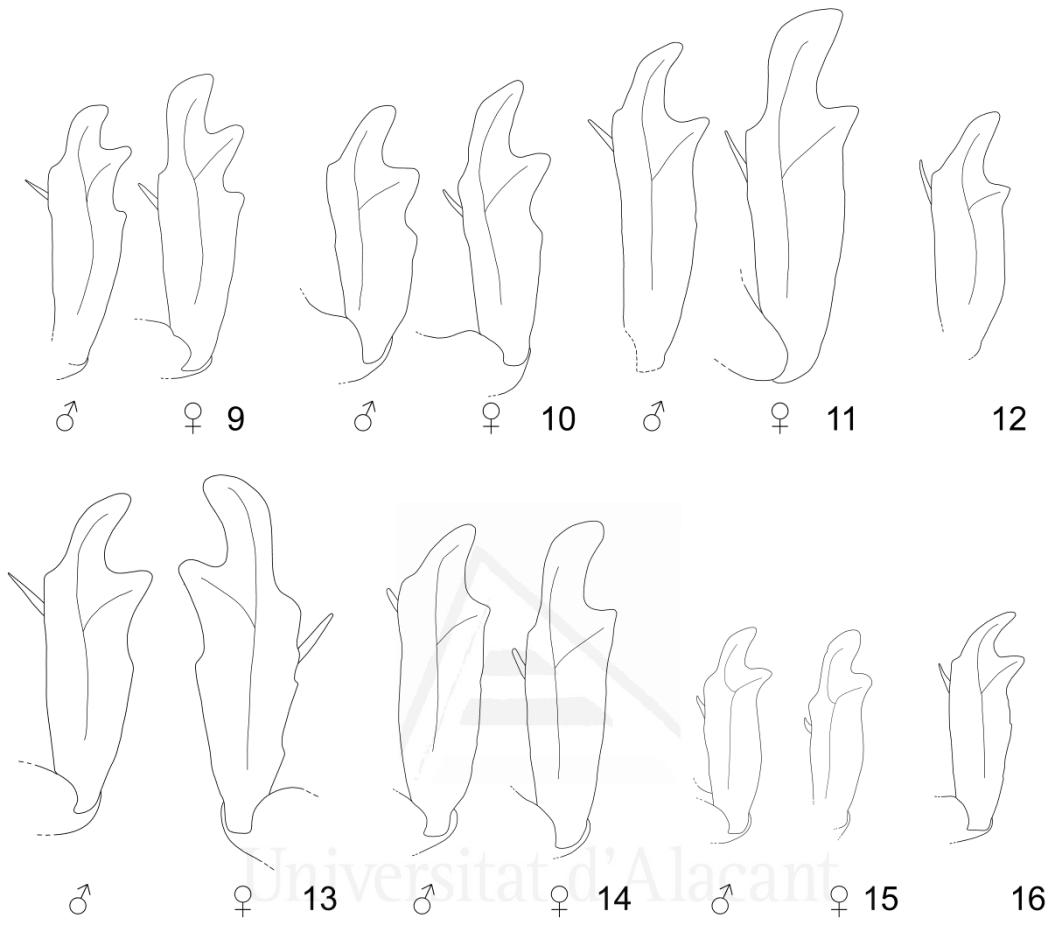
Anomala cyclops sp.n. Filippini, Galante & Micó

Material examined. Holotype: ♂ "Cerro El Hacha, 300m, 12 km SE de La Cruz, Prov. Guanacaste, Costa Rica, 25 jun 1992, III curso Parataxon. L-N 329200,368000 / INBIOCRI000755645".

Paratypes (9): 1♂ "Est. Sta. Rosa, 300m, P. N. Sta. Rosa, Prov. Guanacaste, Costa Rica, 3 a 12 jun 1992, III Curso Parataxon. L- N 313000,359800" / INBIOCRI000458888"; 1♀ "Est. Sta. Rosa, 300 m, P. N. Guanacaste, Prov. Guan, COSTA RICA. D. H. Janzen & W. Hallwachs, Jun 1991, L-N 313000,359800 / INBIOCRI000590279; 1♂ 1♀ "Est. Sta. Rosa, 300m, P. N. Sta. Rosa, Prov. Guanacaste, Costa Rica, 1 a 12 jun 1992, A. M. Mora, L-N 313000,359800" / INBIOCRI000912716 and CEUA00106197; 1♀ "Los Almendros, P. N. Guanacaste, Prov. Guana., COSTA RICA. 12-31 May 1993, E. Lopez, L- N 334800, 369800 / INBIOCRI001168088"; 1♂ "Fca. Jenny, 30 km N de Liberia, P. N. Guanacaste, Prov. Guan., COSTA RICA. 25-29 May 1993. E. Araya. L-N 316200,364400 / INBIOCRI001183834"; 2♂ "Finca Jenny, 30 km N de Liberia, P. N. Guanacaste, Prov. Guan., COSTA RICA. 20-24 May 1993. E. Araya. L-N 316200,364400" / INBIOCRI001184178 and CEUA00106196; 1♀ "Est. Murcielago, 8 km SO. de Cuajiniquil, P. N. Guanacaste, Prov. Guana, COSTA RICA. 100 m. 3 May 1994, C. Cano, L N 320300_347200 # 2907 / INBIOCRI001891273".

Male: Body shape oval. Length 9.82 mm. Width 5.09 mm.

Color. Fig. 2. Head reddish brown. Pronotum ochre with a pentagonal dark brown macula on disc, with apex pointing posteriorly, and a small macula on lateral foveae. Scutellum dark brown. Elytra ochre with dark brown sides, expanding at base, on median and apical parts of suture. Pygidium and venter ochre. Legs ochre with reddish tarsi and apical part of tibiae.



Figures 9–16. Shape of protibia in ♀: *Anomala coffea* (male: holotype; female: paratype, Estación Pitilla, Costa Rica). 10: *A. cyclops* (male: holotype; female: paratype, Los Almendros, Costa Rica). 11: *A. divisa* (male: holotype; female: paratype, Estación Biológica Las Alturas, Costa Rica). 12: *A. mersa* (male: paratype, Sector Palo Verde, Costa Rica). 13: *A. mesosticta* (male: holotype; female: paratype, Rio Sardinas, Costa Rica). 14: *A. robiginosa* (male: holotype; female: paratype, Santa Rosa National Park, Costa Rica). 15: *A. strigodermoides* (male: holotype; female: paratype, Catarata río Buenavista, Alajuela). 16: *A. unilineata* (holotype). Scale = 1mm.

Clypeus trapezoidal, surface densely punctate-reticulate, flat. Anterior margin straight and frontally thin. Ratio width/length 2.42. Frons punctate, less densely than clypeus, with a triangular concavity. Ocular canthum long, thin, with rounded apex.

Interocular ratio (interocular width/width of eye): 2.9. Antenna: ratio funiculus/club 0.85.

Pronotum subtrapezoidal. Ratio width/length 1.75. Lateral margins angulated at 1/3 of pronotum length. Anterior angles quadrate and sharp. Posterior angles obtuse and blunt. Basal margin sinuate, subapical bead complete. Surface with deep dense punctures.

Scutellum. Shape subtriangular, with rounded sides and acute apex. Ratio width/length 1.4. Surface sparsely punctate.

Elytra with costae defined by regular rows of punctures. Subsutural interstice with 2 rows of sparse punctures, 2nd–4th interstices with 1 irregular secondary stria.

Pygidium sparsely punctate with long setae at hind margins. Ratio width/length 1.52.

Space between the mesocoxae narrow, slightly convex. Mesometasternal suture well defined, at base of mesocoxae. Abdominal sternites with 1 row of setae and 3–5 rows of punctures per sternite. Last sternite strigate, with subapical bead thin and sinuate, apical membrane thin.

Protibia (Fig. 10) tridentate, apical tooth long and curved, middle tooth below internal apex of protibia, triangular in shape, acute, basal tooth sharp. Metatibia fusiform. Ratio length/width 3.16. First external carina well developed, surface punctate. Protarsal claws: internal claw bifurcate, with upper branch slightly shorter and half the width of the lower one, inferior margin sinuate.

Male genitalia. Aedeagus (Fig. 18): parameres with wide apex in lateral view and sinuate ventral margin. Endophallus (Fig. 26) with one long glabrous sacculus. Ejaculatory duct opening frontally on a lateral inflation

Female. Similar to male, protibia (Fig. 10) with wider teeth; last sternite with curved apex.

Variation. Head from orange to dark reddish brown; presence of a complete or incomplete reddish brown transversal band on elytra or median expansion on suture; pygidium and venter from ochre to light brown. Body length 8.44–10.29 mm, body

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width 4.41–5.37 mm. Clypeus w/l: 2.11–2.54. Interocular ratio (interocular width/width of eye): 2.50–2.90. Antenna: ratio funiculus/club 0.67–0.85. Pronotum w/l: 1.67–1.78. Scutellum w/l: 1.10–1.43. Pygidium w/l: 1.48–1.68. Metatibia l/w: 2.88–3.28.

Diagnosis: medium-small size, light color with a median dark macula on pronotum and a transversal band on elytra, protibia tridentate, parameres with wide apex in lateral view and sinuate ventral margin.

Etymology: from Latin noun *Cyclops*, *-opis*, one-eyed mythological creature, to be treated as a noun in apposition, for the single macula on pronotum.

Distribution: Guanacaste mountain range, from 100 to 300 m (Fig. 35).

Anomala divisa sp.n. Filippini, Galante & Micó

Material examined. Holotype: ♂ "Alajuela. Costa Rica Cinco Esquinas de Carrizal, 1800m 16 abril de 1988 Col: G. Barrantes / INBIOCR1002517128".

Paratypes (6): 2♂ "Zarcero, Alfaro Ruiz, 1700m Alajuela Pr. COSTA RICA. Apr - May 1989. A. Del Valle & A. Solis, L- N 240500, 493500" / INBIOCR1000022463 and CEUA00106199; 3♂ 1♀ "Est. Biol. Las Alturas 1500 m, Coto Brus, Prov. Puntarenas, Costa Rica, F. Araya, 23 mar a 2 may 1992, L- S 322500,591300" / CEUA00106198, INBIOCR1000909434, INBIOCR1000916198 and INBIOCR1000909406.

Male: Body shape oval. Length 12.87 mm. Width 6.47 mm.

Color. Fig. 3. Head reddish brown with a ochre apical fringe and clypeus. Pronotum ochre with two large trapezoidal reddish brown maculae, touching anterior and posterior margins, with bronze luster. Scutellum ochre with thin reddish sides. Elytra ochre with reddish suture. Pygidium ochre. Legs ochre with light to reddish brown apical part of tibiae and tarsi. Venter reddish to dark brown, sternum with ochre sides.

Clypeus trapezoidal, with anterior angles widely curved, surface densely punctate-reticulate, convex. Anterior margin straight and frontally thin. Ratio width/length 1.99. Frons densely punctate, flat. Ocular canthum long, thin, with acute apex.

Interocular ratio (interocular width/width of eye): 3.52. Antenna: ratio funiculus/club 0.79.

Pronotum subtrapezoidal. Ratio width/length 1.81. Lateral margins angulated at 1/3 of pronotum length. Anterior angles quadrate and sharp, posterior angles quadrate and blunt. Basal margin sinuate, subapical bead complete. Surface with deep dense punctures.

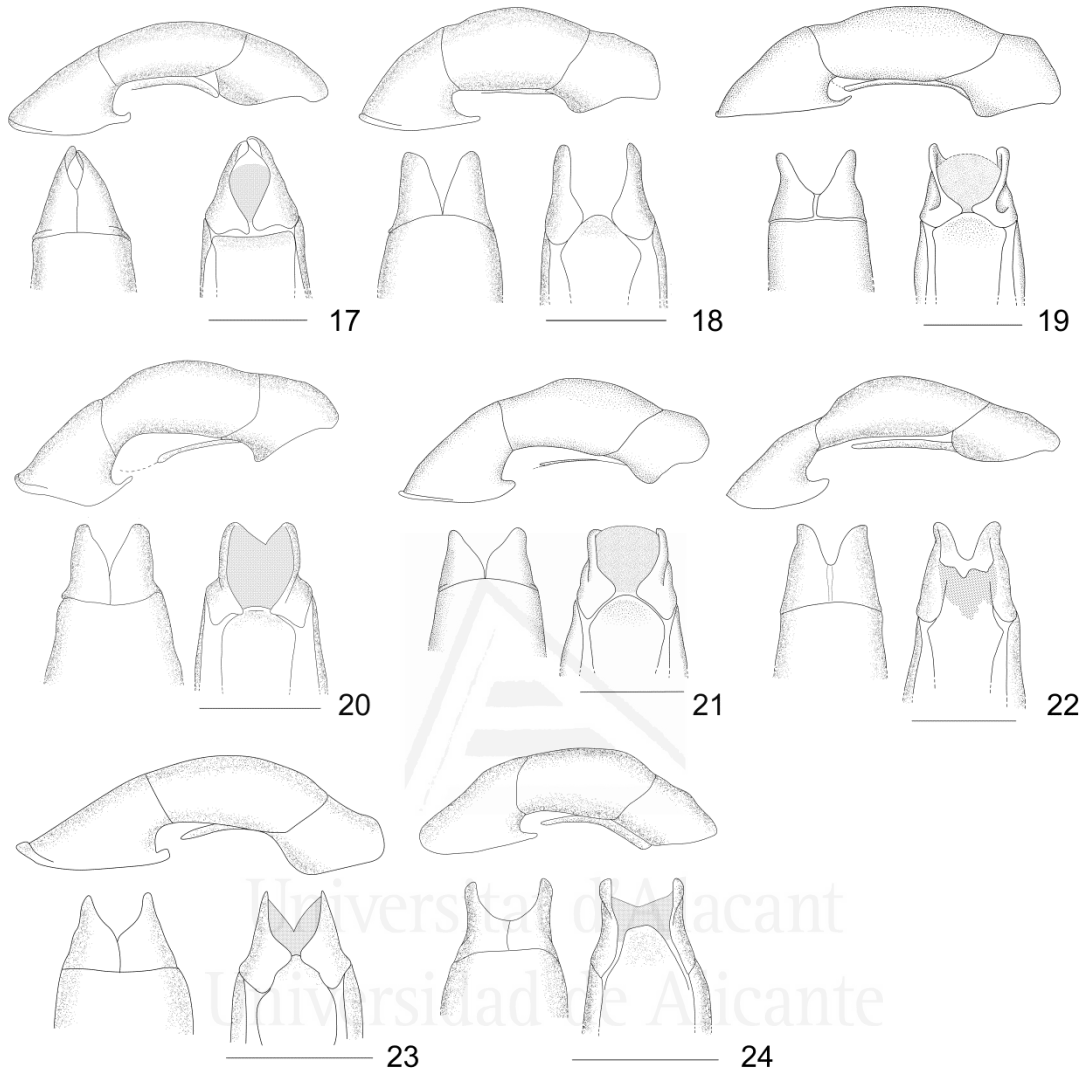
Scutellum. Shape subtriangular, with rounded sides and acute apex. Ratio width/length 1.56. Surface sparsely punctate.

Elytra with costae defined by regular rows of punctures. Subsutural interstice with 2–4 rows of sparse punctures, 2nd–4th interstices with 1–2 irregular secondary stria. Surface covered with secondary punctures.

Pygidium finely granulated with long setae at hind margins. Ratio width/length 1.57. Space between the mesocoxae narrow, slightly convex. Mesometasternal suture well defined, at base of mesocoxae. Abdominal sternites with 1 row of setae (2 rows on second sternite) and 5–7 rows of punctures per sternite. Last sternite strigate, with subapical bead thin and sinuate, apical membrane wide.

Protibia (Fig. 11) bidentate, apical tooth long and curved, basal tooth below internal apex of protibia, triangular in shape, acute. Metatibia slender, fusiform. Ratio length/width 3.39. First external carina constituted by a row of sparse setae, surface punctate. Protarsal claws: internal claw bifurcate, with upper branch of same length and half the width of the lower one. Inferior margin making a sharp angle at half length.

Male genitalia. Aedeagus (Fig. 19): parameres with blunt apex in lateral view, defined ventral angle. Endophallus (Fig. 27) with one ventral and one dorsal inflations. On dorsal inflation a long curved claw, a patch of sclerotized thick setae; on ventral inflation is located the ejaculatory duct opening. Median lobes very thin and long, dorsally between their apices a sclerotized plate is located.



Figures 17–24. Shape of aedeagus, lateral view (top), dorsal view (bottom left), ventral view (bottom right). 17: *Anomala coffea* (paratype, Estación Pitilla, Costa Rica). 18: *A. cyclops* (holotype). 19: *A. divisa* (holotype). 20: *A. mersa* (holotype). 21: *A. mesosticta* (holotype). 22: *A. robiginosa* (paratype, Zarcero, Costa Rica). 23: *A. strigodermoides* (holotype). 24: *A. unilineata* (paratype, Santa Rosa National Park, Costa Rica). Scale = 1mm.

Female. Similar to male, protibia (Fig. 11) with wider teeth; internal protarsal claw narrower with curve inferior margin; last sternite with curved apex.

Variation. Maculae on pronotum can fuse in one large, with bronze or green luster. Female specimen has ochre venter. Claw on endophallus can have bifurcated tip.

Body length 12.04–13.56 mm, body width 6.47–7.18 mm. Clypeus w/l: 1.85–2.01. Interocular ratio (interocular width/width of eye): 3.42–3.93. Antenna: ratio funiculus/club 0.70–0.79. Pronotum w/l: 1.79–1.87. Scutellum w/l: 1.22–1.56. Pygidium w/l: 1.57–1.66. Metatibia l/w: 3.16–3.61.

Diagnosis: medium size, two large trapezoidal dark maculae on pronotum, parameres with blunt apex and defined ventral angle.

Similar species, also present in Costa Rica, are *A. jansoni* Ohaus 1897, but it's slightly larger, with smaller maculae on pronotum and long, slender and curved parameres in a lateral view; *A. quiche* Ohaus 1897, that has smaller and more separated maculae on pronotum, maculae on elytral calli and parameres with wider and blunter apex (aedeagi illustrated in chapter 3.4).

Etymology: from the past participle of Latin verb *divido*, to divide, for the ochre median line on pronotum and dark suture on elytra that visually divide in half the dorsal part of this species.

Distribution: Central and Talamanca mountain ranges, from 1500 to 1800 m (Fig. 36).

Anomala mersa sp.n. Filippini, Galante & Micó

Material examined. Holotype: ♂ "COSTA RICA, Prov. Guanacaste, Bagaces, P.N. Palo Verde, Sector Palo Verde. 0-50m. 29 NOV-15 DIC 1999. W. Porras. Manual L_N_260952_385020 #57243 / INB0003151362".

Paratypes (4): 4♂ "COSTA RICA, Prov. Guanacaste, Bagaces, P.N. Palo Verde, Sector Palo Verde. 0-50m. 29 NOV-15 DIC 1999. W. Porras. Manual L_N_260952_385020 #57243" / INB0003151362, INB0003151360, INB0003151358 and INB0003151412.

Male: Body shape oval. Length 9.31 mm. Width 4.73 mm.

Color. Fig. 4. Head reddish brown. Pronotum dark brown with wide ochre sides, with green luster. Scutellum brown. Elytra dark brown with big ochre maculae on basal part and two small ochre maculae at apex. Pygidium light brown with ochre apex and sides at base. Legs ochre with reddish brown tarsi, metatibiae and apical part of pro-

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and mesotibiae. Venter ochre on sternum, with darker median suture, and reddish brown abdominal sternites.

Clypeus trapezoidal, surface densely punctate-reticulate, flat. Anterior margin straight, frontally thin. Ratio width/length 1.98. Frons densely punctate, convex on suture with clypeus. Ocular canthum long, thin, with rounded apex. Interocular ratio (interocular width/width of eye): 3.46. Antenna: ratio funiculus/club 0.71.

Pronotum subtrapezoidal, basal portions of lateral sides nearly parallel. Ratio width/length 1.66. Lateral margins angulated at $\frac{1}{3}$ of pronotum length. Anterior angles quadrate, sharp, posterior angles quadrate, blunt. Basal margin sinuate, subapical bead complete. Surface with dense punctures.

Scutellum subtriangular, with rounded sides and acute apex. Ratio width/length 1.24. Surface densely punctate.

Elytra with striae defined by regular rows of punctures. Subsutural interstice with 1–2 rows of sparse punctures, 2nd–4th interstices with 1 irregular secondary stria. Surface covered with secondary punctures.

Pygidium strigate with long setae at hind margins. Ratio width/length 1.60.

Space between the mesocoxae narrow, slightly convex. Mesometasternal suture well defined, at base of mesocoxae. Abdominal sternites with 1 row of setae and 5–6 rows of punctures per sternite. Last sternite strigate, with subapical bead thin and sinuate, apical membrane thin.

Protibia (Fig. 12) bidentate, apical tooth long and curved, basal tooth below internal apex of protibia, triangular in shape, sharp. Metatibia slightly narrower subapically. Ratio length/width 2.92. First external carina constituted by a row of sparse setae. Surface rugose. Protarsal claws: internal claw bifurcate, with upper branch slightly shorter and $\frac{2}{3}$ the width of the lower one, inferior margin curved.

Male genitalia. Aedeagus (Fig. 20): parameres with blunt apex in a lateral view, ventral angle acute. Endophallus (Fig. 28) with one long sacculus covered with short

setae, a patch of sclerotized spines at base. Ejaculatory duct opening on a lateral inflation.

Female. Unknown.

Variation. Posterior margin of pronotum dark or with two ochre median maculae, size of ochre maculae on elytra variable, pygidium from ochre, to ochre with light brown maculae on lateral depressions, to light brown; venter from ochre with brown bands on abdominal sternites to mainly brown. Body length 8.93–9.31 mm, body width 4.73–5.00 mm. Clypeus w/l: 1.80–2.02. Interocular ratio (interocular width/width of eye): 3.13–3.61. Antenna: ratio funiculus/club 0.57–0.71. Pronotum w/l: 1.66–1.70. Scutellum w/l: 1.21–1.37. Pygidium w/l: 1.54–1.62. Metatibia l/w: 2.82–3.11.

Diagnosis: small size, elytra dark brown with big ochre maculae on basal part, parameres with blunt apex in a lateral view, ventral angle acute.

Etymology: from the past participle of Latin verb *mergo*, dipped, for the black apical portion of elytra, as if it was dipped into black dye.

Distribution: National park Palo Verde, at top of Nicoya gulf, from 0 to 50 m (Fig. 34).

Anomala mesosticta sp.n. Filippini, Galante & Micó

Material examined. Holotype: ♂ "Los Arbolitos, Prov. Hered. COSTA RICA. 30m. 20-27 MAR 1993. F. Araya. L_N_291400_536100 #1952 / INBIOCR100167711".

Paratypes (9): 2♂ "La Virgen de Sarapiquí, prov. Here., COSTA RICA. 9 a 30 mar 1993. M. Ortiz. L_N_263950_521050" / INBIOCR1001299837 and CEUA00106193; 2♂ "Amubri, Prov. Limon, COSTA RICA. 70 m. 08-27 nov 1993, G. M. Gallardo, L S 385500_578100 # 2461" / CEUA00106192 and INBIOCR1001957606; 1♀ "Limon, Costa Rica Reserva Hitoy-Cerere Rio Cerere 100 msnm 24 marzo 1987 Angel Solis / INBIOCR1002517679"; 1♀ "Rio Sardinas, 10 m, R.N.F.S. Barra del Colorado, Prov. Limon, COSTA RICA. 18 a 30 feb 1993. F. Araya, L-N-291500, 564700 / INBIOCR1001297396"; 1♂ "R.B. Hitoy Cerere, Valle La Estrella, Prov. Limon, COSTA RICA. 100-200m. 9-14 May 1994, G. Carballo, L N 643400_184600 # 2856 / INBIOCR1001798864"; 1♂ "Amubri, Prov. Limon, COSTA RICA. 70m. 12-31 Oct 1993. G.

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Gallardo, L S 385500_578000 # 2407 / INBIOCR1001644531"; 1♂ "Cuatro Esquinas, P. N. Tortuguero, Prov. Limon, COSTA RICA. om, April 1989, R. Aguilar & J. Solano, L- N 280000_590500 / INBIOCR1000084822".

Male: Body shape oval. Length 10.88 mm. Width 5.52 mm.

Color. Fig. 5. Head reddish brown. Pronotum dark brown on disc, with sides and basal median part ochre. Scutellum dark brown with reddish sides. Elytra ochre with dark brown margins, expanding on median and apical parts of suture; punctures of striae pigmented. Pygidium, legs and venter ochre.

Clypeus trapezoidal, surface densely punctate-reticulate, convex. Anterior margin straight, frontally thin. Ratio width/length 2.24. Frons punctate, less densely than clypeus, with a triangular concavity. Ocular canthum long, thin, with rounded apex. Interocular ratio (interocular width/width of eye): 2.99. Antenna: ratio funiculus/club 0.73.

Pronotum subtrapezoidal. Ratio width/length 1.7. Lateral margins angulated at 1/3 of pronotum length. Anterior angles right, sharp, posterior angles obtuse, blunt. Basal margin sinuate, subapical bead complete. Surface with deep dense punctures.

Scutellum. Shape subtriangular, with rounded sides and acute apex. Ratio width/length 1.38. Surface densely punctate.

Elytra with costae defined by regular rows of punctures. Subsutural interstice with 2–4 rows of sparse punctures, 2nd–4th interstices with 1 irregular secondary stria. Surface covered with secondary punctures.

Pygidium with coalescing punctures and long setae at hind margins. Ratio width/length 1.66.

Space between the mesocoxae narrow, slightly convex. Mesometasternal suture well defined, at base of mesocoxae. Abdominal sternites with 1 row of setae and 3–5 rows of punctures per sternite. Sixth abdominal sternite slightly raised, as a bump. Last sternite punctate, with subapical bead thick and sinuate, apical membrane wide.

Protibia (Fig. 13) tridentate, apical tooth long and curved, middle tooth below internal apex of protibia, triangular in shape, acute, basal tooth scarcely developed.

Metatibia fusiform. Ratio length/width 3.23. First external carina well developed. Surface punctate. Protarsal claws: internal claw bifurcate, with upper branch slightly shorter, as wide as the width of the lower one, inferior margin curved.

Male genitalia. Aedeagus (Fig. 21): parameres short with wide blunt apex in lateral view and sinuate ventral margin. Endophallus (Fig. 29) composed by one long sacculus, with a ridge of sclerotized spines at about half the length, and a stripe of sclerotized setae at base. Ejaculatory opening laterally, at apex of an inflation.

Female. Similar to male, protibia (Fig. 13) with longer and wider teeth, last sternite with curved apex.

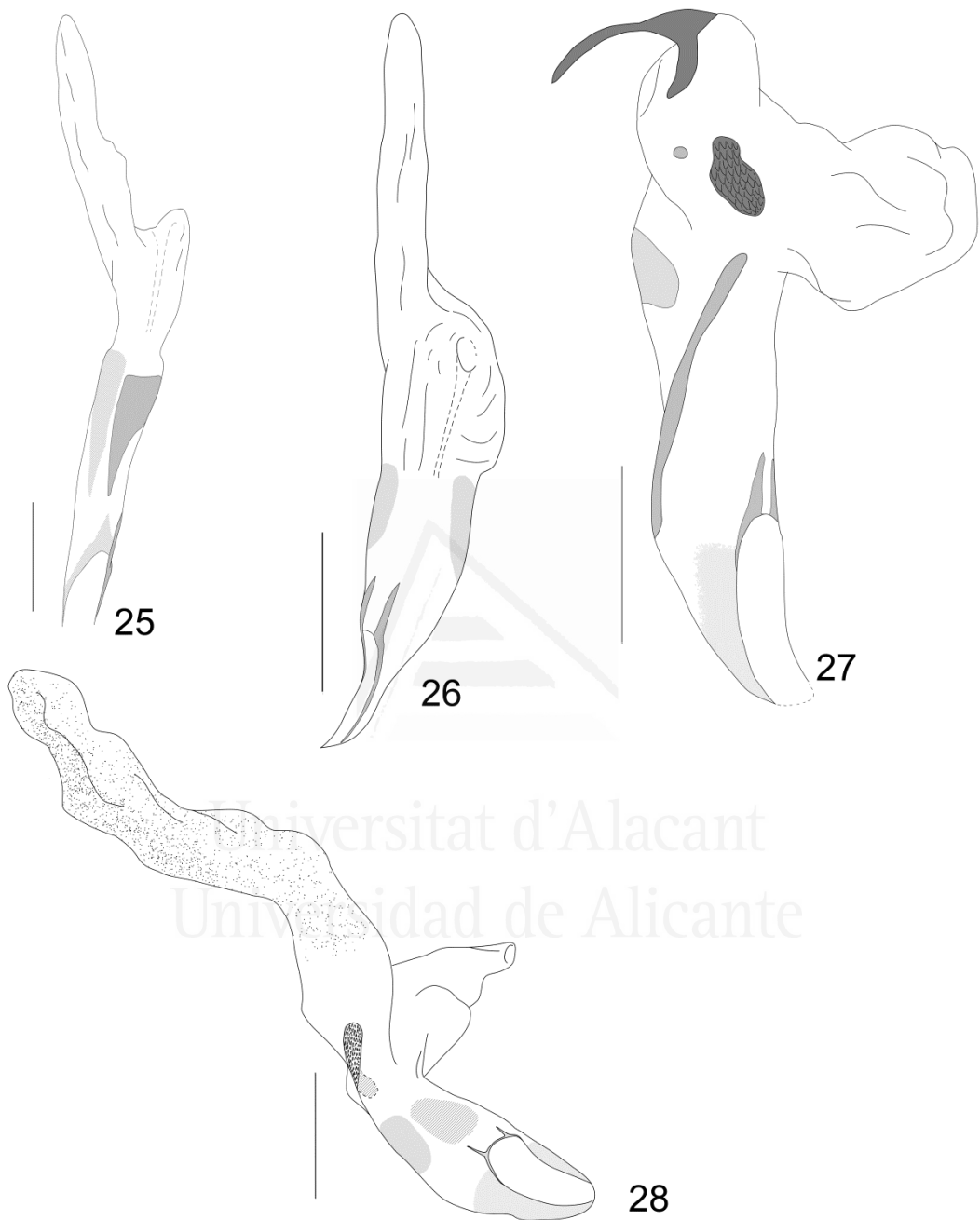
Variation. Head and pronotum disc from reddish to dark brown; extension of dark maculae on pronotum variable, to almost dark with thin ochre sides; dark lateral bands and median expansion on elytra variable in width; venter from ochre to light brown. Body length 10.26–11.76 mm, body width 5.52–6.38 mm. Clypeus w/l: 2.00–2.24. Interocular ratio (interocular width/width of eye): 2.91–3.05. Antenna: ratio funiculus/club 0.73–0.87. Pronotum w/l: 1.62–1.72. Scutellum w/l: 1.33–1.49. Pygidium w/l: 1.59–1.73. Metatibia l/w: 2.79–3.23.

Diagnosis: medium size, elytra ochre with dark brown margins, expanding medially, protibia tridentate, parameres short with wide blunt apex.

Species with similar elytral pattern are *A. denticollis* Bates 1888 (Guatemala), that has sinuate lateral margins of pronotum, and black maculae on calli; *A. hoepfneri* Bates 1888 (Mexico), larger, with dark maculae on basal calli and light colored lateral margins of elytra, wide interstices on elytra, with several irregular rows of punctures.

Etymology: from Greek prefix *mésos*, middle, and adjective *stiktós* maculated, for the central macula on elytra.

Distribution: Caribbean lowlands, from 0 to 200 m (Fig. 35).



Figures. 25–28. Endophallus of 25: *Anomala coffea* (paratype, Estación Pitilla, Costa Rica). 26: *A. cyclops* (paratype, Finca Jenny, Costa Rica). 27: *A. divisa* (holotype). 28: *A. mersa* (paratype, Sector Palo Verde, Costa Rica). Scale = 1mm.

Anomala robiginosa sp.n. Filippini, Galante & Micó

Material examined. Holotype: ♂ "Zarcelero, Alfaro Ruiz, 1700m Alajuela Pr. COSTA RICA. Apr - May 1989. A. Del Valle & A. Solis, L- N 240500_493500 / INBIOCR1002517719".

Paratypes (3): 1♀ "Santa Rosa National Park Guana. Prov. Costa Rica 18-20 May 1979 D. H. Janzen / INBIOCR100011925"; 1♂ "ALAJUELA, COSTA RICA Zarcelero, 1700 m 23-V-87 COL: A. SOLIS B. / CEUA00106202"; 1♂ "Alajuela. Costa Rica. Zarcelero, 1700 m 23 may 1987 Angel Solís / INBIOCR1002517717".

Male: Body shape oval. Length 11.23 mm. Width 5.75 mm.

Color. Fig. 6. Head, pronotum, scutellum bronze brown. Elytra ochre with suture and punctures reddish brown. Pygidium, legs, venter orange brown.

Clypeus trapezoidal, surface densely punctate-reticulate, convex. Anterior margin straight, frontally thin. Ratio width/length 2.09. Frons densely punctate, with a parabolic concavity. Ocular canthum long, thin, with rounded apex. Interocular ratio (interocular width/width of eye): 2.48. Antenna: ratio funiculus/club 0.7.

Pronotum trapezoidal. Ratio width/length 1.84. Lateral margins angulated at 1/3 of pronotum length. Anterior angles quadrate, blunt, posterior angles obtuse, blunt.

Basal margin sinuate, obliterated in the middle. Surface with deep dense punctures.

Scutellum. Shape subtriangular, with straight sides and acute apex. Ratio width/length 1.27. Surface densely punctate.

Elytra with costae defined by rows of sparse coalescing punctures. Subsutural interstice with 1-2 rows of sparse punctures, 2nd-4th interstices with 1 irregular secondary stria.

Pygidium finely granulated, with long setae at hind margins. Ratio width/length 1.65.

Space between the mesocoxae narrow, slightly convex. Mesometasternal suture well defined, at base of mesocoxae. Abdominal sternites with 1 row of setae (2 rows on second sternite) and 3-4 rows of punctures per sternite. Last sternite punctate, with subapical bead thick and sinuate, apical membrane wide.

3.6 Small *Anomala* species

Protibia (Fig. 14) bidentate, apical tooth long and straight, basal tooth below internal apex of protibia, triangular in shape, sharp, obtuse. Metatibia slightly narrower subapically. Ratio length/width 2.98. First external carina constituted by a row of sparse setae. Surface punctate above second external carina and rugose below. Protarsal claws: internal claw bifurcate, with upper branch slightly shorter and $\frac{1}{3}$ the width of the lower one. Inferior margin making a sharp angle at half length.

Male genitalia. Aedeagus (Fig. 22): parameres slender, inferior margin sinuate. Apical portion of ventral plate membranous. Endophallus (Fig. 30) developing dorsally respect to median lobes; a sclerotized flat plate is present posteriorly at base, above which a rounded hairy inflation is present; ejaculatory duct opening located frontally.

Female. Similar to male, protibia (Fig. 14) with longer and wider first tooth; internal protarsal claw narrower with curve inferior margin; last sternite with curved apex.

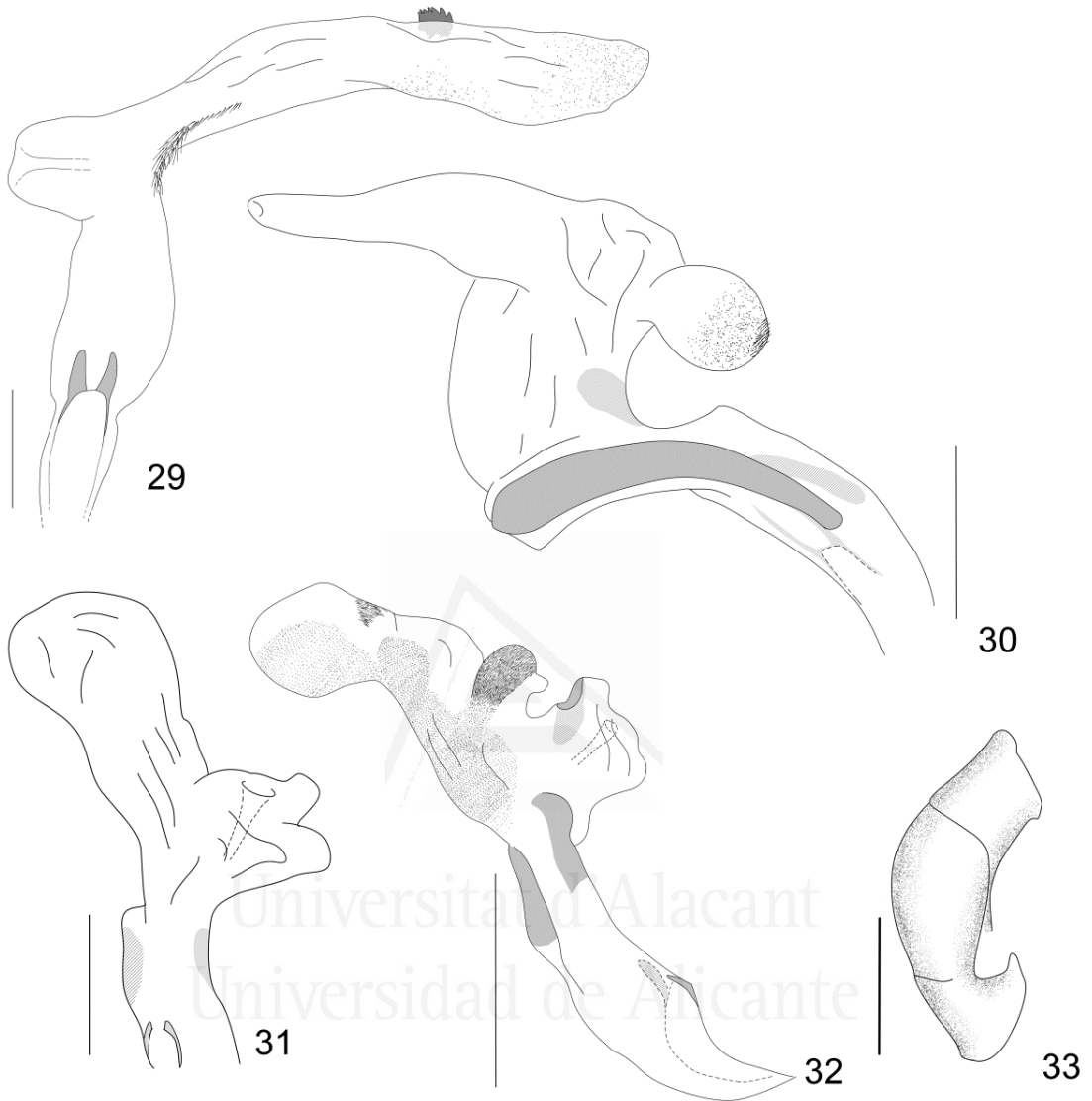
Variation. Head, pronotum and venter from orange to dark brown; presence of small dark maculae on basal third of elytra. Body length 10.68–11.49 mm, body width 5.75–6.44 mm. Clypeus w/l: 2.01–2.33. Interocular ratio (interocular width/width of eye): 2.24–2.75. Antenna: ratio funiculus/club 0.67–0.74. Pronotum w/l: 1.72–1.84. Scutellum w/l: 1.24–1.37. Pygidium w/l: 1.65–1.82. Metatibia l/w: 2.77–3.03.

Diagnosis: medium size, pronotum bronze brown, elytra with pigmented punctures, parameres slender, apex squared in a lateral view, endophallus developing dorsally respect to median lobes.

Very similar to *A. sticticoptera* Blanchard 1851, it can be distinguished by the shape of aedeagus: in this latter species the parameres are shorter, with narrow apex, ventral angle acute and protruding posteriorly (**Fig. 34**).

Etymology: from the Latin adjective *robiginosus*, -a, -um, rusty, for the elytral maculae resembling rust maculae.

Distribution: Guanacaste and Tilarán mountain ranges, from 500 to 1700 m (Fig. 34).



Figures 29–32. Endophallus of 29: *A. mesosticta* (holotype). 30: *A. robiginosa* (holotype). 31: *A. strigodermoides* (holotype). 32: *A. unilineata* (holotype). **Fig. 33.** Aedeagus of *A. sticticoptera*, lateral view (Cuyotenango, Guatemala, MNHUB). Scale = 1mm.

Anomala strigodermoides sp.n. Filippini, Galante & Micó

Type Material. Holotype: ♂ "COSTA RICA. Prov. Alajuela. Bijagua. Albergue Heliconias. 800-900m. 24-26 MAR 2006. B. Gamboa, M. Moraga, J. A. Azofeifa. Tp. Luz. L_N_299800_423800 #85743 / INB0004012910".

3.6 Small *Anomala* species

Paratypes (6): 1♀ "COSTA RICA. Prov. Cartago. Reserva Biol. El Copal. 900-1000m. 24 ABR 2006. B. Gamboa, M. Moraga, E. Navarro. Tp. Luz. L_N_196916_563695 #86066 / INB0004012683"; 1♀ "COSTA RICA. Prov. Alajuela. Bijagua. Albergue Heliconias. 800-900m. 24-26 MAR 2006. B. Gamboa, M. Moraga, J. A. Azofeifa. Tp. Luz. L_N_299800_423800 #85743 / INB0004012911"; 1♀ "COSTA RICA. Prov. Alajuela. Bijagua. Albergue Heliconias. 800-900m. 24-26 MAR 2006. B. Gamboa, M. Moraga, J. A. Azofeifa. Tp. Luz. L_N_299800_423800 #85743 / INB0004012912"; 1♀ "COSTA RICA. Prov. Alajuela. Guatuso. P.N. Volcán Tenorio. Punto 1: Catarata Río Buenavista. 800m. 5 MAY 2008. J. A. Azofeifa. Tp de Luz 1. L_N_298380_427850 #93735 / CEUA00106207"; 1♂ "P.N. Volcán Tenorio. Catarata Río Buenavista. Alajuela, Costa Rica. 780m 15/IV/2010. L. M. Zumbado, J.A.Azofeifa. / CEUA00106208"; 1♂ "P.N. Volcán Tenorio. Catarata Río Buenavista. Alajuela, Costa Rica. 780m 15/IV/2010. L. M. Zumbado, J.A.Azofeifa. / CEUA00106209".

Male: Body shape elongated. Length 9.04 mm. Width 4.89 mm.

Color. Fig. 7. Head , pronotum and scutellum metallic green; elytra ochre with three pairs of brown maculae along basal margin and a brown wavy median transversal band. Rows of punctures lightly pigmented. Entire surface with green luster. Pygidium, legs and venter brown with green luster.

Clypeus trapezoidal, surface densely punctate-reticulate, flat. Anterior margin straight. Ratio width/length 1.9. Frons densely punctate, flat. Ocular canthum long and thin, with acute apex. Interocular ratio (interocular width/width of eye): 2.76. Antenna: ratio funiculus/club 0.64.

Pronotum trapezoidal, long, narrower than elytra. Width 1.26 times length. Lateral margins angulated at $\frac{1}{3}$ of pronotum length. Anterior angles acute, with sharp vertex. Posterior angles obtuse and blunt. Basal margin thin, sinuate complete. Surface irregular, with coalescing punctures.

Scutellum. Shape subtriangular, surface sparsely punctate. Ratio width/length 1.24.

Elytra with striae defined by regular rows of punctures. Surface covered with secondary punctures. Marginal membrane complete very thin.

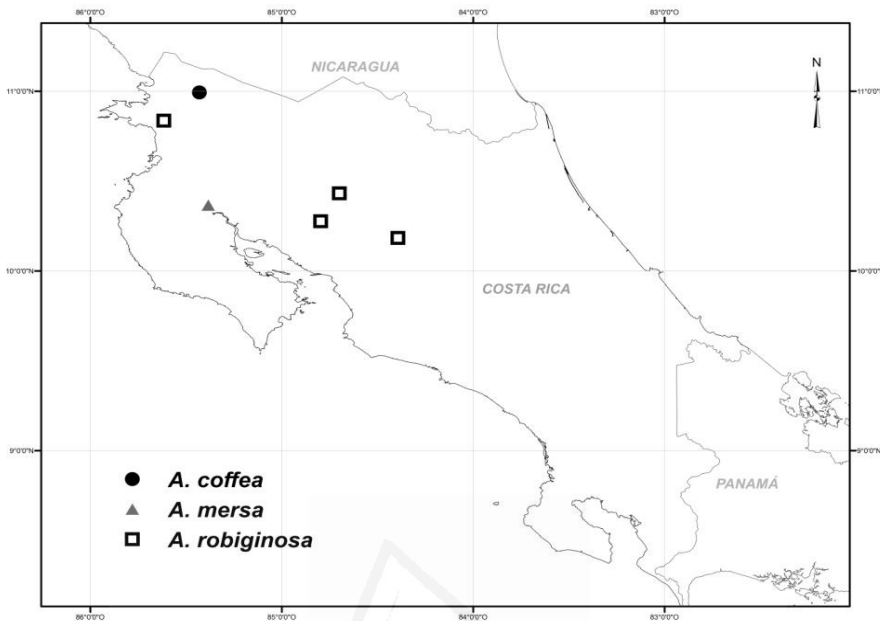


Figure 34. Distribution of *A. coffea*, *A. mersa* and *A. robiginosa*.

Pygidium finely granulated, with short setae on disc and long setae at hind margin. Ratio width/length 1.87.

Space between the mesocoxae narrow, slightly convex. Mesometasternal suture well defined, at base of mesocoxae. Abdominal sternites with 2–3 rows of setae and 3–5 rows of punctures per sternite. Last sternite strigate, with apical margin thin and curved, protruding membrane thin.

Protibia bidentate (Fig. 15); apical tooth long and curved, basal tooth above internal apex of protibia, triangular in shape, acute. Metatibia slender, fusiform. Ratio length/width 2.72. First external carina well developed. Surface punctate above second external carina and rugose below. Protarsal claws: external claw curved; internal claw bifurcate, with upper branch of same length and $\frac{2}{3}$ the width of the lower one; inferior margin making a sharp angle near base.

3.6 Small *Anomala* species

Male genitalia. Aedeagus (Fig. 23): parameres with a squared apex in a lateral view. Endophallus (Fig. 31) with a wide sacculus, ejaculatory duct opening on a basal lateral inflation.

Female. Similar to male; protibia with wider apical tooth; internal protarsal claw narrower with curve inferior margin.

Variation. Elytra with or without green luster; maculae on elytra from reddish to dark brown, may be present on apex also; venter from reddish to brown. Body length 8.17–9.64 mm, body width 4.42–4.89 mm. Clypeus w/l: 1.89–2.08. Interocular ratio (interocular width/width of eye): 2.26–3.04. Antenna: ratio funiculus/club 0.60–0.74. Pronotum w/l: 1.26–1.32. Scutellum w/l: 1.14–1.33. Pygidium w/l: 1.87 (n=1). Metatibia w/l: 2.49–2.82.

Diagnosis: small size, elongated, pronotum narrower than elytra and long, with ratio w/l about 1.30, elytra striated with green luster, aedeagus with parameres squared in lateral view.

Etymology: from the name of genus *Strigoderma* and suffix -oides, for its general resemblance with *Strigoderma* species.

Distribution: Guanacaste and Talamanca mountain ranges, from 750 to 1050 m (Fig. 35).

Anomala unilineata sp.n. Filippini, Galante & Micó

Material examined. Holotype: ♂ "Santa Rosa National Park Guanacaste Prov. COSTA RICA. 17-19 May 1980 DH Janzen & W. Hallwachs / INBIOCR100117054".

Paratype: 1♂ "Santa Rosa National Park Guanacaste Province Costa Rica. D. H. Janzen 5-12 March 1978 / INBIOCR100118447".

Male: Body shape oval. Length 8.52 mm. Width 4.27 mm.

Color. Fig. 8. Head and pronotum dark bronze brown with green luster. Scutellum dark bronze brown. Elytra ochre with dark brown suture and a median wavy band. Pygidium reddish brown. Legs from yellowish to dark brown. Venter reddish brown.

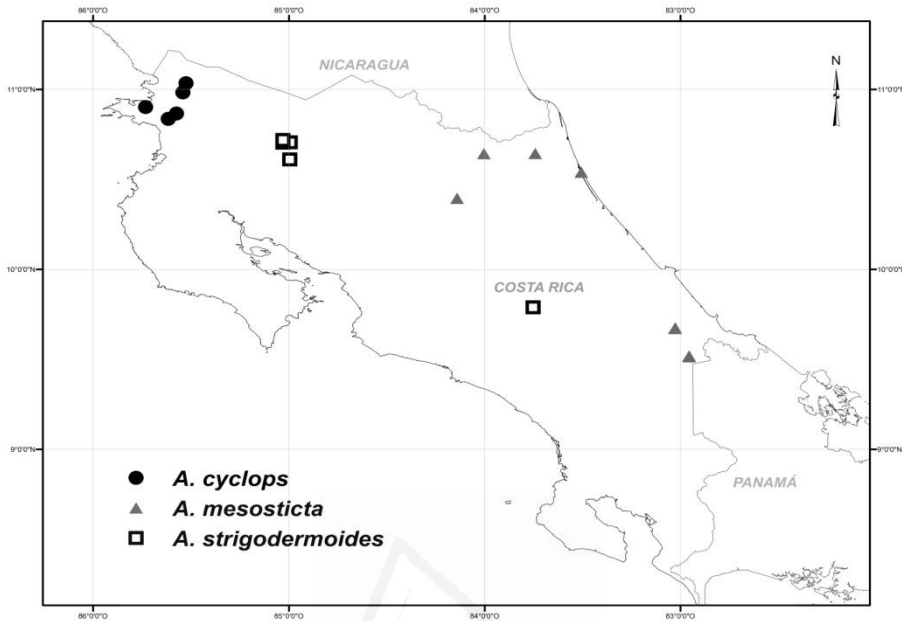


Figure 35. Distribution of *A. cyclops*, *A. mesosticta* and *A. strigodermoides*.

Clypeus trapezoidal, with anterior angles widely curved, surface densely punctate-reticulate, convex. Anterior margin straight, frontally thin. Ratio width/length 2.03. Frons punctate, less densely than clypeus, with a triangular concavity. Ocular canthum long, thin, with acute apex. Interocular ratio (interocular width/width of eye): 2.71. Antenna: ratio funiculus/club 0.7.

Pronotum subtrapezoidal. Ratio width/length 1.57. Lateral margins regularly convex. Anterior angles acute, sharp, posterior angles obtuse, blunt. Basal margin complete. Surface with fine dense punctures.

Scutellum. Shape subtriangular, with rounded sides and blunt apex. Ratio width/length 1.16. Surface sparsely punctate.

Elytra with costae defined by regular rows of punctures. Subsutural interstice with 1–2 rows of sparse punctures, 2nd–4th interstices with 1 irregular secondary stria.

Pygidium strigate with long setae at hind margins. Ratio width/length 1.64.

3.6 Small *Anomala* species

Space between the mesocoxae narrow, flat. Mesometasternal suture well defined, at base of mesocoxae. Abdominal sternites with 1 row of setae and 2–4 rows of punctures per sternite. Last sternite strigate, with subapical bead thin and sinuate, apical membrane thin.

Protibia (Fig. 16) bidentate, apical tooth long and curved, basal tooth below internal apex of protibia, triangular in shape, sharp, acute. Metatibia stout, fusiform. Ratio length/width 3.27. First external carina well developed. Surface rugose. Protarsal claws: external claw strongly curved, internal claw bifurcate, with upper branch of same length and half the width of the lower one, inferior margin sinuate.

Male genitalia. Aedeagus (Fig. 24): parameres with acute blunt apex in lateral view. Endophallus (Fig. 32) elongated, dorsally covered with setae, and with two ventral patches of sclerotized setae. A sclerotized flat plate is present on a ventral inflation, where ejaculatory duct opening is located.

Female. Unknown.

Variation. Head, pronotum and venter reddish to dark brown. Body length 7.74–8.52 mm, body width 4.27–4.28 mm. Clypeus w/l: 2.03–2.07. Interocular ratio (interocular width/width of eye): 2.71–2.83. Antenna: ratio funiculus/club 0.70–0.73. Pronotum w/l: 1.57–1.60. Scutellum w/l: 1.16–1.22. Metatibia l/w: 2.96–3.27.

Diagnosis: small size, pronotum dark bronze brown, elytra ochre with dark brown median wavy band, endophallus elongated, with two ventral patches of sclerotized setae.

Another species with one transversal band on elytra is *A. donovani* Stephens 1830, but it's bigger, with black pronotum, pigmented punctures on elytra and shaded apical portion of elytra.

Other small species, like *A. discoidalis* Bates 1888, *A. retusicollis* Bates 1888, *A. tessellatipennis* Blanchard 1851, *A. undulata* (Melsheimer 1844), have elytra pattern made by isolated maculae, not forming a continue band, apart of different shaped parameres and endophalli.

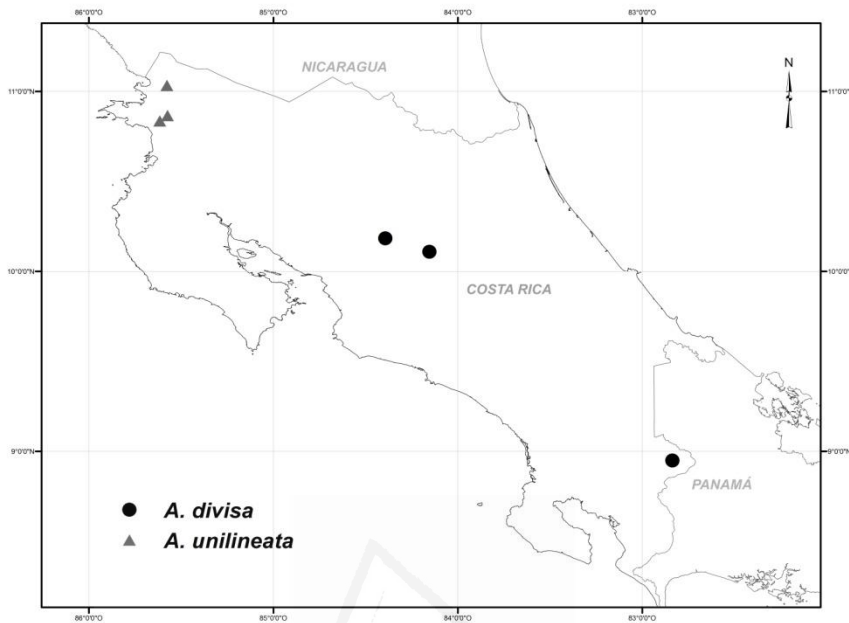


Figure 36. Distribution of *A. divisa* and *A. unilineata*.

Etymology: from Latin adjectives *unus*, -a, -um, one, and *lineatus*, -a, -um, striped, for the single band across elytra.

Distribution: Guanacaste mountain range, from 220 to 300 m (Fig. 36).

Acknowledgements

We thank Mr. Ángel Solís, from the Instituto Nacional de Biodiversidad, Costa Rica for the loan of specimens; Johannes Frisch and J. Willers from the Museum für Naturkunde der Humboldt-Universität, Berlin for assistance with type material consultation. We also thank Dr. Miguel A. Alonso Zarazaga for his tips on nomenclature.

Financial support was provided by the Agencia Española de Cooperación Internacional para el Desarrollo (AECID) projects A/4426/05, A/6788/06, A/019887/08, A/023060/09 and a PhD grant to V. Filippini from the Spanish Ministry of Education.

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Ramírez-Ponce A. & Morón M. Á. 2012. Revision of *Bucaphallanus*, a New Subgenus of *Paranomala* (Coleoptera: Melolonthidae, Rutelinae, Anomalini) with Description of Six New Species from Mexico. *Annals of the Entomological Society of America*, 105(6): 781–803.

Stephens J.F. 1830. *Illustrations of British entomology. Mandibulata. Vol III.* Baldwin and Cradock, London, United Kingdom.



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Capítulo 4

Checklist and identification key of Anomalini (Coleoptera: Scarabaeidae: Rutelinae) of Costa Rica

Universitat d'Alacant
Universidad de Alicante

Listado y clave de identificación de los Anomalini (Coleoptera: Scarabaeidae: Rutelinae) de Costa Rica

Waiting to be sent for publishing

Abstract. In this work we present the checklist for the tribe Anomalini in Costa Rica (genus *Anomala*, *Anomalorhina*, *Callistethus* and *Strigoderma*), with an identification key for all species. *Anomala chrysomelina* is moved to the genus *Callistethus*.

Key words: identification key, new species, *Anomala*, *Callistethus*, *Strigoderma*, *Anomalorhina*, aedeagus, endophallus.

Resumen: En este trabajo se presenta el listado de las especies de la tribu Anomalini de Costa Rica (géneros *Anomala*, *Anomalorhina*, *Callistethus* and *Strigoderma*), con una clave de identificación para todas las especies. *Anomala chrysomelina* se mueve al género *Callistethus*.

Introduction

One reason for the "taxonomic neglect" (Jameson *et al.* 2003) in which the genus *Anomala* has been kept for the past centuries is due to the inverse proportion between the number of species and the taxonomic information about them. Most descriptions date to early XX century and earlier, and their brevity makes it impossible a reliable identification without consulting the type material.

For the Neotropics, only few national checklists are available (Ratcliffe 2002 for Panama and Paucar-Cabrera 2005 for Ecuador) that include Anomalini, and species-level keys are available only for local fauna (for example: Neita *et al.* 2006; Reyes Novelo & Morón 2005; Carrillo Ruiz & Morón 2003; Alcazar Ruiz *et al.* 2003).

In this work we present the checklist for Anomalini of Costa Rica, that comprise 120 species, with photo of the habitus and drawings of male genitalia for nearly all species, and a comprehensive key for identification.

Anomala chrysomelina is moved to the genus *Callistethus*.

Material and methods

The material cited in this publication is deposited in the following collections:

BMNH Natural History Museum, London, United Kingdom

CEUA Colección Entomológica de la Universidad Alicante, Spain

INBIO Instituto Nacional de Biodiversidad, Costa Rica

MNHUB Museum für Naturkunde der Humboldt Universität zu Berlin, Germany

MUCR Museo de insectos, Universidad de Costa Rica, Costa Rica

Procedures for preparation of endophalli, measurements, definitions, morphological terminology as explained in Filippini *et al.* 2013, 2014.

Line drawings were traced in GIMP image manipulation program (version 2.8, www.gimp.org). Original drawings were done with the aid of a camera lucida attached to a stereo microscope (Leica M80) for endophalli, or from photographs for aedeagi (taken with a Leica DFC450 camera mounted on a Leica M205C stereo microscope).

For each species in the checklist the provinces (Fig. 1) where it is present are given. The distribution data have been gathered by labels from identified specimens of INBIO and CEUA collections, and Atta database (<http://atta.inbio.ac.cr/>) of INBio, Costa Rica.

New species identification (excluding newly described species) and corrections of misidentified species are detailed in Table 1.

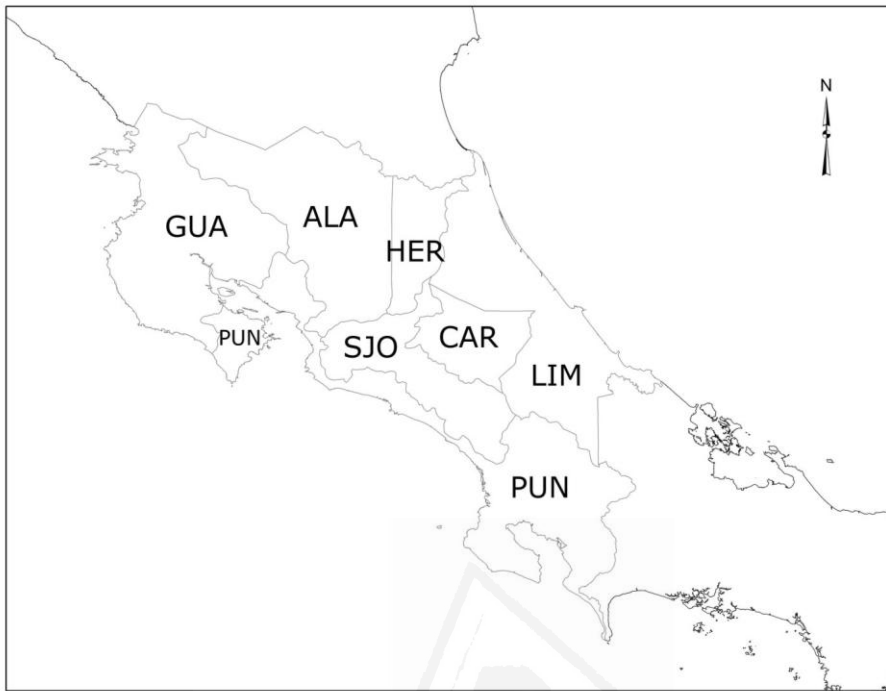


Figure 1. Map of Costa Rica showing provinces. ALA: Alajuela; CAR: Cartago; GUA: Guanacaste; HER: Heredia; LIM: Limón; PUN: Puntarenas; SJO: San José.

Taxonomy and systematics.

Anomala nitidula Blanchard 1851 incertae sedis

Material examined: 1♂ "Guatemala / SPILOTA nitidula Bl." MNHUB; 1♂ "CR Heredia San Rafael 5-XI-1986 col: J.F. Corrales / INBIOCRI002517263"; 1♂ 1♀ "Alajuela, Alfaro Ruiz, Zarcero 7 nov. 1988 Col: A. Solis" / INBIOCRI002517304 and INBIOCRI001007395.

This species show strong affinities with the genus *Balanogonia* Paucar-Cabrera 2003, created based on two species from Mexico, *Balanogonia freudei* (Frey 1968) and *Balanogonia constricta* Paucar-Cabrera 2003, that are also the only members for the genus known until now. The name refers to the evident and unique feature of this genus among Anomalini, that is the male genitalia with parameres perpendicular in

4. Checklist and key

relation to phallobase. Other diagnostic characters are elytra with punctate striae; hind wing with region anterior to RA 3+4 without setae; male genitalia with parameres setose. All these characters are shared also by *Anomala nitidula* Blanchard 1851, however other diagnostic character of the genus are not present in this species: pronotum with anterior angles not acute, not covering posterior 1/3 of eye. This is due to the different shaped pronotum of *A. nitidula*, with acute anterior angles and sinuate basal margin, respect to *B. freudei* and *B. constricta*, that have a suboval pronotum. This is also the case of other possible *Balanogonia* species, as suggested by Paucar-Cabrera (2003): *A. pilosipennis* Ohaus 1897 and *A. villosella* Blanchard 1851. Until further analysis, for example based on molecular data, are conducted on these species to verify if they belong to the same clade, *A. nitidula* is considered *incertae sedis*.

Callistethus chrysomelinus (Bates 1888) new combination

Material examined: 1♂ "Typus / sp figured / V. de Chiriqui 25-4000 ft. Champion / *Anomala chrysomelina* Bates / B.C.A., Col., II(2) *Anomala* " BMNH; 1♂ "San Luis, 1040m, R. B. Monteverde, Prov. Puntarenas, Costa Rica, 24 ago a 15 set 1992, F. A. Quesada, L N 250850_449250 / INBIOCR1000955869"; 1♂ "Buen Amigo, San Luis Monteverde, A. C. Arenal, Prov. Punta, COSTA RICA. 1000-1350 m. May 1994, Z. Fuentes, L N 250850_449250 # 2926 / INBIOCR1001894629"; 1♀ "Est. G. Brenes, 1300m, Res. Biol. Monteverde, Prov. Puntarenas, Costa Rica, E. Bello, Jun 1991, L-N 249750_450075 / INBIOCR1000804874".

It presents the following diagnostic characters of the genus *Callistethus*, as described in Filippini, Galante, Micó 2015³: wide interocular space and small elongated eyes; posterior margin of the pronotum smooth, without bead, straight above the scutellum; presence of a mesosternal process produced slightly beyond the apex of the mesocoxae.

Table 1: Species identifications corrected or added during the study on type material.

WRONG IDENTIFICATIONS	
Original misidentification	New correct identification
<i>Anomala amphicoma</i>	<i>Anomala pseudoeucoma</i>
<i>Anomala chapini</i>	<i>Anomala clathrata</i>
<i>Anomala collaris</i>	<i>Callistethus multiplicatus</i>
<i>Anomala chrysanthe</i>	<i>Callistethus jordani</i>
<i>Anomala guatemalena</i>	<i>Anomala unilineata</i>
<i>Anomala incostans</i>	<i>Anomala pincelada</i>
<i>Anomala jansonii</i>	<i>Anomala estrella</i>
<i>Anomala marginicollis</i>	<i>Callistethus parapulcher</i>
<i>Anomala oreas</i>	<i>Anomala solisi</i>
<i>Anomala phosphora</i>	<i>Callistethus xiphostethus</i>
<i>Anomala sejuncta</i>	<i>Anomala veraecrucis</i>
<i>Anomala sticticoptera</i>	<i>Anomala robiginosa</i>
<i>Anomala xantholea</i>	<i>Callistethus macroxantholeus</i>
<i>Anomala vulcanicola</i>	<i>Anomala tuberculata</i>
NEW IDENTIFICATIONS	
Original morphospecies	New correct identification
<i>Anomala</i> sp.14	<i>Anomala undulata</i>
<i>Anomala</i> sp.158	<i>Anomala ochroptera</i>
<i>Anomala</i> sp.17	<i>Anomala undulata</i>
<i>Anomala</i> sp.181	<i>Anomala quiche</i>
<i>Anomala</i> sp.188	<i>Anomala ruatana</i>
<i>Anomala</i> sp.189	<i>Anomala chloropyga</i>
<i>Anomala</i> sp.243	<i>Anomala veraecrucis</i>
<i>Anomala</i> sp.247	<i>Anomala polygona</i> (?)
<i>Anomala</i> sp.27	<i>Anomala discoidalis</i>
<i>Anomala</i> sp.31	<i>Anomala hoppi</i>
<i>Anomala</i> sp.37	<i>Anomala arara</i>
<i>Anomala</i> sp.48	<i>Anomala trapezifera</i>
<i>Anomala</i> sp.186	<i>Anomala vulcanicola</i>
<i>Anomala geminella</i> (invalid name)	<i>Anomala antica</i>

Checklist of Anomalini of Costa Rica.

Numbers of figures refers respectively to habitus, aedeagus and endophallus.

ANOMALA Samouelle

1. *Anomala aereiventris* Filippini, Micó, Galante 2015 (Figs 2,113,224) (in press)

Distribution: Cartago, San José.

2. *Anomala aglaos* Filippini, Galante, Micó 2015 (Figs 3,114,225) (in press)

Distribution: Alajuela, San José.

3. *Anomala antica* Ohaus 1897 (Figs 4,115,226)

Note: type specimens (Colombia, MNHUB) have aedeagus with longer and thinner parameres than specimens in Costa Rica.

Distribution: Alajuela, Guanacaste, Limón, Puntarenas, San José.

4. *Anomala arara* Ohaus 1897 (Figs 5,116,227)

Distribution: Alajuela, Cartago, Guanacaste, Puntarenas, San José.

5. *Anomala arthuri* Filippini, Micó, Galante 2014 (Figs 6,117,228)

Distribution: Guanacaste.

6. *Anomala aspersa* Filippini, Micó, Galante 2015 (Figs 7,118,229) (in press)

Distribution: Cartago, San José.

7. *Anomala atrivillosa* Filippini, Micó, Galante 2015 (Figs 8,119,230) (in press)

Distribution: Heredia.

8. *Anomala balzapambae* Ohaus 1897 (Figs 9,120,231)

Distribution: Alajuela, Guanacaste, Heredia, Limón, Puntarenas, San José.

9. *Anomala calligrapha* Bates 1888 (Figs 10,121,232)

Distribution: Alajuela, Cartago, Guanacaste, Limón, Puntarenas, San José.

10. *Anomala chiriquina* Bates 1888 (Figs 11,122,233)

Distribution: Alajuela, Cartago, Guanacaste, Puntarenas, San José.

11. *Anomala chloropyga* Ohaus 1897 (Figs 12,123,234)

Distribution: San José.

12. *Anomala clarivillosa* Filippini, Micó, Galante 2015 (Figs 13,124,235) (in press)

Distribution: Cartago.

13. *Anomala clathrata* Ohaus 1930 (Figs 14,125,236)

Distribution: Alajuela, Cartago, Guanacaste, Heredia, Limón, Puntarenas.

14. *Anomala coffea* Filippini, Galante, Micó 2015 (Figs 15,126,237) (in press)

Distribution: Guanacaste.

15. *Anomala contusa* Filippini, Micó, Galante 2015 (Figs 16,127,238) (in press)

Distribution: Guanacaste, San José.

16. *Anomala cupreovariolosa* Filippini, Micó, Galante 2014 (Figs 17,128,239)

Distribution: Puntarenas.

17. *Anomala cupricollis* Chevrolat 1834 (Figs 18,129,240)

Distribution: Alajuela, Cartago, Guanacaste, Heredia, Limón, Puntarenas.

18. *Anomala cyclops* Filippini, Galante, Micó 2015 (Figs 19,130,241) (in press)

Distribution: Guanacaste.

19. *Anomala discoidalis* Bates 1888 (Figs 20,131,242)

Distribution: Alajuela, Cartago, Guanacaste, Heredia, Limón, Puntarenas, San José.

4. Checklist and key

20. *Anomala divisa* Filippini, Galante, Micó 2015 (Figs 21,132,243) (in press)
Distribution: Alajuela, Puntarenas.
21. *Anomala estrella* Filippini, Galante, Micó 2015 (Figs 22,133,244) (in press)
Distribution: Guanacaste, Puntarenas.
22. *Anomala eucoma* Bates 1888 (Figs 23,134,245)
Distribution: Guanacaste, Limón, Puntarenas.
23. *Anomala eulissa* Bates 1888 (Figs 24,135,246)
Distribution: Alajuela, Cartago, Guanacaste, Heredia, Limón, Puntarenas.
24. *Anomala eusticta* Filippini, Micó, Galante 2015 (Figs 25,136,247) (in press)
Distribution: Guanacaste, Puntarenas.
25. *Anomala ferrea* Filippini, Micó, Galante 2014 (Figs 26,137,248)
Distribution: Puntarenas.
26. *Anomala flavacoma* Filippini, Micó, Galante 2013 (Figs 27,138,249)
Distribution: Alajuela, Guanacaste, Limón.
27. *Anomala foraminosa* Bates 1888 (Figs 28,139,250)
Distribution: Guanacaste, Heredia, Limón, Puntarenas, San José.
28. *Anomala globulata* Filippini, Micó, Galante 2015 (Figs 29,140,251) (in press)
Distribution: Cartago, San José.
29. *Anomala hiata* Filippini, Micó, Galante 2015 (Figs 30,141,252) (in press)
Distribution: Puntarenas.
30. *Anomala histrionella* Bates 1888 (Figs 31,142,253)
Distribution: Alajuela, Guanacaste, Puntarenas.

31. *Anomala hoppi* Ohaus 1928 (Figs 32,143,254)

Distribution: Alajuela, Cartago, Guanacaste, Limón, Puntarenas.

32. *Anomala inbio* Filippini, Galante, Micó 2015 (Figs 33,144,255) (in press)

Distribution: Heredia, Limón.

33. *Anomala jansoni* Ohaus 1897 (Figs 34,145)

Note: no specimens apart from the type series are known.

Distribution: "Monte Rotondo, Costa Rica".

34. *Anomala latifalculata* Filippini, Micó, Galante 2015 (Figs 35,146,256) (in press)

Distribution: Cartago.

35. *Anomala leopardina* Filippini, Micó, Galante 2015 (Figs 36,147,257) (in press)

Distribution: Puntarenas.

36. *Anomala levicollis* Filippini, Micó, Galante 2015 (Figs 37,148,258) (in press)

Distribution: Alajuela, Cartago, Guanacaste, Puntarenas.

37. *Anomala longisacculata* Filippini, Micó, Galante 2015 (Figs 38,149,259) (in press)

Distribution: Alajuela, Cartago, Guanacaste, Limón, San José.

38. *Anomala ludoviciana* Schaeffer 1906 (Figs 39,150,260)

Distribution: Guanacaste, Puntarenas.

39. *Anomala megalia* Bates 1888 (Figs 40,151,261)

Distribution: Limón, San José.

40. *Anomala megaparamera* Filippini, Micó, Galante 2013 (Figs 41,152,262)

Distribution: Limón.

41. *Anomala mersa* Filippini, Galante, Micó 2015 (Figs 42,153,263) (in press)

Distribution: Guanacaste.

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42. *Anomala mesosticta* Filippini, Galante, Micó 2015 (Figs 43,154,264) (in press)

Distribution: Heredia, Limón.

43. *Anomala m-fuscum* Filippini, Micó, Galante 2015 (Figs 44,155,265) (in press)

Distribution: Cartago.

44. *Anomala nigroflava* Filippini, Micó, Galante 2014 (Figs 45,156,266)

Distribution: Puntarenas.

45. *Anomala obovata* Ohaus 1933 (Figs 46,157,267)

Distribution: Cartago, Heredia, Limón.

46. *Anomala ochrogastra* Bates 1888 (Figs 47,158,268)

Distribution: Guanacaste, Heredia, Limón, Puntarenas.

47. *Anomala ochroptera* Bates 1888 (Figs 48,159,269)

Distribution: Guanacaste, Puntarenas.

48. *Anomala perspicax* Filippini, Micó, Galante 2015 (Figs 49,160,270) (in press)

Distribution: Cartago, Puntarenas.

49. *Anomala piccolina* Filippini, Micó, Galante 2015 (Figs 50,161,271) (in press)

Distribution: Puntarenas.

50. *Anomala pincelada* Filippini, Galante, Micó 2015 (Figs 51,162,272) (in press)

Distribution: Guanacaste.

51. *Anomala polygona* Bates 1888 (Figs 52,163)

Note: only one recent specimen (apart from the holotype) with dubious identification is known.

Distribution: "Costa Rica" (holotype); San José (1 specimen at MNHUB), Limón? (see Filippini, Micó, Galante 2014)

52. *Anomala popayana* Ohaus 1897 (Figs 53,164,273)

Distribution: Guanacaste, Heredia, Limón, Puntarenas.

53. *Anomala praezellens* Bates 1888 (Figs 54,165,274)

Distribution: Alajuela, Cartago, Guanacaste, Heredia, Limón, Puntarenas, San José.

54. *Anomala pseudoeucoma* Filippini, Micó, Galante 2013 (Figs 55,166,275)

Distribution: Alajuela, Limón, Puntarenas.

55. *Anomala quiche* Ohaus 1897 (Figs 56,167,276)

Note: specimens from Costa Rica differ from type specimen (Guatemala, MNHUB) for having two defined maculae on pronotum instead of one. Aedeagus is coincident.

Distribution: Alajuela, Guanacaste, Heredia, Limón, Puntarenas.

56. *Anomala robiginosa* Filippini, Galante, Micó 2015 (Figs 57,168,277) (in press)

Distribution: Alajuela, Guanacaste.

57. *Anomala ruatana* Bates 1888 (Figs 58,169,278)

Distribution: Guanacaste.

58. *Anomala semicincta* Bates 1888 (Figs 59,170,279)

Distribution: Alajuela, Cartago, Guanacaste, Heredia, Limón, Puntarenas.

59. *Anomala semilla* Filippini, Micó, Galante 2014 (Figs 60,171,280)

Distribution: Alajuela, Guanacaste.

60. *Anomala solisi* Filippini, Micó, Galante 2014 (Figs 61,172,281)

Distribution: Alajuela, Guanacaste, Limón.

61. *Anomala stillaticia* Filippini, Micó, Galante 2015 (Figs 62,173,282) (in press)

Distribution: Cartago.

4. Checklist and key

62. *Anomala strigodermoides* Filippini, Galante, Micó 2015 (Figs 63,174,283) (in press)

Distribution: Alajuela, Cartago.

63. *Anomala subaenea* (Nonfried 1893) (Figs 64,175,284)

Distribution: Guanacaste.

64. *Anomala subridens* Filippini, Micó, Galante 2015 (Figs 65,176,285) (in press)

Distribution: Cartago.

65. *Anomala subusta* Filippini, Micó, Galante 2015 (Figs 66,177,286) (in press)

Distribution: Alajuela, Cartago, Guanacaste, Puntarenas.

66. *Anomala tenoriensis* Filippini, Micó, Galante 2015 (Figs 67,178,287) (in press)

Distribution: Alajuela, Guanacaste.

67. *Anomala testaceipennis* Blanchard 1851 (Figs 68,179,288)

Distribution: Alajuela, Cartago, Guanacaste, Heredia, Limón, Puntarenas, San José.

68. *Anomala trapezifera* Bates 1888 (Figs 69,180,289)

Distribution: Cartago, Limón.

69. *Anomala tuberculata* Filippini, Micó, Galante 2015 (Figs 70,181,290) (in press)

Distribution: Alajuela, Cartago, San José.

70. *Anomala undulata* Melsheimer 1844 (Figs 71,182,291)

Distribution: Alajuela, Cartago, Guanacaste, Heredia, Limón, Puntarenas, San José.

71. *Anomala unilineata* Filippini, Galante, Micó 2015 (Figs 72,183,292) (in press)

Distribution: Guanacaste.

72. *Anomala valida* Burmeister 1844 (Figs 73,184,293)

Distribution: Alajuela, Cartago, Guanacaste, Heredia, Limón, Puntarenas, San José.

73. *Anomala vallisneria* Filippini, Micó, Galante 2015 (Figs 74,185,294) (in press)

Distribution: Alajuela, Cartago, Guanacaste, Puntarenas.

74. *Anomala veraecrucis* Bates 1888 (Figs 75,186,295)

Distribution: Alajuela, Cartago, Guanacaste, Puntarenas.

75. *Anomala volsellata* Filippini, Micó, Galante 2014 (Figs 76,187,296)

Distribution: Puntarenas, San José.

76. *Anomala vulcanicola* Ohaus 1897 (Figs 77,188,297)

Distribution: San José.

77. *Anomala zumbadoi* Filippini, Micó, Galante 2014 (Figs 78,189,298)

Distribution: Puntarenas.

INCERTAE SEDIS

78. *Anomala nitidula* Blanchard 1851 (Figs 80,190,299)

Distribution: Alajuela, Cartago, Guanacaste, Heredia, San José.

ANOMALORHINA Jameson, Paucar-Cabrera, Solís

1. *Anomalorhina osaensis* Jameson, Paucar-Cabrera, Solís 2003

Distribution: Puntarenas.

2. *Anomalorhina turrialbana* Ohaus 1928 (Figs 79,191,300)

Distribution: Alajuela, Cartago.

4. Checklist and key

CALLISTETHUS Blanchard

1. *Callistethus calonotus* (Bates 1888) (Figs 81,192,301)

Distribution: Puntarenas.

2. *Callistethus carbo* Filippini, Galante, Micó 2015 (Figs 82,193,302) (in press)

Distribution: Guanacaste.

3. *Callistethus chlorotoides* (Bates 1888) (Figs 83,194,303)

Distribution: Alajuela, Cartago, Limón, Puntarenas, San José.

4. *Callistethus chontalensis* (Bates 1888) (Figs 84,195,304)

Distribution: Alajuela, Cartago, Guanacaste, Heredia, Limón, Puntarenas.

5. *Callistethus chrysanthe* (Bates 1888) (Figs 85,196)

Note: no specimens apart from the type series are known.

Distribution: "Costa Rica".

6. *Callistethus chrysomelinus* (Bates 1888) (Figs 86,197,305)

Distribution: Puntarenas.

7. *Callistethus flavodorsalis* Filippini, Galante, Micó 2015 (Figs 87,198,306) (in press)

Distribution: Puntarenas.

8. *Callistethus fuscorubens* Filippini, Galante, Micó 2015 (Figs 88,199,307) (in press)

Distribution: Puntarenas.

9. *Callistethus granulipygus* (Bates 1888) (Figs 89,200,308)

Distribution: Alajuela, Guanacaste, Heredia, Limón, Puntarenas, San José.

10. *Callistethus jordani* (Ohaus 1902) (Figs 90,201,309)

Distribution: Guanacaste, Puntarenas.

11. *Callistethus lativittis* Filippini, Galante, Micó 2015 (Figs 91,202,310) (in press)
Distribution: Alajuela, Guanacaste.
12. *Callistethus levigatus* Filippini, Galante, Micó 2015 (Figs 92,203,311) (in press)
Distribution: Alajuela, Cartago, Guanacaste, Puntarenas.
13. *Callistethus macroxantholeus* Filippini, Galante, Micó 2015 (Figs 93,204,312) (in press)
Distribution: Alajuela, Limón, Guanacaste.
14. *Callistethus microxantholeus* Filippini, Galante, Micó 2015 (Figs 94,205,313) (in press)
Distribution: Alajuela, Guanacaste, Heredia, Limón, Puntarenas.
15. *Callistethus mimeloides* (Ohaus 1902) (Figs 95,206,314)
Distribution: Alajuela, Cartago, Guanacaste, Heredia, Limón, Puntarenas, San José.
16. *Callistethus multiplicatus* Filippini, Galante, Micó 2015 (Figs 96,207,315) (in press)
Distribution: Alajuela, Guanacaste, Limón.
17. *Callistethus nicoyus* (Ohaus 1928) (Figs 97,208,316)
Distribution: Alajuela, Heredia, Puntarenas, San José.
18. *Callistethus parapulcher* Filippini, Galante, Micó 2015 (Figs 98,209,317) (in press)
Distribution: Guanacaste, Puntarenas, San José.
19. *Callistethus pseudocollaris* Filippini, Galante, Micó 2015 (Figs 99,210,318) (in press)
Distribution: Puntarenas.
20. *Callistethus ruteloides* Filippini, Galante, Micó 2015 (Figs 100,211,319) (in press)
Distribution: Alajuela, Cartago, Puntarenas.

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21. *Callistethus schneideri* (Ohaus 1905) (Figs 101,212,320)

Distribution: Alajuela, Guanacaste, Heredia, Limón, Puntarenas, San José.

22. *Callistethus specularis* (Bates 1888) (Figs 102,213,321)

Distribution: Alajuela, Cartago, Guanacaste, Heredia, Puntarenas, San José.

23. *Callistethus stannibractea* Filippini, Galante, Micó 2015 (Figs 103,214,322) (in press)

Distribution: Heredia.

24. *Callistethus sulcans* (Bates 1888) (Figs 104,215,323)

Distribution: Alajuela, Guanacaste, Limón.

25. *Callistethus valdecostatus* (Bates 1888) (Figs 105,216,324)

Distribution: Puntarenas, San José.

26. *Callistethus vanpatteni* (Bates 1888) (Figs 106,217,325)

Distribution: Alajuela, Guanacaste, Heredia, Puntarenas.

27. *Callistethus xiphostethus* (Bates 1888) (Figs 107,218,326)

Distribution: Alajuela, Guanacaste, Heredia, San José.

28. *Callistethus yalizo* Filippini, Galante, Micó 2015 (Figs 108,219,327) (in press)

Distribution: Alajuela, Cartago, Heredia.

STRIGODERMA Burmeister

1. *Strigoderma angulicollis* Ohaus 1915

Distribution: Limón.

2. *Strigoderma auriventris* Bates 1888 (Figs 109,220,328)

Distribution: Alajuela, Guanacaste, Limón.

3. *Strigoderma biolleyi* Ohaus 1908 (Figs 110,221,329)

Distribution: Cartago, Puntarenas, San José.

4. *Strigoderma castor* (Newman 1838)

Distribution: Heredia, San José.

5. *Strigoderma marginata* (Olivier 1789)

Distribution: Alajuela, Cartago, Guanacaste, Heredia, Limón, Puntarenas, San José.

6. *Strigoderma micans* Nonfried 1893

Distribution: Guanacaste.

7. *Strigoderma nodulosa* Ohaus 1902 (Figs 111,222,330)

Distribution: Heredia, Limón, Puntarenas.

8. *Strigoderma orbicularis* Burmeister 1855

Distribution: Cartago, Guanacaste, Heredia, Limón, Puntarenas.

9. *Strigoderma rutelina* Bates 1888

Distribution: Alajuela, Puntarenas.

10. *Strigoderma sulcipennis* Burmeister 1844 (Figs 112,223,331)

Distribution: Guanacaste, Puntarenas, San José.

11. *Strigoderma vestita* Burmeister 1844

Distribution: Alajuela, Guanacaste, Puntarenas, San José.

Key to Anomalini species of Costa Rica

Partly modified from: Jameson, Paucar-Cabrera and Solís 2003, Filippini *et al.* 2013, Filippini, Galante, Micó 2015^a, Filippini, Micó, Galante 2015.

A Spanish translation is available as *Anexo 4*.

1. Mesoepimeron well-exposed anterior to base of elytron in dorsal view, elongated shape, pronotum narrower than base of elytra STRIGODERMA Burmeister 18446
- Mesoepimeron concealed by base of elytron or weakly exposed, oval or elongated shape, pronotum as wide as base of elytra 2

2. Frontoclypeal suture incomplete, sides of clypeus elevated at base of canthus, males with pronotal disc with depression, females with apical bead of pronotum produced posteriorly at middle ANOMALORHINA Jameson, Paucar-Cabrera, Solís 200316
- Frontoclypeal suture complete, sides of clypeus weakly elevated or flat at base of canthus, males with pronotal disc evenly convex, females with apical bead of pronotum not produced posteriorly 3

3. Space between mesocoxae flat or slightly convex, not produced beyond mesotrochanters, pronotum with basal bead complete or obliterated in the middle, basal margin sinuate ANOMALA Samouelle 181917
- Presence of a mesosternal process, produced beyond mesotrochanters, pronotum with basal bead or smooth4

4. Parameres perpendicular to the phallobase, metatarsi 1-4 together similar in length to the 5th one, excluding claws, small size *Anomala nitidula* Blanchard 1851
- Parameres in line with the phallobase, metatarsi 1-4 together longer than the 5th one, excluding claws 5
5. Mesosternal process short, not or slightly produced beyond the mesocoxae, apex seen as a bump in lateral view ANOMALA Samouelle 1819 and CALLISTETHUS Blanchard 1851 93
- Mesosternal process long, produced beyond the mesocoxae for more than half the width of mesocoxa, apex free in lateral view CALLISTETHUS Blanchard 1851 109
6. Pronotum with irregular surface, granulate or with impressions 7
- Pronotum homogeneously convex 9
7. Pronotum with granulate surface *Strigoderma nodulosa* Ohaus 1902
- Pronotum with impressions 8
8. Size 11–13 mm, pronotum homogeneously black or copper, elongated shape (elytra >2 times longer than wider) *Strigoderma sulcipennis* Burmeister 1844
- Size 7–9 mm, pronotum green or reddish brown with white sides, rounded shape (elytra <2 times longer than wider) *Strigoderma castor* (Newman 1838)
9. Elytra smooth, venter with metallic colors *Strigoderma auriventris* Bates 1888
- Elytra striated, venter not with metallic colors 10
10. Pronotum with green metallic color 11
- Pronotum brown to black, without metallic luster 13

4. Checklist and key

11. Elytra black with a ochre circle near base *Strigoderma rutelina* Bates 1888
-. Elytra with uniform color 12
12. Pronotum with one central macula or uniform, elytra black or brown
..... *Strigoderma biolleyi* Ohaus 1908
-. Pronotum with two light bands on pronotum, elytra brown
..... *Strigoderma micans* Nonfried 1893
13. Elytra homogeneously brown *Strigoderma vestita* Burmeister 1844
-. Elytra black or brown with black maculae 14
14. Size 11–12 mm *Strigoderma angulicollis* Ohaus 1915
-. Size <8 mm 15
15. Rounded shape, pronotum strongly convex, as wide as base of elytra, size 7–8 mm
..... *Strigoderma orbicularis* Burmeister 1855
-. Elongated shape, pronotum slightly convex, narrower than base of elytra, size 5–7
mm *Strigoderma marginata* (Olivier 1789)
16. Head and pronotum rufous, elytra black or reddish brown; male with two
tubercles on base of frons, clypeus with apex acute in frontal view; females with
subsutural interstice twice as wide as first costa, frontal disc slightly concave
..... *Anomalorhina turrialbana* (Ohaus 1928)
-. Head, pronotum and elytra castaneous; male without tubercles on frons, clypeus
with apex quadrate in frontal view; females with subsutural interstice as wide as first
costa, frontal disc slightly convex
..... *Anomalorhina osaensis* Jameson, Paucar-Cabrera, Solís 2003

17. Protibia tridentate	18
- Protibia bidentate	48
18. Elytra of homogeneous color	19
- Elytra with darker maculae	21
19. Body color dark brown <i>Anomala coffea</i> Filippini, Galante, Micó 2015	
- Pronotum dark brown or green, elytra ochre	20
20. Pronotum of homogeneous color, green or brown, body length 11.0–13.0 mm, aedeagus Fig. 179 <i>Anomala testaceipennis</i> Blanchard 1851	
- Pronotum dark brown with ochre sides, body length 8.5–9.5 mm, aedeagus Fig. 186	<i>Anomala veraecrucis</i> Bates 1888
21. Head and pronotum entirely black, elytra ochre with large irregular black maculae developing longitudinally (Fig. 51) <i>Anomala pincelada</i> Filippini, Galante, Micó 2015	
- Head and pronotum metallic green or brown, pronotum usually with light colored margins, elytra with small maculae on transversal bands or flecks sparse on entire surface	22
22. Pattern on elytra made of one central macula or median transversal band	23
- Pattern on elytra made of various bands of maculae or sparse flecks	24
23. Pronotum mainly dark brown with narrow ochre sides, size 10–12 mm, aedeagus Fig. 154 <i>Anomala mesosticta</i> Filippini, Galante, Micó 2015	
- Pronotum with pentagonal central dark macula, less than half the pronotum width, size 8–10 mm, aedeagus Fig. 130	<i>Anomala cyclops</i> Filippini, Galante, Micó 2015

4. Checklist and key

24. Pronotum with deep impressions .. *Anomala contusa* Filippini, Micó, Galante 2015
-. Pronotum with convex surface 25
25. Presence of setae on pronotum and elytra 26
-. Pronotum and elytra glabrous, pronotum may have a row with a few setae 28
26. Body length 10.0–11.5 mm, pronotum with dense punctation, elytra with two regular rows of maculae, aedeagus in Fig. 147
..... *Anomala leopardina* Filippini, Micó, Galante 2015
-. Body length 12.0–14.0 mm, pronotum with sparse and coarse punctation, elytra irregularly covered with maculae and flecks..... 27
27. Light colour, pronotum with evident sinuate lateral margins, aedeagus as in Fig. 124
..... *Anomala clarivillosa* Filippini, Micó, Galante 2015
-. Dark colour, pronotum with slightly sinuate lateral margins, aedeagus as in Fig. 119
..... *Anomala atrivillosa* Filippini, Micó, Galante 2015
28. Lateral margins of pronotum sinuate 29
-. Lateral margins of pronotum regularly convex or angulated..... 36
29. Side of pronotum deeply sinuate (it crosses an imaginary line from the apical to basal angles), pronotum almost completely dark in colour, aedeagus as in Fig. 163
..... *Anomala polygona* Bates 1888
-. Lateral margins of pronotum weakly sinuate (they do not cross an imaginary line from the apical to basal angles), pronotum with an irregular macula on disc or ochre margins 30

30. Pronotum dark with ochre margins, elytra with regular maculae, aedeagus as in Fig. 141 *Anomala hiata* Filippini, Micó, Galante 2015
 -. Pronotum with an irregular macula on its disc, elytra with several small flecks 31
31. Pronotum with a narrow sinuate macula, elytra with few flecks, length less than 11.5 mm, parameres long with an acute apex and protruding ventral angle in a lateral view (Fig. 155) *Anomala m-fuscum* Filippini, Micó, Galante 2015
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Acknowledgements

We thank Mr. Ángel Solís, from the Instituto Nacional de Biodiversidad, Costa Rica for the loan of specimens; Johannes Frisch and J. Willers from the Museum für Naturkunde der Humboldt-Universität, Berlin; Malcolm D. Kerley, from the Natural History Museum, London for assistance with type material consultation. We also thank Dr. Miguel A. Alonso Zarazaga for his tips on nomenclature.

Financial support was provided by the Agencia Española de Cooperación Internacional para el Desarrollo (AECID) projects A/4426/05, A/6788/06, A/019887/08, A/023060/09 and a PhD grant to V. Filippini from the Spanish Ministry of Education.

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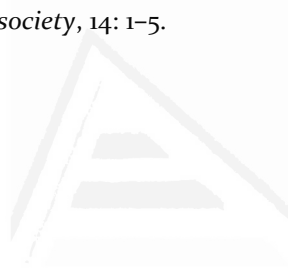
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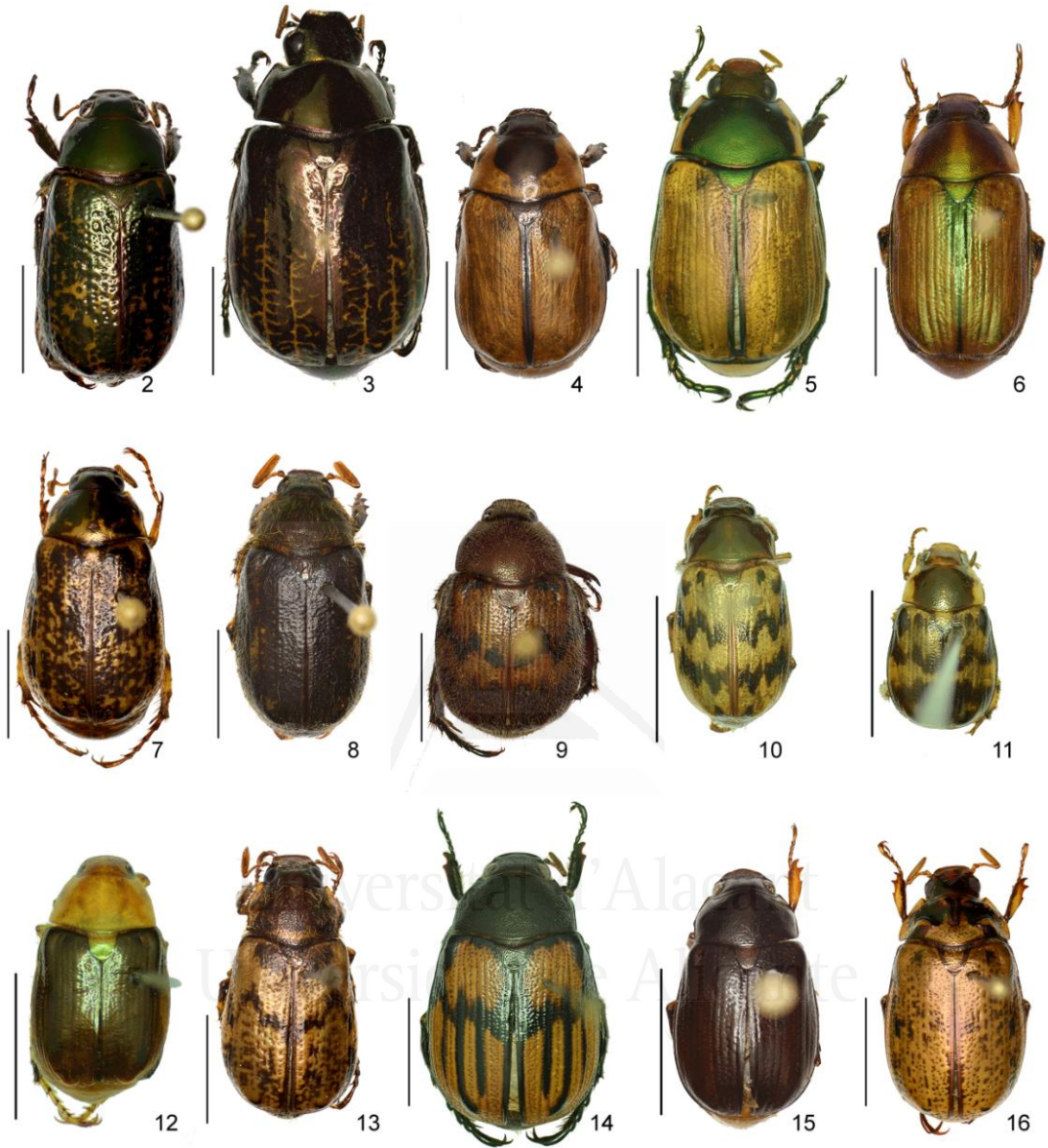
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Figures 2–16. For each specimen is given the locality and province of recollection, and the collection where it is stored. Habitus. 2: *Anomala aereiventris* (Parque Nacional Tapantí, Cartago, INBIO). 3: *A. aglaos* (La Montura, San José, CEUA). 4: *A. antica* (Estación Palo Verde, Guanacaste, INBIO). 5: *A. arara* (Albergue Heliconias, Alajuela, CEUA). 6: *A. arthuri* (Estación Maritza, Guanacaste, INBIO). 7: *A. aspersa* (Villa Mills, Cartago, INBIO). 8: *A. atrivillosa* (Estación Barva, Heredia, INBIO). 9: *A. balzapambae* (Reserva biológica Hitoy Cerere, Limón, INBIO). 10: *A. calligrapha* (Estación Cabro Muco, Guanacaste, CEUA). 11: *A. chiriquina* (Finca Cafrosa, Puntarenas, INBIO). 12: *A. chloropyga* (San Luis, Puntarenas, INBIO). 13: *A. clarivillosa* (La Esperanza, Cartago, CEUA). 14: *A. clathrata* (Estación Cabro Muco, Guanacaste, CEUA). 15: *A. coffea* (Estación Pitilla, Guanacaste, INBIO). 16: *A. contusa* (Volcán Tenorio, Guanacaste, CEUA). Scale = 5 mm.

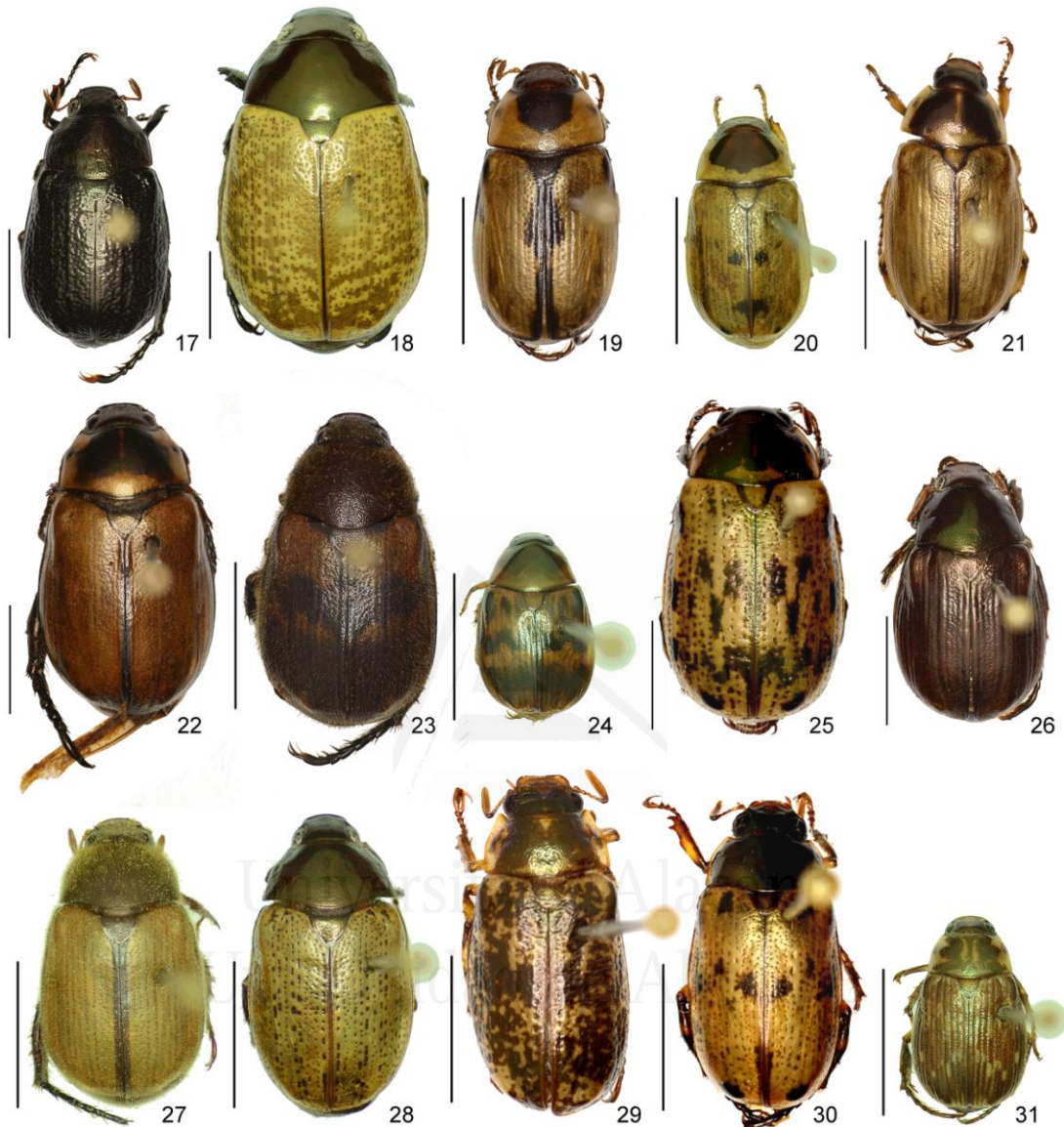


Figure 17–31. Habitus. 17: *Anomala cupreovariolosa* (Las Cruces, Puntarenas, INBIO). 18: *A. cupricollis* (Finca San Gabriel, Alajuela, INBIO). 19: *A. cyclops* (Cerro El Hacha, Guanacaste, INBIO). 20: *A. discoidalis* (Estación Biológica Las Alturas, Puntarenas, INBIO). 21: *A. divisa* (Cinco esquinas de Carrizal, Alajuela, INBIO). 22: *A. estrella* (Estación La Casona, Puntarenas, INBIO). 23: *A. eucoma* (Amubri, Limón, INBIO). 24: *A. eulissa* (Sector Cedrales de la Rita, Limón, INBIO). 25: *A. eusticta* (Estación La Casona, Puntarenas, INBIO). 26: *A. ferrea* (Las Cruces, Puntarenas, INBIO). 27: *A. flavacoma* (Estación Hitoy Cerere, Limón, INBIO). 28: *A. foraminosa* (Estación Hitoy Cerere, Limón, INBIO). 29: *A. globulata* (Macizo de la Muerte, Cartago, INBIO). 30: *A. hiata* (Estación Pittier, Puntarenas, INBIO). 31: *A. histrionella* (Estación Murcielago, Guanacaste, INBIO). Scale = 5 mm.

4. Checklist and key

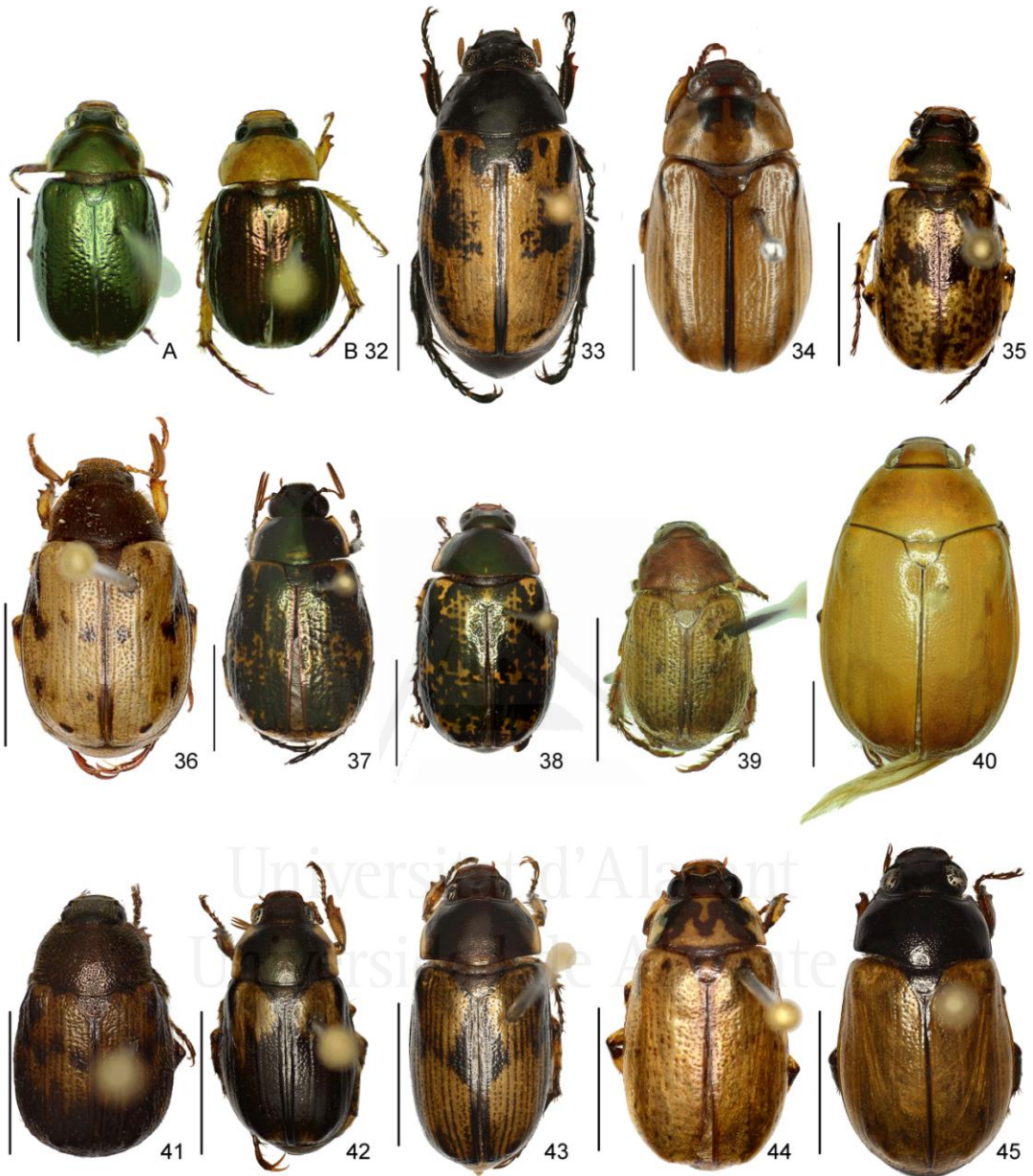
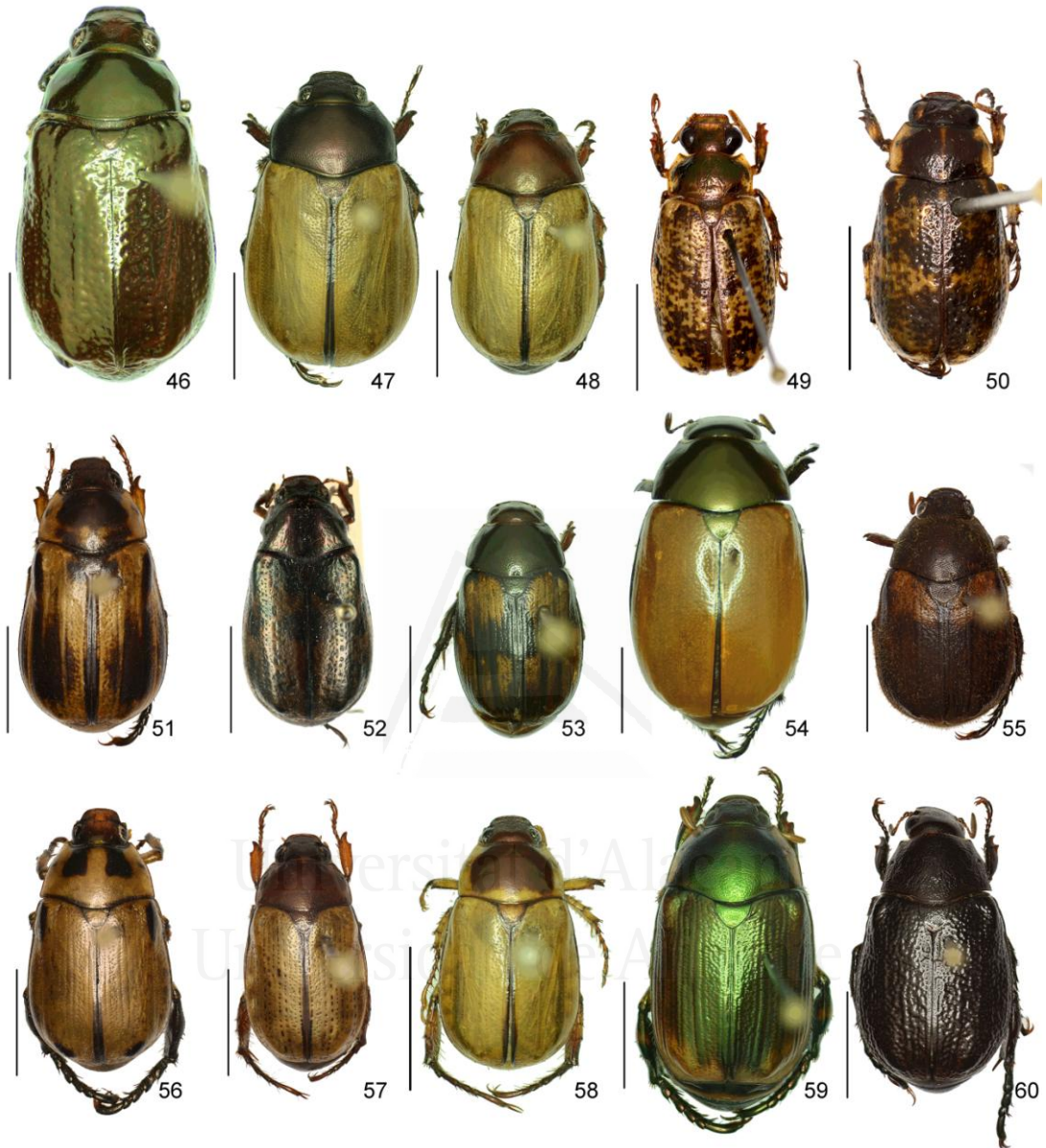
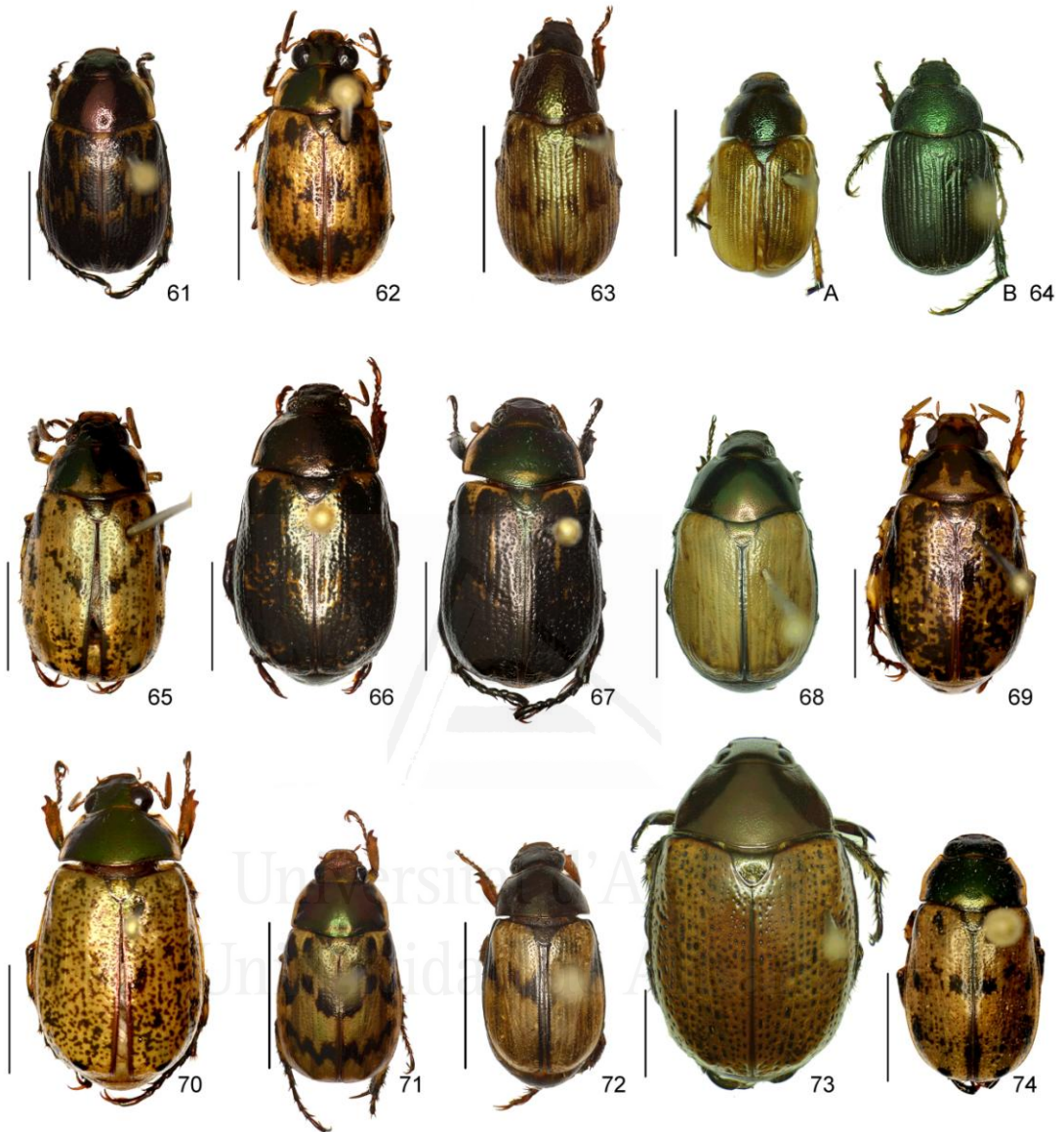


Figure 32–45. Habitus. 32: *Anomala hoppi*, showing variable colorations (A: Río San Lorencito, Alajuela, INBIO; B: Las Cruces, Puntarenas, INBIO). 33: *A. inbio* (Estación Hitoy Cerere, Limón, INBIO). 34: *A. jansoni* (Monte Rotondo, Costa Rica, MNHUB). 35: *A. latifalculata* (Zona Protectora Cerros de la Carpintera, Cartago, INBIO). 36: *A. leopardina* (Finca Cafrosa, Puntarenas, INBIO). 37: *A. levicollis* (Cerro Montezuma, Alajuela, CEUA). 38: *A. longisacculata* (La Montura, San José, CEUA). 39: *A. ludoviciana* (Parque Nacional Santa Rosa, Guanacaste, INBIO). 40: *A. megalia* (Cerro Tortuguero, Limón, INBIO). 41: *A. megaparamera* (Estación Cuatro Esquinas, Limón, INBIO). 42: *A. mersa* (Sector Palo Verde, Guanacaste, INBIO). 43: *A. mesosticta* (Los Arbolitos, heredia, INBIO). 44: *A. m-fuscum* (Río Grande de Orosí, Cartago, INBIO). 45: *A. nigroflava* (Río Rincon, Puntarenas, INBIO). Scale = 5 mm.

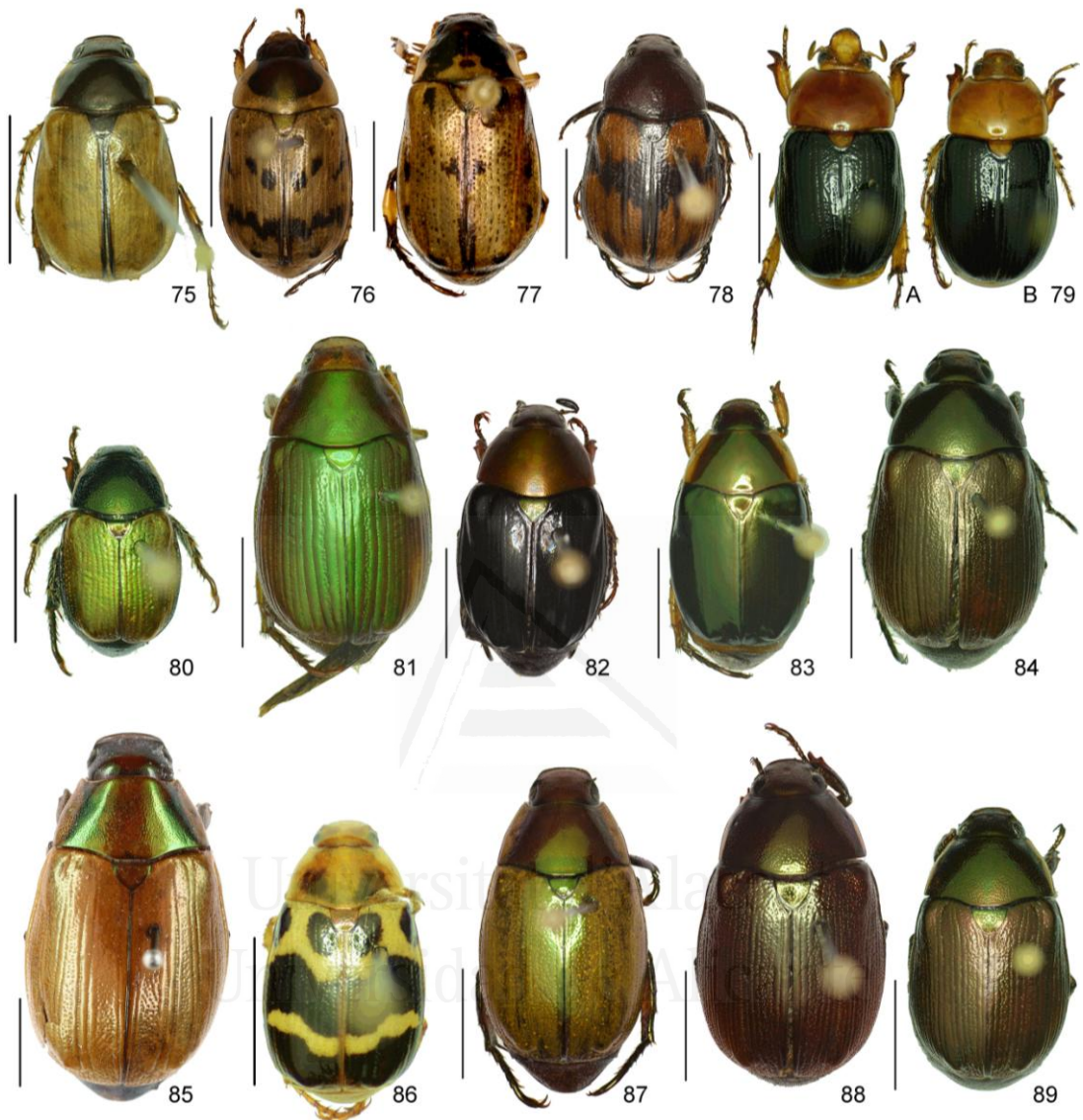


Figures 46–60. Habitus. 46: *Anomala obovata* (Cerro Chompipe, Heredia, INBIO). 47: *A. ochrogastra* (Estación Biológica Las Alturas, Puntarenas, INBIO). 48: *A. ochroptera* (La Maritza, Guanacaste, INBIO). 49: *A. perspicax* (La Esperanza, Cartago CEUA). 50: *A. piccolina* (Estación Biológica Las Alturas, Puntarenas, INBIO). 51: *A. pincelada* (Finca Jenny, Guanacaste, INBIO). 52: *A. polygona* (Escazu, Costa Rica, MNHUB). 53: *A. popayana* (Reserva Biológica Hitoy Cerere, Limón, INBIO). 54: *A. praezellens* (Orosilito, Guanacaste, CEUA). 55: *A. pseudoeucoma* (Estación Hitoy Cerere, Limón, INBIO). 56: *A. quiche* (Estación Maritza, Guanacaste, INBIO). 57: *A. robiginosa* (Zarcelero, Alajuela, INBIO). 58: *A. ruatana* (Playa Naranjo, Guanacaste, INBIO). 59: *A. semicincta* (Estación Cabro Muco, Guanacaste, CEUA). 60: *A. semilla* (Albergue Heliconias, Alajuela, CEUA). Scale = 5 mm.

4. Checklist and key

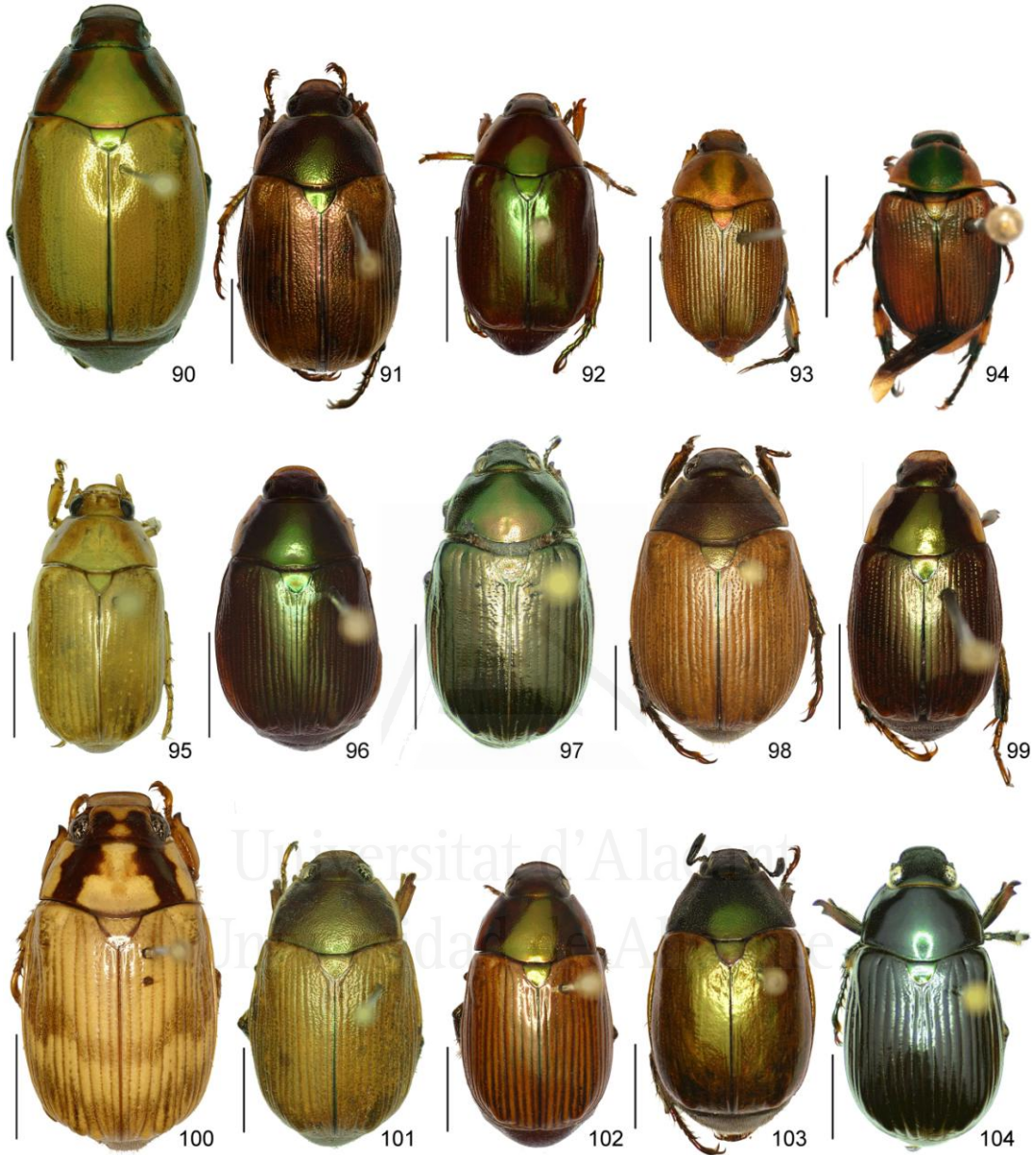


Figures 61-74. Habitus. 61: *Anomala solisi* (Amubri, Limón, INBIO). 62: *A. stillaticia* (La Catarata, Cartago, INBIO). 63: *Anomala strigodermoides* (holotype). 64: *A. subaenea*, showing variable colorations (A: Parque Nacional Santa Rosa, Guanacaste, INBIO; B: Estación Maritza, Guanacaste, INBIO). 65: *A. subridens* (Reserva Forestal Río Macho, Cartago, INBIO). 66: *A. subusta* (Estación Cacao, Guanacaste, INBIO). 67: *A. tenoriensis* (Parque Nacional Volcán Tenorio, Alajuela, INBIO). 68: *A. testaceipennis* (Cecafor, Heredia, INBIO). 69: *A. trapezifera* (Parque Nacional Tapantí, Cartago, CEUA). 70: *A. tuberculata* (Isla Bonita, Alajuela, CEUA). 71: *A. undulata* (San Luis, Puntarenas, INBIO). 72: *A. unilineata* (Parque Nacional Santa Rosa, Guanacaste, INBIO). 73: *A. valida* (Reserva Biológica Hitoy Cerere, Limón, INBIO). 74: *A. vallisneria* (Sector Las Pailas, Guanacaste, INBIO). Scale = 5mm.

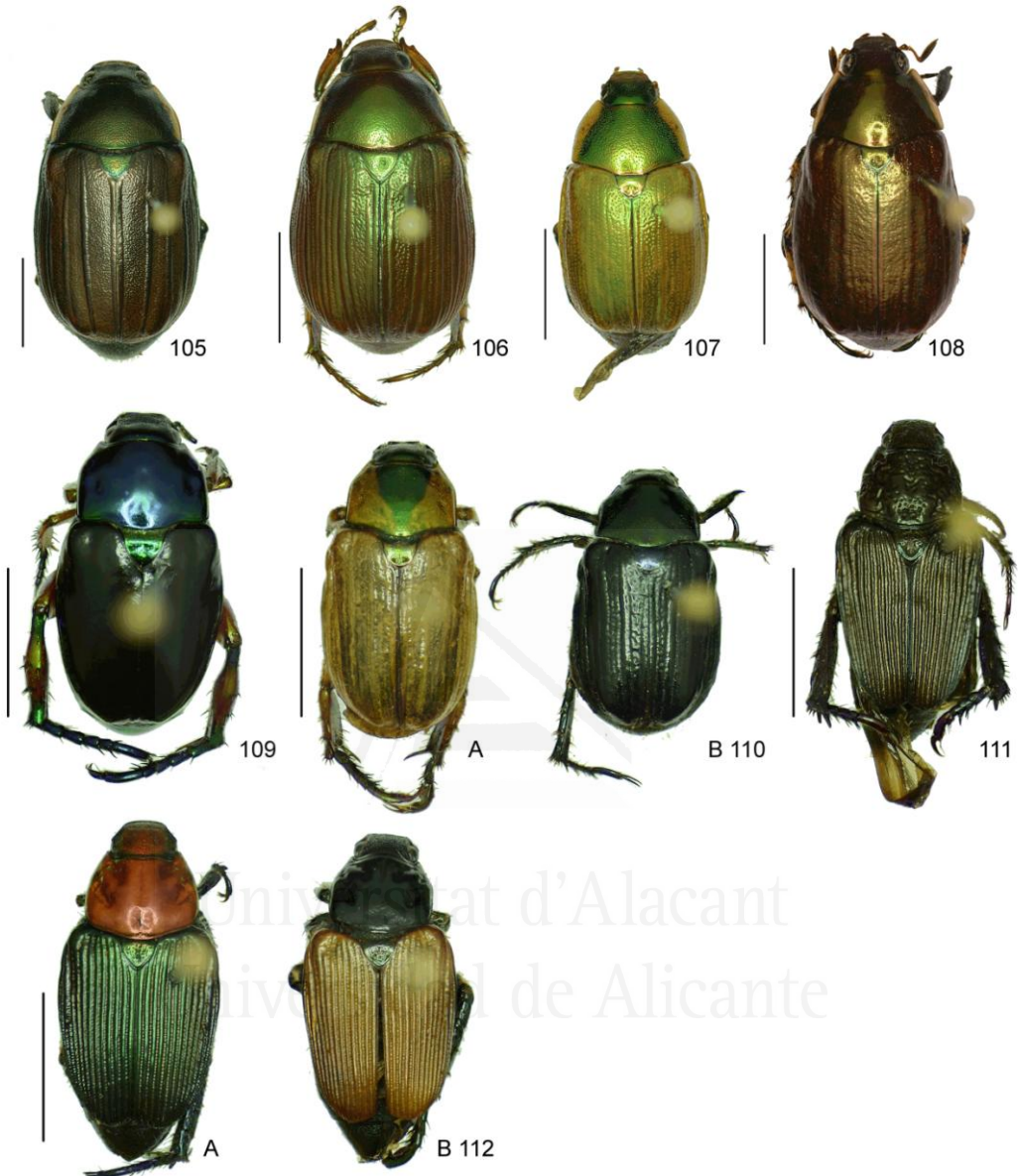


Figures 75-89. Habitus. 75: *Anomala veraecrucis* (Finca Jenny, Guanacaste, INBIO). 76: *A. volsellata* (Cerro Brujo, Puntarenas, INBIO). 77: *A. vulcanicola* (San Gerardo de Dota, San José, INBIO). 78: *A. zumbadoi* (Rancho quemado, Puntarenas, INBIO). 79: *Anomalorhina turrialbana*, A: male, B: female (Cabanga, Alajuela, CEUA, both). 80: *Anomala nitidula* (Zarcero, Alajuela, INBIO). 81: *Callistethus calonotus* (Alto de Las Moras, Puntarenas, INBIO). 82: *C. carbo* (Río San Lorenzo, Guanacaste, INBIO). 83: *C. chlorotoides* (Reserva Biológica Hitoy Cerere, Limón, INBIO). 84: *C. chontalensis* (El Copal, Cartago, CEUA). 85: *C. chrysanthe* (Chiriquí, MNHUB). 86: *C. chrysomelinus* (San Luis, Puntarenas, INBIO). 87: *C. flavodorsalis* (Finca Cafrosa, Puntarenas, INBIO). 88: *C. fuscorubens* (La Esquadra, Puntarenas, INBIO). 89: *C. granulipygus* (Rancho Quemado, Puntarenas, INBIO). Scale = 5mm.

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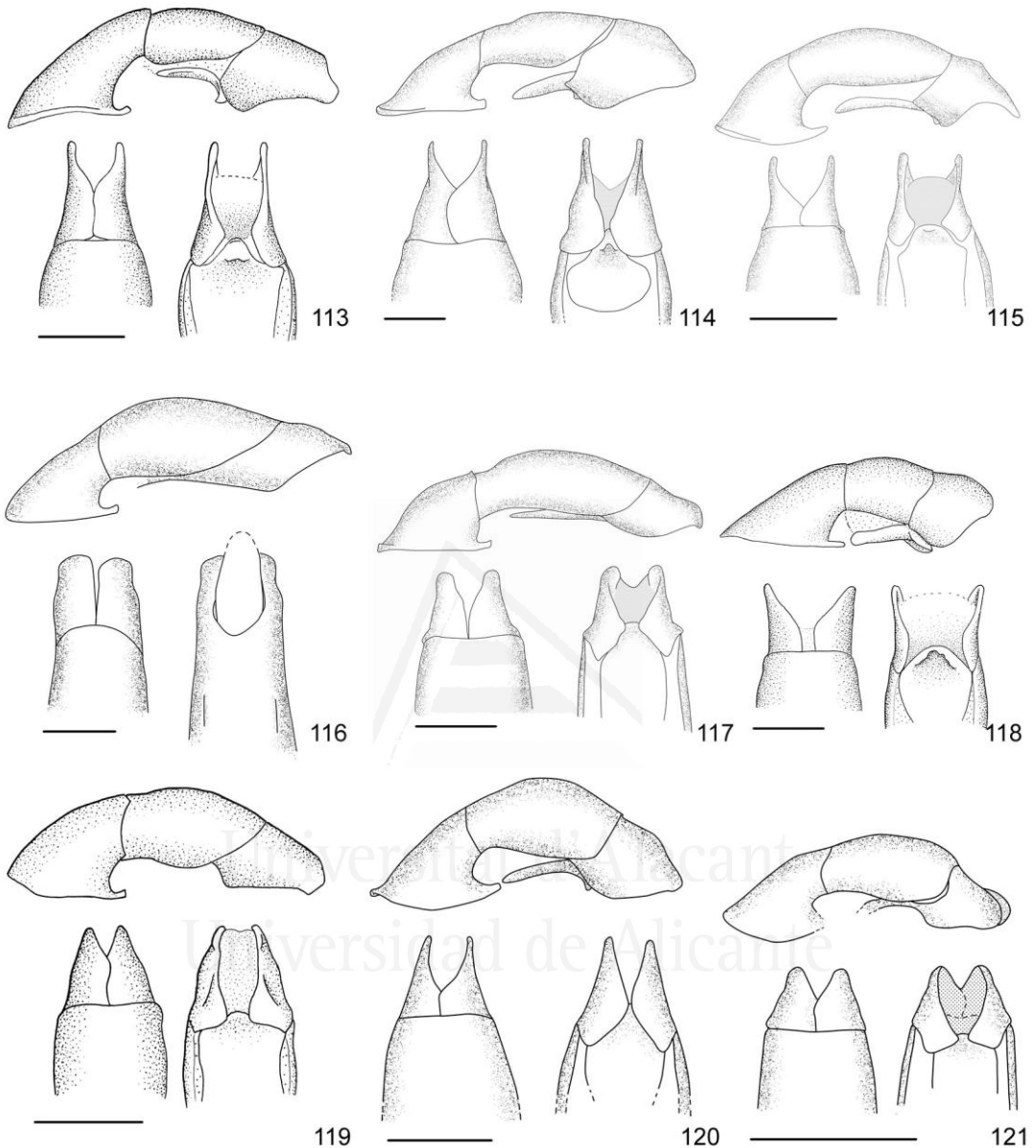


Figures 90–104. Habitus. 90: *Callistethus jordani* (Estación Cacao, Guanacaste, INBIO). 91: *C. lativittis* (Río San Lorenzo, Guanacaste, INBIO). 92: *C. levigatus* (Quebrada Segunda, Cartago, INBIO). 93: *C. macroxantholeus* (Estación Pitilla, Guanacaste, INBIO). 94: *C. microxantholeus* (Est. Pitilla, Guanacaste, INBIO). 95: *C. mimeloides* (La Montura, San José, CEUA). 96: *C. multiplicatus* (Sector Cerro Cocori, Limón, INBIO). 97: *C. nicoyus* (Estación Quebrada Bonita, Puntarenas, INBIO). 98: *C. parapulcher* (Estación Altamira, Puntarenas, INBIO). 99: *C. pseudocollaris* (Estación La Casona, Puntarenas, INBIO). 100: *C. ruteloides* (holotype). 101: *C. schneideri* (Estación Pitilla, Guanacaste, INBIO). 102: *C. specularis* (Río San Lorenzo, Guanacaste, INBIO). 103: *C. stannibractea* (Estación Barva, Heredia, INBIO). 104: *C. sulcans* (Reserva Biológica Hitoy Cerere, Limón). Scale = 5mm.

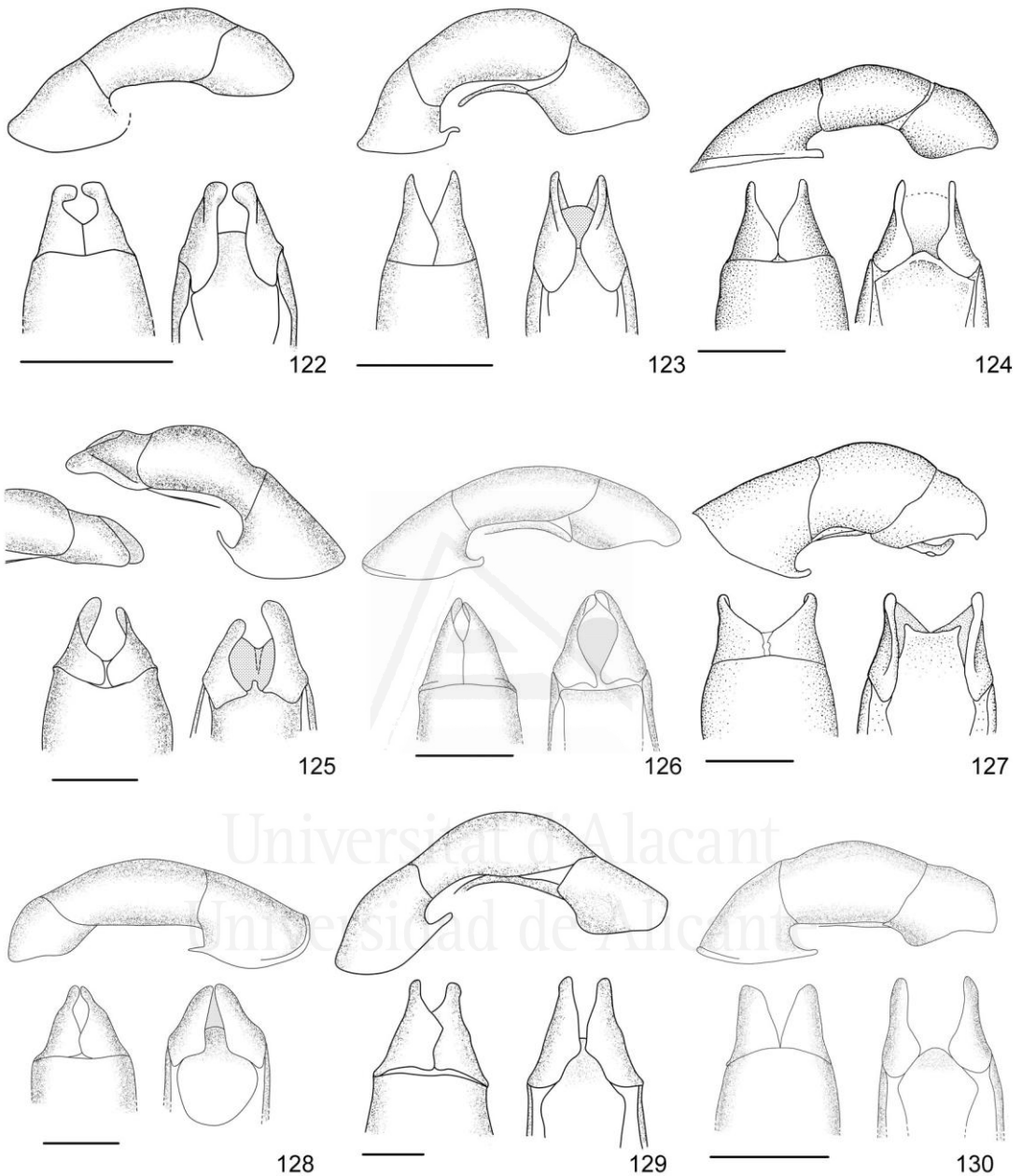


Figures 105 –112. Habitus. 105: *Callistethus valdecostatus* (Estación Biológica Las Alturas, Puntarenas, INBIO). 106: *C. vanpatteni* (Cinco Esquinas de Carrizal, Alajuela, INBIO). 107: *C. xiphostethus* (Estación Las Pailas, Guanacaste, INBIO). 108: *C. yalizo* (holotype). 109: *Strigoderma auriventris* (Sector San Ramón de dos ríos, Alajuela, INBIO). 110: *S. biolleyi*, showing variable colorations (A: Reserva Tapantí, Cartago, INBIO; B: Macizo de la Muerte, Cartago, INBIO). 111: *S. nodulosa* (Urbanización El Colegio, Puntarenas, INBIO). 112: *S. sulcipennis*, showing variable colorations (A: Finca Jenny, Guanacaste, INBIO; B: San Luis, Puntarenas, INBIO). Scale = 5mm.

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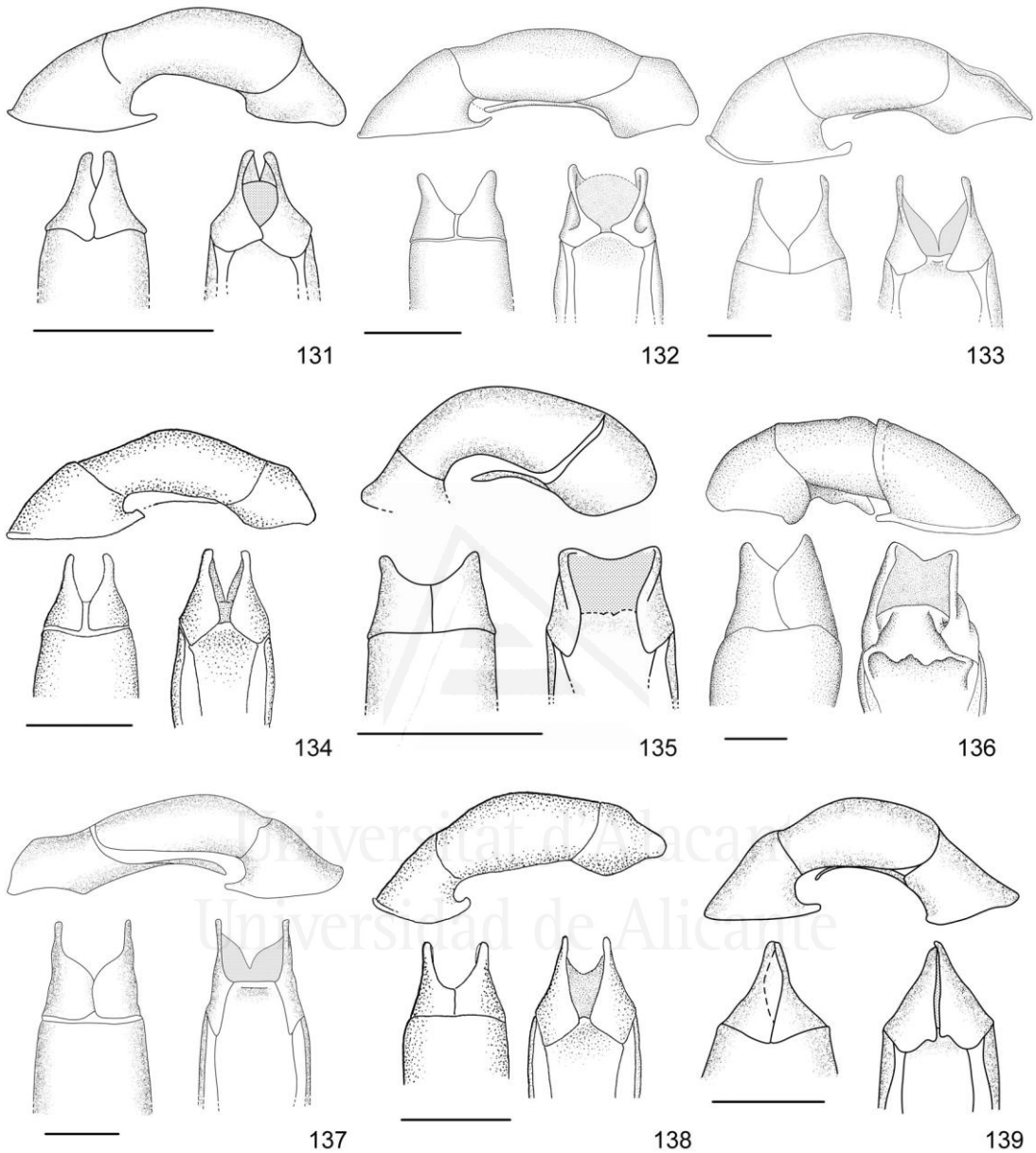


Figures 113–121. Shape of aedeagus, lateral view (top), dorsal view (bottom left), ventral view (bottom right). 113: *Anomala aereiventris* (Parque Nacional Tapantí, Cartago, INBIO). 114: *A. aglaos* (Isla Bonita, Alajuela, CEUA). 115: *A. antica* (Estación Palo Verde, Guanacaste, INBIO). 116: *A. arara* (Estación Cabro Muco, Guanacaste, CEUA). 117: *A. arthuri* (Estación Maritza, Guanacaste, INBIO). 118: *A. aspersa* (Villa Mills, Cartago, INBIO). 119: *A. atrivillosa* (Estación Barva, Heredia, INBIO). 120: *A. balzapambae* (Rancho Quemado, Puntarenas, INBIO). 121: *A. calligrapha* (Cabro Muco, Guanacaste, CEUA). Scale= 1mm.

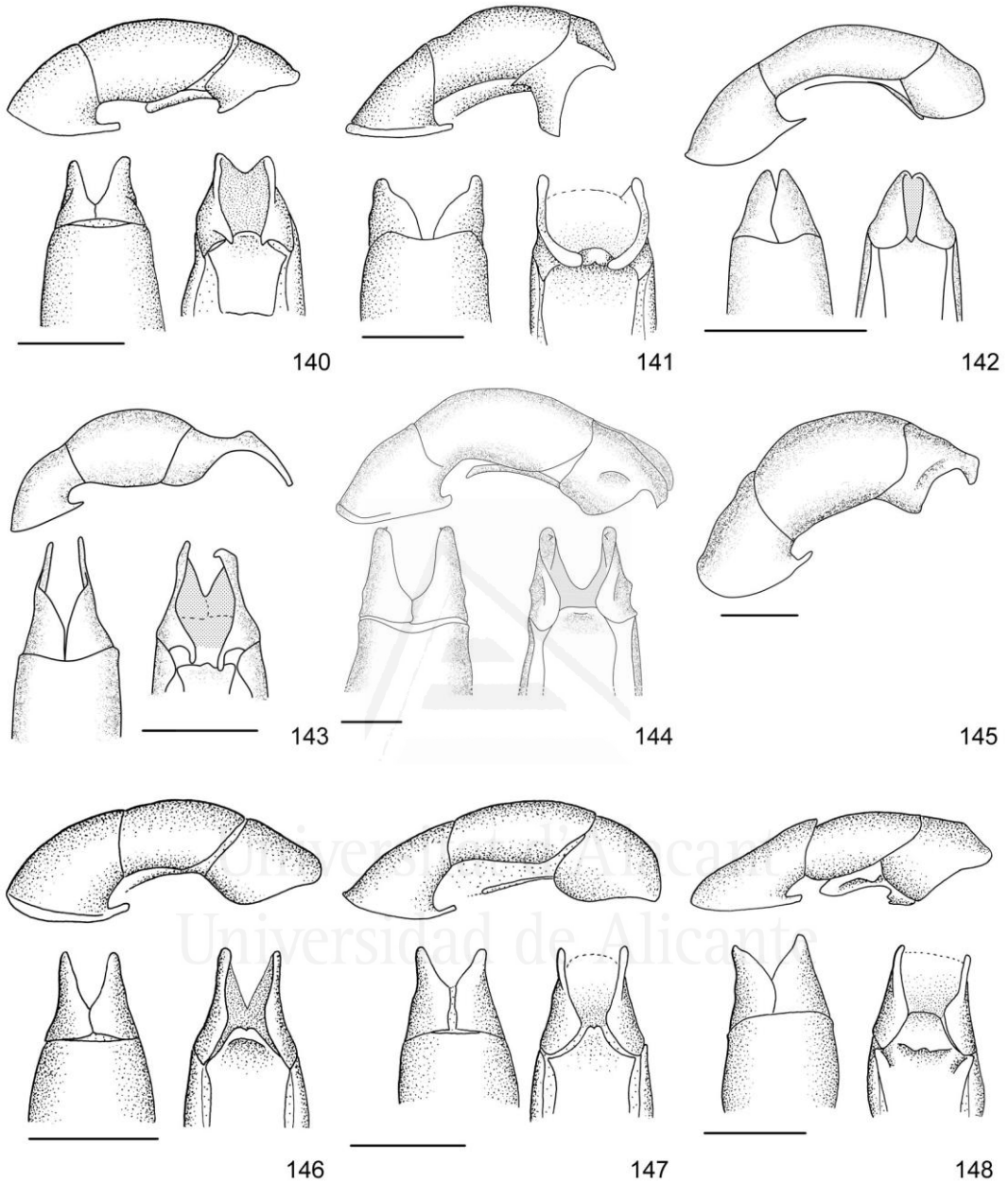


Figures 122–130. Shape of aedeagus, lateral view (top), dorsal view (bottom left), ventral view (bottom right). 122: *Anomala chiriquina* (Finca Cafrosa, Puntarenas, INBIO). 123: *A. chloropyga* (San Luis, Puntarenas, INBIO). 124: *A. clarivillosa* (La Esperanza, Cartago, CEUA). 125: *A. clathrata*, below lateral view: detail of parameres on the other side (Cerro Bitárkara, Limón, CEUA). 126: *A. coffea* (Estación Pitilla, Guanacaste, INBIO). 127: *A. contusa* (Volcán Tenorio, Guanacaste, CEUA). 128: *A. cupreovariolosa* (Las Cruces, Puntarenas, INBIO). 129: *A. cupricollis* (Finca San Gabriel, Alajuela, INBIO). 130: *A. cyclops* (Cerro El Hacha, Guanacaste, INBIO). Scale= 1mm.

4. Checklist and key

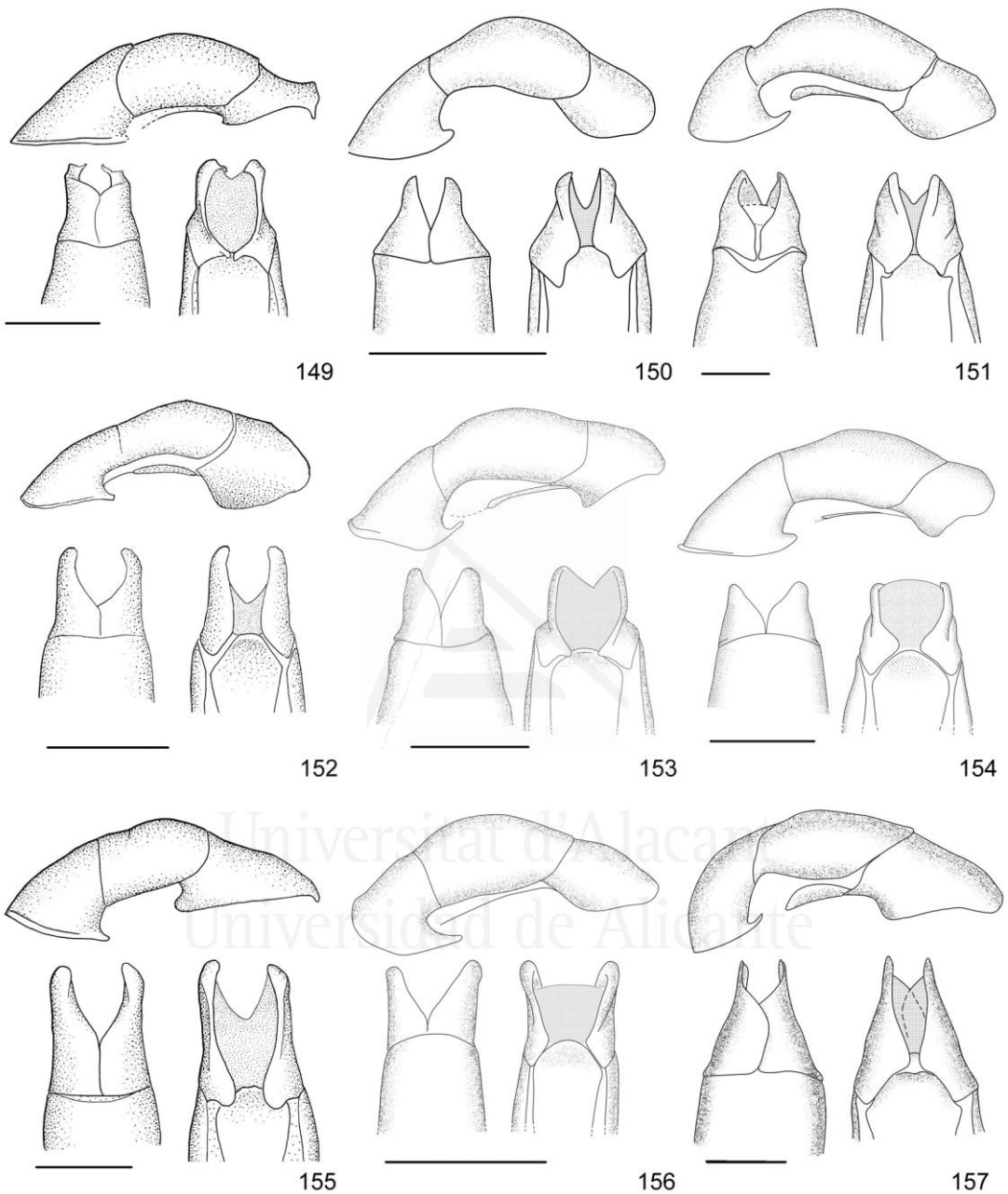


Figures 131–139. Shape of aedeagus, lateral view (top), dorsal view (bottom left), ventral view (bottom right). 131: *Anomala discoidalis* (Estación Cuatro Esquinas, Limón, INBIO). 132: *A. divisa* (Cinco esquinas de Carrizal, Alajuela, INBIO). 133: *A. estrella* (Estación La Casona, Puntarenas, INBIO). 134: *A. eucoma* (San José, San José, MUCR). 135: *A. eulissa* (Estación Biológica La Selva, Heredia, INBIO). 136: *A. eusticta* (Estación La Casona, Puntarenas, INBIO). 137: *A. ferrea* (Las Cruces, Puntarenas, INBIO). 138: *A. flavacoma* (Estación Cabro Muco, Guanacaste, CEUA). 139: *A. foraminosa* (Estación Hitoy Cerere, Limón, INBIO). Scale= mm.

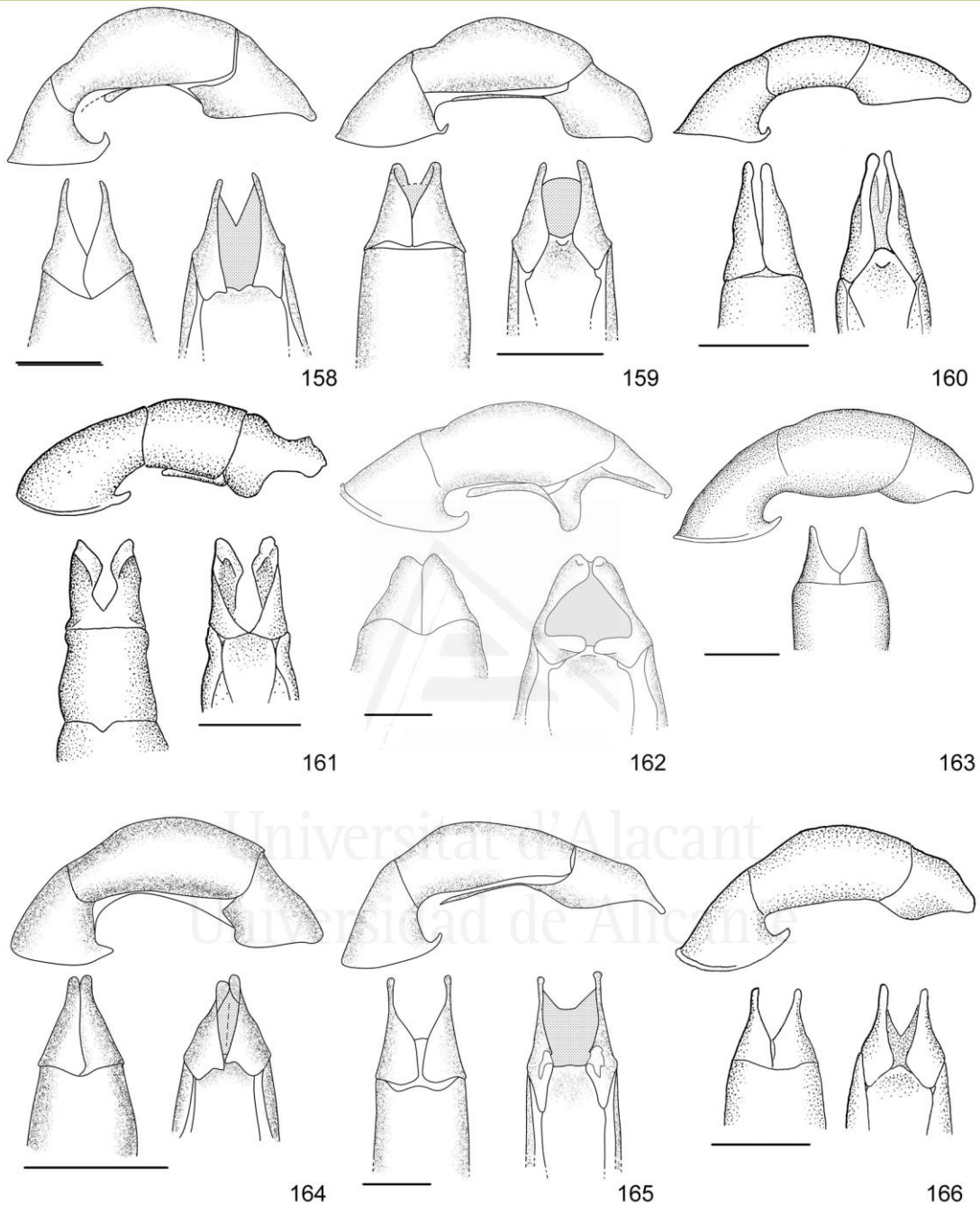


Figures 140–148. Shape of aedeagus, lateral view (top), dorsal view (bottom left), ventral view (bottom right). 140: *Anomala globulata* (Macizo de la Muerte, Cartago, INBIO). 141: *A. hiata* (Estación Pittier, Puntarenas, INBIO). 142: *A. histrionella* (Bahía Santa Elena, Guanacaste, INBIO). 143: *A. hoppi* (Las Cruces, Puntarenas, INBIO). 144: *A. inbio* (Estación Hitoy Cerere, Limón, INBIO). 145: *A. jansoni* (Monte Rotondo, Costa Rica, MNHUB). 146: *A. latifalculata* (Zona Protectora Cerros de la Carpintera, Cartago, INBIO). 147: *A. leopardina* (Finca Cafrosa, Puntarenas, INBIO). 148: *A. levicollis* (Cerro Montezuma, Alajuela, CEUA). Scale= 1mm.

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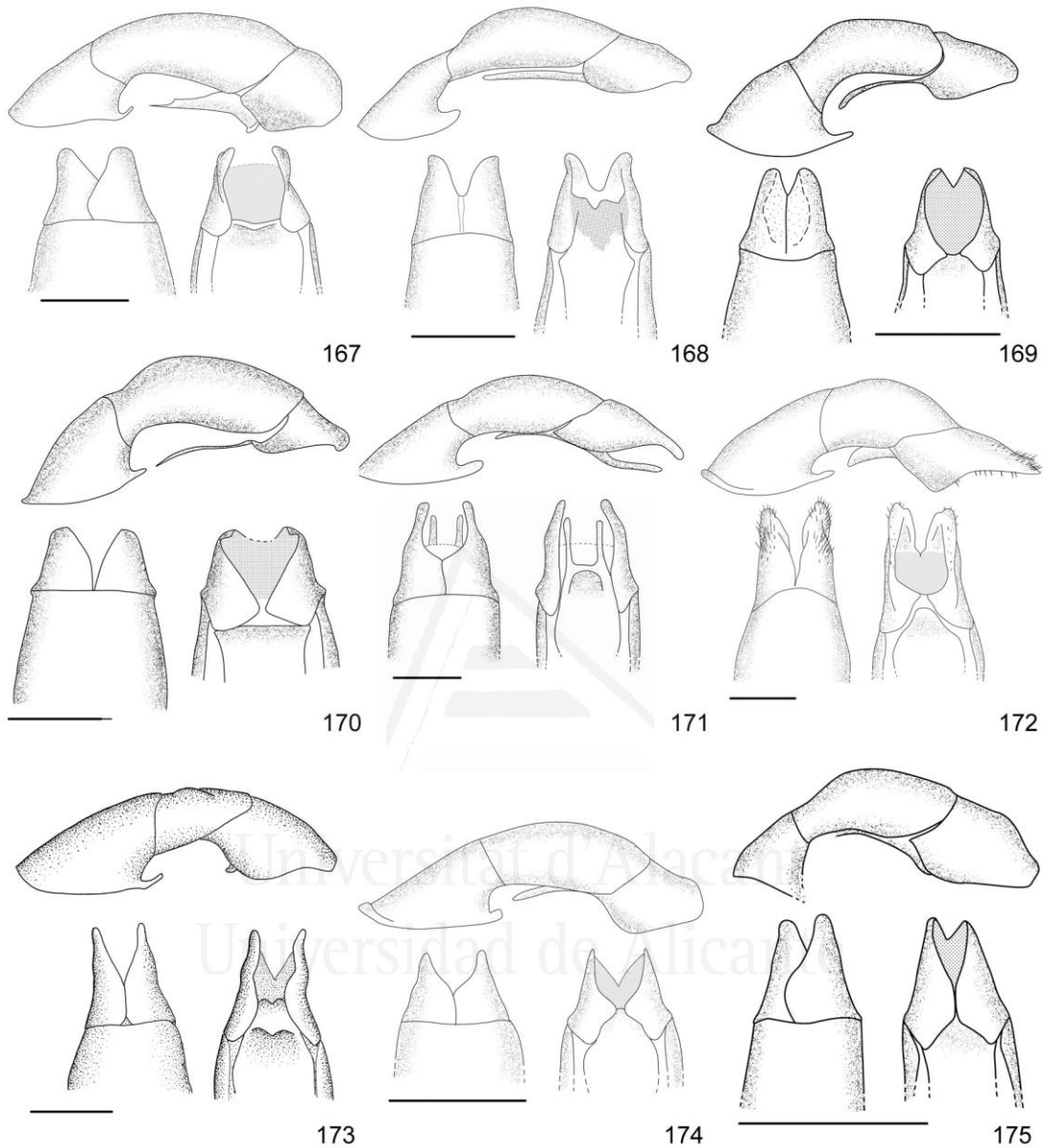


Figures 149–157. Shape of aedeagus, lateral view (top), dorsal view (bottom left), ventral view (bottom right). 149: *Anomala longisacculata* (La Montura, San José, CEUA). 150: *A. ludoviciana* (Finca Jenny, Guanacaste, INBIO). 151: *A. megalia* (Manzanillo, Limón, INBIO). 152: *A. megaparamera* (Estación Cuatro Esquinas, Limón, INBIO). 153: *A. mersa* (Sector Palo Verde, Guanacaste, INBIO). 154: *A. mesosticta* (Los Arbolitos, heredia, INBIO). 155: *A. m-fuscum* (Río Grande de Orosí, Cartago, INBIO). 156: *A. nigroflava* (Río Rincon, Puntarenas, INBIO). 157: *A. obovata* (Quebrada Kuisa, Limón, INBIO). Scale= 1mm.

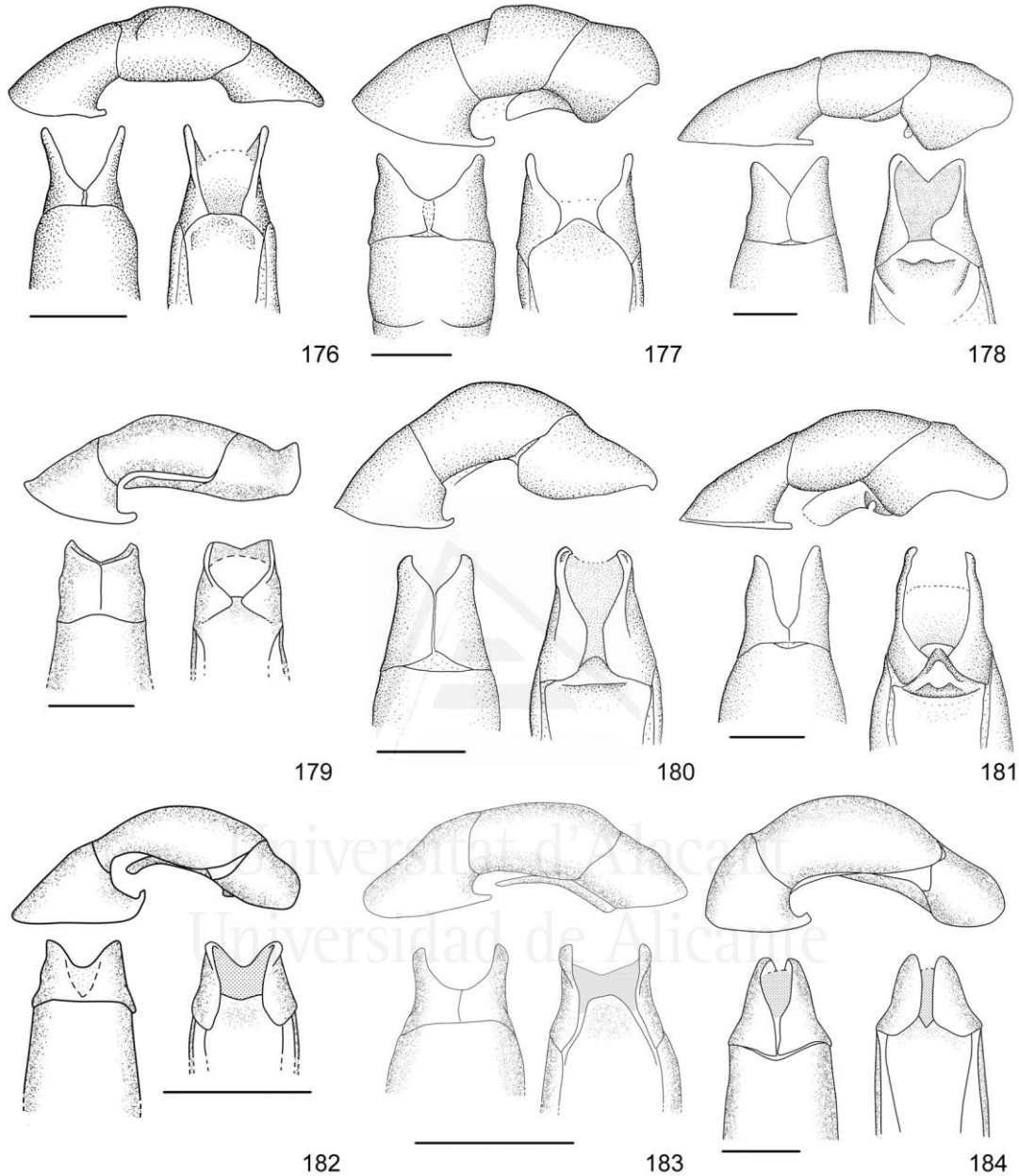


Figures 158–166. Shape of aedeagus, lateral view (top), dorsal view (bottom left), ventral view (bottom right). 158: *Anomala ochrogastra* (Finca Cafrosa, Puntarenas, INBIO). 159: *A. ochroptera* (La Maritza, Guanacaste, INBIO). 160: *A. perspicax* (La Esperanza, Cartago, CEUA). 161: *A. piccolina* (Estación Biológica Las Alturas, Puntarenas, INBIO). 162: *A. pincelada* (Finca Jenny, Guanacaste, INBIO). 163: *A. polygona* (Escazu, Costa Rica, MNHUB). 164: *A. popayana* (Río Banano, Limón, INBIO). 165: *A. praezellens* (Orosilito, Guanacaste, CEUA). 166: *A. pseudoeucoma* (Estación Hitoy Cerere, Limón, INBIO). Scale= 1mm.

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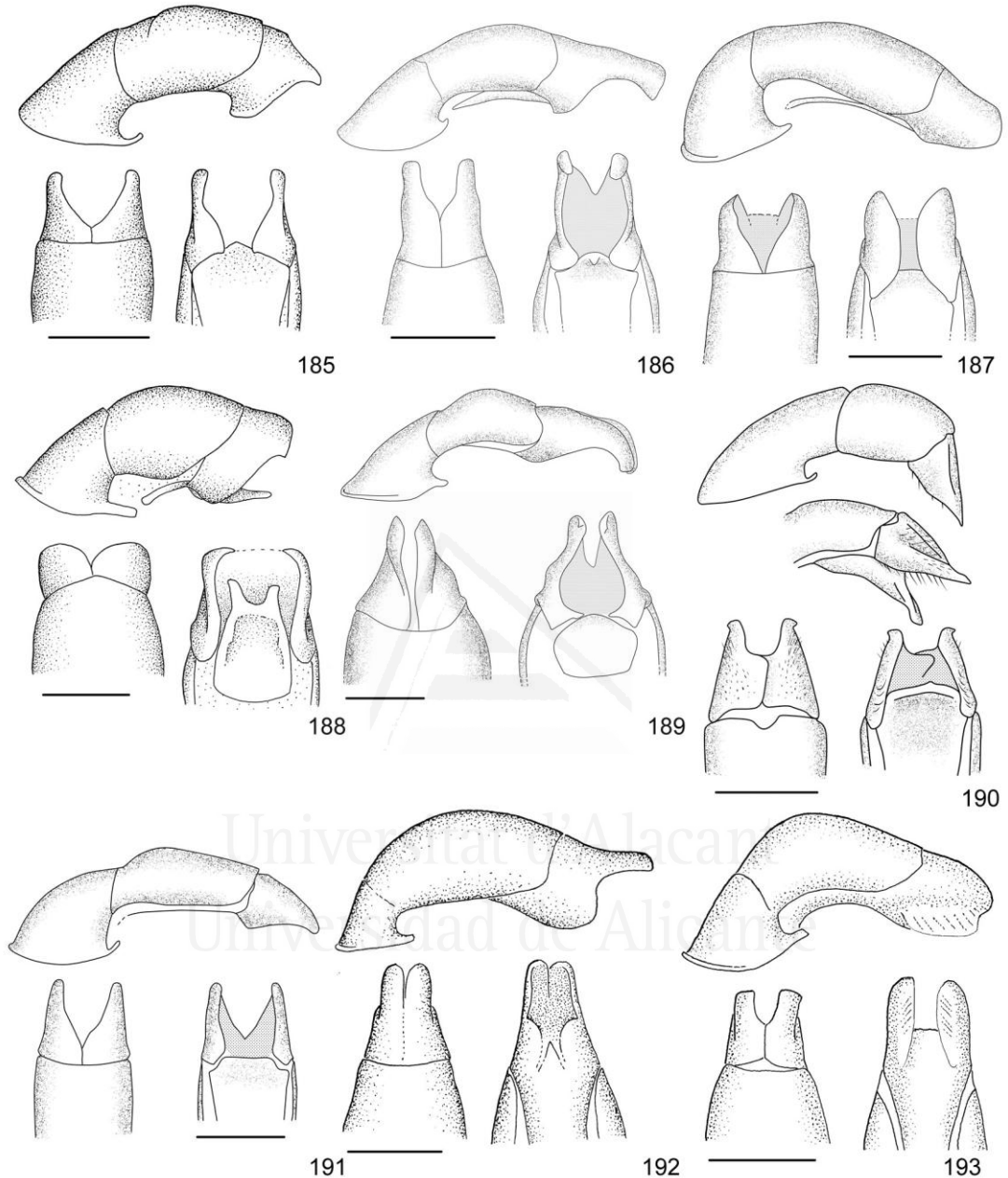


Figures 167–175. Shape of aedeagus, lateral view (top), dorsal view (bottom left), ventral view (bottom right). 167: *Anomala quiche* (Estación Maritza, Guanacaste, INBIO). 168: *A. robiginosa* (Zarcero, Alajuela, INBIO). 169: *A. ruatana* (Playa Naranjo, Guanacaste, INBIO). 170: *A. semicincta* (Albergue Heliconias, Alajuela, CEUA). 171: *A. semilla* (Albergue Heliconias, Alajuela, CEUA). 172: *A. solisi* (Amubri, Limón, INBIO). 173: *A. stillaticia* (La Catarata, Cartago, INBIO). 174: *A. strigodermoides* (holotype). 175: *A. subaenea* (Estación Maritza, Guanacaste, INBIO). Scale= 1mm.

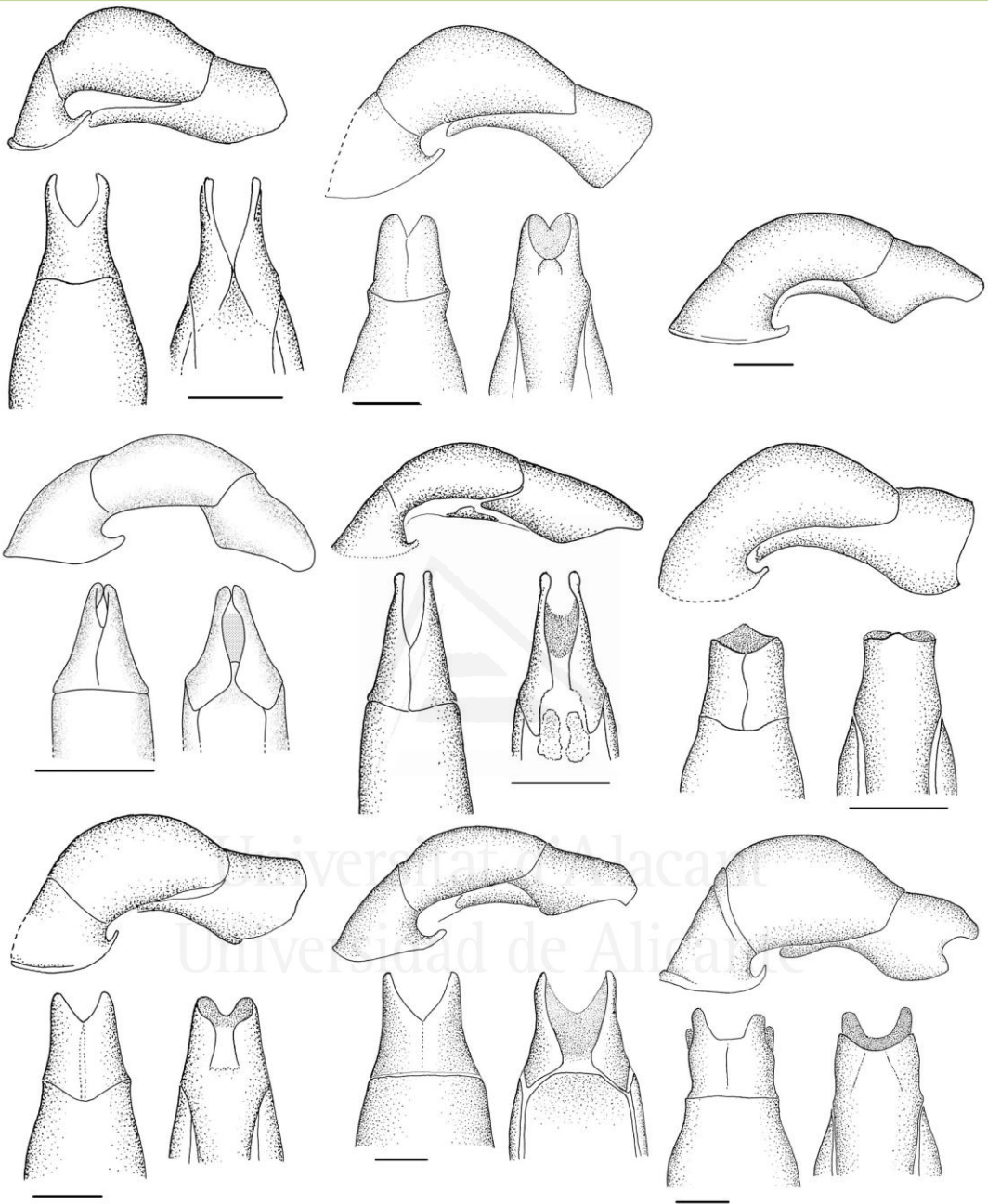


Figures 176-184. Shape of aedeagus, lateral view (top), dorsal view (bottom left), ventral view (bottom right). 176: *Anomala subridens* (Reserva Forestal Río Macho, Cartago, INBIO). 177: *A. subusta* (Estación Cacao, Guanacaste, INBIO). 178: *A. tenoriensis* (Parque Nacional Volcán Tenorio, Alajuela, INBIO). 179: *A. testaceipennis* (Boca Tapada, Alajuela, INBIO). 180: *A. trapezifera* (Parque Nacional Tapantí, Cartago, CEUA). 181: *A. tuberculata* (Isla Bonita, Alajuela, CEUA). 182: *A. undulata* (Estación Cacao, Guanacaste, INBIO). 183: *A. unilineata* (Parque Nacional Santa Rosa, Guanacaste, INBIO). 184: *A. valida* (La Cruz, Guanacaste, INBIO). Scale=1mm.

4. Checklist and key

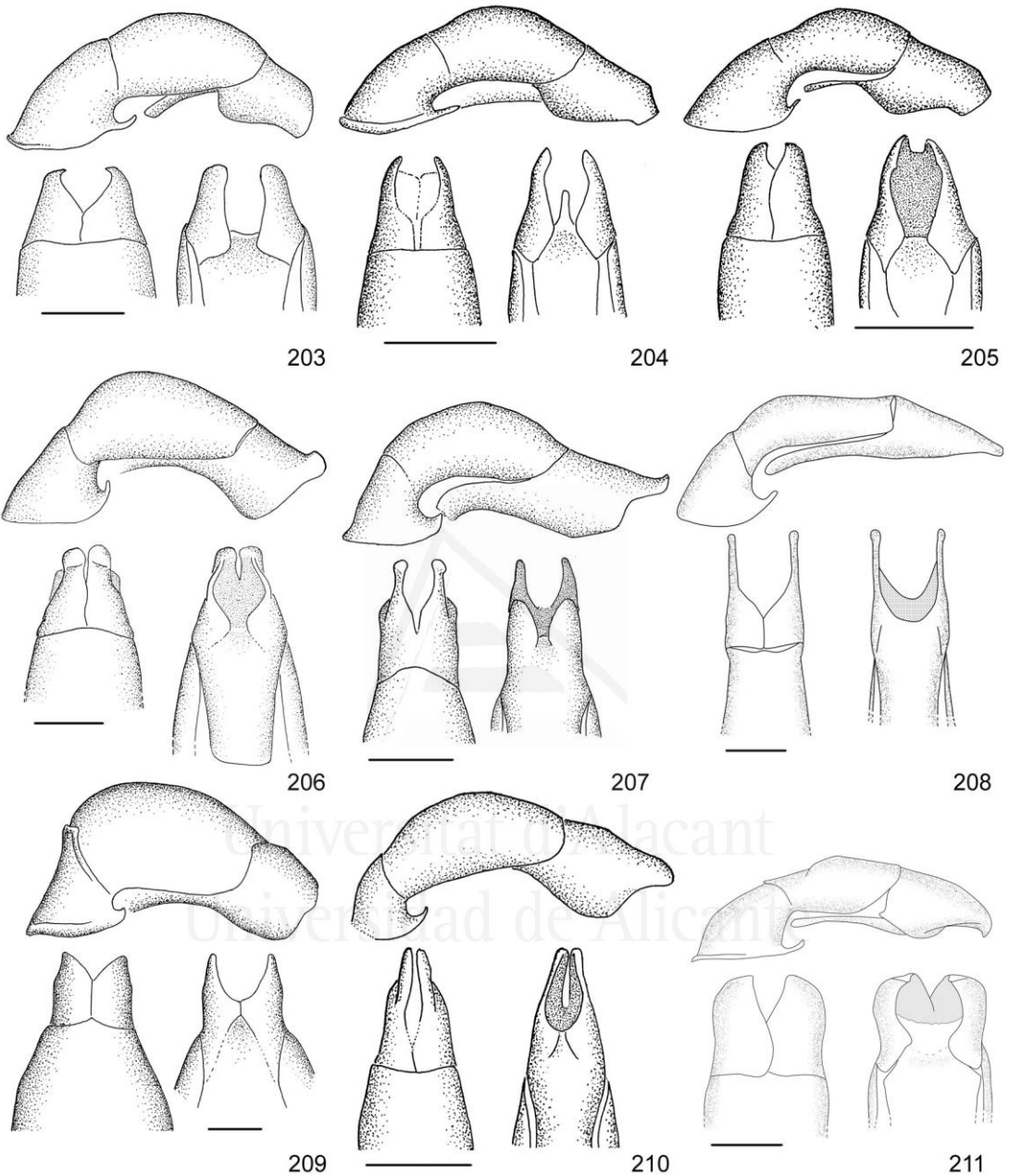


Figures 185-193. Shape of aedeagus, lateral view (top), dorsal view (bottom left), ventral view (bottom right). 185: *Anomala vallisneria* (Sector Las Pailas, Guanacaste, INBIO). 186: *A. veraecrucis* (Finca Jenny, Guanacaste, INBIO). 187: *A. volsellata* (Las Quebraditas, Puntarenas, INBIO). 188: *A. vulcanicola* (San Gerardo de Dota, San José, INBIO). 189: *A. zumbadoi* (Rancho quemado, Puntarenas, INBIO). 190: *A. nitidula*, below lateral view: detail of parameres when endophallus is everted (Lateral view: Guatemala, MNHUB; other: Zarcero, Alajuela, INBIO). 191: *Anomalorhina turrialbana* (Cabanga, Alajuela, CEUA). 192: *Callistethus calonotus* (Alto de Las Moras, Puntarenas, INBIO). 193: *C. carbo* (Río San Lorenzo, Guanacaste, INBIO). Scale=1mm.

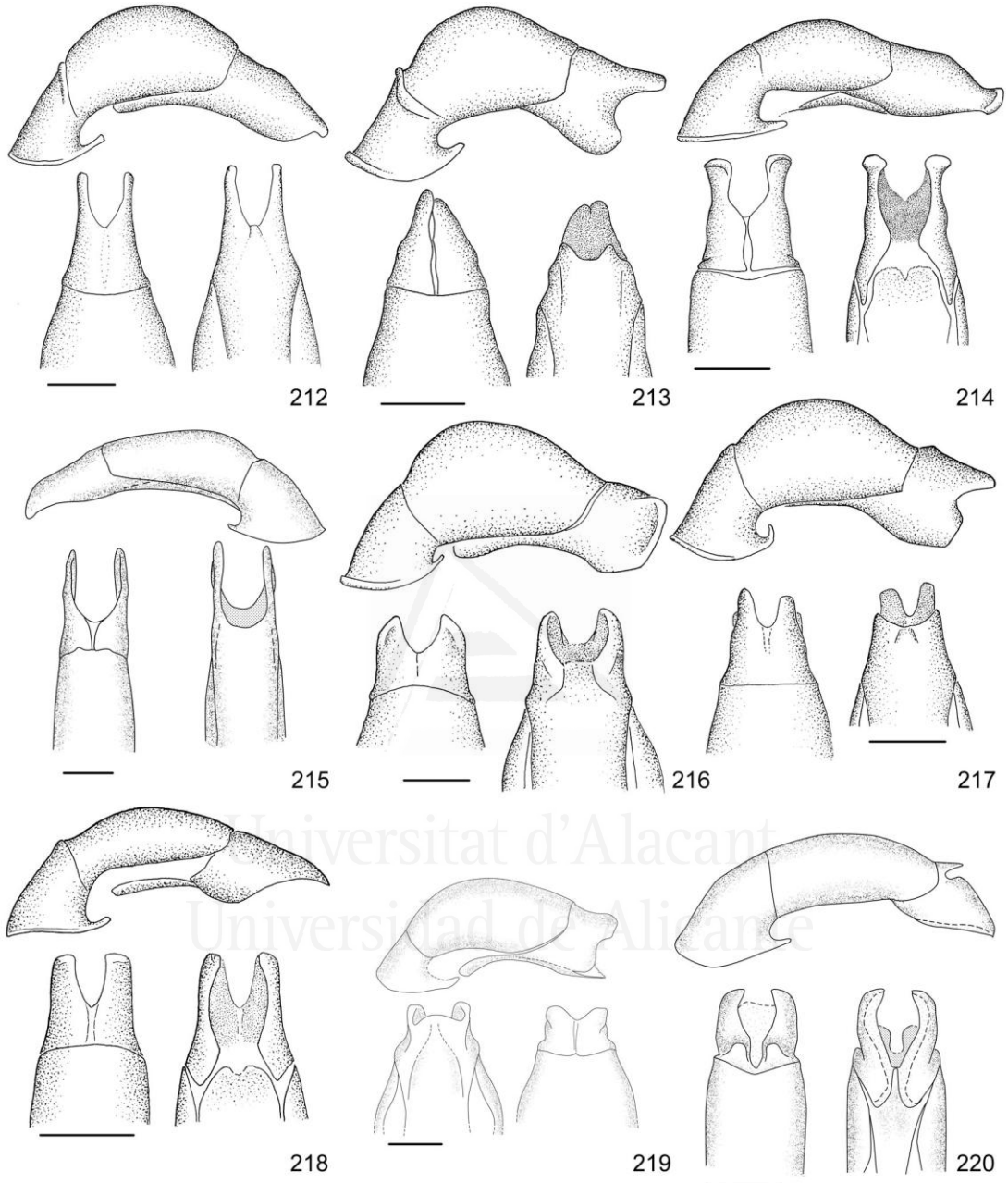


Figures 194-202. Shape of aedeagus, lateral view (top), dorsal view (bottom left), ventral view (bottom right). 194: *Callistethus chlorotoides* (Estación Hitoy Cerere, Limón, INBIO). 195: *C. chontalensis* (El Copal, Cartago, CEUA). 196: *C. chrysanthe* (Chiriqui, MNHUB). 197: *C. chrysoelinus* (San Luis, Puntarenas, INBIO). 198: *C. flavodorsalis* (Finca Cafrosa, Puntarenas, INBIO). 199: *C. fuscrobens* (La Esquadra, Puntarenas, INBIO). 200: *C. granulipygus* (Rancho Quemado, Puntarenas, INBIO). 201: *C. jordani* (Estación Cacao, Guanacaste, INBIO). 202: *C. lativittis* (Dos de Tilaran, Guanacaste, INBIO). Scale=1mm.

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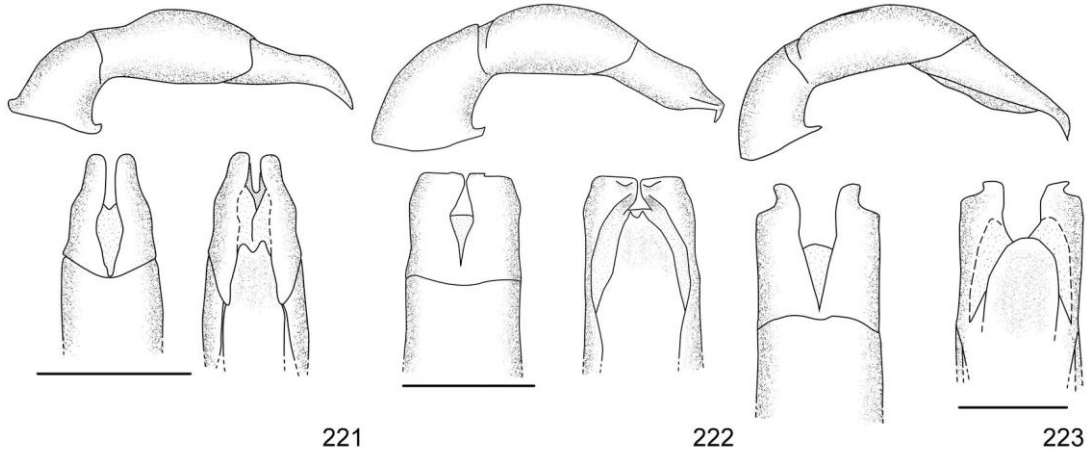


Figures 203-211. Shape of aedeagus, lateral view (top), dorsal view (bottom left), ventral view (bottom right). 203: *Callistethus levigatus* (Estación La Casona, Puntarenas, INBIO). 204: *C. macroxantholeus* (Sector Cerro Cocori, Limón, INBIO). 205: *C. microxantholeus* (Est. Pitilla, Guanacaste, INBIO). 206: *C. mimeloides* (La Montura, San José, CEUA). 207: *C. multiplicatus* (Sector Cerro Cocori, Limón, INBIO). 208: *C. nicoyus* (Estación Quebrada Bonita, Puntarenas, INBIO). 209: *C. parapulcher* (Estación Pittier, Puntarenas, INBIO). 210: *C. pseudocollaris* (Estación La Casona, Puntarenas, INBIO). 211: *C. ruteloides* (holotype). 212: *C. schneideri* (Albergue Heliconias, Alajuela, INBIO). Scale= 1mm.



Figures 212–220. Shape of aedeagus, lateral view (top), dorsal view (bottom left), ventral view (bottom right). 213: *Callistethus specularis* (Costa Rica, BMNH). 214: *C. stannibractea* (Estación Barva, Heredia, INBIO). 215: *C. sulcans* (Reserva Biológica Hitoy Cerere, Limón, INBIO). 216: *C. valdecostatus* (Alto de las Moras, Puntarenas, INBIO). 217: *C. vanpatteni* (Cinco Esquinas de Carrizal, Alajuela, INBIO). 218: *C. xiphostethus* (Los Ángeles, Heredia, INBIO). 219: *C. yalizo* (Cerro Chompipe, Heredia). 220: *Strigoderma auriventris* (Sector San Ramón de dos ríos, Alajuela, INBIO). Scale= 1mm.

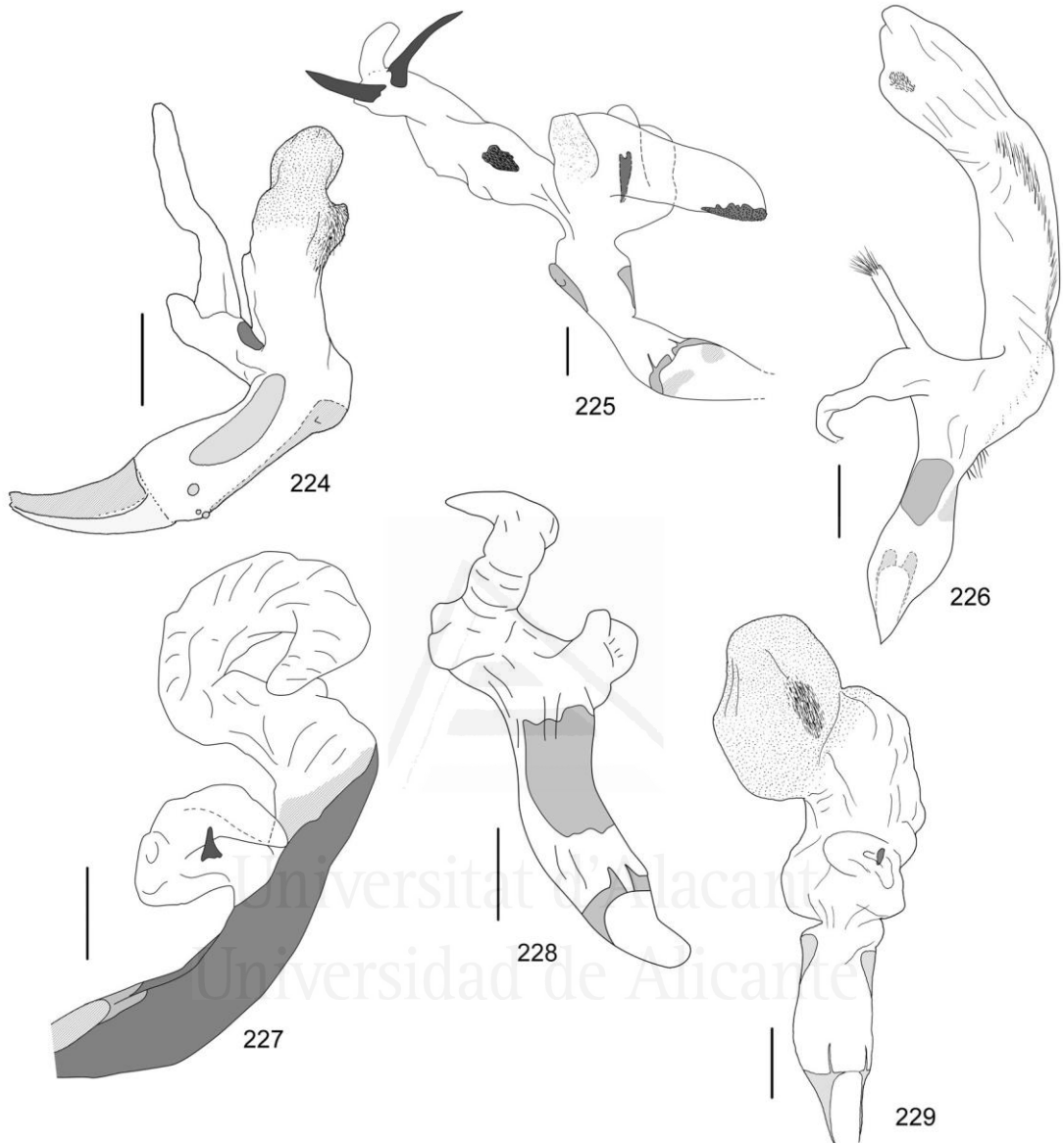
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Figures 221-223. Shape of aedeagus, lateral view (top), dorsal view (bottom left), ventral view (bottom right). 221: *Strigoderma biolleyi* (Macizo de la Muerte, Cartago, INBIO). 222: *S. nodulosa* (Estación Quebrada Bonita, Puntarenas, INBIO). 223: *S. sulcipennis* (Finca Jenny, Guanacaste, INBIO). Scale=1mm.

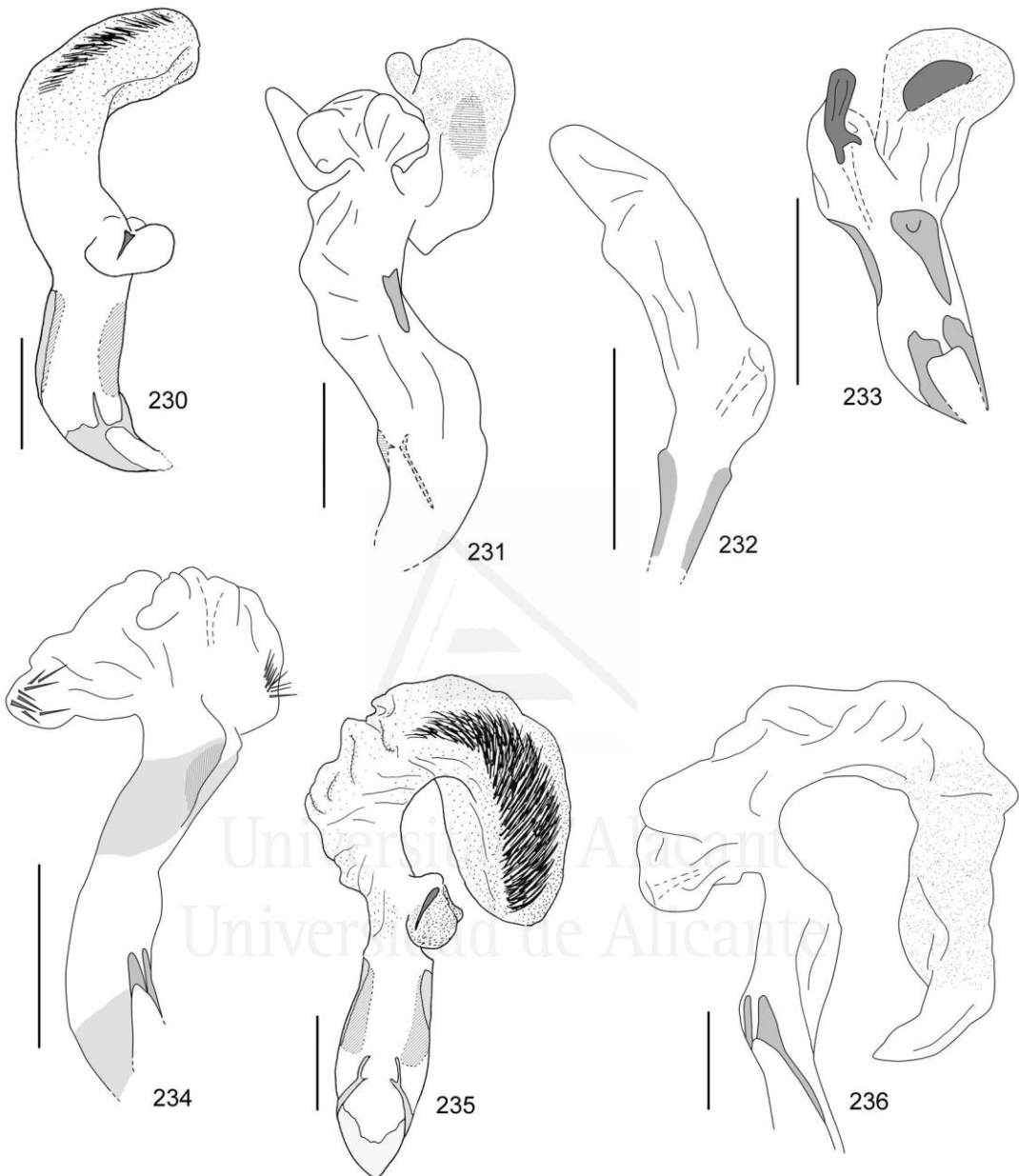


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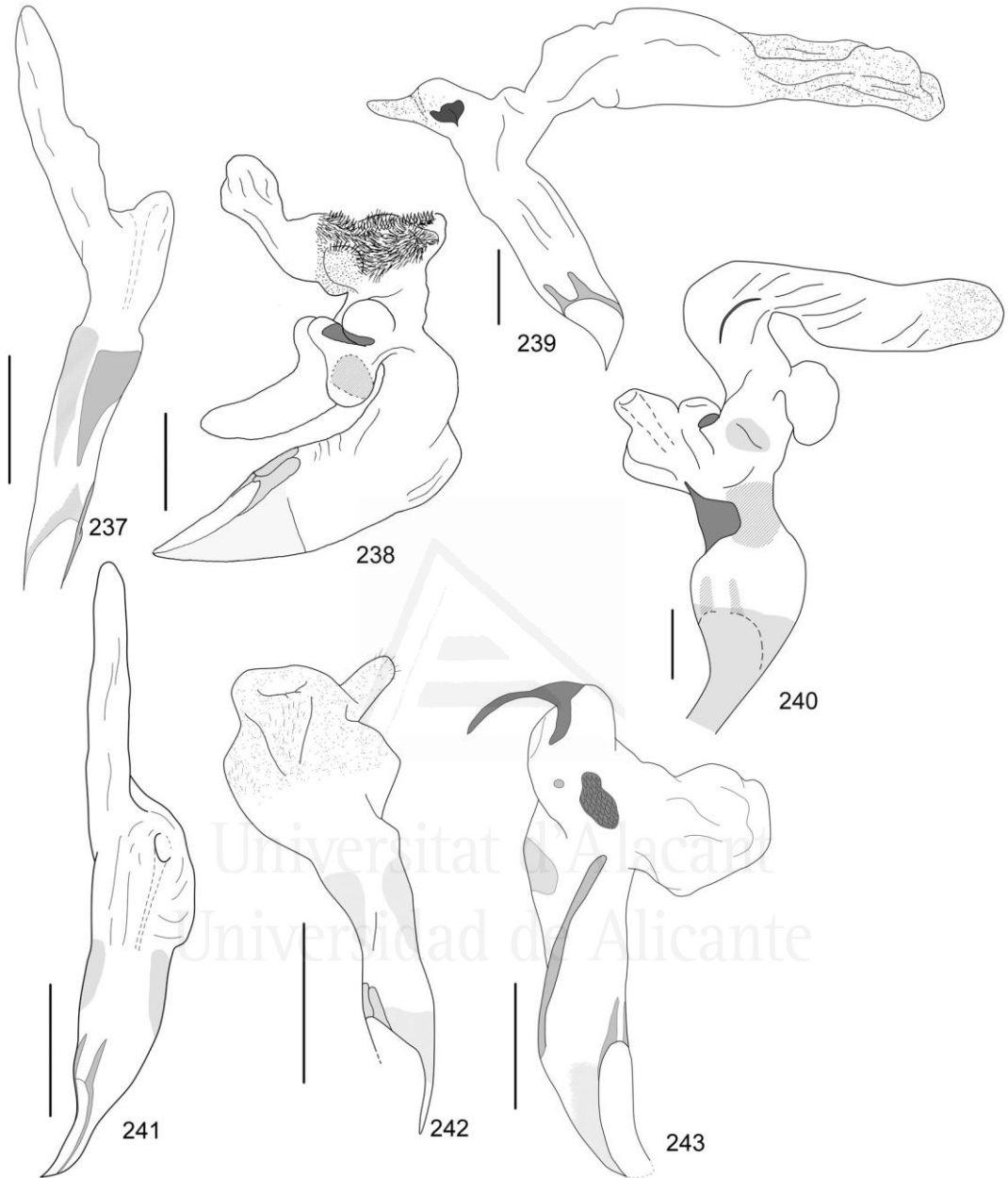


Figures 224–229. Endophallus of 224: *Anomala aereiventris* (Parque Nacional Tapantí, Cartago, INBIO). 225: *A. aglaos* (Isla Bonita, Alajuela, CEUA). 226: *A. antica* (Parque Nacional Santa Rosa, Guanacaste, INBIO). 227: *A. arara* (Albergue Heliconias, Alajuela, CEUA). 228: *A. arthuri* (Estación Maritza, Guanacaste, INBIO). 229: *A. aspersa* (Villa Mills, Cartago, INBIO). Scale= 1mm.

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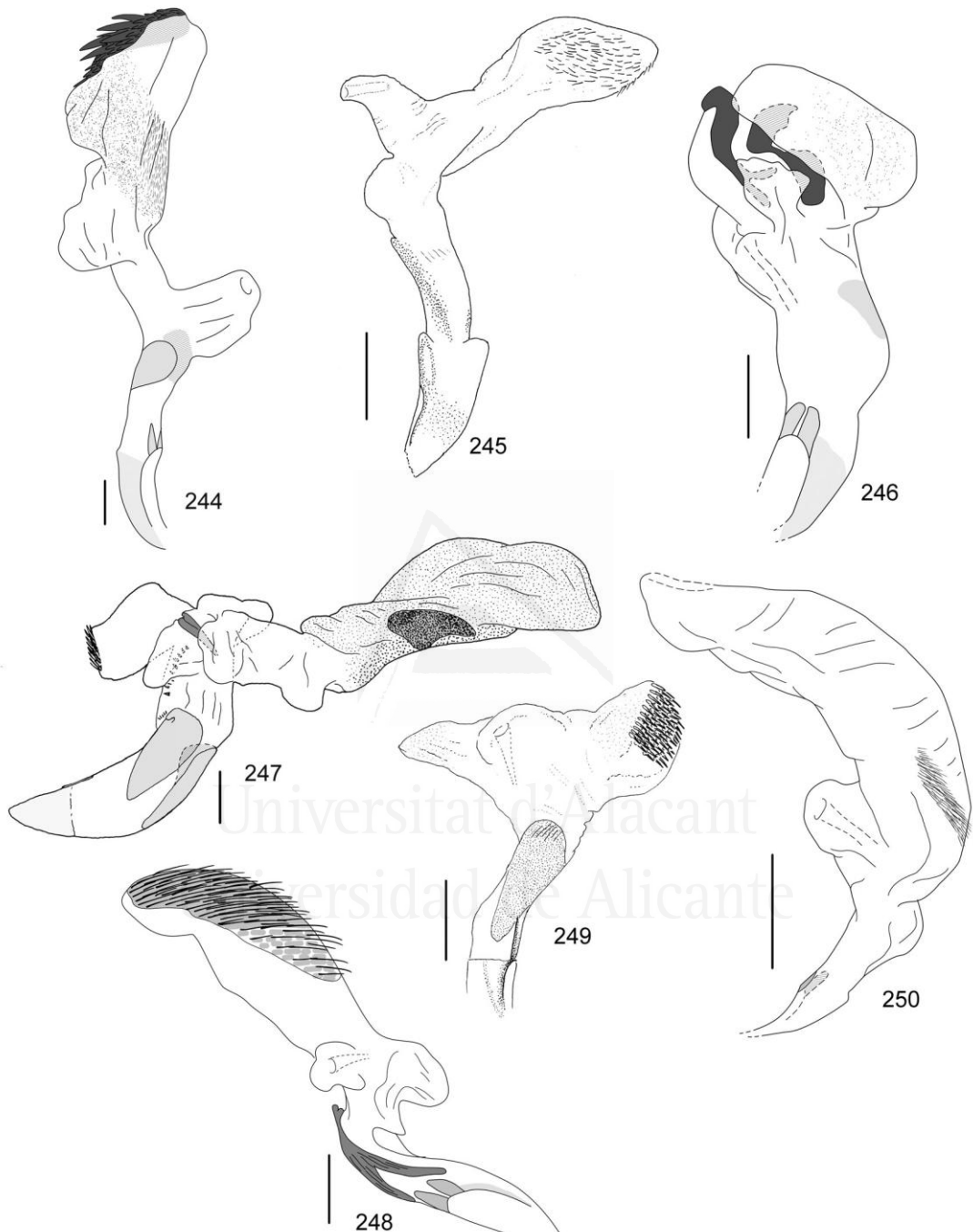


Figures 230–236. Endophallus of 230: *Anomala atrivillosa* (Estación Barva, Heredia, INBIO). 231: *A. balzapambae* (Rancho Quemado, Puntarenas, INBIO). 232: *A. calligrapha* (Cabro Muco, Guanacaste, CEUA). 233: *A. chiriquina* (Estación Biológica Las Alturas, Puntarenas, INBIO). 234: *A. chloropyga* (San Luis, Puntarenas, INBIO). 235: *A. clarivillosa* (La Esperanza del Guarco, Cartago, CEUA). 236: *A. clathrata* (Albergue Heliconias, Alajuela, CEUA). Scale= 1mm.

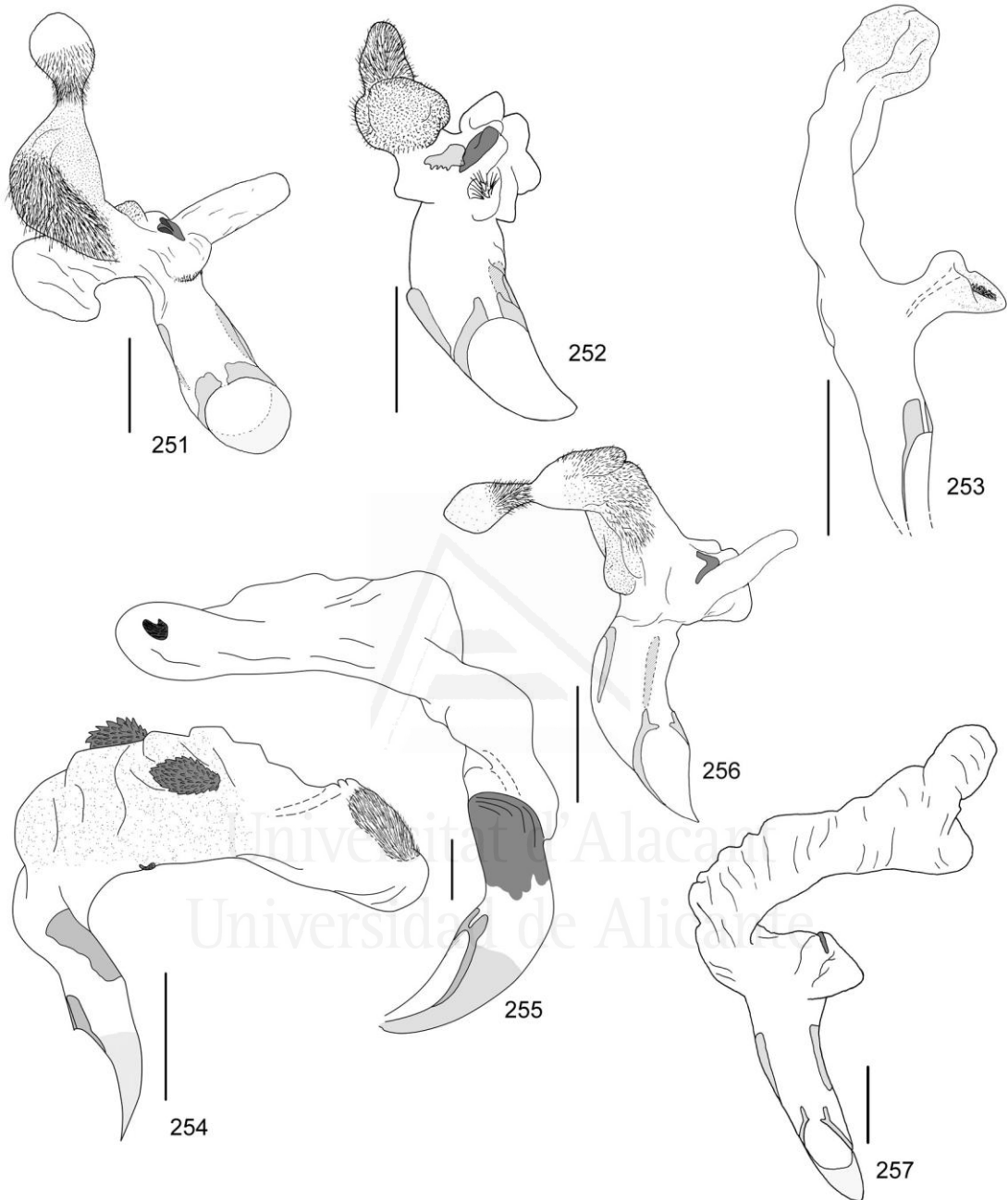


Figures 237–243. Endophallus of 237: *Anomala coffea* (Estación Pitilla, Guanacaste, INBIO). 238: *A. contusa* (Volcán Tenoo, Guanacaste, CEUA). 239: *A. cupreovariolosa* (Zona Protectora Las Tablas, Puntarenas, INBIO). 240: *A. cupricollis* (Las Cruces, Puntarenas, INBIO). 241: *A. cyclops* (Finca Jenny, Guanacaste, INBIO). 242: *A. discoidalis* (Estación Cuatro Esquinas, Limón, INBIO). 243: *A. divisa* (Cinco esquinas de Carrizal, Alajuela, INBIO). Scale= 1mm.

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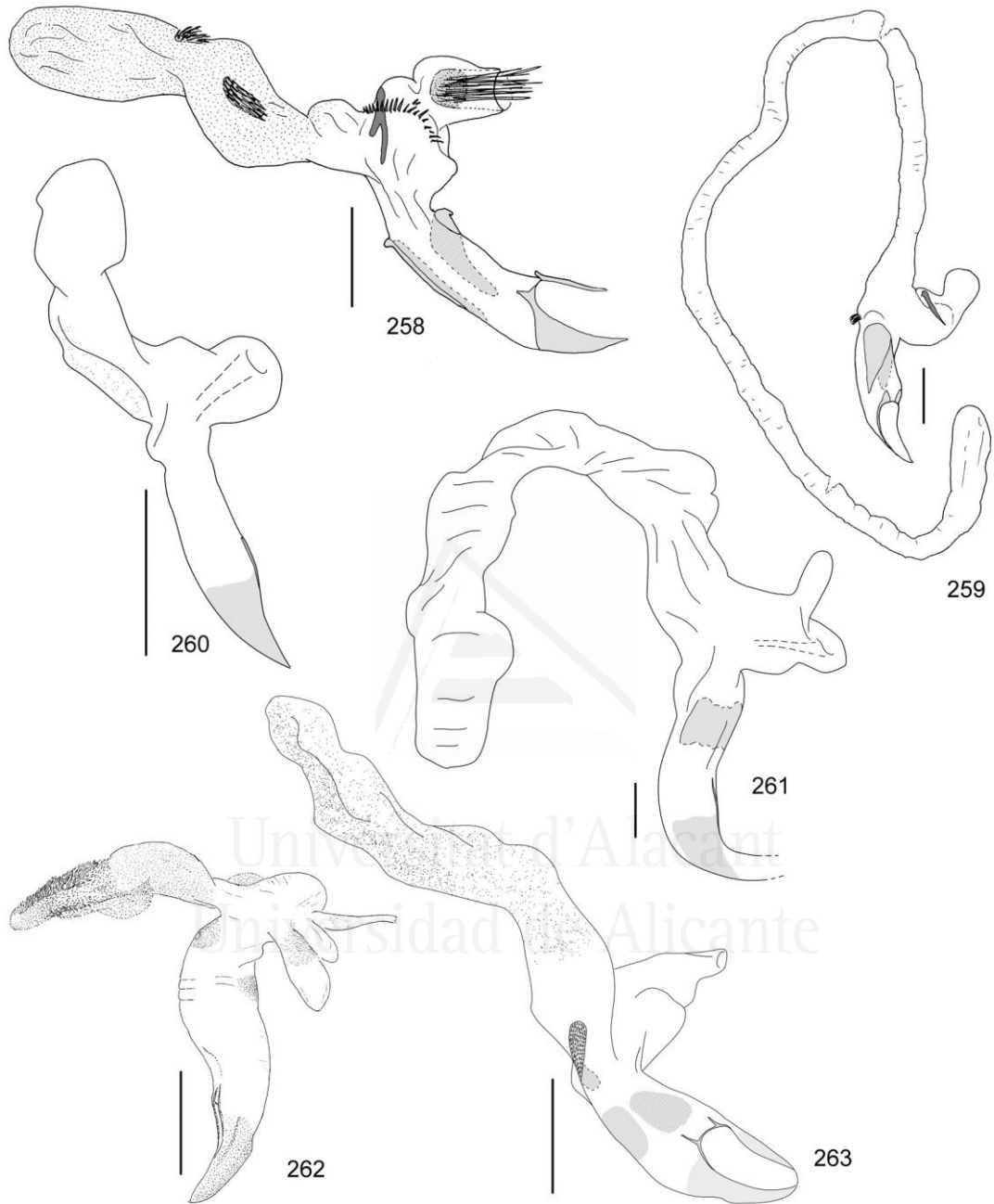


Figures 244-250. Endophallus of 244: *Anomala estrella* (Hacienda Tiquires, San José, INBIO). 245: *A. eucoma* (San José, San José, MUCR). 246: *A. eulissa* (Sector Cedrales de la Rita, Limón, INBIO). 247: *A. eusticta* (Estación La Casona, Puntarenas, INBIO). 248: *A. ferrea* (Las Cruces, Puntarenas, INBIO). 249: *A. flavacoma* (Estación Cabro Muco, Guanacaste, CEUA). 250: *A. foraminosa* (Estación Hitoy Cerere, Limón, INBIO). Scale= 1mm.

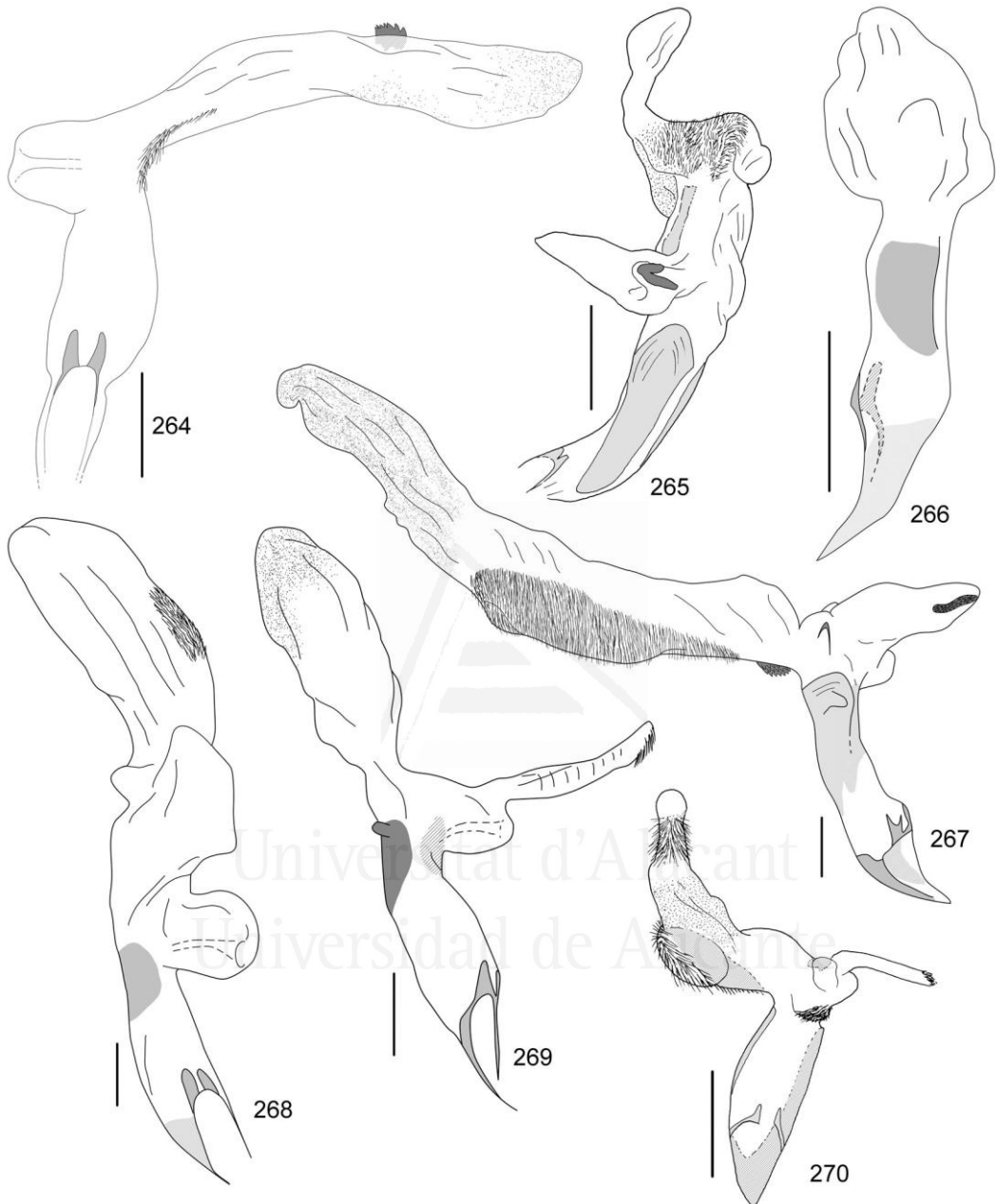


Figures 251–257. Endophallus of 251: *Anomala globulata* (reconstructed from two specimens: Macizo de la Muerte and Reserva forestal Río Macho, Cartago, INBIO). 252: *A. hiata* (Estación Pittier, Puntarenas, INBIO). 253: *A. histrionella* (Estación Murcielago, Guanacaste, INBIO). 254: *A. hoppi*, there is variability in the size and number (1–3) of patches of spines (Las Cruces, Puntarenas, INBIO). 255: *A. inbio* (Estación Hitoy Cerere, Limón, INBIO). 256: *A. latifalculata* (Zona Protectora Cerros de la Carpintera, Cartago, INBIO). 257: *A. leopardina* (Buenos Aires, Puntarenas, INBIO). Scale=1 mm.

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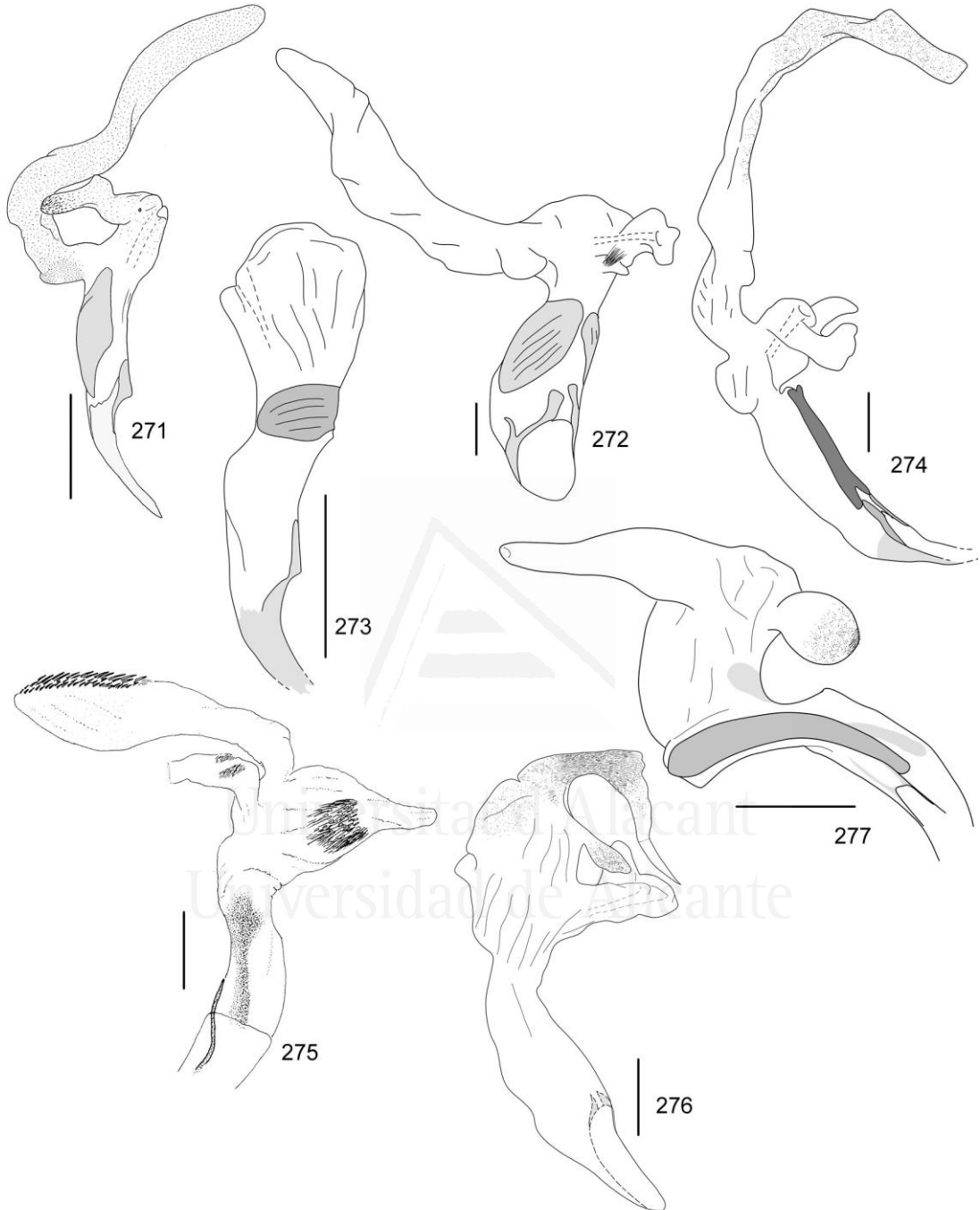


Figures 258-263. Endophallus of 258: *Anomala levicollis* (Estación La Casona, Puntarenas, INBIO). 259: *A. longisacculata* (Cabanga, Alajuela, CEUA). 260: *A. ludoviciana* (Parque Nacional Santa Rosa, Guanacaste, INBIO). 261: *A. megalia* (Cerro Tortuguero, Limón, INBIO). 262: *A. megaparamera* (Estación Cuatro Esquinas, Limón, INBIO). 263: *A. mersa* (Sector Palo Verde, Guanacaste, INBIO). Scale= 1mm.

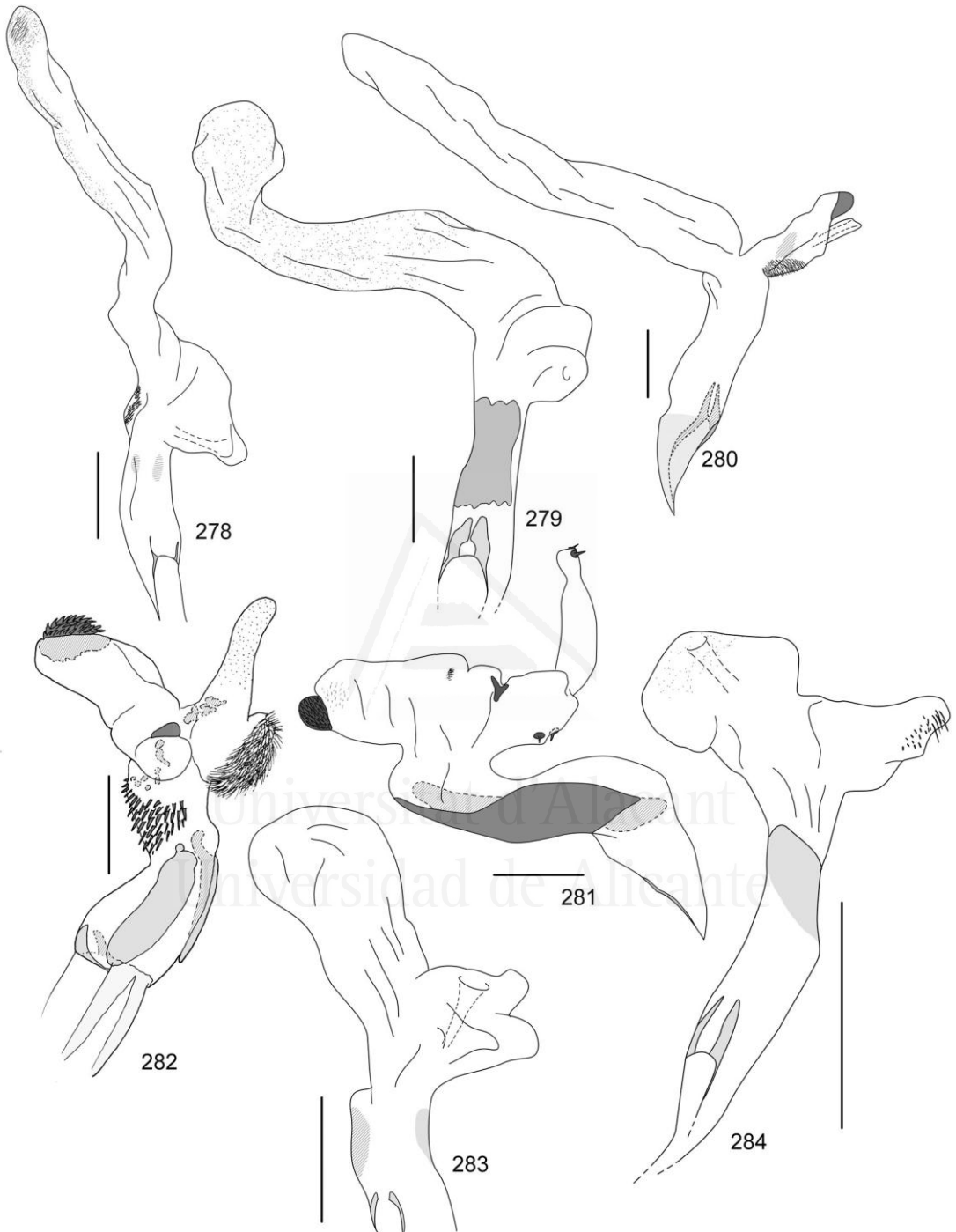


Figures 264-270. Endophallus of 264: *Anomala mesosticta* (Los Arbolitos, heredia, INBIO). 265: *A. m-fuscum* (La Esperanza del Guarco, Cartago, INBIO). 266: *A. nigroflava* (Río Rincon, Puntarenas, INBIO). 267: *A. obovata* (Cerro Chompipe, Heredia, INBIO). 268: *A. ochrogastra* (Estación Las Alturas, Puntarenas, INBIO). 269: *A. ochroptera* (La Maritza, Guanacaste, INBIO). 270: *A. perspicax* (Buenos Aires, Puntarenas, INBIO). Scale= 1mm.

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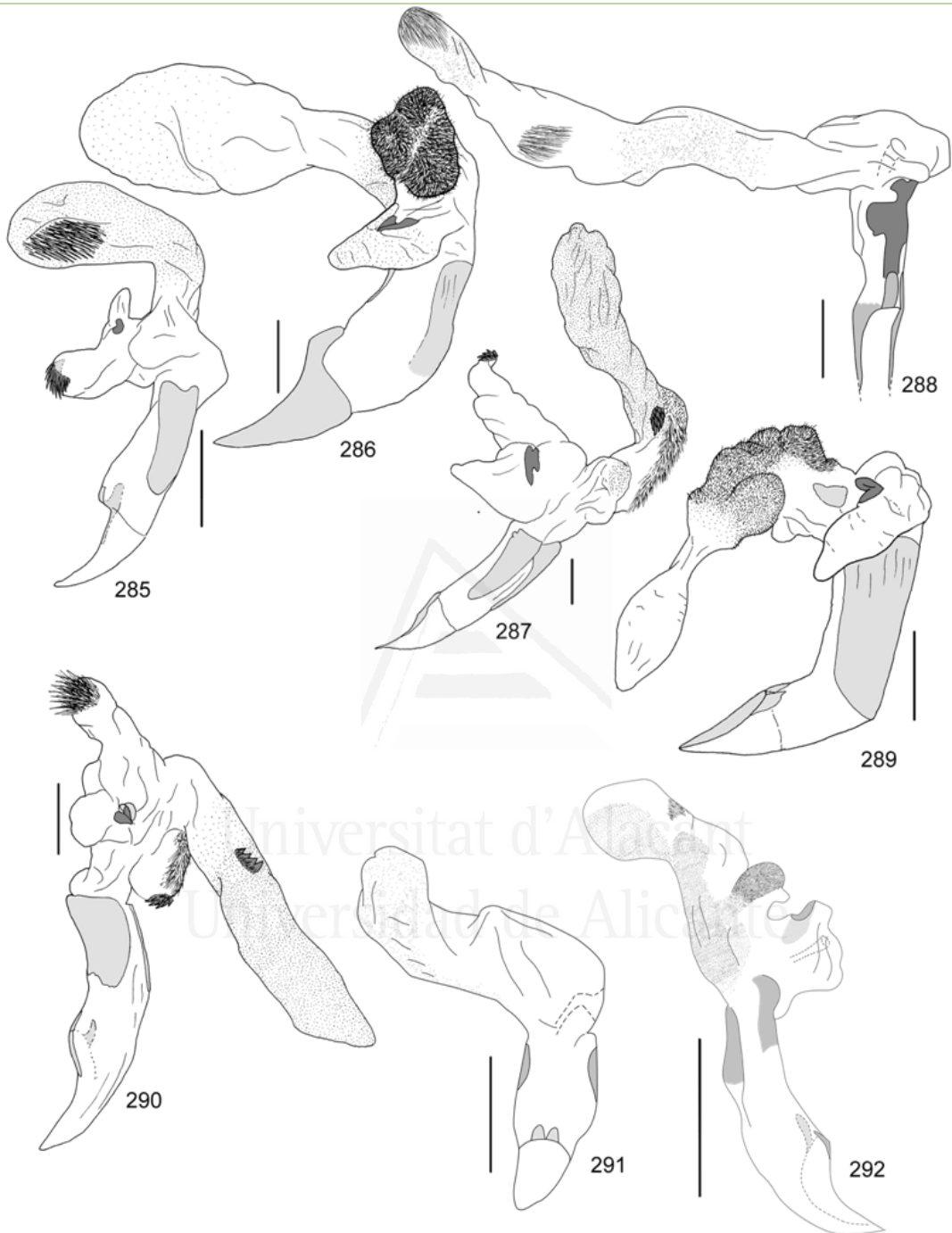


Figures 271–277. Endophallus of 271: *Anomala piccolina* (Estación Biológica Las Alturas, Puntarenas, INBIO). 272: *A. pincelada* (Cuajiniquil, Guanacaste, INBIO). 273: *A. popayana* (Reserva Biológica Hitoy Cerere, Limón, INBIO). 274: *A. praecellens* (Orosilito, Guanacaste, CEUA). 275: *A. pseudoeucoma* (Estación Hitoy Cerere, Limón, INBIO). 276: *A. quiche* (Estación Maritza, Guanacaste, INBIO). 277: *A. robiginosa* (Zarero, Alajuela, INBIO). Scale= 1mm.

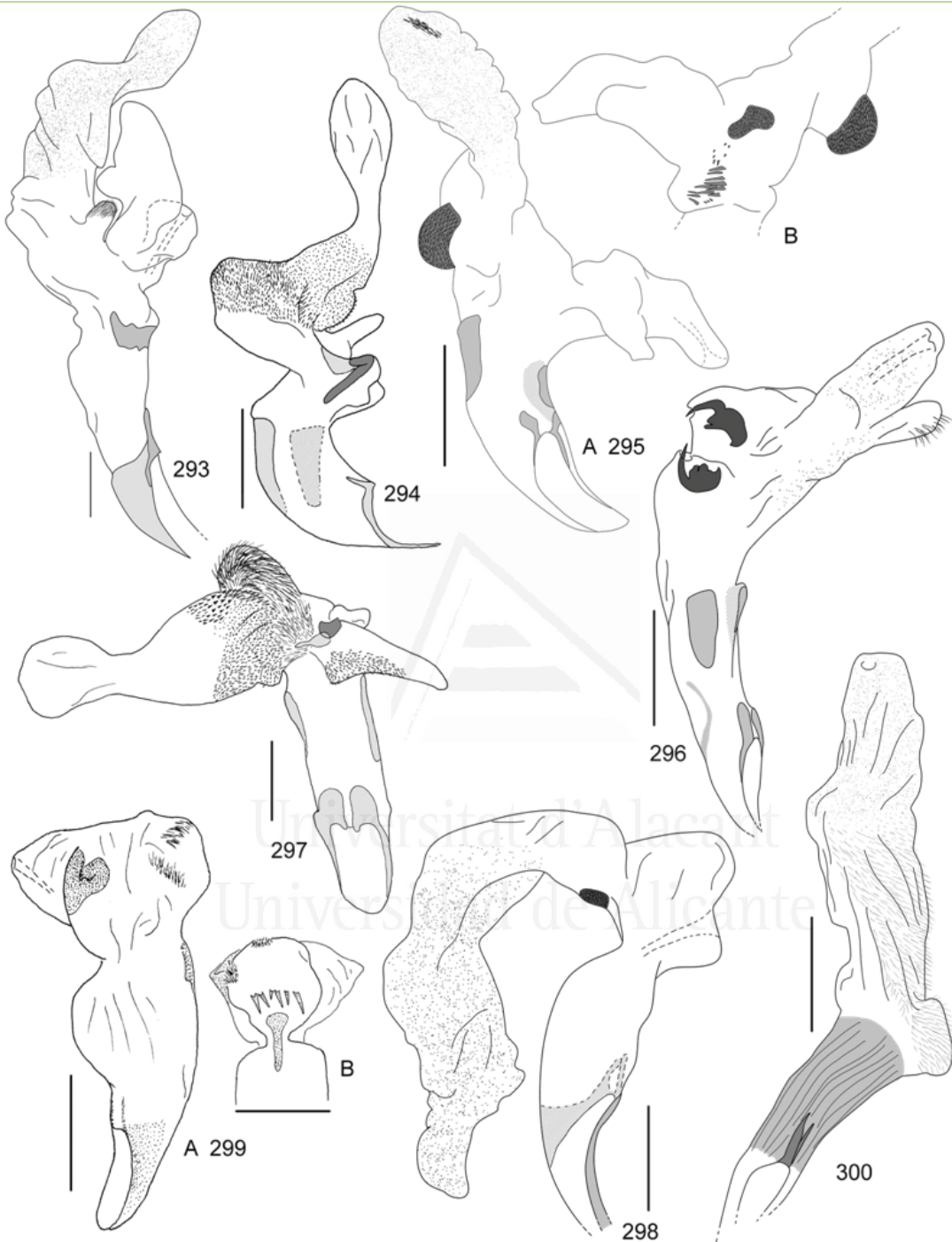


Figures 278–284 . Endophallus of 278: *Anomala ruatana* (Playa Naranjo, Guanacaste, INBIO). 279: *A. semicincta* (Albergue Heliconias, Alajuela, CEUA). 280: *A. semilla* (Albergue Heliconias, Alajuela, CEUA). 281: *A. solisi* (Estación Pitilla, Guanacaste, INBIO). 282: *A. stillaticia* (Río Grande de Orosí, Cartago, INBIO). 283: *A. strigodermoides* (holotype). 284: *A. subaenea* (Estación Maritza, Guanacaste, INBIO). Scale= 1mm.

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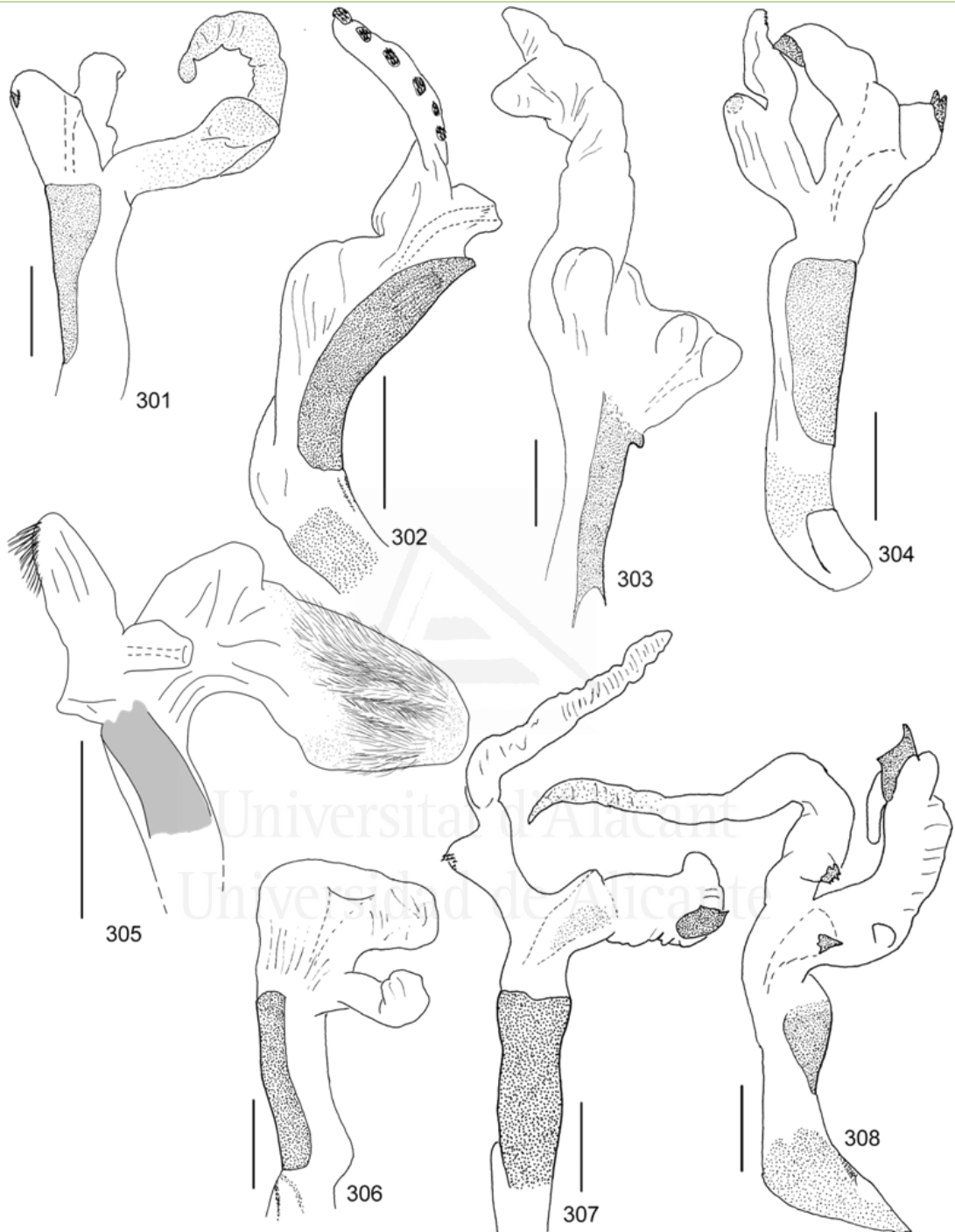


Figures 285–292. Endophallus of 285: *Anomala subridens* (Reserva Forestal Río Macho, Cartago, INBIO). 286: *A. subusta* (Estación Cacao, Guanacaste, INBIO). 287: *A. tenoriensis* (Parque Nacional Volcán Tenorio, Alajuela, INBIO). 288: *A. testaceipennis* (Vuelta Cmpaña, Heredia, INBIO). 289: *A. trapezifera* (Fila Matama, Limón, INBIO). 290: *A. tuberculata* (Albergue Heliconias, Alajuela, CEUA). 291: *A. undulata* (Zarcero, Alajuela, INBIO). 292: *A. unilineata* (Parque Nacional Santa Rosa, Guanacaste, INBIO). Scale= 1mm.

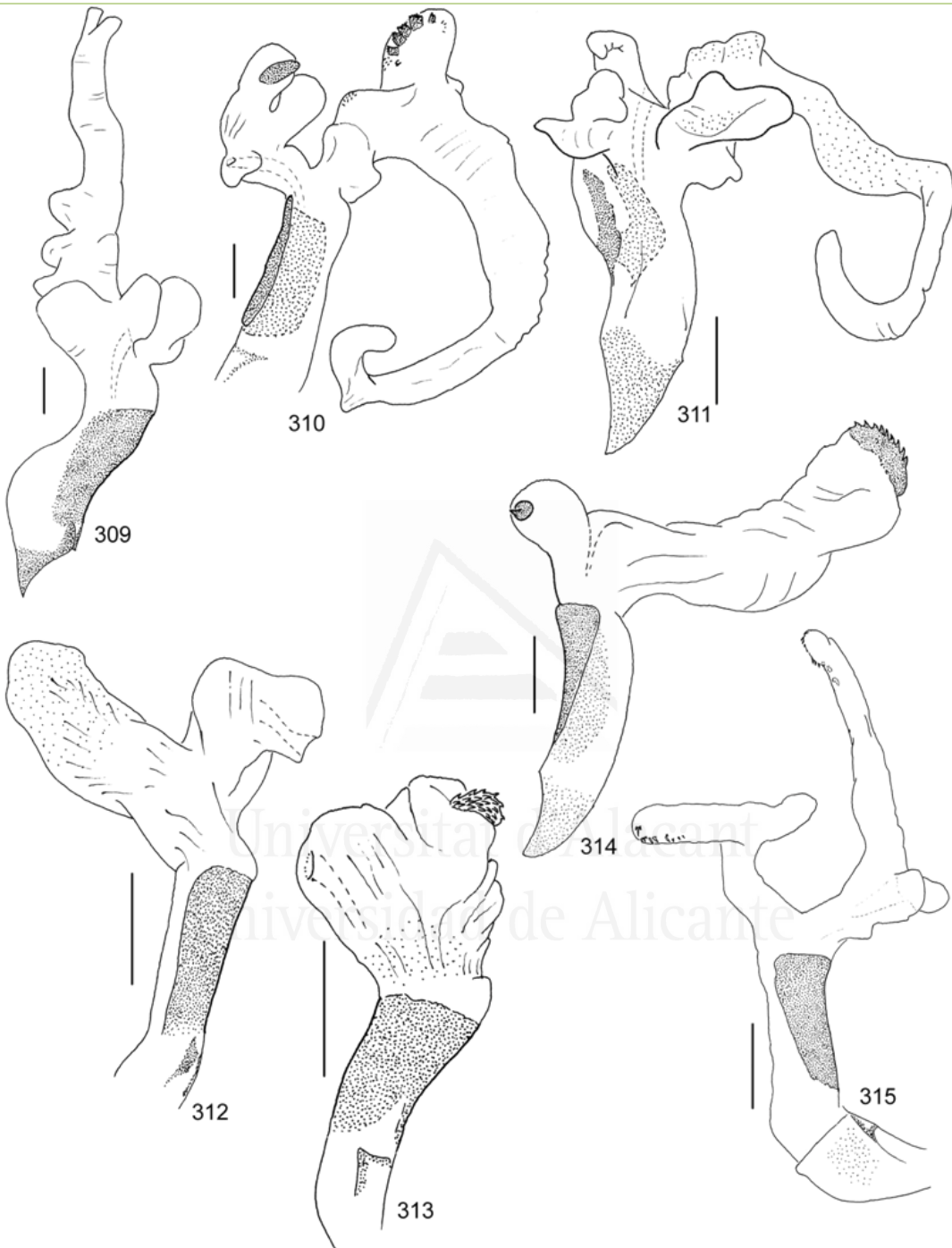


Figures 293–300. Endophallus of 293: *Anomala valida* (Estación Biológica La Selva, Heredia, INBIO). 294: *A. vallisneria* (Sector Las Pailas, Guanacaste, INBIO). 295: *A. veraecrucis*, A and B: opposite lateral views (Finca Jenny, Guanacaste, INBIO). 296: *A. volsellata* (Las Quebraditas, Puntarenas, INBIO). 297: *A. vulcanicola* (San Gerardo de Dota, San José, INBIO). 298: *A. zumbadoi* (Rancho quemado, Puntarenas, INBIO). 299: *A. nitidula*, A: lateral view, B: dorsal view (Zarcero, Alajuela, INBIO). 300: *Anomalorhina turrialbana* (Cabanga, Alajuela, CEUA). Scale= 1mm.

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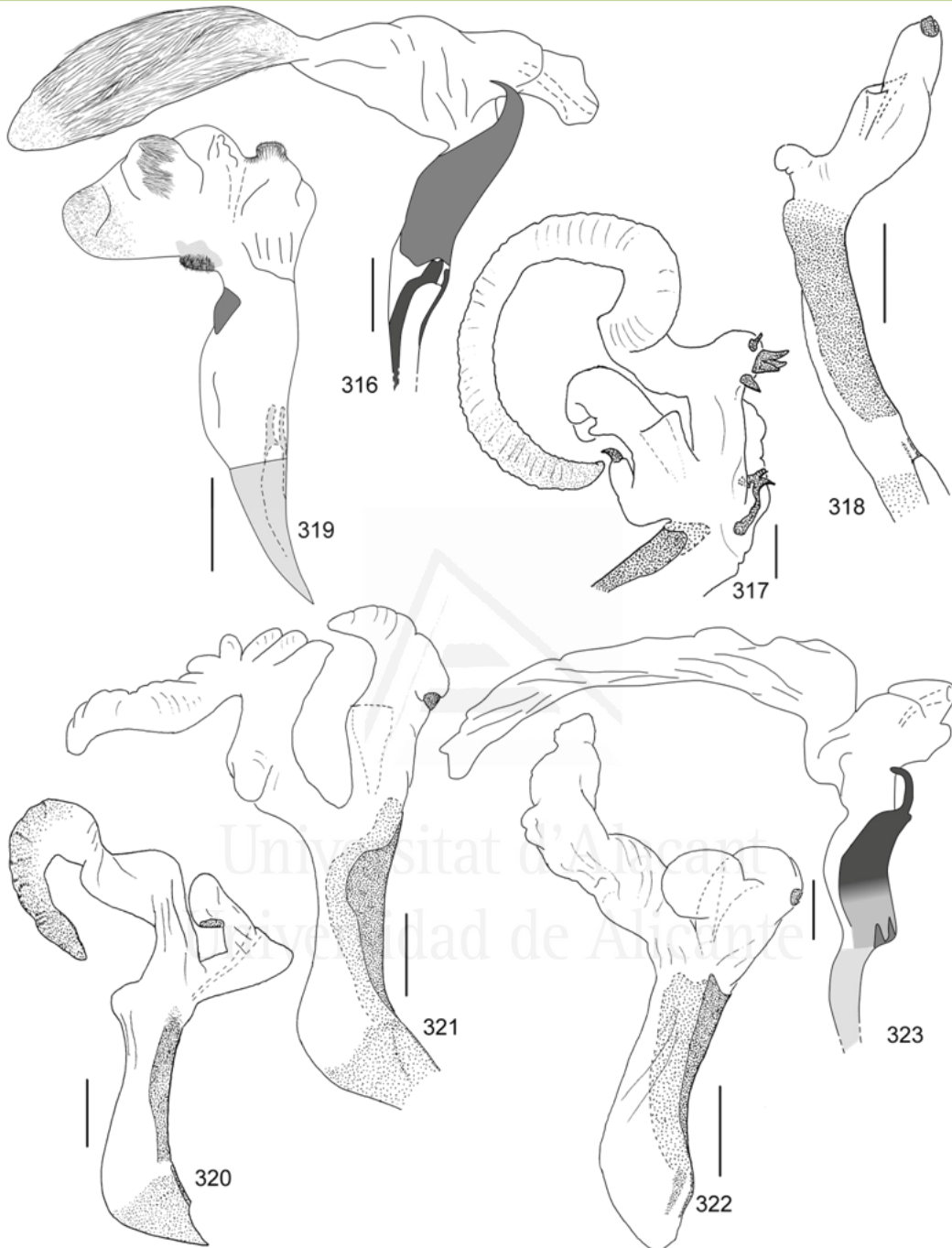


Figures 301–308. Endophallus of 301: *Callistethus calonotus* (Alto de Las Moras, Puntarenas, INBIO). 302: *C. carbo* (Río San Lorenzo, Guanacaste, INBIO). 303: *C. chlorotoides* (Estación Hitoy Cerere, Limón, INBIO). 304: *C. chontalensis* (El Copal, Cartago, CEUA). 305: *C. chrysoelinus* (Buen Amigos, Puntarenas, INBIO). 306: *C. flavodorsalis* (Finca Cafrosa, Puntarenas, INBIO). 307: *C. fusciorubens* (Estación Altamira, Puntarenas, INBIO). 308: *C. granulipygus* (Estación Quebrada Bonita, Puntarenas, INBIO). Scale= 1mm.

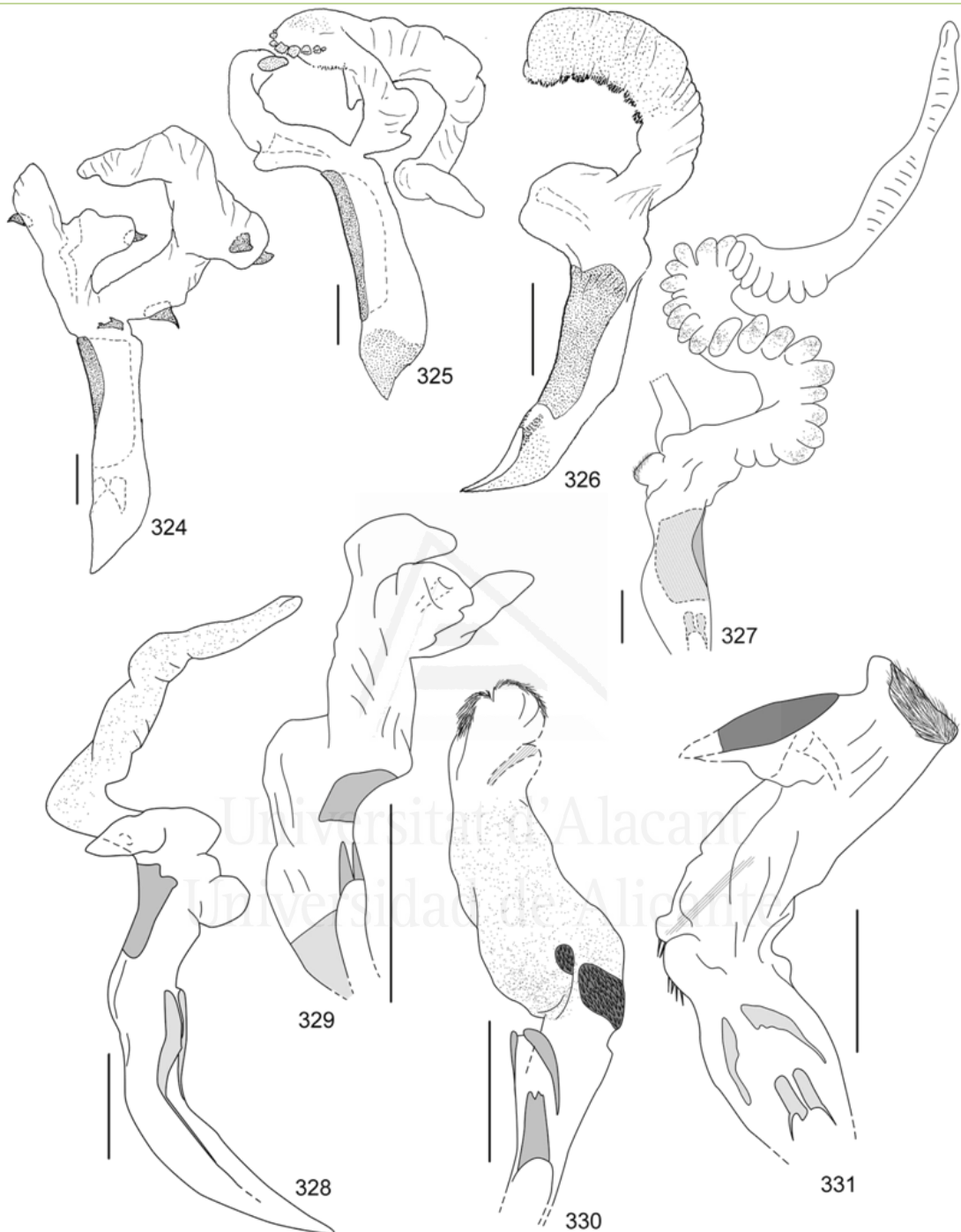


Figures 309-315. Endophallus of 309: *Callistethus jordani* (Estación Cacao, Guanacaste, INBIO). 310: *C. lativittis*, sacculi artificially separated (Albergue Heliconias, Alajuela, CEUA). 311: *C. levigatus* (Quebrada Segunda, Cartago, INBIO). 312: *C. macroxantholeus* (Río San Lorencito, Alajuela, INBIO). 313: *C. microxantholeus* (Est. Pitilla, Guanacaste, INBIO). 314: *C. mimeloides* (Orosilito, Guanacaste, CEUA). 315: *C. multiplicatus* (Sector Cerro Cocori, Limón, INBIO). Scale= 1mm.

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Figures 316-323. Endophasm of 316: *Callistethus nicoyus* (Estación Quebrada Bonita, Puntarenas, INBIO). 317: *C. parapulcher* (Estación Pittier, Puntarenas, INBIO). 318: *C. pseudocollaris* (Estación La Casona, Puntarenas, INBIO). 319: *C. ruteloides* (holotype). 320: *C. schneideri* (Albergue Heliconias, Alajuela, INBIO). 321: *C. specularis*, sacculi artificially separated (Quebrada Segunda, Cartago, INBIO). 322: *C. stannibractea* (Estación Barva, Heredia, INBIO). 323: *C. sulcans* (Estación La Maritza, Guanacaste, INBIO). Scale=1 mm.



Figures 324–331. Endophallus of 324: *Callistethus valdecostatus* (Estación Biológica Las Alturas, Puntarenas, INBIO). 325: *C. vanpatteni* (Cinco Esquinas de Carrizal, Alajuela, INBIO). 326: *C. xiphostethus* (Los Ángeles, Heredia, INBIO). 327: *C. yalizo* (holotype). 328: *Strigoderma auriventris* (Sector San Ramón de dos ríos, Alajuela, INBIO). 329: *Strigoderma biolleyi* (San Luis, Puntarenas, INBIO). 330: *S. nodulosa* (Estación Quebrada Bonita, Puntarenas, INBIO). 331: *S. sulcipennis* (Finca Jenny, Guanacaste, INBIO). Scale= 1mm.

Capítulo 5

Phylogeny and community structure of Anomalini (Coleoptera: Scarabaeidae: Rutelinae) of Costa Rica*

Universitat d'Alacant
Universidad de Alicante

Filogenia y estructura de comunidad de los Anomalini (Coleoptera: Scarabaeidae: Rutelinae) de Costa Rica

*The analyses in this chapter have been carried out in collaboration with Gonzalo Giribet from the Museum of Comparative Zoology & Department of Organismic and Evolutionary Biology, Harvard University,
Waiting to be sent for publishing

Abstract: The main scope of this work is to investigate the mechanisms that influence the current patterns of biological diversity in *Anomala* and *Callistethus* that could help us to understand the mechanisms that have driven the diversification for these species-rich genera. We calculated compositional and phylogenetic beta diversity among the niche-sharing communities, to look for ecological segregation or, on the contrary, broad ecological adaptability both at a species level and accounting for phylogenetic relationships; we then further assess the role of environmental filters through the phylogenetic structure of communities.

Key words: *Anomala*, Anomalini, beta diversity, *Callistethus*, Costa Rica, phylogenetic community structure, phylogeny

Introduction

The genera *Anomala* and *Callistethus* in the Neotropics have a high diversity (Jameson *et al.* 2003), counting for more than 75% of Anomalini species in America.

Inside these genera there are frequent cases of species groups with uniform external morphology, but with marked differences in the male genitalia (Filippini *et al.* 2014, A, C, D), a pattern common in other phytophagous scarab beetles like *Phyllophaga* (Morón & Solís 2001; Morón 2006).

The taxonomy of these genera is still poorly resolved, with data hinting at a marked paraphyly of *Anomala* (Jameson *et al.* 2003; Morón & Ramírez-Ponce 2012; Ramírez-Ponce & Morón 2009; Filippini *et al.* A).

Costa Rica geographical position is inside one of the world hotspots (Zachos & Habel 2011) and represents a sample of high heterogeneity and diversity (Valerio 1999, Gotelli & Colwell 2001, Obando 2002). Its history as an important transition area between Central America and South America (Bergoing 1998) probably contributed

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to its high diversity (García-López *et al.* 2010), next to its ecosystem diversity that is due to different rain patterns and the influence of the two coastal slopes (Atlantic and Pacific) separated by the main mountain ranges that run through the country from North-East to South-West (Kappelle 2001).

In the ranking of world biodiversity Costa Rica it's not among the first places. However, the species density (number of species per unit of area) is the highest in the world (Kohlmann *et al.* 2007)

Recent taxonomical studies on Anomalini in Costa Rica resulted in an increment of 54% of the known diversity for the country. Moreover, regarding the availability of geographical and taxonomical data (Filippini *et al.* E) Costa Rica is a rare case among other Neotropical countries where checklists are still rare and register a lower richness due to lack of study [i. e. in Panama 21 *Anomala* species and 10 *Callistethus* species are registered (Ratcliffe 2002), and in Ecuador 51 and 10 species respectively, (Paucar-Cabrera 2005)]. In all Neotropical area Costa Rica presents a high diversity in both *Anomala* (77 species) and *Callistethus* (28 species) (Filippini *et al.* E).

These facts, together high diversity and availability of taxonomical information, make of Costa Rica an ideal study area for species diversification.

The main scope of this work is to investigate the mechanisms that influence the current patterns of biological diversity in *Anomala* and *Callistethus* that could help us to understand the mechanisms that have driven the diversification for these species-rich genera.

It has been postulated that communities in tropical mountain habitats are relatively stable because broad climatic cycles can be compensated for by short-range movements alongside mountain slopes (Darlington 1970). Tropical communities are also more sensitive to climate variability compared with temperate zones, and hence differences in climate produce stronger barriers (Janzen 1967; Sheldon *et al.* 2011;

Sunday *et al.* 2011), and this is reflected in an increase of beta diversity (Darlington 1970; Macvean & Schuster 1981). Narrow climatic tolerances of species therefore may enhance diversification, as they increase the chance for allopatric isolation, speciation and differentiation of communities in climatically diversified tropical montane regions (C. D. Cadena *et al.* 2012; García-López *et al.* 2013). The influence of ecological processes on communities differentiation and turnover, such as habitat filtering and species interactions, can be identified by the phylogenetic community structure (Webb *et al.* 2002). This approach has been already implemented on studies in tropical environments (Graham *et al.* 2009; Kembel & Hubbell 2006) to search for patterns explaining the high diversity of species in this region.

To investigate the role of ecology in species diversification communities could be considered as groups of species sharing the same environmental niche, instead of physical locality. Three categories of niche descriptors have been chosen for the different points of view they offer: vegetation cover, Holdridge life zones and environmental variables. However, community structure is not only determined by ecological causes, it also depends on historic and evolutionary factors (Hawkins *et al.* 2003, Willig *et al.* 2003, Ricklefs 2004, Wiens & Donoghue 2004, Svenning *et al.* 2006, Hortal *et al.* 2008). One way to solve this problem could be to base the analysis on a phylogeny, and to calculate divergence time estimations to situate the evolution and diversification in time and in a phylogeographic point of view (Couvreur *et al.* 2011; Goldberg *et al.* 2014; Gómez-Zurita 2004).

Regarding all this previous data we selected Costa Rica to analyze the possible diversification causes of both super-diverse genera (*Anomala* and *Callistethus*). We first built a phylogeny of the group using both molecular and morphological characters, and then we calculated compositional and phylogenetic beta diversity among the niche-sharing communities to look for ecological segregation or, on the contrary, broad ecological adaptability both at a species level and accounting for

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phylogenetic relationships; we then further assess the role of environmental filters through the phylogenetic structure of communities.

On this way our main questions were: are ecological communities (defined as species sharing the same niche) isolated one from another, or do they share most of their species? phylogenetically similar species share the same ecological niche or have different ecological specializations? Do the ecology of species act as a filter to their distribution and community composition? What can the timing of diversification tells us about other processes that came into play in diversification and community assembly?

With this study we expected to elucidate some of the causes of the species and community differentiation and to provide a framework for explaining the high species richness of this super-diverse taxa in montane neotropical forests.

Materials and methods

Material analyzed

A total of 102 specimens were selected for the phylogenetic analysis. The specimens were conserved either dried or fixed in 100% ethanol and stored at -80°C .

They correspond to 47 species of *Anomala* and 20 species of *Callistethus* (corresponding to 58% and 68% respectively of the known diversity in Costa Rica); additional Anomalini genera are represented with one species each of *Anomalorhina* and *Strigoderma*; as outgroups were selected species of Rutelini tribe (*Pelidnota* and *Platycoelia*) and Dynastinae (*Cyclocephala*).

DNA extraction and sequencing

DNA was extracted from entire or grounded metafemurs using the DNeasy Blood and Tissue Kit (Qiagen, Hilden, Germany) following the manufacturer's protocol. Two mitochondrial (cytochrome c oxidase subunit I, 658-814 bp; 16S rRNA, 518 bp) and one nuclear (a 2.2-kb fragment of 28S rRNA) genes were amplified and sequenced using primers 16Sa and 16Sb for 16S, LCO1490 and HCOoutout or HCO2190 for COI. Partial 28S rRNA was amplified in three fragments, using the primers 28Srd1a-28Srd4b for the first fragment, 28Sa-28Srd5b for the second fragment and 28Srd4.8a-28Srd7b1 for the third fragment. The total length of the 28S rRNA amplicon is approximately 2267 bp. PCRs were carried out in 25 µl reaction volumes according to standard protocols for GoTaq® DNA Polymerase (Promega, Madison, WI, USA). The PCR product was purified through enzymatic reaction with ExoSAP-IT (USB Corp., Cleveland, OH, USA). Sequencing was performed with the Big Dye® Terminator v3.1 Cycle Sequencing Kit (AppliedBiosystems, Foster City, CA, USA). Chromatograms obtained from the automatic sequencer were read and sequences assembled using the sequence editing software Sequencher™ 4.7 (Gene Codes Corporation, Am Arbor, MI, USA) and annealed in Geneious 6.0.5 (Biomatters Ltd., Auckland, New Zealand). Parts that were difficult to align were eliminated. The sequence identity for each PCR product was checked using the basic local alignment search tool (BLAST). Specimens data are detailed in *Anexo 5*. Sequences from specimens of *A. eucoma* belonging to different separated populations (Filippini *et al.* 2013) have been maintained separated for the analysis.

Additional sequences from specimens stored in CEUA collection (Entomological collection of the University of Alicante) were retrieved from Genbank, after confirming the identification of the original material.

Phylogenetic analysis

First we used PartitionFinder V1.1.1 (Lanfear *et al.* 2012, 2014) to determine the best-fitting partition and substitution model for the phylogenetic analysis, separately for the Bayesian (unlinked branch length option available) and Maximum Likelihood (more substitution models available) analysis. The best-fitting partition and substitution models chosen were for Bayesian: five partitions (16S, 28S, three codons of COI) with linked branch lengths, GTR+I+G for 16S, 28S and COI third codon, SYM+I+G COI first codon, F81+I COI second codon; for ML, same partitions and models as for the Bayesian, except in the models for COI first codon (GTR+I+G) and COI second codon (K81Puf+I). Other partitions and models among the best scoring from the PartitionFinder analysis were tested, and results compared through harmonic mean (Bayesian) or likelihood score (ML), however the first models chosen were the fittest.

Morphological characters were adapted in part from the literature (Smith & Morón 2003; Jameson *et al.* 2003; Ramírez-Ponce & Morón 2009), and additional characters were implemented from the dissection and morphological study of the specimens. Characters variables within a species, or whose interpretation and codification was considered subjective, were excluded from the analysis. The list of the characters used is provided in *Anexo 3*.

We analysed the concatenated data set (3502 bp) in MrBayes 3.2.1 (Ronquist & Huelsenbeck 2003), with unlinked gamma shape, substitution rates, proportion of invariable sites, state frequencies and variable rate prior for each partition. We ran the Monte Carlo Markov chain for ten million generations, sampling every 1000 generations, with two independent runs and eight chains per run. AWTY (Wilgenbusch *et al.* 2004) and Tracer v.1.6 (Rambaut *et al.* 2013) were used to assess convergence. Posterior probabilities are given as statistical branch support.

Maximum likelihood tree searches were conducted in GARLI (Zwickl 2006), running eight independent searches. Bootstrap values were calculated in PAUP* 4.0 (Swofford 1998) from 1000 trees built in GARLI. Mr Bayes and Garli were run through CIPRES Science Gateway (Miller *et al.* 2010).

Divergence time estimation

Divergence time estimation was inferred in BEAST v. 1.8.0. The Bayesian inference and ML trees were used as starting tree for the BEAST runs. The dataset was partitioned in the three genes, with COI partitioned per codon position, and unlinked parameters. Models used were HKY+I+G for 16S and COI, GTR+I+G for 28S. The Yule model was selected as tree prior and an uncorrelated lognormal model was used to estimate rate variation along branches.

Root calibration (Rutelinae + Dynastinae) was set at 74.02 Mya (Ahrens *et al.* 2014), with a normal distribution. Calibration points were set for the basal node Dynastinae-Rutelinae with the oldest known Rutelinae fossil, *Pelidnotites atavus* Cockerell 1920 48.6–40.4 mya, and for Anomalini basal node with fossil American Anomala species *Anomala scudderi* Wickham 1914, 37.2–33.9 Mya (Gateway to Paleobiology Database). Exponential priors were set for all node constraints with the minimum age of the fossil used as zero offset. The exponential prior mean was chosen so that 95% of the probability is contained between the rigid lower bound and a soft maximum bound of a dated fossil layer interval. Selecting the Rutelini species as outgroup, with the Anomalinae as sister group of Dynastinae (Ahrens *et al.* 2014), had no effect on the internal topology, and only limited impact on node ages, so we left the traditional classification and used the *Cyclocephala* species as outgroup.

We set normal distribution priors for substitution rates of each gene, as follow: 0.0054 ± 0.0009 for 16S and 0.0006 ± 0.0003 for 28S (Papadopoulou *et al.* 2010), $0.006 \pm$

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0.003 for COI (due to different rates found in literature, as Papadopoulou *et al.* 2010; Pons *et al.* 2010). Two analyses were run for 5000000 generations for each starting tree. ESS values were checked using Tracer v. 1.6. Trees were combined and sampled every 5000 generations after removing a burn-in of 10% using Logcombiner v. 1.7.2. The chronograms obtained from each starting tree were compared with Bayes factor calculation using Tracer v. 1.6.

Community phylogenetic structure

Distribution data of the species considered were compiled from label data of specimens in CEUA and INBio (Instituto Nacional de Biodiversidad, Costa Rica) collections, and from ATTA database of INBio (<http://atta.inbio.ac.cr>), for a total of 1694 georeferenced points.

Communities were assembled as groups of species sharing the same ecological niche, described in three ways: vegetation cover (classified with UNESCO classes of ecosystem) (World Bank and CCAD, 2000), Holdridge Life zone (Centro Científico Tropical) and with 20 environmental variables (19 precipitation and temperature variables from Worldclim v.14 and altitude) (listed in Table 1), through interception of distribution data and environmental layers.

These three categories were chosen to describe the communities for the different approaches and scale of observation they give to the niche description: vegetation cover (all types registered are listed in Table 2) describes the actual environment where the species live and it takes into account the generic climatic variables which affect the kind of vegetation that grows in a given place, the local variants in the same type of vegetation (see for example the three variants of lowland forests) and level of disturbance (with presence of agro-productive category); Holdridge life zones (listed in Table 2) summarize different environmental variables (precipitation, biotemperature, potential evapotranspiration ratio) into one category and it

therefore offer a less detailed scale than the previous category; single environmental variables (Table 1) were investigated to identify if any and which one(s) would explain the current distribution of taxa and would therefore be suitable as a niche descriptor, being the more general scale of observation among the three categories.

On the 20 environmental variables a PCA analysis (Shaw, 2003) was conducted through PAST 3.04 (Hammer *et al.* 2001), to devise the variable(s) which better represents the species distribution data set, which would be divided in discrete intervals, and used to build communities for the community structure analysis. Vegetation cover map intercepts were checked with satellite images and label data for corrections of dubious ecosystems (due to map resolution) assignation as aquatic environments and agro-productive system.

Table 1: List of environmental variables used for analysis

BIO1 – Annual Mean Temperature
BIO2 – Mean Diurnal Range (Mean of monthly (max temp - min temp))
BIO3 – Isothermality (BIO2/BIO7) (* 100)
BIO4 – Temperature Seasonality (standard deviation *100)
BIO5 – Max Temperature of Warmest Month
BIO6 – Min Temperature of Coldest Month
BIO7 – Temperature Annual Range (BIO5-BIO6)
BIO8 – Mean Temperature of Wettest Quarter
BIO9 – Mean Temperature of Driest Quarter
BIO10 – Mean Temperature of Warmest Quarter
BIO11 – Mean Temperature of Coldest Quarter
BIO12 – Annual Precipitation
BIO13 – Precipitation of Wettest Month
BIO14 – Precipitation of Driest Month
BIO15 – Precipitation Seasonality (Coefficient of Variation)
BIO16 – Precipitation of Wettest Quarter
BIO17 – Precipitation of Driest Quarter
BIO18 – Precipitation of Warmest Quarter
BIO19 – Precipitation of Coldest Quarter
Altitude

5. Phylogeny

For each kind of community (type of vegetation cover, Holdridge life zones, best describing environmental variable(s)), we calculated phylogenetic beta diversity (PBD) as the proportion of branch length shared between two communities divided by the average of the sum of branch lengths of each community (Bryant *et al.* 2008). Expected PBD was calculated under a null model with fixed species richness and turnover among communities, with 10 iterations. These analyses were carried out using the R packages Picante (Kembel *et al.*, 2010). Compositional beta diversity was calculated with Sorensen index of similarity, in R package Vegan (Oksanen *et al.*, 2013), with either all Costa Rican species of *Anomala* and *Callistethus*, and with the subset of species used for the phylogenetic analysis. One-way ANOVA and Kruskal-Wallis test were performed in PAST 3.04 (Hammer *et al.* 2001) to test for differences between total species and subset CBD, to see if the subset of species used for the phylogenetic analysis was representative of the complete fauna; between observed and expected PBD and between observed PBD and subset CBD.

We assessed communities for phylogenetic overdispersion (co-occurring species are more distantly related than expected by chance) or phylogenetic clustering (co-occurring species are more closely related than expected) relative to the chronogram (Webb *et al.* 2002; Cavender-Bares *et al.* 2004). Phylogenetic relatedness of co-occurring taxa in communities was quantified using Net-Relatedness Index (NRI) and Nearest Taxon Index (NTI), calculated from the Standardized Effect Size of Mean Pairwise phylogenetic Distance (MPD) and Mean Nearest Taxon Distance (MNTD) respectively (Webb *et al.* 2002). These analyses were carried out using the R packages Picante (Kembel *et al.*, 2010). Values of NRI or NTI > 0 indicate phylogenetic clustering and values < 0 indicate phylogenetic evenness. MNTD is more sensitive to patterns closer to the tips of the phylogeny while MPD to tree-wide patterns.

Results

Phylogenetic analysis and divergence time

The phylogenetic trees obtained by Bayesian and ML analysis are shown in Figures 1 and 2 respectively. Both show that the genus *Anomala* is poliphyletic, however they differ for the positions of the main *Anomala* clade (A) that groups with *Callistethus* in the Bayesian tree and with other *Anomala* in the ML tree.

Some *Anomala* species enter the *Callistethus* clade (B) in the Bayesian tree (*A. sp.249*, *A. semicincta*, *A. arara*), and other species are placed as sister group of this clade (*A. ferrea*, *A. testaceipennis*, *A. praecellens*) (C). *C. ruteloides* is placed as sister species of the *A. trapezifera* species group (D) in both trees, with low support. *Anomala longisacculata*, who morphologically belongs to the *A. trapezifera* group, is placed basally. The remaining *Anomala* species are grouped in a poorly resolved clade (E).

The *A. eucoma* populations clearly separate into Osa Peninsula + Guanacaste populations (*eucoma* 1 and 2) and the Central Valley population (*eucoma* 3), who pairs with *A. pseudoeucoma*.

As for other Anomalini genera, their position falls inside the other clades: *Anomalorhina* pairs with *Anomala hoppi*, and *Strigoderma* has different positions in the two trees, inside clade B in the Bayesian tree and in clade E in ML tree.

As for the chronogram, analysis carried on from ML or Bayesian trees as starting trees gave similar topologies, with similar node dating, however the Bayes factor calculation gave stronger support to the chronogram from Bayesian starting tree (Figure 3). The ML tree grouping of clade A and B, and the position of *Strigoderma* are maintained, clade C merge with clade B, clade E breaks in 2 smaller clades. *A. longisacculata* is placed basally to the *A. trapezifera* group + *C. ruteloides* clade.

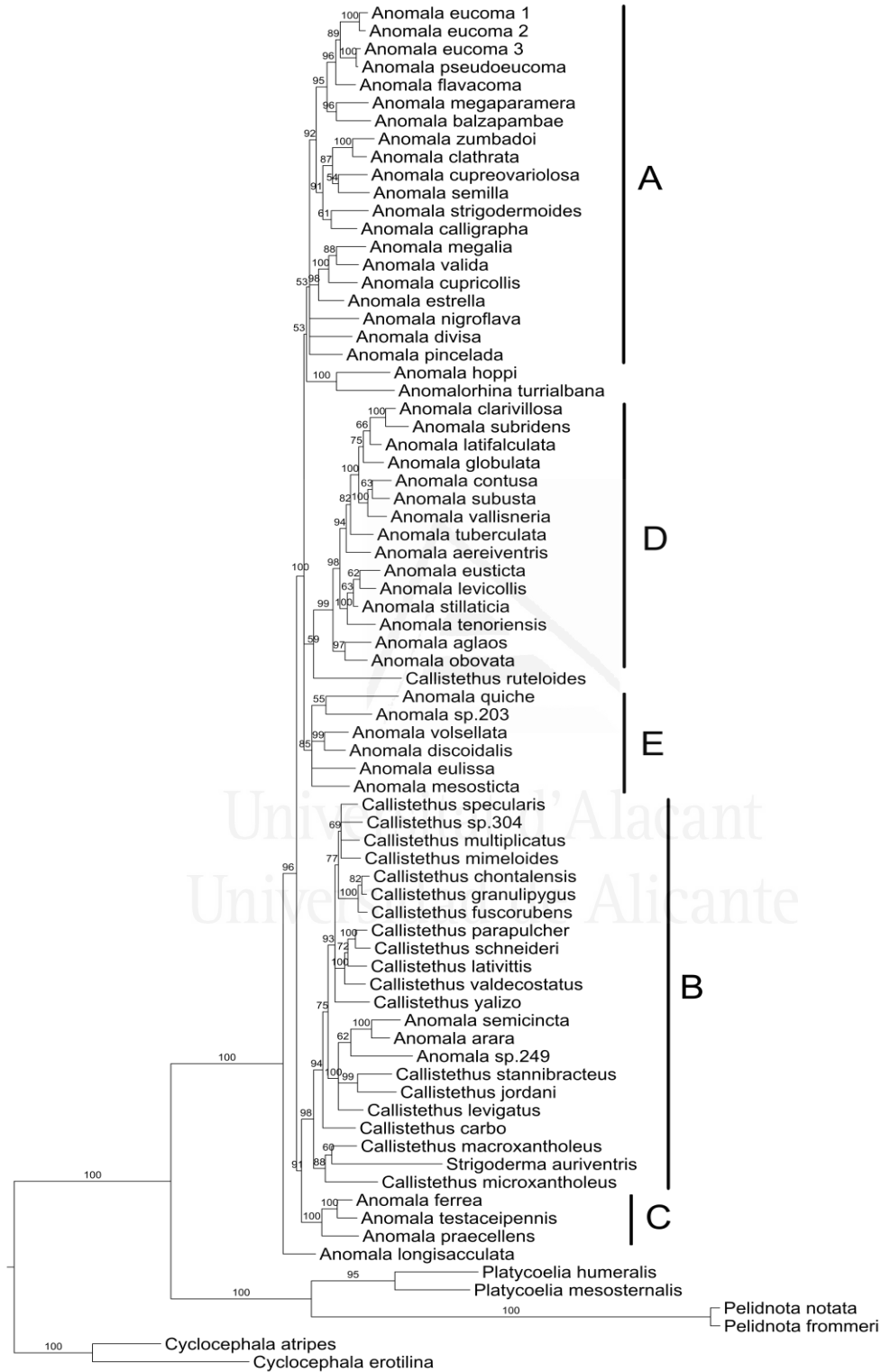


Figure 1. Tree obtained from Bayesian analysis. Numbers represent percentage posterior probabilities. Main clades discussed in text are labelled with letters A-E.

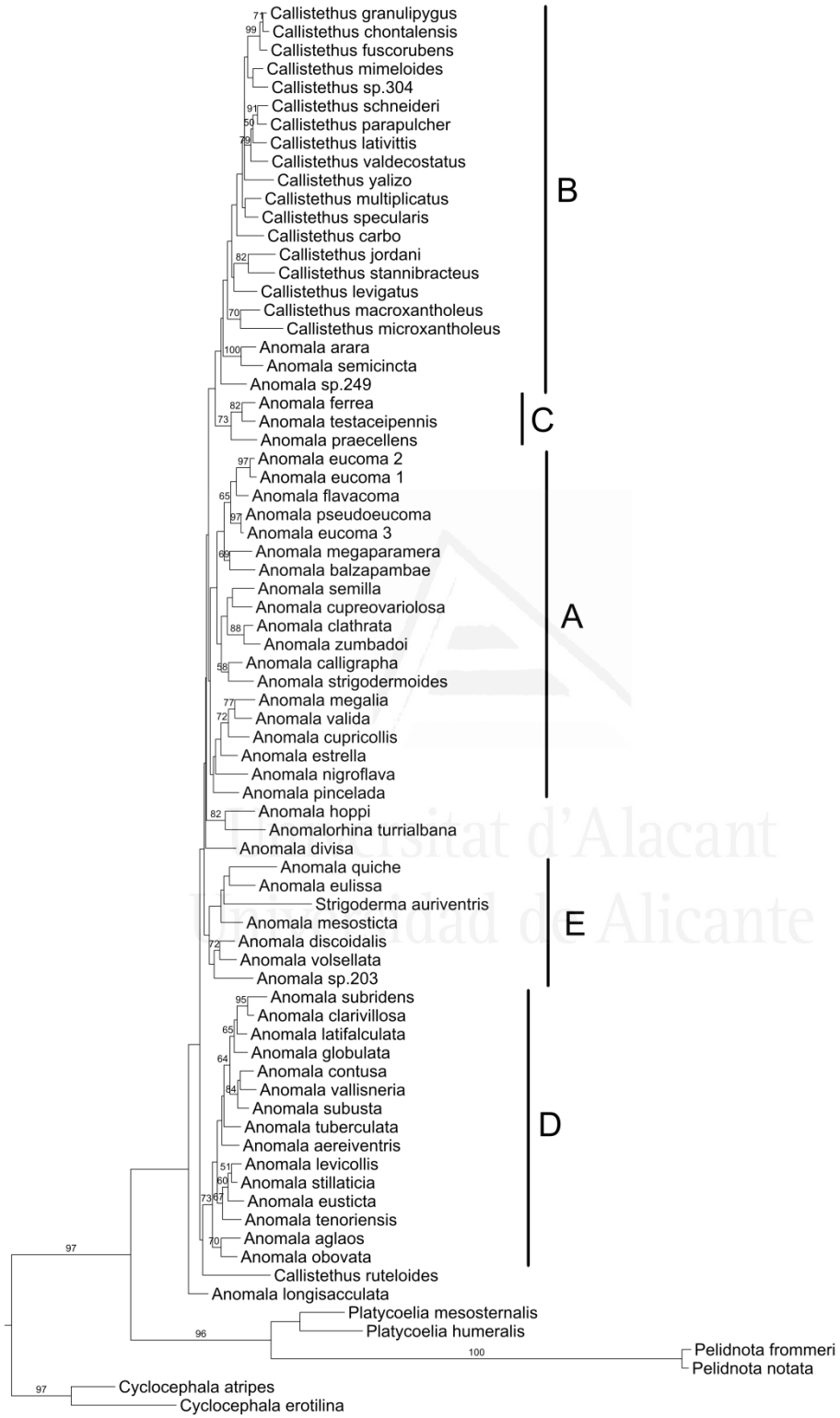


Figure 2. Tree obtained from Maximum Likelihood analysis. Numbers represent bootstrap values. Main clades discussed in text are labelled with letters A-E.



Figure 3. Cladogram obtained with Bayesian tree as starting tree. Node ages are given in mya. Main clades discussed in text are labelled with letters A-E.

The diversification of Anomalini begins 30 mya ago, with fairly regular rate of speciation. The origin of main clades dates to 22–24 mya, including the separation of *Callistethus* from "Anomala" clades 23.7 mya ago. The more recent species branching date to 1–2 mya (*A. eucoma* + *A. pseudoeucoma*, *C. chontalensis* + *C. granulipygus*), while more ancient speciations date to 7–8 mya (*A. ferrea* + *A. testaceipennis*, *A. arara* + *A. semicincta*). It is worth noting how *A. eucoma* 1 and 2 have separated earlier than *A. eucoma* 3 and *A. pseudoeucoma*, even if morphologically they are more similar than the latter two species (Filippini *et al.* 2013)

Beta diversity

The PCA analysis indicated that the first component explain more than 85% of the data variance, and the first two components together explain more than 90%. The environmental variable "Annual precipitation" (BIO12, Table 1) explained significantly the data variance, having a weight of more than 87% on the first two components. It's also the variable with less variance among the ones considered, so its mayor weight may be due mainly to the lack of a structure in the distribution data regarding these variables.

No significant difference was found between Compositional beta diversity (CBD) with all Costa Rican species and CBD of subset of species used for the phylogenetic analysis, for all the three kinds of ecological communities (vegetation cover, Holdridge life zones life and precipitation variable), therefore the analysis carried on the subset of species represented in our phylogeny are representative of the dynamics of complete communities.

Regarding phylogenetic beta diversity, no significant difference was found on the observed and expected phylogenetic beta diversity (PBD) for all communities, hinting at a low level of structure by phylogenetic relationship in the assemblages.

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No significant difference was found between PBD and CBD for annual precipitation variable ($p=0.20$) and life zone communities ($p=0.01$), but for vegetation cover PBD was found significant higher than CBD ($p<0.005$); this may be explained by the presence of different but phylogenetically related species in pairs of communities, in a sort of ecological vicariance.

For annual precipitation pairwise phylogenetic similarity (PS) ranged from 0.46 to 0.89; pairwise compositional community similarity (CS) ranged from 0.28 to 0.82; for life zones communities PS ranged from 0.06 to 0.80, CS from 0 to 0.76; for vegetation cover communities PS ranged from 0.10 to 0.82, CS from 0 to 0.77 (Table 2).

The most similar communities for vegetation cover are the Semi-deciduous lowland forest with Submontane CG and Lower montane forests (Phylogenetic Similarity >0.80 , Compositional Similarity >0.74), and Submontane CG with Lower montane forests (PS >0.77 , CS >0.67); these communities are also the richest, with 33, 37 and 40 species each respectively. Follows in similarity the Lowland forests (CG, VG, ZA variants) and Submontane forest CG (PS >0.60 , CS >0.54). The most different communities were Altimontane forest, Seasonal lowland forest and Mangrove forest, that showed values of similarity inferior to 0.40 with most of the other communities; these are also the communities with lower richness (11, 3 and 3 species respectively) (Table 2a).

For Holdridge life zones, the most similar communities are Tropical and Premontane wet forests with either Tropical moist forest and Premontane rain forest (Phylogenetic Similarity >0.70 , Compositional Similarity >0.65), again among the richest communities (with 35, 39, 25 and 44 species respectively). The most different communities were Lower montane moist forest and Montane rain forest, values of similarity inferior to 0.30 with the other communities (with 2 and 7 species respectively) (Table 2b).

Table 2a Pairwise similarity for a) Vegetation type, b) Holdridge life zones and c) Annual precipitation communities. For each cell, numbers on top are phylogenetic similarity, numbers on bottom are compositional similarity. (continues)

VEGETATION COVER	Savanna	Lowland swamp	Agro-productive	Upper-montane forest CG	Altimontane forest	Lowland forest CG	Lowland forest VG	Lowland forest ZA	Seasonal lowland forest	Lowland forest m.d. ZA	Semi-deciduous lowland forest	Mangrove	Deciduous lowland forest	Submontane forest CG
Lowland swamp	0.43													
Agro-productive	0.22													
Upper-montane forest CG	0.52	0.36												
Altimontane forest	0.35	0.16												
Lowland forest CG	0.24	0.26	0.49											
Lowland forest VG	0.00	0.08	0.33											
Lowland forest ZA	0.28	0.21	0.33	0.60										
Seasonal lowland forest	0.00	0.00	0.09	0.43										
Lowland forest m.d. ZA	0.31	0.66	0.44	0.44	0.25									
Semi-deciduous lowland forest	0.17	0.55	0.33	0.37	0.14									
Mangrove	0.48	0.56	0.53	0.40	0.27	0.57								
Deciduous lowland forest	0.31	0.47	0.42	0.30	0.19	0.54								
Submontane forest CG	0.37	0.67	0.48	0.35	0.20	0.63	0.75							
Submontane forest VG	0.23	0.56	0.38	0.24	0.10	0.62	0.67							
Submontane forest CG	0.42	0.32	0.40	0.35	0.30	0.22	0.29	0.22						
Submontane forest VG	0.25	0.13	0.40	0.13	0.14	0.18	0.25	0.18	0.22					
Lower-montane forest CG	0.46	0.58	0.43	0.24	0.19	0.42	0.59	0.68	0.34					
MEAN	0.33	0.46	0.24	0.08	0.00	0.32	0.41	0.56	0.25	0.48				
	0.38	0.67	0.54	0.36	0.26	0.78	0.63	0.69	0.19	0.48				
	0.26	0.57	0.44	0.27	0.14	0.75	0.59	0.63	0.17	0.35				
	0.60	0.22	0.43	0.15	0.10	0.19	0.31	0.26	0.17	0.23	0.21			
	0.50	0.13	0.27	0.00	0.00	0.06	0.17	0.12	0.00	0.13	0.11			
	0.51	0.62	0.51	0.29	0.19	0.60	0.70	0.65	0.31	0.58	0.70	0.40		
	0.38	0.48	0.43	0.14	0.07	0.51	0.59	0.52	0.32	0.41	0.61	0.32		
	0.31	0.63	0.52	0.35	0.24	0.74	0.61	0.74	0.18	0.51	0.82	0.20	0.60	
	0.19	0.52	0.37	0.24	0.08	0.74	0.55	0.72	0.15	0.40	0.74	0.10	0.49	
	0.46	0.44	0.60	0.31	0.19	0.52	0.58	0.60	0.30	0.51	0.52	0.37	0.54	0.53
	0.20	0.21	0.44	0.15	0.08	0.48	0.39	0.49	0.22	0.29	0.46	0.11	0.39	0.46
	0.34	0.54	0.54	0.43	0.35	0.69	0.61	0.73	0.17	0.47	0.82	0.20	0.60	0.77
	0.22	0.42	0.42	0.38	0.24	0.68	0.56	0.66	0.14	0.30	0.77	0.09	0.46	0.68
	0.44 standard deviation		0.18											
	0.33 deviation		0.20											

a

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Table 2a (continuation) Vegetation cover UNESCO classes: Lowland forest CG (IA1a(1)(a)-CG): Tropical evergreen broad-leaved lowland forest, well-drained, Central Costa Rica and Guanacaste variant; Lowland forest VG (IA1a(1)(a)-VG): Tropical evergreen broad-leaved lowland forest, well-drained, Valle del General variant (Costa Rica); Lowland forest ZA (IA1a(1)(a)-ZA): Tropical evergreen broad-leaved lowland forest, well-drained, Atlantic Zone variant (Costa Rica); Lowland forest m.d. ZA (IA1a(1)(b)-ZA): Tropical evergreen broad-leaved lowland forest, moderately drained, Atlantic Zone variant (Costa Rica); Submontane forest CG (IA1b(1)-CG): Tropical evergreen broad-leaved submontane forest, Central Costa Rica and Guanacaste variant; Submontane forest VG (IA1b(1)-VG): Tropical evergreen broad-leaved submontane forest, Valle del General variant (Costa Rica); Lower-montane forest CG (IA1c(1)-CG): Tropical evergreen broad-leaved lower-montane forest, Central Costa Rica and Guanacaste variant; Upper-montane forest CG (IA1d(1)-CG): Tropical evergreen broad-leaved upper-montane forest, Central Costa Rica and Guanacaste variant; Altimontane forest (IA1e(1)): Tropical evergreen broad-leaved altimontane forest; Seasonal lowland forest (A2a(1)(a)-PN): Tropical evergreen seasonal broad-leaved lowland forest, well-drained, Pacific North and Central Valley variant (Costa Rica); Semi-deciduous lowland (IA3a(1)(a)-PNVC): Tropical semi-deciduous broad-leaved lowland well-drained forest, Pacific North and Central Valley variant (Costa Rica); Mangrove (IA5b(1)): Pacific mangrove forest on clay; Deciduous lowland forest (IB1a(1)): Tropical deciduous broad-leaved lowland forest, well-drained, intervened (in Costa Rica, Northern Pacific variant); Agro-productive (SPA): Agro-productive system; Savanna (VA2b(2)): Short-grass savanna with deciduous shrubs; Lowland swamp (VIIB4-ZA): Tall-herbs lowland swamp, Atlantic Zone variant (Costa Rica).

Table 2b Holdridge Life Zones: LM-mf: Lower Montane moist forest; LM-rf: Lower Montane rain forest; LM-wf: Lower Montane wet forest; M-rf: Montane rain forest; P-mf: Premontane moist forest; P-rf: Premontane rain forest; P-wf: Premontane wet forest; T-df: Tropical dry forest; T-mf: Tropical moist forest; T-wf: Tropical wet forest; SA-rp: Subalpine rain paramo.

LIFE ZONES	LM-mf	P-mf	T-mf	LM-wf	P-wf	T-wf	M-rf	LM-rf	P-rf	T-df
P-mf	0.06 0.00									
T-mf	0.06 0.00	0.61 0.50								
LM-wf	0.19 0.06	0.48 0.29	0.61 0.47							
P-wf	0.14 0.05	0.51 0.36	0.72 0.66	0.69 0.64						
T-wf	0.11 0.05	0.44 0.26	0.76 0.70	0.59 0.52	0.80 0.76					
M-rf	0.30 0.00	0.18 0.11	0.11 0.06	0.27 0.22	0.14 0.04	0.13 0.10				
LM-rf	0.23 0.09	0.45 0.25	0.51 0.35	0.69 0.63	0.56 0.47	0.54 0.43	0.35 0.29			
P-rf	0.13 0.04	0.38 0.22	0.60 0.52	0.69 0.62	0.72 0.67	0.72 0.68	0.21 0.16	0.65 0.55		
T-df	0.06 0.00	0.59 0.50	0.34 0.20	0.22 0.11	0.37 0.23	0.28 0.15	0.05 0.00	0.18 0.08	0.17 0.08	
SA-rp	0.08 0.00	0.23 0.17	0.13 0.08	0.12 0.06	0.09 0.05	0.10 0.06	0.44 0.25	0.16 0.09	0.09 0.04	0.08 0.00
MEAN	0.35 0.25	standard deviation	0.24 0.24							

Table 2c

ANNUAL PRECIPITATION	1000-1999	2000-2999	3000-3999	4000-4999
2000-2999	0.53 0.38			
3000-3999	0.46 0.28	0.89 0.83		
4000-4999	0.52 0.32	0.77 0.67	0.79 0.72	
5000-5999	0.49 0.33	0.60 0.49	0.64 0.56	0.70 0.62
MEAN	0.64 0.52	STANDARD DEVIATION	0.15 0.19	

For annual precipitation, the most similar communities are the ones between 2000 and 4999 mm (Phylogenetic Similarity > 0.77, Compositional Similarity > 0.67, diversity among 36 and 59 species), the most diverse is the one with 1000–1999 mm (PS < 0.50, CS < 0.30, diversity 14 species) (Table 2c).

There are differences about the environmental adaptability of the species that constitute the main clades (Fig. 4b). Clade B ("*Callistethus*") show mostly species with wide ranges of habitat (either for precipitation levels, type of vegetation or life zones); on the contrary, clade D ("*A. trapezifera* species group") presents mostly species with narrow environmental niches; clade A ("main *Anomala*") show species with wide niches alongside species with strict requirements. Consideration among sister taxa require the same precautions as with divergence dating discussed above, however different cases can be seen: 1) species with similar requirements, 2) one species with wide ecological adaptation + one species with narrow ecological requirements, 3) species with different ecological requirements.

For the first case see for example the pairs *C. chontalensis* + *C. granulipygus*, *C. parapulcher* + *C. schneideri*, *A. arara* + *A. semicincta*, *A. macroxantholeus* + *A. microxantholeus* and *A. clarivillosa* + *A. subridens* (Fig. 4a), in which both species occupy a wide range of similar "environments"; for the second case see for example

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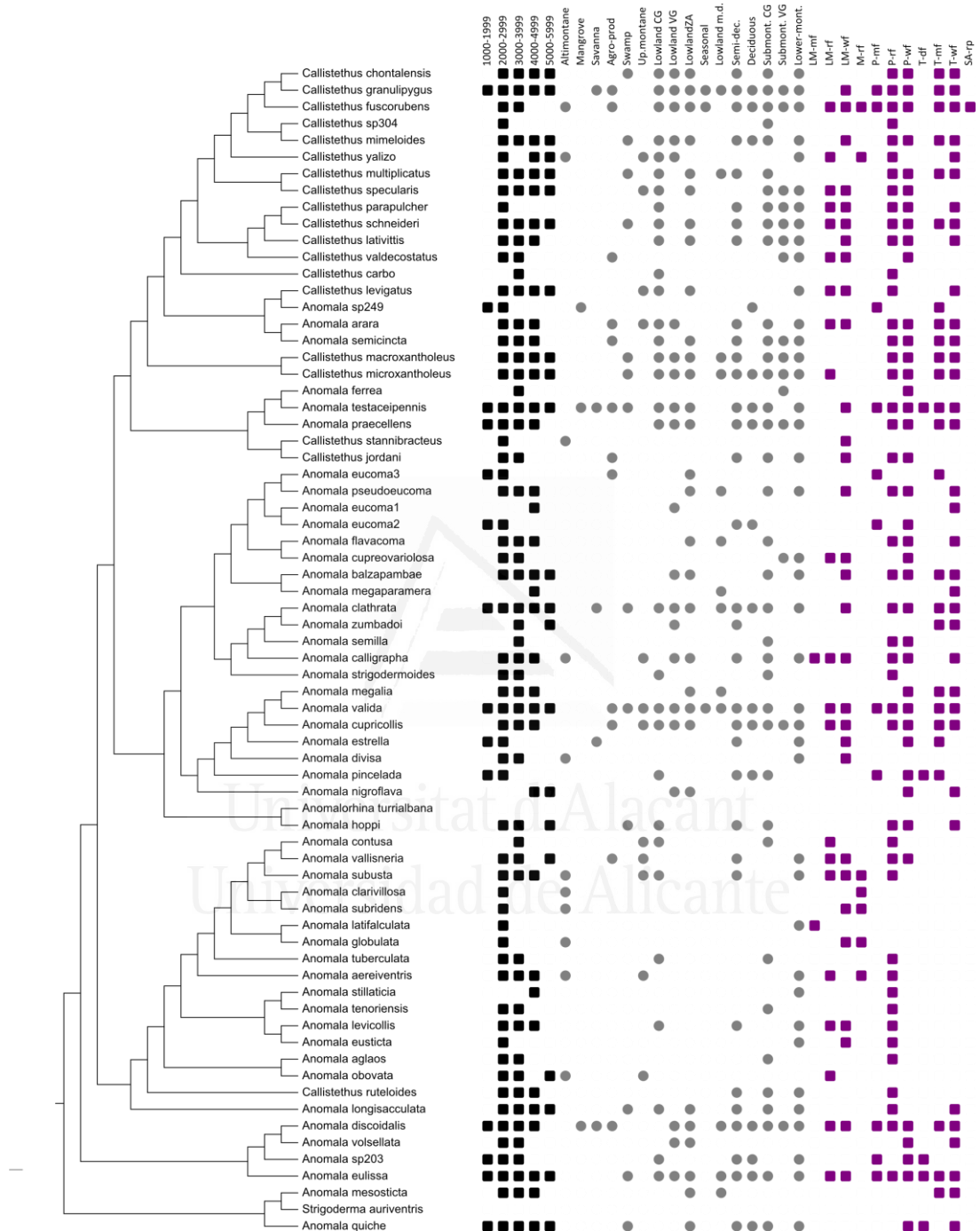


Figure 4a Cladogram with labelled on side the data on presence of species in each environment Black: Annual precipitation segments; Grey: Vegetation cover; Purple: Holdridge life zones.

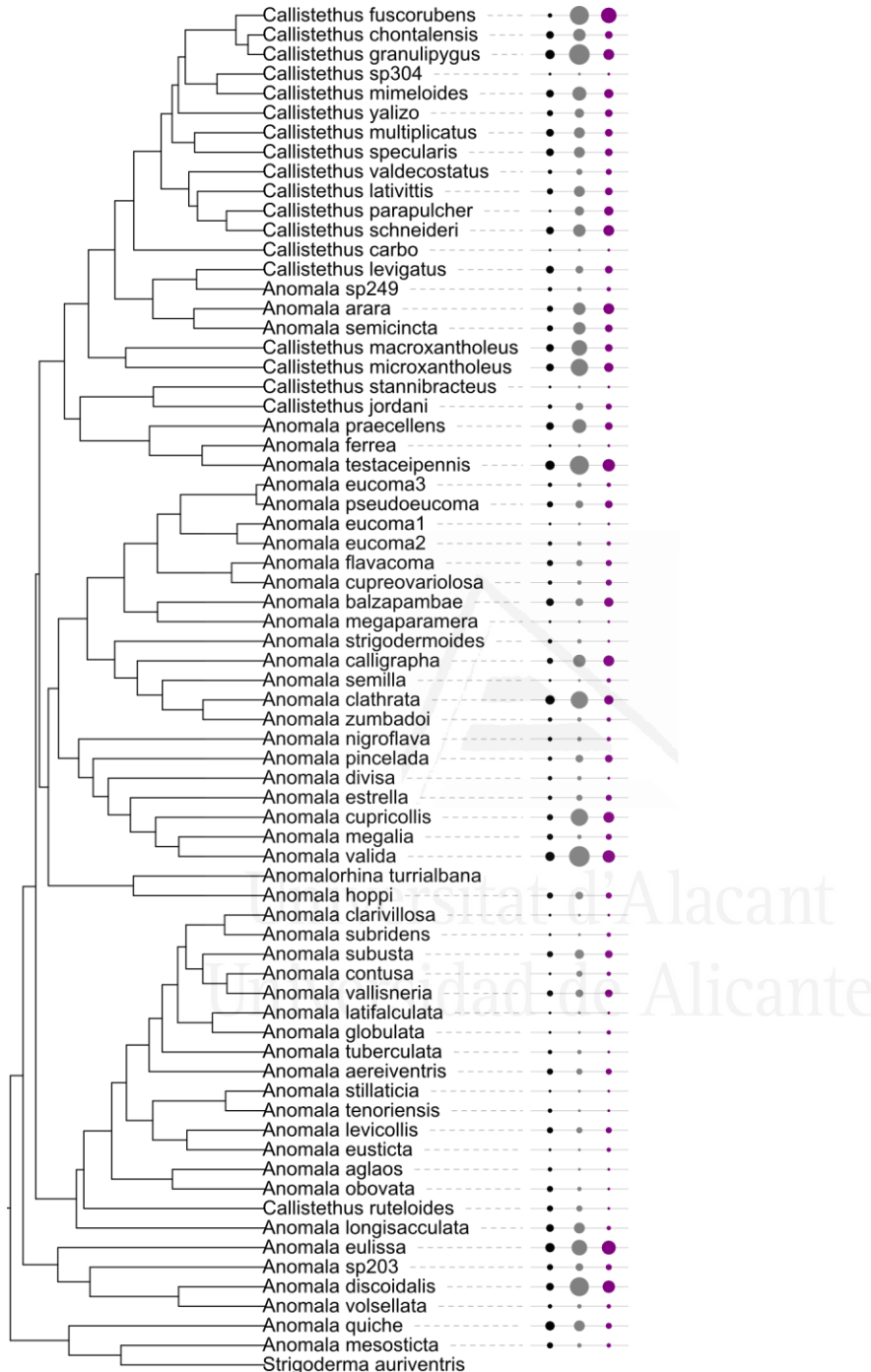


Figure 4b Cladogram with labelled on side the data on width of environments occupied, where circle diameter is proportional to number of environments occupied. Black: Annual precipitation segments; Grey: Vegetation cover; Purple: Holdridge life zones.

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the pairs *A. testaceipennis* + *A. ferrea*, *A. clathrata* + *A. zumbadoi* and *A. levicollis* + *A. eusticta* (Fig. 4a), where the first species of the pair occupy a wide range of environments, while the second only one or few, usually from the same pool of the sister species; for the third case for example the pairs *A. eucoma* 1 + *A. eucoma* 2, *A. latifalculata* + *A. globulata* and *A. stillaticia* + *A. tenoriensis* (Fig. 4a), where each species occupy a narrow range of environments, but different from the one of the sister species.

Community phylogenetic structure

The results of the community phylogenetic structure analysis show a tendency to phylogenetic clustering, but in most cases it is not significant (Table 3). Considering the communities defined by vegetation cover type, the 62% for NRI and 50% of NTI are phylogenetically clustered (25% and 19% statistically significant respectively); for Holdridge life zones communities, 70% for NRI and 80% for NTI (30% and 20% statistically significant respectively); for annual precipitation 20% for NRI, and it drastically change to 0% for NTI (20% and 0% statistically significant respectively).

The phylogenetically dispersed communities of vegetation cover (VIIB₄ -Lowland swamps, Atlantic zone) and Life zones (T-df -Tropical dry forest, Guanacaste region and Nicoya peninsula) correspond to lowland habitats. This tendency is also present in other not significant lowland vegetation covers: Guanacaste region and Nicoya peninsula well-drained habitats (IA₃, IB, VA) and Atlantic zone lowland and mangrove forests (IA_{1a}(1)(b)-ZA, IA₅).

Table 3: Results for NRI and NTI analysis. Numbers in bold have significant p values. Abbreviations as in Table 1. SA-rp lacking among life zones because it presents only one species, and indexes could not be applied.

VEGETATION COVER	n. taxa	NRI	NTI	LIFE ZONE	n. taxa	NRI	NTI	BIO12- Annual Precipitation			
								mm	n. taxa	NRI	NTI
Lowland forest CG	31	3.485778	0.67261383	LM-mf	2	-0.41029499	-0.40644735	1000-1999	15	-1.5244406	-0.18541633
Lowland forest VG	21	0.81589323	1.57866598	LM-rf	21	1.42633466	0.96878827	2000-2999	59	-0.14890804	-0.47171619
Lowland forest ZA	30	0.31452569	0.99723032	LM-wf	30	1.30663208	1.24552722	3000-3999	51	-1.0262212	-0.71977734
Lowland forest m.d. ZA	13	-1.00796891	-0.2506046	M-rf	7	4.59928207	3.32589546	4000-4999	37	0.14423104	-0.59747179
Submontane forest CG	37	0.81954251	-1.14152206	P-mf	11	-0.81022658	0.40605274	5000-5999	23	1.53243093	-0.85561775
Submontane forest VG	15	4.74160784	1.37069989	P-rf	44	2.85891262	0.28148411				
Lower-montane forest CG	40	0.70733486	-0.77613604	P-wf	39	1.00861637	0.08521159				
Upper-montane forest CG	12	1.58162502	2.09840844	T-df	5	-1.87531839	-1.66454256				
Altimontane forest	11	2.2945057	1.26037682	T-mf	25	1.37363534	0.68964654				
Seasonal lowland forest	3	2.15646342	2.68006681	T-wf	35	0.71654648	0.53142883				
Semi-deciduous lowland	33	-0.27415492	-0.76870159								
Mangrove	3	-0.62341104	-0.49102242								
Deciduous lowland	16	-1.1810811	-0.73158911								
Agro-productive	12	0.75623629	0.50402102								
Savanna	5	-0.99555298	-1.27779755								
Lowland swamp	13	-0.31246568	-1.95303333								

Discussion

Taxonomy

The different clades organizations obtained by the different methods for phylogenetic reconstruction hint at the need of further study to resolve these uncertainties, for example adding more species and more or different genes. However it's clear that the traditional view of the main two genera, *Anomala* and *Callistethus*, must be reviewed, with *Anomala* that splits in several clades, and *Callistethus* that receive species not fitting with the traditional definition.

Part of these can be caused by the lack of one or more gene sequences for various species, as is the case of *Strigoderma*, for which only COI fragment could be successfully sequenced.

The species of *Anomala* that enter the *Callistethus* clade have characters shared with this genus, specifically the mesosternal suture, poorly defined in *A. semicincta* and *A. arara*, placed at level of mesotrochanter in *A. praezellens*; wide mesosternal space

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between mesocoxae in *A. testaceipennis* and *A. praecellens*, with mesosternal process only weakly developed in the latter. *A. arara* has tuberculiform last spiracle, found also in *C. stannibractus* and *C. mimeloides*, and other *Callistethus* species. *A. semicincta* and *A. testaceipennis* has fused ventral plate to parameres, a common trait in *Callistethus*. *A. arara* with endophallus in spiral, like *C. chontalensis*, *C. specularis*, *C. valdecostatus*, and *C. parapulcher* (Filippini *et al.* A). If the placement of these species inside the *Callistethus* genus would be confirmed in future studies, it would stress the importance of the presence of a single diagnostic characters from a pool in genus definition, instead of a combination of several characters as is usual.

C. ruteloides, even if presenting a long mesosternal process as in *Callistethus*, also has particular characters that distance it from other *Callistethus* species (Filippini *et al.* B), and it probably belongs to a different lineage from both *Callistethus* and *Anomala*.

The separation of *A. eucoma* populations into different species coincide at a morphological level mainly with differences in adults size: Osa Peninsula and Guanacaste populations/species are small sized (8–10 mm), Central Valley population is medium size (11–13 mm), and they also present subtle differences in the shape of male genitalia (Filippini *et al.* 2013). The geographical separation of the three population, together with the timing of separation, prior in the small sized populations than in the Central valley + *A. pseudoeucoma* pair, support the consideration of each population as a different species.

The pairing of *Anomala hoppi* with *Anomalorhina turrialbana* is a signal of its peculiarity, evident at the morphological level by some unique features like possessing seven teeth on the maxillae (against six teeth in the rest of the Anomalini), the wide space among apical lobes in labrum and labium (that may be due to a feeding specialization), and the accentuated curvature upwards of frontal side of clypeus in males, more than in other *Anomala* and *Callistethus* species, but far

less developed than in *Anomalorhina* males. The relation of this taxon with *Anomalorhina* and their position in respect the other Anomalini genera must be further investigated.

In conclusion, we suggest further taxonomical studies in these directions: the clarification of the position the the *Anomala* species that enter the *Callistethus* clade (*A. semicincta*, *A. arara*, *A. praecellens*, *A. testaceipennis*); the separation of *A. eucoma* complex in three different species, with the small sized populations of Osa Peninsula and Guanacaste to be treated as new species; the creation of a new genus for *C. ruteloides*.

Biogeography

The paleogeographic history of Central America before the closing of Panama isthmus about 3 mya is still uncertain (Kirby *et al.*, 2008); stable sub-aerial land in southern Central America (including Costa Rica) was present during Miocene either as an archipelago, or in form of a peninsula connected to North America (Kirby *et al.* 2008; Kirby & MacFadden 2005), but even earlier, in late Eocene, a large continuous portion of southern Central America could have had emerged, narrowing the strait between southern Central America and South America (Montes *et al.* 2012). Most of the species included in the chronogram are limited in distribution to southern Central America, among Costa Rica, Panama and Nicaragua, with some species also present more at North, within the Neotropical zone (Mexico, Honduras, Guatemala) (*C. granulipygus*, *A. semicincta*, *A. eucoma*, *A. calligrapha*, *A. megalia*, *A. cupricollis*, *A. discoidalis*, *A. quiche*) and some species also present in South America (Bolivia, Ecuador Colombia) (*A. testaceipennis*, *A. balzapambae*, *A. valida*, *A. hoppi*). However it must be noted that general checklists and faunistic studies are scarce in the Neotropics, being limited to Ecuador (Paucar-Cabrera 2005), Panama (Ratcliffe 2002) and Mexico (for example Neita *et al.* 2006; Reyes-Novelo and Morón 2005; Alcázar-

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Ruiz *et al.* 2003), so that the knowledge of the distribution of species is incomplete, and this influences the biogeographic considerations.

The timing of basal diversification are congruent with the origin of the Mesoamerican biotic component, linked to mountain and cloud forests, from the Oligocene (33–23 mya) arrival of South American taxa to the Nuclear Central America (NCA: part of Chiapas, highlands of Guatemala, Honduras, El Salvador and northern Nicaragua, emerged since end of Cretaceous), that lately diversified here and expanded to South America and northern in Mexico (Morrone 2005; Halffter *et al.* 2008; Stuart 1966; Halffter 2003). The presence of subaerial land in southern Central America from the late Eocene (38–34 mya) (Montes *et al.* 2012) would have facilitated this incursion, and would have given a participative role to this zone in the Mesoamerican biotic formation. More species, from both NCA and South America, should be included in the analysis, and more distribution data collected, to test for at which point the clades entered the southern Central America and started diversification, if early in the origin of the Mesoamerican biotic formation, or later from clades that already started diversifying more at North.

The origin of the main clades in the Miocene (23–5 mya) (for example clades B-C, D and E) is congruent with the general view of definitive emergence of Southern Central America during this epoch (Molnar 2008; E. Cadena *et al.* 2012; Kirby & MacFadden 2005; Stuart 1966). Other mayor paleogeological events, as the general uplifting during Pliocene (5–2.6 mya) and glacial cycles during Pleistocene (2.6–0.011 mya) (Macvean and Schuster 1981; García-López *et al.* 2013; Stuart 1966), with alternation of isolation and formation of corridors between volcanic mountains, took place when many of the species already diverged, and probably had a role more on species distribution than diversification. However dates of separation of sister taxa are to be taken cautiously for the gaps in the representation of taxa and differences among topologies.

Community structure

Of the three categories of ecological communities, the ones on a finer scale of observation (vegetation cover and life zones) were the one that gave more information. The results from the analysis on the annual precipitation, though in line with the others, can give rise to only very general considerations and miss information that can be obtained by the other categories. Vegetation cover and life zones community results were similar and lead to the same considerations.

The tendencies showed by the analysis of community structure and beta diversity shows that more stable environments, like evergreen forests (vegetation cover communities), or moist, wet and rain forests (Holdridge life zone communities) (all with high levels of annual precipitations) are rich in species and similar in composition (high beta similarity values) and act as habitat filtering, as showed by the phylogenetic clustering (Webb *et al.* 2002), on the species they host. Habitat filtering is a pattern common in the tropics and that is regarded to have a role in explaining the high diversity at low latitudes (Brown 2014; Wiens & Graham 2005; Wiens *et al.* 2010).

On the contrary, more "extreme" and unstable environments like seasonal, mangrove, altimontane forests and swamp (vegetation cover communities), or dry forest (Holdridge life zone communities) (also represented in the lower level of annual precipitation) are colonized with difficulty: they presents lower richness, with either phylogenetically unrelated species (phylogenetic overdispersion: lowland swamp and dry forest, lowest level of annual precipitation) or with composition that differs from the ones of the more stable environments (low values of beta similarity), this is indicative of the different adaptability capacity of the different lineages to colonize this kind of environments. Most of these environments are placed in the lowlands, that are considered unstable, due to the lack of the chance of short range vertical migration during climate cycles, and patchy (especially for anthropic

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activities) in tropical areas in contrast to the mountain environments (Darlington 1970), and are more prone to be colonized by species that already occupy marginal and unstable habitats, or are ecologically unspecialized, for their ability to disperse for longer distances, due to their independence from strict ecological requirements (Darlington 1970).

As already seen, clades and species have different amplitudes of environments occupied, with for example many *Callistethus* species adapt to different kinds of vegetations and life zones, while most of *A. trapezifera* species group components restricted to few kinds of environments. These different behaviors can shed light on the speciation mechanisms for these groups: new ecological adaptations, environmental shifts or environmental specialization can have played a role in those species pairs with different or wide+strict ecological niches; in this latter case other possibilities could be a distinct niche breadth and ecological adaptability of a small population that get separated from the main one and diversify into a new species, or a "founder effect" on these same aspects of a new isolated population.

On the contrary for species with wide and similar environmental tolerance (and usually also wide distributions), other mechanisms must come into play: the scale of observation is important (Webb *et al.* 2002; Hardy & Senterre 2007), so it's possible that at an even finer scale than the categories analyzed other traits define the niche, like specialized diets, and that at this scale more significant results can be obtained. Ruling out new ecological adaptations as a factor for the high diversity, other mechanisms must be assessed, like allopatric or parapatric speciation, due to instable geological and climate history (but a better knowledge of paleogeographic history of southern Central America is required), even if now most species have wide distribution overlapping with sister taxa. Another path worth to be investigated is the sexual selection, due to the complicated structures in the male genitalia of these species (Filippini *et al.* E, for example for sympatric and widely distributed (in Costa

Rica) pairs like *C. chontalensis* + *C. granulipygus*, *C. macroxantholeus* and *C. microxantholeus*, or *A. arara* and *A. semicineta*), that may had a central role in reproductive isolation.

Acknowledgements

We thank the staff of the laboratory of the Museum of Comparative Zoology & Department of Organismic and Evolutionary Biology, Harvard University, especially to Gonzalo Giribet, Rosa M. Fernández García, Erin McIntyre and Vanessa González, for their invaluable help with the molecular part. We thank Centro Científico Tropical, Costa Rica, for making available the map of Holdridge life zones in Costa Rica. Financial support was provided by the Agencia Española de Cooperación Internacional para el Desarrollo (AECID) projects A/4426/05, A/6788/06, A/019887/08, A/023060/09 and a PhD grant to V. Filippini from the Spanish Ministry of Education.

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Capítulo 6

Discusión general

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Este trabajo taxonómico ha permitido elevar el número de especies conocidas de *Anomala* y *Callistethus* de Costa Rica de 50 a 105, con la descripción en el curso de la investigación para la presente tesis de 57 especies nuevas para la ciencia (capítulo 3).

La consulta de material tipo en diferentes museos permitió no solamente comprobar que la mayoría de los ejemplares considerados previamente en las colecciones (INBio y CEUA) como morfoespecies eran nuevas especies para la ciencia, sino también permitió detectar 14 identificaciones erróneas previas. Estos errores se han podido confirmar mediante el examen del material tipo de las especies presentes en Costa Rica, y las identificaciones posteriores llevadas a cabo sobre las morfoespecies de colecciones (capítulo 4).

De tres especies conocidas sólo por el material tipo, descritas originalmente con ejemplares de Costa Rica, no se han encontrado especímenes colectados posteriormente a la descripción: *Anomala jansoni* Ohaus 1897, *Anomala polygona* Bates 1888 (un ejemplar hembra en la colección de INBio podría pertenecer a esta especie, ver capítulo 3.2) y *Callistethus chrysanthe* (Bates 1888). Las descripciones originales no dan indicaciones precisas sobre la localidad de colecta, pero haría falta una investigación más extensa tanto desde el punto de vista histórico, que permita averiguar las localidades en que colectaron los autores de las especies, como ampliar las colectas a países limítrofes para descubrir el destino de estas especies.

Asimismo, *A. chapini* Robinson 1948 descrita originalmente de Costa Rica, podría resultar ser sinónimo de *A. clathrata* Ohaus 1930, descrita con ejemplares procedentes de Panamá; externamente son muy similares, y la comparación del edeago de especímenes parecidos de Costa Rica (originalmente identificados como *A. chapini*) con el del tipo de *A. clathrata* los identifica como pertenecientes a esta especie; la morfología externa del tipo de *A. chapini* ha sido comprobada por

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fotografía y es aún necesario el estudio del edeago al que aún no hemos podido tener acceso.

La diversidad de *Anomala* y *Callistethus* se ve muy incrementada y complicada por la presencia de complejos de especies, cuyos miembros se pueden distinguir casi únicamente por el estudio de las genitalias masculinas. Ejemplos son las especies similares a *A. eucoma* (capítulo 3.1), el grupo *trapezifera* (capítulo 3.2), el complejo de *C. collaris* (capítulo 3.2), las parejas *A. picelada* - *A. incostans* (capítulo 3.3), *A. solisi* - *A. oreas* (capítulo 3.4), *A. robiginosa* - *A. sticticoptera* (capítulo 3.5).

Por este motivo, la clave general para las especies de Anomalini de Costa Rica (capítulo 4), que incluye material fotográfico y dibujos de las genitalias masculinas, aporta una valiosa ayuda para la identificación de las especies, siendo la primera clave general que permite identificar este diverso grupo taxonómico en el Neotrópico. En los trabajos de descripción, cuando ha sido posible, se han incluido los dibujos de genitalias masculinas de especies similares no presentes en Costa Rica, que para la mayoría constituyen los únicos instrumentos de identificación para estas especies junto a su descripción original.

A nivel sistemático, el meticuloso estudio morfológico y el análisis filogenético (capítulo 5) confirman las sospechas de parafilia entre los dos géneros, con especies de *Anomala* que van a ser incluidas en *Callistethus* y viceversa.

Para *Callistethus* se identificaron caracteres morfológicos adicionales para la definición de este género: margen posterior del pronoto sin reborde, recto o levemente cóncavo en correspondencia del escutelo; proceso mesosternal que llega por lo menos al ápice de las mesocoxas; sutura mesosternal poco definida o ausente, al mismo nivel del margen anterior de los trocánteres; parámetros fusionados a la placa ventral del edeago (capítulo 3.3).

El género *Anomala* resulta constituido por varios clados, por lo cual debería ser subdividido en diferentes géneros (capítulo 5). Uno de los clados principales en que se divide *Anomala* está constituido por especies del grupo *Anomala trapezifera* y especies relacionadas, que presentan caracteres apomórficos con respecto a las demás especies de *Anomala* (capítulo 3.2).

Algunas especies como *A. hoppi* y *C. ruteloides*, tienen caracteres particulares que ya morfológicamente hacen difícil su posicionamiento taxonómico, y a nivel molecular eso se refleja con sus inesperadas afiliaciones: *A. hoppi* con *Anomalorhina* y *C. ruteloides* con especies del grupo *trapezifera*, que podrían tener una explicación en el fenómeno de *long branch attraction*.

Sin embargo, los demás clados de *Anomala* no presentan caracteres morfológicos evidentes que puedan explicar los agrupamientos. Esto abre la puerta a nuevas investigaciones futuras que serán necesarias para aclarar la taxonomía de este grupo que ha resultado ser aún más complicada de lo esperado.

La datación del cladograma (capítulo 5) sitúa el origen de estos clados en el Oligoceno, un resultado congruente con el origen del componente biótico mesoamericano que encontramos en México, formado en el núcleo centroamericano desde taxa provenientes de Suramérica (Morrone 2005; Halffter *et al.* 2008; Halffter 2003). Los resultados muestran que los principales clados se separaron e iniciaron su diversificación en el Mioceno (23–5 ma), época durante la cual parte de Costa Rica ya estaba emergida (Kirby *et al.* 2008; Kirby & MacFadden 2005).

El hecho de que la mayoría de las especies incluidas en el análisis filogenético tengan distribución en Centroamérica meridional (sur de Nicaragua, Costa Rica, Panamá), pone de manifiesto la importancia de esta región en el aporte al componente biótico mesoamericano junto al núcleo centroamericano (parte de Chiapas, cordilleras de Guatemala, Honduras, El Salvador y norte de Nicaragua). Las incertidumbres sobre la

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historia paleogeográfica de la región meridional centroamericana, con varias teorías sobre la extensión y el momento de emersión de superficies en estas zonas (Montes *et al.* 2012, Kirby *et al.* 2008; Kirby & MacFadden 2005), hace difícil localizar el origen de estos clados, no pudiendo concluir si se originaron directamente en la parte meridional, o bien llegaron desde el núcleo centroamericano siguiendo la progresiva emersión de las partes meridionales.

Los patrones de distribución indican que la mayor biodiversidad se encuentra en las vertientes de las principales cordilleras de Costa Rica, que corresponden a las zonas de bosque tropical más prístinas, hecho que confirma estudios con otros grupos (Kohlmann *et al.* 2007).

Los análisis de beta diversidad y estructura de la comunidad (capítulo 5) indican que los hábitats más ricos se corresponden a varios tipos de bosques tropicales siempre verdes que mantienen comunidades similares entre sí (con elevados índices de similitud de beta diversidad), y que a su vez están constituidas por especies cercanas filogenéticamente (comunidades agrupadas filogenéticamente), por lo que se puede inferir que el hábitat actúa de filtro en la dispersión de las especies. Ambientes más inestables, como bosques estacionales, bosques secos, o "extremos" como manglares y bosques de alta montaña, mantienen una riqueza de especies mucho menor, y sus comunidades son muy diferentes de las demás, porque sólo pocas especies, de diferentes linajes, logran colonizarlos.

Las diferentes escalas de observación utilizadas en estos análisis (comunidades basadas en tipo de cobertura vegetal, zonas de vida de Holdridge, precipitación anual) dan resultados congruentes, sin embargo los análisis a escalas más finas (cobertura vegetal y zonas de vida) dieron una información más detallada sobre la influencia de factores ecológicos en la distribución y diversificación de las especies respecto al uso de escalas de observación más generales.

El registro de las especies utilizadas para el análisis filogenético (64% de las especies de Costa Rica) requiere prudencia a la hora de sacar conclusiones generales dado que no es completo, sin embargo la observación de pares de especies hermanas, en cuanto a sus presencia en diferentes tipos de ambientes, nos permiten sugerir diferentes pautas de diversificación para estos grupos. En el caso de parejas donde ambas tienen distribuciones restringidas, o donde una especie tiene un nicho ecológico amplio mientras que la otra está restringida a uno o pocos ambientes, se puede hipotetizar que nuevas adaptaciones ecológicas o especializaciones pueden haber tenido un rol en la diversificación de estas especies. En los casos de parejas de especies donde ambas presentan nichos muy amplios, y en general su distribución se solapa, se hace necesario profundizar en el análisis de los mecanismos evolutivos.

El 97% de las especies estudiadas de *Anomala* y *Callistethus* tiene una distribución que se solapa total o parcialmente con áreas protegidas de Costa Rica (Fig. 1); sólo 3 especies (*Anomala ferrea*, *Callistethus calonotus*, *C. flavodorsalis*) se distribuyen totalmente fuera de áreas protegidas. El 22% de las especies tienen toda su distribución conocida en el interior de áreas protegidas. Esto se podría explicar parcialmente con un sesgo en la elección de lugares de colecta, que se llevó a cabo en zonas prístinas (que probablemente están protegidas), sin embargo sólo el 65% de las localidades de colecta está dentro de áreas protegidas. Se puede concluir que el sistema de parques y reservas de Costa Rica es adecuado para la conservación de especies de Anomalinos.

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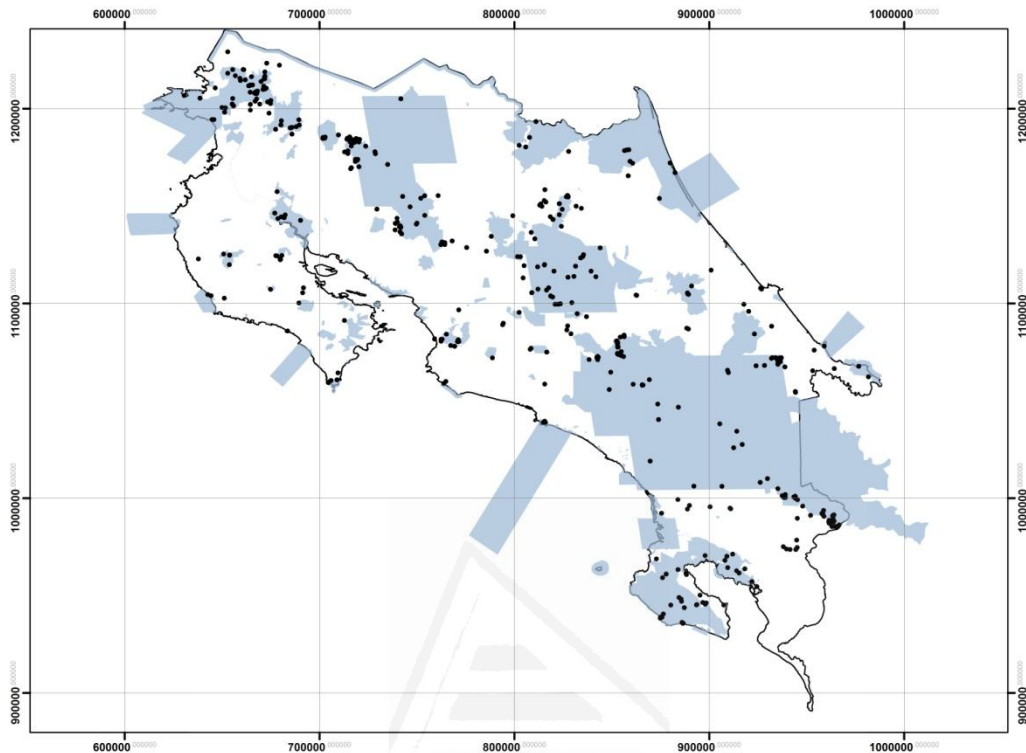


Figura 1: localidades de colecta de las especies consideradas en este trabajo, y en azul las áreas protegidas de Costa Rica (parques nacionales, reservas, refugios, zonas de protección).

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Conclusiones

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1. Después del estudio realizado en el marco de esta tesis doctoral, el número de especies conocidas de estos Anomalini en Costa Rica se ha incrementado en un 47%, pasando de 50 especies a 105 de las cuales 78 son *Anomala* y 28 *Callistethus*.

After the study realized in the context of this thesis, the number of known species of these genera of Anomalini in Costa Rica has increased by 47%, from 50 to 105 species, of which 78 are Anomala and 28 Callistethus.

2. Del total de las 105 especies citadas, 57 especies resultaron nuevas para la ciencia, habiéndose descrito 44 especies nuevas de *Anomala* y 13 de *Callistethus*.

Of the 105 species cited, 57 species were new to science, and have been described 44 new species of Anomala and 13 of Callistethus.

3. Análisis moleculares han permitido verificar que el género *Callistethus* está compuesto por especies con proceso mesosternal largo y corto, mientras las especies del grupo *validus* (sensu Machatschke 1957) pertenecen a *Anomala* (en sentido amplio).

Molecular analyzes allowed to verify that the genus Callistethus is composed of species with long and short mesosternal process while the validus species group (sensu Machatschke 1957) belong to Anomala (sensu lato).

4. El análisis de caracteres para el estudio filogenético en *Callistethus* determinó que los siguientes caracteres tienen valor diagnóstico: margen posterior del pronoto sin reborde, recto o levemente cóncavo en frente al escutelo; proceso mesosternal que llega por lo menos al ápice de las mesocoxas; sutura mesosternal

poco definida o ausente, al mismo nivel del margen anterior de los trocánteres; parámetros fusionados a la placa ventral del edeago.

Analysis of characters for the phylogenetic study of Callistethus determined that the following characters have diagnostic value: posterior margin of pronotum rimless, straight or slightly concave in front of the scutellum; mesosternal process that reaches at least the apex of mesocoxae; mesosternal suture indistinct or absent, at the same level of the anterior margin of trochanters; parameres fused to the ventral plate of aedeagus.

5. El análisis del material tipo ha permitido concluir que *Callistethus kolbei* es sinónimo de *C. specularis*.

The study of type material has led to the conclusion that Callistethus kolbei is synonymous with C. specularis.

6. El análisis de las especies incluidas actualmente en el género *Anomala* ha permitido concluir que es un grupo polifilético.

The analysis of the species currently included in the genus Anomala let us conclude that it is a polyphyletic group.

7. El grupo de especies *trapezifera* y especies cercanas, constituyen un clado bien definido que se caracteriza por la presencia como apomorfia de un *spiculum* esclerotizado en el endofalo.

The trapezifera species group and closely related species, constitute a distinct clade that is characterized by the presence as apomorphy of a sclerite in the endophallus.

8. El origen de los clados costarricenses de *Anomala* y *Callistethus* se sitúa en el Oligoceno y la diversificación de los clados principales en el Mioceno, fechas congruentes con el origen del componente biótico mesoamericano.

The origin of Costa Rican clades of Anomala and Callistethus is located in the Oligocene, and diversification of the major clades in the Miocene, dates that are consistent with the origin of the Mesoamerican biotic component.

9. Los habitat más ricos en especies corresponden a varios tipos de bosques tropicales siempre verdes que se encuentran en las laderas de las principales cordilleras del país, el 97% de las especies estudiadas tiene una distribución que se solapa total o parcialmente con áreas protegidas de Costa Rica.

The richest habitat in species correspond to various types of evergreen tropical forests, found on the slopes of the main mountain ranges of the country; 97% of the studied species has a distribution that overlaps fully or partially with protected areas of Costa Rica.

10. El tipo de habitat actúa de filtro sobre la dispersión de las especies e influye en la composición de las comunidades.

The kind of habitat acts as a filter on the dispersal of species and influences the composition of communities.

11. Nuevas adaptaciones ecológicas o especializaciones en algunos casos pueden haber jugado un papel importante en la diversificación de nuevas especies.

New ecological adaptations or specializations in some cases may have played an important role in the diversification of new species.

Apéndices



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Anexo 1

Especímenes estudiados para el presente trabajo.

código	especie	se xo	etiqueta
CEUA00105842	<i>Anomala aereiventris</i>	♂	La Esperanza 2300m. Prov. Cartago Costa Rica 29/08/2008 Leg. A. García, M.Zumbado
CEUA00105843	<i>Anomala aereiventris</i>	♂	La Esperanza 2300m. Prov. Cartago Costa Rica 30/08/2008 Leg. A. García, M.Zumbado
INB0004098939	<i>Anomala aereiventris</i>	♂	COSTA RICA. Prov. Cartago. P.N. Tapanti. 1250-1400m. 3-5 JUN 2007. Barries, Cate. Tp. Luz. L_N_190766_560354 #91943
INBIOCRI000478018	<i>Anomala aereiventris</i>	♂	Est. Zurqui, 1600m, P. N. Braulio Carrillo, 500 m antes del Tunel, Prov. S. Jose, COSTA RICA, G. Maass, May 1991, L- N 226800_535200
INBIOCRI000849194	<i>Anomala aereiventris</i>	♀	R. Dos Amigos, 1450 m, P. N. Tapanti, Prov. Cartago, Costa Rica, 28 set 1992, A. Solis L-N 187600,560250
INBIOCRI000910796	<i>Anomala aereiventris</i>	♂	Quebrada Segunda, P. N. Tapanti, 1250m, Prov. Cartago, Costa Rica, Oct 1992, G. Mora, L- N 194000_560000
INBIOCRI001716957	<i>Anomala aereiventris</i>	♀	P.N. Tapanti, Prov. Carta, COSTA RICA. 1480m, Nov 1992, G. Mora, L-N 187500_560200 #1554
INBIOCRI002517713	<i>Anomala aereiventris</i>	♂	San Jose Costa Rica P.N. Braulio Carrillo. Est. Zurqui Tunel 1500m 15 octubre 1985 A.M. Chacon & M.M. Chavarria
CEUA	<i>Anomala aglaos</i>	♂	La Montura, Prov. San José, Costa Rica. 10/10/2007 Leg. M. Moraga
CEUA	<i>Anomala aglaos</i>	♀	La Montura, Prov. Guanacaste, Costa Rica. 13/06/2007 Det. D. Briceño
CEUA00106183	<i>Anomala aglaos</i>	♂	Isla Bonita, Prov. Alajuela, Costa Rica. 11/06/2007 Leg. M. Moraga
CEUA00106184	<i>Anomala aglaos</i>	♂	La Montura, Prov. San José, Costa Rica 07/11/2007 Leg. M. Moraga
CEUA00106186	<i>Anomala aglaos</i>	♀	COSTA RICA. Prov. Alajuela. Guatuso. P.N. Volcán Tenorio. Punto 1: Catarata Río Buenavista. 800m. 5 JUN 2008. J. A. Azofeifa. Tp de Luz 2. L_N_298380_427850 #93849
CEUA00106187	<i>Anomala aglaos</i>	♀	COSTA RICA Prov. San José. P.N. Braulio Carrillo. Sitio La Montura. 1100m. 12 JUL 2007. A. García, M. Moraga. Tp. Luz 2. L_N_232500_539125 #92245
CEUA00106189	<i>Anomala aglaos</i>	♀	Isla Bonita, Prov. Alajuela, Costa Rica. 6/11/2007 Leg. A. García, M. Moraga
INBIO	<i>Anomala aglaos</i>	♂	COSTA RICA Prov. San José. P.N. Braulio Carrillo. Sitio La Montura. 1100m. 13 JUN 2007. A. García, M. Moraga, M.A. Zumbado. Tp. Luz 1. L_N_232500_539125 #92217
INBIO	<i>Anomala aglaos</i>	♀	La Montura Prov. San José Costa Rica 13/06/2007 Det. D. Briceño
INBIOCRI000417432	<i>Anomala antica</i>	♀	Est. Sta. Rosa, 300m, P. N. Sta. Rosa, Prov. Guanacaste, Costa Rica, Feb 1992, F. Araya L- N 313000_359800
INBIOCRI000430686	<i>Anomala antica</i>	♂	Est. Sta. Rosa, 300m, P. N. Sta. Rosa, Prov. Guanacaste, Costa Rica, 3 a 12 jun 1992, III Curso Parataxon. L- N 313000_359800
INBIOCRI000430801	<i>Anomala antica</i>	♀	Est. Sta. Rosa, 300m, P. N. Sta. Rosa, Prov. Guanacaste, Costa Rica, 3 a 12 jun 1992, III Curso Parataxon. L- N 313000_359800
INBIOCRI000430985	<i>Anomala antica</i>	♂	Est. Sta. Rosa, 300m, P. N. Sta. Rosa, Prov. Guanacaste, Costa Rica, 3 a 12 jun 1992, III Curso Parataxon. L- N 313000_359800
INBIOCRI000458794	<i>Anomala antica</i>	♂	Est. Sta. Rosa, 300m, P. N. Sta. Rosa, Prov. Guanacaste, Costa Rica, 3 a 12 jun 1992, III Curso Parataxon. L- N 313000_359800
INBIOCRI000458966	<i>Anomala antica</i>	♀	Est. Sta. Rosa, 300m, P. N. Sta. Rosa, Prov. Guanacaste, Costa Rica, 3 a 12 jun 1992, III Curso Parataxon. L- N 313000_359800
INBIOCRI000458991	<i>Anomala antica</i>	♂	Est. Sta. Rosa, 300m, P. N. Sta. Rosa, Prov. Guanacaste, Costa Rica, 3 a 12 jun 1992, III Curso Parataxon. L- N 313000_359800
INBIOCRI000469539	<i>Anomala antica</i>	♂	Est. Palo Verde, 10m, P. N. Palo Verde, Prov. Guanacaste, Conta Rica, U. Chavarria, May 1992, L- N 259000_388400
INBIOCRI000469559	<i>Anomala antica</i>	♂	Est. Palo Verde, 10m, P. N. Palo Verde, Prov. Guanacaste, Conta Rica, U. Chavarria, May 1992, L- N 259000_388400
INBIOCRI001118531	<i>Anomala antica</i>	♂	Santa Rosa National Park Guanacaste Province Costa Rica. D. H. Janzen 5-12 March 1978
INBIOCRI001118543	<i>Anomala antica</i>	♂	Santa Rosa National Park Guana. Prov. Costa Rica 18-22 May 1978 D. H. Janzen
INBIOCRI001118546	<i>Anomala antica</i>	♂	Santa Rosa National Park Guanacaste Province Costa Rica. D. H. Janzen 5-12 March 1978

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INBIOCRI001118563	<i>Anomala antica</i>	♀	P. N. Manuel Antonio, 80m Quepos, Prov. Puntarenas, Costa Rica, Set 1992, G. Varela L-S 370900,448800
INBIOCRI001118570	<i>Anomala antica</i>	♂	Santa Rosa National Park Guana. Prov. Costa Rica 14-17 May 1978 D. H. Janzen
CEUA	<i>Anomala arara</i>	♂	COSTA RICA. Prov. Alajuela. Upala. P.N. Volcán Tenorio. Alb. Heliconias. Send. a Laguna Danta. 900m. 16 JUN 2007. J. D. Gutierrez. Tp. Luz 2. L N 299100_424000 #92208
CEUA	<i>Anomala arara</i>	♀	COSTA RICA. Prov. Alajuela. Upala. P.N. Volcán Tenorio. Alb. Heliconias. Send. a Laguna Danta. 900m. 16 JUN 2007. J. D. Gutierrez. Tp. Luz 2. L N 299100_424000 #92208
CEUA	<i>Anomala arara</i>	♀	Esperanza del Guarco. Cartago, Costa Rica. 2300m. 5/6/2008. Leg. A. García, M. Zumbado
CEUA00106165	<i>Anomala arthuri</i>	♂	La Maritza, Hda. Orosi Gste. Pr. Costa Rica 550 m. 25 May 1986 W. Hallwachs, D.H. Janzen
CEUA00106166	<i>Anomala arthuri</i>	♀	Est. Maritza, 600m, lado O Vol. Orosi, Prov. Guan. COSTA RICA R. Blanco, May 1990, L- N 326900_373000
INBIOCRI000264744	<i>Anomala arthuri</i>	♂	Est. Maritza, 600m, lado O Vol. Orosi, Prov. Guan. COSTA RICA R. Blanco, May 1990, L- N 326900_373000
INBIOCRI000264745	<i>Anomala arthuri</i>	♀	Est. Maritza, 600m, lado O Vol. Orosi, Prov. Guan. COSTA RICA R. Blanco, May 1990, L- N 326900_373000
INBIOCRI000264750	<i>Anomala arthuri</i>	♂	Est. Maritza, 600m, lado O Vol. Orosi, Prov. Guan. COSTA RICA R. Blanco, May 1990, L- N 326900_373000
INBIOCRI000264752	<i>Anomala arthuri</i>	♂	Est. Maritza, 600m, lado O Vol. Orosi, Prov. Guan. COSTA RICA R. Blanco, May 1990, L- N 326900_373000
INBIOCRI002517224	<i>Anomala arthuri</i>	♂	P.N. Guanacaste Sector Maritza 18 junio 1988 col: D. Janzen
INBIOCRI002754668	<i>Anomala arthuri</i>	♀	La Maritza. Hda. Orosi Gste. Pr. Costa Rica 550m. 2-5 June 1986 W. Hallwachs, D.H. Janzen
INBIOCRI002754779	<i>Anomala arthuri</i>	♀	La Maritza. Hda. Orosi Gste. Pr. Costa Rica 550m. 2-5 June 1986 W. Hallwachs, D.H. Janzen
CEUA00106067	<i>Anomala aspersa</i>	♂	Est. Cuerici, 4.6 Km al E. de Villa Mills, Prov. San Jose, COSTA RICA. 2600m. 22-25 NOV 1995. A. M. Maroto, de Luz L S 389400_499600 #6458
CEUA00106068	<i>Anomala aspersa</i>	♀	Est. Cuerici, 4.6 Km al E. de Villa Mills, Prov. San Jose, COSTA RICA. 2600m. 22-25 NOV 1995. A. M. Maroto, de Luz L S 389400_499600 #6458
INBIOCRI001147712	<i>Anomala aspersa</i>	♂	COSTA RICA. Prov. Cartago. Paraíso. R.F. Río Macho. Villa Mills. 3000m. 22 DEC 1995. A. Solis. L S 390000_495000 #93637
INBIOCRI002362410	<i>Anomala aspersa</i>	♀	Est. Cuerici, 4.6 Km al E. de Villa Mills, Prov. San Jose, COSTA RICA. 2600m. 24-28 NOV 1995. A. Picado, L S 389400_499600 #6429
INBIOCRI002365349	<i>Anomala aspersa</i>	♀	Est. Cuerici, Send. El Carbon, 5 Km al E. de Villa Mills, Prov. San Jose, COSTA RICA. 2600m. 28 NOV 1995. A. Picado, L S 389550_500050 #6426
INBIOCRI002367655	<i>Anomala aspersa</i>	♂	Est. Cuerici, 4.6 Km al E. de Villa Mills, Prov. San Jose, COSTA RICA. 2600m. 22-25 NOV 1995. A. M. Maroto, de Luz L S 389400_499600 #6458
INBIOCRI002389254	<i>Anomala aspersa</i>	♂	Est. Cuerici, 4.6 Km al E. de Villa Mills, Sendero al Mirador, Prov. San Jose, COSTA RICA. 2640m. 21-24 OCT 1995. A. Picado, de Luz L S 389700_499600 #6314
INBIOCRI002603491	<i>Anomala aspersa</i>	♀	COSTA RICA. Prov. Cartago, Reserva Río Macho. Est. Ojo de Agua. 2960m. 24-26 FEB 1998. E. Alfaro. Tp. Luz L S 396300_483500 #49903
CEUA00106059	<i>Anomala atrivillosa</i>	♂	Est. Barva, P. N. Braulio Carrillo, 2500m, Prov. Here, COSTA RICA, B. Apu & G. Varela, Jul 1990 L- N 233200_523100
CEUA00106060	<i>Anomala atrivillosa</i>	♂	Est. Barva, P. N. Braulio Carrillo, 2500m, Prov. Here, COSTA RICA, B. Apu & G. Varela, Jul 1990 L- N 233200_523100
INBIOCRI000121099	<i>Anomala atrivillosa</i>	♀	Estac. Barva, Braulio Carrillo, N. P. 2500 m. Heredia COSTA RICA. Feb 1990. A. Fernandez, L N 233400_523200
INBIOCRI000178001	<i>Anomala atrivillosa</i>	♂	Estac. Barva, Braulio Carrillo, N. P. 2500 m. Heredia, COSTA RICA. Apr 1990. A. Fernandez, L N 233400_523200
INBIOCRI000221955	<i>Anomala atrivillosa</i>	♂	Est. Barva, P. N. Braulio Carrillo, 2500m, Prov. Here, COSTA RICA, A. Fernandez, Jun 1990, L- N 233400_523200
INBIOCRI000221965	<i>Anomala atrivillosa</i>	♂	Est. Barva, P. N. Braulio Carrillo, 2500m, Prov. Here, COSTA RICA, A. Fernandez, Jun 1990, L- N 233400_523200
INBIOCRI000385671	<i>Anomala atrivillosa</i>	♂	Est. Barva, P. N. Braulio Carrillo, 2500m, Prov. Here, COSTA RICA, B. Apu & G. Varela, Jul 1990 L- N 233200_523100
INBIOCRI000485565	<i>Anomala atrivillosa</i>	♀	Est. Barva, P. N. Braulio Carrillo, 2500m, Prov. Here, COSTA RICA, G. Rivera, May 1990, L- N 233400_523200
INBIOCRI000616119	<i>Anomala atrivillosa</i>	♂	Est. Barva, P. N. Braulio Carrillo, 2500m, Prov. Here, COSTA RICA, A. Fernandez, Jun 1990, L- N 233400_523200
CEUA	<i>Anomala balzapambae</i>	♀	COSTA RICA. Prov. Cartago. Jiménez. Pejibaye. Selva. Alb. El Copal. 1000m, 16 JUL 2007. A. García, M. A. Zumbado. Tp. Luz 2. L N 196750_563695 #92253
CEUA00019656	<i>Anomala balzapambae</i>	♀	Quebrada González, P.N. Braulio Carrillo (Costa Rica) 550m 21-9-06 Luz casa Leg.: Micó, García, Galante
CEUA00105805	<i>Anomala balzapambae</i>	♀	Volcán Tenorio 700m. Estación El Pilón Guanacaste Costa Rica 20/06/2009 Leg. E. Galante
INBIOCRI000340846	<i>Anomala balzapambae</i>	♀	Rancho Quemado, Pen. Osa, Prov. Punt. COSTA RICA, B. Apu, Oct - Nov 1990 L- S 292500_511000
INBIOCRI001155377	<i>Anomala balzapambae</i>	♂	Rancho Quemado, Pen. de Osa, Prov. Punta, COSTA RICA. 200m. 14-28 Jul 1993. A. Gutierrez, L S 292500_511000 # 2254

INBIOCRI001622886	<i>Anomala balzapambae</i>	♂	Rancho Quemado, Pen. de Osa, Prov. Punta, COSTA RICA. 200m. 08-28 Nov 1993, A. Marin. L_S_292500_511000 #2469
INBIOCRI001799048	<i>Anomala balzapambae</i>	♂	R.B. Hitoy Cerere, Valle La Estrella, Prov. Limon, COSTA RICA. 100-200m. 9-14 May 1994, G. Carballo, L N 643400_184600 # 2856
INBIOCRI001802328	<i>Anomala balzapambae</i>	♀	R.B. Hitoy Cerere, Valle La Estrella, Prov. Limon, COSTA RICA. 100-200m. 4-20 Abr 1994, G. Carballo, L N 643400_184600 # 2855
INBIOCRI001994842	<i>Anomala balzapambae</i>	♂	Rancho Quemado, Pen. Osa, Prov. Punta, COSTA RICA. 200m. 1 NOV-1 DIC 1992. A. L. Marin, L S 292500_511000 #3197
INBIOCRI000122647	<i>Anomala balzapambae?</i>	♂	Finca La Selva Pto. Viejo Sarapiquí, Heredia COSTA RICA. Feb 1990 C. Chaves & R. Aguilar L N 268800_535300
CEUA	<i>Anomala calligrapha</i>	♀	Albergue Heliconias, Prov. Alajuela, Costa Rica. 14/06/2007 Leg. D. Gutiérrez
CEUA00003334	<i>Anomala calligrapha</i>	♀	Albergue Heliconias, Prov. Alajuela, Costa Rica. 31/01/2006 Trampa de lus (17:15-21:00). Leg. Micó, García, Galante
CEUA00105803	<i>Anomala calligrapha</i>	♀	Albergue Heliconias, Prov. Alajuela, Costa Rica. 9/13/2007 Leg. D. Gutiérrez
INBIOCRI000259213	<i>Anomala chiriquina</i>	♂	Fca. Cafrosa, Est. Las Mellizas, P. N. Amistad, 1300m, Prov. Punt. COSTA RICA, M. Ramirez & G. Mora, May 1990. L-S 316100_596100
INBIOCRI000292589	<i>Anomala chiriquina</i>	♂	Fca. Cafrosa, Est. Las Mellizas, P. N. Amistad, 1300m, Prov. Punt. COSTA RICA. M. Ramirez, Abr 1991, L-S 316100_596100
INBIOCRI00077159	<i>Anomala chiriquina</i>	♂	Est. Biol. Las Alturas 1500 m, Coto Brus, Prov. Puntarenas, Costa Rica, F. Araya, 23 mar a 2 may 1992, L-S 322500_591300
INBIOCRI000987614	<i>Anomala chiriquina</i>	♂	Est. Biol. Las Alturas, 1500m, Coto Brus, Prov. Puntarenas, Costa Rica, M. Ramirez, Mar 1992 L-S 322500_591300
INBIOCRI002517510	<i>Anomala chiriquina</i>	♀	Cartago, Costa Rica San Ramon de Tres Rios Parque del Este 22 julio 1984 Recol: Angel Solis
INBIOCRI000219023	<i>Anomala chloropyga</i>	♂	Quepos, 120m, P. N. Manuel Antonio, Prov. Punt. COSTA RICA, G. Varela & R. Zuñiga, Nov 1990, L-S 370900_449800
INBIOCRI000772430	<i>Anomala chloropyga</i>	♀	Est. Sirena, 0-100m, P. N. Corcovado, Prov. Puntarenas, Costa Rica, 21 mar a 21 abr 1992, Z. Fuentes, L-S 270500_508300
INBIOCRI000842492	<i>Anomala chloropyga</i>	♂	San Luis, 1040m, R. B. Monteverde, Prov. Puntarenas, Costa Rica, Nov 1992, Z. Fuentes, L- N 250850_449250
CEUA	<i>Anomala clarivillosa</i>	♂	La Esperanza 2300m. Prov. Cartago. Costa Rica. 29/08/2008 Leg. A. García, M. Zumbado.
CEUA	<i>Anomala clarivillosa</i>	♀	Est. Barva P.N. Braulio Carrillo, 2500m, Prov. Here. COSTA RICA, A. Fernandez. Jun 1990. L-N-233400, 528200
CEUA00105904	<i>Anomala clarivillosa</i>	♂	La Esperanza 2300m. Prov. Cartago. Costa Rica. 30/08/2008 Leg. A. García, M. Zumbado.
CEUA00105905	<i>Anomala clarivillosa</i>	♂	La Esperanza 2300m. Prov. Cartago. Costa Rica. 30/08/2008 Leg. A. García, M. Zumbado.
CEUA00105906	<i>Anomala clarivillosa</i>	♂	La Esperanza 2300m. Prov. Cartago. Costa Rica. 29/08/2008 Leg. A. García, M. Zumbado.
CEUA00105907	<i>Anomala clarivillosa</i>	♂	La Esperanza 2300m. Prov. Cartago. Costa Rica. 29/08/2008 Leg. A. García, M. Zumbado.
CEUA00105908	<i>Anomala clarivillosa</i>	♀	La Esperanza 2300m. Prov. Cartago. Costa Rica. 29/08/2008 Leg. A. García, M. Zumbado.
CEUA00105909	<i>Anomala clarivillosa</i>	♂	COSTA RICA. Prov. Cartago. P.N. Tapantí. La Esperanza del Guarco. 2334m. 5 MAY 2008. A. García, M.A. Zumbado. Tp. Luz 2. L N 188418_552219 #93739
CEUA00105910	<i>Anomala clarivillosa</i>	♂	COSTA RICA. Prov. Cartago. P.N. Tapantí. Macizo de la Muerte. La Esperanza del Guarco. 2300m. 1 AGO 2008. M.A. Zumbado, A. García. Tp. Luz 2. L N 188418_552219 #94550
INB0003396663	<i>Anomala clarivillosa</i>	♀	COSTA RICA. Prov. Cartago, R.F. Río Macho, Macizo de la Muerte, Estac. Esperanza del Guarco, 2600m, 13 OCT 2001, R. Tenorio, T. de Luz. L N 185600_550000 #65588
INB0003422351	<i>Anomala clarivillosa</i>	♂	COSTA RICA. Prov. Cartago, El Guarco, R.F. Río Macho, Est. La Esperanza del Guarco, 2700m, 22 - 27 ENE 2002, R. G. Tenorio, Luces ambiente L N 185600_550000 #66624
INBIOCRI002517404	<i>Anomala clarivillosa</i>	♀	Cartago. Costa Rica Río Macho. 2Km de Interamericana Sur 12 set de 1988. 2600m. A. Solis
CEUA	<i>Anomala clathrata</i>	♂	Cerro Bitárkara. Prov. Limón, Costa Rica. 11/09/2007 Det. W. Arana
CEUA	<i>Anomala clathrata</i>	♂	Cerro Bitárkara. Prov. Limón, Costa Rica. 11/09/2007 Det. W. Arana
CEUA	<i>Anomala clathrata</i>	♀	Albergue Heliconias, Prov. Alajuela, Costa Rica. 31/01/2008 Leg. D. Gutiérrez
CEUA	<i>Anomala clathrata</i>	♀	Albergue Heliconias, Prov. Alajuela, Costa Rica. 31/01/2008 Leg. D. Gutiérrez
CEUA00003317	<i>Anomala clathrata</i>	♂	Albergue Heliconias, Bijagua (Costa Rica). 750m 30-1-2006. T. luz (18:45-22:00). Leg.: Micó, García, Galante.
CEUA00106194	<i>Anomala coffea</i>	♂	Est. Pitilla, 700m, 9km S Sta. Cecilia, P.N. Guanacaste, Prov. Guanacaste, Costa Rica, 22 oct a 2 nov 1992, C. Moraga L-N 330200_380200
CEUA00106195	<i>Anomala coffea</i>	♀	Est. Pitilla, 700 m, 9 km S Sta. Cecilia, P. N. Guanacaste, Prov. Guan. COSTA RICA, C. Moraga, 6-28 Ene 1992, L- N 330200_380200
INB0003315374	<i>Anomala coffea</i>	♀	Estac. Pitilla, 700m, 9 Km S. Santa Cecilia, Guanac. Pr. COSTA RICA Nov 1988 GNP Biodiversity Survey W85 25 40". N10 59'26"

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INB0003315377	<i>Anomala coffea</i>	♀	Estac. Pitilla, 700m, 9 Km S. Santa Cecilia, Guanac. Pr. COSTA RICA Jul 1988 GNP Biodiversity Survey W85 25 40", N10 59 26"
INBIOCRI000304012	<i>Anomala coffea</i>	♂	Est. Pitilla, 700 m, 9 km S Sta. Cecilia, P. N. Guanacaste, Prov. Guanacaste, Costa Rica, Tp Malaise, 1990. L N 330200,380200
INBIOCRI000405393	<i>Anomala coffea</i>	♂	Est. Pitilla, 700 m, 9 km S Sta. Cecilia, P. N. Guanacaste, Prov. Guanacaste, Costa Rica, C. Moraga, 2 a 15 may 1992, L N 330200,380200
INBIOCRI000405396	<i>Anomala coffea</i>	♂	Est. Pitilla, 700 m, 9 km S Sta. Cecilia, P. N. Guanacaste, Prov. Guanacaste, Costa Rica, C. Moraga, 2 a 15 may 1992, L N 330200,380200
INBIOCRI000409517	<i>Anomala coffea</i>	♂	Est. Pitilla, 700 m, 9 km S Sta. Cecilia, P. N. Guanacaste, Prov. Guanacaste, Costa Rica, C. Moraga 8 a 24 ago 1991, L- N 330200,380200
INBIOCRI000523773	<i>Anomala coffea</i>	♂	Est. Pitilla, 700m, 9 km S Sta. Cecilia, P. N. Guanacaste, Prov. Guanacaste, Costa Rica, K. Taylor, 31 mar - 29 abr 1992, L- N 330200,380200
CEUA	<i>Anomala contusa</i>	♂	Albergue Heliconias, Prov. Alajuela, Costa Rica. 14/06/2007 Leg. D. Gutiérrez
CEUA00019659	<i>Anomala contusa</i>	♀	Tapantí (Costa Rica). 1300m 26-9-06. T. luz 17:00-23:00. Leg.: Micó, García, Galante
CEUA00019662	<i>Anomala contusa</i>	♂	Estación Zurquí. P.N. B. Carrillo (Costa Rica) 1550m 22-9-06. Luz de mercurio. Leg.: Micó, García, Galante
CEUA00105854	<i>Anomala contusa</i>	♂	Volcán Tenorio 1300m. Prov. Guanacaste. Costa Rica. 31/08/2008 Leg. J.A.Azofeifa
CEUA00105865	<i>Anomala contusa</i>	♂	Volcán Tenorio 1300m. Prov. Guanacaste. Costa Rica. 31/08/2008 Leg. J.A.Azofeifa
CEUA00105866	<i>Anomala contusa</i>	♂	Volcán Tenorio 1300m. Prov. Guanacaste. Costa Rica. 30/09/2008 Leg. J.A.Azofeifa
CEUA00105867	<i>Anomala contusa</i>	♀	Volcán Tenorio 1300m. Prov. Guanacaste. Costa Rica. 30/08/2008 Leg. J.A.Azofeifa
CEUA00105868	<i>Anomala contusa</i>	♀	Volcán Tenorio 1300m. Prov. Guanacaste. Costa Rica. 30/08/2008 Leg. J.A.Azofeifa
CEUA00105871	<i>Anomala contusa</i>	♂	Volcán Tenorio 1300m. Prov. Guanacaste. Costa Rica. 31/08/2008 Leg. J.A.Azofeifa
INBIO	<i>Anomala contusa</i>	♀	Volcán Tenorio 1300m. Prov. Guanacaste. Costa Rica. 30/08/2008 Leg. J.A.Azofeifa
INBIO	<i>Anomala contusa</i>	♂	Volcán Tenorio 1300m. Prov. Guanacaste. Costa Rica. 01/09/2008 Leg. J.A.Azofeifa
CEUA00106170	<i>Anomala cupreovariolosa</i>	♂	Zona Protectora Las Tablas, Prov. Punta, COSTA RICA. 1380m. 21 SET 1995. M. Chinchilla, de Luz L S 319300 594700 #6296
CEUA00106171	<i>Anomala cupreovariolosa</i>	♂	Est. Biol. Las Alturas 1500 m, Coto Brus, Prov. Puntarenas, Costa Rica, F. Araya, 23 mar a 2 may 1992, L- S 322500 591300
INB0003316144	<i>Anomala cupreovariolosa</i>	♀	COSTA RICA, Prov. Puntarenas, Coto Brus, Sabalito, Z. P. Las Tablas, Est. Las Alturas. 1600m. 16 MAY 1999. I. A. Chacón. Manual, L S 323100 591500 #55283
INBIOCRI001717589	<i>Anomala cupreovariolosa</i>	♂	Estacion Biologica Las Alturas, Coto Brus, Prov. Punta, COSTA RICA. 1500m. Abr 1992. M. Ramirez, L S 322500 591300 #1184
INBIOCRI002337293	<i>Anomala cupreovariolosa</i>	♂	Zona Protectora Las Tablas, 1.5 Km NE de la Estacion, Prov. Punta, COSTA RICA. 1180m. 23 AGO-6 SET 1995. M. Chinchilla, L S 317800 594700 #5870
INBIOCRI002341975	<i>Anomala cupreovariolosa</i>	♀	Zona Protectora Las Tablas, Prov. Punta, COSTA RICA. 1380m. 21 SET 1995. M. Chinchilla, de Luz L S 319300 594700 #6296
INBIOCRI002394710	<i>Anomala cupreovariolosa</i>	♀	Est. Pittier, Rio Gemelo, Puntarenas, Costa Rica. 1670m. 16-22 MAR 1996. M. Moraga, L S 330900 577400 #7059
INBIOCRI002517681	<i>Anomala cupreovariolosa</i>	♂	Puntarenas. Costa Rica. San Vito Las Cruces. 20 NOV 1988. A. Solis
INBIOCRI002517682	<i>Anomala cupreovariolosa</i>	♂	Puntarenas. Costa Rica. San Vito Las Cruces. 20 NOV 1988. A. Solis
INBIOCRI002517683	<i>Anomala cupreovariolosa</i>	♂	Puntarenas. Costa Rica. San Vito Las Cruces. 20 NOV 1988. A. Solis
INBIOCRI002601796	<i>Anomala cupreovariolosa</i>	♂	COSTA RICA, Prov. Puntarenas, Est. Biologica Las Alturas, Send. a Cerro Echandí. 1580m. 28 FEB 1998. B. Gamboa. Tp. Luz. L S 322900 591050 #49700
INBIOCRI000644593	<i>Anomala cupricollis</i>	♀	Fca. San Gabriel, 2 km suroeste Dos Rios, 600m, Prov. Alaj., COSTA RICA, II curso Parataxon. May 1990, L- N 318800 383500
INBIOCRI000915999	<i>Anomala cupricollis</i>	♂	Est. Biol. Las Alturas 1500 m, Coto Brus, Prov. Puntarenas, Costa Rica, F. Araya, 23 mar a 2 may 1992, L- S 322500 591300
INBIOCRI002517554	<i>Anomala cupricollis</i>	♂	Fca. San Gabriel, 2km SW de Dos Rios, Alajuela Prov. COSTA RICA. 600m, May 1989 GNP Biodiv. Survey L N 318800 383500
INBIOCRI002517612	<i>Anomala cupricollis</i>	♂	COSTA RICA. Prov. Puntarenas, San Vito, Las Cruces. 29 ABR. 1988. A. Solis.
CEUA00106196	<i>Anomala cyclops</i>	♂	Finca Jenny, 30 km N de Liberia, P. N. Guanacaste, Prov. Guan., COSTA RICA. 20-24 May 1993. E. Araya. L-N 316200,364400
CEUA00106197	<i>Anomala cyclops</i>	♀	Est. Sta. Rosa, 300m, P. N. Sta. Rosa, Prov. Guanacaste, Costa Rica, 1 a 12 jun 1992, A. M. Mora, L-N 313000,359800
INBIOCRI000431060	<i>Anomala cyclops</i>	♀	Est. Sta. Rosa, 300m, P. N. Sta. Rosa, Prov. Guanacaste, Costa Rica, 3 a 12 jun 1992, III Curso Parataxon. L- N 313000 359800
INBIOCRI000458888	<i>Anomala cyclops</i>	♂	Est. Sta. Rosa, 300m, P. N. Sta. Rosa, Prov. Guanacaste, Costa Rica, 3 a 12 jun 1992, III Curso Parataxon. L- N 313000,359800

INBIOCRI000590279	<i>Anomala cyclops</i>	♀	Est. Sta. Rosa, 300 m, P. N. Guanacaste, Prov. Guan, COSTA RICA. D. H. Janzen & W. Hallwachs, Jun 1991, L- N 313000,359800
INBIOCRI000755645	<i>Anomala cyclops</i>	♂	Cerro El Hacha, 300m, 12 km SE de La Cruz, Prov. Guanacaste, Costa Rica, 25 jun 1992, III curso Parataxon. L-N 329200,368000
INBIOCRI000912714	<i>Anomala cyclops</i>	O	Est. Sta. Rosa, 300m, P. N. Sta. Rosa, Prov. Guanacaste, Costa Rica, 1 a 12 jun 1992, A. M. Mora, L-N 313000_359800
INBIOCRI000912716	<i>Anomala cyclops</i>	♂	Est. Sta. Rosa, 300m, P. N. Sta. Rosa, Prov. Guanacaste, Costa Rica, 1 a 12 jun 1992, A. M. Mora, L-N 313000,359800
INBIOCRI001168088	<i>Anomala cyclops</i>	♀	Los Almendros, P. N. Guanacaste, Prov. Guana., COSTA RICA. 12-31 May 1993, E. Lopez, L- N 334800, 369800
INBIOCRI001183834	<i>Anomala cyclops</i>	♂	Fca. Jenny, 30 km N de Liberia, P. N. Guanacaste, Prov. Guan., COSTA RICA. 25-29 May 1993. E. Araya. L-N 316200,364400
INBIOCRI001184178	<i>Anomala cyclops</i>	♂	Finca Jenny, 30 km N de Liberia, P. N. Guanacaste, Prov. Guan., COSTA RICA. 20-24 May 1993. E. Araya. L-N 316200,364400
INBIOCRI001891273	<i>Anomala cyclops</i>	♀	Est. Murcielago, 8 km SO. de Cuajiniquil, P. N. Guanacaste, Prov. Guana, COSTA RICA. 100 m. 3 May 1994, C. Cano, L N 320300_347200 # 2907
CEUA	<i>Anomala discoidalis</i>	♂	Albergue Heliconias, Prov. Alajuela, Costa Rica. 17/07/2007 Leg. D. Gutiérrez
CEUA	<i>Anomala discoidalis</i>	♀	Est. Cuatro Esquinas, P.N. Tortuguero, 0m, Prov. Limon, COSTA RICA. R. Delgado, Oct 1990, L-N-280000, 590500
CEUA	<i>Anomala discoidalis</i>	♂	La Esperanza 2300m. Prov. Cartago. Costa Rica. 29/09/2008 Leg. A. García, M. Zumbado.
CEUA	<i>Anomala discoidalis</i>	♀	Albergue Heliconias. Prov. Alajuela Costa Rica 19/07/2007 Leg. D. Gutierrez
INBIOCRI000248553	<i>Anomala discoidalis</i>	♂	Cerro Tortuguero, P. N. Tortuguero, 0-100m, Prov. Limon, COSTA RICA. U. Chavarría, Jun 1990, L- N 285000_588000
INBIOCRI000285056	<i>Anomala discoidalis</i>	♂	Est. Cuatro Esquinas, P. N. Tortuguero, 0 m, Prov. Limon, COSTA RICA, R. Delgado, Oct 1990, L- N 280000_590500
INBIOCRI000285067	<i>Anomala discoidalis</i>	♂	Est. Cuatro Esquinas, P. N. Tortuguero, 0 m, Prov. Limon, COSTA RICA, R. Delgado, Oct 1990, L- N 280000_590500
INBIOCRI000285092	<i>Anomala discoidalis</i>	♂	Est. Cuatro Esquinas, P. N. Tortuguero, 0 m, Prov. Limon, COSTA RICA, R. Delgado, Oct 1990, L- N 280000_590500
INBIOCRI000364019	<i>Anomala discoidalis</i>	♂	Est. Cuatro Esquinas, 0m, P. N. Tortuguero, Prov. Limon, COSTA RICA. E. Quesada., Jun 1990, L- N 280000_590500
INBIOCRI000909457	<i>Anomala discoidalis</i>	♂	Est. Biol. Las Alturas 1500 m, Coto Brus, Prov. Puntarenas, Costa Rica, F. Araya, 23 mar a 2 may 1992, L- S 322500_591300
INBIOCRI000994364	<i>Anomala discoidalis</i>	♀	Est. Las Pailas, 800 m, P.N. Rincon de la Vieja, Prov. Guan., COSTA RICA. 9-27 feb 1993, K. Taylor. L- N 306300_388600
INBIOCRI000994367	<i>Anomala discoidalis</i>	♀	Est. Las Pailas, 800 m, P.N. Rincon de la Vieja, Prov. Guan., COSTA RICA. 9-27 feb 1993, K. Taylor. L- N 306300_388600
INBIOCRI000994368	<i>Anomala discoidalis</i>	♀	Est. Las Pailas, 800 m, P.N. Rincon de la Vieja, Prov. Guan., COSTA RICA. 9-27 feb 1993, K. Taylor. L- N 306300_388600
INBIOCRI000994369	<i>Anomala discoidalis</i>	♀	Est. Las Pailas, 800 m, P.N. Rincon de la Vieja, Prov. Guan., COSTA RICA. 9-27 feb 1993, K. Taylor. L- N 306300_388600
INBIOCRI001355739	<i>Anomala discoidalis</i>	♂	Est. Las Pailas, 800 m, P.N. Rincon de la Vieja, Prov. Guan., COSTA RICA. 10 a 27 Mar 1993, K. Taylor, L- N 306300_388600
INBIOCRI002517617	<i>Anomala discoidalis</i>	♀	ALAJUELA, COSTA RICA Zarcerro, 1700 m 23-V-87 COL: A. SOLIS B.
INBIOCRI002517625	<i>Anomala discoidalis</i>	♀	ALAJUELA, COSTA RICA Zarcerro, 1700 m 23-V-87 COL: A. SOLIS B.
INBIOCRI002553132	<i>Anomala discoidalis</i>	♂	COSTA RICA, Prov. Puntarenas, San Vito. Humedal San Joaquin, 1000m. 10-12 SET 1996. E. Navarro, M. Moraga, A. M. Maroto, L. Angulo. L_ S_309300_578000 #8492
CEUA00106198	<i>Anomala divisa</i>	♂	Est. Biol. Las Alturas 1500 m, Coto Brus, Prov. Puntarenas, Costa Rica, F. Araya, 23 mar a 2 may 1992, L- S 322500,591300
CEUA00106199	<i>Anomala divisa</i>	♂	Zarcerro, Alfaro Ruiz, 1700m Alajuela Pr. COSTA RICA. Apr - May 1989. A. Del Valle & A. Solis, L- N 240500, 493500
INBIOCRI000020297	<i>Anomala divisa</i>	O	Zarcerro, Alfaro Ruiz, 1700m Alajuela Pr. COSTA RICA. Apr - May 1989. A. Del Valle & A. Solis, L- N 240500_493500
INBIOCRI000022442	<i>Anomala divisa</i>	O	Zarcerro, Alfaro Ruiz, 1700m Alajuela Pr. COSTA RICA. Apr - May 1989. A. Del Valle & A. Solis, L- N 240500_493500
INBIOCRI000022463	<i>Anomala divisa</i>	♂	Zarcerro, Alfaro Ruiz, 1700m Alajuela Pr. COSTA RICA. Apr - May 1989. A. Del Valle & A. Solis, L- N 240500, 493500
INBIOCRI000909406	<i>Anomala divisa</i>	♀	Est. Biol. Las Alturas 1500 m, Coto Brus, Prov. Puntarenas, Costa Rica, F. Araya, 23 mar a 2 may 1992, L- S 322500,591300
INBIOCRI000909434	<i>Anomala divisa</i>	♂	Est. Biol. Las Alturas 1500 m, Coto Brus, Prov. Puntarenas, Costa Rica, F. Araya, 23 mar a 2 may 1992, L- S 322500,591300
INBIOCRI000916198	<i>Anomala divisa</i>	♂	Est. Biol. Las Alturas 1500 m, Coto Brus, Prov. Puntarenas, Costa Rica, F. Araya, 23 mar a 2 may 1992, L- S 322500,591300
INBIOCRI002517128	<i>Anomala divisa</i>	♂	Alajuela. Costa Rica Cinco Esquinas de Carrizal, 1800m 16 abril de 1988 Col: G. Barrantes
CEUA00105806	<i>Anomala estrella</i>	♀	Los Almendros, P. N. Guanacaste, Prov. Guanacaste, Costa Rica, 28 mar a 24 apr 1992, M. Reyes, L- N 334800_369800

CEUA00106164	<i>Anomala estrella</i>	♂	San Jose. Costa Rica Hda. Tiquires. 1500m Rio Tiquires 28 marzo 1988 Col.A.Solis
INBIOCRI000238024	<i>Anomala estrella</i>	♂	Est. Maritza, 600 m, lado O Vol. Orosi, Prov. Guan. COSTA RICA. R. Blanco, Abr 1990, L- N 326900 373000
INBIOCRI000898149	<i>Anomala estrella</i>	♀	Est. La Casona, 1520m, Res. Biol. Monteverde, Prov. Puntarenas, Costa Rica, N. Obando, Mar 1992 L-N 253250,449700
INBIOCRI000898152	<i>Anomala estrella</i>	♀	Est. La Casona, 1520m, Res. Biol. Monteverde, Prov. Puntarenas, Costa Rica, N. Obando, Mar 1992 L-N 253250,449700
INBIOCRI000898153	<i>Anomala estrella</i>	♂	Est. La Casona, 1520m, Res. Biol. Monteverde, Prov. Puntarenas, Costa Rica, N. Obando, Mar 1992 L-N 253250,449700
INBIOCRI001331532	<i>Anomala estrella</i>	♂	Est. Las Pailas, 800 m, P.N. Rincon de la Vieja, Prov. Guan., COSTA RICA. 6 ene a 13 abr 1993, J. Sihezar, G. Rodriguez, L- N 306300 388600
INBIOCRI001355780	<i>Anomala estrella</i>	♀	Est. Las Pailas, 800 m, P.N. Rincon de la Vieja, Prov. Guan., COSTA RICA. 10 a 27 Mar 1993, K. Taylor, L- N 306300 388600
INBIOCRI002517165	<i>Anomala estrella</i>	♂	Estac. Maritza, 600 m. W side Volcan Orosi Guanac. Pr. COSTA RICA. 17 May 1988. Janzen & Hallwachs W85 29 37", N10 57 39"
INBIOCRI002517166	<i>Anomala estrella</i>	♀	Estac. Maritza, 600 m. W side Volcan Orosi Guanac. Pr. COSTA RICA. 17 May 1988. Janzen & Hallwachs W85 29 37", N10 57 39"
INBIOCRI002517167	<i>Anomala estrella</i>	♀	Estac. Maritza, 600 m. W side Volcan Orosi Guanac. Pr. COSTA RICA. 17 May 1988. Janzen & Hallwachs W85 29 37", N10 57 39"
INBIOCRI001785409	<i>Anomala eucoma</i>	♂	Amubri, A.C. Amistad., Prov. Limon, COSTA RICA. 70 m. 4-30 Abr 1994, G. Gallardo, L S 385500 578100 # 2822
INBIOCRI001871405	<i>Anomala eucoma</i>	♀	Amubri, A.C. Amistad., Prov. Limon, COSTA RICA. 70 m. 2-31 May 1994, G. Gallardo, L N 385000 578100 # 2928
INBIOCRI001875336	<i>Anomala eucoma</i>	♂	Amubri, Talamanca., A.C. Amistad, Prov. Limón, COSTA RICA. 70 m . 6-28 Jun 1994, G. Gallardo, L N 385000 578100 #3006
INBIOCRI002008852	<i>Anomala eucoma</i>	♂	Amubri, Prov. Limón, COSTA RICA. 70m. 1-22 Oct 1994. G. Gallardo, L S 385500 578000 #3266
INBIOCRI002018611	<i>Anomala eucoma</i>	♂	Amubri, Prov. Limón, COSTA RICA. 70m. 3-9 SET 1994. G.M. Gallardo, L S 385500 578000 #3201
INBIOCRI002235510	<i>Anomala eucoma</i>	♀	Amubri, Prov. Limón, COSTA RICA. 70m. 1-22 JUN 1995. G. Gallardo, L S 385000 578100 #5333
INB0004129881	<i>Anomala eucoma</i>	♀	COSTA RICA. Prov. Puntarenas. P.N. Corcovado, Est. Sirena. 0-100m. 21 FEB 2004. E. Holzer. C. Libre. L S 270850 509176 #92946
INB0004129883	<i>Anomala eucoma</i>	♂	COSTA RICA. Prov. Puntarenas. P.N. Corcovado, Est. Sirena. 0-100m. 21 FEB 2004. E. Holzer. C. Libre. L S 270850 509176 #92946
INB0004129886	<i>Anomala eucoma</i>	♂	COSTA RICA. Prov. Puntarenas. P.N. Corcovado, Est. Sirena. 0-100m. 21 FEB 2004. E. Holzer. C. Libre. L S 270850 509176 #92946
INB0004129887	<i>Anomala eucoma</i>	♀	COSTA RICA. Prov. Puntarenas. P.N. Corcovado, Est. Sirena. 0-100m. 21 FEB 2004. E. Holzer. C. Libre. L S 270850 509176 #92946
INBIOCRI000198374	<i>Anomala eucoma</i>	♂	Est. Sirena, Corcovado N. P. , Puntarenas, Prov. COSTA RICA, 0-100m, Jan 1990, G. Fonseca, L S 270500 508300
INBIOCRI000203726	<i>Anomala eucoma</i>	♂	Sirena, Corcovado N. P. Puntarenas Province COSTA RICA. 0 - 100m. G. Fonseca, Dic 1989, L- S 270500 508300
INBIOCRI000376353	<i>Anomala eucoma</i>	♂	Est. Sirena, P. N. Corcovado, 0-100m, Prov. Punt., COSTA RICA F. Quesada, Jun 1990, L- S 270500 508300
INBIOCRI000446957	<i>Anomala eucoma</i>	♂	Est. Sirena, P. N. Corcovado, 0 -100m, Prov. Punt., COSTA RICA, G. Fonseca, Oct 1989, L- S 270500 508300
INBIOCRI000496082	<i>Anomala eucoma</i>	♂	Est. Sirena, 0-100m, P. N. Corcovado, Prov. Puntarenas, Costa Rica, G. Rodriguez, Abr 1992, L- S 270500 508300
INBIOCRI000496083	<i>Anomala eucoma</i>	♀	Est. Sirena, 0-100m, P. N. Corcovado, Prov. Puntarenas, Costa Rica, G. Rodriguez, Abr 1992, L- S 270500 508300
INBIOCRI000506778	<i>Anomala eucoma</i>	♀	Est. Sirena, 0-100m, P. N. Corcovado, Prov. Punt., COSTA RICA, G. Fonseca, Ene 1992, L- S 270500 508300
INBIOCRI000644521	<i>Anomala eucoma</i>	♂	Est. Sirena, P. N. Corcovado, 0 - 100m, Prov. Punt., COSTA RICA. N. Obando, Jun 1990, L- S 270500 508300
INBIOCRI000644524	<i>Anomala eucoma</i>	♂	Est. Sirena, P. N. Corcovado, 0 - 100m, Prov. Punt., COSTA RICA. N. Obando, Jun 1990, L- S 270500 508300
INBIOCRI000652257	<i>Anomala eucoma</i>	♂	Est. Palo Verde, 10m, Ref. Nac. Fauna Silv. R. L. Rodriguez, Prov. Guan., COSTA RICA, D. Acevedo, Jun 1991, L- N 259000 388400
INBIOCRI000652258	<i>Anomala eucoma</i>	♂	Est. Palo Verde, 10m, Ref. Nac. Fauna Silv. R. L. Rodriguez, Prov. Guan., COSTA RICA, D. Acevedo, Jun 1991, L- N 259000 388400
INBIOCRI000708286	<i>Anomala eucoma</i>	♀	Est. Sirena, 0-100m, P. N. Corcovado, Prov. Puntarenas, Costa Rica, Jun 1992, G. Fonseca, L -S 270500 508300
INBIOCRI000713719	<i>Anomala eucoma</i>	♂	Est. Las Pailas, 800m, P. N. Rincon de la Vieja, Prov. Guanacaste, Costa Rica, 1 a 22 jul 1992, D. Garcia, L- N 306300 388600
INBIOCRI000714400	<i>Anomala eucoma</i>	♂	Est. Sirena, 0-100m, P. N. Corcovado, Prov. Puntarenas, Costa Rica, Jun 1992, G. Fonseca, L -S 270500 508300
INBIOCRI000849675	<i>Anomala eucoma</i>	♂	Fca. Jenny, 30 km N de Liberia, P. N. Guanacaste, Prov. Guanacaste, Costa Rica, 20 ago a 12 set 1992, E. Araya, L N 316200 364400
INBIOCRI000917846	<i>Anomala eucoma</i>	♀	P. N. Manuel Antonio, 80m Quepos, Prov. Puntarenas, Costa Rica, Set 1992, G. Varela L-S 370900,448800

INBIOCRI001180822	<i>Anomala eucoma</i>	♀	Tierras Morenas, 700m, Prov. Guan., COSTA RICA. May 1993. G. Rodriguez. L-N-283950, 424500
INBIOCRI001180834	<i>Anomala eucoma</i>	♀	Tierras Morenas, 700m, Prov. Guan., COSTA RICA. May 1993. G. Rodriguez. L-N-283950, 424500
INBIOCRI001383202	<i>Anomala eucoma</i>	♂	Est. Las Pailas, 800 m, P.N. Rincon de la Vieja, Prov. Guan. COSTA RICA. 15 May-11 Jun 1993, K. E. Taylor, L- N 306300_388600
INBIOCRI001650501	<i>Anomala eucoma</i>	♀	Est. Las Pailas, P.N. Rincón de la Vieja, Prov. Guana. COSTA RICA. 800 m. 16-24 Ago 1993. D. García, L N 306300_388600 #2268
INBIOCRI001693034	<i>Anomala eucoma</i>	♂	Finca Jenny, 30 km N de Liberia, P.N. Guanacaste, Prov. Guana, COSTA RICA. 300m. Mar 1991. R. Espinoza, L N 316200_364400 #1678
INBIOCRI001861399	<i>Anomala eucoma</i>	♂	Est. Las Pailas, P.N. Rincón de la Vieja, A.C. Guanacaste, Prov. Guana. COSTA RICA. 800 m. 8-26 May 1994. K.E. Taylor, L N 306300_388600 #2912
INBIOCRI001861400	<i>Anomala eucoma</i>	♂	Est. Las Pailas, P.N. Rincón de la Vieja, A.C. Guanacaste, Prov. Guana. COSTA RICA. 800 m. 8-26 May 1994. K.E. Taylor, L N 306300_388600 #2912
INBIOCRI001861401	<i>Anomala eucoma</i>	♂	Est. Las Pailas, P.N. Rincón de la Vieja, A.C. Guanacaste, Prov. Guana. COSTA RICA. 800 m. 8-26 May 1994. K.E. Taylor, L N 306300_388600 #2912
INBIOCRI001879319	<i>Anomala eucoma</i>	♂	Est. Las Pailas, P.N. Rincón de la Vieja, A.C. Guanacaste, Prov. Guana. COSTA RICA. 800 m. 7-26 May 1994. D. García, L N 306300_388600 #2910
INBIOCRI001967801	<i>Anomala eucoma</i>	♀	Est. Las Pailas, P.N. Rincón de la Vieja, Prov. Guanacaste, Costa Rica. 800 m. 19 Jun- 1 Jul 1993. D. G. García, L N 306300_388600 #2189
INBIOCRI002517326	<i>Anomala eucoma</i>	♂	Fca. Jenny, 300m, 31 Km N. Liberia, Guanacaste Prov. COSTA RICA, Nov 1988 GNP Biodiversity Survey W85 34 27", N10 51 55"
INBIOCRI002517343	<i>Anomala eucoma</i>	♂	Estac. Maritza, 600 m, W side Volcan Orosi Guanac. Pr. COSTA RICA. June 1988. Janzen & Hallwachs W85 29' 37" .N10 57' 39"
INBIOCRI002517348	<i>Anomala eucoma</i>	♂	Estac. Maritza, 600 m, W side Volcan Orosi Guanac. Pr. COSTA RICA. June 1988. Janzen & Hallwachs W85 29' 37" .N10 57' 39"
INBIOCRI002517752	<i>Anomala eucoma</i>	O	Sirena Corcovado N. P. Puntarenas Prov. COSTA RICA, 0-100m, R. Blanco & G. Fonseca. April 1989 L-S 270500,508300
INBIOCRI001646226	<i>Anomala eucoma</i>	♂	Amubri, A.C. Amistad., Prov. Limon, COSTA RICA. 70 m. 4-21 Dec 1993, G. Gallardo, L S 385500_578100 # 2480.
INBIOCRI001296460	<i>Anomala eucoma?</i>	♀	Est. Esquinas, 0 m, Península de Osa, Prov. Punt., COSTA RICA. Ene 1993. F. Quesada. L-S-301400,542200
INBIOCRI001816692	<i>Anomala eucoma?</i>	♀	Est. Esquinas, Pen. De Osa., A. C. Osa, Prov. Punta. COSTA RICA. 200 m. Ene 1994. J. F. Quesada, L S 301400_542200 #2550
CEUA00106225	<i>Anomala eulissa</i>	♀	Isla Bonita, Prov. Alajuela, Costa Rica. 13/06/2007 Leg. M. Moraga
INBIOCRI000845901	<i>Anomala eulissa</i>	♀	Est. Pitilla, 700 m, 9 km S Sta. Cecilia, P. N. Guanacaste, Prov. Guanacaste, Costa Rica, 24 ago a 11 set 1992, P. Rios, L- N 330200_380200
INBIOCRI000899812	<i>Anomala eulissa</i>	♀	Sector Cerro Cocori, Fca. de E. Rojas, 150 m, Prov. Limon, Costa Rica, 9 a 30 nov 1992, E. Rojas, L- N 286000_567500
INBIOCRI001276524	<i>Anomala eulissa</i>	♂	COSTA RICA. Prov. Heredia. Sarapiquí. Z.P. La Selva. Est. Biol. La Selva. 50-150m. 18 MAY 1993. INBio-OET. L N_268151_534671 #87726
INBIOCRI002365057	<i>Anomala eulissa</i>	♂	Sector Cedrales de la Rita, Prov. Limon, COSTA RICA. 10m. OCT 1995. E. Rojas, de Luz L N_278600_566500 #6403
INBIOCRI002365061	<i>Anomala eulissa</i>	♂	Sector Cedrales de la Rita, Prov. Limon, COSTA RICA. 10m. OCT 1995. E. Rojas, de Luz L N_278600_566500 #6403
INBIOCRI002517747	<i>Anomala eulissa</i>	♂	Costa Rica. Prov. Alajuela, San Ramón, R.B. Alberto Manuel Brenes, Río San Lorencito. 800m. 03 OCT 1986. Solís. Manual. L N_470700_245400 #8324
CEUA00106063	<i>Anomala eusticta</i>	♀	Est. La Casona,R.B. Monteverde, Prov. Punta, COSTA RICA. 1520m. 3-24 ABR 1995. A. Azofeifa, L N_253900_449300 #5288
CEUA00106064	<i>Anomala eusticta</i>	♂	Est. La Casona, 1520 m, Res. Biol. Monteverde, Prov. Punt., COSTA RICA. Abr 1991, N. Obando. L- N 253250_449700
INBIOCRI000423420	<i>Anomala eusticta</i>	♀	Derrumbe, Est. Cacao, lado oeste del V. Cacao, Prov. Guanacaste, Costa Rica, III Curso Parataxon., May 1992, L- N 323700_376700
INBIOCRI000728625	<i>Anomala eusticta</i>	♂	Est. La Casona, 1520m, Res. Biol. Monteverde, Prov. Puntarenas, Costa Rica, May 1992, N. Obando, L- N 253250,449700
INBIOCRI000788705	<i>Anomala eusticta</i>	♀	Est. La Casona, 1520m, Res. Biol. Monteverde, Prov. Puntarenas, Costa Rica, K. Flores, Mar 1992 L-N 253250_449700
INBIOCRI000788709	<i>Anomala eusticta</i>	♂	Est. La Casona, 1520m, Res. Biol. Monteverde, Prov. Puntarenas, Costa Rica, K. Flores, Mar 1992 L-N 253250_449700
INBIOCRI001320027	<i>Anomala eusticta</i>	♂	Est. La Casona,1520 m, Res. Biol. Monteverde, Prov. Punt., COSTA RICA. Mar 1991, N. Obando, L- N 253250_449700
INBIOCRI001694171	<i>Anomala eusticta</i>	♂	Estacion La Casona, R. B. Monteverde, Prov. Punta, COSTA RICA. 1520m. Jun 1991. N. Obando, L N 253250_449700 #1714
INBIOCRI002453046	<i>Anomala eusticta</i>	♂	Est. La Casona,R.B. Monteverde, Prov. Punta, COSTA RICA. 1520m. 3-24 ABR 1995. A. Azofeifa, L N_253900_449300 #5288
INBIOCRI002453178	<i>Anomala eusticta</i>	♂	Est. La Casona,R.B. Monteverde, Prov. Punta, COSTA RICA. 1520m. 3-24 ABR 1995. A. Azofeifa, L N_253900_449300 #5288
INBIOCRI002453179	<i>Anomala eusticta</i>	♀	Est. La Casona,R.B. Monteverde, Prov. Punta, COSTA RICA. 1520m. 3-24 ABR 1995. A. Azofeifa, L N_253900_449300 #5288
INBIOCRI002453180	<i>Anomala eusticta</i>	♂	Est. La Casona,R.B. Monteverde, Prov. Punta, COSTA RICA. 1520m. 3-24 ABR 1995. A. Azofeifa, L N_253900_449300 #5288

INBIOCRI002453183	<i>Anomala eusticta</i>	♂	Est. La Casona, R.B. Monteverde, Prov. Punta, COSTA RICA. 1520m. 3-24 ABR 1995. A. Azofeifa, L_N_253900_449300 #5288
CEUA00106169	<i>Anomala ferrea</i>	♀	Puntarenas. Costa Rica. San Vito Las Cruces. 20 NOV 1988. Col. A. Solís
INBIOCRI002517841	<i>Anomala ferrea</i>	♂	COSTA RICA. Prov. Puntarenas, San Vito Las Cruces. 20 NOV 1988. A. Solís
INBIOCRI002517842	<i>Anomala ferrea</i>	♀	COSTA RICA. Prov. Puntarenas, San Vito Las Cruces. 20 NOV 1988. A. Solís
INBIOCRI002517843	<i>Anomala ferrea</i>	♀	Puntarenas. Costa Rica. San Vito Las Cruces. 20 NOV 1988. Col. A. Solís
INBIOCRI002517844	<i>Anomala ferrea</i>	♀	Puntarenas. Costa Rica. San Vito Las Cruces. 20 NOV 1988. Col. A. Solís
INBIOCRI002517845	<i>Anomala ferrea</i>	♂	Puntarenas. Costa Rica. San Vito Las Cruces. 20 NOV 1988. Col. A. Solís
INBIOCRI002517847	<i>Anomala ferrea</i>	♀	Puntarenas. Costa Rica. San Vito Las Cruces. 20 NOV 1988. Col. A. Solís
INBIOCRI002517848	<i>Anomala ferrea</i>	♂	Puntarenas. Costa Rica. San Vito Las Cruces. 20 NOV 1988. Col. A. Solís
INBIOCRI002517850	<i>Anomala ferrea</i>	♀	Puntarenas. Costa Rica. San Vito Las Cruces. 20 NOV 1988. Col. A. Solís
CEUA00003306	<i>Anomala flavacoma</i>	♂	Albergue Heliconias, Bijagua (Costa Rica). 750m 30-1-2006. Luz casa (18:45-22:00). Leg.: Micó, García, Galante.
CEUA00003320	<i>Anomala flavacoma</i>	♂	Volcán Tenorio. Alajuela. Costa Rica. 1160m. 7/4/2008. Leg. J.A. Azofeifa
CEUA00105076	<i>Anomala flavacoma</i>	♂	Estación Cabro Muco, Repr. ICE - Z.P. Miravalles, Guanacaste. Costa Rica. 1000m 12/06/2010. L. Filippini, Moraga.
CEUA00105077	<i>Anomala flavacoma</i>	♀	Estación Cabro Muco, Repr. ICE - Z.P. Miravalles, Guanacaste. Costa Rica. 1000m 12/06/2010. L. Filippini, Moraga.
INBIOCRI000393339	<i>Anomala flavacoma</i>	♂	Est. Hitoy Cerere, 100m, R. Cerere, Res. Biol. Hitoy Cerere, Prov. Limón, COSTA RICA, R. Guzman. 12 - 28 Abr 1992. L_N_184600_643400 #1137
INBIOCRI000926676	<i>Anomala flavacoma</i>	♂	Est. Hitoy Cerere, 100m, R. Cerere, Res. Biol. Hitoy Cerere, Prov. Limon, Costa Rica, Nov 1992 G. Carballo L- N 184200_643300
INBIOCRI000926680	<i>Anomala flavacoma</i>	♀	Est. Hitoy Cerere, 100m, R. Cerere, Res. Biol. Hitoy Cerere, Prov. Limon, Costa Rica, Nov 1992 G. Carballo L- N 184200_643300
INBIOCRI000926686	<i>Anomala flavacoma</i>	♀	Est. Hitoy Cerere, 100m, R. Cerere, Res. Biol. Hitoy Cerere, Prov. Limon, Costa Rica, Nov 1992 G. Carballo L- N 184200_643300
INBIOCRI000926688	<i>Anomala flavacoma</i>	♂	R. San Lorenzo, 1050m, R.F. Cord. Guanacaste (Tenorio), Prov. Guan. COSTA RICA. C. Alvarado, Jun 1991, L-N-287800, 427600
INBIOCRI000975444	<i>Anomala flavacoma</i>	♂	Est. Hitoy Cerere, 100 m, R. Cerere, Res. Biol. Hitoy Cerere, Prov. Limon, COSTA RICA. Abr 1993. G. Carballo. L- N 184200_643300
INBIOCRI002337602	<i>Anomala flavacoma</i>	♀	Dos de Tilarán (San Ramón), Prov. Guana. COSTA RICA. 1100m. MAY 1995. G. Rodriguez. L_N_262600_437500 #5891
INBIOCRI002337626	<i>Anomala flavacoma</i>	♀	Dos de Tilarán (San Ramón), Prov. Guana. COSTA RICA. 1100m. MAY 1995. G. Rodriguez. L_N_262600_437500 #5891
INBIOCRI002517822	<i>Anomala flavacoma</i>	♂	Limon, Costa Rica Reserva Hitoy-Cerere Rio Cerere 100 msnm 24 marzo 1987 Angel Solís
INBIOCRI000020620	<i>Anomala flavacoma</i>	♂	Cuatro Esquinas, P. N. Tortuguero, Prov. Limon, COSTA RICA. 0m. 26 Aug - 6 Set 1989, J. Solano, L N 280000_590500
INBIOCRI000196452	<i>Anomala foraminosa</i>	♂	Cerro Tortuguero, P. N. Tortuguero, 100m Limon COSTA RICA. Feb. 1990 J. Solano L-N 285000-588000
INBIOCRI000298660	<i>Anomala foraminosa</i>	♀	Est. Cuatro Esquinas, P. N. Tortuguero, 0 m, Prov. Limon, COSTA RICA. R. Delgado, Nov 1990, L- N 280000_590500
INBIOCRI000484254	<i>Anomala foraminosa</i>	♂	Est. Hitoy Cerere, Res. Biol. Hitoy Cerere, R. Cerere, 200m, Prov. Limon, COSTA RICA. G. Carballo, Mar 1991, L- N 184200_643300
INBIOCRI000595919	<i>Anomala foraminosa</i>	♀	Est. Hitoy Cerere, Res. Biol. Hitoy Cerere, R. Cerere, 200m, Prov. Limon, COSTA RICA, A. Moreno, Abr 1991, L- N 184200_643300
INBIOCRI001400030	<i>Anomala foraminosa</i>	♂	Est. Hitoy Cerere, 100 m, R. Cerere, Res. Biol. Hitoy Cerere, Prov. Limon, COSTA RICA. Abr 1993. G. Carballo. L- N 184200_643300
INBIOCRI002517708	<i>Anomala foraminosa</i>	♂	Limon, Costa Rica Reserva Hitoy-Cerere Rio Cerere 100 msnm 24 marzo 1987 Angel Solís
CEUA00105884	<i>Anomala globulata</i>	♀	Esperanza del Guarco. Cartago, Costa Rica. 2300m. 5/6/2008. Leg. A. García, M. Zumbado
CEUA00105885	<i>Anomala globulata</i>	♀	COSTA RICA. Prov. Cartago. P.N. Tapanti Macizo de la Muerte. La Esperanza del Guarco. 2300m. 6 MAY 2008. M. A. Zumbado, A. García. Tp. de luz 1. L_N_188418_552219 #93862
CEUA00105886	<i>Anomala globulata</i>	♂	Esperanza del Guarco. Cartago, Costa Rica. 2300m. 5/6/2008. Leg. A. García, M. Zumbado
INB0003489988	<i>Anomala globulata</i>	♂	COSTA RICA. Prov. Cartago, R.F. Río Macho, Alred. Estación la Esperanza, 2650m, 26 - 29 MAY 2002, R. González, Luz ambiente, L_N_185600_550000 #69624
INB0003489989	<i>Anomala globulata</i>	♂	COSTA RICA. Prov. Cartago, R.F. Río Macho, Alred. Estación la Esperanza, 2650m, 26 - 29 MAY 2002, R. González, Luz ambiente, L_N_185600_550000 #69624
INB0003500676	<i>Anomala globulata</i>	♂	COSTA RICA. Prov. Cartago, P.N. Tapanti - Macizo de La Muerte, Send. Quebrada las Piedras, 2650m, 21-22 JUN 2002, R. González, Luces ambiente, L_N_186100_550100 #70064

INBIOCRI002319885	<i>Anomala globulata</i>	♂	Fila El Alto, Camino entre Legua y San Francisco, Prov. San J. COSTA RICA. 2000m. 22-26 MAY 1995. A. Solis, M. M. Chavarria, L_N_188500_524000 #5461
CEUA00106069	<i>Anomala hiata</i>	♂	Est. Pittier, Send. Rio Gemelo. Puntarenas, Costa Rica. 1670m. 16 MAR 1996. A. M. Maroto, de Luz L_S_330900_577400 #7240
INBIOCRI002238414	<i>Anomala hiata</i>	♂	Est. Pittier, Prov. Punta, COSTA RICA. 1670m. 23 ENE-2 FEB 1995. E. Nunez, L_S_330900_577400 #5401
INBIOCRI002390299	<i>Anomala hiata</i>	♀	Est. Pittier, Puntarenas, Costa Rica. 1670m. 4-22 ENE 1996. E. Navarro, de Luz L_S_330900_577400 #6816
INBIOCRI002390301	<i>Anomala hiata</i>	♂	Est. Pittier, Puntarenas, Costa Rica. 1670m. 4-22 ENE 1996. E. Navarro, de Luz L_S_330900_577400 #6816
INBIOCRI000469491	<i>Anomala histrionella</i>	♂	Est. Palo Verde, 10m, P. N. Palo Verde, Prov. Guanacaste, Conta Rica, U. Chavarria, May 1992, L-N 259000_388400
INBIOCRI000991590	<i>Anomala histrionella</i>	♂	Fca. Jenny, 30 km N de Liberia, P. N. Guanacaste, Prov. Guanacaste, Costa Rica, 20 may a 11 jun 1992, E. Araya, L- N 316200,364400
INBIOCRI001900021	<i>Anomala histrionella</i>	♂	Est. Murcielago, 8 km SO. de Cuajiniquil, P. N. Guanacaste, Prov. Guana, COSTA RICA. 100 m. 6-23 Jun 1994, C. Cano, L N 320300_347200 # 3030
INBIOCRI001900022	<i>Anomala histrionella</i>	♀	Est. Murcielago, 8 km SO. de Cuajiniquil, P. N. Guanacaste, Prov. Guana, COSTA RICA. 100 m. 6-23 Jun 1994, C. Cano, L N 320300_347200 # 3030
INBIOCRI001966351	<i>Anomala histrionella</i>	♂	Bahia Santa Elena, P. N. Guanacaste, A. C. Guanacaste, Prov. Guana, COSTA RICA. 100 m. 11 Jun 1994, F.A. Quesada, L N 321800_339100 # 3019
CEUA	<i>Anomala hoppi</i>	♂	La Montura, Prov. San José, Costa Rica. 10/08/2007 Leg. M. Moraga
CEUA00106223	<i>Anomala hoppi</i>	♂	Cerro Bitárkara. Prov. Limón, Costa Rica. 13/08/2007 Det. W. Arana
INBIOCRI000409515	<i>Anomala hoppi</i>	♀	Est. Pitilla, 700 m, 9 km S Sta. Cecilia, P. N. Guanacaste, Prov. Guanacaste, Costa Rica, C. Moraga 8 a 24 ago 1991, L- N 330200_380200
INBIOCRI000423781	<i>Anomala hoppi</i>	♀	Sector Cerro Cocori, Fca. de E. Rojas, 150 m, Prov. Limon, Costa Rica, E. Rojas, 28 may a 17 Jun 1992, L-N 286000, 567500
INBIOCRI002517692	<i>Anomala hoppi</i>	♂	ALAJUELA, COSTA RICA, SAN RAMON, RIO S. LORENCITO, 800M 15 junio 1988 COL: A. SOLIS BLANCO
INBIOCRI002517694	<i>Anomala hoppi</i>	♀	COSTA RICA. Prov. Puntarenas, San Vito, Las Cruces. 29 ABR. 1988. A. Solis.
INBIOCRI002517695	<i>Anomala hoppi</i>	♀	COSTA RICA. Prov. Puntarenas, San Vito, Las Cruces. 29 ABR. 1988. A. Solis
INBIOCRI002517697	<i>Anomala hoppi</i>	♀	COSTA RICA. Prov. Puntarenas, San Vito, Las Cruces. 29 ABR. 1988. A. Solis.
INBIOCRI002517700	<i>Anomala hoppi</i>	♂	COSTA RICA. Prov. Puntarenas, San Vito, Las Cruces. 29 ABR. 1988. A. Solis.
CEUA00106172	<i>Anomala inbio</i>	♂	COSTA RICA. Prov. Limón. R.B. Hitoy Cerere. Send. Tepezcuintle. 0-100m. 25 MAR 2008. A. Solis, C. Hernández. Libre. L_N_184300_643300 #93807
CEUA00106173	<i>Anomala inbio</i>	♀	R.B. Hitoy Cerere, Valle La Estrella, Prov. Limon, COSTA RICA. 100-200m. 4-20 Abr 1994, G. Carballo, L N 643400_184600 # 2855
INB0003703490	<i>Anomala inbio</i>	♂	COSTA RICA. Prov. Limón, R.B. Hitoy Cerere, Estación Hitoy Cerere, 100m, 21 MAR 2003, B. Gamboa, Tp. de Luz, L_N_184120_643471 #73276
INB0004211777	<i>Anomala inbio</i>	♂	COSTA RICA. Prov. Heredia. Sarapiquí. Est. Biol. La Tirimbina. Mirador. 167m. 23-24 ABR 2009. C. Hernández, D. Díaz. Tp. Luz. L_N_266268_523359 #96599
INB0004211778	<i>Anomala inbio</i>	♂	COSTA RICA. Prov. Heredia. Sarapiquí. Est. Biol. La Tirimbina. Mirador. 167m. 23-24 ABR 2009. C. Hernández, D. Díaz. Tp. Luz. L_N_266268_523359 #96599
INBIOCRI000975461	<i>Anomala inbio</i>	♂	Est. Hitoy Cerere, 100 m, R. Cerere, Res. Biol. Hitoy Cerere, Prov. Limon, COSTA RICA. Abr 1993. G. Carballo. L- N 184200_643300
INBIOCRI001802267	<i>Anomala inbio</i>	♂	R.B. Hitoy Cerere, Valle La Estrella, Prov. Limon, COSTA RICA. 100-200m. 4-20 Abr 1994, G. Carballo, L N 643400_184600 # 2855
INBIOCRI001802285	<i>Anomala inbio</i>	♂	R.B. Hitoy Cerere, Valle La Estrella, Prov. Limon, COSTA RICA. 100-200m. 4-20 Abr 1994, G. Carballo, L N 643400_184600 # 2855
INBIOCRI001802287	<i>Anomala inbio</i>	♂	R.B. Hitoy Cerere, Valle La Estrella, Prov. Limon, COSTA RICA. 100-200m. 4-20 Abr 1994, G. Carballo, L N 643400_184600 # 2855
INBIOCRI001802301	<i>Anomala inbio</i>	♀	R.B. Hitoy Cerere, Valle La Estrella, Prov. Limon, COSTA RICA. 100-200m. 4-20 Abr 1994, G. Carballo, L N 643400_184600 # 2855
INBIOCRI002415599	<i>Anomala inbio</i>	♂	COSTA RICA, Prov. Limon, Est. Hitoy Cerere, 100m. 21 MAR-7 ABR 1998. E. Rojas. Tp. Luz L_N_184600_643400 #49943
INB0004158428	<i>Anomala latifalculata</i>	♂	COSTA RICA. Prov. Cartago. La Unión. Z.P. C. Carpintera. Campo Esc. Istarú. 1750m. 19 JUL 2008. J. Azofeifa, B. Hernández, M. Moraga, M. Zumbado. Luz Mercurio. L_N_208125_539750 #94434
INB0004158455	<i>Anomala latifalculata</i>	♂	COSTA RICA. Prov. Cartago. La Unión. Z.P. C. Carpintera. Campo Esc. Istarú. 1750m. 19 JUL 2008. J. Azofeifa, B. Hernández, M. Moraga, M. Zumbado. Luz Mercurio. L_N_208125_539750 #94434
CEUA00106061	<i>Anomala leopardina</i>	♂	COSTA RICA, Prov. Puntarenas, Finca Cafrosa, 1 Km NE. de la Escuela Progreso. 1180m. 23 NOV 1995. M. Chinchilla. de Luz L_S_318500_595500 #8267
CEUA00106062	<i>Anomala leopardina</i>	♀	PUNTARENAS COSTA RICA Las Mellizas 22 nov 1987 COL: A. SOLIS B.
INB0003111201	<i>Anomala leopardina</i>	♀	COSTA RICA, Prov. Puntarenas, Coto Brus, Estación Pittier. 1670m. 9-22 ENE 2000. R. González. de Luz L_S_330030_578645 #56791
INB0003337380	<i>Anomala leopardina</i>	♂	COSTA RICA. Prov. Puntarenas, Buenos Aires, Camino a Olan. 1425m. 15 al 19 FEB 1999. R. A. Zuniga. Luz. L_S_358631_550525 #63429

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INBIOCRI000464313	<i>Anomala leopardina</i>	♂	Est. Biol. Las Alturas 1500 m, Coto Brus, Prov. Punt., COSTA RICA, M. A. Zumbado, Dic 1991, L- S 322500 591300
INBIOCRI000464438	<i>Anomala leopardina</i>	♀	Est. Biol. Las Alturas 1500 m, Coto Brus, Prov. Punt., COSTA RICA, M. A. Zumbado, Dic 1991, L- S 322500 591300
INBIOCRI002470471	<i>Anomala leopardina</i>	♂	COSTA RICA, Prov. Puntarenas, Finca Cafrosa, 1 Km NE. de la Escuela Progreso. 1180m. 23 NOV 1995. M. Chinchilla. de Luz L_S_318500_595500 #8267
INBIOCRI002470481	<i>Anomala leopardina</i>	♀	COSTA RICA, Prov. Puntarenas, Finca Cafrosa, 1 Km NE. de la Escuela Progreso. 1180m. 23 NOV 1995. M. Chinchilla. de Luz L_S_318500_595500 #8267
CEUA00105844	<i>Anomala levicollis</i>	♂	La Esperanza 2300m. Prov. Cartago Costa Rica 30/08/2008 Leg. A. García, M.Zumbado
CEUA00105845	<i>Anomala levicollis</i>	♂	Volcán Tenorio. Alajuela. Costa Rica. 1160m. 7/4/2008. Leg. J.A. Azofeifa
CEUA00105846	<i>Anomala levicollis</i>	♀	Volcán Tenorio 1160m. Prov. Guanacaste. Costa Rica. 31/08/2008. Leg. J.A. Azofeifa
CEUA00105847	<i>Anomala levicollis</i>	♂	Volcán Tenorio 1160m. Prov. Guanacaste. Costa Rica. 31/08/2008. Leg. J.A. Azofeifa
CEUA00105848	<i>Anomala levicollis</i>	♂	Volcán Tenorio 1160m. Prov. Guanacaste. Costa Rica. 31/08/2008. Leg. J.A. Azofeifa
CEUA00105849	<i>Anomala levicollis</i>	♀	COSTA RICA. Prov. Alajuela. Guatuso. P.N. V. Tenorio. Punto 3: Los Pelados. Falda Norte Cerro Montezuma. 1300m. 5 JUN 2008. J. A. Azofeifa. Tp. de Luz 2. L_N_297410_424680 #93856
CEUA00105850	<i>Anomala levicollis</i>	♂	COSTA RICA. Prov. Alajuela. Guatuso. P.N. V. Tenorio. Punto 2: Falda N Cerro Montezuma. 1160m. 6 MAY 2008. J. A. Azofeifa. Tp. de Luz 1. L_N_297500_425050 #93745
CEUA00105851	<i>Anomala levicollis</i>	♂	COSTA RICA. Prov. Alajuela. Guatuso. P.N. Volcán Tenorio. Punto 4: Cerro Montezuma. 1510m. 4 JUL 2008. J. A. Azofeifa. Tp. de Luz 2. L_N_2971750_424050 #94274
CEUA00105852	<i>Anomala levicollis</i>	♂	Volcán Tenorio 1160m. Prov. Guanacaste. Costa Rica. 01/09/2008. Leg. J.A. Azofeifa
CEUA00105853	<i>Anomala levicollis</i>	♀	COSTA RICA. Prov. Alajuela. Guatuso. P.N. Volcán Tenorio. Punto 4: Cerro Montezuma. 1510m. 6 MAY 2008. J. A. Azofeifa. Tp. de Luz 2. L_N_2971750_424050 #94176
INBIOCRI000103717	<i>Anomala levicollis</i>	♂	Estac. Cacao, 1000-1400m, SW side Volcan Cacao, Guanac. Pr. COSTA RICA Malaise Tp, 1988-1989, GNP Biodiv. Survey. L_N_323300_375700 #22
INBIOCRI000365225	<i>Anomala levicollis</i>	♀	R. San Lorenzo, 1050m, R. F. Cord. Guanacaste (Tenorio), Prov. Guan. COSTA RICA. C. Alvarado, Jul 1991, L- N 287800_427600
INBIOCRI000415243	<i>Anomala levicollis</i>	♂	Rio San Lorenzo, 1050 m, Tierras Morenas, Z. P. Tenorio, Prov. Guanacaste, Costa Rica, C. Alvarado, Abr 1992, L- N 287800_427600
INBIOCRI000510194	<i>Anomala levicollis</i>	♂	Est. La Casona, 1520m, Res. Biol. Monteverde, Prov. Punt. COSTA RICA, N. Obando, Set 1991, L- N 253250_449700
INBIOCRI000535975	<i>Anomala levicollis</i>	♀	Quebrada Segunda, Ref. Nac. Fauna Silv. Tapanti, 1250m, Prov. Cartago, Costa Rica, G. Mora, Abr 1992, L- N 194000_560000
INBIOCRI000949598	<i>Anomala levicollis</i>	♂	Rio San Lorenzo, 1050m, Tierras Morenas, Z. P. Tenorio, Prov. Guanacaste, Costa Rica, Nov 1992 G. Rodriguez L N 287800_427600
INBIOCRI001357769	<i>Anomala levicollis</i>	♂	Est. La Casona, 1520 m, Res. Biol. Monteverde, Prov. Punt., COSTA RICA. Ago 1991, N. Obando, L N 253250,449700
CEUA	<i>Anomala levicollis</i>	♀	Volcán Tenorio 1300m. Prov. Cartago. Costa Rica. 31/08/2008. Leg. J.A. Azofeifa
CEUA	<i>Anomala levicollis</i>	♂	Volcán Tenorio. Alajuela. Costa Rica. 1160m. 7/4/2008. Leg. J.A. Azofeifa
INBIOCRI001780596	<i>Anomala levicollis</i>	♂	Est. La Casona, R.B. Monteverde, Prov. Punta, COSTA RICA. 1520 m. Mar 1994, N. Obando. L N 253250_449700 # 2819
CEUA	<i>Anomala longisacculata</i>	♂	La Montura, Prov. San José, Costa Rica. 08/12/2007 Leg. M. Moraga
CEUA	<i>Anomala longisacculata</i>	♀	Cerro Bitárkara. Prov. Limón. Costa Rica. 13/08/2007 Leg. W. Arana
CEUA00019641	<i>Anomala longisacculata</i>	♀	Quebrada González, P.N. Braulio Carrillo (Costa Rica) 550m 21-9-06 T.luz 17:00-21:00 Leg.: Micó, García, Galante
CEUA00019643	<i>Anomala longisacculata</i>	♀	Pitilla. Send. Orosilito. P.N. Guanacaste (Costa Rica) 1150m 5-10-06 T. luz 16:30-6:00. Leg.: Micó, García, Galante
CEUA00105872	<i>Anomala longisacculata</i>	♂	La Montura Prov. San José Costa Rica 07/11/2007 Leg. M. Moraga
CEUA00105873	<i>Anomala longisacculata</i>	♂	La Montura Prov. San José Costa Rica 08/12/2007 Leg. M. Moraga
CEUA00105874	<i>Anomala longisacculata</i>	♂	La Montura Prov. San José Costa Rica 08/12/2007 Leg. M. Moraga
CEUA00105875	<i>Anomala longisacculata</i>	♀	Albergue Heliconias. Prov. Alajuela Costa Rica 31/01/2008 Leg. D. Gutierrez
CEUA00105876	<i>Anomala longisacculata</i>	♀	La Montura Prov. San José Costa Rica 12/06/2007 Leg. M. Moraga
CEUA00105877	<i>Anomala longisacculata</i>	♀	El Copal. Prov. Cartago. Costa Rica. 16/06/2007 Leg. M. Moraga
CEUA00105878	<i>Anomala longisacculata</i>	♀	El Copal. Prov. Cartago. Costa Rica. 14/07/2007 Leg. M. Moraga
CEUA00105911	<i>Anomala longisacculata</i>	♀	Cabanga, finca J.Martinez. P. Alajuela. 480m, Costa Rica. 10/II/2010 trampa 1. L. M. Zumbado, J.A.Azofeifa.

CEUA00105912	<i>Anomala longisacculata</i>	♂	Cabanga, finca J.Martínez. P. Alajuela. 480m, Costa Rica. 10/II/2010 trampa 1. L. M. Zumbado, J.A.Azofeifa.
CEUA00105913	<i>Anomala longisacculata</i>	♀	Cabanga, finca J.Robles. Prov. Alajuela. 480m, Costa Rica. 10/II/2010 trampa 2. L. M. Zumbado, J.A.Azofeifa.
CEUA00105914	<i>Anomala longisacculata</i>	♀	Cabanga, finca J.Robles. Prov. Alajuela. 480m, Costa Rica. 10/II/2010 trampa 2. L. M. Zumbado, J.A.Azofeifa.
CEUA00105915	<i>Anomala longisacculata</i>	♂	Cabanga, finca J.Robles. Prov. Alajuela. 480m, Costa Rica. 10/II/2010 trampa 2. L. M. Zumbado, J.A.Azofeifa.
INBIOCRIO00293147	<i>Anomala longisacculata</i>	♂	Est. Pitilla, 700 m, 9 km S Sta. Cecilia, Prov. Guan. COSTA RICA, el curso Parataxon., May 1990, L N 330200_380200
INBIOCRIO00618273	<i>Anomala longisacculata</i>	♂	Sector Cerro Cocori, Fca. de E. Rojas, 150m, Prov. Limon, COSTA RICA, E. Rojas, Oct 1991, L- N 286000_567500
INBIOCRIO00819518	<i>Anomala longisacculata</i>	♂	Rio Sardinas, 10 m, R.N.F.S. Barra del Colorado, Prov. Limon, Costa Rica, Set 1992, F. Araya, L N 291500_564700
INBIOCRIO01118411	<i>Anomala ludoviciana</i>	♂	Santa Rosa National Park Guana. Prov. Costa Rica 18-22 May 1978 D. H. Janzen
INBIOCRIO01118411	<i>Anomala ludoviciana</i>	♂	Santa Rosa National Park Guana. Prov. Costa Rica 18-22 May 1978 D. H. Janzen
INBIOCRIO01118414	<i>Anomala ludoviciana</i>	♀	Santa Rosa National Park Guanac. Prov., Costa Rica 25-26 May 1978 D. H. Janzen
INBIOCRIO01118415	<i>Anomala ludoviciana</i>	♀	Santa Rosa National Park Guana. Prov. Costa Rica 18-22 May 1978 D. H. Janzen
INBIOCRIO01118416	<i>Anomala ludoviciana</i>	♂	Santa Rosa National Park Guana. Prov. Costa Rica. 29-31 May 1979 D.H. Janzen
INBIOCRIO02517753	<i>Anomala ludoviciana</i>	♂	Fca. Jenny, 300m, 31 Km N. Liberia, Guanacaste Prov. COSTA RICA, Nov 1988 GNP Biodiversity Survey W85 34 27", N10 51 55"
CEUA	<i>Anomala megalia</i>	♂	La Montura, Prov. San José, Costa Rica. 11/10/2007 Leg. M. Moraga
INBIOCRIO00035911	<i>Anomala megalia</i>	♂	Cuatro Esquinas, P. N. Tortuguero, Prov. Limon, COSTA RICA. 0m. 26 Aug - 6 Set 1989, J. Solano, L N 280000_590500
INBIOCRIO00223551	<i>Anomala megalia</i>	♀	Cerro Tortuguero, P. N. Tortuguero, 0 - 100m, Prov. Limon, COSTA RICA. J. Solano, Jun 1990. L- N 285000_588000
INBIOCRIO00224338	<i>Anomala megalia</i>	♂	Cerro Tortuguero, P. N. Tortuguero, 0 - 100m, Prov. Limon, COSTA RICA. U. Chavarría, Jul 1990, L- N 285000_588000
INBIOCRIO00988672	<i>Anomala megalia</i>	♂	Manzanillo, 0-100m, RNFS Gandoca y Manzanillo, Prov. Limon, Costa Rica, 22 oct a 11 nov 1992, K. Taylor, L S 398100_610600
INBIOCRIO00020633	<i>Anomala megaparamera</i>	♂	Cuatro Esquinas, P. N. Tortuguero, Prov. Limon, COSTA RICA. 0m. 26 Aug - 6 Set 1989, J. Solano, L N 280000_590500
INBIOCRIO00086333	<i>Anomala megaparamera</i>	♀	Cuatro Esquinas, P. N. Tortuguero, Prov. Limon, COSTA RICA. 0m, Set 1989. J. Solano, L N 280000_590500
INBIOCRIO00244606	<i>Anomala megaparamera</i>	♀	Est. Cuatro Esquinas, P. N. Tortuguero, 0m, Prov. Limon, COSTA RICA, U. Chavarría, Jul 1990, L- N 280000_590500
INBIOCRIO00285104	<i>Anomala megaparamera</i>	♂	Est. Cuatro Esquinas, P. N. Tortuguero, 0 m, Prov. Limon, COSTA RICA, R. Delgado, Oct 1990, L- N 280000_590500
INBIOCRIO00462921	<i>Anomala megaparamera</i>	♂	Est. Cuatro Esquinas, 0m, P. N. Tortuguero, Prov. Limon, COSTA RICA. E. Quesada., Jun 1990, L- N 280000_590500
INBIOCRIO00552532	<i>Anomala megaparamera</i>	♂	Cerro Tortuguero, 0-120m P. N. Tortuguero, Prov. Limon, COSTA RICA, R. Delgado, Feb 1992, L- N 285000_588000
INBIOCRIO00670946	<i>Anomala megaparamera</i>	♂	Est. Cuatro Esquinas, P. N. Tortuguero, 0m, Prov. Limon, COSTA RICA, E. Quesada, Jul 1990, L- N 280000_590500
CEUA00106201	<i>Anomala mersa</i>	♂	COSTA RICA, Prov. Guanacaste, Bagaces, P.N. Palo Verde, Sector Palo Verde. 0-50m. 29 NOV-15 DIC 1999. W. Porras. Manual L_N_260952_385020 #57243
INB0003151358	<i>Anomala mersa</i>	♂	COSTA RICA, Prov. Guanacaste, Bagaces, P.N. Palo Verde, Sector Palo Verde. 0-50m. 29 NOV-15 DIC 1999. W. Porras. Manual L_N_260952_385020 #57243
INB0003151359	<i>Anomala mersa</i>	♀	COSTA RICA, Prov. Guanacaste, Bagaces, P.N. Palo Verde, Sector Palo Verde. 0-50m. 29 NOV-15 DIC 1999. W. Porras. Manual L_N_260952_385020 #57243
INB0003151360	<i>Anomala mersa</i>	♂	COSTA RICA, Prov. Guanacaste, Bagaces, P.N. Palo Verde, Sector Palo Verde. 0-50m. 29 NOV-15 DIC 1999. W. Porras. Manual L_N_260952_385020 #57243
INB0003151362	<i>Anomala mersa</i>	♂	COSTA RICA, Prov. Guanacaste, Bagaces, P.N. Palo Verde, Sector Palo Verde. 0-50m. 29 NOV-15 DIC 1999. W. Porras. Manual L_N_260952_385020 #57243
INB0003151363	<i>Anomala mersa</i>	♀	COSTA RICA, Prov. Guanacaste, Bagaces, P.N. Palo Verde, Sector Palo Verde. 0-50m. 29 NOV-15 DIC 1999. W. Porras. Manual L_N_260952_385020 #57243
INB0003151412	<i>Anomala mersa</i>	♂	COSTA RICA, Prov. Guanacaste, Bagaces, P.N. Palo Verde, Sector Palo Verde. 0-50m. 29 NOV-15 DIC 1999. W. Porras. Manual L_N_260952_385020 #57243
CEUA00106192	<i>Anomala mesosticta</i>	♂	Amubri, Prov. Limon, COSTA RICA. 70 m. 08-27 nov 1993, G. M. Gallardo, L S 385500_578100 # 2461
CEUA00106193	<i>Anomala mesosticta</i>	♂	La Virgen de Sarapiquí, prov. Here., COSTA RICA. 9 a 30 mar 1993. M. Ortiz. L N 263950_521050
INBIOCRIO00084822	<i>Anomala mesosticta</i>	♂	Cuatro Esquinas, P. N. Tortuguero, Prov. Limon, COSTA RICA. 0m, April 1989, R. Aguilar & J. Solano, L- N 280000_590500
INBIOCRIO00524204	<i>Anomala mesosticta</i>	♂	Est. Hitoy Cerere, 100 m, R. Cerere, Res. Biol. Hitoy Cerere, Prov. Limon, COSTA RICA, G. Garbalo 6-25 Nov 1991. L- N 184200_643300

INBIOCRI001297396	<i>Anomala mesosticta</i>	♀	Rio Sardinias, 10 m, R.N.F.S. Barra del Colorado, Prov. Limon, COSTA RICA. 18 a 30 feb 1993. F. Araya, L-N-291500, 564700
INBIOCRI001299837	<i>Anomala mesosticta</i>	♂	La Virgen de Sarapiquí, prov. Here., COSTA RICA. 9 a 30 mar 1993. M. Ortiz. L N 263950 521050
INBIOCRI001644531	<i>Anomala mesosticta</i>	♂	Amubri, Prov. Limon, COSTA RICA. 70m. 12-31 Oct 1993. G. Gallardo, L S 385500_578000 # 2407
INBIOCRI001677111	<i>Anomala mesosticta</i>	♂	Los Arbolitos, Prov. Hered. COSTA RICA. 30m. 20-27 MAR 1993. F. Araya. L_N_291400_536100 #1952
INBIOCRI001798864	<i>Anomala mesosticta</i>	♂	R.B. Hitoy Cerere, Valle La Estrella, Prov. Limon, COSTA RICA. 100-200m. 9-14 May 1994, G. Carballo, L N 643400_184600 # 2856
INBIOCRI001871466	<i>Anomala mesosticta</i>	♂	Amubri, A.C. Amistad., Prov. Limon, COSTA RICA. 70 m. 2-31 May 1994, G. Gallardo, L N 385000 578100 # 2928
INBIOCRI001957606	<i>Anomala mesosticta</i>	♂	Amubri, Prov. Limon, COSTA RICA. 70 m. 08-27 nov 1993, G. M. Gallardo, L S 385500_578100 # 2461
INBIOCRI002517679	<i>Anomala mesosticta</i>	♀	Limon, Costa Rica Reserva Hitoy-Cerere Rio Cerere 100 msnm 24 marzo 1987 Angel Solis
CEUA00105903	<i>Anomala m-maculata</i>	♂	Esperanza del Guarco. Cartago, Costa Rica. 2300m. 5/5/2008. Leg. A. García, M. Zumbado
INBIOCRI002255351	<i>Anomala m-maculata</i>	♂	R. Grande de Orosi, desde Puente R. Dos Amigos hasta la Represa, Prov. Cartá, COSTA RICA. 1400-1800m. MAR 1995. R. Delgado. L_N_186600_562000 #4418
INBIOCRI002467325	<i>Anomala m-maculata</i>	♂	R. Grande de Orosi, desde Puente R. Dos Amigos hasta la Represa, Prov. Cartago, COSTA RICA. 1800m. 22 AGO-15 SET 1995. R. Delgado, Interseccion L_N_186600_562000 #6234
CEUA00106190	<i>Anomala nigroflava</i>	♂	COSTA RICA. Prov. Puntarenas. Gofito. Jiménez. Est. El Tigre, Area Administrativa. 47m. 28-29 NOV 2007. J. A. Azofeifa. Tp. Luz. L_S_277800_529600 #92870
CEUA00106191	<i>Anomala nigroflava</i>	♀	COSTA RICA. Prov. Puntarenas. Gofito. Jiménez. Est. El Tigre, Area Administrativa. 47m. 8-9 NOV 2007. J. A. Azofeifa. Tp. Luz. L_S_277800_529600 #92860
INB0004127874	<i>Anomala nigroflava</i>	♂	COSTA RICA. Prov. Puntarenas. Gofito. Jiménez. Est. El Tigre, Area Administrativa. 47m. 8-9 NOV 2007. J. A. Azofeifa. Tp. Luz. L_S_277800_529600 #92860
INBIOCRI001303744	<i>Anomala nigroflava</i>	♀	Est. Esquinas, Om, Peninsula de Osa., Prov. Punt., COSTA RICA Ene 1993, M. Segura, L S 301400,542200
INBIOCRI002169259	<i>Anomala nigroflava</i>	♂	Rio Rincon, Prov. Punta, COSTA RICA. 0m. 10 MAY 1995. M. Moraga, de Luz L N 280450 517500 #4635
INBIOCRI002169264	<i>Anomala nigroflava</i>	♀	Rio Rincon, Prov. Punta, COSTA RICA. 0m. 10 MAY 1995. M. Moraga, de Luz L N 280450 517500 #4635
INBIOCRI001007395	<i>Anomala nitidula</i>	♀	CR Heredia San Rafael 5-XI-1986 col: J.F. Corrales
INBIOCRI002517243	<i>Anomala nitidula</i>	♀	Alajuela, Alfaro Ruiz, Zarcero 7 nov. 1988 Col: A. Solis
INBIOCRI002517263	<i>Anomala nitidula</i>	♂	Alajuela, Alfaro Ruiz, Zarcero 7 nov. 1988 Col: A. Solis
INBIOCRI002517302	<i>Anomala nitidula</i>	♂	Alajuela, Alfaro Ruiz, Zarcero 7 nov. 1988 Col: A. Solis
INBIOCRI002517304	<i>Anomala nitidula</i>	♂	Alajuela, Alfaro Ruiz, Zarcero 7 nov. 1988 Col: A. Solis
CEUA00106224	<i>Anomala obovata</i>	♀	COSTA RICA. Prov. Cartago. P.N. Tapantí Macizo de la Muerte. La Esperanza del Guarco. 2300m. 31 MAY 2008. M. A. Zumbado, A. García. Tp. de Luz 1. L_N_188418_552219 #93861
INB0003313894	<i>Anomala obovata</i>	♂	COSTA RICA. Prov. Heredia, Cerro Chompipe. 2000m. 18 MAY 1990. J. Corrales, E. Phillips, J. Ugalde. L_N_230000_528000 #243
INB0003313896	<i>Anomala obovata</i>	♀	COSTA RICA. Prov. Heredia, Cerro Chompipe 2000m. 18 MAY 1990 J. Corrales. L_N_230000_528000 #48032
INB0003313897	<i>Anomala obovata</i>	♀	COSTA RICA. Prov. Heredia, Cerro Chompipe 2000m. 18 MAY 1990 J. Corrales. L_N_230000_528000 #48032
INBIOCRI001149971	<i>Anomala obovata</i>	♂	COSTA RICA, Prov. Limon, Q. Kuisa, Talamanca. 2200m. 16 MAR 1993. A. Fernandez. L_S_365400_547800 #7732
INBIOCRI001973529	<i>Anomala obovata</i>	♂	Cerro Chompipe, R.B. Chompipe, Prov. Hered, COSTA RICA. 2000-2100 m. 12 May 1994, J.F. Corrales, L N 229900_528600 # 3032
INBIOCRI000607217	<i>Anomala ochrogastra</i>	♂	Fca. Cafrosa, Est. Las Mellizas, P. N. Amistad, 1300m, Prov. Punt. COSTA RICA. G. Mora, Mar 1991, L- S 316100_596100
INBIOCRI000751653	<i>Anomala ochrogastra</i>	♂	Est. Biol. Las Alturas 1500m, Coto Brus, Prov. Puntarenas, Costa Rica, Ene 1992, M. Ramirez, L S 322500_591300
INBIOCRI000751662	<i>Anomala ochrogastra</i>	♂	Est. Biol. Las Alturas 1500m, Coto Brus, Prov. Puntarenas, Costa Rica, Ene 1992, M. Ramirez, L S 322500_591300
INBIOCRI000751663	<i>Anomala ochrogastra</i>	♀	Est. Biol. Las Alturas 1500m, Coto Brus, Prov. Puntarenas, Costa Rica, Ene 1992, M. Ramirez, L S 322500_591300
INBIOCRI000909361	<i>Anomala ochrogastra</i>	♀	Est. Biol. Las Alturas 1500 m, Coto Brus, Prov. Puntarenas, Costa Rica, F. Araya, 23 mar a 2 may 1992, L- S 322500_591300
INBIOCRI000909411	<i>Anomala ochrogastra</i>	♂	Est. Biol. Las Alturas 1500 m, Coto Brus, Prov. Puntarenas, Costa Rica, F. Araya, 23 mar a 2 may 1992, L- S 322500_591300
INBIOCRI000916192	<i>Anomala ochrogastra</i>	♀	Est. Biol. Las Alturas 1500 m, Coto Brus, Prov. Puntarenas, Costa Rica, F. Araya, 23 mar a 2 may 1992, L- S 322500_591300
INBIOCRI002612602	<i>Anomala ochroptera</i>	♀	La Mariksa, Hda. Orosi Gste. Pr. Costa Rica 550 m. 25 May 1986 W. Hallwachs, D.H. Janzen

INBIOCRI002612658	<i>Anomala ochroptera</i>	♂	La Mariksa, Hda. Orosi Gste. Pr. Costa Rica 550 m. 25 May 1986 W. Hallwachs, D.H. Janzen
INBIOCRI002612668	<i>Anomala ochroptera</i>	♂	La Mariksa, Hda. Orosi Gste. Pr. Costa Rica 550 m. 25 May 1986 W. Hallwachs, D.H. Janzen
INBIOCRI002754803	<i>Anomala ochroptera</i>	♂	La Maritza. Hda. Orosi Gste. Pr. Costa Rica 550m. 2-5 June 1986 W. Hallwachs, D.H. Janzen
CEUA	<i>Anomala perspicax</i>	♂	COSTA RICA. Prov. Cartago. P.N. Tapanti Macizo de la Muerte. La Esperanza del Guarco. 2300m. 31 MAY 2008. M. A. Zumbado, A. García. Tp. de Luz 1. L_N_188418_552219 #93861
CEUA	<i>Anomala perspicax</i>	♀	COSTA RICA. Prov. Cartago. P.N. Tapanti Macizo de la Muerte. La Esperanza del Guarco. 2300m. 5 MAY 2008. A. García, M. A. Zumbado. Tp. de Luz 1. L_N_188418_552219 #93739
CEUA00105879	<i>Anomala perspicax</i>	♂	La Esperanza 2300m. Prov. Cartago. Costa Rica. 30/06/2008 Leg. A. García, M. Zumbado.
CEUA00105880	<i>Anomala perspicax</i>	♀	COSTA RICA. Prov. Cartago. P.N. Tapanti Macizo de la Muerte. La Esperanza del Guarco. 2300m. 6 MAY 2008. M. A. Zumbado, A. García. Tp. Luz 2. L_N_188418_552219 #94177
CEUA00105882	<i>Anomala perspicax</i>	♀	COSTA RICA. Prov. Cartago. P.N. Tapanti Macizo de la Muerte. La Esperanza del Guarco. 2300m. 6 MAY 2008. M. A. Zumbado, A. García. Tp. de Luz 1. L_N_188418_552219 #93862
CEUA00105883	<i>Anomala perspicax</i>	♀	COSTA RICA. Prov. Cartago. P.N. Tapanti Macizo de la Muerte. La Esperanza del Guarco. 2300m. 6 MAY 2008. M. A. Zumbado, A. García. Tp. de Luz 1. L_N_188418_552219 #93862
CEUA00105887	<i>Anomala perspicax</i>	♂	COSTA RICA. Prov. Cartago. P.N. Tapanti Macizo de la Muerte. La Esperanza del Guarco. 2334m. 5 MAY 2008. A. García, M. A. Zumbado. Tp. de Luz 2. L_N_188418_552219 #93739
INB0003787797	<i>Anomala perspicax</i>	♂	COSTA RICA. Prov. Puntarenas, R.I. Ujarrás-Salitre-Cabagra, Buenos Aires, 2990m, 19 SEP 2003, M. Alfaro, Tp. Luz, L_S_369282_539197 #75710
INBIO	<i>Anomala perspicax</i>	♀	COSTA RICA. Prov. Cartago. P.N. Tapanti Macizo de la Muerte. La Esperanza del Guarco. 2300m. 31 MAY 2008. M. A. Zumbado, A. García. Tp. de Luz 1. L_N_188418_552219 #93861
CEUA00106065	<i>Anomala piccolina</i>	♂	Est. Biol. Las Alturas 1500m, Coto Brus, Prov. Puntarenas, Costa Rica, Ago 1992, M. Ramirez y E. Sancho L-S 322500_591300
INB0003378870	<i>Anomala piccolina</i>	♀	COSTA RICA. Prov. Puntarenas, P. Int. La Amistad, Estac. Altamira, Send. Gigantes, 1300 - 1400m, 8 SEP 2001. R. G. Tenorio, Libre L_S_331300_571500 #64778
INBIOCRI000874944	<i>Anomala piccolina</i>	♂	Est. Biol. Las Alturas 1500m, Coto Brus, Prov. Puntarenas, Costa Rica, Ago 1992, M. Ramirez y E. Sancho L-S 322500_591300
INBIOCRI000874987	<i>Anomala piccolina</i>	♂	Est. Biol. Las Alturas 1500m, Coto Brus, Prov. Puntarenas, Costa Rica, Ago 1992, M. Ramirez y E. Sancho L-S 322500_591300
CEUA00106160	<i>Anomala pinclada</i>	♂	Est. Biol. Murciélago, 8 km S.O. de Cuajiniquil, Prov. Guana, COSTA RICA. 100m. 16 Jun- 4 Jul 1993. F. Quesada, L N 320300_347200 # 2177
CEUA00106161	<i>Anomala pinclada</i>	♀	Finca Jenny, 30 km N de Liberia, P.N. Guanacaste, Prov. Guan., COSTA RICA. 18-25 Abr 1993, E. Araya, L-N 316200_364400
INBIOCRI000685348	<i>Anomala pinclada</i>	♀	R. Gongora, 600m, P. N. Guanacaste, Prov. Guanacaste, Costa Rica, Jun 1992, III Curso Parataxon. L-N 318500_375500
INBIOCRI000863924	<i>Anomala pinclada</i>	♂	3 Km este de Cuajiniquil, 300m, Prov. Guanacaste, Costa Rica, 25 jun 1992, III curso Parataxon. L-N 325600_355200
INBIOCRI000912618	<i>Anomala pinclada</i>	♂	Est. Sta. Rosa, 300m, P. N. Sta. Rosa, Prov. Guanacaste, Costa Rica, 1 a 12 jun 1992, A. M. Mora, L-N 313000_359800
INBIOCRI001116980	<i>Anomala pinclada</i>	♂	Santa Rosa National Park Guanacaste Prov. COSTA RICA. 9-11 May 1980 DH Janzen & W Hallwachs
INBIOCRI001167798	<i>Anomala pinclada</i>	♀	Finca Jenny, 30 km N de Liberia, P.N. Guanacaste, Prov. Guan., COSTA RICA. 18-25 Abr 1993, E. Araya, L-N 316200_364400
INBIOCRI001167801	<i>Anomala pinclada</i>	♂	Fca. Jenny, 30 km N de Liberia, P.N. Guanacaste, Prov. Guan., COSTA RICA. 18-25 Abr 1993, E. Araya, L-N 316200_364400
INBIOCRI001180936	<i>Anomala pinclada</i>	♀	Tierras Morenas, Rio San Lorenzo, Tenorio, Prov. Guana, COSTA RICA, 1050m. May 1993. G. Rodríguez, L S 283950_424500 # 2118
INBIOCRI001183321	<i>Anomala pinclada</i>	♀	Fca. Jenny, 30 km N de Liberia, P.N. Guanacaste, Prov. Guan., COSTA RICA. 9-14 May 1993. E. Araya, L-N 316200_364400
INBIOCRI001183402	<i>Anomala pinclada</i>	♂	Fca. Jenny, 30 km N de Liberia, P.N. Guanacaste, Prov. Guan., COSTA RICA. 9-14 May 1993. E. Araya, L-N 316200_364400
INBIOCRI001909257	<i>Anomala pinclada</i>	♂	Sector Las Pailas, P. N. Guanacaste, A. C. Guanacaste, Prov. Guana, COSTA RICA. 800 m. 6-26 Jun 1994, K. Taylor, L N 309500_389500 # 3063
INB0003724484	<i>Anomala polygona?</i>	♀	COSTA RICA. Prov. Limón, P.I. L. A., Send. Circular, 2450m, 27-29 MAR 2003, R. González, D. Rubí, R. Delgado, M. Alfaro, Tp. Luz Mercurio, L_S_340258_577465 #74176
INBIOCRI000480785	<i>Anomala popayana</i>	♂	Est. Hitoy Cerere, Res. Biol. Hitoy Cerere, R. Cerere, 200 m Prov. Limon, COSTA RICA G. Garbalo, Abr 1991. L N 184200, 643300
INBIOCRI000485075	<i>Anomala popayana</i>	♀	Est. Hitoy Cerere, 100 m, R. Cerere, Res. Biol. Hitoy Cerere, Prov. Limon, COSTA RICA G. Garbalo 4-20 Dic 1991, L-N -184200_643300
INBIOCRI002517208	<i>Anomala popayana</i>	♂	Limon, Costa Rica Reserva Hitoy-Cerere Rio Cerere 100 msnm 24 marzo 1987 Angel Solís
INBIOCRI002517216	<i>Anomala popayana</i>	♂	Limon. Costa Rica Rio Banano.200msnm 27 marzo 1987 Angel Solís
INBIOCRI002517217	<i>Anomala popayana</i>	♀	Limon. Costa Rica Rio Banano.200msnm 27 marzo 1987 Angel Solís
INBIOCRI002517218	<i>Anomala popayana</i>	♂	Limon. Costa Rica Rio Banano.200msnm 27 marzo 1987 Angel Solís
CEUA	<i>Anomala praecellens</i>	♂	Orosilito. Prov. Guanacaste. Costa Rica. 16/06/2007. Det. D. Briceño

CEUA	<i>Anomala praecellens</i>	♂	Orosilito. Prov. Guanacaste. Costa Rica. 7/13/2007. Leg. D. Briceño
CEUA	<i>Anomala praecellens</i>	♀	Orosilito. Prov. Guanacaste. Costa Rica. 6/16/2007. Leg. D. Briceño
CEUA	<i>Anomala praecellens</i>	♀	COSTA RICA. Prov. Cartago. Jiménez. Pejibaye. Selva. Alb. El Copal. 1000m. 17 JUN 2007. A. García, M. Moraga. Tp. Luz 1. L_N_196750_563695 #92225
CEUA00106217	<i>Anomala praecellens</i>	♂	COSTA RICA. Prov. Guanacaste. P.N. Guanacaste. Est. Pitilla. Send. Cerro Orosilito. 900m. 14 JUL 2007. D. Briceño. Tp. Luz 2. L_N_328800_379700 #92250
CEUA	<i>Anomala pseudoeucoma</i>	♀	Albergue Heliconias, Prov. Alajuela, Costa Rica. 31/01/2008 Leg. D. Gutiérrez
CEUA00003272	<i>Anomala pseudoeucoma</i>	♂	Albergue Heliconias, Prov. Alajuela, Costa Rica. 31/01/2006 . Trampa de lus (17:15-21:00) Leg. Micó, García, Galante
CEUA00105078	<i>Anomala pseudoeucoma</i>	♂	Albergue Heliconias, Prov. Alajuela, Costa Rica. 11/11/2007 Leg. D. Gutiérrez
CEUA00105079	<i>Anomala pseudoeucoma</i>	♂	Albergue Heliconias, Prov. Alajuela, Costa Rica. 11/11/2007 Leg. D. Gutiérrez
CEUA00105080	<i>Anomala pseudoeucoma</i>	♀	Isla Bonita, Prov. Alajuela, Costa Rica. 12/07/2007 Leg. M. Moraga
CEUA00105081	<i>Anomala pseudoeucoma</i>	♀	Albergue Heliconias, Prov. Alajuela, Costa Rica. 31/01/2008 Leg. D. Gutiérrez
CEUA00105082	<i>Anomala pseudoeucoma</i>	♂	Albergue Heliconias, Prov. Alajuela, Costa Rica. 14/09/2007 Leg. D. Gutiérrez
INBIOCRI000055767	<i>Anomala pseudoeucoma</i>	♀	Cerro Tortuguero, P. N. Tortuguero, Prov. Limon, COSTA RICA. 100 m. Nov 1989. J. Solano, L N 285000_588000
INBIOCRI000093803	<i>Anomala pseudoeucoma</i>	♂	Fca. Cafrosa, Est. Las Mellizas, P. N. Amistad, Puntarenas Pr. COSTA RICA, 1300 m. 20 Aug - 4 Set 1989, M. Ramirez & G. Mora, L S 316100_596100
INBIOCRI000141229	<i>Anomala pseudoeucoma</i>	♂	Cerro Tortuguero, P. N. Tortuguero, Prov. Limon, COSTA RICA. 100 m. Nov 1989. J. Solano, L N 285000_588000
INBIOCRI000242771	<i>Anomala pseudoeucoma</i>	♂	Cerro Tortuguero, P. N. Tortuguero, 0 - 100m, Prov. Limon, COSTA RICA. J. Solano, May 1990. L-N 253250_449700
INBIOCRI000334543	<i>Anomala pseudoeucoma</i>	♂	Cerro Tortuguero, 0-100m, P. N. Tortuguero, Prov. Limon, COSTA RICA, R. Delgado, 26 Ene-14 Feb 1992, L-N 285000_588000
INBIOCRI000393407	<i>Anomala pseudoeucoma</i>	♂	Est. Hitoy Cerere, 100m, R. Cerere, Res. Biol. Hitoy Cerere, Prov. Limón, COSTA RICA, R. Guzman. 12 - 28 Abr 1992. L_N_184600_643400 #1137
INBIOCRI000479636	<i>Anomala pseudoeucoma</i>	♂	Cerro Tortuguero, 0-120m, P. N. Tortuguero, Prov. Limon, COSTA RICA, R. Delgado, Set 1991, L-N 285000_588000
INBIOCRI000632624	<i>Anomala pseudoeucoma</i>	♂	Est. La Casona, 1520 m, Res. Biol. Monteverde, Prov. Punt. COSTA RICA, N. Obando, Oct 1991, L-N 253250_449700
INBIOCRI000632689	<i>Anomala pseudoeucoma</i>	♂	Est. La Casona, 1520 m, Res. Biol. Monteverde, Prov. Punt. COSTA RICA, N. Obando, Oct 1991, L-N 253250_449700
INBIOCRI001799052	<i>Anomala pseudoeucoma</i>	♂	R.B. Hitoy Cerere, Valle La Estrella, Prov. Limon, COSTA RICA. 100-200m. 9-14 May 1994, G. Carballo, L N 643400_184600 # 2856
INBIOCRI001937988	<i>Anomala pseudoeucoma</i>	♂	San Luis, Monteverde, Prov. Punta, COSTA RICA, 1040 m. nov 1993. Z. Fuentes L- N 250850_449250 #2443
INBIOCRI002517319	<i>Anomala pseudoeucoma</i>	♂	Limon, Costa Rica Reserva Hitoy-Cerere Rio Cerere 100 msnm 24 marzo 1987 Angel Solís
INBIOCRI002517836	<i>Anomala pseudoeucoma</i> (54)	♂	Alajuela, Costa Rica, San Ramon, Rio S. Lorencito, 800m 3 octubre 1986 Col: A. Solís Blanco.
INBIOCRI002517838	<i>Anomala pseudoeucoma</i> (54)	♀	Alajuela, Costa Rica. Reserva de San Ramón. Río San Lorencito, 850m. 1 abril 1987 Angel Solís
INBIOCRI002517839	<i>Anomala pseudoeucoma</i> (54)	♀	Alajuela, Costa Rica. Reserva de San Ramón. Río San Lorencito, 850m. 1 abril 1987 Angel Solís
INBIOCRI002517840	<i>Anomala pseudoeucoma</i> (54)	♀	Alajuela, Costa Rica. Reserva de San Ramón. Río San Lorencito, 850m. 1 abril 1987 Angel Solís
INBIOCRI000430681	<i>Anomala quiche</i>	♂	Est. Sta. Rosa, 300m, P. N. Sta. Rosa, Prov. Guanacaste, Costa Rica, 3 a 12 jun 1992, III Curso Parataxon. L- N 313000_359800
INBIOCRI000441362	<i>Anomala quiche</i>	♂	Est. Maritza, 600m, lado O Vol. Orosi, Prov. Guanacaste, Costa Rica, R. Guzman, 28 feb - 10 mar 1992, L- N 326900_373000
INBIOCRI000724623	<i>Anomala quiche</i>	♀	Est. Maritza, 600m, lado O Vol. Orosi, Prov. Guanacaste, Costa Rica, G. Gallardo, 28 feb - 10 mar 1992, L-N 326900_373000
INBIOCRI000744292	<i>Anomala quiche</i>	♀	Est. Maritza, 600 m, lado O Vol. Orosi, Prov. Guanacaste, Costa Rica, E. Taylor, 28 feb - 10 mar 1992, L- N 326900_373000
INBIOCRI001331408	<i>Anomala quiche</i>	♂	Est. Las Pailas, 800 m, P.N. Rincon de la Vieja, Prov. Guan., COSTA RICA. 6 ene a 13 abr 1993, J. Sihezar, G. Rodriguez, L- N 306300_388600
INBIOCRI001331539	<i>Anomala quiche</i>	♂	Est. Las Pailas, 800 m, P.N. Rincon de la Vieja, Prov. Guan., COSTA RICA. 6 ene a 13 abr 1993, J. Sihezar, G. Rodriguez, L- N 306300_388600
INBIOCRI001861463	<i>Anomala quiche</i>	♀	Est. Las Pailas, P.N. Rincon de la Vieja, A. C. Guanacaste, Prov. Guana, COSTA RICA. 800 m. 8-26 May 1994, K. E. Taylor, L N 306300_388600 # 2912
CEUA00106202	<i>Anomala robiginosa</i>	♂	ALAJUELA, COSTA RICA Zarcero, 1700 m 23-V-87 COL: A. SOLIS B.
INBIOCRI000022412	<i>Anomala robiginosa</i>	♀	Lado Este de Laguna Arenal, Tunel del ICE, Jan 1989, D. Janzen, L N 268000_460000

INBIOCRI000111925	<i>Anomala robiginosa</i>	♀	Santa Rosa National Park Guana. Prov. Costa Rica 18-20 May 1979 D. H. Janzen
INBIOCRI002517716	<i>Anomala robiginosa</i>	♂	San Luis, 1040m, R. B. Monteverde, Prov. Puntarenas, Costa Rica, Set 1992. Z. Fuentes L- N 250850 449250
INBIOCRI002517717	<i>Anomala robiginosa</i>	♂	Alajuela. Costa Rica. Zarcerro, 1700 m 23 may 1987 Angel Solís
INBIOCRI002517719	<i>Anomala robiginosa</i>	♂	Zarcerro, Alfaro Ruiz, 1700m Alajuela Pr. COSTA RICA. Apr - May 1989. A. Del Valle & A. Solis, L- N 240500 493500
INB0001118429	<i>Anomala ruatana</i>	O	Santa Rosa National Park, Guanacaste Prov. COSTA RICA. Mar 1983 300m DH Janzen & W.Hallwachs
INB0001118454	<i>Anomala ruatana</i>	O	Santa Rosa National Park, Guanacaste Prov. COSTA RICA April 1984 300m DH Janzen & W.Hallwachs
INBIOCRI000386646	<i>Anomala ruatana</i>	♂	Playa Naranjo, P. N. Sta. Rosa, Prov. Guan., COSTA RICA, E. Alcazar, May 1991, L-N 309300 354200
INBIOCRI000386648	<i>Anomala ruatana</i>	♂	Playa Naranjo, P. N. Sta. Rosa, Prov. Guan., COSTA RICA, E. Alcazar, May 1991, L-N 309300 354200
INBIOCRI000386650	<i>Anomala ruatana</i>	♂	Playa Naranjo, P. N. Sta. Rosa, Prov. Guan., COSTA RICA, E. Alcazar, May 1991, L-N 309300 354200
INBIOCRI000469520	<i>Anomala ruatana</i>	♂	Est. Palo Verde, 10m, P. N. Palo Verde, Prov. Guanacaste, Costa Rica, U. Chavarría, May 1992, L- N 259000 388400
INBIOCRI000481375	<i>Anomala ruatana</i>	♂	Fca. Jenny, 30 km N de Liberia, P. N. Guanacaste, Prov. Guan. COSTA RICA R. Espinoza, Abr 1991, L- N 316200 364400
INBIOCRI000492834	<i>Anomala ruatana</i>	♀	Est. Katalina, Parque Nacional Palo Verde, Prov. Guanacaste, Costa Rica A. Gutierrez, 13 abr 1992, L-N 257150,398250
INBIOCRI000863879	<i>Anomala ruatana</i>	♂	3 Km este de Cuajiniquil, 300m, Prov. Guanacaste, Costa Rica, 25 jun 1992, III curso Parataxon. L-N 325600 355200
INBIOCRI001327068	<i>Anomala ruatana</i>	♀	Fca. Jenny, 30 km N de Liberia, P. N. Guanacaste, Prov. Guan., COSTA RICA. 20 a 27 mar 1993, E. Araya, L- N 316200 364400
INBIOCRI001327071	<i>Anomala ruatana</i>	♀	Fca. Jenny, 30 km N de Liberia, P. N. Guanacaste, Prov. Guan., COSTA RICA. 20 a 27 mar 1993, E. Araya, L- N 316200 364400
INBIOCRI001693033	<i>Anomala ruatana</i>	♀	Finca Jenny, 30 km N de Liberia, P.N. Guanacaste, Prov. Guana, COSTA RICA. 300m. Mar 1991. R. Espinoza, L N 316200 364400 # 1678
CEUA	<i>Anomala semicincta</i>	♂	COSTA RICA. Prov. Cartago. Jiménez. Pejibaye. Selva. Alb. El Copal. 1000m. 15 JUN 2007. A. García, M. Moraga. Tp. Luz 2. L. N. 196750 563695 #92222
CEUA	<i>Anomala semicincta</i>	♂	COSTA RICA. Prov. Alajuela. Upala. P.N. Volcán Tenorio. Alb. Heliconias. Send. a Laguna Danta. 900m. 16 JUN 2007. J.D. Gutierrez. Tp. Luz 2. L. N. 299100 424000 #92208
CEUA	<i>Anomala semicincta</i>	♀	COSTA RICA. Prov. Alajuela. Upala. P.N. Volcán Tenorio. Alb. Heliconias. Send. a Laguna Danta. 900m. 16 JUN 2007. J.D. Gutierrez. Tp. Luz 2. L. N. 299100 424000 #92208
CEUA	<i>Anomala semicincta</i>	♀	COSTA RICA. Prov. Cartago. Jiménez. Pejibaye. Selva. Alb. El Copal. 1000m. 16 JUN 2007. A. García, M. Moraga. Tp. Luz 2. L. N. 196750 563695 #92224
CEUA00003336	<i>Anomala semicincta</i>	♂	Albergue Heliconias. Bijagua (Alajuela) 31/01/2006 750m. Leg: Micó, García, Galante. Trampa de luz (17:15-21:00)
CEUA	<i>Anomala semilla</i>	♂	COSTA RICA. Prov. Alajuela. Upala. P.N. Volcán Tenorio. Alb. Heliconias. Send. a Laguna Danta. 900m. 16 JUN 2007. J.D. Gutierrez. Tp. Luz 1. L. N. 299100 424000 #92207
CEUA	<i>Anomala semilla</i>	♀	COSTA RICA. Prov. Alajuela. Upala. P.N. Volcán Tenorio. Alb. Heliconias. Send. a Laguna Danta. 900m. 18 AGO 2007. J.D. Gutierrez. Tp. Luz 1. L. N. 299100 424000 #92260
CEUA00106174	<i>Anomala semilla</i>	♂	Albergue Heliconias, Prov. Alajuela, Costa Rica. 15/06/2007 Leg. D. Gutiérrez
CEUA00106175	<i>Anomala semilla</i>	♂	COSTA RICA. Prov. Alajuela. Upala. P.N. Volcán Tenorio. Alb. Heliconias. Send. a Laguna Danta. 900m. 15 JUN 2007. J. D. Gutiérrez. Tp. Luz 1. L. N. 299100 424000 #92206
CEUA00106176	<i>Anomala semilla</i>	♂	COSTA RICA. Prov. Alajuela. Upala. P.N. Volcán Tenorio. Alb. Heliconias. Send. a Laguna Danta. 900m. 15 JUN 2007. J. D. Gutiérrez. Tp. Luz 1. L. N. 299100 424000 #92206
CEUA00106177	<i>Anomala semilla</i>	♀	COSTA RICA. Prov. Alajuela. Upala. P.N. Volcán Tenorio. Alb. Heliconias. Send. a Laguna Danta. 900m. 15 JUL 2007. J. D. Gutiérrez. Tp. Luz 1. L. N. 299100 424000 #92233
CEUA00106178	<i>Anomala semilla</i>	♀	Estación Cabro Muco. Repr. ICE-Z.P. Miravalles. Guanacaste, Costa Rica. 1000 m 12/06/2010 L.Filippini, Moraga
CEUA00106181	<i>Anomala semilla</i>	♀	Estación Cabro Muco. Repr. ICE-Z.P. Miravalles. Guanacaste, Costa Rica. 1000 m 12/06/2010 L.Filippini, Moraga
CEUA00106182	<i>Anomala semilla</i>	♀	Estación Cabro Muco. Repr. ICE-Z.P. Miravalles. Guanacaste, Costa Rica. 1000 m 12/06/2010 L.Filippini, Moraga
INBIO	<i>Anomala semilla</i>	♂	Estación Cabro Muco. Repr. ICE-Z.P. Miravalles. Guanacaste, Costa Rica. 1000 m 12/06/2010 L.Filippini, Moraga
INBIO	<i>Anomala semilla</i>	♀	Estación Cabro Muco. Repr. ICE-Z.P. Miravalles. Guanacaste, Costa Rica. 1000 m 12/06/2010 L.Filippini, Moraga
CEUA00106162	<i>Anomala solisi</i>	♂	Est. Cacao, 1000-1400m, Lado SO Vol. Cacao, P. N. Guan. Prov. Guanacaste, Costa Rica, R. Guzman, 21 a 28 may 1992, L- N 323300 375700
CEUA00106163	<i>Anomala solisi</i>	♀	COSTA RICA. Prov. Guanacaste. P.N. Rincón de la Vieja. Hda. Santa María. 839m. 21 MAY 2003. Cate, Barries, Uhler. Tp. Luz. L. N. 304918 394213 #86772
INB001711642	<i>Anomala solisi</i>	♀	Sector San Ramon, Prov. Alaju, COSTA RICA. 620 m. 13-28 Mar 1994, K. Taylor, L N 318100 381900 # 2763
INBIOCRI000120915	<i>Anomala solisi</i>	♀	Estac. Pitilla, 700 m, 9 km S Sta. Cecilia, Guanac. Pr. COSTA RICA, Nov 1989, C. Moraga & P. Rios, L N 330200 380200

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INBIOCRI000195592	<i>Anomala solisi</i>	♂	Estac. Pitilla, 700m, 9 km S Sta. Cecilia, Guanacaste, COSTA RICA, Mar 1990, P. Rios, C. Moraga & R. Blanco, L- N 330200_380200
INBIOCRI000195830	<i>Anomala solisi</i>	♂	Estac. Pitilla, 700m, 9 km S Sta. Cecilia, Guanacaste, COSTA RICA, Mar 1990, P. Rios, C. Moraga & R. Blanco, L- N 330200_380200
INBIOCRI000255275	<i>Anomala solisi</i>	♂	Est. Cacao, 1000-1400m, Lado suroeste del Volcan Cacao, Prov. Guan., COSTA RICA, II curso Parataxon., Jun 1990, L- N 323300_375700
INBIOCRI000693146	<i>Anomala solisi</i>	♂	Est. Pitilla, 700 m, 9 km S Sta. Cecilia, Prov. Guan, COSTA RICA C. Moraga, Abr 1991, L- N 330200_380200
INBIOCRI000751373	<i>Anomala solisi</i>	♂	Amubri, 70m, Talamanca, Prov. Limon, Costa Rica, 1 a 22 jul 1992, G. Gallardo, L-5 385500_578050
INBIOCRI000819517	<i>Anomala solisi</i>	♂	Rio Sardinias, 10 m, R.N.F.S. Barra del Colorado, Prov. Limon, Costa Rica, Set 1992, F. Araya, L N 291500_564700
INBIOCRI001794815	<i>Anomala solisi</i>	♀	Rio Sardinias, R.N.F.S. Barra del Colorado, Prov. Limon, COSTA RICA. 10m. 6-14 Abr 1994, F. Araya, L N 291500_564700 # 2854
INBIOCRI002517383	<i>Anomala solisi</i>	♂	Estac. Pitilla, 700m, 9 Km S. Santa Cecilia, Guanac. Pr. COSTA RICA Jun 1988 GNP Biodiversity Survey W85 25'40", N10 59'26"
INBIOCRI002517690	<i>Anomala solisi</i>	♀	Estac. Pitilla, 700m, 9 Km S. Santa Cecilia, Guanac. Pr. COSTA RICA Jun 1988 GNP Biodiversity Survey W85 25'40", N10 59'26"
INBIOCRI001133424	<i>Anomala sp 203</i>	♀	Est. Las Pailas, P.N. Rincon de la Vieja, Prov. Guana, COSTA RICA. 800 m. 17-23 Jul 1993, K. Taylor, L N 306300_388600
INBIOCRI001133430	<i>Anomala sp 203</i>	♀	Est. Las Pailas, P.N. Rincon de la Vieja, Prov. Guana, COSTA RICA. 800 m. 17-23 Jul 1993, K. Taylor, L N 306300_388600
INBIOCRI001133431	<i>Anomala sp 203</i>	♀	Est. Las Pailas, P.N. Rincon de la Vieja, Prov. Guana, COSTA RICA. 800 m. 17-23 Jul 1993, K. Taylor, L N 306300_388600
INBIOCRI001133453	<i>Anomala sp 203</i>	♀	Est. Las Pailas, P.N. Rincon de la Vieja, Prov. Guana, COSTA RICA. 800 m. 17-23 Jul 1993, K. Taylor, L N 306300_388600
INBIOCRI001133457	<i>Anomala sp 203</i>	♀	Est. Las Pailas, P.N. Rincon de la Vieja, Prov. Guana, COSTA RICA. 800 m. 17-23 Jul 1993, K. Taylor, L N 306300_388600
INBIOCRI001133462	<i>Anomala sp 203</i>	♀	Est. Las Pailas, P.N. Rincon de la Vieja, Prov. Guana, COSTA RICA. 800 m. 17-23 Jul 1993, K. Taylor, L N 306300_388600
INBIOCRI001175754	<i>Anomala sp 203</i>	♀	Fca. Jenny, 30 km N de Liberia, P. N. Guanacaste, Prov. Guan., COSTA RICA. 18 a 25 feb 1993. E. Araya. L-N 316200_364400
INBIOCRI001291191	<i>Anomala sp 203</i>	♀	Fca. Jenny, 30 km N de Liberia, P. N. Guanacaste, Prov. Guan., COSTA RICA. 19 a 26 ene 1993, E. Araya, L- N 316200_364400
INBIOCRI001291192	<i>Anomala sp 203</i>	♀	Fca. Jenny, 30 km N de Liberia, P. N. Guanacaste, Prov. Guan., COSTA RICA. 19 a 26 ene 1993, E. Araya, L- N 316200_364400
INBIOCRI001748159	<i>Anomala sp 203</i>	♀	Finca Jenny, 30km N de Liberia,, Prov. Guana, COSTA RICA. 240m. 16-23 Jul 1993. E. Araya, L N 317150_363700 # 2746
INBIOCRI001838456	<i>Anomala sp 203</i>	♀	Est. Las Pailas, P.N. Rincon de la Vieja, A. C. Guanacaste, Prov. Guana, COSTA RICA. 800 m. 19 Jun-1 Jul 1993, K. E. Taylor, L N 306300_388600 # 2200
INBIOCRI001879358	<i>Anomala sp 203</i>	♀	Est. Las Pailas, P.N. Rincon de la Vieja, A. C. Guanacaste, Prov. Guana, COSTA RICA. 800 m. 7-26 May 1994, D. G. Garcia, L N 306300_388600 # 2910
INBIOCRI001901267	<i>Anomala sp 203</i>	♀	Finca Jenny, P. N. Guanacaste, A. C. Guanacaste, Prov. Guana, COSTA RICA. 240 m. 7-12 Jun 1994, E. Araya, L N 317150_363700 # 3071
INBIOCRI001909310	<i>Anomala sp 203</i>	♀	Sector Las Pailas, P. N. Guanacaste, A. C. Guanacaste, Prov. Guana, COSTA RICA. 800 m. 6-26 Jun 1994, K. Taylor, L N 309500_389500 # 3063
INBIOCRI001913592	<i>Anomala sp 203</i>	♀	Finca Jenny, 30km N de Liberia, Prov. Guana, COSTA RICA. 240 m. Ene 1994, E. Araya, L N 317150_363700 # 2621
INBIOCRI001975005	<i>Anomala sp 203</i>	♀	Fca. Jenny, 30 km N Liberia, Prov. Guanacaste, Costa Rica, 300 m. Ene 1992, E. Araya, L N 316200_364400 # 1741
INBIOCRI002384026	<i>Anomala sp 203</i>	♀	Finca Jenny, 30 km N. de Liberia, Guanacaste, Costa Rica. 240m. 5-29 JUN 1996. E. Araya, de Luz L_ N_ 317150_363700 #7547
INBIOCRI002384027	<i>Anomala sp 203</i>	♀	Finca Jenny, 30 km N. de Liberia, Guanacaste, Costa Rica. 240m. 5-29 JUN 1996. E. Araya, de Luz L_ N_ 317150_363700 #7547
INBIOCRI002459940	<i>Anomala sp 203</i>	♀	COSTA RICA, Prov. Guanacaste, Finca Jenny, 30 km N. de Liberia. 240m. 10-30 OCT 1996. E. Araya. de Luz L_ N_ 317150_363700 #44655
INBIOCRI002459941	<i>Anomala sp 203</i>	♀	COSTA RICA, Prov. Guanacaste, Finca Jenny, 30 km N. de Liberia. 240m. 10-30 OCT 1996. E. Araya. de Luz L_ N_ 317150_363700 #44655
INBIOCRI002459942	<i>Anomala sp 203</i>	♀	COSTA RICA, Prov. Guanacaste, Finca Jenny, 30 km N. de Liberia. 240m. 10-30 OCT 1996. E. Araya. de Luz L_ N_ 317150_363700 #44655
CEUA00105855	<i>Anomala sp.</i>	♀	Esperanza del Guarco. Cartago, Costa Rica. 2300m. 5/6/2008. Leg. A. García, M. Zumbado
INB0003030478	<i>Anomala sp.</i>	♀	COSTA RICA, Prov. Alajuela, A.C.A, San Ramón, Reserva Biol Alberto Brenes, Río Lorencito. 850m. 19-27 MAR 1999. M. Paniagua. Libre L_ N_ 245500_470800 #52469
INB0003129438	<i>Anomala sp.</i>	♀	COSTA RICA. Prov. Heredia, P. N. Braulio Carrillo, Transecto entre La Selva y V. Barva, Refugio, 1070m. 15-20 FEB 2001, A. Solís, T. Foso . L_ N_ 527281_249761 #61535
INBIOCRI000025346	<i>Anomala sp.</i>	♀	Fila Matama, 1680m, Limon, Limon Prov. COSTA RICA. Apr 1989, A. Chacon & G. Herrera, L- N 197000_630500
INBIOCRI000532212	<i>Anomala sp.</i>	♀	Est. Zurqui, 1600m, P. N. Braulio Carrillo, 500 m antes del Tunel, Prov. S. Jose, COSTA RICA, G. Maass, May 1991, L- N 226800_535200
INBIOCRI001626338	<i>Anomala sp.</i>	♂	Finca Jenny, 30 km norte de Liberia, Prov. Guana, COSTA RICA. 300m. 10-17 Nov 1993, E. Araya, L N 316200_364400 # 2484

INBIOCR1002337624	<i>Anomala sp.</i>	♂	Dos de Tilaran (San Ramon), Prov. Guana, COSTA RICA. 1100m. MAY 1995. G. Rodriguez, L_N_262600_437500 #5891
INBIOCR1002371927	<i>Anomala sp.</i>	♀	Est. Cuerici, Sendero al Mirador, 4.6 Km al E. de Villa Mills, San Jose, Costa Rica. 2640m. 19-20 ABR 1996. B. Gamboa, de Luz L_S_389700_499600 #7048
INBIOCR1003129438	<i>Anomala sp.</i>	♀	COSTA RICA. Prov. Heredia, P. N. Braulio Carrillo, Transecto entre La Selva y V. Barva, Refugio, 1070m. 15-20 FEB 2001, A. Solís, T. Foso. L_N_527281_249761 #61535
MUCR	<i>Anomala sp.</i>	♂	COSTA RICA AMERICA CENTRAL (print) Fila Cruces Coto Brus Light Trap Feb 94 (handwritten) Luis D. Gómez # (print) 94716 (handwritten)
CEUA00019640	<i>Anomala sp.11B</i>	♂	Estación Zurquí. P.N. B. Carrillo (Costa Rica). 1550m 22-9-06. T. luz 17:00-22:00 Leg.: Micó, García, Galante
CEUA00019663	<i>Anomala sp.11B</i>	♂	Estación Zurquí. P.N. B. Carrillo (Costa Rica). 1550m 22-9-06. T. luz 17:00-22:00 Leg.: Micó, García, Galante
CEUA	<i>Anomala sp.12</i>	♂	Albergue Heliconias, Bijagua (Costa Rica). 750m 30-1-2006. T. luz (18:45-22:00). Leg.: Micó, García, Galante.
INB0004012577	<i>Anomala sp.238</i>	♂	COSTA RICA. Prov. San José. Tarrazú. San Carlos. Reserva Ríos Paraíso. Albergue Pecarí. 405m. 30 ABR-3 MAY 2006. B. Gamboa, M. Moraga, J. A. Azofeifa. Tp. Luz. L_S_390500_449600 #86039
INBIOCR1001913830	<i>Anomala sp.245</i>	♂	Parque Nacional Tapanti, Prov. Cartá, COSTA RICA. 1650 m. Feb 1994, G. Mora, L N 194000_559800 # 2626
INB0003718583	<i>Anomala sp.249</i>	♀	COSTA RICA. Prov. Guanacaste, Nandayure, Playa San Miguel, Om, 8 DEC 2002, W. Porras, Red de Golpe, L_N_200400_391150 #73824
INB0003853178	<i>Anomala sp.249</i>	♀	COSTA RICA. Prov. Guanacaste, R.V.S. Ostional, Cuajiniquil, Playa Ostional, 0 - 5m, 13 JUN 2004, B. Gamboa, Y. Cárdenas, D. Briceño, M. Moraga, Tp. Luz, L_N_219450_350300 #77318
INB0003853179	<i>Anomala sp.249</i>	♀	COSTA RICA. Prov. Guanacaste, R.V.S. Ostional, Cuajiniquil, Playa Ostional, 0 - 5m, 13 JUN 2004, B. Gamboa, Y. Cárdenas, D. Briceño, M. Moraga, Tp. Luz, L_N_219450_350300 #77318
INB0003853180	<i>Anomala sp.249</i>	♀	COSTA RICA. Prov. Guanacaste, R.V.S. Ostional, Cuajiniquil, Playa Ostional, 0 - 5m, 13 JUN 2004, B. Gamboa, Y. Cárdenas, D. Briceño, M. Moraga, Tp. Luz, L_N_219450_350300 #77318
INB0003853182	<i>Anomala sp.249</i>	♂	COSTA RICA. Prov. Guanacaste, R.V.S. Ostional, Cuajiniquil, Playa Ostional, 0 - 5m, 13 JUN 2004, B. Gamboa, Y. Cárdenas, D. Briceño, M. Moraga, Tp. Luz, L_N_219450_350300 #77318
INB0003853184	<i>Anomala sp.249</i>	♀	COSTA RICA. Prov. Guanacaste, R.V.S. Ostional, Cuajiniquil, Playa Ostional, 0 - 5m, 13 JUN 2004, B. Gamboa, Y. Cárdenas, D. Briceño, M. Moraga, Tp. Luz, L_N_219450_350300 #77318
INB0003853187	<i>Anomala sp.249</i>	♀	COSTA RICA. Prov. Guanacaste, R.V.S. Ostional, Cuajiniquil, Playa Ostional, 0 - 5m, 13 JUN 2004, B. Gamboa, Y. Cárdenas, D. Briceño, M. Moraga, Tp. Luz, L_N_219450_350300 #77318
INB0003853316	<i>Anomala sp.249</i>	♀	COSTA RICA. Prov. Guanacaste, Nicoya, Ostional, Río Montaña, 0-100m, 15 JUN 2004, B. Gamboa, D. Briceño, M. Moraga, Y. Cárdenas, Tp. Luz, L_N_218850_352050 #77315
INB0004012268	<i>Anomala sp.255</i>	♂	COSTA RICA. Prov. Limón. P.N. Braulio Carrillo. Quebrada Gonzalez. 500-600m. 1-4 MAR 2006. J. A. Azofeifa, M. Moraga, B. Gamboa. Tp. Luz. L_N_237438_542921 #86315
INBIOCR1004012267	<i>Anomala sp.255</i>	♂	COSTA RICA. Prov. Limón. P.N. Braulio Carrillo. Quebrada Gonzalez. 500-600m. 1-4 MAR 2006. J. A. Azofeifa, M. Moraga, B. Gamboa. Tp. Luz. L_N_237438_542921 #86315
CEUA00106066	<i>Anomala stillaticia</i>	♂	Quebrada Segunda, P. N. Tapanti, 1250m, Prov. Cartago, Costa Rica, Jul 1992, G. Mora, L- N 194000_560000
INB0004158463	<i>Anomala stillaticia</i>	♂	COSTA RICA. Prov. Cartago. La Unión. Z.P. C. Carpintera. Campo Esc. Istarú. 1750m. 19 JUL 2008. J. Azofeifa, B. Hernández, M. Moraga, M. Zumbado. Luz Mercurio. L_N_208125_539750 #94434
INBIOCR1001907330	<i>Anomala stillaticia</i>	♀	Quebrada Segunda, P. N. Tapanti, A. C. Amistad, Prov. Cartá, COSTA RICA. 1150 m. Jun 1994, G. Mora, L N 194000_559800 # 3009
INBIOCR1002037919	<i>Anomala stillaticia</i>	♂	La Catarata, Prov. Cartá, COSTA RICA. 1700m. AGO 1994. G. Mora, Desconocido L_N_560300_190900 #3183
INBIOCR1002392030	<i>Anomala stillaticia</i>	♂	R. Grande de Orosi, desde Administracion hasta Sendero La Pava, Prov. Cartago, COSTA RICA. 1150-1600m. DIC 1995. G. Mora, Interseccion L_N_192500_560400 #648
CEUA00003304	<i>Anomala strigodermoides</i>	♂	Albergue Heliconias, Bijagua (Costa Rica). 750m 30-1-2006. T. luz (18:45-22:00). Leg.: Micó, García, Galante.
CEUA00106207	<i>Anomala strigodermoides</i>	♀	COSTA RICA. Prov. Alajuela. Guatuso. P.N. Volcán Tenorio. Punto 1: Catarata Río Buenavista. 800m. 5 MAY 2008. J. A. Azofeifa. Tp de Luz 1. L_N_298380_427850 #93735
CEUA00106208	<i>Anomala strigodermoides</i>	♂	P.N. Volcán Tenorio. Catarata Río Buenavista. Alajuela, Costa Rica. 780m 15/IV/2010. L. M. Zumbado, J.A.Azofeifa.
CEUA00106209	<i>Anomala strigodermoides</i>	♂	P.N. Volcán Tenorio. Catarata Río Buenavista. Alajuela, Costa Rica. 780m 15/IV/2010. L. M. Zumbado, J.A.Azofeifa.
INB0004012683	<i>Anomala strigodermoides</i>	♀	COSTA RICA. Prov. Cartago. Reserva Biol. El Copal. 900-1000m. 24 ABR 2006. B. Gamboa, M. Moraga, E. Navarro. Tp. Luz. L_N_196916_563695 #86066
INB0004012910	<i>Anomala strigodermoides</i>	♂	COSTA RICA. Prov. Alajuela. Bijagua. Albergue Heliconias. 800-900m. 24-26 MAR 2006. B. Gamboa, M. Moraga, J. A. Azofeifa. Tp. Luz. L_N_299800_423800 #85743
INB0004012911	<i>Anomala strigodermoides</i>	♀	COSTA RICA. Prov. Alajuela. Bijagua. Albergue Heliconias. 800-900m. 24-26 MAR 2006. B. Gamboa, M. Moraga, J. A. Azofeifa. Tp. Luz. L_N_299800_423800 #85743
INB0004012912	<i>Anomala strigodermoides</i>	♀	COSTA RICA. Prov. Alajuela. Bijagua. Albergue Heliconias. 800-900m. 24-26 MAR 2006. B. Gamboa, M. Moraga, J. A. Azofeifa. Tp. Luz. L_N_299800_423800 #85743
INBIOCR1000415372	<i>Anomala strigodermoides (202) no prestado</i>	♀	Río San Lorenzo, 1050 m, Tierras Morenas, Z. P. Tenorio, Prov. Guanacaste, Costa Rica, C. Alvarado, Abr 1992, L-N 287800_427600
INBIOCR1000930555	<i>Anomala strigodermoides (202) no prestado</i>	♀	Río San Lorenzo, 1050 m, Tierras Morenas, Z. P. Tenorio, Prov. Guanacaste, Costa Rica, Abr 1992 F. Quesada L-N 287800_427600
INBIOCR1000265134	<i>Anomala subaenea</i>	♂	Est. Maritza, 600m, lado O Vol. Orosi, Prov. Guan. COSTA RICA R. Blanco, May 1990, L- N 326900_373000
INBIOCR1000755807	<i>Anomala subaenea</i>	♂	Cerro El Hacha, 300m, 12 km SE de La Cruz, Prov. Guanacaste, Costa Rica, 25 jun 1992, Ill curso Parataxon. L-N 329200_368000

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INBIOCRI000755808	<i>Anomala subaenea</i>	♂	Cerro El Hacha, 300m, 12 km SE de La Cruz, Prov. Guanacaste, Costa Rica, 25 jun 1992, III curso Parataxon. L-N 329200_368000
INBIOCRI000755809	<i>Anomala subaenea</i>	♀	Cerro El Hacha, 300m, 12 km SE de La Cruz, Prov. Guanacaste, Costa Rica, 25 jun 1992, III curso Parataxon. L-N 329200_368000
INBIOCRI001118308	<i>Anomala subaenea</i>	♀	Santa Rosa National Park Guana. Prov. Costa Rica 18-20 May 1979 D. H. Janzen
INBIOCRI001118309	<i>Anomala subaenea</i>	♂	Santa Rosa National Park Guana. Prov. Costa Rica 18-20 May 1979 D. H. Janzen
CEUA00105856	<i>Anomala subridens</i>	♀	Esperanza del Guarco. Cartago, Costa Rica. 2300m. 5/6/2008. Leg. A. García, M. Zumbado
CEUA00105857	<i>Anomala subridens</i>	♂	La Esperanza 2300m. Prov. Cartago. Costa Rica. 29/09/2008 Leg. A. García, M. Zumbado.
CEUA00105858	<i>Anomala subridens</i>	♂	La Esperanza 2300m. Prov. Cartago. Costa Rica. 29/09/2008 Leg. A. García, M. Zumbado.
CEUA00105859	<i>Anomala subridens</i>	♂	La Esperanza 2300m. Prov. Cartago. Costa Rica. 29/08/2008 Leg. A. García, M. Zumbado.
CEUA00105860	<i>Anomala subridens</i>	♂	La Esperanza 2300m. Prov. Cartago. Costa Rica. 30/08/2008 Leg. A. García, M. Zumbado.
CEUA00105861	<i>Anomala subridens</i>	♀	La Esperanza 2300m. Prov. Cartago. Costa Rica. 28/09/2008 Leg. A. García, M. Zumbado.
CEUA00105862	<i>Anomala subridens</i>	♂	La Esperanza 2300m. Prov. Cartago. Costa Rica. 29/08/2008 Leg. A. García, M. Zumbado.
CEUA00105863	<i>Anomala subridens</i>	♂	La Esperanza 2300m. Prov. Cartago. Costa Rica. 28/09/2008 Leg. A. García, M. Zumbado.
CEUA00105864	<i>Anomala subridens</i>	♂	La Esperanza 2300m. Prov. Cartago. Costa Rica. 30/08/2008 Leg. A. García, M. Zumbado.
INB0003340288	<i>Anomala subridens</i>	♂	COSTA RICA. Prov. Cartago, El Guarco, San Isidro, Est. Esperanza. 2600m. 14 al 21 MAR 2001. R. González. Luz. L_N_185285_550117 #63507
INB0003422347	<i>Anomala subridens</i>	♂	COSTA RICA. Prov. Cartago, El Guarco, R.F. Río Macho, Est. La Esperanza del Guarco, 2700m, 22 - 27 ENE 2002, R. G. Tenorio, Luces ambiente L_N_185600_550000 #66624
INB0003535819	<i>Anomala subridens</i>	♂	COSTA RICA. Prov. Cartago, R.F. Río Macho, Calle hasta Límite con Pina, 2700m, 25-30 AGO 2002, R. González Tenorio, Luz ambiente, L_N_185700_550400 #71384
INB0003546276	<i>Anomala subridens</i>	♂	COSTA RICA. Prov. Cartago, R.F. Río Macho, Calle hasta Límite con Pina, 2700m, 9 - 14 OCT 2002, R. González Tenorio, Luz normal, L_N_185700_550400 #71781
INB0003546311	<i>Anomala subridens</i>	♂	COSTA RICA. Prov. Cartago, R.F. Río Macho, Calle hasta Límite con Pina, 2700m, 9 - 14 OCT 2002, R. González Tenorio, Luz normal, L_N_185700_550400 #71781
INB0003553609	<i>Anomala subridens</i>	♀	COSTA RICA. Prov. Cartago, R.F. Río Macho, Calle hasta Límite con Pina, 2700m, 16 - 21 NOV 2002, R. González Tenorio, Luz normal, L_N_185700_550400 #72156
INB0003553868	<i>Anomala subridens</i>	♀	COSTA RICA. Prov. Cartago, R.F. Río Macho, Send. Límite con Parcelas UNA, 2550m, 13-24 NOV 2002, R. González Tenorio, Tp. Intersección, L_N_185550_549600 #72166
INBIOCRI002435185	<i>Anomala subridens</i>	♂	Est. Cuerici, 4.6 Km al E. de Villa Mills, Prov. San Jose, COSTA RICA. 2600m. 21-26 SET 1995. A. Picado, de Luz. L_S_389400_499600 #6307
CEUA	<i>Anomala subusta</i>	♀	Volcán Tenorio. Alajuela. Costa Rica. 1160m. 6/4/2008. Leg. R. González
CEUA	<i>Anomala subusta</i>	♂	COSTA RICA. Prov. Alajuela. Guatuso. P.N. Volcán Tenorio. Punto 4: Cerro Montezuma. 1510m. 4 JUN 2008. J. A. Azofeifa. Tp luz 2. L_N_297175_424050 #94240
CEUA00105804	<i>Anomala subusta</i>	♀	COSTA RICA Prov. Alajuela. Guatuso. P.N. Volcán Tenorio. Punto 2: Falda N Cerro Montezuma. 1160m. 4 Jun 2008. J. A. Azofeifa. Tp. de Luz 2. L_N_297500_425050 #93853
CEUA00105824	<i>Anomala subusta</i>	♂	Volcán Tenorio. Alajuela. Costa Rica. 1160m. 6/4/2008. Leg. R. González
CEUA00105825	<i>Anomala subusta</i>	♂	COSTA RICA. Prov. Alajuela. Guatuso. P.N. Volcán Tenorio. Punto 3: Los Pelados Falda N Cerro Montezuma. 1300m. 3 JUL 2008. J. A. Azofeifa. Tp luz 1. L_N_297410_424680 #94265
CEUA00105826	<i>Anomala subusta</i>	♂	COSTA RICA. Prov. Alajuela. Guatuso. P.N. Volcán Tenorio. Punto 4: Cerro Montezuma. 1510m. 4 JUL 2008. J. A. Azofeifa. Tp. Luz 2. L_N_297175_424050 #94274
CEUA00105827	<i>Anomala subusta</i>	♂	COSTA RICA. Prov. Cartago. Paraíso. P.N.Tapantí. Torre Muestreo. 1600m. 31 MAY 2008. R. Gonzalez. Tp. Luz 1. L_N_189292_560783 #94242
CEUA00105828	<i>Anomala subusta</i>	♂	COSTA RICA. Prov. Cartago. Paraíso. P.N.Tapantí. Torre Muestreo. 1600m. 31 MAY 2008. R. Gonzalez. Tp. Luz 1. L_N_189292_560783 #94242
CEUA00105829	<i>Anomala subusta</i>	♂	COSTA RICA. Prov. Cartago. Paraíso. P.N.Tapantí. Torre Muestreo. 1600m. 31 MAY 2008. R. Gonzalez. Tp. Luz 1. L_N_189292_560783 #94242
CEUA00105830	<i>Anomala subusta</i>	♂	COSTA RICA. Prov. Alajuela. Guatuso. P.N. Volcán Tenorio. Punto 4: Cerro Montezuma. 1510m. 3 JUL 2008. J. A. Azofeifa. Tp Luz 1. L_N_297175_424050 #942730
CEUA00105831	<i>Anomala subusta</i>	♀	COSTA RICA. Prov. Cartago. Paraíso. P.N.Tapantí. Torre Muestreo. 1600m. 31 MAY 2008. R. Gonzalez. Tp. Luz 1. L_N_189292_560783 #94242
CEUA00105832	<i>Anomala subusta</i>	♀	COSTA RICA. Prov. Cartago. Paraíso. P.N.Tapantí. Torre Muestreo. 1600m. 2 JUN 2008. R. Gonzalez. Tp. Luz 1. L_N_189292_560783 #93858
CEUA00105833	<i>Anomala subusta</i>	♀	COSTA RICA. Prov. Alajuela. Guatuso. P.N. Volcán Tenorio. Punto 4: Cerro Montezuma. 1510m. 4 JUN 2008. J. A. Azofeifa. Tp. Luz 2. L_N_297175_424050 #94240
CEUA00105834	<i>Anomala subusta</i>	♀	La Esperanza 2300m. Prov. Cartago. Costa Rica 30/08/2008 Leg. A. García, M. Zumbado
CEUA00105835	<i>Anomala subusta</i>	♂	COSTA RICA. Prov. Cartago. Paraíso. P.N.Tapantí. Torre Muestreo. 1600m. 2 JUN 2008. R. Gonzalez. Tp. Luz 1. L_N_189292_560783 #93858

INB0003850383	<i>Anomala subusta</i>	♂	COSTA RICA. Prov. Cartago, Transecto Irazú - Braulio Carrillo, Camp. N° 1, 1760m, 2 - 4 JUN 2004, W. Porras, M. Zumbado, Libre, L_N_226940_549456 #77262
INB0004154055	<i>Anomala subusta</i>	♂	COSTA RICA. Prov. Alajuela. Guatuso. P.N. Volcán Tenorio. Punto 4: Cerro Montezuma. 1510m. 28 JUN 2008. J. A. Azofeifa. Tp. Luz. L_N_297175_424050 #94187
INB0004154069	<i>Anomala subusta</i>	♀	COSTA RICA. Prov. Alajuela. Guatuso. P.N. Volcán Tenorio. Punto 4: Cerro Montezuma. 1510m. 28 JUN 2008. J. A. Azofeifa. Tp. Luz. L_N_297175_424050 #94187
INBIOCRI000531837	<i>Anomala subusta</i>	♀	Est. Cacao, 1000-1400m, Lado SO Vol. Cacao, P. N. G., Prov. Guan, COSTA RICA, Elfin Rainforest 91, May 1991, L- N 323300_375700
INBIOCRI000531838	<i>Anomala subusta</i>	♂	Est. Cacao, 1000-1400m, Lado SO Vol. Cacao, P. N. G., Prov. Guan, COSTA RICA, Elfin Rainforest 91, May 1991, L- N 323300_375700
INBIOCRI000531839	<i>Anomala subusta</i>	♂	Est. Cacao, 1000-1400m, Lado SO Vol. Cacao, P. N. G., Prov. Guan, COSTA RICA, Elfin Rainforest 91, May 1991, L- N 323300_375700
INBIOCRI000531840	<i>Anomala subusta</i>	♀	Est. Cacao, 1000-1400m, Lado SO Vol. Cacao, P. N. G., Prov. Guan, COSTA RICA, Elfin Rainforest 91, May 1991, L- N 323300_375700
INBIOCRI000533192	<i>Anomala subusta</i>	♀	Est. Cacao, 1000-1400m, Lado SO Vol. Cacao, P. N. G., Prov. Guan, COSTA RICA, Elfin Rainforest 91, May 1991, L- N 323300_37570
INBIOCRI000533193	<i>Anomala subusta</i>	♂	Est. Cacao, 1000-1400m, Lado SO Vol. Cacao, P. N. G., Prov. Guan, COSTA RICA, Elfin Rainforest 91, May 1991, L- N 323300_375700
INBIOCRI000533195	<i>Anomala subusta</i>	♂	Est. Cacao, 1000-1400m, Lado SO Vol. Cacao, P. N. G., Prov. Guan, COSTA RICA, Elfin Rainforest 91, May 1991, L- N 323300_375700
INBIOCRI000533196	<i>Anomala subusta</i>	♂	Est. Cacao, 1000-1400m, Lado SO Vol. Cacao, P. N. G., Prov. Guan, COSTA RICA, Elfin Rainforest 91, May 1991, L- N 323300_375700
INBIOCRI001912044	<i>Anomala subusta</i>	♀	Estación La Casona, Prov. Puntarenas, COSTA RICA, 1520 m. agos 1993, N. G. Obando, L N 253250_449700 #2295
INBIOCRI001802492	<i>Anomala sulcans</i>	♀	R.B. Hitoy Cerere, Valle La Estrella, Prov. Limon, COSTA RICA. 100-200m. 4-20 Abr 1994, G. Carballo, L N 643400_184600 #2855
INBIOCRI002400494	<i>Anomala sulcans</i>	♂	Estacion Maritza, 1 Km E. de Entrada a Guajiniquil, Guanacaste, Costa Rica. 600m. 9-14 MAY 1996. Gira Parataxonomos A.C.G., de Luz L_N_326900_373000 #7586
INBIOCRI002612592	<i>Anomala sulcans</i>	♂	La Mariksa, Hda. Orosi Gste. Pr. Costa Rica 550 m. 25 May 1986 W. Hallwachs, D.H. Janzen
INBIOCRI002754782	<i>Anomala sulcans</i>	♀	La Maritza. Hda. Orosi Gste. Pr. Costa Rica 550m. 2-5 June 1986 W. Hallwachs, D.H. Janzen
INBIOCRI002754785	<i>Anomala sulcans</i>	♂	La Maritza. Hda. Orosi Gste. Pr. Costa Rica 550m. 2-5 June 1986 W. Hallwachs, D.H. Janzen
INB0004075900	<i>Anomala tenoriensis</i>	♂	COSTA RICA. Prov. Alajuela. Guatuso. Sitio Catarata Río Buenavista. 700-800m. 23 MAR 2007. J. A. Azofeifa. Tp. Luz. L_N_298474_428857 #91074
INB0004219250	<i>Anomala tenoriensis</i>	♂	COSTA RICA. Prov. Alajuela. Guatuso. P.N. Volcán Tenorio. Punto 1: Catarata Río Buenavista. 800m. 25-26 MAY 2009. J. A. Azofeifa. Tp. Luz Mercurio. L_N_298380_427850 #97190
CEUA	<i>Anomala tenoriensis</i>	♀	COSTA RICA. Prov. Alajuela. Guatuso. P.N. Volcán Tenorio. Punto 1: Catarata Río Buenavista. 800m. 4 JUN 2008. J. A. Azofeifa. Tp. Luz 1. L_N_298380_427850 #93847
CEUA	<i>Anomala tenoriensis</i>	♂	COSTA RICA. Prov. Alajuela. Guatuso. P.N. Volcán Tenorio. Punto 1: Catarata Río Buenavista. 800m. 6 MAY 2008. J. A. Azofeifa. Tp. Luz 1. L_N_298380_427850 #93736
CEUA00105836	<i>Anomala tenoriensis</i>	♂	COSTA RICA. Prov. Alajuela. Guatuso. P.N. Volcán Tenorio. Punto 1: Catarata Río Buenavista. 800m. 5 MAY 2008. J. A. Azofeifa. Tp. Luz 2. L_N_298380_427850 #93735
CEUA00105837	<i>Anomala tenoriensis</i>	♀	COSTA RICA. Prov. Alajuela. Guatuso. P.N. Volcán Tenorio. Punto 1: Catarata Río Buenavista. 800m. 5 MAY 2008. J. A. Azofeifa. Tp. Luz 2. L_N_298380_427850 #93735
CEUA00105838	<i>Anomala tenoriensis</i>	♀	Volcán Tenorio 700m. Estación El Pilón. Guanacaste Costa Rica 21/06/2009 Leg. E. Galante
CEUA00105839	<i>Anomala tenoriensis</i>	♀	COSTA RICA. Prov. Alajuela. Guatuso. P.N. Volcán Tenorio. Punto 1: Catarata Río Buenavista. 800m. 4 JUL 2008. J. A. Azofeifa. Tp. de Luz 1. L_N_298380_427850 #93847
CEUA00105840	<i>Anomala tenoriensis</i>	♀	COSTA RICA. Prov. Alajuela. Guatuso. P.N. Volcán Tenorio. Punto 1: Catarata Río Buenavista. 800m. 5 MAY 2008. J. A. Azofeifa. Tp. Luz 2. L_N_298380_427850 #93735
CEUA00105841	<i>Anomala tenoriensis</i>	♂	COSTA RICA. Prov. Alajuela. Guatuso. P.N. Volcán Tenorio. Punto 1: Catarata Río Buenavista. 800m. 7 MAY 2008. J. A. Azofeifa. Tp. Luz 1. L_N_298380_427850 #93736
CEUA00106216	<i>Anomala testaceipennis</i>	♂	Restaurante Rancho de Billo, car. 34. 45 km para Jacó. Puntarenas, Costa Rica. 15/08/2009. L. V. Filippini
INB0003027516	<i>Anomala testaceipennis</i>	♂	COSTA RICA, Prov. Guanacaste, A.C.G, La Cruz, Pque Nal Guanacaste, Cerro El Hacha. 400m. 18 SET-7 OCT 1987. I. A. Chacón. de Luz L_N_320000_364000 #52541
INB0003710355	<i>Anomala testaceipennis</i>	♂	COSTA RICA. Prov. Puntarenas, P.N. Corcovado, Send. Río Madrigal, 5m, 20 MAR - 3 ABR 2003 , A. Azofeifa, Libre, L_S_267200_517500 #73589
INB0003849558	<i>Anomala testaceipennis</i>	♀	COSTA RICA. Prov. Alajuela, Pital, Boca Tapada, Casa del Dr. Murillo, 50 - 100m, 24 MAY 2004, B. Hernández, Tp. Luz, L_N_294649_510697 #77249
INB0003856185	<i>Anomala testaceipennis</i>	♂	COSTA RICA. Prov. Alajuela, Pital, Boca Tapada, Casa del Dr. Murillo, 50 - 100m, 25 JUN 2004, B. Hernández, Tp. Luz, L_N_294649_510697 #77477
INB0004027784	<i>Anomala testaceipennis</i>	♂	COSTA RICA. Prov. Heredia. Sarapiquí. Cecafor. 50m. 1-4 AGO 2006. J. A. Azofeifa, B. Gamboa, M. Moraga. Tp. Luz. L_N_263229_539616 #86841
INB0004047259	<i>Anomala testaceipennis</i>	♀	COSTA RICA. Prov. Punt. Punt. Manglar boca Río Aranjuez. Pto.B.1Km W Hito Geográfico Pto.Alto. 20m. 4 DEC 2006. Moraga, Zumbado, Azofeifa, Gamboa. Tp. Luz. L_N_220630_445554 #90196
INB0004080839	<i>Anomala testaceipennis</i>	♂	COSTA RICA. Prov. Limón. Valle La Estrella. Bananito Lodge. 80m. 19-20 MAY 2007. J. A. Azofeifa, J. Montero. Tp. Luz. L_N_200889_639300 #91343
INB0004160163	<i>Anomala testaceipennis</i>	♀	COSTA RICA. Prov. Alajuela. San Ramón. Est. Biol. Villa Blanca. 1115m. 8-10 AGO 2008. R. Rojas. Tp. Luz Mercurio. L_N_242482_483371 #94534

INB0004160173	<i>Anomala testaceipennis</i>	♂	COSTA RICA. Prov. Alajuela. San Ramón. Est. Biol. Villa Blanca. 1115m. 8-10 AGO 2008. R. Rojas. Tp. Luz Mercurio. L_N_242482_483371 #94534
INBIOCRI000012042	<i>Anomala testaceipennis</i>	♀	Est. El Ceibo Braulio Carrillo, N. P. Heredia, Pr. COSTA RICA. 400-600m. Set 1989, R. Aguilar & M. Zumbado, L N 527700,256500
INBIOCRI000820754	<i>Anomala testaceipennis</i>	♀	Finca Naranjo Valenciana, 2 km sur Pueblo Nuevo, Sarapiquí, 90 m, Prov. Heredia, Costa Rica, 9 a 30 nov 1992, M. Ortiz, L- N 271800_523750
INBIOCRI001116996	<i>Anomala testaceipennis</i>	♂	Santa Rosa National Park Guanacaste Prov. COSTA RICA. 1-15 Jan 1982 300m DH Janzen & W. Hallwachs
INBIOCRI001318961	<i>Anomala testaceipennis</i>	♂	Vuelta Campana, R. Terraba, 100-500 m, Rey Curre, Prov. Punt., COSTA RICA. Mar 1993. S. Rojas, L S 325700_544300
INBIOCRI001318962	<i>Anomala testaceipennis</i>	♂	Vuelta Campana, R. Terraba, 100-500 m, Rey Curre, Prov. Punt., COSTA RICA. Mar 1993. S. Rojas, L S 325700_544300
INBIOCRI001361726	<i>Anomala testaceipennis</i>	♂	Grano de Oro, 1120 m, Chirripo, Turrialba, Prov. Cart., COSTA RICA Mar 1993. P. Campos, L-N 200250,595900
INBIOCRI001873495	<i>Anomala testaceipennis</i>	♀	Tierras Morenas, Tilarán, A. C. Arenal, Prov. Guana, COSTA RICA. 685 m. May 1994, G. Rodríguez, L N 283450_424200 # 2932
INBIOCRI002460909	<i>Anomala testaceipennis</i>	♀	COSTA RICA, Prov. Guanacaste, Est. Los Almendros. 12 Km Carretera a Santa Cecilia. 270-300m. 10-28 OCT 1996. E. Lopez. L_N_334850_369500 #44787
INBIOCRI002462149	<i>Anomala testaceipennis</i>	♂	COSTA RICA, Guanacaste, Est. Los Almendros. 12 Km Carretera a Santa Cecilia. 300m. 13-15 JUN 1996. E. Lopez. de Luz L_N_334850_369500 #8411
INBIOCRI002517807	<i>Anomala testaceipennis</i>	♂	Fca. Jenny, 300m, 31kmN. Liberia, Guanacaste Prov. COSTA RICA, Sep 1988 GNP Biodiversity Survey W85 34'27", N10 51'55"
INBIOCRI002610466	<i>Anomala testaceipennis</i>	♀	COSTA RICA, Prov. Alajuela, Zarcerro, 19 de mayo 1999 Col: A. Solis, Trampas Feromona Valina-Isoleucina
INBIOCRI000006031	<i>Anomala testaceipennis?</i>	♂	Fca. Jenny, 30 km N Liberia, Guan. N. P., Guan. Prov. COSTA RICA, Oct 1988, GNP Biod. Survey, L N 316200_364400
CEUA	<i>Anomala trapezifera</i>	♀	COSTA RICA. Prov. Cartago. Paraíso. P.N. Tapanti. Torre Muestreo. 1600m. 2 JUN 2008. R. Gonzalez Tenorio. Tp de Luz 1. L_N_189292_560783 #93858
CEUA	<i>Anomala trapezifera</i>	♀	Estación Zurquí. P.N. B. Carrillo (Costa Rica). 1550m 22-09-06. T. luz 17:00-22:00 Leg.: Micó, García, Galante
CEUA00105802	<i>Anomala trapezifera</i>	♀	La Esperanza 2300m. Prov. Cartago. Costa Rica. 29/08/2008 leg. A. García, M.Zumbado
CEUA00105896	<i>Anomala trapezifera</i>	♀	Tapantí. Cartago, Costa Rica. 1600m. 6/2/2008. Leg. R. González
CEUA00105897	<i>Anomala trapezifera</i>	♂	COSTA RICA. Prov. Cartago. Paraíso. P.N. Tapanti. Torre Muestreo. 1600m. 31 MAY 2008. R. Gonzalez. Tp de Luz 1. L_N_189292_560783 #94242
CEUA00105898	<i>Anomala trapezifera</i>	♂	COSTA RICA. Prov. Cartago. Paraíso. P.N. Tapanti. Torre Muestreo. 1600m. 2 JUN 2008. R. Gonzalez. Tenorio. Tp de Luz 1. L_N_189292_560783 #93858
CEUA00105899	<i>Anomala trapezifera</i>	♀	Tapantí 1600m Prov. Cartago Costa Rica 30/08/2008 Leg. R. González
CEUA00105900	<i>Anomala trapezifera</i>	♀	COSTA RICA. Prov. Cartago. P.N. Tapanti. Torre Muestreo. 1600m. 5 MAY 2008. B. Hernandez. Tp de Luz 2. L_N_189292_560783 #94182
CEUA00105901	<i>Anomala trapezifera</i>	♀	Tapantí 1600m Prov. Cartago Costa Rica 28/08/2008 Leg. R. González
CEUA00105902	<i>Anomala trapezifera</i>	♀	COSTA RICA. Prov. Cartago. Paraíso. P.N. Tapanti. Torre Muestreo. 1600m. 2 JUN 2008. R. Gonzalez. Tenorio. Tp de Luz 1. L_N_189292_560783 #93858
INBIOCRI000025346	<i>Anomala trapezifera</i>	♂	Fila Matama, 1680m, Limon, Limon Prov. COSTA RICA. Apr 1989, A. Chacon & G. Herrera, L- N 197000_630500
INBIOCRI002517704	<i>Anomala trapezifera</i>	♀	Cartago. Costa Rica Reserva Tapanti. 1500m. Rio Grande de Orosi 9 de junio de 1988 A. Chacon
CEUA	<i>Anomala tuberculata</i>	♂	COSTA RICA. Prov. Alajuela. Sarapiquí. Isla Bonita. 900m. 11 AGO 2007. A. García, M. Moraga. Tp. Luz 1. L_N_246700_518375 #92267
CEUA	<i>Anomala tuberculata</i>	♀	COSTA RICA. Prov. Alajuela. Upala. P.N. Volcán Tenorio. Alb. Heliconias. Send. a Laguna Danta. 900m. 12 SEPT 2007. J. D. Gutierrez. Tp. Luz 2. L_N_299100_424000 #92292
CEUA00105888	<i>Anomala tuberculata</i>	♂	Isla Bonita, Prov. Alajuela, Costa Rica. 06/11/2007 Leg. M. Moraga
CEUA00105889	<i>Anomala tuberculata</i>	♂	COSTA RICA. Prov. Alajuela. Upala. P.N. Volcán Tenorio. Alb. Heliconias. Send. a Laguna Danta. 900m. 12 SEPT 2007. J. D. Gutierrez. Tp. Luz 2. L_N_299100_424000 #92292
CEUA00105891	<i>Anomala tuberculata</i>	♀	La Montura. Prov. San José. Costa Rica. 06/11/2007 Leg. M. Moraga
CEUA00105892	<i>Anomala tuberculata</i>	♂	Isla Bonita. Prov. Alajuela. Costa Rica. 08/11/2007 Leg. M. Moraga
CEUA00105894	<i>Anomala tuberculata</i>	♂	COSTA RICA. Prov. Alajuela. Guatuso. P.N. Volcán Tenorio. Punto 3: Los Pelados. Falda N Cerro Montezuma. 1300m. 3 JUL 2008. J. A. Azofeifa. Tp. Luz 1. L_N_297410_42680 #94265
CEUA00105895	<i>Anomala tuberculata</i>	♀	Volcán Tenorio 1160m. Prov. Cartago. Costa Rica. 30/09/2008. Leg. J.A. Azofeifa
INBIO	<i>Anomala tuberculata</i>	♀	COSTA RICA. Prov. Alajuela. Sarapiquí. Isla Bonita. 900m. 11 AGO 2007. A. García, M. Moraga. Tp. Luz 1. L_N_246700_518375 #92267
INBIO	<i>Anomala tuberculata</i>	♂	La Montura. Prov. San José. Costa Rica. 07/11/2007 Leg. M. Moraga
INBIOCRI000020196	<i>Anomala undulata</i>	♀	Zarcerro, Alfaro Ruiz, 1700m Alajuela Pr. COSTA RICA. Apr - May 1989. A. Del Valle & A. Solis, L- N 240500_493500

INBIOCRI000020256	<i>Anomala undulata</i>	♀	Zarcelero, Alfaro Ruiz, 1700m Alajuela Pr. COSTA RICA. Apr - May 1989. A. Del Valle & A. Solis, L- N 240500_493500
INBIOCRI000022433	<i>Anomala undulata</i>	♂	Zarcelero, Alfaro Ruiz, 1700m Alajuela Pr. COSTA RICA. Apr - May 1989. A. Del Valle & A. Solis, L- N 240500_493500
INBIOCRI000022526	<i>Anomala undulata</i>	♂	Zarcelero, Alfaro Ruiz, 1700m Alajuela Pr. COSTA RICA. Apr - May 1989. A. Del Valle & A. Solis, L- N 240500_493500
INBIOCRI000022562	<i>Anomala undulata</i>	♂	Zarcelero, Alfaro Ruiz, 1700m Alajuela Pr. COSTA RICA. Apr - May 1989. A. Del Valle & A. Solis, L- N 240500_493500
INBIOCRI000419950	<i>Anomala undulata</i>	♂	Est. Cacao, 1000-1400m, Lado SO Vol. Cacao, P. N. Guan., Prov. Guanacaste, Costa Rica, M. Ortiz, 21 a 29 may 1992, L- N 323300_375700
INBIOCRI000496778	<i>Anomala undulata</i>	♂	Est. La Casona, Res. Biol. Monteverde, 1520m, Prov. Punt. COSTA RICA, E. Bello, Oct 1990, L- N 253250_449700
INBIOCRI000650194	<i>Anomala undulata</i>	♂	Fca. Cafrosa, Est. Las Mellizas, P. N. Amistad, 1300m, Prov. Punt. COSTA RICA, J. C. Saborio, Jun - Jul 1990, L- S 316100_596100
INBIOCRI000761699	<i>Anomala undulata</i>	♀	San Luis, 1040m, R. B. Monteverde, Prov. Puntarenas, Costa Rica, Ago 1992. Z. Fuentes L- N 250850_449250
INBIOCRI000778274	<i>Anomala undulata</i>	♂	Est. Cacao, 1000-1400m, Lado SO Vol. Cacao, P. N. Guan., Prov. Guanacaste, Costa Rica, K. Taylor, 21 a 29 may 1992, L- N 323300_375700
INBIOCRI000876714	<i>Anomala undulata</i>	♂	San Luis, 1040m, R. B. Monteverde, Prov. Puntarenas, Costa Rica, Set 1992. Z. Fuentes L- N 250850_449250
INBIOCRI000955895	<i>Anomala undulata</i>	♂	San Luis, 1040m, R. B. Monteverde, Prov. Puntarenas, Costa Rica, 24 ago a 15 set 1992, F. A. Quesada, L N 250850_449250
INBIOCRI000955899	<i>Anomala undulata</i>	♂	San Luis, 1040m, R. B. Monteverde, Prov. Puntarenas, Costa Rica, 24 ago a 15 set 1992, F. A. Quesada, L N 250850_449250
INBIOCRI000955902	<i>Anomala undulata</i>	♀	San Luis, 1040m, R. B. Monteverde, Prov. Puntarenas, Costa Rica, 24 ago a 15 set 1992, F. A. Quesada, L N 250850_449250
INBIOCRI000978902	<i>Anomala undulata</i>	♂	Est. La Casona, 1520m, Res. Biol. Monteverde Prov. Puntarenas, Costa Rica, Ago 1992, N. Obando, L- N 253250_449700
INBIOCRI001309405	<i>Anomala undulata</i>	♂	Est. La Casona, 1520 m, Res. Biol. Monteverde, Prov. Punt., COSTA RICA. Abr 1991, N. Obando. L- N 253250_449700
INBIOCRI001357749	<i>Anomala undulata</i>	♂	Est. La Casona, 1520 m, Res. Biol. Monteverde, Prov. Punt., COSTA RICA. Ago 1991, N. Obando, L N 253250,449700
INBIOCRI000684715	<i>Anomala unilineata</i>	♀	Fca. Jenny, 30 km N de Liberia, P. N. Guanacaste, Prov. Guanacaste, Costa Rica, 20 may a 11 jun 1992, E. Araya, L- N 316200,364400
INBIOCRI001117054	<i>Anomala unilineata</i>	♂	Santa Rosa National Park Guanacaste Prov. COSTA RICA. 17-19 May 1980 DH Janzen & W. Hallwachs
INBIOCRI001118445	<i>Anomala unilineata</i>	♂	Santa Rosa National Park Guanacaste Province Costa Rica. D. H. Janzen 5-12 March 1978
INBIOCRI001118447	<i>Anomala unilineata</i>	♂	Santa Rosa National Park Guanacaste Province Costa Rica. D. H. Janzen 5-12 March 1978
CEUA00003280	<i>Anomala valida</i>	♀	Horquetas (Costa Rica) 12-2-2006 Tronco. Leg.: Micó, García, Galante
CEUA00003281	<i>Anomala valida</i>	♀	Horquetas (Costa Rica) 12-2-2006 Tronco. Leg.: E. Galante
CEUA00005810	<i>Anomala valida</i>	♀	COSTA RICA PUNTARENAS Boca Coronado 9-VIII-2001 Leg.:E. Galante
CEUA00005811	<i>Anomala valida</i>	♂	COSTA RICA PUNTARENAS Boca Coronado 9-VIII-2001 Leg.:E. Galante
CEUA00015985	<i>Anomala valida</i>	♀	Tapantí (Costa Rica) 1300m 26-9-06 Luz casa. Leg.: Micó, García, Galante
INB0003171816	<i>Anomala valida</i>	♀	COSTA RICA, Prov. Limón, Valle de la Estrella, R.B. Hitoy Cerere, Estación Hitoy Cerere. 200m. 26 MAY 2000. A. López. Luz acuática L_N_184120_643470 #57552
INB0003171935	<i>Anomala valida</i>	♂	COSTA RICA, Prov. Limón, Valle de la Estrella, R.B. Hitoy Cerere, Sendero Espavel 300m. 29 MAY 2000. A. López. Luz L_S_401500_570200 #57564
INB0003301821	<i>Anomala valida</i>	♀	Costa Rica. Prov. Limón, R.B. Hitoy Cerere. Queb Barrera. 160m. 30 JUL 2000. W. Arana. Luz acuática. L_N_643471_184120 #58246
INB0003314421	<i>Anomala valida</i>	♂	COSTA RICA, Heredia: Est. Biol. La Selva, 50-150m, 10 26 N 84 01 W Jun 1993, INBio-OET
INB0003321951	<i>Anomala valida</i>	♂	COSTA RICA. Prov. Heredia, Sarapiquí, Zona Prot La Selva, Est. Biol. La Selva, 50-150m, 05 MAY 1999. D. Brenes. Manual. L_N_268000_535600 #62974
INB0003322467	<i>Anomala valida</i>	♀	COSTA RICA. Prov. Heredia, Sarapiquí, Zona Prot La Selva, Est. Biol. La Selva, 50-150m, 26 MAY 1999. D. Brenes. Manual. L_N_268000_535600 #62991
INB0003322506	<i>Anomala valida</i>	♂	COSTA RICA. Prov. Heredia, Sarapiquí, Zona Prot La Selva, Est. Biol. La Selva, 50-150m, 22 OCT 1999. D. Brenes. Manual. L_N_268000_535600 #62994
INB0003322700	<i>Anomala valida</i>	♂	COSTA RICA. Prov. Heredia, Sarapiquí, Zona Prot La Selva, Est. Biol. La Selva, 50-150m,19 MAY 1999. D. Brenes. Manual. L_N_268000_535600 #63002
INB0003322702	<i>Anomala valida</i>	♀	COSTA RICA. Prov. Heredia, Sarapiquí, Zona Prot La Selva, Est. Biol. La Selva, 50-150m,19 MAY 1999. D. Brenes. Manual. L_N_268000_535600 #63002
INB0003420486	<i>Anomala valida</i>	♀	COSTA RICA. Prov. Limón, R.B. Hitoy Cerere, Send. Plano Espavel, 100 - 200m, 30 AGO 2000, W. Arana, T. de Luz. L_N_184700_644200 #66569
INB0003853289	<i>Anomala valida</i>	♂	COSTA RICA. Prov. Guanacaste, Nicoya, Ostional, Río Montaña, 0-100m, 15 JUN 2004, B. Gamboa, D. Briceño, M. Moraga, Y. Cárdenas, Tp. Luz, L_N_218850_352050 #77315

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INB0003853293	<i>Anomala valida</i>	♂	COSTA RICA. Prov. Guanacaste, Nicoya, Ostional, Río Montaña, 0-100m, 15 JUN 2004, B. Gamboa, D. Briceño, M. Moraga, Y. Cárdenas, Tp. Luz, L_N 218850_352050 #77315
INB0004129730	<i>Anomala valida</i>	♂	COSTA RICA Prov. Guanacaste, La Cruz, nr. Río Sapoa, 130m. 13 MAY 2006. E. Holzer, C. Libre. L_N 343992_361618 #92943
INB0004129732	<i>Anomala valida</i>	♂	COSTA RICA Prov. Guanacaste, La Cruz, nr. Río Sapoa, 130m. 13 MAY 2006. E. Holzer, C. Libre. L_N 343992_361618 #92943
INB0004129734	<i>Anomala valida</i>	♂	COSTA RICA Prov. Guanacaste, La Cruz, nr. Río Sapoa, 130m. 13 MAY 2006. E. Holzer, C. Libre. L_N 343992_361618 #92943
INBIOCRIO00118162	<i>Anomala valida</i>	♂	Estac. Bijagual, 500m, Res. Biol. Carara, San Jose Prov. COSTA RICA. Dic 1989, R. Zúñiga, L N 192250_474760
INBIOCRIO00269520	<i>Anomala valida</i>	♂	Est. Hitoy Cerere, Res. Biol. Hitoy Cerere, Río Cerere, 200m, Prov. Limon, COSTA RICA, G. Carballo, Nov 1990, L- N 184200_643300
CEUA00106070	<i>Anomala vallisneria</i>	♂	ALAJUELA, COSTA RICA Zarcero, 1700 m 23-V-87 COL: A. SOLIS B.
CEUA00106071	<i>Anomala vallisneria</i>	♀	Derrumbe, Est. Cacao, lado oeste del V. Cacao, Prov. Guanacaste, Costa Rica, III Curso Parataxon., May 1992, L- N 323700_376700
INB0003111558	<i>Anomala vallisneria</i>	♂	COSTA RICA, Prov. Puntarenas, Coto Brus, Estación Pittier. 1670m. 20 ENE 2000. R. González. de Luz L_ S 330030_578645 #56802
INBIOCRIO00022476	<i>Anomala vallisneria</i>	♂	Zarcero, Alvaro Ruiz, 1700m Alajuela Pr. COSTA RICA. Apr - May 1989. A. Del Valle & A. Solis, L- N 240500_493500
INBIOCRIO01780597	<i>Anomala vallisneria</i>	♂	Est. La Casona, R.B. Monteverde, Prov. Punta, COSTA RICA. 1520 m. Mar 1994, N. Obando. L N 253250_449700 # 2819
INBIOCRIO02130711	<i>Anomala vallisneria</i>	♂	Sector Sendero Volcan, 3.5 Km SSW del Volcan Rincon de la Vieja, Prov.Guana, COSTA RICA. 1100m. 9-10 Jun 1994. D. Garcia, L_N 308407_388816 #3046
INBIOCRIO02130712	<i>Anomala vallisneria</i>	♀	Sector Sendero Volcan, 3.5 Km SSW del Volcan Rincon de la Vieja, Prov.Guana, COSTA RICA. 1100m. 9-10 Jun 1994. D. Garcia, L_N 308407_388816 #3046
INBIOCRIO02182027	<i>Anomala vallisneria</i>	♂	Est. La Casona, Monteverde, Prov. Punta, COSTA RICA. 1520m. 27 MAR-24 ABR 1995. K. Martinez, L_N 253900_449300 #4427
INBIOCRIO02253276	<i>Anomala vallisneria</i>	♀	R. Grande de Orosi, desde Puente R. Dos Amigos hasta la Represa, Prov. Carta, COSTA RICA. 1400-1800m. MAR 1995. R. Delgado. L_N 186600_562000 #4418
INBIOCRIO02253287	<i>Anomala vallisneria</i>	♀	R. Grande de Orosi, desde Puente R. Dos Amigos hasta la Represa, Prov. Carta, COSTA RICA. 1400-1800m. MAR 1995. R. Delgado. L_N 186600_562000 #4418
INBIOCRIO02460977	<i>Anomala vallisneria</i>	♂	COSTA RICA. Guanacaste. Sector Las Pailas, Copelares. P. N. Guanacaste, 1600 m. 6-26 Jun 1994, K. Taylor, L N 203500_501800 # 3066
INBIOCRIO02460978	<i>Anomala vallisneria</i>	♂	COSTA RICA. Guanacaste. Sector Las Pailas, Copelares. P. N. Guanacaste, 1600 m. 6-26 Jun 1994, K. Taylor, L N 203500_501800 # 3066
INBIOCRIO02460985	<i>Anomala vallisneria</i>	♂	COSTA RICA. Guanacaste. Sector Las Pailas, Copelares. P. N. Guanacaste, 1600 m. 6-26 Jun 1994, K. Taylor, L N 203500_501800 # 3066
INBIOCRIO02460986	<i>Anomala vallisneria</i>	♂	COSTA RICA. Guanacaste. Sector Las Pailas, Copelares. P. N. Guanacaste, 1600 m. 6-26 Jun 1994, K. Taylor, L N 203500_501800 # 3066
INBIOCRIO02517395	<i>Anomala vallisneria</i>	♂	ALAJUELA, COSTA RICA Zarcero, 1700 m 23-V-87 COL: A. SOLIS B.
INBIOCRIO02517397	<i>Anomala vallisneria</i>	♂	ALAJUELA, COSTA RICA Zarcero, 1700 m 23-V-87 COL: A. SOLIS B.
INBIOCRIO02517398	<i>Anomala vallisneria</i>	♀	ALAJUELA, COSTA RICA Zarcero, 1700 m 23-V-87 COL: A. SOLIS B.
INBIOCRIO02517401	<i>Anomala vallisneria</i>	♀	ALAJUELA, COSTA RICA Zarcero, 1700 m 23-V-87 COL: A. SOLIS B.
INBIOCRIO00912668	<i>Anomala veraecrucis</i>	♂	Est. Sta. Rosa, 300m, P. N. Sta. Rosa, Prov. Guanacaste, Costa Rica, 1 a 12 jun 1992, A. M. Mora, L-N 313000_359800
INBIOCRIO01167469	<i>Anomala veraecrucis</i>	♀	Fca. Jenny, 30 km N de Liberia, P.N. Guanacaste, Prov. Guan., COSTA RICA. 18-25 Abr 1993, E. Araya, L- N 316200,364400
INBIOCRIO01183421	<i>Anomala veraecrucis</i>	♂	Fca. Jenny, 30 km N de Liberia, P.N. Guanacaste, Prov. Guan., COSTA RICA. 9-14 May 1993. E. Araya, L-N 316200,364400
INBIOCRIO01184220	<i>Anomala veraecrucis</i>	♀	Fca. Jenny, 30 km N de Liberia, P. N. Guanacaste, Prov. Guan., COSTA RICA. 20-24 May 1993. E. Araya. L-N 316200,364400
INBIOCRIO02384065	<i>Anomala veraecrucis</i>	♂	Finca Jenny, 30 km N. de Liberia, Guanacaste, Costa Rica. 240m. 5-29 JUN 1996. E. Araya, de Luz L_N 317150_363700 #7547
INBIOCRIO02517855	<i>Anomala veraecrucis</i>	♀	Fca. Jenny, 300m, 31Km N. Liberia, Guanacaste Prov. COSTA RICA, Oct 1988 GNP Biodiversity Survey W85 34 27", N10 51 55"
INBIOCRIO02517856	<i>Anomala veraecrucis</i>	♂	COSTA RICA. Prov. Cartago. Jiménez. Pejibaye. Selva. Alb. El Copal. 1000m. 15 JUN 2007. A. Garcia, M. Moraga. Tp. Luz 2. L_N_196750_563695 #92222
INBIOCRIO02517860	<i>Anomala veraecrucis</i>	♀	Fca. Jenny, 300m, 31Km N. Liberia, Guanacaste Prov. COSTA RICA, Oct 1988 GNP Biodiversity Survey W85 34 27", N10 51 55"
INBIOCRIO02517870	<i>Anomala veraecrucis</i>	♂	Fca. Jenny, 300m, 31 Km N. Liberia, Guanacaste Prov. COSTA RICA, Nov 1988 GNP Biodiversity Survey W85 34 27", N10 51 55"
CEUA00106205	<i>Anomala volsellata</i>	♂	COSTA RICA. Prov. Puntarenas, Golfito, P. N. Corcovado, Cerro Rincón, Las Quebraditas, 500m, 1 MAY 2002, A. Azofeifa, A. Solis, Tp. Luz, L_S 275200_520100 #70567
CEUA00106206	<i>Anomala volsellata</i>	♀	Est. Bijagual, 600 m. N de Bijagualito, Prov. San J, COSTA RICA. 500m. ABR 1995. J. C. Saborio, L_N 191800_476800 #4826
INB0004191779	<i>Anomala volsellata</i>	♂	COSTA RICA. Prov. Puntarenas. Osa. R.F. Golfo Dulce. Cerro Brujo. 612m. 24-25 ENE 2009. J. A. Azofeifa, A. Chamorro. Tp. Luz Mercurio. L_S 290700_509100 #95674

INB0004191843	<i>Anomala volsellata</i>	♀	COSTA RICA. Prov. Puntarenas. Osa. R.F. Golfo Dulce. Cerro Brujo. 612m. 24-25 ENE 2009. J. A. Azofeifa, A. Chamorro. Tp. Luz Mercurio. L_S_290700_509100 #95674
INBIOCRI000168281	<i>Anomala volsellata</i>	♂	Estac. Carara, 200m R. B. Carara, Puntarenas COSTA RICA. Mar. 1990, R. Zuñiga, L N 195250_478700
INBIOCRI002190664	<i>Anomala volsellata</i>	♂	Est. Bijagual, 600 m. N de Bijagualito, Prov. San J, COSTA RICA. 500m. ABR 1995. J. C. Saborio, L_N_191800_476800 #4826
INBIOCRI000407451	<i>Anomala vulcanicola</i>	♂	San Gerardo de Dota, 2000-2500m, Prov. San Jose, Costa Rica, Curso Tachinidae y Syrphidae, 22-26 feb 1992, L- S 387400_482700
INBIOCRI000407453	<i>Anomala vulcanicola</i>	♂	San Gerardo de Dota, 2000-2500m, Prov. San Jose, Costa Rica, Curso Tachinidae y Syrphidae, 22-26 feb 1992, L- S 387400_482700
INBIOCRI000407478	<i>Anomala vulcanicola</i>	♂	San Gerardo de Dota, 2000-2500m, Prov. San Jose, Costa Rica, Curso Tachinidae y Syrphidae, 22-26 feb 1992, L- S 387400_482700
INBIOCRI000407616	<i>Anomala vulcanicola</i>	♂	San Gerardo de Dota, 2000-2500m, Prov. San Jose, Costa Rica, Curso Tachinidae y Syrphidae, 22-26 feb 1992, L- S 387400_482700
INBIOCRI000407620	<i>Anomala vulcanicola</i>	♂	San Gerardo de Dota, 2000-2500m, Prov. San Jose, Costa Rica, Curso Tachinidae y Syrphidae, 22-26 feb 1992, L- S 387400_482700
INBIOCRI000407689	<i>Anomala vulcanicola</i>	♀	San Gerardo de Dota, 2000-2500m, Prov. San Jose, Costa Rica, Curso Tachinidae y Syrphidae, 22-26 feb 1992, L- S 387400_482700
INBIOCRI002371927	<i>Anomala vulcanicola</i>	♀	Est. Cuerici, Sendero al Mirador, 4.6 Km al E. de Villa Mills, San Jose, Costa Rica. 2640m. 19-20 ABR 1996. B. Gamboa, de Luz L_S_389700_499600 #7048
CEUA00106203	<i>Anomala zumbadoi</i>	♂	COSTA RICA. Prov. Puntarenas. Pen. de Osa. P.N. Piedras Blancas. Est. Esquinas. Boca del Río Esquinas. 200m. DEC 1993. M. Segura, J. Quesada. L_S_301400_542200 #2537
CEUA00106204	<i>Anomala zumbadoi</i>	♀	Rancho Quemado, Península de Osa, 200m, Prov. Punt., Costa Rica, F. Quesada, Dic 1991. L_S_292500_511000 #990
INBIOCRI000483150	<i>Anomala zumbadoi</i>	♀	Rancho Quemado, Península de Osa, 200m. Prov. Punt., COSTA RICA, F. Quesada, Dic 1991, L- S 292500_511000
INBIOCRI000483151	<i>Anomala zumbadoi</i>	♂	Rancho Quemado, Península de Osa, 200m. Prov. Punt., COSTA RICA, F. Quesada, Dic 1991, L- S 292500_511000
INBIOCRI000483153	<i>Anomala zumbadoi</i>	♀	Rancho Quemado, Península de Osa, 200m. Prov. Punt., COSTA RICA, F. Quesada, Dic 1991, L- S 292500_511000
INBIOCRI000483154	<i>Anomala zumbadoi</i>	♀	Rancho Quemado, Península de Osa, 200m. Prov. Punt., COSTA RICA, F. Quesada, Dic 1991, L- S 292500_511000
INBIOCRI000483189	<i>Anomala zumbadoi</i>	♂	Rancho Quemado, Península de Osa, 200m. Prov. Punt., COSTA RICA, F. Quesada, Dic 1991, L- S 292500_511000
INBIOCRI000938230	<i>Anomala zumbadoi</i>	♂	Rancho Quemado, 200m, Península de Osa, Prov. Puntarenas, Costa Rica, Nov 1992, R. Aguilar, M. Segura y F Quesada L-S 292500, 511000
INBIOCRI000938231	<i>Anomala zumbadoi</i>	♂	Rancho Quemado, 200m, Península de Osa, Prov. Puntarenas, Costa Rica, Nov 1992, R. Aguilar, M. Segura y F Quesada L-S 292500, 511000
INBIOCRI000938232	<i>Anomala zumbadoi</i>	♀	Rancho Quemado, 200m, Península de Osa, Prov. Puntarenas, Costa Rica, Nov 1992, R. Aguilar, M. Segura y F Quesada L-S 292500, 511000
INBIOCRI001132046	<i>Anomala zumbadoi</i>	♀	COSTA RICA. Prov. Puntarenas. Vuelta Campana. Río Terraba. Rey Curre. 300-300 m. 4-31 jul 1993. S. Rojas. L S 325750_544450 # 2264
CEUA	<i>Anomalorhina turrialbana</i>	♂	Cabanga, finca J.Martinez. 500m. P. Alajuela, Costa Rica. 13/04/10 Trampa 1. L. M. Zumbado, J.A.Azofeifa.
CEUA00105807	<i>Anomalorhina turrialbana</i>	♀	Cabanga, finca J.Martinez. 500m. P. Alajuela, Costa Rica. 13/04/10 Trampa 1. L. M. Zumbado, J.A.Azofeifa.
INBIOCRI001926936	<i>Callistethus calonotus</i>	♂	COSTA RICA. Prov. Puntarenas. Buenos Aires. R.I. Boruca-Térraba. Alto de las Moras. 800-1000m. 24 MAR 1993. E. Phillips, S. Rojas, M. Solis. L_S_326800_533800 #1977
CEUA00105294	<i>Callistethus carbo</i>	♂	Río San Lorenzo, 1050m, Tierras Morenas, Z.P. Tenorio, Prov. Guanacaste Costa Rica. A. Marín 23 mar a 21 abr 1992 L-N 287800,427600
INBIOCRI000415440	<i>Callistethus carbo</i>	♂	Río San Lorenzo, 1050 m, Tierras Morenas, Z. P. Tenorio, Prov. Guanacaste, Costa Rica, C. Alvarado, Abr 1992, L- N 287800_427600
INBIOCRI000791864	<i>Callistethus carbo</i>	♀	Río San Lorenzo, 1050 m, Tierras Morenas, Z. P. Tenorio, Prov. Guanacaste, Costa Rica, Abr 1992 F. Quesada L- N 287800_427600
INBIOCRI000930501	<i>Callistethus carbo</i>	♂	Río San Lorenzo, 1050m, Tierras Morenas, Z.P. Tenorio, Prov. Guanacaste Costa Rica. Abr 1992 F. Quesada L-N 287800,427600
INBIOCRI000930505	<i>Callistethus carbo</i>	♂	Río San Lorenzo, 1050m, Tierras Morenas, Z.P. Tenorio, Prov. Guanacaste Costa Rica. Abr 1992 F. Quesada L-N 287800,427600
INBIOCRI000930506	<i>Callistethus carbo</i>	♀	Río San Lorenzo, 1050m, Tierras Morenas, Z.P. Tenorio, Prov. Guanacaste Costa Rica. Abr 1992 F. Quesada L-N 287800,427600
INBIOCRI000930510	<i>Callistethus carbo</i>	♂	Río San Lorenzo, 1050m, Tierras Morenas, Z.P. Tenorio, Prov. Guanacaste Costa Rica. Abr 1992 F. Quesada L-N 287800,427600
INBIOCRI000387306	<i>Callistethus chlorotoides</i>	♂	Est. Hitoy Cerere, 100 m, R. Cerere, Res. Biol. Hitoy Cerere, Prov. Limón, COSTA RICA, E. Lopez, 12 - 28 Abr 1992. L_N_184600_643400 #1138
INBIOCRI000926690	<i>Callistethus chlorotoides</i>	♂	Est. Hitoy Cerere, 100m, R. Cerere, Res. Biol. Hitoy Cerere, Prov. Limon, Costa Rica, Nov 1992 G. Carballo L- N 184200_643300
INBIOCRI001802348	<i>Callistethus chlorotoides</i>	♀	R.B. Hitoy Cerere, Valle La Estrella, Prov. Limon, COSTA RICA. 100-200m. 4-20 Abr 1994, G. Carballo, L N 643400_184600 # 2855
INBIOCRI001802395	<i>Callistethus chlorotoides</i>	♂	R.B. Hitoy Cerere, Valle La Estrella, Prov. Limon, COSTA RICA. 100-200m. 4-20 Abr 1994, G. Carballo, L N 643400_184600 # 2855
INBIOCRI002517471	<i>Callistethus chlorotoides</i>	♀	Río Sucio Est. Carrillo Braulio Carrillo San Jose C.R. 30-3-86 Col: E. Carvajal

CEUA	<i>Callistethus chontalensis</i>	♂	COSTA RICA. Prov. Cartago. Jiménez. Pejibaye. Selva. Alb. El Copal. 1000m. 14 JUL 2007. A. García, M.A. Zumbado. Tp. Luz 2. L_N_196750_563695 #92251
CEUA	<i>Callistethus chontalensis</i>	♂	El Copal. Prov. Cartago. Costa Rica. 14/12/2007 Leg. R. González
CEUA	<i>Callistethus chontalensis</i>	♂	Cerro Bitárkara. Prov. Limón. Costa Rica. 10/10/2007 Det. W. Arana
CEUA	<i>Callistethus chontalensis</i>	♀	Cerro Bitárkara. Prov. Limón. Costa Rica. 14/06/2007 Det. W. Arana
CEUA	<i>Callistethus chontalensis</i>	♀	Cerro Bitárkara. Prov. Limón. Costa Rica. 12/07/2007 Det. W. Arana
INBIOCRI000804874	<i>Callistethus chrysomelinus</i>	♀	Est. G. Brenes, 1300m, Res. Biol. Monteverde, Prov. Puntarenas, Costa Rica, E. Bello, Jun 1991, L-N 249750_450075
INBIOCRI000955869	<i>Callistethus chrysomelinus</i>	♂	San Luis, 1040m, R. B. Monteverde, Prov. Puntarenas, Costa Rica, 24 ago a 15 set 1992, F. A. Quesada, L N 250850_449250
INBIOCRI001870861	<i>Callistethus chrysomelinus</i>	♂	Buen Amigo, San Luis Monteverde, A. C. Arenal, Prov. Punta, COSTA RICA. 1000-1350 m. May 1994, Grace Fuentes, L N 250850_449250 # 2927
INBIOCRI001894629	<i>Callistethus chrysomelinus</i>	♂	Buen Amigo, San Luis Monteverde, A. C. Arenal, Prov. Punta, COSTA RICA. 1000-1350 m. May 1994, Z. Fuentes, L N 250850_449250 # 2926
INBIOCRI001918367	<i>Callistethus chrysomelinus</i>	♀	San Luis, Monteverde, A. C. Arenal, Prov. Puntarenas, Costa Rica, 900 m. Jun 1993, Z. Fuentes, L N 250850_449250 # 2198
CEUA00105279	<i>Callistethus flavodorsalis</i>	♂	Fca. Cafrosa, Est. Las Mellizas, P.N. Amistad, 1300 m, Prov. Punt. COSTA RICA. M. Ramirez & G. Mora, Oct 1989. L-S-316100-596100
CEUA00105280	<i>Callistethus flavodorsalis</i>	♂	Est. Biol. Las Alturas, 1500m, Coto Brus, Prov. Puntarenas, Costa Rica. M.A. Zumbado, Oct 1991 L-S 322500,591300
INBIOCRI000376991	<i>Callistethus flavodorsalis</i>	♀	Est. Biol. Las Alturas, 1500m, Coto Brus, Prov. Puntarenas, Costa Rica. M.A. Zumbado, Oct 1991 L-S 322500,591300
INBIOCRI000478885	<i>Callistethus flavodorsalis</i>	♂	Fca. Cafrosa, Est. Las Mellizas, P.N. Amistad, 1300 m, Prov. Punt. COSTA RICA. M. Ramirez & G. Mora, Oct 1989. L-S-316100-596100
INBIOCRI000478886	<i>Callistethus flavodorsalis</i>	♂	Fca. Cafrosa, Est. Las Mellizas, P.N. Amistad, 1300 m, Prov. Punt. COSTA RICA. M. Ramirez & G. Mora, Oct 1989. L-S-316100-596100
INBIOCRI000478896	<i>Callistethus flavodorsalis</i>	♂	Fca. Cafrosa, Est. Las Mellizas, P.N. Amistad, 1300 m, Prov. Punt. COSTA RICA. M. Ramirez & G. Mora, Oct 1989. L-S-316100-596100
INBIOCRI000478900	<i>Callistethus flavodorsalis</i>	♂	Fca. Cafrosa, Est. Las Mellizas, P.N. Amistad, 1300 m, Prov. Punt. COSTA RICA. M. Ramirez & G. Mora, Oct 1989. L-S-316100-596100
INBIOCRI000632447	<i>Callistethus flavodorsalis</i>	♂	Est. Biol. Las Alturas, 1500m, Coto Brus, Prov. Puntarenas, Costa Rica. M.A. Zumbado, Oct 1991 L-S 322500,591300
CEUA00105284	<i>Callistethus fuscrobens</i>	♂	Est. Altamira, Buenos Aires PILA ACLA, Cerro Biolley, Prov. Punta, COSTA RICA. 1300-1450m. 23-30 OCT 1995. R.Villalobos, L_S_331700_572100 #6347
INB0003316029	<i>Callistethus fuscrobens</i>	♀	COSTA RICA. Prov. Puntarenas, San Vito Las Cruces. 20 NOV 1988. A. Solis
INB0003316037	<i>Callistethus fuscrobens</i>	♂	COSTA RICA. Prov. Puntarenas, San Vito Las Cruces. 20 NOV 1988. A. Solis
INBIOCRI000010139	<i>Callistethus fuscrobens</i>	♂	La Escuadra, P. N. Amistad, Puntarenas, Prov. COSTA RICA. 1340 m. 14 April 1989, M. Ramirez & G. Mora, L S 326700_581200
INBIOCRI000483196	<i>Callistethus fuscrobens</i>	♀	Rancho Quemado, Peninsula de Osa, 200m. Prov. Punt., COSTA RICA, F. Quesada, Dic 1991, L-S 292500_511000
INBIOCRI002349998	<i>Callistethus fuscrobens</i>	♀	Albergue Cerro de Oro, Prov. Punta, COSTA RICA. 150m. 30 AGO 1995. L. Angulo, de Luz L_S_279650_518450 #5982
INBIOCRI002442931	<i>Callistethus fuscrobens</i>	♂	Estacion Altmira, 1 Km. S del Cerro Biolley, Puntarenas, Costa Rica. 1450m. 13-26 MAY 1996. R. Villalobos, de Luz L_S_331700_572100 #7538
INBIOCRI000495854	<i>Callistethus granulipygus</i>	♂	Rancho Quemado, 200m, Peninsula de Osa, Prov. Puntarenas, Costa Rica, D. Brenes, Abr 1992, L-S 292500_511000
INBIOCRI000917819	<i>Callistethus granulipygus</i>	♂	P. N. Manuel Antonio, 80m Quepos, Prov. Puntarenas, Costa Rica, Set 1992, G. Varela L-S 370900,448800
INBIOCRI000917840	<i>Callistethus granulipygus</i>	♀	P. N. Manuel Antonio, 80m Quepos, Prov. Puntarenas, Costa Rica, Set 1992, G. Varela L-S 370900,448800
INBIOCRI001329584	<i>Callistethus granulipygus</i>	♂	Est. Queb. Bonita, 50 m, Res. Biol. Carara, Prov. Punt., COSTA RICA. 4 a 26 ene 1993, R. Guzman, L-N 194500_469850
INBIOCRI000044163	<i>Callistethus jordani</i>	♂	Estac. Cacao, 1000-1400m, SW side Volcan Cacao, Guanac. Pr. COSTA RICA Set 1989, R. Blanco & C. Chaves, L N 323300_375700
INBIOCRI000226225	<i>Callistethus jordani</i>	♂	Est. Cacao, 1000-1400m, Lado suroeste del Volcan Cacao, Prov. Guan., COSTA RICA, II curso Parataxon., Jun 1990, L- N 323300_375700
INBIOCRI000254615	<i>Callistethus jordani</i>	♂	Est. Cacao, 1000-1400m, Lado suroeste del Volcan Cacao, Prov. Guan., COSTA RICA, II curso Parataxon., Jun 1990, L- N 323300_375700
INBIOCRI000254628	<i>Callistethus jordani</i>	♀	Est. Cacao, 1000-1400m, Lado suroeste del Volcan Cacao, Prov. Guan., COSTA RICA, II curso Parataxon., Jun 1990, L- N 323300_375700
INBIOCRI000256481	<i>Callistethus jordani</i>	♂	Est. Cacao, 1000 - 1400m, Lado suroeste del Volcan Cacao, Prov. Guan, COSTA RICA, Benigno Guadamuz y Familia. Set - Dic 1989. L_N_323300_375700 #336
INBIOCRI000447482	<i>Callistethus jordani</i>	♀	Cerro Plano, Res. Biol. Monteverde, 1300m, Prov. Punt, COSTA RICA, E Bello, Dic 1990, L- N 255200_446800
INBIOCRI000909339	<i>Callistethus jordani</i>	♀	Est. Biol. Las Alturas 1500 m, Coto Brus, Prov. Puntarenas, Costa Rica, F. Araya, 23 mar a 2 may 1992, L-S 322500_591300

CEUA00003273	<i>Callistethus lativittis</i>	♂	Albergue Heliconias, Bijagua (Costa Rica). 750m 30-1-2006. T. luz (18:45-22:00). Leg.: Micó, García, Galante.
CEUA00003307	<i>Callistethus lativittis</i>	♀	Albergue Heliconias, Bijagua (Costa Rica). 750m 30-1-2006. T. luz (18:45-22:00). Leg.: Micó, García, Galante.
CEUA00003313	<i>Callistethus lativittis</i>	♀	Albergue Heliconias, Bijagua (Costa Rica). 750m 30-1-2006. T. luz (18:45-22:00). Leg.: Micó, García, Galante.
CEUA00003318	<i>Callistethus lativittis</i>	♂	Albergue Heliconias, Bijagua (Costa Rica). 750m 31-1-2006. T. luz (17:15-21:00). Leg.: Micó, García, Galante.
CEUA00105285	<i>Callistethus lativittis</i>	♀	Estación Cabro Muco, Repr. ICE - Z.P. Miravalles, Guanacaste. Costa Rica. 1000m 12/06/2010. L. Filippini, Moraga.
INBIOCRI001873737	<i>Callistethus lativittis</i>	♂	Rio San Lorenzo, Z.P. Tenorio A.C.A. Tilaran, Prov. Guana, COSTA RICA. 1050 m. May 1994, G. Rodríguez, L N 427600_287800 # 2933
INBIOCRI002246434	<i>Callistethus lativittis</i>	♀	Sect. San Ramon de Dos Rios, Prov. Alaju, COSTA RICA. 620m. 18 MAR-13 ABR 1995. F. A. Quesada, L N 318100_381900 #5274
INBIOCRI002337541	<i>Callistethus lativittis</i>	♂	Dos de Tilaran (San Ramon), Prov. Guana, COSTA RICA. 1100m. MAY 1995. G. Rodríguez, L N 262600_437500 #5891
CEUA00105281	<i>Callistethus levigatus</i>	♂	COSTA RICA Prov. Alajuela. Guatuso. P.N. Volcán Tenorio. Punto 2: Falda N Cerro Montezuma. 1160m. 3 Jun 2008. J. A. Azofeifa. Tp de Luz 2. L N 297500_425050 #93851
INBIOCRI000269242	<i>Callistethus levigatus</i>	♀	Est. La Casona, Res. Biol. Monteverde, 1520m, Prov. Punt. COSTA RICA, N. Obando, Set 1990, L- N 253250_449700
INBIOCRI000269243	<i>Callistethus levigatus</i>	♂	Est. La Casona, Res. Biol. Monteverde, 1520m, Prov. Punt. COSTA RICA, N. Obando, Set 1990, L- N 253250_449700
INBIOCRI000415209	<i>Callistethus levigatus</i>	♀	Rio San Lorenzo, 1050 m, Tierras Morenas, Z. P. Tenorio, Prov. Guanacaste, Costa Rica, C. Alvarado, Abr 1992, L- N 287800_427600
INBIOCRI000668743	<i>Callistethus levigatus</i>	♂	R. San Lorenzo, 1050m, R. F. Cord. Guanacaste (Tenorio) , Prov. Guan. COSTA RICA C. Alvarado, Jun 1991, L- N 287800_427600
INBIOCRI000712086	<i>Callistethus levigatus</i>	♂	Quebrada Segunda, P. N. Tapanti, 1250m, Prov. Cartago, Costa Rica, Jul 1992, G. Mora, L- N 194000_560000
INBIOCRI001325937	<i>Callistethus levigatus</i>	♀	Est. La Casona, 1520 m, Res. Biol. Monteverde, Prov. Punt., COSTA RICA. May 1991, N. Obando. L-N 253250,449700
CEUA00105292	<i>Callistethus macroxantholeus</i>	♀	Est. Pitilla, 700 m, 9 km S Sta. Cecilia, P. N. Guanacaste, Prov. Guan. COSTA RICA R. W. Flowers, 13 May 1991, L- N 330200_380200
CEUA00105293	<i>Callistethus macroxantholeus</i>	♂	Sector Cerro Cocori, Fca. de E. Rojas, 150 m, Prov. Limon, Costa Rica, E. Rojas, Abr 1992, L- N 286000_567500
INBIOCRI000248848	<i>Callistethus macroxantholeus</i>	♀	Est. Cacao, 1000-1400m, Lado suroeste del Volcan Cacao, Prov. Guan., COSTA RICA, II curso Parataxon., Jun 1990, L- N 323300_375700
INBIOCRI000405392	<i>Callistethus macroxantholeus</i>	♂	Est. Pitilla, 700 m, 9 km S Sta. Cecilia, P. N. Guanacaste, Prov. Guanacaste, Costa Rica, C. Moraga, 2 a 15 may 1992, L N 330200_380200
INBIOCRI000411910	<i>Callistethus macroxantholeus</i>	♀	Est. Cacao, 1000-1400m, Lado SO Vol. Cacao, P. N. Guan., Prov. Guanacaste, Costa Rica, R. Vargas 21 a 28 may 1992, L- N 323300_375700
INBIOCRI000450920	<i>Callistethus macroxantholeus</i>	♂	Est. Pitilla, 700m, 9km S Sta Cecilia, P. N. Guanacaste Prov. Guan. COSTA RICA, C. Moraga, May 1991, L- N 330200_380200
INBIOCRI000930543	<i>Callistethus macroxantholeus</i>	♀	Rio San Lorenzo, 1050 m, Tierras Morenas, Z. P. Tenorio, Prov. Guanacaste, Costa Rica, Abr 1992 F. Quesada L- N 287800_427600
INBIOCRI000930545	<i>Callistethus macroxantholeus</i>	♂	Rio San Lorenzo, 1050 m, Tierras Morenas, Z. P. Tenorio, Prov. Guanacaste, Costa Rica, Abr 1992 F. Quesada L- N 287800_427600
INBIOCRI000930551	<i>Callistethus macroxantholeus</i>	♀	Rio San Lorenzo, 1050 m, Tierras Morenas, Z. P. Tenorio, Prov. Guanacaste, Costa Rica, Abr 1992 F. Quesada L- N 287800_427600
INBIOCRI000930553	<i>Callistethus macroxantholeus</i>	♀	Rio San Lorenzo, 1050 m, Tierras Morenas, Z. P. Tenorio, Prov. Guanacaste, Costa Rica, Abr 1992 F. Quesada L- N 287800_427600
INBIOCRI001102734	<i>Callistethus macroxantholeus</i>	♀	P.N.Guanacaste Sector Mengo 15 mayo 1988 Col: D. Janzen
INBIOCRI001315235	<i>Callistethus macroxantholeus</i>	♂	Est. Pitilla, 700m, 9 km S Sta. Cecilia, P. N. Guanacaste, Prov. Guan., COSTA RICA. 19 May -3 Jun 1993. C. Moraga, L N 330200_380200
INBIOCRI001364690	<i>Callistethus macroxantholeus</i>	♀	R. San Lorencito, 900m, R. F. San Ramón, 5 km N de Colonia Palmareña, Prov. Alaju., COSTA RICA. 13-18 Jun 1993. I Curso Scarabeidae. L N 244500_470700 #2125
INBIOCRI002517220	<i>Callistethus macroxantholeus</i>	♂	Estac. Pitilla, 700m, 9km S Santa Cecilia, Guanac., Pr. COSTA RICA. 21 Mar-21 Abr 1989, GNP Biod. Sur. L N 330200,380200
CEUA00105288	<i>Callistethus microxantholeus</i>	♂	Volcán Tenorio. Guanacaste. Costa Rica. 700m 03/VIII/2009 ex larva F L. 20/VI/2009 L. Filippini, Galante, Marcos.
CEUA00105289	<i>Callistethus microxantholeus</i>	♀	Cabanga, finca J.Robles. Alajuela, Costa Rica. 500m. 10/II/2010 trampa 2 L. M. Zumbado, J.A.Azofeifa.
CEUA00105290	<i>Callistethus microxantholeus</i>	♂	Cabanga, finca J.Robles. Alajuela, Costa Rica. 500m 12/II/2010. Trampa 2 L. M. Zumbado, J.A.Azofeifa.
CEUA00105291	<i>Callistethus microxantholeus</i>	♂	P.N. Volcán Tenorio. Catarata Río Buenavista. P. Alajuela, Costa Rica. 780m 15/12/2009. L. M. Zumbado, J.A.Azofeifa.
INBIOCRI000211290	<i>Callistethus microxantholeus</i>	♀	Estac. Pitilla, 700m, 9 km S Sta. Cecilia, Guanacaste, COSTA RICA, Mar 1990, P. Rios, C. Moraga & R. Blanco, L- N 330200_380200

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INBIOCRI000235712	<i>Callistethus microxantholeus</i>	♂	Est. Magsasay, P. N. Braulio Carrillo, 200 m, Prov. Here, COSTA RICA R. Aguilar, Oct 1990, L- N 264600_531100
INBIOCRI000235713	<i>Callistethus microxantholeus</i>	♂	Est. Magsasay, P. N. Braulio Carrillo, 200 m, Prov. Here, COSTA RICA R. Aguilar, Oct 1990, L- N 264600_531100
INBIOCRI000550223	<i>Callistethus microxantholeus</i>	♂	Sector Cerro Cocori, Fca. de E. Rojas. 150 m, Prov. Limon, COSTA RICA, E. Rojas, Dic 1991, L N 286000,567500
INBIOCRI000757517	<i>Callistethus microxantholeus</i>	♂	Amubri, 70m, Talamanca, Prov. Limon, Costa Rica, 1 a 22 jul 1992, G. Gallardo, L-S 385500_578050
INBIOCRI000963755	<i>Callistethus microxantholeus</i>	♀	Rancho Quemado, 200m, Peninsula de Osa, Prov. Puntarenas, Costa Rica, Ago 1992, M. Segura, L S 292500_511000
INBIOCRI001315179	<i>Callistethus microxantholeus</i>	♂	Est. Pitilla, 700m, 9 km S Sta. Cecilia, P. N. Guanacaste, Prov. Guan., COSTA RICA. 19 May -3 Jun 1993. C. Moraga, L N 330200_380200
INBIOCRI001376210	<i>Callistethus microxantholeus</i>	♂	Est. Magsasay, 200 m, P. N. Braulio Carrillo, Prov. Here., COSTA RICA. May 1991. A. Fernandez, L- N 264600_531000
INBIOCRI001384952	<i>Callistethus microxantholeus</i>	♀	Sector Cerro Cocori, Fca de E. Rojas, 150 M, Prov. Limon, COSTA RICA. Mar 1993. E. Rojas, L N 286000_567500
INBIOCRI001385120	<i>Callistethus microxantholeus</i>	♀	Sector Cerro Cocori, Fca de E. Rojas, 150 M, Prov. Limon, COSTA RICA. Mar 1993. E. Rojas, L N 286000_567500
INBIOCRI001397208	<i>Callistethus microxantholeus</i>	♂	Est. Pitilla, 700m, 9 km S Sta. Cecilia, P. N. Guanacaste, Prov. Guan., COSTA RICA. 18 abr a 19 may 1993, P. Rios, L- N 330200_380200
INBIOCRI001397241	<i>Callistethus microxantholeus</i>	♂	Est. Pitilla, 700m, 9 km S Sta. Cecilia, P. N. Guanacaste, Prov. Guan., COSTA RICA. 18 abr a 19 may 1993, P. Rios, L- N 330200_380200
INBIOCRI002517192	<i>Callistethus microxantholeus</i>	♂	Alajuela. Costa Rica. Reserva de San Ramon. Rio San Lorencito. 850m. 1 abril 1987. Angel Solis
INBIOCRI002517193	<i>Callistethus microxantholeus</i>	♂	Heredia. Costa Rica Pto. Viejo. Finca La Selva 9 setiembre 1986 M.M.Chavarria-Diaz
INBIOCRI002517222	<i>Callistethus microxantholeus</i>	♂	Heredia. Costa Rica Puerto Viejo Sarapiquí. Finca La Selva. 35m. 30 abril 1987 M. M. Chavarria Diaz
CEUA	<i>Callistethus mimeloides</i>	♂	La Montura, Prov. San José, Costa Rica. 11/10/2007 Leg. M. Moraga
CEUA	<i>Callistethus mimeloides</i>	♂	COSTA RICA. Prov. Alajuela. Upala. P.N. Volcán Tenorio. Alb. Heliconias. Send. a Laguna Danta. 900m. 17 AGO 2007. J. D. Gutierrez. Tp. Luz 1. L N_299100_424000 #92259
CEUA	<i>Callistethus mimeloides</i>	♂	Orosilito. Prov. Guanacaste. Costa Rica. 10/10/2007. Leg. D. Briceño
CEUA	<i>Callistethus mimeloides</i>	♀	Estación Pitilla. P.N. Guanacaste (Costa Rica) 750m 3-10-06 T. luz 22:00-2.00. Leg.: Micó, García, Galante.
CEUA00105282	<i>Callistethus multiplicatus</i>	♀	Volcán Tenorio. Guanacaste. Costa Rica. 750-800m 30/XI/2009 Ex larva L. 22/VI/2009. L. Filippini
CEUA00105283	<i>Callistethus multiplicatus</i>	♂	Cabanga, finca J.Martínez. 500m. P. Alajuela, Costa Rica. 20/7/10 Ex larva L. 9/6/10
INBIOCRI000035475	<i>Callistethus multiplicatus</i>	♀	Estac. Pitilla, 700m, 9km S Santa Cecilia, Guanac. Pr. COSTA RICA. Set 1989, GNP Biodiversity Survey, L- N 330200_380200
INBIOCRI000086335	<i>Callistethus multiplicatus</i>	♂	Cuatro Esquinas, P. N. Tortuguero, Prov. Limon, COSTA RICA. 0m, Set 1989. J. Solano, L N 280000_590500
INBIOCRI000104897	<i>Callistethus multiplicatus</i>	♀	Estación Pitilla, 700m, 9km S Santa Cecilia, Guanac. Pr. COSTA RICA. FEB 1989. GNP Biodiversity Survey. 330200,380200
INBIOCRI000774896	<i>Callistethus multiplicatus</i>	♂	Sector Cerro Cocori, Fca. de E. Rojas, 150 m, Prov. Limon, Costa Rica, E. Rojas, 31 ene - 21 feb 1992, L- N 286000_567500
INBIOCRI000937526	<i>Callistethus multiplicatus</i>	♂	Manzanillo, 0-100m, RNFS Gandoca y Manzanillo, Prov. Limon, Costa Rica, 9 set a 13 oct 1992, K. Taylor, L- S 398100_610600
INBIOCRI001331162	<i>Callistethus multiplicatus</i>	♂	Sector Cerro Cocori, 30 Km N de Cariari, Prov. Limón, COSTA RICA. 100m. Mar 1992. E. Rojas. L N_286000_567500 #1740
INBIOCRI001331163	<i>Callistethus multiplicatus</i>	♂	Sector Cerro Cocori, 30 Km N de Cariari, Prov. Limón, COSTA RICA. 100m. Mar 1992. E. Rojas. L N_286000_567500 #1740
INBIOCRI001353063	<i>Callistethus multiplicatus</i>	♀	Cerro Tortuguero, 0-120 m, P.N. Tortuguero, Prov. Limon, COSTA RICA. Mar 1993, R. Delgado. L N 285000_588000
INBIOCRI002517475	<i>Callistethus multiplicatus</i>	♂	Limon. Costa Rica Pacuarito Las Brisas 20 julio 1986 M.M. Chavarria Diaz
INBIOCRI002517498	<i>Callistethus multiplicatus</i>	♂	Costa Rica, Heredia Pto. Viejo de Sarapiquí Finca La Selva 35msnm 24 marzo-4 abril 1987 M.M. Chavarria Diaz
INBIOCRI000509010	<i>Callistethus nicoyus</i>	♂	Est. Queb. Bonita, 50m, Res. Biol. Carara, Prov. Puntarenas, Costa Rica, P. Campos, 17 mar a 30 abr 1992, L- N 194500_469850
INBIOCRI000537325	<i>Callistethus nicoyus</i>	♂	Est. Queb. Bonita, 50m, Res. Biol. Carara, Prov. Puntarenas, Costa Rica, P. Campos, 17 mar a 30 abr 1992, L- N 194500_469850
INBIOCRI000814311	<i>Callistethus nicoyus</i>	♂	Est. Queb. Bonita, 50m, Res. Biol. Carara, Prov. Puntarenas, Costa Rica, J. C. Saborio, Abr 1992 L- N 194500_469850
INBIOCRI001007497	<i>Callistethus nicoyus</i>	♀	CR Alajuela Brasil 6 mayo 1985 Col L. Corrales
INBIOCRI002516932	<i>Callistethus nicoyus</i>	♀	Brasil Sta Ana 15 mayo 1978 V. Hidalgo R

CEUA00105286	<i>Callistethus parapulcher</i>	♀	La Amistad, Sect. Altamira, Buenos Aires, Prov. Punta, COSTA RICA. 1200m. 21 Feb-10 Mar 1994, R. Delgado, L S 572100_331700 # 2691
CEUA00105287	<i>Callistethus parapulcher</i>	♂	COSTA RICA. Prov. Puntarenas. Buenos Aires. Alto Jalisco. 900-1000m. 22-26 FEB 2009. E. Ulate, J. A. Azofeifa, M. Moraga. Tp. Luz Mercurio. L S 327533_523213 #95832
INB0004197431	<i>Callistethus parapulcher</i>	♀	COSTA RICA. Prov. Puntarenas. Buenos Aires. Alto Jalisco. 900-1000m. 22-26 FEB 2009. E. Ulate, J. A. Azofeifa, M. Moraga. Tp. Luz Mercurio. L S 327533_523213 #95832
INBIOCRI000209842	<i>Callistethus parapulcher</i>	♀	Fca. Cafrosa, Est. Las Mellizas, P. N. Amistad, 1300m, Puntarenas COSTA RICA Feb 1990. M. Ramirez, L S 316100_596100
INBIOCRI001837034	<i>Callistethus parapulcher</i>	♀	Estacion Pitilla, 9 km S. Santa Cecilia, P. N. Guanacaste, Prov. Guanacaste, Costa Rica, 700 m. 19-22 Jun 1993, G. Carballo, L N 330200_380200 # 2199
INBIOCRI001855012	<i>Callistethus parapulcher</i>	♀	La Amistad, Sector Altamira, Cerro Biolley, A. C. Amistad, Prov. Punta, COSTA RICA. 1800 m. Ene 1994, R. Delgado, L S 332700_572400 # 2547
INBIOCRI002091974	<i>Callistethus parapulcher</i>	♀	Est. Altamira, Buenos Aires, A. C. Amistad, Prov. Punta, COSTA RICA. 1150-1400 m. Dic 1994, M. Segura, L S 331700_572100 # 3377
INBIOCRI002183336	<i>Callistethus parapulcher</i>	♂	Est. Pittier, PILA-ACLA, Prov. Punta, COSTA RICA. 1670m. 5-18 ENE 1995. R. Villalobos, L N 330900_577400 #4437
INBIOCRI002199232	<i>Callistethus parapulcher</i>	♂	Est. Pittier, PILA-ACLA, Prov. Punta, COSTA RICA. 1670m. 5-18 ENE 1995. L. Angulo, L N 330900_577400 #4669
INBIOCRI002199233	<i>Callistethus parapulcher</i>	♂	Est. Pittier, PILA-ACLA, Prov. Punta, COSTA RICA. 1670m. 5-18 ENE 1995. L. Angulo, L N 330900_577400 #4669
INBIOCRI002205729	<i>Callistethus parapulcher</i>	♂	COSTA RICA. Prov. Puntarenas. Estación Pittier. 1670m. 6 al 18 ENE 1995. A. Azofeifa. L S 330900_577400 #4830
INBIOCRI002357497	<i>Callistethus parapulcher</i>	♀	Est. Santa Elena, Viejo, Santa Elena, Las Nubes, Prov. San J, COSTA RICA. 1210m. 20-24 NOV 1995. B. Gamboa, de Luz L S 371750_507800 #6432
INBIOCRI002357500	<i>Callistethus parapulcher</i>	♂	Est. Santa Elena, Viejo, Santa Elena, Las Nubes, Prov. San J, COSTA RICA. 1210m. 20-24 NOV 1995. B. Gamboa, de Luz L S 371750_507800 #6432
INBIOCRI002381386	<i>Callistethus parapulcher</i>	♂	Estacion Altmira, 1 Km. S del Cerro Biolley, Sendero Gigantes del Bosque, Puntarenas, Costa Rica. 1300-1450m. 20-23 NOV 1995. M. Moraga, de Luz L S 331700_572100 #7055
INBIOCRI002517067	<i>Callistethus parapulcher</i>	♂	Puntarenas, Costa Rica San Vito, Las Cruces 20 nov 1988 Col: A. Solis
INBIO0003313790	<i>Callistethus pseudocollaris</i>	♀	COSTA RICA, Prov. Puntarenas, A.C.L.A.P, P.I.L.A, Coto Brus, Send Cerro Pittier Estación. 1750m. 29-30 DIC 1998. M. Moraga. Sombrereta L S 331250_577150 #51998
INBIOCRI000489689	<i>Callistethus pseudocollaris</i>	♀	La Escudra, 1600-1900m Parque Internac. La Amistad, Prov. Punt., COSTA RICA, M. Zumbado, Ene 1992, L S 326700_581200
INBIOCRI000691543	<i>Callistethus pseudocollaris</i>	♂	Est. La Casona, 1520m, Res. Biol. Monteverde, Prov. Puntarenas, Costa Rica, Jul 1992, N. Obando, L N 253250_449700
INBIOCRI000834197	<i>Callistethus pseudocollaris</i>	♀	San Luis, 1040m, R. B. Monteverde, Prov. Puntarenas, Costa Rica, Set 1992. Z. Fuentes L N 250850_449250
INBIOCRI001325936	<i>Callistethus pseudocollaris</i>	♂	Est. La Casona, 1520 m, Res. Biol. Monteverde, Prov. Punt., COSTA RICA. May 1991, N. Obando. L N 253250,449700
CEUA00019649	<i>Callistethus ruteloides</i>	♂	Tapantí (Costa Rica) 1300m 26-9-06 T. luz 23:00-01:00 Leg.: Micó, García, Galante
CEUA00106210	<i>Callistethus ruteloides</i>	♀	Tapantí (Costa Rica) 1300m 29-9-06 T. luz 17:00-23:00 Leg.: Micó, García, Galante
CEUA00106211	<i>Callistethus ruteloides</i>	♀	El Copal, Prov. Cartago, Costa Rica. 17/06/2007 Leg. M. Moraga
CEUA00106212	<i>Callistethus ruteloides</i>	♀	COSTA RICA. Prov. Alajuela. Upala. P.N. Volcán Tenorio. Alb. Heliconias. Send. a Laguna Danta. 900m. 16 JUN 2007. J. D. Gutiérrez. Tp. Luz 2. L N 299100_424000 #92208
INBIOCRI000959028	<i>Callistethus ruteloides</i>	♂	Quebrada Segunda, P. N. Tapantí, 1250 m, Prov. Cartago, Costa Rica, G. Mora, May 1992 L-N 194000_560000
INBIOCRI000987456	<i>Callistethus ruteloides</i>	♂	Est. Biol. Las Alturas, 1500m, Coto Brus, Prov. Puntarenas, Costa Rica. M. Ramirez. Mar 1992 L-S 322500_591300
INBIOCRI001669692	<i>Callistethus ruteloides</i>	♀	Q. Segunda, P.N. Tapantí, Prov. Carta, COSTA RICA. 1300m. Set 1993. G. Mora, L N 194000_559800 #2326
INBIOCRI001820190	<i>Callistethus ruteloides</i>	♂	Quebrada Segunda, P.N.Tapantí, Prov. Carta, COSTA RICA. 1150 m. May 1994, G. Mora, L N 194000_559800 # 2852
INBIOCRI002443066	<i>Callistethus ruteloides</i>	♀	COSTA RICA, Prov. Cartago, R. Grande de Orosi, desde Administracion hasta Sendero La Pava. 1150-1600m. ABR 1996. G. Mora. L N 192500_560400 #7658
CEUA	<i>Callistethus schneideri</i>	♂	Albergue Heliconias, Bijagua (Costa Rica). 750m 31-1-2006. T. luz (17:15-21:00). Leg.: Micó, García, Galante.
CEUA	<i>Callistethus schneideri</i>	♂	Cerro Bitárkara. Prov. Limón. Costa Rica. 11/10/2007 Det. W. Arana
CEUA	<i>Callistethus schneideri</i>	♂	Cerro Bitárkara. Prov. Limón. Costa Rica. 10/10/2007 Det. W. Arana
CEUA	<i>Callistethus schneideri</i>	♂	Cerro Bitárkara. Prov. Limón. Costa Rica. 11/10/2007 Det. W. Arana
CEUA	<i>Callistethus schneideri</i>	♂	Cerro Bitárkara. Prov. Limón. Costa Rica. 11/10/2007 Det. W. Arana
CEUA	<i>Callistethus schneideri</i>	♀	Cerro Bitárkara. Prov. Limón. Costa Rica. 11/10/2007 Det. W. Arana
CEUA	<i>Callistethus schneideri</i>	♀	Río San Lorenzo, 1050m, Tierras Morenas, Z.P. Tenorio, Prov. Guanacaste Costa Rica. Abr 1992 F. Quesada L-N 287800, 427600

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CEUA00003257	<i>Callistethus schneideri</i>	♂	Albergue Heliconias, Bijagua (Costa Rica). 750m 31-1-2006. T. luz (17:15-21:00). Leg.: Micó, García, Galante.
INBIOCR1001392672	<i>Callistethus schneideri</i>	♀	R. San Lorencito, 900m, R. F. San Ramón, 5 km N de Colonia Palmareña, Prov. Alajua., COSTA RICA. 13-18 Jun 1993. I Curso Scarabaeidae. L N 244500_470700 #2125
INBIOCR1002517105	<i>Callistethus schneideri</i>	♀	Estac. Pitilla, 700m, 9 Km S. Santa Cecilia, Guanac. Pr. COSTA RICA Jun 1988 GNP Biodiversity Survey W85 25'40" ,N10 59'26"
INB0003016484	<i>Callistethus sp.</i>	♀	COSTA RICA, Prov. Limón, R.B. Hitoy Cerere. Camino hacia el cerro. 560m. JUL 1998. E. Rojas. Tp. Mantillo. L S_400742_570120 #51617
INB0003021727	<i>Callistethus sp.</i>	♀	COSTA RICA, Prov. Alajuela, A.C.A, San Carlos, Reserva Ftal Arenal, Sector Tucanes. 640m. 14 OCT-3 DIC 1998. G. Carballo. Malaise L_N_269600_457600 #51996
INB0003048563	<i>Callistethus sp.</i>	♀	COSTA RICA, Prov. Limón, A.C.L.A.C, Central, Valle de la Estrella, Reserva Biol Hitoy Cerere, Est Hitoy Cerere. 160m. 28 SET-11 OCT 1999. W. Arana. Intersección L_N_184120_643471 #53772
INB0003048564	<i>Callistethus sp.</i>	♀	COSTA RICA, Prov. Limón, A.C.L.A.C, Central, Valle de la Estrella, Reserva Biol Hitoy Cerere, Est Hitoy Cerere. 160m. 28 SET-11 OCT 1999. W. Arana. Intersección L_N_184120_643471 #53772
CEUA00105801	<i>Callistethus sp.304</i>	♂	Cerro Bitárkara. Prov. Limón, Costa Rica. 11/08/2007 Leg. W. Arana
CEUA00105278	<i>Callistethus specularis</i>	♂	Isla Bonita. Prov. Alajuela, Costa Rica. T. luz 2. 9 sep 2007. Leg. A. García
INBIOCR1000416015	<i>Callistethus specularis</i>	♂	Rio San Lorenzo, 1050 m, Tierras Morenas, Z. P. Tenorio, Prov. Guanacaste, Costa Rica, Abr 1992 F. Quesada L- N 287800_427600
INBIOCR1000440192	<i>Callistethus specularis</i>	♀	Quebrada Segunda, Ref. Nac. Fauna Silv. Tapanti, 1250m, Prov. Cartago, Costa Rica, R. Vargas, abr 1992, L- N 194000_560000
INBIOCR1000440198	<i>Callistethus specularis</i>	♂	Quebrada Segunda, Ref. Nac. Fauna Silv. Tapanti, 1250m, Prov. Cartago, Costa Rica, R. Vargas, abr 1992, L- N 194000_560000
INBIOCR1000930529	<i>Callistethus specularis</i>	♀	Rio San Lorenzo, 1050 m, Tierras Morenas, Z. P. Tenorio, Prov. Guanacaste, Costa Rica, Abr 1992 F. Quesada L- N 287800_427600
INBIOCR1000930532	<i>Callistethus specularis</i>	♂	Rio San Lorenzo, 1050 m, Tierras Morenas, Z. P. Tenorio, Prov. Guanacaste, Costa Rica, Abr 1992 F. Quesada L- N 287800_427600
CEUA00105277	<i>Callistethus stannibractea</i>	♂	Estac. Barva. Braulio Carrillo, N.P. 2500 m. Heredia COSTA RICA. Feb 1990. G. Rivera 233400-523200
INBIOCR1000108624	<i>Callistethus stannibractea</i>	♂	Est. Barva, Braulio Carrillo N. P., Pr. Heredia. COSTA RICA. 2500 m. Oct 1989 G. Rivera & A. Fernandez L N 233400_523200
INBIOCR1000121090	<i>Callistethus stannibractea</i>	♂	Estac. Barva, Braulio Carrillo, N. P. 2500 m. Heredia COSTA RICA. Feb 1990. A. Fernandez, L N 233400_523200
INBIOCR1000164337	<i>Callistethus stannibractea</i>	♂	Estac. Barva. Braulio Carrillo, N.P. 2500 m. Heredia COSTA RICA. Mar 1990. G. Rivera 233400-523200
INBIOCR1002517467	<i>Callistethus stannibractea</i>	♂	Estac. Barva, BraulioCarrillo N.P., Pr. Heredia. COSTA RICA. 2500m. April 1989 M. Zumbado & A. Fernandez
INBIOCR1002517469	<i>Callistethus stannibractea</i>	♂	Estac. Barva, BraulioCarrillo N.P., Pr. Heredia. COSTA RICA. 2500m. April 1989 M. Zumbado & A. Fernandez
INBIOCR1000209843	<i>Callistethus valdecostatus</i>	♂	Fca. Cañosa, Est. Las Mellizas, P. N. Amistad, 1300m, Puntarenas COSTA RICA Feb 1990. M. Ramirez, L- S 316100_596100
INBIOCR1000915883	<i>Callistethus valdecostatus</i>	♂	Est. Biol. Las Alturas 1500 m, Coto Brus, Prov. Puntarenas, Costa Rica, F. Araya, 23 mar a 2 may 1992, L- S 322500_591300
INBIOCR1001926964	<i>Callistethus valdecostatus</i>	♀	COSTA RICA. Prov. Puntarenas. Buenos Aires. R.I. Boruca-Térraba. Alto de las Moras. 800-1000m. 24 MAR 1993. E. Phillips, S. Rojas, M. Solis. L S_326800_533800 #1977
INBIOCR1001926965	<i>Callistethus valdecostatus</i>	♂	COSTA RICA. Prov. Puntarenas. Buenos Aires. R.I. Boruca-Térraba. Alto de las Moras. 800-1000m. 24 MAR 1993. E. Phillips, S. Rojas, M. Solis. L S_326800_533800 #1977
INBIOCR1002517631	<i>Callistethus valdecostatus</i>	♀	Fca. Cañosa, Est. Las Mellizas, P.N. Amistad, Puntarenas Pr. COSTA RICA, 1300m. April 1989 M. Ramirez & G. Mora L S 316100,599200
INB0004238840	<i>Callistethus vanpatteni</i>	♂	Alajuela. Costa Rica Cinco Esquinas de Carrizal, 1800m 16 abril de 1988 Col: G. Barrantes
INB0004238841	<i>Callistethus vanpatteni</i>	♂	Alajuela. Costa Rica Cinco Esquinas de Carrizal, 1800m 16 abril de 1988 Col: G. Barrantes
INB0004238842	<i>Callistethus vanpatteni</i>	♀	C.R. Heredia. San Rafael. 15-5-1985 Col: E. Carvajal
INBIOCR1000020305	<i>Callistethus vanpatteni</i>	♂	Zarcoero, Alfaro Ruiz, 1700m Alajuela Pr. COSTA RICA. Apr - May 1989. A. Del Valle & A. Solis, L- N 240500_493500
INBIOCR1001331541	<i>Callistethus xiphostethus</i>	♂	Est. Las Pailas, 800 m, P.N. Rincon de la Vieja, Prov. Guan., COSTA RICA. 6 ene a 13 abr 1993, J. Sihezar, G. Rodriguez, L- N 306300_388600
INBIOCR1002517476	<i>Callistethus xiphostethus</i>	♀	ALAJUELA COSTA RICA Zarcoero A. Ruiz 12 dic 1986 COL: A. SOLIS B.
INBIOCR1002517477	<i>Callistethus xiphostethus</i>	♀	La Cima de Copey Dota de la Iglesia de Cannon 2 km Sur 2200m ULN 184500 545700 28 octubre 1995 M. Marta Chavarria Diaz
INBIOCR1002517479	<i>Callistethus xiphostethus</i>	♂	CR. Heredia San Rafael Los Angeles 12 Nov. 1994 JF. Corrales
INBIOCR1002517480	<i>Callistethus xiphostethus</i>	♂	CR. Heredia San Rafael Los Angeles 12 Nov. 1994 JF. Corrales
CEUA00003201	<i>Callistethus yalizo</i>	♂	V. Platanar P.N. Juan Castro Blanco (Costa Rica) 1800m 29-1-2006. T. luz (18:30-21:00). Leg.: Micó, García, Galante
CEUA00106167	<i>Callistethus yalizo</i>	♂	Esperanza del Guarco, Cartago, Costa Rica. 2300 m 5/6/2008 Leg. A. García, M.Zumbado

CEUA00106168	<i>Callistethus yalizo</i>	♀	COSTA RICA. Prov. Cartago. P.N. Tapanti. La Esperanza del Guarco. 2334m. 5 MAY 2008. A. García, M.A. Zumbado. Tp. Luz 2. L_N_188418_552219 #93739
INBIO	<i>Callistethus yalizo</i>	♂	Costa Rica, Cartago Prov., Tapanti N. Pk. Dam area, vi-4-1997 RW Hamilton /RWHC
INBIOCRI000183743	<i>Callistethus yalizo</i>	♂	Cerro Chompipe, Res. Biol. Chompipe, Prov. Here, COSTA RICA, J. F. Corrales, 7 Abr 1991, L- N 230000_528000
INBIOCRI000894947	<i>Callistethus yalizo</i>	♀	Quebrada Segunda, P. N. Tapanti, 1250M, Prov. Cartago, Costa Rica, Mar 1992, R. Vargas, L-N 194000_560000
INBIOCRI001964129	<i>Callistethus yalizo</i>	♂	P.N. Tapanti, La Represa, A. C. Amistad, Prov. Carta, COSTA RICA. 1650 m. 23 Mar 1994, G. Mora, A. Solis, E. Ulate, L N 185900_563360 # 2783
INBIOCRI002253282	<i>Callistethus yalizo</i>	♂	R. Grande de Orosi, desde Puente R. Dos Amigos hasta la Represa, Prov. Carta, COSTA RICA. 1400-1800m. MAR 1995. R. Delgado. L_N_186600_562000 #4418
BMNH(E)838054	<i>Cyclocephala erotylina</i>		edeago
BMNH(E)838055	<i>Cyclocephala erotylina</i>		edeago
CEUA	<i>Cyclocephala erotylina</i>	♀	COSTA RICA. Prov. Cartago. Jiménez. Pejibaye. Selva. Alb. El Copal. 1000m. 15 JUL 2007. A. García, M. A. Zumbado. Tp. Luz 2. L_N_196750_563695 #92252
CEUA	<i>Cyclocephala erotylina</i>	♂	El Copal, Prov. Cartago, Costa Rica. 12/10/2007 Leg. R. González
CEUA00106226	<i>Cyclocephala erotylina</i>	♂	COSTA RICA. Prov. Cartago. Jiménez. Pejibaye. Selva. Alb. El Copal. 1000m. 13 AGO 2007. A. García, M. Moraga, M. A. Zumbado. Tp. Luz 1. L_N_196750_563695 #92280
CEUA00003701	<i>Dilophochila bolacoides</i>	♂	México, Veracruz, Ayahualulco. 26-VII-1999. Leg.: E. Galante
CEUA00003693	<i>Epectinaspis mexicana</i>	♂	Xico (Ver.) Mexico. 18-8-2000. Leg.: E. Micó, J.R. Verdú, L. Arellano
CEUA00003694	<i>Epectinaspis mexicana</i>	♂	Briones (Ver.) Mexico.10-8-2000. Leg.: E. Micó, J.R. Verdú
CEUA00003695	<i>Epectinaspis mexicana</i>	♀	Martinica-Banderilla (Ver.) Mex. 19-7-2000. Leg.: E. Micó, J.R. Verdú, L. Arellano
CEUA	<i>Platycoelia humeralis</i>	♂	La Montura. Prov. Sn José Costa Rica. 09/10/2007 Leg. M. Moraga
CEUA00015920	<i>Platycoelia humeralis</i>	♀	Estación Zurquí, P.N. B. Carrillo (Costa Rica) 1550m 22-9-06. T. luz 17:00-23:00. Leg.: Micó, García, Galante
CEUA00016245	<i>Platycoelia humeralis</i>	♂	Tapanti (Costa Rica) 1300m 25-9-06 T. luz 23:00-3:00 Leg.: Micó, García, Galante
INBIOCRI000704210	<i>Strigoderma auriventris</i>	♀	2 km N Colonia Blanca, 800m. P. N. Rincon de la Vieja, Prov. Alajuela, Costa Rica, 13 a 28 jun 1992, III curso Parataxon. L- N 308800_397800
INBIOCRI002146709	<i>Strigoderma auriventris</i>	♂	Sect. San Ramon de Dos Rios, Prov. Alaju, COSTA RICA. 620m. 27 ABR-11 MAY 1995. F. A. Quesada, L_N_318100_381900 #5282
INBIOCRI002146725	<i>Strigoderma auriventris</i>	♀	Sect. San Ramon de Dos Rios, Prov. Alaju, COSTA RICA. 620m. 27 ABR-11 MAY 1995. F. A. Quesada, L_N_318100_381900 #5282
INB0003440610	<i>Strigoderma biolleyi</i>	♂	COSTA RICA. Prov. Cartago, P.N. Tapanti - Macizo de La Muerte, Sector la Represa, 1500 - 1600m, 17 MAR 2002, M. Alfaro, Libre L_N_186600_560400 #67222
INB0004238838	<i>Strigoderma biolleyi</i>	♀	Cartago, Costa Rica Reserva Tapanti 20 julio 86 1500m A. Solis B.
INBIOCRI000447386	<i>Strigoderma biolleyi</i>	♀	Cerro Plano, Res. Biol. Monteverde, 1300m, Prov. Punt, COSTA RICA, E Bello, Dic 1990, L- N 255200_446800
INBIOCRI000704437	<i>Strigoderma biolleyi</i>	♂	Quebrada Segunda, P. N. Tapanti, 1250m, Prov. Cartago, Costa Rica, Ago 1991, G. Mora, L-N 194000_560000
INBIOCRI000891467	<i>Strigoderma biolleyi</i>	♂	San Luis, 1040m, R. B. Monteverde, Prov. Puntarenas, Costa Rica, Oct 1992, Z. Fuentes y M. A. Zumbado, L- N 250850_449250
INBIOCRI001967558	<i>Strigoderma biolleyi</i>	♂	San Luis, 1040m, R.B. Monteverde, Prov. Punt, COSTA RICA. Mar 1993, Z. Fuentes. L N 250850_449250
INBIOCRI001734718	<i>Strigoderma nodulosa</i>	♂	R.B. Hitoy Cerere, Valle La Estrella, Prov. Limon, COSTA RICA. 100-200m. 21 Feb-8 Mar 1994, G. Carballo, L N 643400_184600 # 2688
INBIOCRI001892019	<i>Strigoderma nodulosa</i>	♂	Est. Quebrada Bonita, R. B. Carara, Prov. Punta, COSTA RICA. 50 m. May 1994, R. M. Guzman, L N 194500_469850 # 2914
INBIOCRI002559836	<i>Strigoderma nodulosa</i>	♀	COSTA RICA, Prov. Puntarenas, Urvanizacion El Colegio. 10m. 5-20 SET 1997. A. Azofeifa. Colecta Nocturna. L_S_276500_539600 #47723
INBIOCRI000862557	<i>Strigoderma sulcipennis</i>	♀	San Luis, 1040m, R. B. Monteverde, Prov. Puntarenas, Costa Rica, Oct 1992, Z. Fuentes, L- N 250850_449250
INBIOCRI001158667	<i>Strigoderma sulcipennis</i>	♀	Finca Jenny, 30 km norte de Liberia, Prov. Guana, COSTA RICA, 300m. 5-26 agos 1993, E. Araya, L N 316200_364400 #2335
INBIOCRI001158680	<i>Strigoderma sulcipennis</i>	♂	Finca Jenny, 30 km norte de Liberia, Prov. Guana, COSTA RICA, 300m. 5-26 agos 1993, E. Araya, L N 316200_364400 #2335
INBIOCRI002384129	<i>Strigoderma sulcipennis</i>	♂	Finca Jenny, 30 km N. de Liberia, Guanacaste, Costa Rica. 240m. 5-29 JUN 1996. E. Araya, L_N_317150_363700 #7549
CEUA00003821	<i>Yaaxkumukia conabioi</i>	♂	Cañada Talquian. Unión Juárez, Chiapas (Mexico) 7-4-2002 Leg.: E. Galante
CEUA00003825	<i>Yaaxkumukia conabioi</i>	♀	Cañada Talquian. Unión Juárez, Chiapas (Mexico) 7-4-2002 Leg.: E. Galante

Anexo 2

Especímenes tipo (incluidos subespecies y sinónimos) y otro material consultados en las siguientes colecciones. BMNH: The Natural History Museum, London, United KingdomMLUH: Martin-Luther-Universitat, Halle, Germany. MNHN: Museum National d'Histoire Naturelle, Paris, France. MNHUB: Museum für Naturkunde der Humboldt Universität zu Berlin, Germany.



Universitat d'Alacant
Universidad de Alicante

Species	Author	Museum
<i>A. ampicoma</i>	Bates 1888	BMNH MNHN
<i>A. antica</i>	Ohaus 1897	MNHUB
<i>A. arara</i>	Ohaus 1897	MNHUB
<i>A. arrawaka</i>	Ohaus 1902	MNHUB
<i>A. atomogramma</i>	Bates 1888	BMNH MNHN
<i>A. attenuata</i>	Bates 1888	BMNH MNHN
<i>A. balzapambae</i>	Ohaus 1897	MNHN MNHUB
<i>A. barbarae</i>	Frey 1968	BMNH MNHUB
<i>A. barbicollis</i>	Bates 1888	BMNH MNHN
<i>A. batesi</i>	Ohaus 1902	MNHUB
<i>A. beckeri</i>	Ohaus 1897	MNHUB
<i>A. bogotensi</i>	Ohaus 1897	MNHUB
<i>A. boliviana</i>	Ohaus 1897	MNHUB
<i>A. bruchiana</i>	Ohaus 1911	MNHUB
<i>A. calceata</i>	Chevolat 1865	MNHUB
<i>A. calligrapha</i>	Bates 1888	MNHUB
<i>A. capito</i>	Ohaus 1897	MNHUB
<i>A. carinifrons</i>	Bates 1888	MNHN
<i>A. castaniceps</i>	Bates 1888	BMNH MNHN
<i>A. catoxantha</i>	Burmeister 1855	MLUH
<i>A. championi</i>	Bates 1888	BMNH
<i>A. chevrolati</i>	Bates 1888	BMNH MNHUB
<i>A. chiriquina</i>	Bates 1888	BMNH
<i>A. chloroptera</i>	Burmeister 1844	MLUH
<i>A. chloropyga</i>	Ohaus 1897	BMNH MNHUB
<i>A. chromicolor</i>	Burmeister 1855	MLUH
<i>A. chrysanthe</i>	Bates 1888	BMNH MNHUB
<i>A. chrysomelina</i>	Bates 1888	BMNH
<i>A. cincta</i>	Say 1835	MNHUB
<i>A. clathrata</i>	Ohaus 1930	MNHUB
<i>A. cnetropyga</i>	Bates 1888	BMNH MNHN
<i>A. columbica</i>	Ohaus 1902	MNHUB
<i>A. compressicollis</i>	Bates 1888	BMNH
<i>A. conradi</i>	Bates 1888	BMNH
<i>A. cribriceps</i>	Bates 1888	BMNH
<i>A. decolor</i>	Bates 1888	BMNH MNHN
<i>A. denticollis</i>	Bates 1888	BMNH
<i>A. discoidalis</i>	Bates 1888	BMNH MNHUB
<i>A. donovani</i>	Stephens 1830	MNHN
<i>A. doryphorina</i>	Bates 1888	BMNH MNHN
<i>A. eucoma</i>	Bates 1888	BMNH MNHN
<i>A. eulissa</i>	Bates 1888	BMNH MNHUB
<i>A. flamina</i>	Ohaus 1933	MNHUB
<i>A. flavilla</i>	Bates 1888	BMNH MNHN
<i>A. flavizona</i>	Bates 1888	BMNH MNHN MNHUB
<i>A. flohri</i>	Ohaus 1897	MNHUB
<i>A. foraminosa</i>	Bates 1888	BMNH MNHUB
<i>A. forreri</i>	Bates 1888	BMNH MNHN
<i>A. foveiceps</i>	Ohaus 1897	MNHUB
<i>A. fulgidicollis</i>	Blanchard 1851	MNHN
<i>A. fulvocostata</i>	Ohaus 1902	MNHUB
<i>A. gemella</i>	Say 1835	MNHUB
<i>A. guatemalena</i>	Bates 1888	BMNH

Species	Author	Museum
<i>A. hispidipennis</i>	Ohaus 1897	MNHUB
<i>A. hispidula</i>	Bates 1888	BMNHMNHN
<i>A. histrionella</i>	Bates 1888	BMNHMNHN
<i>A. hoegei</i>	Ohaus 1897	MNHN MNHUB
<i>A. hoepfneri</i>	Bates 1888	BMNH MNHUB
<i>A. hoppi</i>	Ohaus 1928	MNHUB
<i>A. hylobia</i>	Ohaus 1897	MNHUB
<i>A. incostans</i>	Burmeister 1844	MLUH
<i>A. jordani</i>	Ohaus 1902	MNHUB
<i>A. juquilensis</i>	Ohaus 1897	MNHUB
<i>A. laesicollis</i>	Bates 1888	BMNH MNHN
<i>A. lepida</i>	Burmeister 1844	MLUH
<i>A. ligulipes</i>	Ohaus 1897	MNHUB
<i>A. limbaticollis</i>	Blanchard 1851	MNHN
<i>A. luciae</i>	Blanchard 1851	MNHN
<i>A. lucicola</i>	Fabricius 1798	MNHUB
<i>A. megalops</i>	Bates 1888	BMNH MNHN
<i>A. mesocnemis</i>	Ohaus 1902	MNHUB MNHN
<i>A. micans</i>	Burmeister 1844	MLUH
<i>A. millepora</i>	Bates 1888	BMNH MNHN
<i>A. mimeloides</i>	Ohaus 1902	MNHUB
<i>A. minima</i>	Ohaus 1897	MNHUB
<i>A. mutabilis</i>	Ohaus 1897	MNHUB
<i>A. nigrosellata</i>	Ohaus 1905	MNHUB
<i>A. nitescens</i>	Bates 1888	BMNH MNHN
<i>A. nitidula</i>	Blanchard 1851	BMNH MNHN
<i>A. nutans</i>	Bates 1888	BMNH
<i>A. obovata</i>	Ohaus 1933	MNHUB
<i>A. ochroptera</i>	Bates 1888	BMNH MNHN
<i>A. oreas</i>	Ohaus 1897	MNHUB
<i>A. phosphora</i>	Bates 1888	BMNH MNHN
<i>A. pilosipennis</i>	(Ohaus 1897)	MNHUB
<i>A. plurisulcata</i>	Bates 1888	BMNH MNHUB
<i>A. polygona</i>	Bates 1888	MNHN
<i>A. popayana</i>	Ohaus 1897	MNHUB
<i>A. praecellens</i>	Bates 1888	BMNH MNHN
<i>A. punctatipennis</i>	Blanchard 1851	MNHN
<i>A. quiché</i>	Ohaus 1897	MNHUB
<i>A. quirina</i>	Ohaus 1933	MNHUB
<i>A. repressa</i>	Ohaus 1908	MNHUB
<i>A. retusicollis</i>	Bates 1888	BMNH MNHN
<i>A. rhizotrogoides</i>	Blanchard 1851	MNHN
<i>A. rhodope</i>	Bates 1888	BMNH MNHN MNHUB
<i>A. ruatana</i>	Bates 1888	BMNH MNHN
<i>A. salticola</i>	Ohaus 1897	MNHUB
<i>A. sejuncta</i>	Bates 1888	BMNH MNHN
<i>A. semicincta</i>	Bates 1888	BMNH MNHN
<i>A. semitonsa</i>	Bates 1888	BMNH MNHN MNHUB
<i>A. simillima</i>	Ohaus 1897	MNHUB
<i>A. stempelmanni</i>	Ohaus 1914	MNHUB
<i>A. sticticoptera</i>	Blanchard 1851	MNHN MNHUB
<i>A. strigicollis</i>	Ohaus 1902	MNHUB
<i>A. subaenea</i>	Nonfried 1893	MNHUB

Species	Author	Museum
<i>A. sylphis</i>	Bates 1888	BMNH MNHN
<i>A. tessellatipennis</i>	Blanchard 1851	MNHN
<i>A. testaceipennis</i>	Blanchard 1851	MNHUB MNHN
<i>A. tolenis</i>	Bates 1888	BMNH MNHN
<i>A. toluhana</i>	Ohaus 1902	BMNH
<i>A. trapezifera</i>	Bates 1888	MNHN
<i>A. undulata</i>	Melsheimer 1844	BMNH MNHUB
<i>A. variolata</i>	Bates 1888	BMNH
<i>A. variolosa</i>	Ohaus 1928	MNHUB
<i>A. vayana</i>	Ohaus 1930	MNHUB
<i>A. veraecrucis</i>	Bates 1888	BMNH MNHN
<i>A. vespertilio</i>	Ohaus 1902	MNHN MNHUB
<i>A. villosella</i>	Blanchard 1851	MNHUB
<i>A. violacea</i>	Burmeister 1844	MLUH MNHUB
<i>A. vulcanicola</i>	Ohaus 1897	MNHN MNHUB
<i>A. xantholea</i>	Bates 1888	BMNH
<i>A. xiphostetha</i>	Bates 1888	BMNH MNHN MNHUB
<i>A. zapotensis</i>	Bates 1888	BMNH MNHN
<i>C. aequatorialis</i>	(Ohaus 1897)	MNHUB MNHN
<i>C. antis</i>	(Ohaus 1902)	MNHUB
<i>C. benicolus</i>	(Ohaus 1897)	MNHUB
<i>C. bimaculatus</i>	(Blanchard 1851)	MNHN
<i>C. biolleyi</i>	(Ohaus 1902)	MNHUB
<i>C. buchwaldianus</i>	(Ohaus 1908)	MNHUB
<i>C. calonotus</i>	(Bates 1888)	BMNH MNHN
<i>C. caucanus</i>	(Ohaus 1897)	MNHUB
<i>C. cayapó</i>	(Ohaus 1902)	MNHUB
<i>C. chalcosomus</i>	(Blanchard 1851)	MNHN MNHUB
<i>C. chlorotoides</i>	(Bates 1888)	MNHN
<i>C. chontalensis</i>	(Bates 1888)	BMNH MNHN
<i>C. coeruleus</i>	(Ohaus 1908)	MNHUB
<i>C. collaris</i>	(Burmeister 1844)	MLUH
<i>C. cupricollis</i>	(Chevrolat 1834)	MNHN
<i>C. eckhardti</i>	(Ohaus 1897)	MNHUB
<i>C. flavofemoratus</i>	(Ohaus 1897)	MNHUB
<i>C. fulvopiceus</i>	(Ohaus 1928)	MNHUB
<i>C. granulipygus</i>	(Bates 1888)	BMNHMNHN
<i>C. hiekei</i>	(Frey 1968)	MNHUB
<i>C. jansoni</i>	(Ohaus 1897)	MNHUB
<i>C. kolbei</i>	(Ohaus 1897)	MNHUB
<i>C. kulzeri</i>	(Frey 1968)	MNHUB
<i>C. ladinus</i>	(Ohaus 1902)	MNHUB
<i>C. levii</i>	(Blanchard 1851)	MNHN
<i>C. marginicollis</i>	(Bates 1888)	BMNH MNHUB
<i>C. megalis</i>	(Bates 1888)	BMNH MNHN
<i>C. microcephalus</i>	(Burmeister 1844)	MLUH
<i>C. mojo</i>	(Ohaus 1897)	(MNHUB)
<i>C. naponensis</i>	(Ohaus 1897)	MNHUB
<i>C. nicoyus</i>	(Ohaus 1928)	MNHUB
<i>C. ochrogastus</i>	(Bates 1888)	BMNH MNHN
<i>C. panamensis</i>	(Ohaus 1902)	MNHUB

Species	Author	Museum
<i>C. penai</i>	(Frey 1968)	MNHUB
<i>C. plagiatas</i>	(Nonfried 1894)	MNHUB
<i>C. porcatus</i>	(Blanchard 1851)	MNHN
<i>C. pulcher</i>	(Blanchard 1851)	MNHN
<i>C. pupillatus</i>	(Burmeister 1844)	BMNH MLUH MNHN
<i>C. pyropygus</i>	(Nonfried 1891)	MNHUB
<i>C. rosenbergi</i>	(Ohaus 1902)	MNHUB
<i>C. rufomicans</i>	(Ohaus 1897)	MNHUB
<i>C. specularis</i>	(Bates 1888)	BMNH
<i>C. strigidiodes</i>	(Blanchard 1851)	MNHN
<i>C. sulcans</i>	(Bates 1888)	BMNH
<i>C. tricostulatus</i>	(Ohaus 1897)	MNHUB
<i>C. validus</i>	(Burmeister 1844)	MLUH
<i>C. vanpatteni</i>	(Bates 1888)	BMNH MNHN
<i>C. viduus</i>	(Newman 1838)	BMNH
<i>C. virescens</i>	(Burmeister 1844)	MLUH
Sin material tipo		
<i>A. binotata</i>	(Gyllenhaal in Schönherr 1817)	BMNH MNHUB MNHN
<i>A. brunnipennis</i>	(Gyllenhaal in Schönherr 1817)	BMNH MNHUB MNHN
<i>A. cavifrons</i>	Leconte 1868	MNHUB
<i>A. centralis</i>	Leconte 1863	BMNH MNHN
<i>A. crinicollis</i>	Ohaus 1902	MNHUB MNHN
<i>A. hondurae</i>	(Nonfried 1891)	MNHUB
<i>A. insularis</i>	(Laporte 1840)	BMNH MNHUB MNHN
<i>A. ludoviciana</i>	Schaeffer 1906	BMNH
<i>A. medellina</i>	Ohaus 1897	BMNH MNHUB MNHN
<i>A. peninsularis</i>	Schaeffer 1906	MNHUB
<i>C. atropurpureus</i>	(Ohaus 1897)	BMNH
<i>C. cicatricosus</i>	(Perty 1832)	BMNH MNHUB MNHN
<i>C. marginatus</i>	(Fabricius 1792)	BMNH MNHUB MNHN
<i>C. nigroaeneus</i>	(Ohaus 1897)	BMNH MNHUB MNHN
<i>C. puncticollis</i>	(Kirsch 1885)	MNHUB MNHN
<i>C. pyritosus</i>	(Erichson 1847)	MNHUB
<i>C. sulcipennis</i>	(Laporte 1840)	BMNH MNHUB MNHN
<i>C. suratus</i>	(Burmeister 1844)	MNHUB

Anexo 3

Caracteres morfológicos utilizados para el análisis filogenético.

1. **Perfil dorsal del borde anterior del clipeo masculino:**
 - o. sinuado
 1. recto o redondeado
 2. escotado
2. **Forma del clipeo masculino en vista dorsal:**
 - o. subtrapezoidal
 1. rectangular
 2. redondo o parabólico
3. **Prominencia central del clipeo:**
 - o. ausente
 1. presente
4. **Elevación del borde anterior del clipeo:**
 - o. débil o moderada
 1. pronunciada
5. **Superficie de la frente:**
 - o. plana o convexa
 1. cóncava
6. **Presencia de tubérculos en la cabeza del macho:**
 - o. ausente
 1. presente
7. **Distancia interocular:**
 - o. angosta, entre 2 y 4 diámetros oculares
 1. ancha, más de 4 diámetros oculares
8. **Longitud del canto ocular:**
 - o. corto y ancho
 1. largo y esbelto
9. **Número de artejos antenales:**
 - o. 10

1. 9
10. **Longitud de la maza antenal en machos respecto a la hembra:**
 0. más larga por más de $1/4$ de la longitud total
 1. similar o ligeramente mayor
11. **Borde apical mandibular:**
 0. simple
 1. con 2 dientes
 2. con 3 dientes
12. **Borde apical de las mandíbulas en posición lateral:**
 0. recto
 1. curvado lateralmente respecto al resto de la superficie
13. **Número de espinas del diente maxilar:**
 0. menos de seis
 1. seis
 2. siete
14. **Dimensión dientes maxilares:**
 0. largos y curvados
 1. cortos y rectos
15. **Forma del borde anterior del labro:**
 0. recto o sinuado
 1. proyectado
 2. cuadrilobulado
16. **Perfil del margen apical del labio:**
 0. sinuado
 1. escotado
 2. proyectado
 3. cuadrilobulado
17. **Superficie del labio:**
 0. cóncava en prementón y mentón
 1. uniformemente convexa
 2. plana
18. **Amplitud de la base del prementón:**
 0. estrecha, haciendo notables los ángulos apicales del mentón

1. amplia, al mismo nivel que el ápice del mentón
- 19. Proporciones del pronoto ancho mesial/largo:**
 - o. estrecho: $4/3$ más ancho que largo
 1. normal: próximo a 2 veces más ancho que largo
 2. ancho: notablemente más ancho que largo (>2)
- 20. Posición del ápex de la curva de los lados laterales del pronoto:**
 - o. en el tercio anterior
 1. en la mitad
- 21. Anchura de la base del pronoto respecto a la base de los élitros:**
 - o. más angosta
 1. similar
- 22. Extensión de la estructura laminar cuticular del margen anterior del pronoto:**
 - o. completa
 1. incompleta
- 23. Margen posterior del pronoto:**
 - o. con reborde
 1. liso
- 24. Forma del borde posterior del pronoto:**
 - o. sinuado
 1. emarginado o recto en correspondencia del escutelo
- 25. Forma del borde lateral del pronoto:**
 - o. redondeado o angulado
 1. sinuado
- 26. Aspecto de la superficie del pronoto:**
 - o. liso
 1. irregular
- 27. Superficie del pronoto de los machos:**
 - o. débilmente convexa
 1. fuertemente convexa
- 28. Forma dorsal del pronoto:**
 - o. trapezoidal

1. rectangular o cuadrado
29. **Borde anterior del pronoto escotado ligeramente:**
 0. no
 1. si
30. **Presencia de fóvea mediana en el pronoto:**
 0. ausente
 1. presente
31. **Posición de los mesoepímeros respecto al húmero elital:**
 0. interna o al mismo nivel, no visibles dorsalmente
 1. expuesta y visible
32. **Espacio intercoxal del mesoesternón:**
 0. estrecho: $1/4$ del ancho de la coxa
 1. amplio: $1/2$ del ancho de la coxa
 2. ancho: similar al ancho de la coxa
33. **Desarrollo del mesoesternón:**
 0. no producido
 1. producido hasta la mesocoxa, con ápex ligado al mesoventrite
 2. producido sobrepasando la mesocoxa de por lo menos mitad de la altura de la coxa, con ápex separado del mesoventrite
34. **Sutura mesometaesternal:**
 0. bien definida
 1. pobremente definida o ausente
35. **Posición de la sutura mesometaesternal:**
 0. basal
 1. llegando al mesotrocanter
36. **Número de dientes en las protibias:**
 0. uno
 1. dos
 2. tres
37. **Longitud relativa de la primera espina protibial en el macho:**
 0. corta: menor o igual a $1/5$ de la longitud total
 1. larga: mayor a $1/5$

38. **Protibia masculina ensanchada respecto a la femenina:**
- o. notablemente
 1. poco o nada
39. **Posición en vista lateral del denticulo del 5º protarsómero masculino:**
- o. mesial
 1. basal
40. **Longitud del primer protarsómero en machos:**
- o. similar a la longitud de los otros
 1. más largo
41. **Longitud del 5º protarsómero en machos:**
- o. más corto de la suma de los tarsómeros 1-4
 1. similar a la suma de los tarsómeros 1-4
 2. más largo de la suma de los tarsómeros 1-4
42. **Longitud del 5º mesotarsómero:**
- o. similar a la suma de los tarsómeros 1-4
 1. más corto de la suma de los tarsómeros 1-4
43. **Forma del onichium:**
- o. cilíndrico
 1. laminar
44. **Proporción de los élitros:**
- o. menor o igual a 1.14
 1. mayor o igual a 1.15
45. **Macrotectura de los élitros:**
- o. costillas delineadas por puntos o surcos e intersticios punteados finamente
 1. punteados irregulares
 2. lisos
 3. estriados
46. **Lámina cuticular del borde epipleural:**
- o. ausente
 1. presente
47. **Extensión de la estructura laminar cuticular del borde epipleural:**
- o. incompleta (hasta la mitad o menos)

1. casi completa
- 48. Forma general del élitro:**
 - o. punto más ancho en la mitad
 1. punto más ancho en el tercio apical
 2. punto más ancho en la base
- 49. Forma del ápice de la sutura elitral:**
 - o. curva
 1. angulada o espiniforme
- 50. Parches de setas en los bordes pleurales:**
 - o. ausentes
 1. presentes
- 51. Forma del 6° espiráculo abdominal:**
 - o. anular (ligeramente evertido)
 1. tuberculiforme (protuberante y cilíndrico)
- 52. Longitud de la membrana apical del último esternito abdominal en los machos:**
 - o. estrecha: menos de 1/2 de la anchura de la parte basal
 1. ancha: más de 1/2 de la anchura de la parte basal
- 53. Longitud del tecto respecto a la pieza basal:**
 - o. más largo
 1. similar
 2. más corto
- 54. Callos laterales del tecto:**
 - o. ausentes
 1. presentes
- 55. Presencia de placa ventral:**
 - o. presente
 1. ausente
- 56. Placa ventral:**
 - o. fusionada a los parámetros
 1. separada de los parámetros
- 57. Aspecto de la placa ventral:**
 - o. lisa

1. con protuberancias
2. con un repliegue apical
3. que termina en punta

58. Parámetros:

- o. separados
1. fusionados entre ellos

59. Forma del margen ventral de los parámetros:

- o. curvo
1. sinuado
2. fuertemente sinuado, dos apices al mismo nivel
3. cuadrado

60. Forma del ápice de los parámetros en vista lateral:

- o. agudos
1. obtusos pero sobresalientes
2. obtusos y anchos, continuos con los márgenes

61. Orientación del ápice de los parámetros:

- o. verticales
1. horizontales

62. Parámetros con parte membranosa:

- o. no
1. si

63. Lóbulo mediano:

- o. ausente
1. esclerificado

64. Número y posición de las esclerotizaciones del lóbulo mediano:

- o. una ventral
1. dos laterales
2. una dorsal

65. Porción apical del lóbulo mediano:

- o. lisa
1. proyectada en forma de espina

66. Presencia de pliegues laterales en el lóbulo mediano:

- o. no

1. si
- 67. Forma de los brazos del Spiculum Gastrale:**
 - o. horizontales (en forma de T)
 1. oblicuos (en forma de Y o V)
- 68. Tamaño de la porción basal del Spiculum Gastrale:**
 - o. larga: más de la mitad del brazo
 1. corta: hasta mitad de la longitud del brazo
 2. ausente
- 69. Posición de la abertura del canal eyaculador:**
 - o. apical
 1. lateral
 2. en medio
- 70. Esclerotización del canal eyaculador:**
 - o. no esclerotizado
 1. canal esclerotizado
 2. presencia de spiculum esclerotizado
- 71. Brazos del saco interno:**
 - o. forma globular
 1. un solo brazo largo
 2. dos brazos de longitud similar
 3. dos brazos de longitud marcadamente desigual
- 72. Brazo accesorio del endofalo en espiral:**
 - o. no
 1. si
- 73. Elementos del saco interno, placas esclerotizadas:**
 - o. ausentes
 1. presentes
- 74. Elementos del saco interno, parches de espinas gruesas:**
 - o. ausentes
 1. en parches limitados, con espinas generalmente gruesas y oscuras

Anexo 4

Clave dicotómica para la identificación de los Anomalini de Costa Rica en español

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Anexo 5

Datos de los especímenes utilizados para el análisis filogenético del capítulo 5.

Cons.: método de conservación



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FAMILIA	TRIBU	ESPECIE	CONS.	AÑO	VOUCHER	LOCALIDAD
Rutelidae	Anomalini	Anomala_cupricollis	etanol	2010	CEUA00105809	Cabanga, Alajuela, Costa Rica.
Rutelidae	Anomalini	Anomala_cupricollis	etanol	2010	CEUA00105810	Cabanga, Alajuela, Costa Rica.
Rutelidae	Anomalini	Anomala_discoidalis	etanol	2009	CEUA00105820	Cabanga, Alajuela, Costa Rica.
Rutelidae	Anomalini	Anomala_discoidalis	etanol	2009	CEUA00105821	Cabanga, Alajuela, Costa Rica.
Rutelidae	Anomalini	Anomala_aereiventris	seco	2008	CEUA00105843	La Esperanza, Cartago. Costa Rica
Rutelidae	Anomalini	Anomala_aglaos	seco	2008	CEUA00106186	Volcán Tenorio, Alajuela, Costa Rica.
Rutelidae	Anomalini	Anomala_aglaos	etanol	2010	CEUA00106232	Catarata Río Buenavista, Alajuela, Costa Rica.
Rutelidae	Anomalini	Anomala_arara	etanol	2007-08	CEUA	retrieved from GenBank
Rutelidae	Anomalini	Anomala_arara	etanol	2010	CEUA00106237	Catarata Río Buenavista, Alajuela, Costa Rica.
Rutelidae	Anomalini	Anomala_arara	etanol	2010	CEUA00106238	Catarata Río Buenavista, Alajuela, Costa Rica.
Rutelidae	Anomalini	Anomala_balzapambae	seco	2008	CEUA00105805	Volcán Tenorio, Alajuela, Costa Rica.
Rutelidae	Anomalini	Anomala_calligrapha	etanol	2007-08	CEUA	retrieved from GenBank
Rutelidae	Anomalini	Anomala_calligrapha	seco	2007	CEUA00105803	Albergue Heliconias, Alajuela, Costa Rica
Rutelidae	Anomalini	Anomala_chapini	etanol	2010	CEUA00106227	Cabanga, Alajuela, Costa Rica.
Rutelidae	Anomalini	Anomala_chapini	etanol	2010	CEUA00106228	Cabanga, Alajuela, Costa Rica.
Rutelidae	Anomalini	Anomala_clarivillosa	seco	2008	CEUA00105909	La Esperanza, Cartago. Costa Rica
Rutelidae	Anomalini	Anomala_contusa	seco	2008	CEUA00105866	Volcán Tenorio, Alajuela, Costa Rica.
Rutelidae	Anomalini	Anomala_cupreovariolosa	seco	1995	CEUA00106170	Las Tablas, Puntarenas, Costa Rica
Rutelidae	Anomalini	Anomala_discoidalis	etanol	2007-08	CEUA	retrieved from GenBank
Rutelidae	Anomalini	Anomala_divisa	seco	1992	CEUA00106198	Las Alturas, Puntarenas, Costa Rica
Rutelidae	Anomalini	Anomala_estrella	seco	1992	CEUA00105806	Los Almendros, Guanacaste, Costa Rica.
Rutelidae	Anomalini	Anomala_eucoma_1	seco	1992	CEUA00105265	Estación Sirena, Puntarenas, Costa Rica
Rutelidae	Anomalini	Anomala_eucoma_2	seco	1993	CEUA00105267	Estación Las Pailas, Guanacaste, Costa Rica.

Rutelidae	Anomalini	Anomala_eucoma_2	seco	1993	CEUA00105266	Estación Las Pailas, Guanacaste, Costa Rica
Rutelidae	Anomalini	Anomala_eucoma_3	seco	1993	CEUA00105271	Amubri, Limon, Costa Rica.
Rutelidae	Anomalini	Anomala_eucoma_3	seco	1994	CEUA00105270	Amubri, Limon, Costa Rica.
Rutelidae	Anomalini	Anomala_eulissa	seco	2008	CEUA00106225	Isla Bonita, Alajuela, Costa Rica.
Rutelidae	Anomalini	Anomala_eusticta	seco	1995	CEUA00106063	Estación La Casona, Puntarenas, Costa Rica
Rutelidae	Anomalini	Anomala_ferrea	seco	1988	INBIOCRI002517845	San Vito Las Cruces, Puntarenas, Costa Rica
Rutelidae	Anomalini	Anomala_flavacoma	seco	2010	CEUA00105076	Estación Cabro Muco, Guanacaste, Costa Rica.
Rutelidae	Anomalini	Anomala_globulata	seco	2008	CEUA00105885	Tapantí, Cartago, Costa Rica.
Rutelidae	Anomalini	Anomala_hoppi	seco	2008	CEUA00106223	Cerro Bitárkara, Limón, Costa Rica.
Rutelidae	Anomalini	Anomala_levicollis	seco	2008	CEUA00105850	Volcán Tenorio, Alajuela, Costa Rica.
Rutelidae	Anomalini	Anomala_longisacculata	etanol	2007-08	CEUA	retrieved from GenBank
Rutelidae	Anomalini	Anomala_longisacculata	etanol	2009	CEUA00106233	Cabanga, Alajuela, Costa Rica.
Rutelidae	Anomalini	Anomala_megalia	seco	1992	INBIOCRI000988672	Manzanillo, Limon, Costa Rica.
Rutelidae	Anomalini	Anomala_megaparamera	seco	1990	CEUA00105268	Estación Cuatro Esquinas, Limon, Costa Rica.
Rutelidae	Anomalini	Anomala_mesosticta	etanol	2010	CEUA00106231	Cabanga, Alajuela, Costa Rica.
Rutelidae	Anomalini	Anomala_nigroflava	seco	2007	CEUA00106190	Estación El Tigre, Puntarenas, Costa Rica
Rutelidae	Anomalini	Anomala_obovata	seco	2008	CEUA00106224	Tapantí, Cartago, Costa Rica.
Rutelidae	Anomalini	Anomala_perspica	seco	2008	CEUA00105879	Tapantí, Cartago, Costa Rica.
Rutelidae	Anomalini	Anomala_pincelada	seco	1993	CEUA00106160	Estación Murcielago, Guanacaste, Costa Rica
Rutelidae	Anomalini	Anomala_praecellens	etanol	2007-08	CEUA	retrieved from GenBank
Rutelidae	Anomalini	Anomala_praecellens	seco	2007	CEUA00106217	Estacion Pitilla, Guanacaste, Costa Rica.
Rutelidae	Anomalini	Anomala_pseudoeucoma	etanol	2010	CEUA00106229	Cabanga, Alajuela, Costa Rica.
Rutelidae	Anomalini	Anomala_quiche	seco	1993	INBIOCRI001331539	Estación Las Pailas, Guanacaste, Costa Rica
Rutelidae	Anomalini	Anomala_semicineta	etanol	2010	CEUA00106230	Catarata Río Buenavista, Alajuela, Costa Rica.

Rutelidae	Anomalini	Anomala_semilla	etanol	2007-08	CEUA	retrieved from GenBank
Rutelidae	Anomalini	Anomala_semilla	seco	2007	CEUA00106175	Volcán Tenorio, Alajuela, Costa Rica.
Rutelidae	Anomalini	Anomala_sp203	seco	1996	INBIOCR1002459941	Finca Jenny, Guanacaste, Costa Rica
Rutelidae	Anomalini	Anomala_sp249	seco	2004	INBIOCR1003853316	Ostional, Guanacaste, Costa Rica
Rutelidae	Anomalini	Anomala_stillaticia	seco	1992	CEUA00106066	Quebrada Segunda, Cartago, Costa Rica
Rutelidae	Anomalini	Anomala_strigodermoides	seco	2010	CEUA00106215	Catarata Río Buenavista, Alajuela, Costa Rica.
Rutelidae	Anomalini	Anomala_subridens	seco	2008	CEUA00105864	La Esperanza, Cartago, Costa Rica
Rutelidae	Anomalini	Anomala_subridens	seco	2008	CEUA00105802	La Esperanza, Cartago, Costa Rica
Rutelidae	Anomalini	Anomala_subusta	seco	2008	CEUA00105804	Volcán Tenorio, Alajuela, Costa Rica.
Rutelidae	Anomalini	Anomala_tenoriensis	seco	2008	CEUA00105841	Volcán Tenorio, Alajuela, Costa Rica.
Rutelidae	Anomalini	Anomala_testaceipennis	seco	2010	CEUA00106216	Restaurante Rancho de Billo, Puntarenas, Costa Rica
Rutelidae	Anomalini	Anomala_testaceipennis	etanol	2010	CEUA00106234	Buenavista, Alajuela, Costa Rica.
Rutelidae	Anomalini	Anomala_tuberculata	etanol	2007-08	CEUA	retrieved from GenBank
Rutelidae	Anomalini	Anomala_tuberculata	etanol	2010	CEUA00106235	Catarata Río Buenavista, Alajuela, Costa Rica.
Rutelidae	Anomalini	Anomala_tuberculata	etanol	2010	CEUA00106236	Catarata Río Buenavista, Alajuela, Costa Rica.
Rutelidae	Anomalini	Anomala_valida	seco	2008	CEUA00003281	Horquetas, Heredia, Costa Rica
Rutelidae	Anomalini	Anomala_vallisneria	seco	1992	CEUA00106071	Estación Cacao, Guanacaste, Costa Rica
Rutelidae	Anomalini	Anomala_volsellata	seco	2009	INBIOCR1004191779	Cerro Brujo, Puntarenas, Costa Rica
Rutelidae	Anomalini	Anomala_zumbadoi	seco	1991	CEUA00106203	Boca del Río Esquinas, Puntarenas, Costa Rica
Rutelidae	Anomalini	Anomalorhina_turrialbana	seco	2010	CEUA00105807	Cabanga, Alajuela, Costa Rica.
Rutelidae	Anomalini	Callistethus_mimeloides	etanol	2007-08	CEUA	retrieved from GenBank
Rutelidae	Anomalini	Callistethus_chontalensis	etanol	2010	CEUA00105811	Catarata Río Buenavista, Alajuela, Costa Rica.
Rutelidae	Anomalini	Callistethus_chontalensis	etanol	2010	CEUA00105812	Cabanga, Alajuela, Costa Rica.
Rutelidae	Anomalini	Callistethus_granulipygus	etanol	2010	CEUA00105813	Cabanga, Alajuela, Costa Rica.

Rutelidae	Anomalini	Callistethus_schneideri	etanol	2010	CEUA00105816	Catarata Río Buenavista, Alajuela, Costa Rica.
Rutelidae	Anomalini	Callistethus_schneideri	etanol	2010	CEUA00105817	Catarata Río Buenavista, Alajuela, Costa Rica.
Rutelidae	Anomalini	Callistethus_specularis	seco	2007	CEUA00105278	Isla Bonita, Alajuela, Costa Rica.
Rutelidae	Anomalini	Callistethus_carbo	seco	1992	CEUA00105294	Río San Lorenzo, Guanacaste, Costa Rica.
Rutelidae	Anomalini	Callistethus_fuscorubens	seco	1995	CEUA00105284	Estación Altamira, Puntarenas, Costa Rica.
Rutelidae	Anomalini	Callistethus_jordani	seco	1992	INBIOCR1000909339	Estación Biológica Las Alturas, Puntarenas, Costa Rica.
Rutelidae	Anomalini	Callistethus_lativittis	etanol	2010	CEUA00105814	Cabanga, Alajuela, Costa Rica.
Rutelidae	Anomalini	Callistethus_lativittis	etanol	2010	CEUA00105815	Cabanga, Alajuela, Costa Rica.
Rutelidae	Anomalini	Callistethus_levigatus	seco	2007	CEUA00105281	Volcán Tenorio, Alajuela, Costa Rica.
Rutelidae	Anomalini	Callistethus_macroxantholeus	seco	1992	CEUA00105293	Sector Cerro Cocori, Limon, Costa Rica
Rutelidae	Anomalini	Callistethus_macroxantholeus	etanol	2010	CEUA00105818	Catarata Río Buenavista, Alajuela, Costa Rica.
Rutelidae	Anomalini	Callistethus_microxantholeus	etanol	2010	CEUA00105819	Cabanga, Alajuela, Costa Rica.
Rutelidae	Anomalini	Callistethus_microxantholeus	etanol	2010	CEUA00105822	Cabanga, Alajuela, Costa Rica.
Rutelidae	Anomalini	Callistethus_microxantholeus	etanol	2010	CEUA00105823	Cabanga, Alajuela, Costa Rica.
Rutelidae	Anomalini	Callistethus_mimeloides	etanol	2010	CEUA00105808	Catarata Río Buenavista, Alajuela, Costa Rica.
Rutelidae	Anomalini	Callistethus_multiplicatus	seco	2010	CEUA00105283	Cabanga, Alajuela, Costa Rica
Rutelidae	Anomalini	Callistethus_parapulcher	seco	2009	CEUA00105287	Alto Jalisco, Puntarenas, Costa Rica
Rutelidae	Anomalini	Callistethus_rutelooides	seco	2007	CEUA00106211	Albergue El Copal, Cartago, Costa Rica
Rutelidae	Anomalini	Callistethus_sp304	seco	2007	CEUA00105801	Cerro Bitárkara, Limón, Costa Rica
Rutelidae	Anomalini	Callistethus_stannibracteus	seco	1990	CEUA00105277	Estacion Barva, Heredia, Costa Rica.
Rutelidae	Anomalini	Callistethus_valdecostatus	seco	1993	INBIOCR1001926964	Alto de las Moras, Puntarenas, Costa Rica.
Rutelidae	Anomalini	Callistethus_yalizo	seco	2008	CEUA00106167	La Esperanza, Cartago. Costa Rica
Dynastinae	Cyclocephalini	Cyclocephala_erotilina	etanol	2007-08	CEUA	retrieved from GenBank
Dynastinae	Cyclocephalini	Cyclocephala_atripes	etanol	2010	CEUA00106239	Catarata Río Buenavista, Alajuela, Costa Rica.

anexo 5

Dynastinae	Cyclocephalini	Cyclocephala_erotilina	seco	2007	CEUA00106226	Albergue El Copal, Cartago, Costa Rica
Rutelidae	Rutelini	Pelidnota frommeri	etanol	2007-08	CEUA	retrieved from GenBank
Rutelidae	Rutelini	Pelidnota notata	etanol	2007-08	CEUA	retrieved from GenBank
Rutelidae	Rutelini	Platycoelia humeralis	etanol	2007-08	CEUA	retrieved from GenBank
Rutelidae	Rutelini	Platycoelia mesosternalis	etanol	2007-08	CEUA	retrieved from GenBank
Rutelidae	Anomalini	Platycoelia_humeralis	seco	2008	CEUA00015920	Estación Zurquí, San José, Costa Rica
Rutelidae	Anomalini	Strigoderma_auriventris	seco	1992	INBIOCR1000704210	Rincón de la Vieja, Guanacaste, Costa Rica



Reunido el Tribunal que suscribe en el día de la fecha acordó otorgar, por _____ a la
Tesis Doctoral de Dña. Valentina Filippini la calificación de _____ .

Alicante de de

El Secretario,

El Presidente,



Universitat d'Alacant
Universidad de Alicante
UNIVERSIDAD DE ALICANTE

ESCUELA DE DOCTORADO

La presente Tesis de Dña. Valentina Filippini ha sido registrada con el nº _____ del
registro de entrada correspondiente.

Alicante __ de _____ de ____

El Encargado del Registro

La defensa de la tesis doctoral realizada por D^a Valentina Filippini se ha realizado en las siguientes lenguas: castellano e inglés, lo que unido al cumplimiento del resto de los requisitos establecidos en la Normativa propia de la UA le otorga la mención de “Doctor Internacional”.

Alicante de de

El Secretario,



El Presidente,

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