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DATA PAPER

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ChiloKey, an interactive identification tool for the geophilomorph centipedes of Europe (Chilopoda, Geophilomorpha)

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Abstract

ChiloKey is a matrix-based, interactive key to all 179 species of Geophilomorpha (Chilopoda) recorded from Europe, including species of uncertain identity and those whose morphology is known partially only. The key is intended to assist in identification of subadult and adult specimens, by means of microscopy and simple dissection techniques whenever necessary. The key is freely available through the web at: http://www.biologia.unipd.it/chilokey/ and at http://www.interactive-keys.eu/chilokey/.

Keywords

Interactive key, identification, morphology, Chilopoda, Geophilomorpha, Europe

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General description

Purpose: At present, species identification of centipedes (Chilopoda) can be hardly carried on through effective identification tools, because adequate keys or diagnostic tables are available only for selected faunas and taxonomic subgroups. More often, the identification of specimens still requires retrieving and interpreting the original species descriptions, which are scattered in the primary taxonomic literature. Additionally, it often requires comparing the specimens of unknown identity with reference specimens that have been already identified by expert taxonomists.

This is true in particular for the diverse centipede order Geophilomorpha, which comprises 40% of all known species of Chilopoda (Bonato et al. 2011). This applies also to the European taxa, despite the fact that Europe has been investigated more thoroughly than all other continents. Indeed, modern and effective keys are available for different countries in northern and central Europe (e.g., Barber 2008 for Great Britain, Andersson et al. 2005 for Sweden), but these keys cover relatively poor faunas, whereas most of the European taxonomic diversity is harboured in the southern countries (Bonato and Minelli 2009). As for southern Europe, modern keys have been published only for very few areas (e.g., Stoev 2002 for Bulgaria, Iorio 2006 for part of France). At present, as a matter of fact, the identification of specimens from most part of Europe needs complementing outdated faunas and keys (above all, Brolemann 1930 for France, Matic 1972 for Romania) with taxonomic descriptions published in different languages, most often in regional taxonomic journals.

Recently, after completing a comprehensive synopsis of the European species of Geophilomorpha (Bonato and Minelli 2014), the rapid improvement of technologies and expertise in developing identification tools (Dallwitz 2000, Delgado Calvo-Flores et al. 2006, Penev et al. 2009, Cerretti et al. 2012) prompted us to build a matrix-based interactive tool to assist in species identification of geophilomorphs from the entire Europe, based on examination of morphological characters. This paper is intended as a "Data Paper" describing this tool, following Penev et al. (2009, 2012).

Project details

Project title: ChiloKey.
Personnel: The authors.
Study area descriptions/descriptor: The key includes all species of Chilopoda Geophilomorpha that have been recorded from Europe. The area is delimited according to the conventional boundaries adopted in Fauna Europaea (de Jong 2013; Fig. 1).

Taxonomic coverage

General taxonomic coverage description: The key includes a total 179 species (supplementary file 1), following the taxonomy and nomenclature recently proposed by Bonato and Minelli (2014).

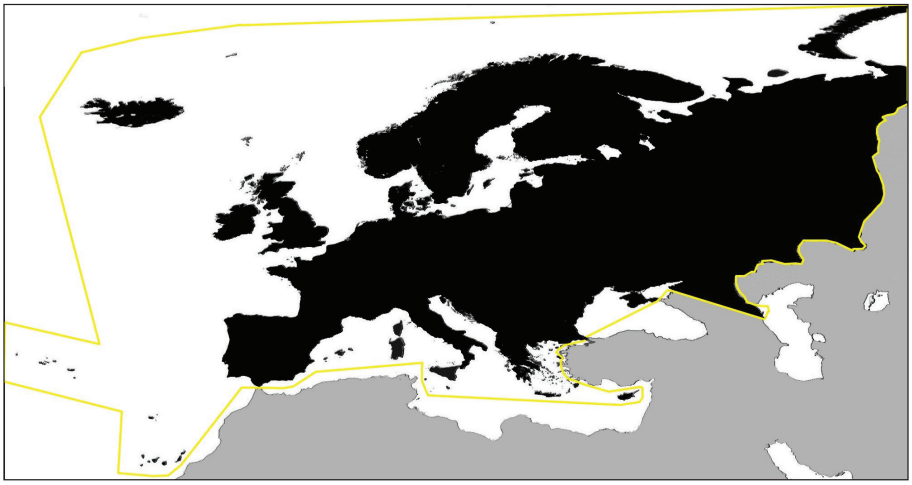

Figure 1. Conventional boundaries of the geographical area where ChiloKey is applicable.

Applicability and identification units: The key is intended to allow species-level identification of adult or subadult specimens, i.e. specimens with visible gonopods. The key allows also distinguishing the sex. Within a single species, the male and female phenotypes are treated operationally as distinct identification units, because some of the characters employed (different in different species) are also sexually dimorphic, and because some characters are applicable and effective in distinguishing species only for the male but not for the female or vice versa.

Morphological terminology: The key follows the conventional morphological terminology defined and illustrated by Bonato et al. (2010). Relevant body parts are labelled accordingly in the photos illustrating the character states (see below).

Operational methods: Only a few characters can be evaluated properly by means of a stereomicroscope, with incident light and at low magnification. In most cases, it is recommended to examine the specimen by means of a microscope, in transmitted light and at higher magnification, after including the specimen in a non-permanent microscopic slide.

The effective evaluation of some characters requires one or both of the following operations:

– detaching head from trunk. Recommended protocol: keeping the specimen under a stereomicroscope, on soft ground, with the dorsal side upwards; piercing the dorsal membrane between head and forcipular tergite repeatedly by means of a scalpel-like pin;
– detaching the maxillary complex from the remaining part of the head. Recommended protocol: after detaching head from trunk, keeping the head under a stereomicroscope, on a soft ground, with the ventral side upwards; piercing the lateral membranes connecting the second maxillary coxosternite to the pleurites repeatedly by means of a scalpel-like pin.

Further practical instructions are given by Pereira (2000) and Foddai et al. (2002).

Characters: A total of 89 characters have been considered, including 51 binary characters, 37 multistate characters with 3–5 alternative states each, and a "filtering" character (number of leg-bearing segment), which is allowed to assume any integer value up to 999. Of the characters, 15 are depending on the state of another character, therefore their applicability is constrained. The characters have been selected giving priority to those with null or negligible intraspecific variation with respect to our state definitions, and to those that do not require dissection. Among the characters proposed and employed in the literature as diagnostic between species, we excluded those that have been found or suspected to be actually poorly effective, because of either intraspecific variability or artifactual origin (Bonato and Minelli 2014). In the key, characters are arranged in four sections according to the operations required or recommended for their evaluation (Fig. 2): (i) characters that can be evaluated on the entire body, keeping the specimen with the ventral side upwards ("without dissection, ventral view"; 54 characters); (ii) as before, but with the dorsal side upwards ("without dissection, dorsal view"; 13 characters); (iii) characters that can only be evaluated after detaching the head from the trunk, keeping both pieces with the ventral side upwards ("after detaching head from trunk, ventral view"; 12 characters); (iv) characters that can only be evaluated after removing the maxillary complex from the head and keeping both the maxillary complex and the remaining part of the head with their ventral side upwards ("after detaching maxillary complex from head, ventral view"; 9 characters). Within a section, characters are arranged in anatomical order, anterior to posterior, proximal to distal. Characters that are diagnostic at the genus level are highlighted. Most character states are illustrated by microscopic photos taken on specimens of representative species.

Sources of data: Characters have been coded for each species referring to selected published descriptions and illustrations (indicated in the species-file under "Main references", see below; full references in supplementary file 2). Published information has been ignored when suspected or found to be inaccurate or based on misidentified specimens. For 67 species, data have been confirmed by us or integrated by direct examination of representative specimens, in the Bonato-Minelli collection, at the Department of Biology, University of Padova (supplementary file 1).

For a single species, more than one state have been assigned to a character whenever (i) there is interindividual variation, including sexual dimorphism, or (ii) the actual condition of the character is uncertain in the species, or (iii) subjectivity in evaluation could bring different users to score different states as present in the specimens at hand.

As to the number of leg-bearing segments, almost all species reported from Europe are known or expected to have interindividual variation in the number, the range of variation differing in different species, and the width of variation correlating approximately with the average value (Minelli et al. 2010). For a single species, when the number has been counted in more than a hundred specimens from at least two dozens of localities, the exact range between the recorded minimum and maximum has been adopted as a confident estimate of the intraspecific range of variation. Conversely, when the number has been counted in fewer specimens, and thus the variation in the species is probably underestimated, the intraspecific range has been estimated

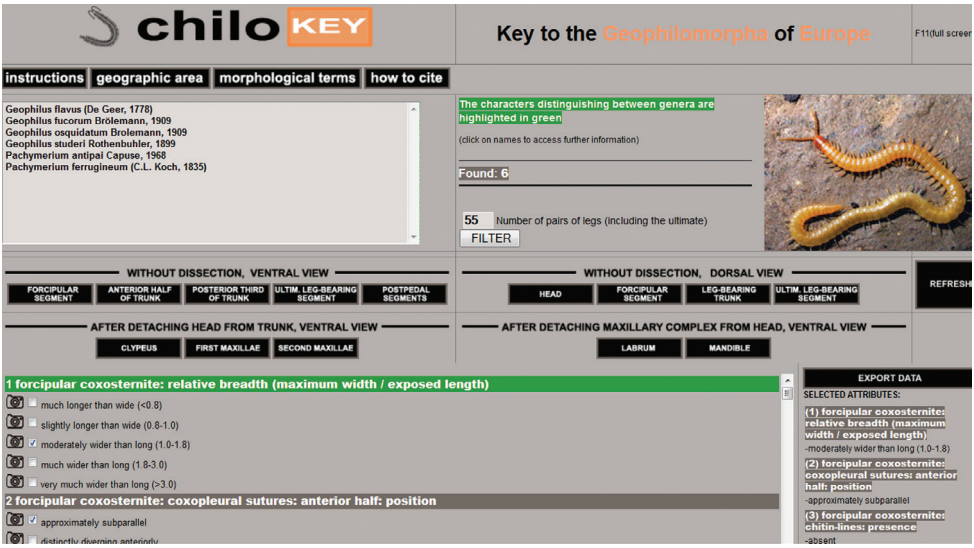

Figure 2. Screenshot of ChiloKey.

tentatively by considering the known average figure in the species and hypothesizing a 30% coefficient of variation (which is the average variation estimated in the intensely sampled species, as listed in supplementary file 1). This should not be taken as meaning that all segment numbers between the lowest and the highest value attributed to a given species have been actually recorded, or even occur in nature; discontinuities in the distribution of segment numbers within a species are well known, especially in species with very high segment number (e.g., Minelli and Bortoletto 1988).

Species-files: For any species, the following information is provided in a standardized way: "Valid name" of the species; "Family"; "Other names" (other names frequently used for the species after 1950, including synonyms, different generic combinations and alternative spellings); "Short description"; "Similar species" (selected species that could be misidentified, with main differential characters listed in parentheses); "Distribution" (known distribution in Europe, listing the main geographical areas from where the species has been reported reliably); "Taxonomic notes"; "Main references" (published sources that we considered for the morphology of the species; full citations in supplementary file 2).

Taxonomic ranks

Phylum: Arthropoda
Class: Chilopoda
Order: Geophilomorpha
Family: Dignathodontidae, Geophilidae, Himantariidae, Linotaeniidae, Mecistocephalidae, Oryidae, Schendylidae

Genus: *Acanthogeophilus, Algerophilus, Arctogeophilus, Arenophilus, Bebekium, Bothriogaster, Clinopodes, Dicellophilus, Dignathodon, Diphyonyx, Escaryus, Espagnella, Eurygeophilus, Folkmanovius, Galliophilus, Geophilus, Gnathoribautia, Haplophilus, Haploschendyla, Henia, Himantariella, Himantarium, Nannophilus, Nothogeophilus, Nyctunguis, Orya, Pachymerium, Photophilus, Pleurogeophilus, Schendyla, Schizotaenia, Stenotaenia, Stigmatogaster, Strigamia, Thracophilus, Tuoba*

Spatial coverage

General spatial coverage: The key includes all species of Chilopoda Geophilomorpha that have been recorded from Europe. In addition to the species whose validity is not questioned at present, included are also the nominal species whose taxonomic distinction is still uncertain and/or whose morphology is known only incompletely. Instead, we excluded alien species that have been occasionally reported from Europe but are probably not established in the wild, and also those that have been reported from Europe only by mistake.
Coordinates: between 33°50'24"N and 72°8'24"N Latitude; between 12°6'36"W and 43°45'0"E Longitude

Natural collections description
Parent collection identifier: Not applicable
Collection name: Department of Biology, University of Padova
Collection identifier: http://www.bio.unipd.it/
Specimen preservation method: Alcohol

Methods

Distribution

a) http://www.biologia.unipd.it/chilokey/
b) http://www.interactive-keys.eu/chilokey/

Repository: Department of Biology, University of Padova, Padova, Italy
Metadata language: English
Date of metadata creation: 2014-06-05
Platform: Windows Server 2003 - Microsoft Framework .NET 4
Programming Language: Asp.NET
Data base: MS Windows SQLSERVER, IIS6, NET 4.0
Application version: ChiloKey 1.0
Update police: The application can be augmented/updated only by, or in agreement with, the corresponding authors of this paper. Authors keep updated both the web ap-

plication, by implementing new functions, and the data matrix, by improving encoded descriptions of terminal taxa. Every change can be monitored on the homepage and reported in the TXT export data file, by updating the number of the application version and by changing the date of the last modification to the data matrix. A short message on the homepage may describe differences from the previous version, if needed.

Use of the primary data: Primary data are available from the corresponding authors by agreement.

Licence for the use of the key: Creative Commons Attribution License 3.0 (CC-BY), which permits unrestricted use, distribution, and reproduction in any medium, provided the original authors and source are credited.

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Supplementary material 1

Species of Geophilomorpha included in ChiloKey 1.0

Authors: Lucio Bonato, Alessandro Minelli, Massimo Lopresti, Pierfilippo Cerretti

Data type: Species data.

Explanation note: Species of Geophilomorpha included in ChiloKey 1.0, as released in 2014, and other species of Geophilomorpha reported from Europe but not included in ChiloKey 1.0, because either not established in the wild or most probably recorded only erroneously.

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Supplementary material 2

Bibliographic sources for the morphology matrix

Authors: Lucio Bonato, Alessandro Minelli, Massimo Lopresti, Pierfilippo Cerretti

Data type: References list.

Explanation note: Bibliographic sources for the morphology matrix of the species of Geophilomorpha in ChiloKey 1.0, as released in 2014.

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RESEARCH ARTICLE

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A synoptic review of the genus *Thaumaspis* Bolívar (Orthoptera, Tettigoniidae, Meconematinae) with the description of a new genus and four new species

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Abstract

Two new species of the new genus *Athaumaspis* **gen. n.**, *Athaumaspis minutus* **sp. n.** and *Athaumaspis tibetanus* **sp. n.** from Vietnam and China are described. The subgenus *Pseudothaumaspis* of *Thaumaspis* is elevated to generic status and another two new species *Pseudothaumaspis bispinosus* **sp. n.** and *Pseudothaumaspis furcocercus* **sp. n.** are described, the remaining species of *Thaumaspis* are reviewed and keyed with the four new species.

Keywords

Orthoptera, Tettigoniidae, Meconematinae, taxonomy, *Athaumaspis*, *Thaumaspis, Pseudothaumaspis,* new species

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Introduction

The genus *Thaumaspis* is recognized by their opisthognathous head, short wings, and completely membranous genitalia of male. The genus was proposed by Bolívar for *Thaumaspis trigonurus* Bolívar, 1900. *Xiphidiopsis hastaticercus* Tinkham, 1936 and *Xiphidiopsis yachowensis* Tinkham, 1944 were placed into the genus by Bey-Bienko (1957). However, Gorochov (1993) thought *X. hastaticercus* was similar to *Chandozhinskia* Gorochov, 1993 without a formal assignation. Jin and Xia (1994) listed this species in *Thaumaspis*. We examined specimens of this species found there was no difference between *Thaumaspis hastaticercus* and *Chandozhinskia bivittata* except for length of wings and presence of some stripes, so we believe *T. hastaticercus* should be included in *Chandozhinskia*, as to whether they are the same species with different wing morphs or not needs molecular evidence. *X. yachowensis* was assigned to *Neocyrtopsis* Liu & Zhang, 2007 by Wang et al. (2013). Afterwards, *Thaumaspis* was subdivided into three subgenera (Gorochov 1993, 1998) based on features of pronotum, tegmina and male genitalia: *Thaumaspis* s. str., *Isothaumaspis* Gorochov, 1993 and *Pseudothaumaspis* Gorochov, 1998. Subsequently, *Thaumaspis* (*Thaumaspis*) *henanensis* Liu & Wang, 1998 (female) and *Thaumaspis* (*Thaumaspis*) *bifurcata* Liu, Zhou & Bi, 2010 (male) were placed in *Thaumaspis* both known from singletons, but now their status seems to be short of evidence and for further study the opposite sexes are required.

Gorochov (1993, 1998) included *Thaumaspis* in tribe Meconematini, but the OSF website still grouped it in Meconematinae with another 31 genera out of three tribes. Actually, those genera that were excluded from tribe Phlugidini and Phisidini should be included in Meconematini. Tirbe Phlugidini is known for their very large compound eyes, both opened protibial tympana, rounded posterior margin of pronotum, shorter tegmina than wings (except brachypterous species), ventral spines of fore femora, and short also base inflated ovipositor; Phisidini is known for their stronger ventral spines of fore and middle femora, shield protibial tympana, truncated posterior margin of pronotum, long tegmina longer than or equal to wings (except brachypterous species), and longer ovipositor (some with denticulate margins at apical half); as for Meconematini, the key features are unarmed femora, opened protibial tympana at least on one side, rounded posterior margin of pronotum, tegmina no longer than wings (except brachypterous species), and longer ovipositor with smooth margins (sometimes with an apical hook). Thus according to generic characteristics, there is no doubt for inclusion of *Thaumaspis* in tribe Meconematini.

Thaumaspis currently contains eight species. Here we elevate the subgenus *Pseudothaumaspis* to normal rank in consideration of hypognathous head and unique ventral arms of male 10th abdominal tergite. We also describe two new species of *Pseudothaumaspis*, propose a new genus *Athaumaspis* gen. n. which includes *Thaumaspis* (*Thaumaspis*) *bifurcata* Liu, Zhou & Bi, 2010 for another two new species. Four new species are from China and Vietnam: *Athaumaspis minutus* sp. n., *Athaumaspis tibetanus* sp. n., *Pseudothaumaspis bispinosus* sp. n. and *Pseudothaumaspis furcocercus* sp. n.

Material and methods

The materials for this research were collected by us (from China) and came from the Bishop Museum (from Vietnam). Morphological structures were examined using a Leica MZ 125 and an OLYMUPS SZX 16 stereomicroscope, images were taken using a Motic Moticam Pro 252A digital imaging system, and drawings were produced by Adobe Photoshop from the digital images. All type specimens of new species are deposited in the SEM (Shanghai Entomological Museum, Chinese Academy of Science.) and the BPBM (Bernice Pauahi Bishop Museum, Hawaii).

In the specimen measurements, we measured length of body by distance between apex of fastigium verticis and posterior margin of tenth abdominal tergite, ovipositor by distance between base of subgenital plate and apex of ovipositor; pronotum, tegmina and posterfemora by distance between summit of base and apex. All length are shown in millimeter.

Systematics

Key to species of genus *Thaumaspis* Bolívar, 1900, *Athaumaspis* gen. n. and *Pseudothaumaspis* Gorochov, 1998, stat. n.

1 Head hypognathous, ovipositor short and up curve, or unknown **2**

– Head obliquely opisthognathous, ovipositor almost straight and long..... ..... ***Thaumaspis* Bolívar, 1900**...**7**

2 Pair of unique ventral arms at male 10th abdominal tergite ....***Pseudothaumaspis* Gorochov, 1998, stat. n.**....**3**

– Ventral part of male 10th abdominal tergite as usual .....***Athaumaspis* gen. n.**..**5**

3 Each lower lobe of hind knee with an apical spine **4**

– Spine of genicular lobe absent..... ***Pseudothaumaspis furcocercus* sp. n.**

4 Apex of male cerci with 3 processes; subgential plate of female transverse .... ***Pseudothaumaspis gialaiensis* Gorochov, 1998**

– Male cerci robust, with 2 long inner processes; female unknown .... ***Pseudothaumaspis bispinosus* sp. n.**

5 Pronotum of male without markings; female unknown **6**

– Body smaller, pronotum with blackish brown and yellow patches ....***Athaumaspis minutus* sp. n.**

6 Posterior marginal process on abdominal tergite 10 larger, cerci long ....***Athaumaspis tibetanus* sp. n.**

– Posterior marginal process on abdominal tergite 10 very small, cerci short and stout .....***Athaumaspis bifurcatus* (Liu, Zhou & Bi, 2010), comb. n.**

7 Male 10th abdominal tergite bearing a single process at hind margin; female ovipositor almost straight..... ***Thaumaspis* (*Thaumaspis*) Bolívar, 1900**...**8**

– Male 10th abdominal tergite without processes at hind margin; female unknown ..... ***Thaumaspis* (*Isothaumaspis*) Gorochov, 1993**
..... ***Thaumaspis* (*I.*) *forcipatus* Bolívar, 1900**

8 Female subgenital plate almost triangular **9**

– Female subgenital plate nearly quadrate, hind margin circularly truncate; male unknown ..... ***Thaumaspis*(*T.*) *longipes* Bolívar, 1900**

9 Single process of male 10th abdominal tergite triangular, apex sparsely denticulated, male cerci with distinct processes; female subgenital plate not transverse, apex sharp ..... ***Thaumaspis* (*T.*) *trigonurus* Bolívar, 1900**

– Single process of male 10th abdominal tergite longer, separate into 2 lobes apically, male cerci without process; female subgenital plate more or less transverse, apex blunt **10**

10 Middle process of male 10th abdominal tergite rearwards produced, male cerci extremely bent inwards; female subgenital plate hardly transverse, nearly circular ..... ***Thaumaspis? siccifolii* (Karny, 1922)**

– Male unknown; female subgenital plate transverse, circular or triangular .. **11**

11 Fastigium of vertex conical; female subgenital plate nearly triangular .....
..... ***Thaumaspis* (*T.*) *montanus* Bey-Bienko, 1957**

– Fastigium of vertex cylindrical; female subgenital plate nearly circular .....
..... ***Thaumaspis* (*T.*) *castetsi* Gorochov, 1993**

Genus *Thaumaspis* Bolívar, 1900

Thaumaspis: Bolívar 1900: 768, t. 11, figs 11a–b; Kirby 1906: 373; Caudell 1912: 2; Karny 1924: 135; Beier 1966: 280; Gorochov 1993: 261; Jin and Xia 1994: 26; Otte 1997: 97; Gorochov 1998: 114.

Type species. *Thaumaspis trigonurus* Bolívar, 1900.

Description. Body small sized. Head opisthognathous. Fastigium of vertex short without sulcus dorsally, face extremely oblique, last segment of maxillary palpi longer than the preceding. Pronotum with low lateral lobes, humeral sinus absent; auditory foramina of thorax entirely exposed. Tegmina shorter than pronotum, with the stridulating organ in male, hind wing degraded. Auditory foramina of fore tibiae opened, hind tibiae with 2 pairs of apical spurs. Male 10th abdominal tergite bearing a single process on posterior margin or absence, cerci elongate with processes, subgenital plate with short styli, genitalia entirely membranous. Female subgenital plate nearly triangular, ovipositor shorter than hind femora, ventral valve with a small apical hook.

Diagnosis. The opisthognathous head and low lateral lobes of pronotum can easily distinguished them from other genera, for now *Thaumaspis* is the only genus with opisthognathous head of tribe Meconematini.

Subgenus *Thaumaspis* Gorochov, 1993

Thaumaspis (*Thaumaspis*): Gorochov 1993: 261; Jin and Xia 1994: 26; Otte 1997: 97; Gorochov 1998: 114.

Type species. *Thaumaspis trigonurus* Bolívar, 1900.

Diagnosis. Pronotum shorter, tegmina extremely short and truncate at apex, male 10th abdominal tergite attached a single process at hind margin and female subgenital plate nearly triangular.

1. *Thaumaspis* (*Thaumaspis*) *trigonurus* Bolívar, 1900
Figs 1–6

Thaumaspis trigonurus: Bolívar 1900: figs 11, a–b; Kirby 1906: 373; Caudell 1912: 3; Beier 1966: 280.
Thaumaspis (*Thaumaspis*) *trigonurus*: Gorochov 1993: figs 169–176, 261–262; Gorochov 1998: 114.

Diagnosis. Apex of the male posterior process at 10 abdominal tergite sparsely dentate (Fig. 2). Cerci slightly curved, basal half with numerous short processes (Figs 3, 4), styli short. Female subgenital plate triangular, apex slightly sharp (Fig. 5).

Coloration. Body greenish, unicolor.

Measurement. (length in mm) Body, ♂♀9.0; pronotum, ♂♀3.8; tegmina, ♂♀0.5–1.5; hind femora, ♂♀7.0; ovipositor, ♀7.0.

Distribution. India.

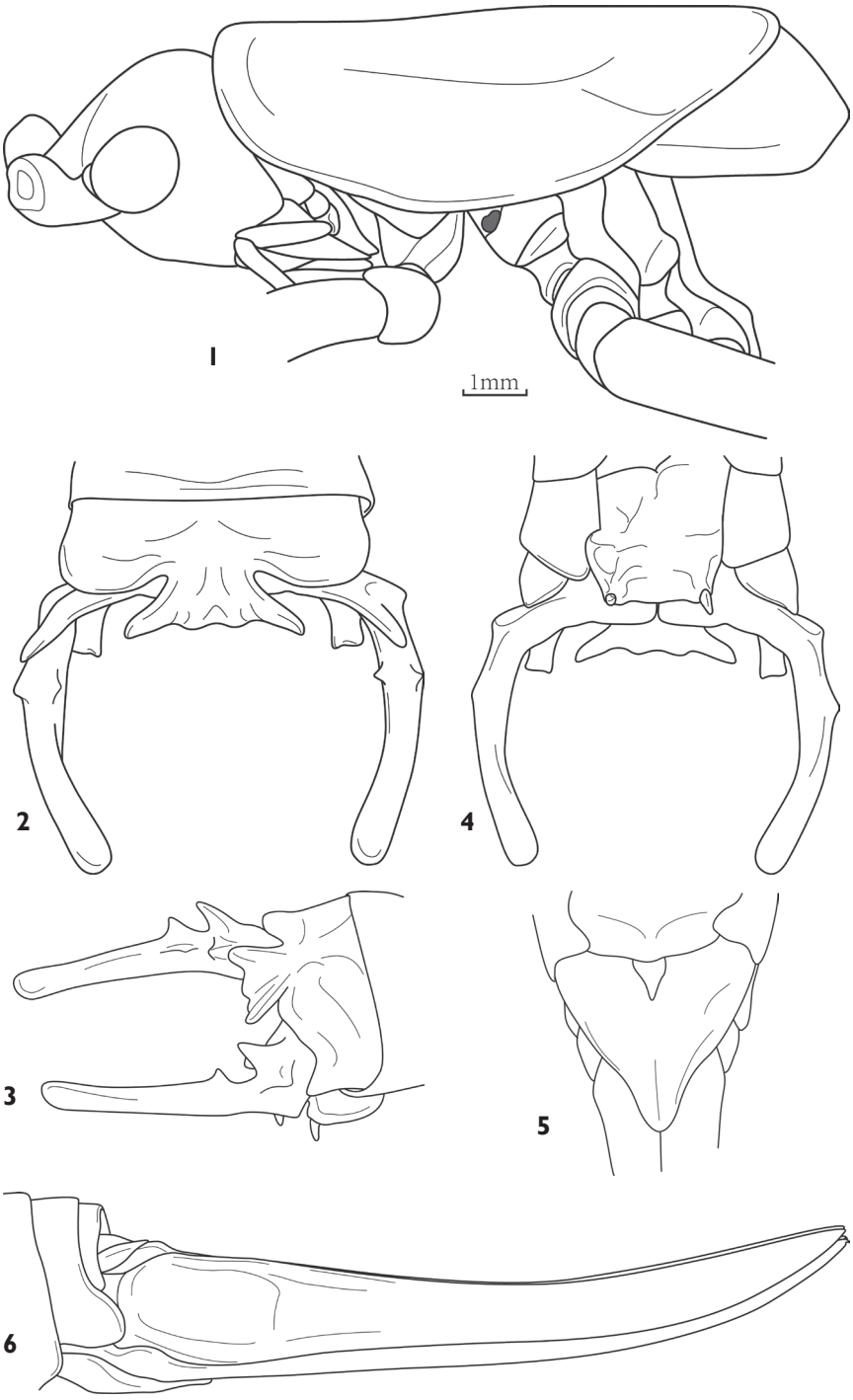
2. *Thaumaspis*? *siccifolii* (Karny, 1922)
Figs 7–11

Cecidophaga siccifolii: Karny 1922: 299, fig. 3.
Thaumaspis siccifolii: Karny 1924: 135, figs 54 a–f; Beier 1966: 280.
Thaumaspis (*Thaumaspis*) *siccifolii*: Otte 1997: 98.

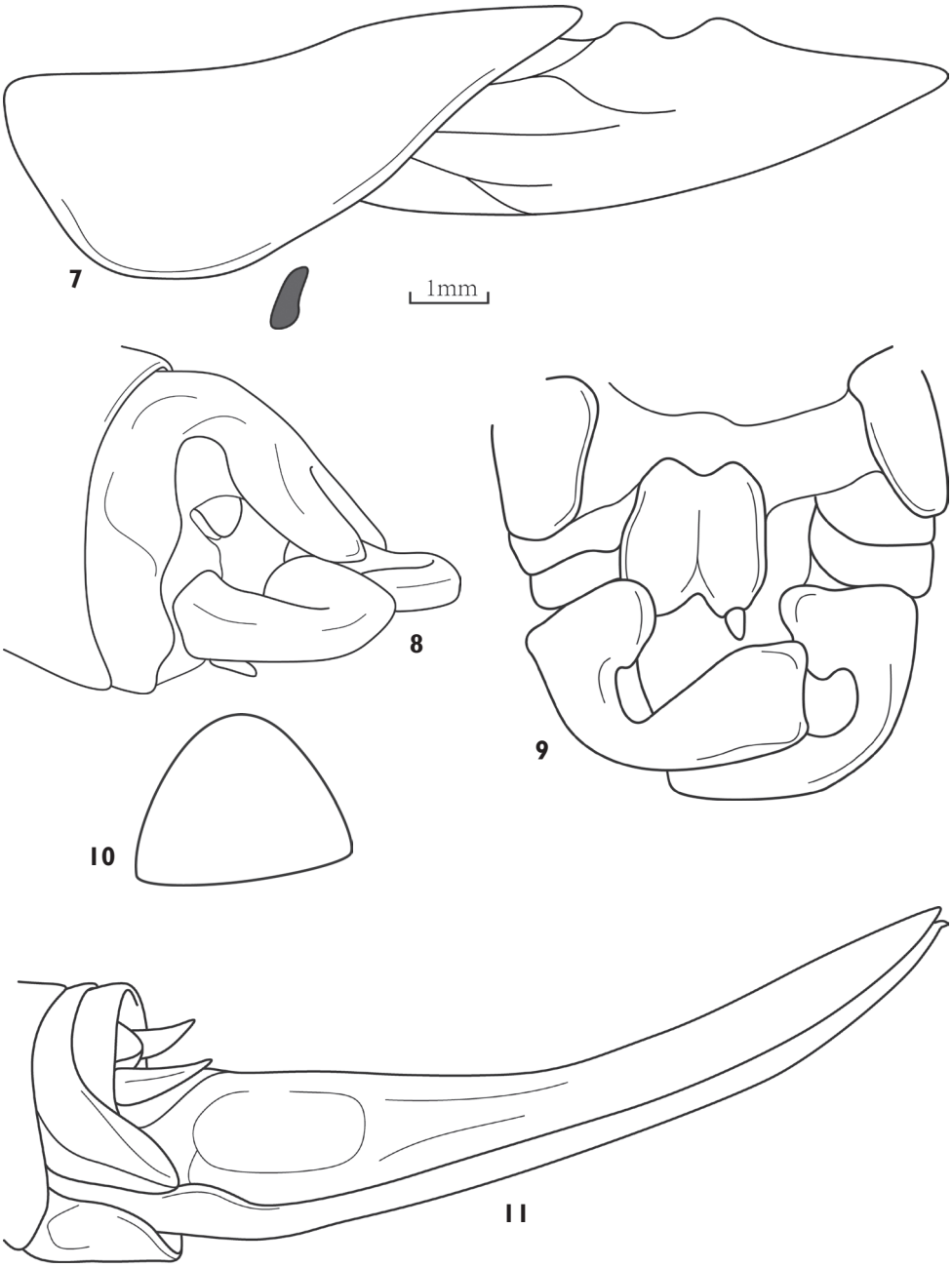
Diagnosis. Head hypognathous. Male 10th abdominal tergite transverse, middle lobe divided into 2 finger-shaped apices (Fig. 8). Cerci extremely incurved, ventral base and subapex widened (Fig. 9). Subgenital plate almost trapezoidal. Female subgenital plate almost circular (Fig. 10).

Coloration. Body olive-green, eyes darkish, antennae with dark rings.

Measurement. (length in mm) Body, ♂8.0, ♀8.5–9.5; pronotum, ♂3.0, ♀2.5; tegmina, ♂♀3.0; hind femora, ♂♀8.0–8.5; ovipositor, ♀5.5–6.0.



Figures 1–6. *Thaumaspis* (*Thaumaspis*) *trigonurus* Bolívar, 1900 (after OSF website) **1** head, pronotum and tegmina, lateral view **2**end of male abdomen, dorsal view **3** end of male abdomen, lateral view **4** end of male abdomen, ventral view **5** subgenital plate of female, ventral view **6** female abdomen terminal, lateral view.



Figures 7–11. *Thaumaspis*? *siccifolii* (Karny, 1922) (after OSF website and Karny) **7** pronotum and tegmina, lateral view **8** end of male abdomen, dorsal-lateral view **9** end of male abdomen, ventral view **10** subgenital plate of female, ventral view (after Karny) **11** female abdomen terminal, lateral view.

Discussion. The general features of this species ally to *Cecidophagula*, such as characters of head and wings. Actually, it had been described as a *Cecidophagula* originally before Karny assigned it to *Thaumaspis* in consideration of the single process of genital segments. Gorochov excluded this species in his study (1993, 1998). Since we are unable to examine type material we still leave it in *Thaumaspis*.

Distribution. Indonesia.

3. *Thaumaspis* (*Thaumaspis*) *montanus* Bey-Bienko, 1957

Figs 12–13

Thaumaspis montanus: Bey-Bienko 1957: 411, fig. 13; Bey-Bienko 1962: 135; Beier 1966: 280; Liu and Jin1994: 109; Jin and Xia1994: 26.

Thaumaspis (*Thaumaspis*) *montana*: Gorochov 1993: 82; Gorochov 1998: 114, figs 102–103.

Diagnosis. Female tegmina rather shorter than pronotum, subgenital plate short, nearly triangular, apex blunt (Fig. 13). Male unknown.

Coloration. Body yellowish (maybe greenish in life), totally unicolor.

Measurement. (length in mm) Body, ♀9.5; pronotum, ♀3.7; tegmina, ♀3.2; hind femora, ♀8.5; ovipositor, ♀7.5.

Distribution. China (Yunnan, Tengchong).

4. *Thaumaspis* (*Thaumaspis*) *castetsi* Gorochov, 1993

Figs 14–16

Thaumaspis (*Thaumaspis*) *castetsi*: Gorochov 1993: 83, figs 177–179, 263; Gorochov 1998: 114.

Diagnosis. Female subgenital plate transverse, hind margin with middle circular convex (Fig. 15). Ovipositor almost straight (Fig. 16). Male unknown.

Coloration. Body yellowish, unicolor.

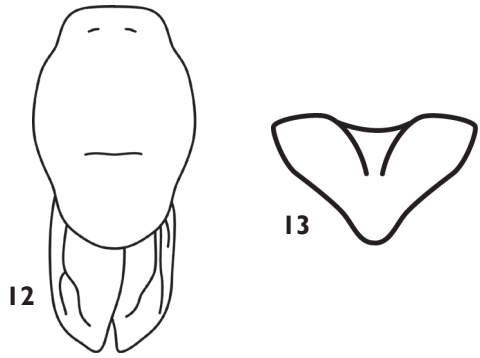
Measurement. (length in mm) Body, ♀11.0; pronotum, ♀3.7; tegmina, ♀2.4; hind femora, ♀7.5; ovipositor, ♀7.0.

Distribution. India.

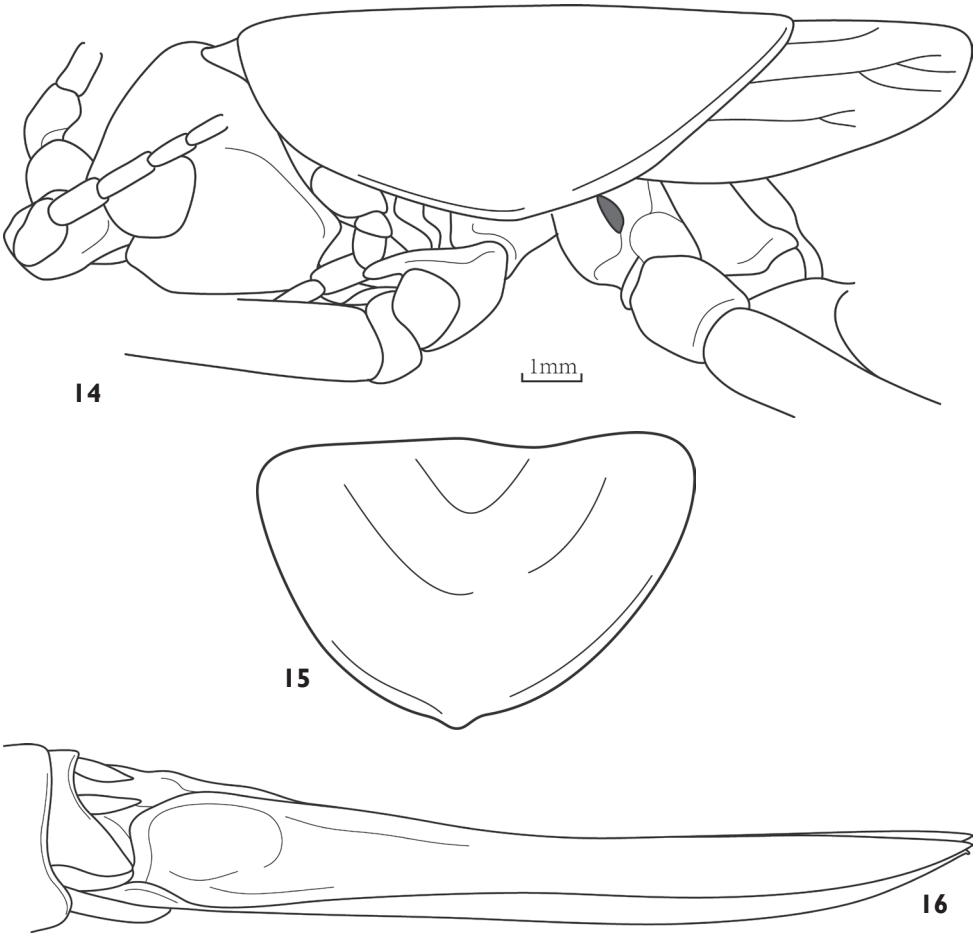
5. *Thaumaspis* (*Thaumaspis*) *longipes* Bolívar, 1900

Figs 17–19

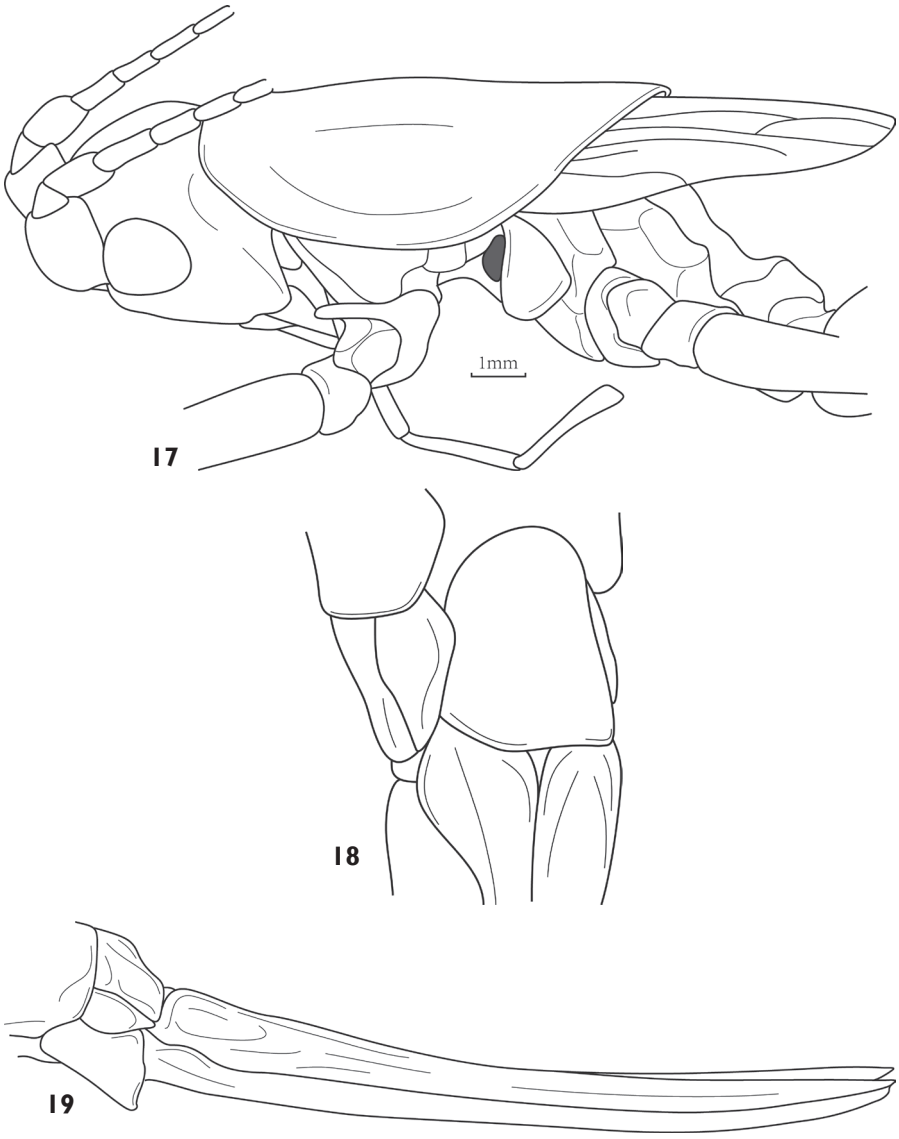
Thaumaspis longipes: Bolívar 1900: 769, t. 11, fig. 13; Kirby 1906: 373; Caudell 1912: 3; Beier 1966: 280.



Figures 12–13. *Thaumaspis* (*Thaumaspis*) *montana* Bey-Bienko, 1957 (after Gorochov) **12** pronotum and tegmina, dorsal view **13** subgenital plate of female, ventral view.



Figures 14–16. *Thaumaspis* (*Thaumaspis*) *castetsi* Gorochov, 1993 (after OSF website) **14** head, pronotum and tegmina, lateral view **15** subgenital plate of female, ventral view **16** female abdomen terminal, lateral view.



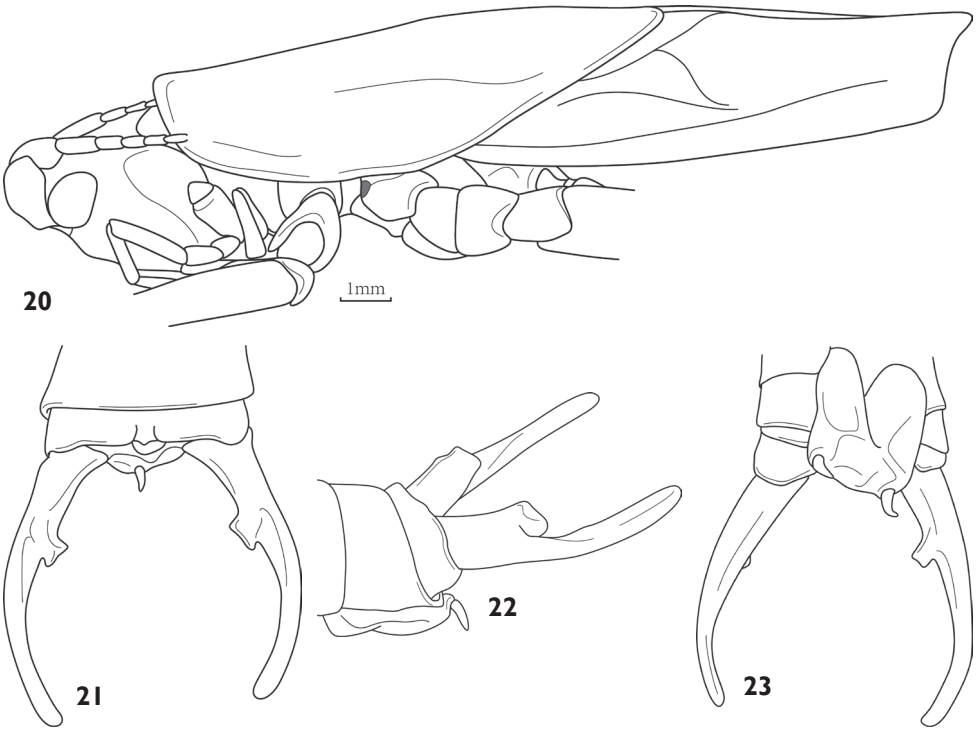
Figures 17–19. *Thaumaspis*(*Thaumaspis*) *longipes* Bolívar, 1900 (after OSF website) **17** pronotum and tegmina, lateral view **18** subgenital plate of female, ventral view **19** female abdomen terminal, lateral view.

Thaumaspis (*subgenus*?) *longipes*: Gorochov 1993: 83, figs 184–186, 265.
Thaumaspis (*Pseudothaumaspis*?) *longipes*: Gorochov 1998: 114–115.

Diagnosis. Female tegmina no longer than pronotum, apex pointed. Subgenital plate nearly quadrate, hind margin circularly truncated (Fig. 19). Male unknown.

Coloration. Body greenish, unicolor.

Measurement. (length in mm) Body, ♀12.0; pronotum, ♀3.8; tegmina, ♀3.0; hind femora, ♀10.0; ovipositor, ♀10.0.



Figures 20–23. *Thaumaspis* (*Isothaumaspis*) *forcipatus* Bolívar, 1900 (after OSF website) **20** head, pronotum and tegmina, lateral view **21** end of male abdomen, dorsal view **22** end of male abdomen, lateral view **23** end of male abdomen, ventral view.

Distribution. India (New Delhi).

Subgenus *Isothaumaspis* Gorochov, 1993

Thaumaspis (*Isothaumaspis*): Gorochov 1993: 83, figs 181–183.

Type species. *Thaumaspis forcipatus* Bolívar, 1900.

Diagnosis. This subgenus differs from nominotypical subgenus by longer pronotum equal to tegmina, posterior marginal processes of male 10th abdominal tergite absent.

6. *Thaumaspis* (*Isothaumaspis*) *forcipatus* Bolívar, 1900

Figs 20–23

Thaumaspis forcipatus: Bolívar 1900: 769, t. 11, figs 12a–b; Kirby 1906: 373; Caudell 1912: 3; Beier 1966: 280.

Thaumaspis (*Isothaumaspis*) *forcipatus*: Gorochov 1993: 83, figs 180–183, 264; Gorochov 1998: 114.

Diagnosis. Male pronotum longer, tegmina almost equal to pronotum, apex truncate (Fig. 20). 10th abdominal tergite with a median notch at middle of hind margin (Fig. 21). Cerci longer, slightly incurved, median portion with one lobe truncated in apex (Fig. 22). Female unknown.

Measurement. (length in mm) Body, ♂11.0; pronotum, ♂4.8; tegmina, ♂4.8; hind femora, ♂5.5.

Distribution. India.

Genus *Athaumaspis* Wang & Liu, gen. n.

http://zoobank.org/D0F10EB4-C1F6-440C-A6B0-6723D1BD0506

Type species. *Athaumaspis minutus* sp. n.

Description. Body small of this tribe. Head hypognathous, low in profile. Fastigium of vertex short with shallow furrow dorsally, last segment of maxillary palpi little longer than the preceding. Pronotum with lower paranota, humeral sinus absent; auditory foramina of thorax entirely exposed. Tegmina shorter than pronotum, with the stridulating organ in male, hind wing degraded. Auditory foramina of fore tibiae opened, hind tibiae with 2 pairs of apical spurs. Male 10th abdominal tergite with branched process at posterior margin, cerci elongate or branched, subgenital plate with short styli, genitalia entirely membranous. Female subgenital plate transverse, rounded at posterior margin, ovipositor short and upcurved, ventral valve with a small apical hook.

Diagnosis. This new genus similar to *Thaumaspis* in body size and bearing posterior marginal process of abdominal tergite 10, but quite different by hypognathous head, marginal process of abdominal tergite 10 bifurcated.

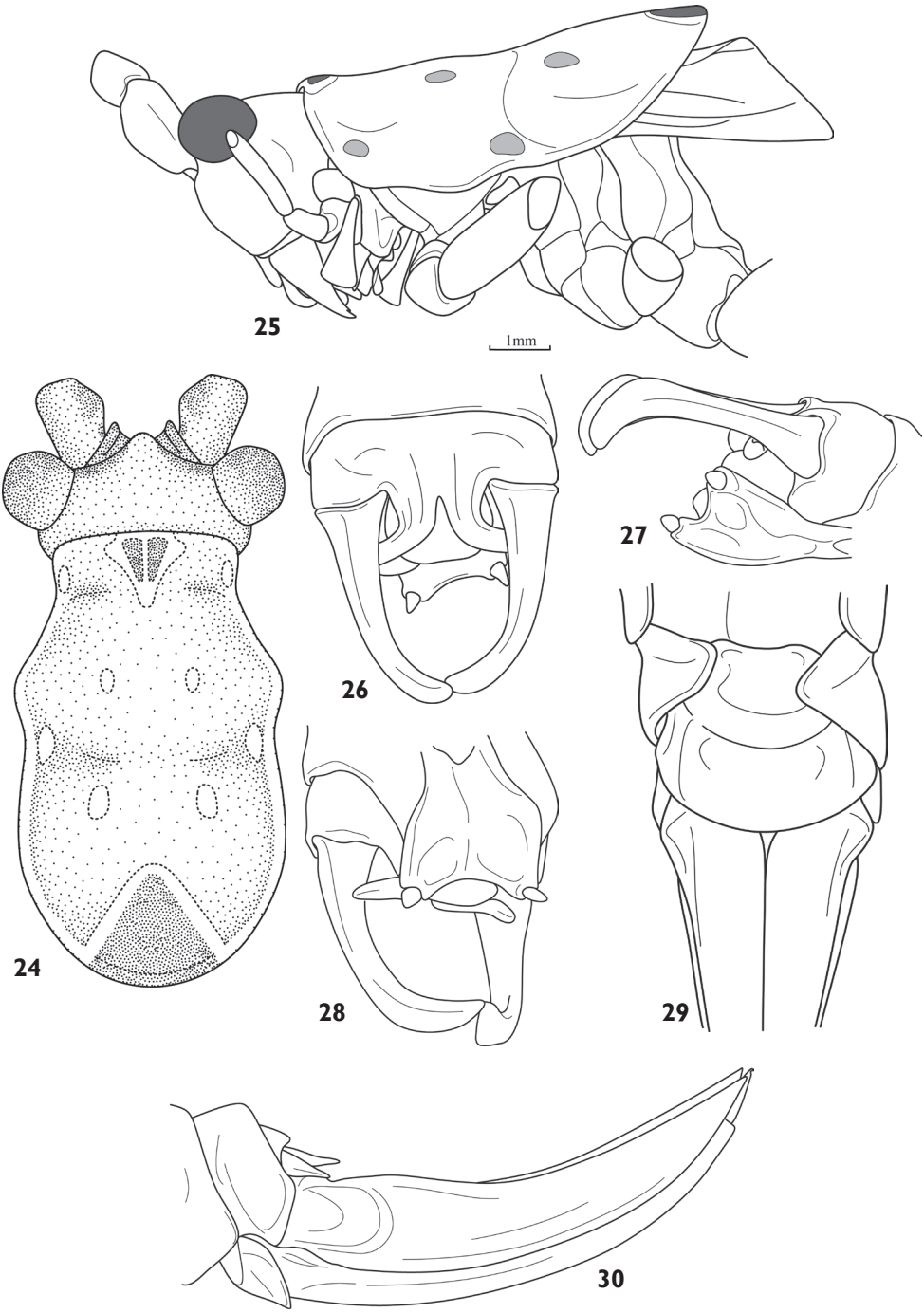
7. *Athaumaspis minutus* Wang & Liu, sp. n.

http://zoobank.org/829CEB3D-6C75-4098-8773-C9BBE472BF5C

Figs 24–30

Materials. Holotype♂, paratype2♀♀, Vietnam, Mt. Lang Bian, Alt. 1500–2000m, 1961.V.19–VI.8, coll. N.R. Spencer (BPBM). Deposited in SEM temporarily.

Description. Male. Head low in profile. Fastigium of vertex rather short, shallowly furrowed on dorsum (Fig. 24), face slightly oblique (Fig. 25), compound eyes oval and protruded outwards, last segment of maxillary palpi longer than preceding. The superior and inferior edge of pronotum nearly paralled from a lateral view, metazona slightly elevated, paranota of pronotum lower, hind margin rounded, humeral sinus absent; auditory foramina of thorax entirely exposed. Tegmina shorter than pronotum, hind margin obliquely truncated, hind wings reduced. Fore tibiae armed spines of type 4, 4 (1, 1) on either margin of ventral surface, hind tibiae with 20–23 dorsal teeth each margin above and 2 pairs of apical spurs. Posterior margin of abdominal tergite 10 with middle process,



Figures 24–30. *Athaumaspis minutus* sp. n. **24** head, pronotum and tegmina, dorsal view **25** head, pronotum and tegmina, lateral view **26** end of male abdomen, dorsal view **27** end of male abdomen, lateral view **28** end of male abdomen, ventral view **29** subgenital plate of female, ventral view **30** female abdomen terminal, lateral view.

distinctly branched (Fig. 26). Epiproct reduced. Cerci elongate, rather simple, incurved in its apical third, dorsal surface with weak keels (Fig. 27). Subgenital plate narrowed basally, broad in apical half, hind margin roundly emarginate with rather short styli (Fig. 28).

Female. General roughly as in male. Cerci short and conical, subgenital plate transverse and flabellate, hind margin circular convex (Fig. 29). Ovipositor is short, upcurved, ventral valve with a weak apical hook.

Coloration. Body yellowish (maybe greenish in life), eyes blackish brown, antennae with inconspicuous darkish rings, fore and hind margins of pronotum either with blackish brown marking rounded yellow rim (Fig. 24), lateral lobe with 4 yellow markings.

Measurement. (length in mm) Body, ♂7.5, ♀8.0; pronotum, ♂2.8, ♀2.2; tegmina, ♂1.0, ♀0.8; hind femora, ♂6.5, ♀7.0; ovipositor, ♀3.8.

Diagnosis. This new species distinguishes from other species of the genus in body smaller, pronotum with blackish brown and yellow markings, female subgential plate with rounded posterior edge.

Etymology. The specific epithet referrers body form of this species, from Latin minūtus. The gender of the epithet is masculine.

Distribution. Vietnam.

8. *Athaumaspis tibetanus* Wang & Liu, sp. n.

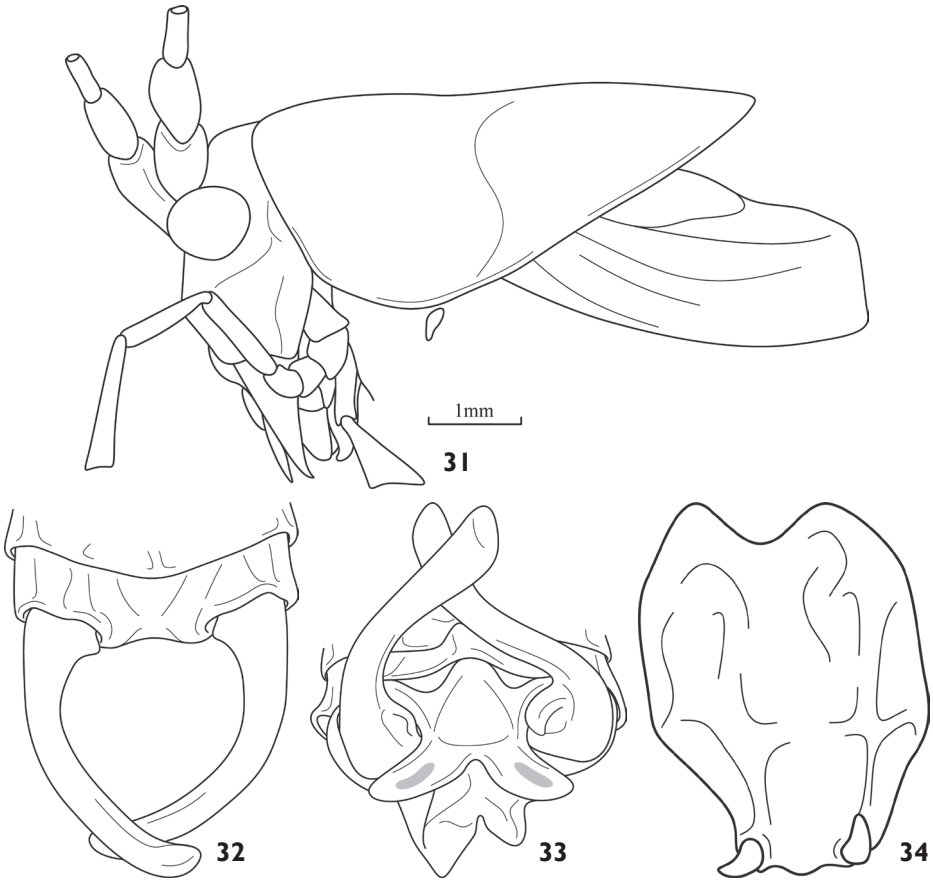
http://zoobank.org/C0DE31AE-E56B-47E3-AC1E-5141CBAB73BA
Figs 31–34

Materials. Holotype ♂ (# 14088760), China, Xizang, Nyalam Country, Zhangmu, Alt. 2300m, 2010.VII.17–18, coll. W.X. Bi; Paratype 1♂ (# 14088761), same data as holotype (SEM).

Description. Male. Head high in profile. Fastigium of vertex short, dorsum shallowly furrowed in middle, face slightly oblique (Fig. 31), but higher, compound eyes subovoid and moderately protruded, last segment of maxillary palpi slightly longer than preceding. Protonum nearly triangular in profile, metazona little elevated, paranota higher, hind margin obliquely truncated without humeral sinus; auditory foramina of thorax entirely exposed. Tegmina shorter than pronotum by one third, posterior edge truncated; hind wings deduced. Fore tibiae spines armed 4, 4 (1, 1), hind tibiae with 19–20 dorsal teeth either margin above and 2 pairs of apical spurs. 10th abdominal tergite bearing an extended process at the middle of hind margin, bending vertically downwards and invisible dorsally (Fig. 32), apex distinctly branched (Fig. 33). Epiproct reduced. Cerci longer, inner surface of base occurs a lobe, incurved in one third, apex moderately expanding. Subgenital plate longer than width, apical two fifth narrowing towards tip, little convex at median hind margin, styli short (Fig. 34).

Female unknown.

Coloration. Body yellowish (may be greenish in life), unicolor.



Figures 31–34. *Athaumaspis tibetanus* sp. n. based on # 14088761 (**31, 34**) and # 14088760 (**32, 33**) **31** head, pronotum and tegmina, lateral view **32** end of male abdomen, dorsal view **33** middle process of male 10th abdominal tergite, rear view **34** subgenital plate of male, ventral view.

Measurement. (length in mm) Body, ♂7.0–8.0; pronotum, ♂3.3–3.5; tegmina, ♂2.0; hind femora, ♂6.5–7.0.

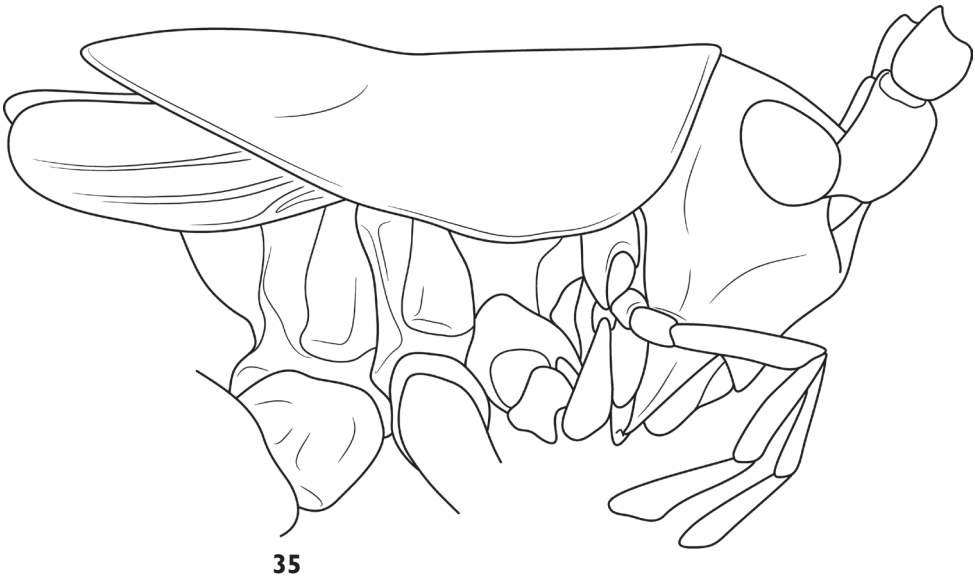
Diagnosis. This species looks different from type species in general, distinguishes mainly by higher head and pronotum in profile and inner lobe of cerci; but shearing branched process of male 10th abdominal tergite and simple but slender cerci.

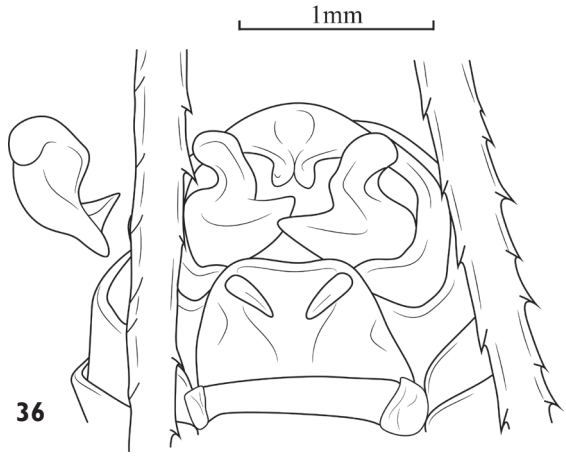
Etymology. The specific epithet is Latinized name of district Tibet where this species distributed. The gender of the epithet is masculine.

Distribution. China (Xizang).

9. *Athaumaspis bifurcatus* (Liu, Zhou & Bi, 2010), comb. n.
Figs 35–36

Thaumaspis bifurcata: Liu et al. 2010: 81.





Figures 35–36. *Athaumaspis bifurcatus* (Liu, Zhou & Bi, 2010) comb. n. **35** head, pronotum and tegmina, lateral view **36** end of male abdomen, ventral-rear view, and right cercus, dorsal view.

Diagnosis. Posterior margin of male 10th abdominal tergite with a small branched process, male cercus stout and bifurcated, superior ramus clubbed, inferior ramus with an inner triangular lobe at proximal part.

Coloration. Body yellowish green. Eyes and spines of hind tibiae blackish, genicular lobes of all femora each with a blackish spot.

Material examined. Holotype♂, paratype1♂, Daitianping, Fengyangshan National Nature Reserve, Zhejiang, Alt. 1200m, 2008.X.20, coll. S.L. Liu.

Measurement. (length in mm) Body, ♀6,5; pronotum, ♀3.5; tegmina, ♀2.0; hind femora, ♀6.5.

Discussion. The cerci of this species are stouter and quite different from previous 2 species of this genus which makes it easy to tell them apart, meanwhile the species meets the diagnosis of *Athaumaspis* in hypognathous head and bifurcated posterior marginal process of abdominal tergite 10. According to the features of male here we treat this species as an *Athaumaspis*. The specific epithet of this species originally was feminine, primarily based on Gorochov (1993), but according to type species of *Thaumaspis* the genus is masculine and 'bifurcata' should be 'bifurcatus', The same apply for *Athaumaspis* and *Pseudothaumaspis*.

Distribution. China (Zhejiang).

Genus *Pseudothaumaspis* Gorochov, 1998, stat. n.

Thaumaspis (*Pseudothaumaspis*): Gorochov 1998: 115.

Type species. *Pseudothaumaspis gialaiensis* Gorochov, 1998.

Diagnosis. This genus differs from *Thaumaspis* by hypognathous head, differs form all previous genera by unusual ventral arms at lower part of male 10th abdominal tergite, moreover posterior marginal processes of this tergite absence or instead of by small lobes, varied apex of cerci and almost trilobed posterior part of female subgenital plate. We believed hypognathous head and unique ventral arm of male 10th abdominal tergite sufficient to exclude *Pseudothaumaspis* from *Thaumaspis* and elevate it to generic status.

10. *Pseudothaumaspis gialaiensis* Gorochov, 1998

Figs 37–41

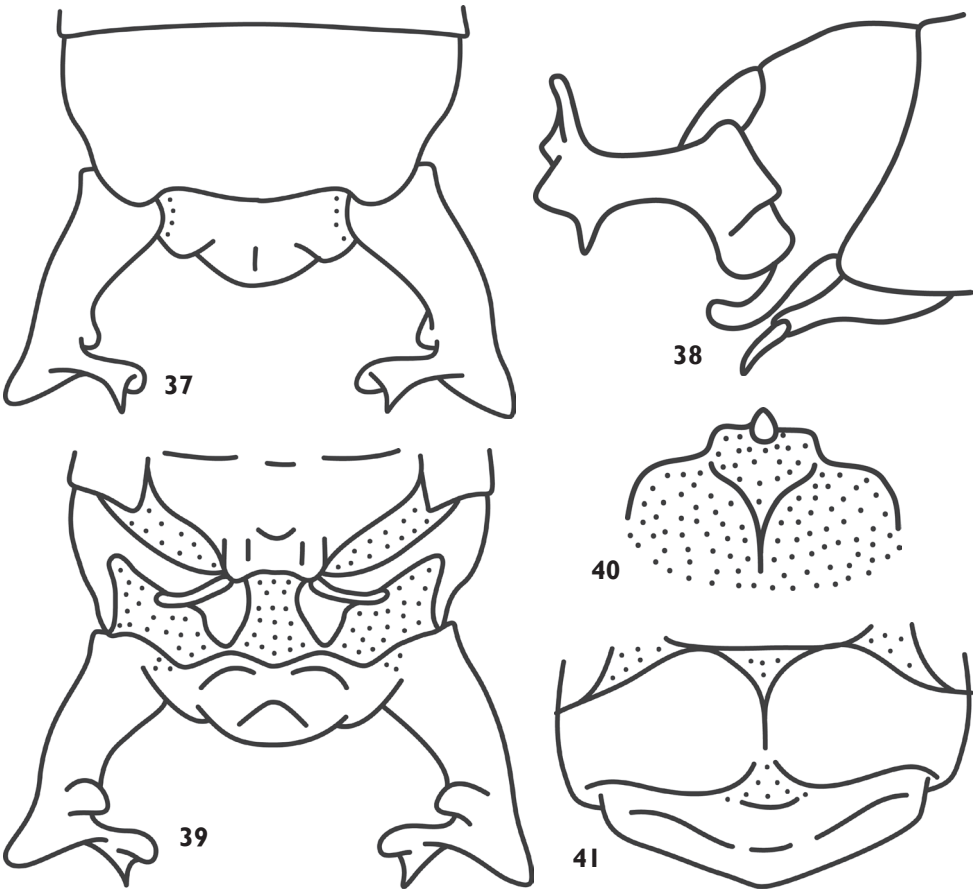
Thaumaspis (*Pseudothaumaspis*) *gialaiensis*: Gorochov 1998: 115, figs 104–109.

Diagnosis. Lower lobe of the male hind knee with spine, apex of male cerci with 3 processes (Figs 37–39), shorter subgenital plate with longer styli, genital smaller, apex with small a sclerous corium (Fig. 40). Female subgential plate transverse (Fig. 41), hind margin bent downwards; ventral valve of ovipositor with an apical hook.

Coloration. Body yellowish green, almost unicolor, antennae with brown rings, lower part of the pronotum lateral lobe with brown edge; apex of tibiae, tarsus and spine of tibiae darkened.

Measurement. (length in mm) Body, ♂13.0–14.0, ♀12.0–13.0; pronotum, ♂4.2–4.5, ♀4.0–4.2; tegmina, ♂4.0–4.5, ♀3.0; hind femora, ♂13.5–14.0, ♀14.0–15.0; ovipositor, ♀5.8–6.0.

Distribution. Vietnam.



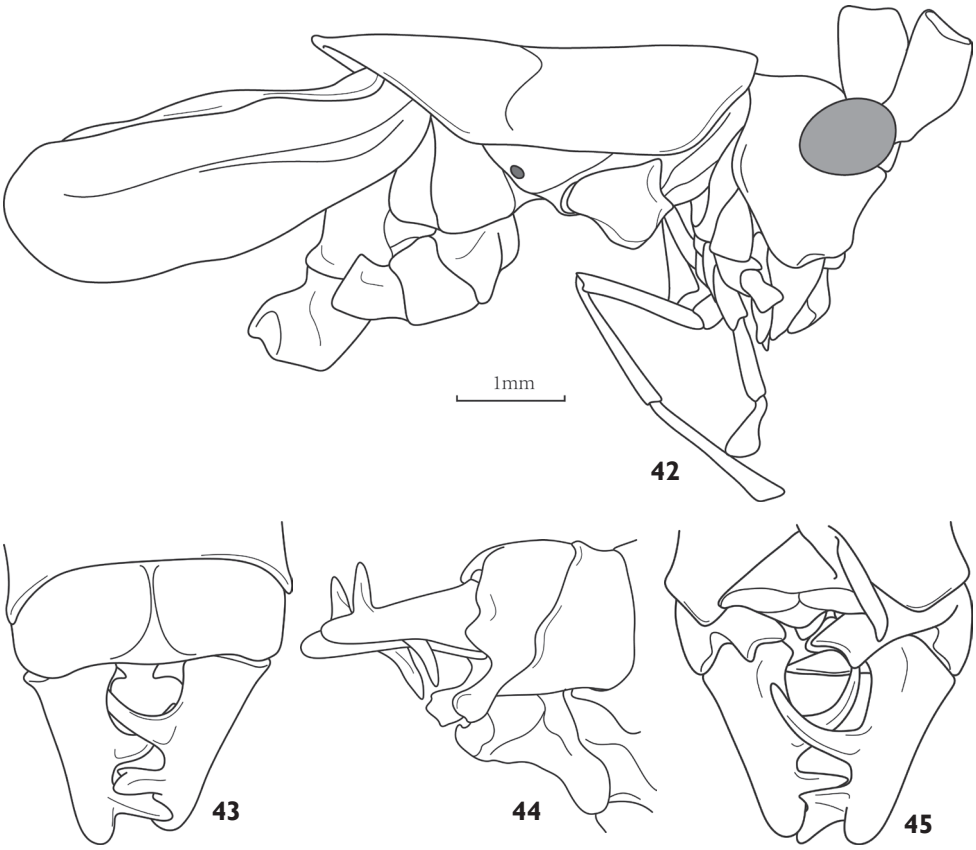
Figures 37–41. *Pseudothaumaspis gialaiensis* Gorochov, 1998 (after Gorochov) **37** end of male abdomen, dorsal view **38** end of male abdomen, lateral view **39** end of male abdomen, ventral view **40** male genitals, dorsal view **41** subgenital plate of female, ventral view.

11. *Pseudothaumaspis bispinosus* Wang & Liu, sp. n.

http://zoobank.org/C3EBFD67-A6E6-4B04-9A2D-243437D35BB6
Figs 42–45

Materials. Holotype♂, Vietnam, 40km S of Dilanh (Djiring), Alt. 543m, 1960.IV.26, coll. L.W. Quate (BPBM). Deposited in SEM temporarily.

Description. Male. Fastigium of vertex short, without dorsal groove, face slightly oblique (Fig. 42), compound eyes oval and protruded forwards and outwards, last segment of maxillary palpi slightly longer than preceding. The superior edge and inferior edge of pronotum paralleled and almost straight, paranota lower, front margin little sinuate, hind margin straight without humeral sinus and obliquely truncated; auditory foramina of thorax small and entirely exposed. Tegmina almost equal to pronotum, apex rounded; hind wings degenerate. Fore tibiae armed ventral spines of type 4, 4 (1, 1), lower lobe of the hind knee bearing a spine, hind tibiae with 28–31 dorsal teeth each



Figures 42–45. *Pseudothaumaspis bispinosus* sp. n. **42** head, pronotum and tegmina, lateral view **43** end of male abdomen, dorsal view **44** end of male abdomen, lateral view **45** end of male abdomen, ventral view.

margin above and 2 pairs of apical spurs. Hind margin of 10th abdominal tergite little sinuate (Fig. 43), lower part becoming a pair of elongate branches (Figs 44–45); cerci robust, generally conical and apex blunt, but each with 2 long inner processes: prior one downward, posterior one upward and little branched at apex. Subgenital plate damaged.

Female unknown.

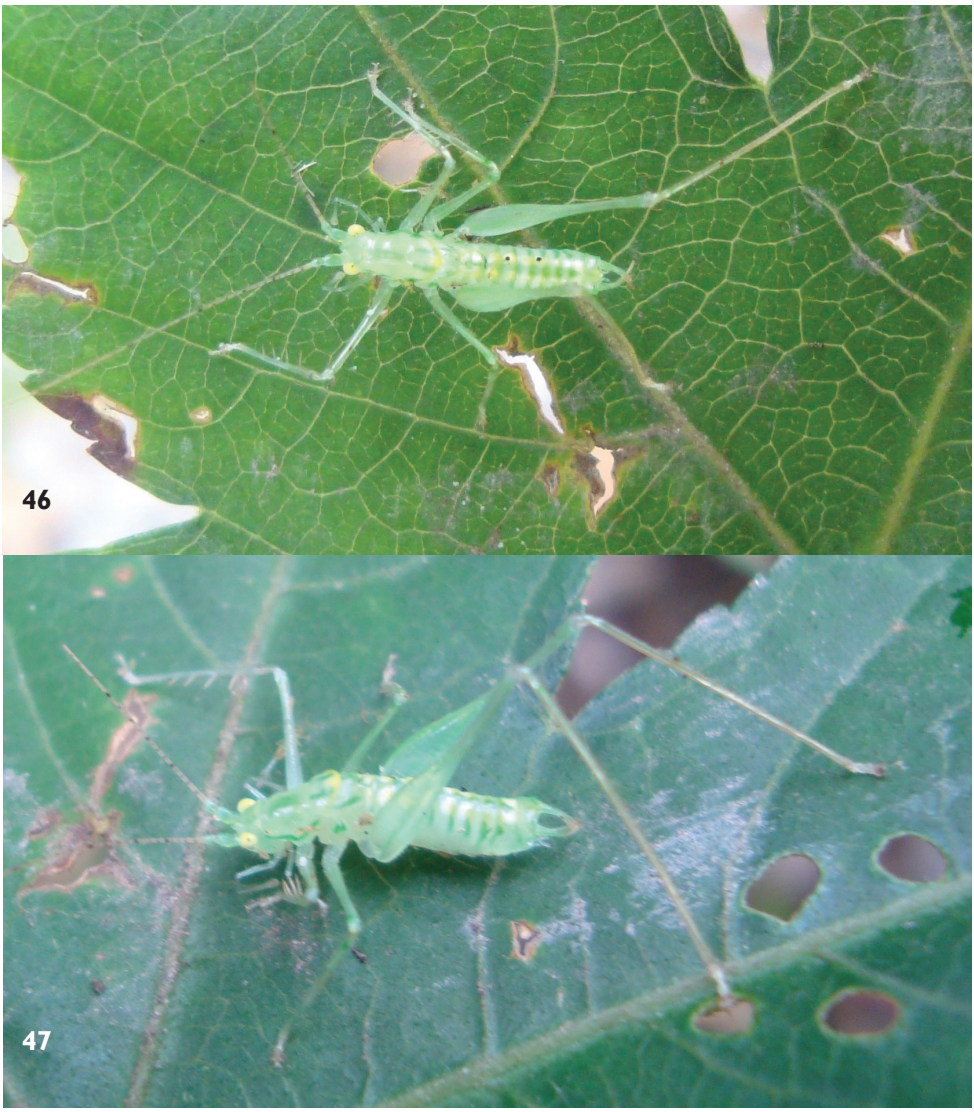
Coloration. Body yellowish (may be greenish alive), eyes blackish brown, antennae with inconspicuous darkish rings.

Measurement. (length in mm) Body, ♂12.0; pronotum, ♂3.8; tegmina, ♂4.0; hind femora, ♂12.0.

Discussion. This new species is similar to *Pseudothaumaspis gialaiensis* Gorochov, 1998, but differs mainly in the appearance of the male cerci. The single specimen of this species is in bad condition, especially the abdomen. Fortunately, the unique ventral arms of the 10th abdominal segment and the cerci are intact.

Etymology. The specific epithet refers to the character of male cerci which bearing 2 spinous processes, compose by prefix 'bi-' which means double and 'spinosus' which means spiny.

Distribution. Vietnam.



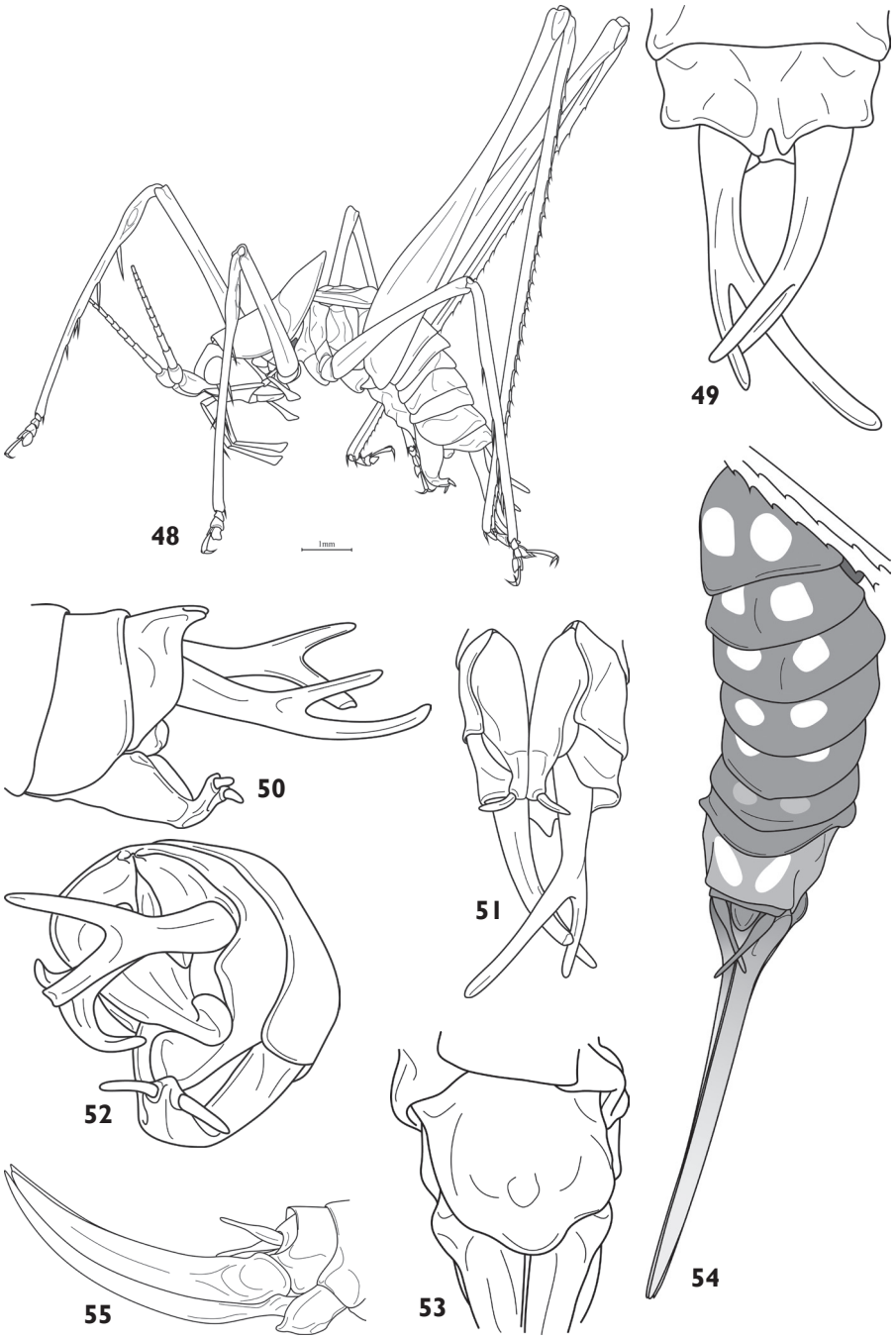
Figures 46–47. *Pseudothaumaspis furcocercus* sp. n., ecological photograph, lateral view and dorsal view.

12. *Pseudothaumaspis furcocercus* Wang & Liu, sp. n.

http://zoobank.org/31992FC9-40FC-4628-871E-2B60DC7E1464
Figs 46–55

Materials. Holotype♂ (# 14086640), China, Guangxi, Wuming, Damingshan, Alt. 1250m, 2013.VII.19–25, coll. W.B. Zhu, X.W. Liu, H.Q. Wang, H.G. Zhang. Paratype1♂ (# 14088762) 1♀ (# 14088763), same data as holotype (SEM).

Description. Male. Body form small and slender. Fastigium of vertex short, without dorsal groove, face slightly oblique (Fig. 48), compound eyes subglobular, last segment of



Figures 48–55. *Pseudothaumaspis furcocercus* sp. n. based on # 14086640 (**48–52**) and # 14088763 (**52–55**) **48** male body, lateral view **49** end of male abdomen, dorsal view (left cerci damaged at apex) **50** end of male abdomen, lateral view **51** end of male abdomen, ventral view **52** end of male abdomen, rear view **53** female subgenital plate, ventral view **54** female abdomen (2–11segments), dorsal view **55** ovipositor, lateral view.

maxillary palpi slightly longer than preceding. Pronotum saddle shaped in lateral view, paranota with concave dorsal margins, ventral margin rounded, humeral sinus absent, transverse sulcus distinct especially posterior one, metazona short, rather pointed at the posterior tip; auditory foramina of thorax small and exposed. Tegmina shoter than pronotum by one third, apex truncate; hind wings degenerate. Legs very long and rather thin (Fig. 46), fore tibiae with ventral spines armed 4, 4 (1, 1), lower lobe of the hind knee without spine, hind tibiae with 21–29 dorsal teeth either margin above and 2 pairs of apical spurs. Posterior median edge of 10th abdominal tergite elongate with a deep apical incision forming 2 small lobes (Fig. 49), lower area bearing a pair of ventral arms, not elongate and apex oblate (Fig. 52). Slim cerci branched at a half, incurved, lower branch longer. Subgenital base broad, apical one third narrow and up curved, styli very long (Figs 50–52).

Female. Body form similar to that of male. Fastigium of vertex little longer and more slender, a shallow furrow on the dorsum, last segment of maxillary palpi much longer than preceding. Paranota of pronotum subacute at inferior margin, transverse sulcus distinct as in male, but metazona even shorter. Tegmina short as in male, pointed at apex, inferior margin obliquely truncated, veins conspicuous. Posterior margin of 9th abdominal tergite straight, cercus slender, fusiform, apex thin and acute (Fig. 54); subgenital plate downward swell, trilobed at hind margin, mesolobe prominently convex. Ovipositor short, base upcurved, ventral valve without apical hook.

Coloration. In life of male. Body lightish green, emerald green and lightish yellow variegated. Flagella pale brown with darkish rings, scape and pedicel consistent with body color. Compound eyes vivid yellow. Both lateral rims of pronotum emerald green, but posterior edge vivid yellow, dorsum with green longitudinal stripes and patches. Each abdomen tergite with a pair of bright yellow oval patches and posterior edge darkish green. Hind tibiae, Tarsi and cerci terminal pale brown.

Dry specimen. Body brownish, antennae with inconspicuous darks rings, forma and tibia darkened around the knee joint. Male unicolor; female abdomen largely blackish brown, ventral surface totally black including subgenital plate, abdomen tergites each compact with a pair of large pale patches dorsally, base of ovipositor darkened.

Measurement. (length in mm) Body, ♂7.4–8.7, ♀10.2; pronotum, ♂3.2–3.6, ♀3.8; tegmina, ♂1.9, ♀1.5; hind femora, ♂8.3–8.9, ♀9.5; ovipositor, ♀4.5.

Etymology. The specific epithet from Latin 'forca' + 'cercus', corresponding the feature of male bifurcate cerci. The gender of the epithet is masculine.

Discussion. Bearing those unique arms, clearly it is a *Pseudothaumaspis*, but tegmina terminal, lower lobe of hind knee, small lobes of posterior edge of last abdominal tergite are quite different from previous species.

Distribution. China (Guangxi).

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RESEARCH ARTICLE

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New records of spider wasps (Hymenoptera, Pompilidae) from Colombia

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Abstract

New records of genera and species of spider wasps (Hymenoptera: Pompilidae) from Colombia are provided. *Agenioideus, Cryptocheilus, Evagetes, Mystacagenia,* and *Xerochares* are newly recorded genera from Colombia. Nineteen species are first recorded from Colombia: *Aimatocare vitrea* (Fox); *Ageniella azteca* (Cameron); *Ageniella curtipinus* (Cameron); *Ageniella fallax* (Arlé); *Ageniella hirsuta* Banks; *Ageniella pilifrons* (Cameron); *Ageniella pretiosa* Banks; *Ageniella sanguinolenta* (Smith); *Ageniella zeteki* (Banks); *Agenioideus birkmanni* (Banks); *Aporus* (*Aporus*) *cuzco* Evans; *Aporus* (*Cosmiaporus*) *diverticulus* (Fox); *Aporus* (*Notoplaniceps*) *canescens* Smith; *Euplaniceps exilis* (Banks); *Euplaniceps herbertii* (Fox); *Irenangelus clarus* Evans; *Mystacagenia bellula* Evans; *Phanochilus nobilitatus* (Smith) and *Xerochares expulsus* Schulz. The following species and genera have their occurence ranges expanded for South America: *Ageniella azteca* (Cameron); *Ageniella zeteki* (Banks); *Agenioideus birkmanni* (Banks); and *Xerochares expulsus* Schulz; *Cryptocheilus* Panzer; and *Xerochares* Evans.

Keywords

Pompilidae, new record, Neotropical, South America

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Introduction

Spider wasps (Hymenoptera: Pompilidae) are a widespread group of about 5,000 described species (Pitts et al. 2006) in approximately 120 genera (Wasbauer 1995). In the Neotropical region there are four subfamilies, 60 genera, and about 1,000 species (Fernández 2000, Hanson and Wasbauer 2006). The taxonomy and systematics of pompilids are poorly understood, making it one of the most taxonomically challenging families of Hymenoptera. Future work should be focused on making extensive collections and appropriate identifications to get a better understanding of their taxonomy.

The fauna of spider wasps from Colombia and South America is poorly known and not fully explored. Colombia has about 29 genera and approximately 143 species of spider wasps described (Fernández 2000). As part of a project on the systematics of Pompilidae from Colombia and northern South America, we offer new records of genera and species for these regions.

Materials and methods

Examined specimens. When citing the examined material, a backslash indicates a separate label. The specimens are deposited in the Entomological collection of the Instituto Alexander von Humboldt, Villa de Leiva, Colombia (IAvH-E), and in the Instituto de Ciencias Naturales of the Universidad Nacional de Colombia, Bogotá, Colombia (ICN). Specimens from the Utah State University Entomology Collection, Logan, UT (EMUS) were examined for *Agenioideus birkmanni* and *Phanochilus nobilitatus.*

Results

The following species and genera are reported for the first time for Colombia.

Subfamily Ceropalinae

Irenangelus clarus Evans, 1969

Specimen data. BOLIVAR. SFF Los Colorados, Alto el Mirador, [9°54'N, 75°7'W], 400m, malaise, 4–30 ene 2002, E. Deulufeut, M2935 / IAvH-E 107755 (1m, IAvH-E).

Comments. This species has been recorded for Brazil and Argentina (Fernández 2000).

Subfamily Pepsinae

***Aimatocare vitrea* (Fox, 1897)**

Specimen data. RISARALDA. SFF Otún Quimbaya, Robledal, [4°44'N, 75°35'W], 1980m, malaise, 4–18 ene 2003, G. López, M3704, (1m, IAvH-E); 18 feb–4 mar 2003, G. López, M3699, (1m, IAvH-E). VAUPÉS. Estación Mosiro-Itajura (Caparú), Centro Ambiental, [1°4'S, 69°31'W], 60m, malaise, 9–25 feb 2003, J. Pinzón, M3639, (1f, IAvH-E).

Comments. This species has been recorded for Brazil and British Guiana (Fernández 2000).

***Ageniella azteca* (Cameron, 1891)**

Specimen data. TOLIMA. Armero-Guayabal, Hda. Cardonal, [5°5'385"N, 74°46'395"W], 350m, 17 nov 1995, F. Fernández / IAvH-E 107940, (1f, IAvH-E).

Comments. New record for South America. This species was first described for Mexico and later recorded for Nicaragua (Wahis 1995).

***Ageniella curtipinus* (Cameron, 1912)**

Specimen data. BOLÍVAR. Zambrano, Hda. Monterrey, [9°45'N, 74°49'W], 10m, malaise, 29 may 1993, F. Fernandez / IAvH-E 107937, (1f, IAvH-E).

Comments. This species has been recorded for Bristih Guiana, Peru, and Trinidad (Wahis 1995).

***Ageniella fallax* (Arlé, 1947)**

Specimen data. BOLÍVAR. SFF Los Colorados, Diana, [9°54'N, 75°7'W], 150m, malaise, 15–30 sep 2000, E. Deulufeut / IAvH-E 107760, (1m, IAvH-E).

Comments. This species has been recorded for Argentina, Brazil, Peru (Fernández 2000), and Panama (Cambra 2005).

***Ageniella hirsuta* Banks, 1946**

Specimen data. PUTUMAYO. PNN La Paya, Loma Alta, [0°6'S, 74°58'W], 350m, malaise, 18 jun-1 jul 2003, R. Cobete, (1f, IAvH-E).

Comments. This species has been recorded for Ecuador (Fernández 2000).

Ageniella pilifrons (Cameron, 1912)

Specimen data. CAUCA. PNN Gorgona. [2°58'N, 78°11'W], 60m, malaise, 3–18 ene 2001, H. Torres, M1235 / IAvH-E 107720, (1f, IAvH-E). META. PNN Sierra de la Macarena, Cerro El Tablazo, [3°20'N, 73°56'W], 486m, manual, 26 dic 2001, D. Campos, M2614 / IAvH-E 10760 (1f, IAvH-E); Caño La Curia, 580m, 23 dic 1993, con Heteropodidae , F. Fernández / IAvH-E 107942, (1 f, IAvH-E); Cabaña Cerrillo, [3°21'N, 73°56'W], 460m, malaise, 4–17 ene 2003, A.Herrera & W. Villalba, (1f, IAvH-E).

Comments. This species has been recorded for British Guiana (Fernández 2000).

Ageniella pretiosa Banks, 1946

Specimen data. AMAZONAS. PNN Amacayacu. San Martín, [3°23'S, 70°6'W], 150m, malaise, 2–7 jul 2000, B. Amado / IAvH-E 107614, (1f, IAvH-E); Mocagua, [3°23'S, 70°6'W], 150m, malaise, 12–19 jun 2000, A. Parente / IAvH-E 107619, (1f, IAvH-E); VICHADA, PNN Tuparro, Cerro Tomás, [5°21'N; 67°51'W], 140m, malaise, 17–26 dic 2000, W. Villalba / IAvH-E 107628 / IAvH-E 107629, (2f, IAvH-E).

Comments. This species has been recorded for Peru (Fernández 2000).

Ageniella sanguinolenta (Smith, 1864).

Specimen data. AMAZONAS. PNN Amacayacu, San Martín, [3°23'S, 70°6'W], 150m, malaise, 5–19 nov 2001, D. Chota / IAvH-E 107618, (1 f, IAvH-E); BOLÍVAR. SFF Los Colorados, Diana, [9°54'N, 75°7'W], 150m, Malaise, 16–30 nov 2000, E. Deulufeut / IAvH-E 107756, (1f, IAvH-E); CAUCA. PNN Gorgona, El Helechal, 2°58'N, 78°11'W, 30m, malaise, 9–27 ago 2001, H. Torres / IAvH-E 107710 (1f, IAvH-E).

Comments. This species has been recorded for Brazil (Smith 1864).

Ageniella zeteki (Banks, 1925)

Specimen data. CAUCA. PNN Gorgona, Antigua Laguna, [2°58'N, 78°11'W), 70m, malaise, 18 jul-16 ago 2000, H. Torres / IAvH-E 107697 (1f, IAvH-E); El Helechal, [2°58'N, 78°11'W], 30m, malaise, 12–28 sep 2001, H. Torres / IAvH-E 107696, (1f, IAvH-E). CHOCÓ. PNN Utría, Cocalito Dosel, [6°1'N, 77°, 20'W], 20m, malaise, 30 jul–16 ago 2000, J. Pérez / IAvH-E 107762 (1f, IAvH-E). VICHADA. PNN Tuparro. Centro administrativo, [5°21'N, 67°51'W], 100m, malaise, 22 may-3 jun 2001, I. Gil / IAvH-E 107632, (1f, IAvH-E).

Comments. New record for South America. This species was previously recorded for Panama (Banks 1925, Cambra et al. 2004).

***Cryptocheilus* sp.**

Specimen data. BOYACÁ. Sotaquirá, Hueco, 1 abr 1969, J. R. Alba, (1m, ICN).

Comments. New record for South America. *Cryptocheilus* Panzer, 1806 is a cosmopolitan genus with six species described from the Nearctic Region and two from the Neotropical region: *Cryptocheilus neotropicalis* is found in Panama and *Cryptocheilus santosi* is found in Costa Rica and Panama (Cambra and Wahis 2005). This species does not fit the diagnosis of any of the Central American species. The specimen studied herein is similar to *C. pallidipennis* (Banks, 1912), but this species has Nearctic distribution (Townes 1957). A revision of the New World species of the genus is needed to determine if the studied specimen is an undescribed species or not.

***Mystacagenia bellula* Evans, 1973**

Specimen data. CUNDINAMARCA, PNN Sumapaz, Cabañas Las Mirlas, [4°30'N, 73°45'W], malaise, 3–30 abr 2002, H. Vargas / IAvH-E 107683, (1f, IAvH-E); [4°48'N, 73°52'W], 710m, malaise, 19 mar–3 abr 2002, H. Vargas, (1f, IAvH-E). META. PNN Sierra de la Macarena, Caño Curia, Sendero Cachicamos, [3°21'N, 73°56'W], 460m, malaise, 9–24 feb 2003, W. Villalba, (1f, IAvH-E); Villavicencio, Vda. Vanguardia, Pozo Azul, malaise, 16–17 abr 2005, Sistematica Animal, (1f, ICN).

Comments. The genus, known only from females, is rarely collected and comprises four known species: *M. variegata* Evans (Brazil), *M. bellula* Evans (Peru), *M. albiceps* Evans (Peru) and *M. elengatula* Evans (Panama) (Evans 1973, 1980).

***Phanochilus nobilitatus* (Smith, 1864)**

Specimen data. AMAZONAS. Amacayacu, Mata-Mata, 03°48'36"S, 70°20'57"W, malaise, ii.1989, F. Fernández (1f, IAvH 107951). META. PNN Sierra de La Macarena, Cabaña Cerrillo, 3°21'N 73°56'W, 480 m, malaise trap, 10.xi–21.xii.2002, A. Herrera & W. Villalba leg. M.2982 (1f, EMUS).

Comments. This species has been recorded for British Guiana and Peru (Fernández 2000).

Subfamily Pompilinae

***Agenioideus birkmanni* (Banks, 1910)**

Specimen data. MAGDALENA. PNN Tayrona, Palangana, [11°20'N, 74°2'W], 30m, malaise, 31 ene–15 feb 2002, R. Henríquez, M3032, (2m, IAvH-E).

Comments. New record for South America. This species has been previously recorded from northern Oregon east to New Jersey and south to Oaxaca, Mexico (Wasbauer and Kimsey 1985). Specimens from Costa Rica are found in EMUS. This record represents a considerable range extension of what was previously known as a Nearctic species.

Xerochares expulsus Schulz, 1906

Specimen data. MAGDALENA. PNN Tayrona, Neguanje, [11°20'N, 74°2'W]; 10m, malaise, 17–27 sep 2001, R. Henríquez, (13m, 1f IAvH-E); 28 jul–18 ago 2001, R. Henriquez, (10m, 1f, IAvH-E); Palangana, [11°20'N, 74°2'W], 30m, malaise, 4–23 may 2001, R. Henríquez, (5m, IAvH-E).

Comments. New record for South America. The species was previously known from southern New Mexico to western Mexico to Guatemala, El Salvador, and Nicaragua (Evans 1966; Wasbauer and Kimsey 1985).

Evagetes sp.

Specimen data. BOYACÁ. SFF Iguaque, Cabana Chaina, [5°25'N, 73°27'W], 2,600m, malaise, 9–26 sep 2002, A. Roberto, (22m, IAvH-E).

Comments. *Evagetes* Lepeletier, 1845 is a cleptoparasitic genus rarely collected and poorly known in the Neotropics, with four described species from Southern South America (Evans 1966, Fernández 2000). There is no recent taxonomic revision of the genus, therefore, the identification at the species-level is challenging.

Aporus (Aporus) cuzco Evans, 1973

Specimen data. BOYACÁ. SFF Iguaque, Cabaña Chaina, [5°25'N, 73°27'W], 2,600m, malaise, 16 sep–6 oct 2001, P. Reina, M2199 / IAvH-E 107986, (1m, IAvH-E); 9–26 sep 2002, A. Roberto, M3332, (1m, IAvH-E); 6–25 oct 2001, P. Reina, M2477, (1m, IAvH-E); Villa de Leyva, El Roble, 2,200m, red, 9 jun 2001, D. Campos, et al. / IAvH-E 108278, (1f, IAvH-E). CAQUETÁ. PNN Picachos, [2°44'N, 74°53'W], 1,560m, malaise, 1–7 nov 1997, E. González / IAvH-E 108219, (1f, IAvH-E). CUNDINAMARCA. PNN Sumapaz, Jardín Botánico, [4°30'N, 73°45'W], malaise, 4–24 ene 2002, H. Vargas, M3109 / IAvH-E 107989, (1f, IAvH-E); [3°48'N, 73°56'W], 730m, malaise, 4–24 ene 2002, H. Vargas, M3109, (1m, IAvH-E). HUILA. PNN Cueva de los Guacharos, Alto el Mirador, [1°38'N, 76°6'W], 1,980m, malaise, 6–21 abr 2002, J. Fonseca, M3127, M3258, (2f, IAvH-E); 4–18 feb 2002, F. Quevedo / IAvH-E 108187, (1f, IAvH-E). MAGDALENA. Santa Marta, Ciudad Perdida, [11°14'50"N, 74°12'6"W], 1,200m, 25–26 nov 1995, A. Amarillo, CES260 / IAvH-E 108244, (1f, IAvH-E); PNN Tayrona, Cerro San Lucas, La Antena, [11°20'N, 74°2'W], 700m, malaise, 19–24 jul 2002, M.

Sharkey, D. Arias & E. Torres, (1m, IAvH-E). NARIÑO. R.N. La Planada, Parcela Olga, [1°15'N, 78°15'W], 1,850m, malaise, 29 feb-14 mar 2004, G. Olivia, M4710, (1f, IAvH-E); Centro Administrativo, [1°15'N, 78°15'W], 1,700m, red, 9–12 ago 2004, D. Arias, M4901, (1m, IAvH-E). NORTE DE SANTANDER. ANU Los Estoraques, Platanillo, [8°13'N, 73°14'W], 1,516m, malaise, 1–15 sep 2003, J. Vargas, M4087, (1m, IAvH-E). QUINDÍO. Circasia, Vda. Buenavista, Fca. Calamar, [4°36'53"N, 75°41'56"W], 1,460m, malaise, 10 oct 1999, E. González / IAvH-E 108262, (1m, IAvH-E). RISARALDA. SFF Otún Quimbaya, Cuchilla camino, [4°43'N, 75°35'W], 2,050m, malaise, 26 sep-11 oct 2003, G. López, M4212, (1f, IAvH-E); Robledal, [4°44'N, 75°35'W], 1,980m, malaise, 4–18 ene 2003, G. López, M3704, (1f, IAvH-E); 20 dic 2002–3 ene 2003, R. Walker, M2974, (1f, IAvH-E). VALLE DEL CAUCA. PNN Farallones de Cali, Cgto. Los Andes, Vda. Quebradahonda, [3°34'N, 76°40'W], 1,730m, malaise, 26 ago 1998, N. Beltrán & H. Peña / IAvH-E 108253, (1f, IAvH-E); La Meseta, [3°34'N, 76°40'W], 2,080m, malaise, 24 dic 2003–27 ene 2004, S. Sarria & M. Losso, M4553, (1f, IAvH-E).

Comments. This species has been recorded for Peru (Fernández 2000).

Aporus (Cosmiaporus) diverticulus (Fox, 1897)

Specimen data. HUILA. PNN Cueva de los Guacharos, Alto el Mirador, [1°38'N, 76°6'W], 1,980m, malaise, 21 abr–5 may 2002, J. Fonseca, M3128, (1m, IAvH-E); PUTUMAYO. PNN La Paya, Cabaña Chagra, [0°7'S, 74°56'W], 320m, malaise, 16–30 dic 2001, E. Lozano / IAvH-E 108201, (1f, IAvH-E).

Comments. This species has been recorded for Brazil (Fernández 2000).

Aporus (Notoplaniceps) canescens Smith, 1873

Specimen data. AMAZONAS. PNN Amacayacu, Matamata, [3°41'S, 70°15'W], 150m, malaise, 24 mar–3 abr 2000, A. Parente, M38, (1m, IAvH-E); San Martín, [3°23'S, 70°6'W], 150m, malaise, 22–30 ene 2001, B. Amado / IAvH-E 108233, (1f, IAvH-E). CAQUETÁ. Santa Rosita, [1°20'N, 76°6'W], 600m, malaise, 22 jul-4 ago 2000, F. Ruales / IAvH-E 108212, (1f, IAvH-E). MAGDALENA, PNN Tayrona, Cerro San Lucas, La Antena, 11°20'N, 74°2'W, 700m, malaise, 19–24 jul 2002, M. Sharkey, D. Arias & E. Torres, M3258, (1m, IAvH-E). META. PNN Sumapaz, Qda. La Cristalina, [3°48'N, 73°56'W], 614m, malaise, 20 ago-5 sep 2003, H. Vargas & A. Torrijos, M4342, (1f, IAvH-E); PNN Sierra de la Macarena, cabaña Cerrillo, [3°21'N, 73°56'W], 460m, malaise, 10 nov-21 dic 2002, A. Herrera &W Villalba, M2982, (1f, IAvH-E); PNN Tinigua, Vda. Bajo Raudal, malaise, 5–19 ene 2003, C. Sánchez, M3477, (1m, IAvH-E). PUTUMAYO. PNN La Paya, cabaña Viviano, [0°7'S, 74°56'W], 320m, malaise, 18–21 abr 2002, R. Cobete, M3252, (1f, IAvH-E). RISARALDA. SFF Otún Quimbaya, Robledal, [4°44'N, 75°35'W], 1.980m, malaise, 4–18 ene 2003, G. López, M3704, (1m, IAvH-E); VAUPÉS. Estación Mosiro-Itajura (Caparu), Centro Ambiental, [1°4'S, 69°31'W], 60m, malaise,

9–25 feb 2003, J. Pinzón, M3639, (1m, IAvH-E); fit, 20 ene-1 feb 2003, M. Sharkey & D. Arias, M3388, (IAvH-E); VICHADA. PNN El Tuparro, Cerro Tomás, [5°21'N, 67°51'W], 140m, malaise, 27 dic 2000–5 ene 2001, M955, W. Villalba, (1f, IAvH-E).

Comments. This species has been recorded for Trinidad and Tobago, Argentina, Brazil, and Peru (Fernández 2000).

Euplaniceps exilis (Banks, 1944)

Specimen data. CAQUETÁ. PNN Serranía de Chiribiquete, Caño-Amú, Bos.inundable y tierra firme, [0°14'N, 72°27'W], 300m, malaise, 21–25 nov 2000, E. González & M. Ospina, M961, (1m, IAvH-E); Puerto Abeja, [0°4'N, 72°26'W], 310m, 29 oct-12 nov 2000, J. Forero, M955, (1m, IAvH-E). MAGDALENA. PNN Tayrona, Zaino, [11°20'N, 74°2'W], 50m, malaise, 14–30 jul 2000, R. Henriquez, M564, (1m, IAvH-E). META. PNN Sierra de la Macarena, Caño Curia, Sendero Cachicamos, [3°21'N, 73°38'W], 493m, malaise, 13–30 sep 2004, W. Villalba, (1m, IAvH-E). VAUPÉS, RN Mosiro-Itajura (Caparú), Centro Ambiental, [1°4'S, 69°31'W], 60m, malaise, 20 ene–1 feb 2003, M. Sharkey & D. Arias, M3386, (1m, IAvH-E); Antigua Cabaña, [1°4'N, 69°3'W], 60m, malaise, 17–29 abr 2003, J. Pinzón, M3615, (IAvH-E). VICHADA. PNN El Tuparro, Cerro Tomás, [5°21'N, 67°51'W], 140m, malaise, 17–26 dic 2000, W. Villalba, M1386, (2m, IAvH-E); Centro Administrativo, [5°21'N, 67°51'W], 100m, 15–19 jul 2000, M510, W. Villalba, (1m, IAvH-E).

Comments. This species has been recorded for Guiana and Suriname (Banks 1944, Cambra et al. 2013)

Euplaniceps herbertii (Fox, 1897)

Specimen data. MAGDALENA. PNN Tayrona, Cerro San Lucas, [11°19'N, 73°53'W], 400m, malaise, 6–11 nov 2003, C. Sarmiento, (1f, IAvH-E). META. PNN Sierra de la Macarena, Caño Curia, Sendero Cachicamos, [3°21'N, 73°56'W], 460m, malaise, 21 dic 2002–4 ene 2003, M. Duarte, (1f, IAvH-E); 10 nov-21 dic 2002, M. Duarte, (1f, IAvH-E).

Comments. This species has been recorded for Guiana and Brazil (Fernández 2000, Cambra et al. 2013).

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Taxonomic note and description of new species of *Fissocantharis* Pic from China (Coleoptera, Cantharidae)

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Abstract

Two new species of *Fissocantharis* Pic are described, *F. bifoveatus* **sp. n.** (CHINA: Yunnan) and *F. acuticollis* **sp. n.** (CHINA: Zhejiang, Fujian, Guangdong, Hunan). *F. pieli* (Pic, 1937) is redescribed and *F. kontumensis* Wittmer, 1989 is provided with a supplementary description. *F. shanensis* (Wittmer, 1997) is synonymized with *F. kontumensis*. For the above four species, illustrations of male genitalia are provided, for the latter three also photos of female genitalia and abdominal sternites VIII, and for the new species photos of male habitus and antennae are presented. Additionally, the specific name of *F. wittmeri* (Y. Yang & X. Yang, 2009), preoccupied by *F. wittmeri* (Kazantsev, 2007), is replaced by *F. walteri* Y. Yang & X. Yang, nom. n. And *F. wittmeri* (Kazantsev, 2007) is found to be a junior objective synonym of *F. denominata* (Wittmer, 1997).

Keywords

Taxonomy, *Fissocantharis*, synonym, homonym, new species, new name, China

Introduction

Fissocantharis Pic, 1921 is one of the largest genera of cantharid beetles, with about 200 species known worldwide, and the generic diagnosis was most recently redefined by Yang, Brancucci and Yang (2009). During our recent study, two remarkable new species of this genus from China were discovered. Here the new species are described

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under the names of *F. bifoveatus* sp. n. and *F. acuticollis* sp. n., which are related to *F. pieli* (Pic, 1937) and *F. kontumensis* Wittmer, 1989 respectively. A key to their similar species has been already provided by Yang, Okushima and Yang (2012), so only some differential diagnosis between each new species and its related species are summarized in the present study.

Furthermore, based on an examination of the types, *F. shanensis* (Wittmer, 1997) (Type locality: Myanmar: Shan States), originally in *Micropodabrus* Pic, 1920, is considered to be a junior synonym of *F. kontumensis* Wittmer, 1989 (Type locality: Vietnam: Kon Tum), which is recorded to China (Yunnan) for the first time.

Additionally, the specific name of *F. wittmeri* (Y. Yang & X. Yang, 2009), a replacement name for *Rhagonycha coomani* Pic, 1935 (Type locality: Vietnam: Tonkin) and preoccupied by *F. wittmeri* (Kazantsev, 2007), here is replaced by *F. walteri* Y. Yang & X. Yang, nom. n. *F. wittmeri* (Kazantsev, 2007), which was a replacement name for *Podabrus formosanus* Wittmer, 1954, is found to be an unnecessary replacement name and a junior objective synonym of *F. denominata* (Wittmer, 1997).

In the present study, the characters of female genitalia and abdominal sternite VIII are emphasized in the description of *Fissocantharis* species for the first time.

Material and method

The material is preserved in the following collections. Primary types were returned to the collections from which they were borrowed or were otherwise deposited in public museums.

IZAS Institute of Zoology, Chinese Academy of Sciences, Beijing, China;
MHBU Museum of Hebei University, Baoding, China;
MNHN Muséum national d'Histoire naturelle, Paris, France;
NHMB Naturhistorisches Museum Basel, Switzerland;
SYSU Sun Yat-Sen University, Guangzhou, China.

The genitalia of both sexes and abdominal sternites VIII of females were dissected and cleared in 10% KOH solution, and the female genitalia was dyed with hematoxylin. Habitus photos were taken by a Leica M205 A microscope, multiple layers were stacked using Combine ZM (Helicon Focus 5.3). Line drawings were made with the aid of camera lucida attached to a Leica MZ12.5 stereomicroscope, then edited in CorelDRAW 12 and Adobe Photoshop 8.0.1.

Complete label data are cited for type specimens, using square brackets "[ ]" for our remarks and comments, quotation marks to separate data from different labels.

Body length was measured from the anterior margin of the clypeus to the elytral apex and body width across the humeral part of elytra. Morphological terminology of female genitalia follows that of Brancucci (1980). The abbreviations in the figures are as follows, ag: accessory gland; co: coxite; di: diverticulum; tg9: abdominal tergite IX; sd: spermathecal duct; sp: spermatheca; ov: median oviduct; va: vagina.

Taxonomy

***Fissocantharis pieli* (Pic, 1937)**
Figs 3, 6, 11–13

Lycocerus pieli Pic, 1937: 172.
Micropodabrus pieli: Wittmer 1997: 312, figs 178–180.
Fissocantharis pieli: Yang et al. 2009: 49.

Type material examined. Lectorype ♂ (MNHN): [p] "Mokan Shan \ 3.V.1930 \ coll. O. Piel", [p] "LECTOTYPUS", [h] "Lycocerus \ pieli n. sp.", [h] "Micropodabrus \ pieli \ (Pic) \ det. W. Wittmer". Paralectorype: 1♀ (MNHN): same data, 1.V.1930.

Additional material examined. CHINA: **Zhejiang**: 2♂♂, 1♀ (IZAS): "Mokan Shan [Mogan Shan], 30.IV.1936, coll. O. Piel"; 1♀ (IZAS): same data, 3.V.1936; 1♀ (IZAS): Tianmu Shan, 6.V.1981, leg. P.Y. Yu; 2♂♂ (MHBU): Longquan, Fengyang Shan, 1250m, 31.III.2007, leg. J. Cao. **Fujian**: 1♂ (NHMB): "Fukien, Kuatun [Fujian, Guadun], 2300m, 27.40n.Br., 117.40ö.L., 5.IV.1938, J. Klapperich"; 1♂ (NHMB): same data, 30.III.1938; 1♂ (NHMB): "Fukien, Kuatun, 21.IV.1946, Tschung Sen."; 1♂ (NHMB): "Fukien, Shaowu, Tachuland, 22.IV.1945".

Redescription. Male. Body black, clypeus and genae light brown, pronotum and elytra red, more or less darkened at median longitudinal groove of pronotum.

Head subquadrate, evenly narrowed behind eyes, dorsum slightly convex in center, with a distinct middle longitudinal line, each side with a small transverse impression behind antennal socket, head surface finely imbricate-punctate, matt, covered with sparse, fine, reddish brown decumbent pubescence; eyes moderately protruding, head width across eyes slightly wider than anterior margin of pronotum; terminal maxillary palpomeres nearly long-triangular, arcuate and sharp at apical one-third length of inner margin; antennae extending to apical one-third length of elytra, antennomeres II nearly as long as wide at apices, III–VIII distinctly and IX–X slightly widened apically, slightly flattened on dorsal sides, III about twice as long as wide at apices, IV slightly longer than III, the whole length of III–V and basal parts of VI with narrow longitudinal ridges along outer margins, VI–VIII each with a deep and nearly oblong fovea on dorsal side, the foveae slightly widened apically and smooth on inner surface, with all margins delimitated and well-developed on VI–VII, but apical margins reduced on VIII, XI slightly longer than X, nearly parallel-sided and pointed at apex.

Pronotum subquadrate, slightly longer than wide, widest near posterior margin, anterior margin arcuate, anterior angles widely rounded, lateral margins slightly sinuate, moderately diverging posteriorly, posterior angles obtusely rectangular, posterior margin nearly straight and narrowly bordered, disc moderately convex on posterolateral parts, with a distinct median longitudinal groove, surface pubescent and punctate like that of head.

Elytra about 4.5 times longer than pronotum, 3.5 times longer than humeral width, which about one-third wider than posterior margin of pronotum, outer margins nearly parallel, disc surface rugulose-lacunose, densely and coarsely punctate, matt, covered

with dense, short and decumbent reddish brown pubescence, combined with much sparser, longer, semierected pubescence, elytral venation well developed.

All claws bifid, the lower claws nearly as long as upper ones on proclaws, distinctly shorter than on meso- and metaclaws.

Abdominal sternite IX nearly triangular. Aedeagus (Figs 11–13): ventral process of each paramere abruptly narrowed apically and rounded at apex; conjoint dorsal plate of parameres distinctly shorter than ventral processes, slightly emarginated in middle of apical margin and lateroapical angles; middle node of basal pieces moderately diverging apically.

Female. Similar to males, but antennae shorter and wider, extending to elytral midlength, antennomeres III–X nearly triangular, each about 1.5 times as long as wide at apex, III–V slightly and VI–VIII distinctly concaved on dorsal sides, without delimitated margins and not smooth on inner surface. Pronotum nearly as wide as long, slightly convex on posterolateral parts. Elytra with outer margins slightly diverging posteriorly. Legs with all lower claws distinctly shorter than upper ones. Abdominal sternite VIII (Fig. 3) narrowly rounded at apex, hardly emarginated in middle of posterior margin. Internal reproductive organ of genitalia (Fig. 6): vagina stout and abruptly extended apically as a thin and long duct; diverticulum and spermathecal duct arising from the end the long duct of vagina; diverticulum moderately long, thin and spiral; spermathecal duct slightly shorter than diverticulum; spermatheca slightly thicker and longer than diverticulum, provided with moderately long and thin accessory gland, distinctly longer than spermatheca.

Body length: 10.0–12.0 mm; width: 2.0–2.5 mm.

Distribution. China (Zhejiang, Fujian).

Remarks. The characteristic antennae and aedeagus were illustrated by Wittmer (1997), but other morphological characters are poorly known except the simple description in the original publication (Pic, 1937). Under this consideration, we redescribe this species here and provide illustrations of its main diagnostic characters.

Fissocantharis bifoveatus Y. Yang & X. Yang, sp. n.

http://zoobank.org/BE256688-BCA0-4C42-A1EE-183EF86563D3

Figs 1, 9, 14–16

Type material. Holotype ♂ (IZAS): "**CHINA, Yunnan** Provin., Gongshan, Dulongjiang, Miliwang, above Bapo, 27.72383°N, 98.36117°E, 1956m, 31.X.2004, night, Liang Hongbin collector, California Academy & IOZ, Chinese Acad. Sci.". Paratypes: 1♂ (IZAS): same data to holotype; 1♂ (IZAS): "CHINA, Yunnan Provin., Gongshan, Dulongjiang, Kongdang, roadside, 27.87696°N, 98.33587°E, 1525m, 25.X.2004, day, Liang Hongbin collector, California Academy & IOZ, Chinese Acad. Sci."; 1♂ (IZAS): "CHINA, Yunnan Provin., Gongshan, Bingzhongluo, Chaohong Bridge, beach, 28.06671°N, 98.58360°E, 1540m, 11.XI.2004, day, Liang Hongbin collector, California Academy & IOZ, Chinese Acad. Sci.".

Figures 1–5. 1–2 Male habitus, dorsal view **3–5** abdominal sternite VIII of female, ventral view: **1** *Fissocantharis bifoveatus* sp. n. **2, 5** *F. acuticollis* sp. n. **3** *F. pieli* (Pic, 1937) **4** *F. kontumensis* Wittmer, 1989. Scale bars: **1–2**=2.0 mm; **3–5**=1.0 mm.

Description. Male (Fig. 1). Body black, mandibles dark brown, elytra red.

Head subquadrate, evenly narrowed behind eyes, dorsum slightly convex in center, with a distinct middle longitudinal line, each side with a small transverse

impression behind antennal socket, head surface finely imbricate-punctate, matt, covered with sparse, fine, reddish brown decumbent pubescence; eyes moderately protruding, head width across eyes slightly wider than anterior margin of pronotum; terminal maxillary palpomeres nearly long-triangular, arcuate at apical one-third length of inner margin; antennae (Fig. 9) extending to apical one-third length of elytra, antennomeres II nearly as long as wide at apices, III–VIII distinctly widened apically, slightly flattened on dorsal sides, III–VII with outer apical angles distinctly protruding, III about twice as long as wide at apices, IV slightly longer than III, IV–VI (Fig. 9a) each with a small, round, shallow impression at basal one-third of dorsal side, the whole length of IV–VI and basal parts of VII with narrow longitudinal ridges along inner margins, VII–VIII (Fig. 9b) each with a deep oblong fovea on dorsal side, the foveae smooth on inner surfaces, with all margins delimitated and well-developed, IX–XI nearly parallel-sided, XI slightly longer than X and pointed at apex.

Pronotum subquadrate, slightly longer than wide, widest near posterior margin, anterior margin arcuate, anterior angle widely rounded, lateral margins slightly sinuate, moderately diverging posteriorly, posterior angles nearly rectangular, posterior margin nearly straight and narrowly bordered, disc moderately convex on posterolateral parts, with a distinct median longitudinal groove, surface pubescent and punctate like that of head .

Elytra about 4.5 times longer than pronotum, 3.5 times longer than humeral width, which about one-third wider than posterior margin of pronotum, outer margins nearly parallel, disc surface rugulose-lacunose, densely and coarsely punctate, matt, covered with dense, short and decumbent reddish brown pubescence, combined with much sparser, longer, semierected pubescence, elytral venation well developed, moderately costate.

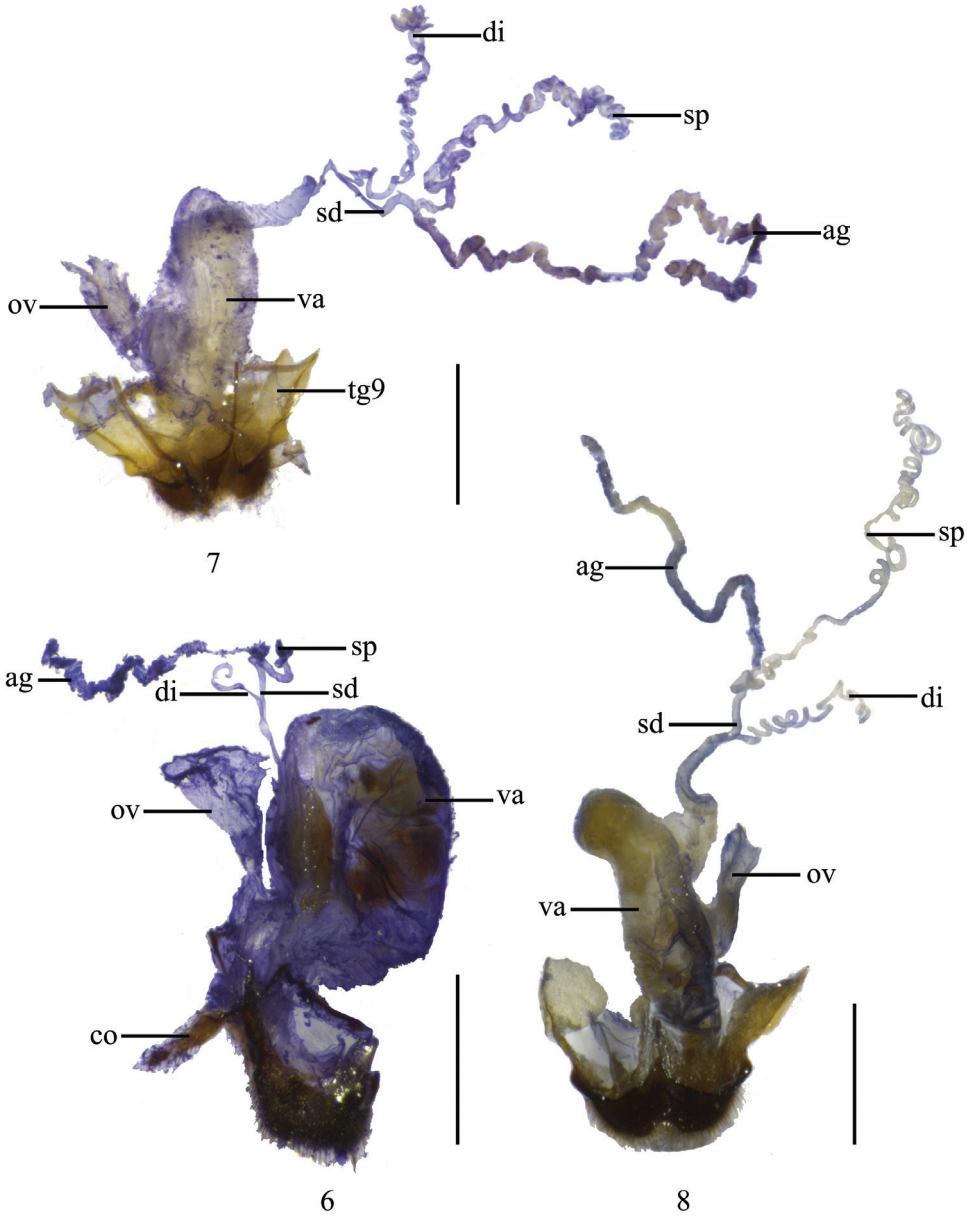
All claws bifid, the lower claws nearly as long as upper ones at pro- and mesoclaws, slightly shorter than at metaclaws.

Abdominal sternite IX nearly triangular at apex. Aedeagus (Figs 14–16): ventral process of each paramere slightly narrowed apically and rounded at apex, with inner margins curling up outwards; conjoint dorsal plate of parameres distinctly shorter than ventral processes, largely and triangularly emarginated in middle of apical margin, lateroapical angles obtusely triangular; middle node of basal pieces strongly diverging apically.

Female. Unknown.

Body length (males): 8.0–9.0 mm; width: 1.8–2.0 mm.

Diagnosis. This species is similar to *F. pieli* (Pic), but differs from the latter by the characteristic antennae of the male with antennomeres IV–VI each with a small, round, shallow impression at basal one-third of dorsal side, VII–VIII each with a deep oblong fovea on dorsal side; pronotum black; aedeagus: ventral process of each paramere slightly narrowed apically, with inner margins curling up outwards; conjoint dorsal plate of parameres largely and triangularly emarginated in middle of apical margin.



Figures 6–8. Female genitalia, lateral view: **6** *Fissocantharis pieli* (Pic, 1937) **7** *F. kontumensis* Wittmer, 1989 **8** *F. acuticollis* sp. n. Scale bars: 1.0 mm.

Distribution. China (Yunnan).

Etymology. The specific name is derived from the Latin *bi* (two) and *fovea* (pit), referring to its antennomeres VII–VIII each with a deep fovea on dorsal sides in males.

***Fissocantharis kontumensis* Wittmer, 1989**
Figs 4, 7, 17−19

Fissocantharis kontumensis Wittmer, 1989: 215, figs 12, 13.
Micropodabrus shanensis Wittmer, 1997: 313, figs 181, 182. syn. n.
Fissocantharis shanensis: Yang et al. 2009: 49.

Type material examined. *Fissocantharis kontumensis*: Holotype ♂ (NHMB): [p] "VIETNAM: Buon-loi \ 40 km N of Ankhe \ Prov. Gia. Lai Kontum \ 12.–14.6.1985", [p] "HOLOTYPUS", [h] "F. \ kontumensis \ Wittm. \ det. W. Wittmer", [p] "Naturhist. \ Museum Basel \ coll. W. Wittmer", [p] "CANTHARIDAE \ CANTH00001272".

Micropodabrus shanensis: Holotype ♂ (NHMB): [p] "S. SHAN States \ Burma 1500m. \ Taunggyi 1.VIII- \ 22.IX.(19)34 Malaise", [p] "HOLOTYPUS", [h] "Micropodabrus \ shanensis \ Wittm. \ det. W. Wittmer", [p] "Naturhist. \ Museum Basel \ coll. W. Wittmer", [p] "CANTHARIDAE \ CANTH00000259". (The antennomeres IX-XI, right prometarsomeres IV-V, left metatarsus of the holotype were missing.)

Additional material examined. CHINA: **Yunnan**: 1♂ (IZAS): Xishuangbanna, Mengzhe, 1200m, 29.VIII.1958, leg. F.J. Pu ; 1♂ (IZAS): Xishuangbanna, Mengla, 620−650m, 10.VI.1959, leg. F.J. Pu ; 1♂, 2♀♀ (IZAS): Xishuangbanna, Meng'a, 1050−1080m, 4.VIII.1958, leg. S.Y. Wang; 1♀ (IZAS): Lancang, 1000m, 26.VII.1957, leg. L.C. Zang; 1♂ (IZAS): same locality, 25.VII.1957, leg. S.Y. Wang; 1♂ (IZAS): Jinping, Changpotou, 1300m, 25.V.1956, leg. K.R. Huang; 1♀ (MHBU): Longling, Lameng, 3.VIII.2005, leg. B.Y. Mao & J.S. Xu.

Supplementary description. Male. Aedeagus (Figs 17−19): ventral process of each paramere slightly widened and rounded at apex; conjoint dorsal plate of parameres distinctly shorter than ventral processes, largely roundly emarginated in middle of apical margin, lateroapical angles slightly acute; middle node of basal pieces moderately diverging apically.

Female. Abdominal sternite VIII (Fig. 4) slightly truncate at apex, bisinuately emarginated in middle of posterior margin. Internal reproductive organ of genitalia (Fig. 7): vagina abruptly extended apically as a long and thick duct; diverticulum and spermathecal duct arising from the end the long duct of vagina; diverticulum long, thin and spiral; spermathecal duct distinctly shorter and slightly thicker than diverticulum; spermatheca nearly as long as and slightly thicker than diverticulum, provided with moderately long and thin accessory gland, slightly longer than spermatheca.

Body length: 8.0−10.0 mm; width: 2.0−2.2 mm.

Distribution. China (new record: Yunnan); Vietnam; Myanmar.

Remarks. *F. shanensis* (Wittmer, 1997) was described on a single male holotype. Although some differential characters from *F. kontumensis* Wittmer, 1989 were suggested by Wittmer (1997), these differences of quantitative change in the antenna and conjoint dorsal plate of parameres of aedeagus turned out to be intraspecific variability, based on our examination of both types and a large series of additional material. Therefore, we synonymize *F. shanensis* (Wittmer, 1997) with *F. kontumensis* Wittmer, 1989 here.

Figures 9–10. Male antennae, dorsal view: **9** *Fissocantharis bifoveatus* sp. n. (**9a** antennomeres IV–VI, dorsal view **9b** antennomeres VII–VIII, dorsal view) **10** *F. acuticollis* sp. n. (**10a** antennomeres IV–VII, outer view **10b** antennomeres VIII–XI, outer view). Scale bars: 1.0 mm.

***Fissocantharis acuticollis* Y. Yang & X. Yang, sp. n.**
http://zoobank.org/5BD2F700-8AAB-4375-8C80-248AA1BC0224
Figs 2, 5, 10, 20−22

Type material. Holotype ♂ (MHBU): **CHINA: Zhejiang**: 1Taishun, Wuyanling, 28.VII−3.VIII.2005, leg. Y.B. Ba. Paratypes: 1♀ (MHBU): same data as the holotype; 1♀ (MHBU): same data, 2.VIII.2005; 1♀ (MHBU): same data, 31.VII.2005; 1♀ (IZAS): Qingyuan, Baishanzu, 800m, 14.VIII.1993, leg. H. Wu. **Guangdong**: 1♀ (SYSU): Xinfeng, 10.VII.1991, leg. R. Zeng; 1♂ (SYSU): same locality, 8.VII.1991,

leg. Q.Z. Ye; 1♀ (SYSU): same locality, 9.VII.1991, leg. R. Chen; 1♂ (SYSU): same locality, 9.VII.1991, leg. Z.Y. Weng; 1♂ (SYSU): same data, 8.VII.1991; 1♂ (SYSU): Fengkai, Heishiding, 18.–22.VII.2007, leg. L. Shi; 1♂ (SYSU): same locality, 4.VII.1987, leg. S.X. Zhong; 1♀ (SYSU): same locality, 12.VII.1999, leg. J.N. Yang; 1♀ (IZAS): Ruyuan, Nanling Nature Reserve, Ruyang Reserve Station, 1030−1420m, 20.VII.2008, leg. G.Y. Yang. **Hunan**: 1♂ (IZAS): Shennong Valley, Shennong Waterfall, 600−900m, 7.VII.2008, leg. X.Y. Zhu & Z. Yang; 1♀ (IZAS): Yanling, Shidu, Taoyuandong, 868m, 26.478°N, 114.04°E, 7.VII.2008, T.Y. Jiao; 1♂ (IZAS): Yizhang, 14.–15.VII.2008, leg. R.R. Wang & L. Ding (above all transliterated from Chinese labels). **Fujian**: 1♂ (NHMB): "Guatun, Fukien, China, 8.V.1946 (Tschung Sen.)"; 1♀ (NHMB): "Yen-ping, China, 2.VII.1917, Ac. 5148".

Description. Male (Fig. 2). Body black, clypeus and mouthparts except maxillary and labial palpi dark brown, pronotum and elytra yellowish brown.

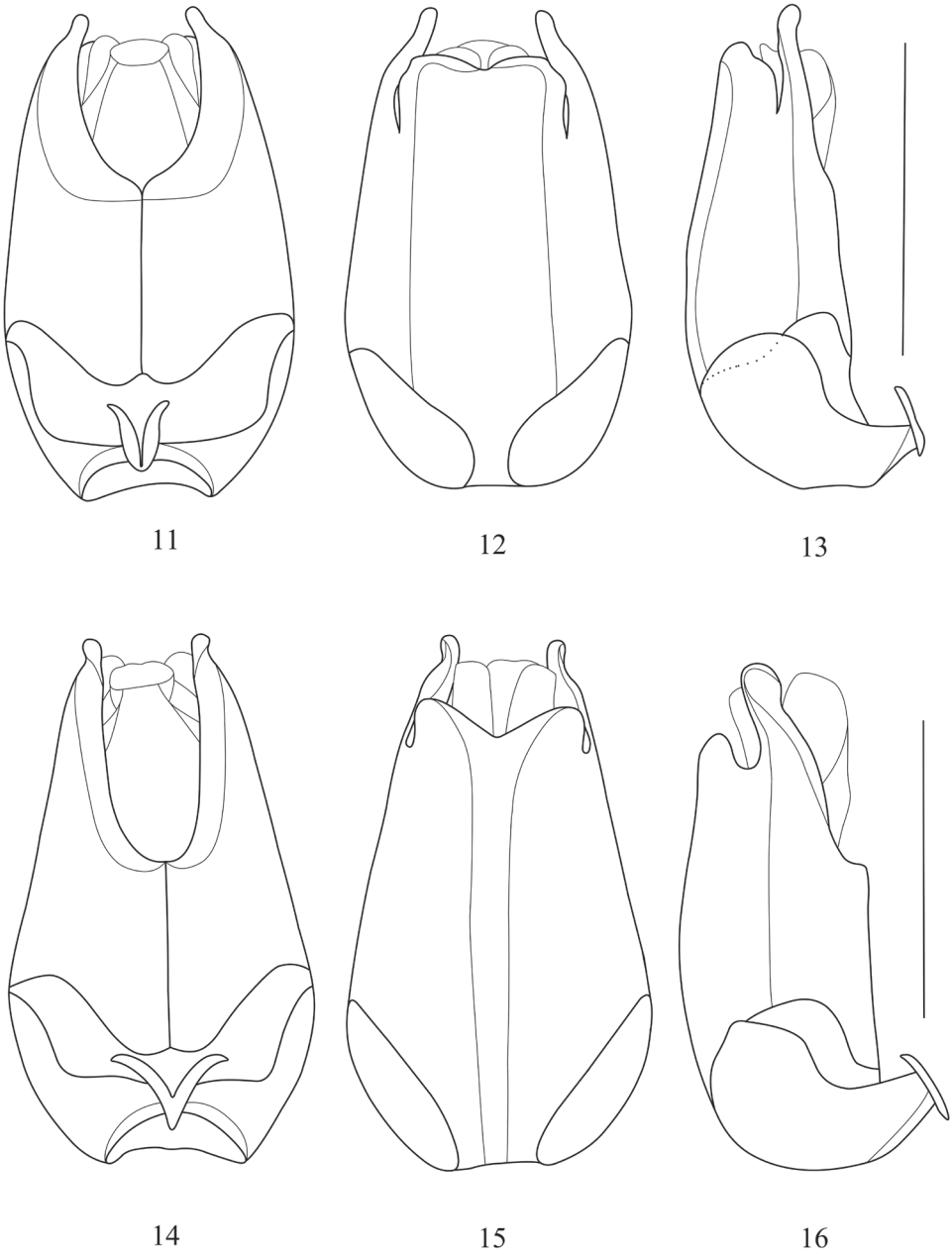
Head subquadrate, evenly narrowed behind eyes, dorsum nearly flat, with a indistinct middle longitudinal line, each side with a small transverse impression behind antennal socket, head surface densely and finely punctate, semilustrous, covered with sparse, fine, yellowish brown decumbent pubescence; eyes moderately protruding, head width across eyes nearly as wide as anterior margin of pronotum; terminal maxillary palpomeres nearly long-triangular, almost obliquely truncate at apical one-third length of inner margin; antennae (Fig. 10) extending to basal one-third length of elytra, antennomeres II nearly as long as wide at apices, III−XI distinctly thickened, III−X widened apically, III nearly as long as wide at apices, IV slightly longer than III, VI longest, apical parts of IV, the whole length of V−X and basal parts of XI with longitudinal deep grooves along outer margins (Figs 10a,b), XI nearly parallel-sided and pointed at apex.

Pronotum nearly trapeziform, distinctly wider than long, widest at posterior margin, anterior margin slightly arcuate, anterior angles obtusely rectangular, lateral margins nearly straight, strongly diverging posteriorly, posterior angles triangular and sharp, posterior margin nearly straight and narrowly bordered, slightly emarginated in middle, disc strongly convex on posterolateral parts, with a distinct median longitudinal groove, surface finely imbricate-punctate, matt, covered with dense, fine, yellowish brown decumbent pubescence.

Elytra about 4.0 times longer than pronotum, 2.5 times longer than humeral width, which about one-third wider than posterior margin of pronotum, outer margins slightly diverging posteriorly, disc surface rugulose-lacunose, densely and coarsely punctate, matt, covered with dense, short and decumbent reddish brown pubescence, combined with much sparser, longer, semierected pubescence, elytral venation moderately developed.

All claws bifid, the lower claws slightly shorter than upper ones on all claws.

Abdominal sternite IX nearly triangular at apex. Aedeagus (Figs 20−22): ventral process of each paramere bent inwards and rounded at apex, with a triangular protuberance at inner margin; conjoint dorsal plate of parameres nearly as long as ventral processes, distinctly roundly emarginated in middle of apical margin, lateroapical angles rounded; middle node of basal pieces strongly diverging apically.



Figures 11–16. Aedeagus (**11, 14** ventral view **12, 15** dorsal view **13, 16** lateral view): **11–13** *Fissocantharis pieli* (Pic, 1937) **14–16** *F. bifoveatus* sp. n. Scale bars: 1.0 mm.

Female. Similar to males, but antennae slightly thickened, without longitudinal grooves on antnnomeres VI−XI. Head width across eyes distinctly narrower than anterior margin of pronotum. All claws with lower claws distinctly shorter than upper

ones. Abdominal sternite VIII (Fig. 5) largely truncate at apex, bisinuately emarginated on each side of posterior margin. Internal reproductive organ of genitalia (Figs 20−22): vagina tapered and extended apically as a long duct; diverticulum and spermathecal duct arising from the end the long duct of vagina; diverticulum moderately long, thin and spiral; spermathecal duct distinctly shorter and slightly thicker than diverticulum; spermatheca much longer than diverticulum, provided with moderately long and thin accessory gland, distinctly shorter than spermatheca.

Body length: 9.0−11.0 mm; width: 2.3−3.0 mm.

Diagnosis. This species is similar to *F. kontumensis* Wittmer, but differs from the latter by the characteristic antennae of the male with apical parts of antennomeres IV and the whole length of V with longitudinal grooves along outer margins; pronotum distinctly wider than long, with triangular and sharp posterior angles, disc strongly convex on posterolateral parts; aedeagus: ventral process of each paramere with inner margins distinctly protuberant in middle, conjoint dorsal plate of parameres nearly as long as ventral processes, roundly emarginated in middle of apical margin, with rounded lateroapical angles.

Distribution. China (Zhejiang, Fujian, Guangdong, Hunan).

Etymology. The specific name is derived from the Latin *acutus* (acute) and *collum* (neck), referring to its pronotum with triangular and sharp posterior angles.

Remarks. Some specimens are variable, with head almost yellowish brown, pronotum and elytra more or less darkened, elytral venation hardly visible.

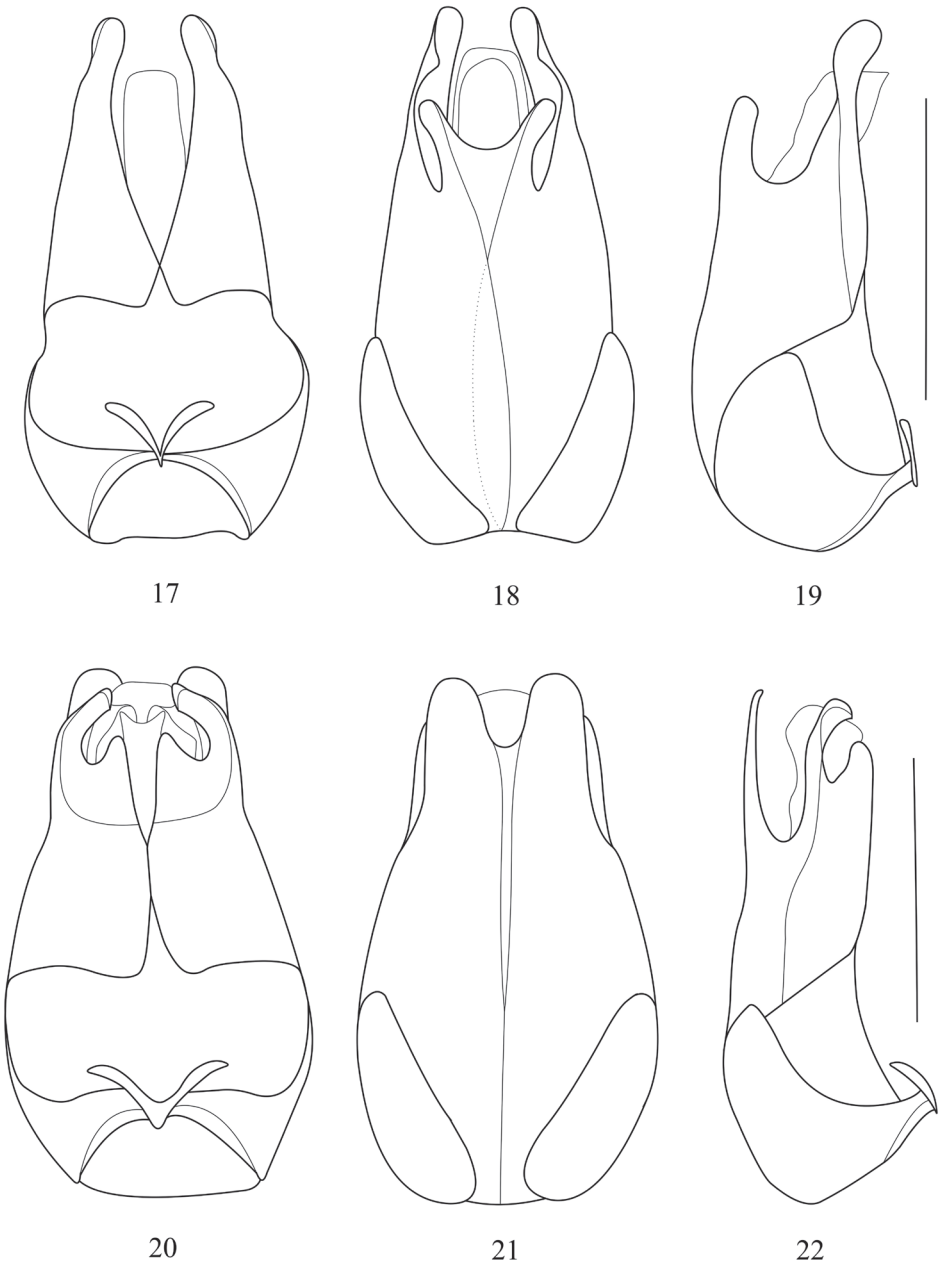
Fissocantharis walteri Y. Yang & X. Yang, nom. n.

Rhagonycha coomani Pic, 1935: 12.
Kandyosilis coomani: Wittmer 1989: 226.
Micropodabrus coomani: Wittmer 1997: 312 [secondary hononym, preoccupied by *Micropdabrus coomani* (Pic, 1926: 35), originally in *Lycocerus*].
Micropodabrus wittmeri Y. Yang & X. Yang, 2009: 67 (replacement name for *Micropodabrus coomani* (Pic, 1935), nec Pic, 1926) [primary homonym, preoccupied by *Micropodabrus wittmeri* Kazantsev, 2007]. syn. n.
Fissocantharis wittmeri Y. Yang & X. Yang, 2009: Yang et al. 2009: 49.

Distribution. Vietnam (Tonkin).

Etymology. The species is named after the first name of late Dr. Walter Wittmer.

Remarks. This species was originally described in *Rhagonycha* Eschescholtz, 1830, and initially transferred to *Kandyosilis* Pic, 1929 (Wittmer, 1989), then later to *Micropodabrus* (Wittmer, 1997), where it became a junior secondary homonym of *Micropdabrus coomani* (Pic, 1926), which was originally in *Lycocerus* Gorham, 1889, so its specific name was replaced by *Micropodabrus wittmeri* Y. Yang & X. Yang, 2009. However, the latter had been preoccupied by *M. wittmeri* Kazantsev, 2007, so *M. wittmeri* Y. Yang & X. Yang, 2009 is permanently invalid as a junior homonym (ICZN



Figures 17–22. Aedeagus (**17, 20** ventral view **18, 21** dorsal view **19, 22** lateral view): **17–19** *Fissocantharis kontumensis* Wittmer, 1989 **20–22** *F. acuticollis* sp. n. Scale bars: 1.0 mm.

4th, Article 57.2) and must be replaced by a new substitute name (ICZN 4th, Article 60.1). Now this species is placed in *Fissocantharis* Pic, 1921, so a replacement name is proposed here as *F. walteri* Y. Yang & X. Yang, nom. n.

***Fissocantharis denominata* (Wittmer, 1997)**

Podabrus formosanus Wittmer, 1954: 274.
Micropodabrus taiwanus Wittmer, 1982: 130 [replacement name for *Podabrus formosanus* Wittmer, 1954].
Micropodabrus denominatus Wittmer, 1997: 310 [replacement name for *Micropodabrus taiwanus* Wittmer, 1982, nec Wittmer, 1979].
Micropodabrus wittmeri Kazantsev, 2007: 54 [replacement name for *Micropodabrus taiwanus* Wittmer, 1982, nec Wittmer, 1979]. syn. n.
Fissocantharis denominata: Yang et al. 2009: 49.
Fissocantharis wittmeri Kazantsev: Yang et al. 2009: 49.

Distribution. China (Taiwan).

Remarks. Kazantsev (2007) proposed *Micropodabrus wittmeri* as a replacement name for *M. formosanus* (Wittmer, 1954), which was originally described in *Podabrus* Westwood, 1838. However, *M. formosanus* had been already replaced by a replacement name as *M. denominatus* Wittmer, 1997, so *M. wittmeri* Kazantsev, 2007 is a junior objective synonym of *M. denominatus*, which is the valid name as the oldest available name applied to this species (ICZN 4th, Article 57.2).

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We are grateful to late Dr. Michel Brancucci (NHMB) not only for his providing a chance for the first author to visit and study in the Naturhistorisches Museum Basel for one year, but also for giving her a lot of valuable suggestions in studying on the taxonomy of Cantharidae. We are also indebted to Mr. Antoine Mantilleri (MNHN) and Prof. Hong Pang (SYSU) for their kind helps in accessing to the cantharid collections under their charge. Thanks are due to the anonymous referee for their valuable comments on our manuscript and Mr. John MacDermott (USA) for correcting our English.

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Wittmer W (1989) 42. Beitrag zur Kenntnis der indo-malaiischen Cantharidae und Malachiidae (Coleoptera). Entomologica Basiliensia 13: 209–237.

Wittmer W (1997) Neue Cantharidae (Col.) aus dem indo-malaiischen und palaearktischen Faunengebiet mit Mutationen. 2. Beitrag. Entomologica Basiliensia 20: 223–366.

Yang YX, Brancucci M, Yang XK (2009) Synonymical notes on the genus *Micropodabrus* Pic and related genera (Coleoptera, Cantharidae). Entomologica Basiliensia et Collectionis Frey 31: 49–54.

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Yang YX, Yang XK (2009) A new species of *Micropodabrus* Pic from Hainan, China, and a new name to replace *M. coomani* (Pic) (Coleoptera, Cantharidae). Zootaxa 2014: 65–68.

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RESEARCH ARTICLE

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The *integripennis* species group of *Geocharidius* Jeannel, 1963 (Carabidae, Bembidiini, Anillina) from Nuclear Central America: a taxonomic review with notes about biogeography and speciation

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Abstract

Our review recognizes 15 species of the *integripennis* species group of *Geocharidius* from Nuclear Central America, include three species previously described (*G. gimlii* Erwin, *G. integripennis* (Bates) and *G. zullinii* Vigna Taglianti) and 12 described here as new. They are: *G. andersoni* **sp. n.** (type locality: Chiapas, Chiapas Highlands, Cerro Huitepec) and *G. vignatagliantii* **sp. n.** (type locality: Chiapas, Motozintla, Sierra Madre de Chiapas, Benito Juárez) from Mexico; *G. antigua* **sp. n.** (type locality: Sacatepéquez, 5 km SE of Antigua), *G. balini* **sp. n.** (type locality: Suchitepéquez, 4 km S of Volcan Atitlán), *G. erwini* **sp. n.** (type locality: Quiché Department, 7 km NE of Los Encuentros), *G. jalapensis* **sp. n.** (type locality: Jalapa Department, 4 km E of Mataquescuintla), *G. longinoi*, **sp. n.** (type locality: El Progreso Department, Cerro Pinalón), and *G. minimus* **sp. n.** (type locality: Sacatepéquez Department, 5 km SE of Antigua) from Guatemala; and *G. celaquensis* **sp. n**. (type locality: Lempira Department, Celaque National Park), *G. comayaguanus* **sp. n.** (type locality: Comayagua Department, 18 km ENE of Comayagua), *G. disjunctus* **sp. n**. (type locality: Francisco Morazán, La Tigra National Park), and *G. lencanus* **sp. n.** (type locality: Lempira Department, Celaque National Park) from Honduras. For all members of the group, adult structural characters, including male and female genitalia, are described, and a taxonomic key for all members of the *integripennis* species group is presented based on these characters. Behavioral and biogeographical aspects of speciation in the group are discussed, based on the morphological analysis. In all cases of sympatry, pairs of closely related species show greater differences in sizes than pairs of more remotely related

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species. *Integripennis* group species occupy six different montane areas at elevations above 1300m, with no species shared among them. Major faunal barriers in the region limiting present species distributions include the Motagua Fault Zone and a gap between the Guatemalan Cordillera volcanic chain and the Honduran Interior Highlands no higher than 900m in elevation. Highest species diversity is in the Guatematan Cordillera (six species), second highest in the Honduran Interior Highlands area (four species).

Keywords

Coleoptera, Adephaga, Carabidae, Bembidiini, Anillina, *Geocharidius*, new species, Nuclear Central America, Motagua Fault Zone, biogeography, sympatric speciation

Introduction

Geocharidius Jeannel, 1963 was established for a Guatemalan species, *G. integripennis* (Bates), described in "Biologia Centralia-Americana" (Bates 1882). Jeannel's description of *Geocharidius* omitted or misinterpreted several important morphological details, leading Vigna Taglianti (1973) to re-describe the genus on the basis of the two species, *G. integripennis* and *G. zullinii* Vigna Taglianti, known to him at that time. Providing new evidence, Vigna Taglianti (l.c.) proposed a new phyletic lineage for *Geocharidius*, which had been placed by Jeannel (1963) in a lineage with the Mediterranean *Geocharis* Ehlers and *Rhegmatobius* Jeannel. The new lineage integrated the New World anillines of Jeannel's "scotodipnienne" stock of genera (i.e. those taxa, members of which have a mental tooth along with the umbilicate series of elytral pores of type B (Jeannel 1937), where pores 7 and 8 and 8 and 9 are separated from each other by equal distances. According to Vigna Taglianti (1973) this lineage included also *Mexanillus* Vigna Taglianti, described in the same paper, and perhaps also *Mystroceridius* Reichardt (1970) from the Galapagos Islands. Since then, several new genera of the "scotodipnienne" stock of anilline genera have been described from the New World (Zaballos 1997; Mateu and Etonti 2002). At present, *Geocharidius* includes 5 species (Lorenz 2005; Zaballos 2004), four of which are limited in their distribution to Guatemala (Erwin 1982). Ecologically, representatives of *Geocharidius* are adapted for life in forest litter, and these beetles are comparatively easy to collect using litter sifting techniques.

From 2008 to 2011, the "Leaf Litter Arthropods of Mesoamerica" (LLAMA) project (http://llama.evergreen.edu/) generated the first significant samples of the leaf litter invertebrate fauna of Mesoamerica (including southern Mexico). This project focused on sampling ants and weevils from the litter layer of the tropical forest floor, but it also sampled many different non-target taxa, including many litter anillines. By 2012, the second author (DHK) had assembled on loan most available material representing Mesoamerican Anillina at the California Academy of Sciences, San Francisco. Several hundred specimens of the subtribe were borrowed from the collections of the six institutions noted below. This material served as the basis of and inspiration for the current report. In this paper, we present the results of a taxonomic study of one intrageneric group of species of *Geocharidius*, the *integripennis* species group.

Materials and methods

This study is based on examination of 455 specimens belonging to the *integripennis* group of species of *Geocharidius*, which includes 15 species. Material was borrowed from and/or is deposited in the following institutions, identified in the text by the following associated codens:

CAS California Academy of Sciences, 55 Music Concourse Drive, San Francisco, California 94118 (D. H. Kavanaugh, Curator)

CMNC Canadian Museum of Nature, Entomology, P.O. Box 3443, Station D, Ottawa, Ontario, Canada, K1P 6P4 (R. S. Anderson, Curator)

CMNH Carnegie Museum of Natural History, Pittsburgh, Pennsylvania, U.S.A. 15213 (R. L. Davidson, Collections Manager)

KUNHM University of Kansas Natural History Museum, 1345 Jayhawk Blvd., Lawrence, Kansas, 66045-7593USA (Z. Falin, Collection Manager)

MNHN Muséum national d'Histoire naturelle de Paris, 57 Rue Cuvier, Paris, 75005, France (T. Deuve and A. Taghavian)

NMNH Department of Entomology, United States National Museum of Natural History, Smithsonian Institution, Washington, D. C., U.S.A. 20013-7012 (T. L. Erwin, Curator)

Verbatim label data are given for type specimens of all newly described taxa, with label breaks indicated by a slash ("\"). For a series of KUNHM specimens with the same geographical labels but differing in various barcode numbers only, these numbers were replaced in the text by periods of ellipsis ("…").

Measurements. All specimens were measured electronically using a Leica M420 macroscope equipped with a Syncroscopy AutoMontage photomicroscopy system (SYNCROSCOPY, Synoptics Ltd.). Measurements for various body parts are encoded as follows: LH = length of head, measured along midline from anterior margin of labrum to a virtual line connecting posterior supraorbital setae; WH = width of head, at level of anterior supraorbital setae; WPm = maximum width across pronotum; WPa = width across anterior angles of pronotum; WPp = width across posterior angles of pronotum; LP = length of pronotum from base to apex along midline; WE = width of elytra, at level of 4th umbilicate setae; LE = length of the elytra, from apex of scutellum to apex of left elytron; SBL = standardized body length, a sum of LH, LP and LE. Measurements of SBL are given in millimeters; others are presented as eight ratios: mean widths-WH/WPm and WPm/WE and body parts-WPa/WPp, WPm/WPp, WPm/LP, WE/LE, LE/SBL and WE/SBL. All values are given as mean ± standard deviation.

Illustrations. Digital photographs of the dorsal habitus of new species were taken with the AutoMontage system using a Leica M420 macroscope. Line drawings of selected body parts were made using grids on a Labomed Lx400 compound microscope. Scanning electron micrographs were made with coating on a LEO 1450VP SEM. Diagrams were prepared using Statistica 6.0. (StatSoft Inc.).

Dissections. Dissections were made using standard techniques. Genitalia were dissected from abdomens of specimens previously softened in boiling water for 20–30 minutes. Contents of the abdomen were cleared using boiling 10% KOH for 2-3 minutes to remove internal tissues, and then washed in hot water before examination. After examination, genitalia were mounted on plastic transparent boards in dimethylhydantoin formaldehyde resin (DMHF) and pinned beneath the specimen. In some species, investigation of body parts was undertaken in the following way. The whole specimen was cleared using boiling 10% KOH for ~5 minutes, then washed and dissected. Disassembled body parts from a single specimen were placed on plastic transparent cardboard, properly oriented, mounted in DMHF and pinned together with the specimen labels.

Type material. The authors had no opportunity to investigate type material of the Mexican species of Anillina described by A. Vigna Taglianti. The identification of *Geocharidius zullinii* was made only on the basis of the original description of the species (Vigna Taglianti 1973). Types of the Guatemalan species of *Geocharidius* described by T. L. Erwin in his revision of Central American Bembidiini (Erwin 1982) were examined. All paratypes listed in the treatments for new species have been labeled with appropriate yellow paratypes labels, which have not been included in the verbatim label data provided for each specimen.

Terms. Terms used in the paper are largely of general use and follow the literature (Ball and Bousquet 2000; Ball and Shpeley 2005, 2009; Erwin 1974; Jeannel 1963), except those for ventral surface structures, terms for which follow the Handbook of Zoology (Lawrence et al. 2010). We use the term "dorsal sclerites" (eg. Fig. 9A, D, E and H) to refer to a complex of more or less sclerotized plates and/or flagellum-like pieces in the dorsobasal region of the retracted internal sac of the male median lobe. These sclerotized elements are highly varied in their size, shape and number and/or degree of fusion among males of different species of this species group, and we have not yet distinguished individual homologies among the varied elements. However, we distinguish this complex of sclerites as a group from the "ventral sclerites" complex found in males of many species of *Anillinus* Casey (1918) along with the dorsal sclerite complex (eg., see Sokolov 2014, fig. 6K, vsc). We defined Nuclear Central America as the region between the Isthmus of Tehuantepec and the Nicaraguan Depression (Schuchert, 1935).

Species ranking. Species recognition is in accordance with our previous approach (Sokolov et al. 2004), except for cases explained in the text.

Arrangement of taxa in the text. Taxonomic treatments of species are arranged separately by country for the region (i.e. Mexico, Guatemala and Honduras) consistent with the geographical distinctions made in our key to species. For each country, species treatments are arranged in alphabetical order..

Descriptions. The scheme of description generally follows that of Ball and Shpeley (2005, 2009).

Map. The map (Fig. 22) was downloaded from the web-site: http://www.maps-for-free.com/ and adjusted using Adobe Photoshop® software.

Taxonomy

Geocharidius Jeannel

Geocharidius Jeannel, 1963: 107 (type species *Anillus integripennis* Bates, 1882, by original designation)

Recognition. The members of this genus are distinguished from those of the other North and Central American Anillina by the following combination of characters: frontal area of head with small median tubercle; maxillary palps with palpomere 4 shorter than 1/4 that of palpomere 3; labial ligula without paraglossae, mentum and submentum separated by mental-submental suture; pronotum convex, with short vestiture throughout, including the areas forward of the lateral setae; elytra without fixed discal setae and with the 7th and the 8th and the 8th and the 9th pores of the umbilicate series separated by equal distances; metendoventrite linear without lateral arms; and intercoxal process between the hind legs widely triangular (Sokolov 2013).

Included taxa. The species of *Geocharidius*, as treated at present (Lorenz 2005), are arranged in two groups, based on body form: those with a subdepressed form and those with a globose habitus (Erwin 1982). Species with members subdepressed in habitus (Fig. 2A–C) correspond to the type species of the genus and are treated below as the *integripennis* species group. Members of the genus with a globose habitus (Fig. 2D), like *Geocharidius phineus* Erwin, *Geocharidius romeoi* Erwin and similar undescribed species, are not treated in this report.

The *integripennis* species group

Recognition. Members of this group are distinguished from the other representatives of the genus by the following combination of external characters: head totally covered with microlines, microsculpture mesh pattern isodiametric (Figs 1A–C) and elytra only moderately convex (subdepressed) (Fig. 2A–C). Most species also have members with the elytra totally covered with microlines in form of isodiametric mesh pattern (Figs 1G–H), males with long copulatory sclerites of the internal sac (Figs 9, 13, 19) and females with simple, not bilobate, spermatheca (Figs 11, 17, 21).

Description. *Size.* SBL range 1.15-1.61 mm.

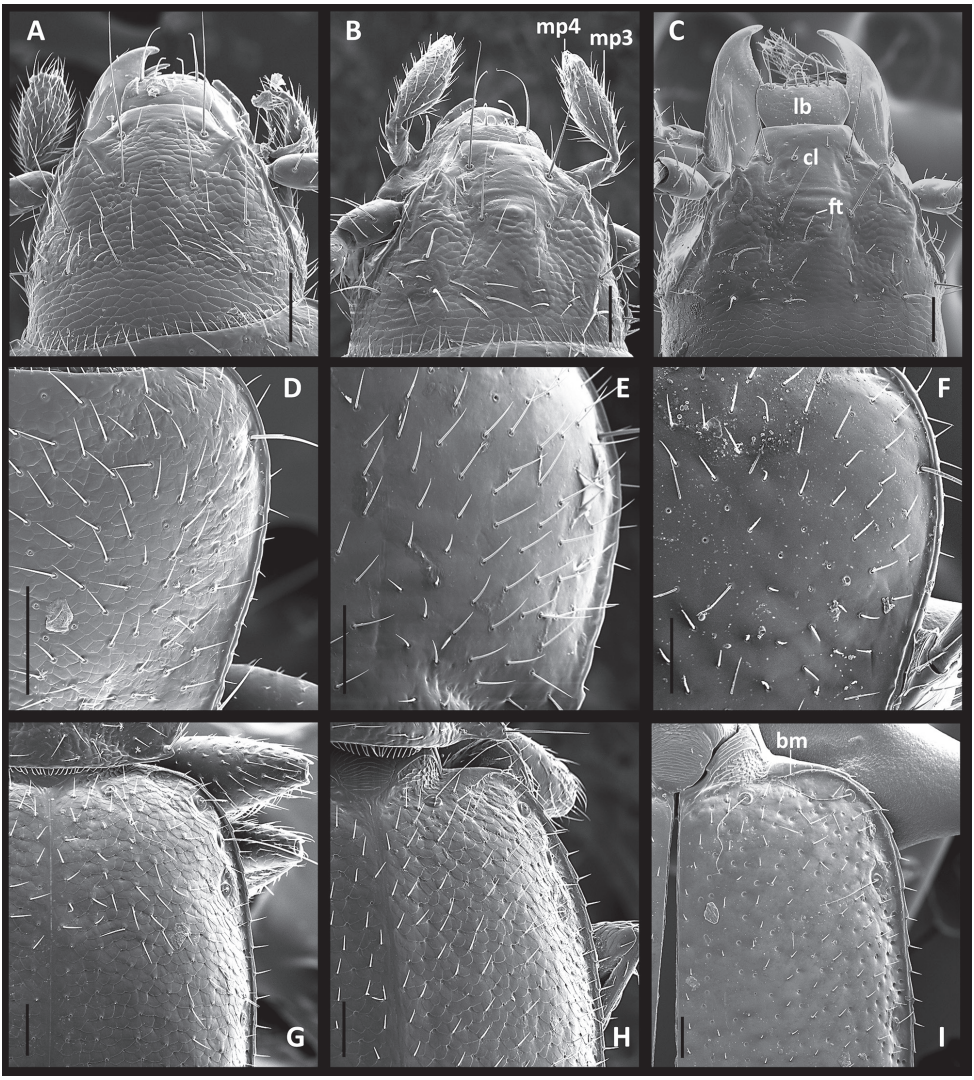
Habitus. Body form slightly to moderately convex, subparallel or slightly ovoid.

Color. Body monocolorous, brunneorufous or rufotestaceous, appendages testaceous.

Microsculpture. Dorsal surface with polygonal sculpticells present on head in all species, also on elytra except in *G. andersoni* members with smooth elytra (Fig. 1I). Development of microsculpture on pronotum and proepisternum (pes) varied among different species (Figs 1D–F, Figs 3A–C).

Luster. Body surface shiny.

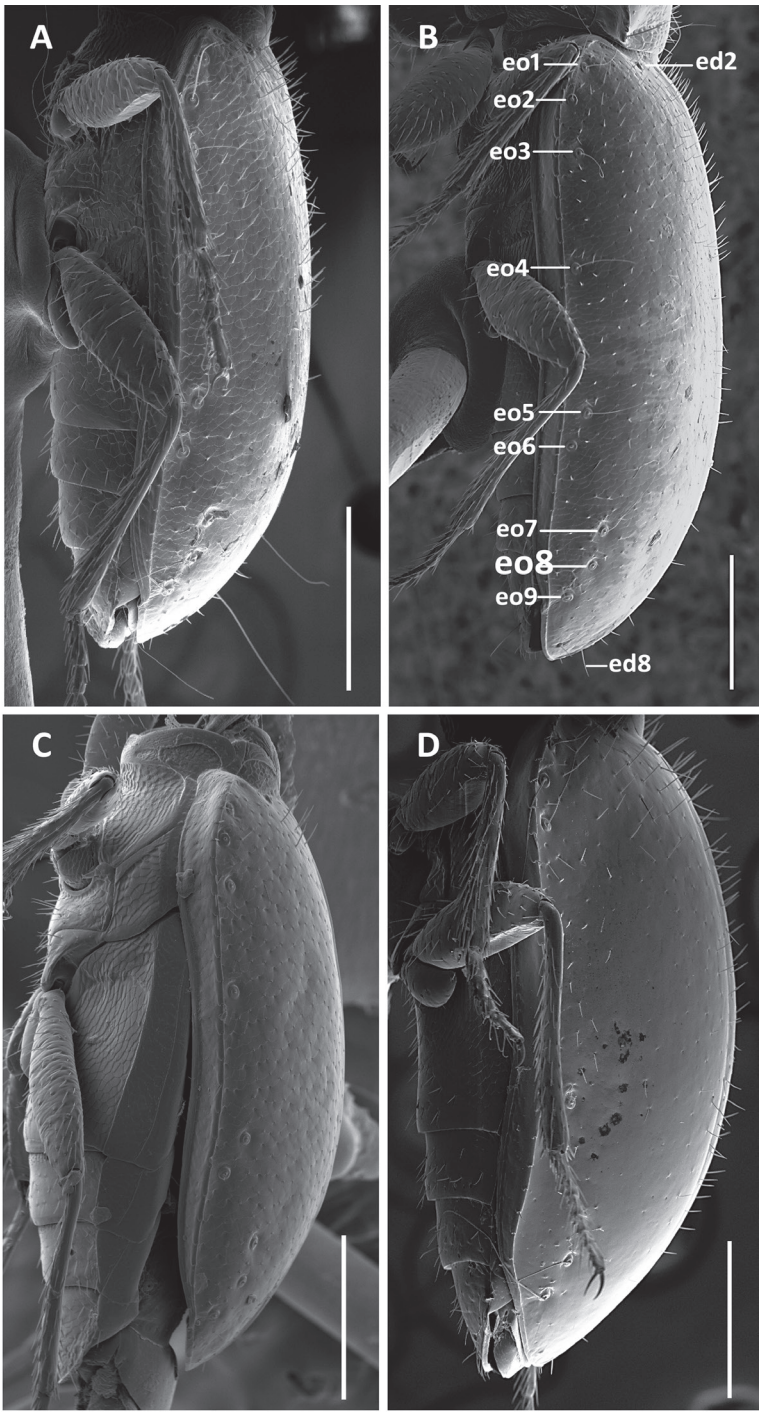
Macrosculpture. Body surface sparsely and finely punctate.



Figures 1. SEM illustrations of structural features of body parts of *Geocharidius* species. **A–C** head, dorsal aspect: **A** *G. balini* **B** *G. zullinii* **C** *G. andersoni.* **D–F** right half of pronotum, dorsal aspect: **D** *G. balini* **E** *G. zullinii* **F** *G. andersoni*. **G–I** basal part of right elytron: **G** *G. balini* **H** *G. zullinii* **I** *G. andersoni* Legend: bm – basal margin; cl – clypeus; ft – frontal tubercle; lb – labrum; mp3 – maxillary palpomere 3; mp4 – maxillary palpomere 4. Scale = 0.05mm.

Vestiture. Body surface covered with sparse yellow setae of moderate and more or less equal length throughout.

Fixed setae. Primary head setae include one pair of clypeal, one pair of frontal and two pairs of supraorbital setae. Mentum (Fig. 5) with two pairs of long primary (paramedial [pms] and lateral [lms]) setae. Submentum (Fig. 5) with three groups of setae: two (Fig. 5D) to three (Fig. 5C) in medial row (mss), two (Fig. 5F) to three (Fig. 5C)



Figures 2. SEM illustrations of structural features and shape of elytra of *Geocharidius* species, left lateral aspect. **A** *G. erwini* **B** *G. jalapensis* **C** *G. comayaguanus* **D** *G. phineus*. Legend: ed2 – scutellar seta; ed8 – apical seta; eo1-9 – setae 1-9 from the umbilicate series. Scale = 0.2mm.

in lateral rows (lss) and one pair of primary basal setae (prss). Elytra without discal setae (Fig. 2), but with scutellar (ed2) and apical setae (ed8) present. Last three (7th, 8th and 9th) pores of umbilicate series (eo7, eo8 and eo9) in line and equally spread apart (Fig. 2B). Fifth abdominal ventrite (Fig. 3G–I) of male with one pair (Fig. 3H) and of female with two pairs (Fig. 3I) of abdominal setae along the posterior margin.

Head (Fig. 1A–C). Anterior margin of clypeus straight. Frontal area with small tubercle medially near frontoclypeal suture. Fronto-lateral carinae distinct and long.

Eyes. Absent.

Antennae. Submoniliform, with 11antennomeres, extended to about posterior margin of pronotum. Antennomeres 1 and 2 elongate, of approximately equal length and 1.4-1.5 times longer than antennomere 3, which is only slightly elongate and 1.1-1.2 times longer than antennomere 4. Antennomere 4 the shortest and 1.1.-1.2 times shorter than antennomere 5. Antennomeres 5 to 10 globose, antennomere 11 conical and 1.6-1.7 times longer than antennomere 10.

Labrum (Fig. 1A–C). Transverse with straight, entire anterior margin, with six setae apically, increasing in size from central pair outward.

Mandibles (Fig. 4). Right mandible with distinct anterior (art) and posterior (prt) retinacular, terebral (tt), and molar (mt) teeth. Left mandible with terebral and molar teeth only. Premolar teeth absent from both mandibles.

Maxillae. Cardo trianguloid, stipes with dorsal and ventral lobes, galea dimerous, lacinia standard for bembidiines. Palpus (Fig. 1A–B) with short 4th palpomere, 0.2–0.25 length of palpomere 3.

Labium (Fig. 5). Mental tooth present; mentum (m) and submentum (sm) divided by mental-submental suture. Glossal sclerite (gsc) bisetose, without distinct paraglossae.

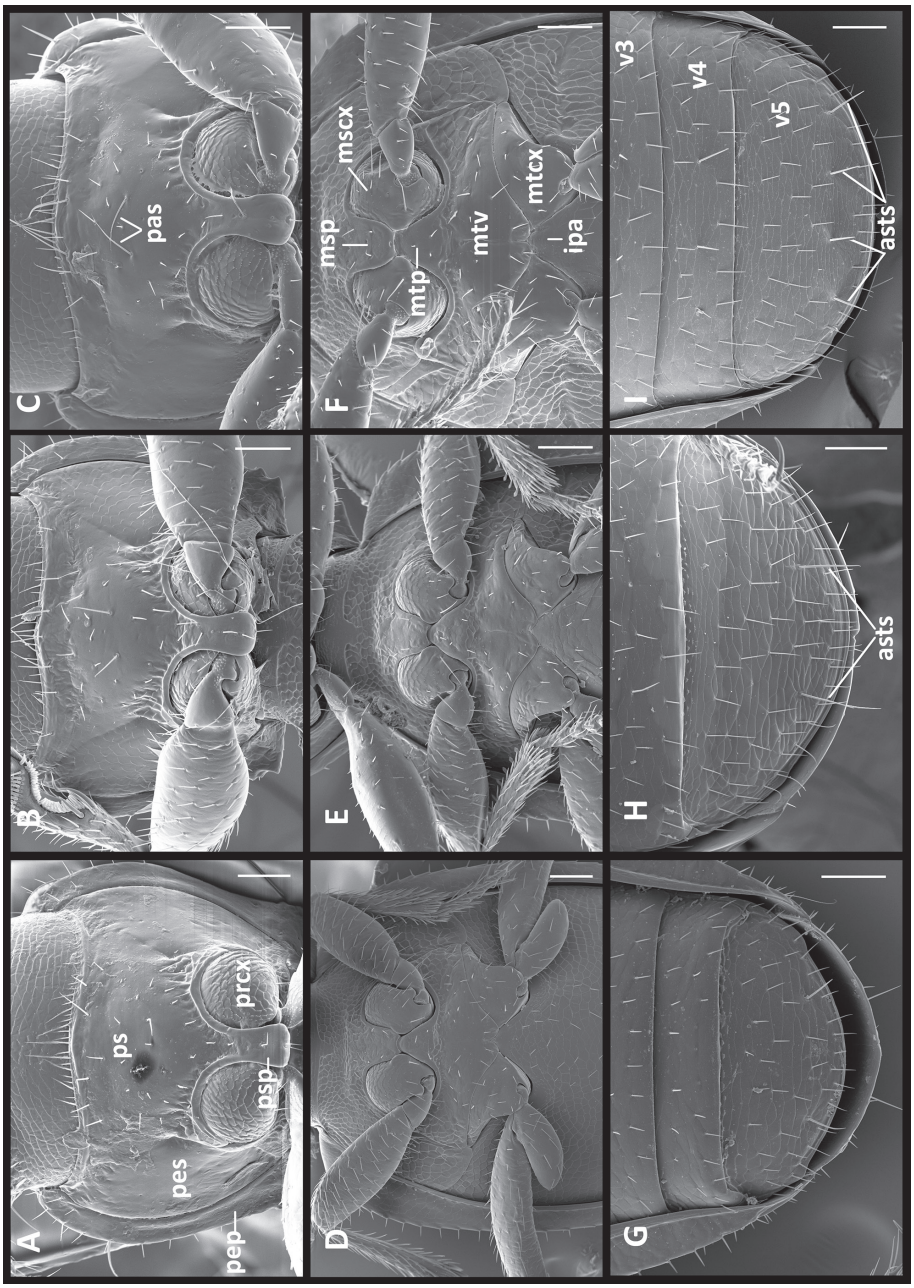
Prothorax. Pronotum cordiform, of moderate length (LP/SBL varied from 0.23 to 0.24 among species, LP/LE varied from 0.38 to 0.42 among species), moderately convex, not sinuate posteriorly. Basal margin of pronotum with slightly protruding medial portion. Anterior angles indistinct, broadly rounded. Posterior angles denticulate, with two or three small denticles anterior to angles. Prosternum (Fig. 3A–C, ps) slightly protruding at the anterior margin medially, there with a group of longer setae relative to other prosternal vestiture, also with a pair of long ambulatory sensor setae (pas) at the middle of sclerite. Prosternal intercoxal process unmargined, slightly dilated apically and obtusely truncate at apex, with a row of sparse setulae along midline.

Scutellum. Externally visible, triangular, with rounded apex.

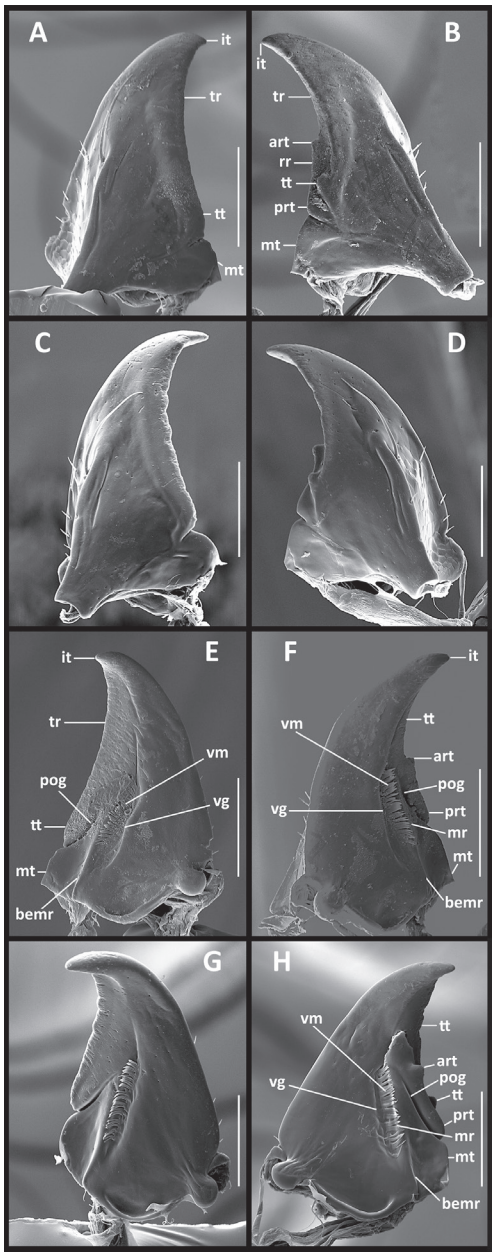
Elytra. Moderate in length (LE/SBL varied from 0.57 to 0.60 among species), without visible interneurs. Basal margination varied (long in some species, extended halfway between humeral angle and scutellar pore (Fig. 1H–I, bm), very short in others, length about equal to diameter of basal setiferous pore socket (Fig. 1G)) but distinct in all species. Lateral elytral margin without subapical sinuation in apical half.

Hind wings. Absent.

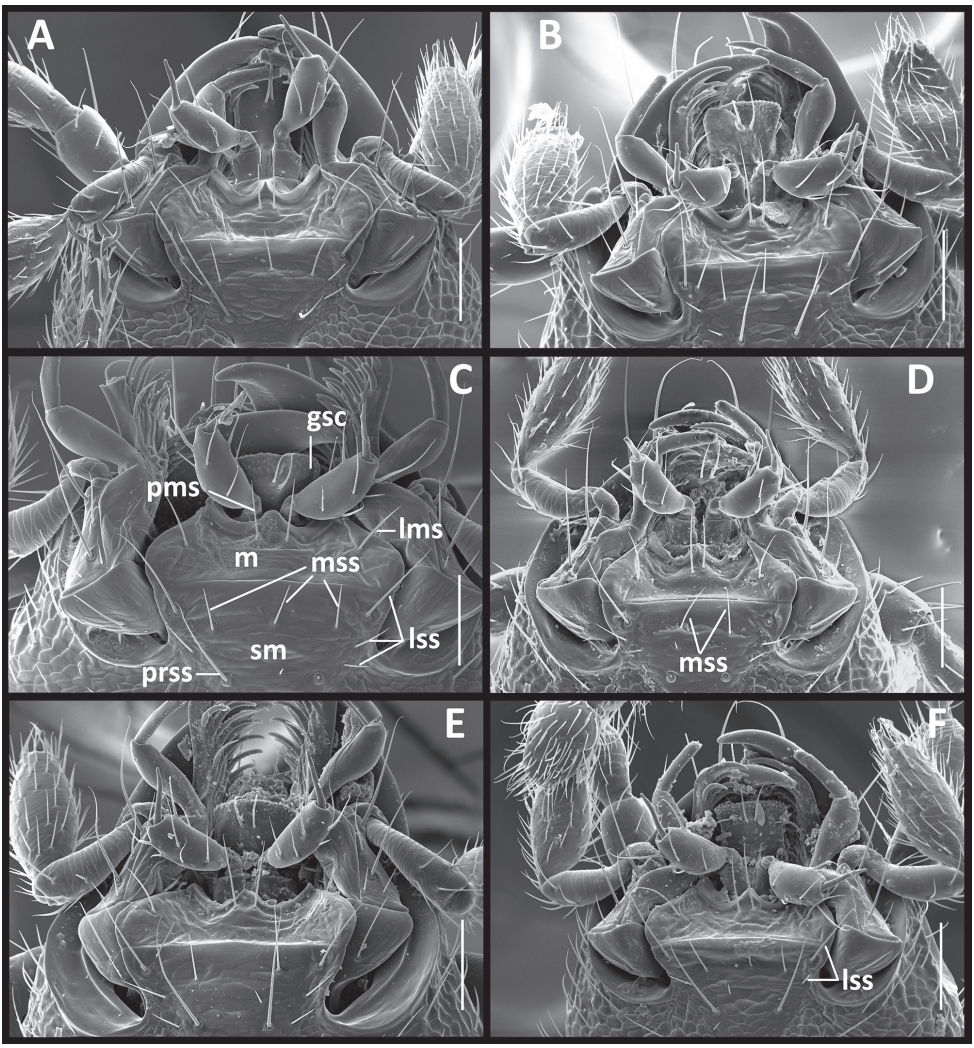
Pterothoracic venter (Fig. 3D–F). Metaventrite (mtv) short, distance between meso- and metacoxae (mtcx) slightly less than the diameter of mesocoxa (mscx). Metanepisternum



Figures 3. SEM illustrations of structural features of body parts of *Geocharidius* species. **A–C** prothorax, ventral aspect: **A** *G. zullinii* **B** *G. erwini* **C** *G. comayaguanus*. **D–F** pterothorax, ventral aspect: **D** *G. jalapensis* **E** *G.minimus* **F** *G. comayaguanus*. **G–I** abdominal ventrites 3-5: **G** *G. minimus,* male **H** *G. jalapensis*, male **I** *G. jalapensis* female. Legend: asts – abdominal sternal terminal seta; ipa –intercoxal process of abdominal ventrite 2; mscx – mesocoxa; msp – mesosternal process; mtcx – metacoxa; mtp – metasternal process; mtv – metaventrite; pas – prosternal ambulatory seta; pep – proepipleuron; pes – proepisternum; prcx – procoxa; ps – prosternum; psp – prosternal process; v3-v5 – abdominal ventrites 3-5. Scale = 0.05mm.



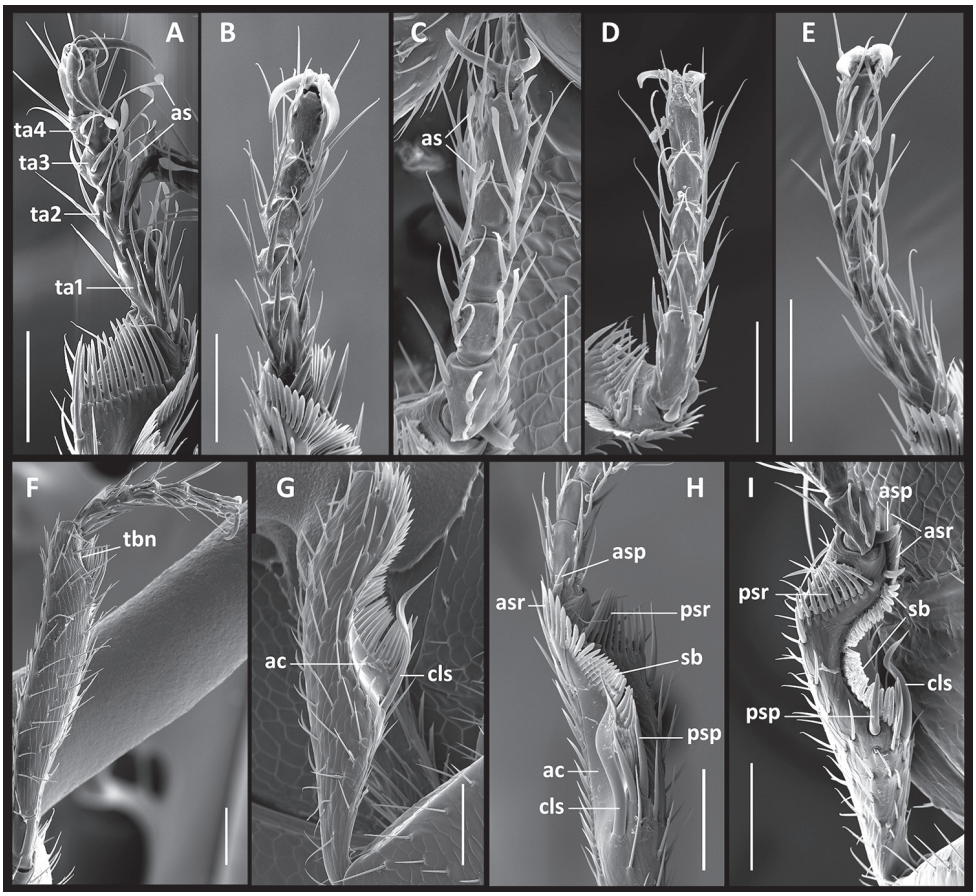
Figures 4. SEM illustrations of structural features of mandibles of *Geocharidius* species. **A–B** *G. zullinii*: dorsal aspect of left and right mandibles, respectively **C–D** *G. jalapensis*: dorsal aspect of left and right mandibles, respectively **E–F** *G. zullinii*:–ventral aspect of left and right mandibles, respectively **G–H** *G. jalapensis*: ventral aspect of left and right mandibles, respectively (right mandible with Λ-shaped crack apically from retinacular ridge). Legend: art – anterior retinacular tooth; bemr – molar ridge, basal extension; it – incisor tooth; mr – molar ridge; mt – molar tooth; pog – posterior occlusal grove; prt – posterior retinacular tooth; rr – retinacular ridge; tr – terebral ridge; tt – terebral tooth; vg – ventral groove; vm – microtrichia. Scale = 0.05mm.



Figures 5. SEM illustrations of structural features of labial complex of *Geocharidius* species. **A** *G. erwini* **B** *G. balini* **C** *G. lencanus* **D** *G. zullinii* **E** *G. longinoi* **F** *G. minimus*. Legend: gsc – glossal sclerite; lms – lateral mental seta; lss – lateral submental seta; m – mentum; mss – medial submental seta; pms – paramedial mental seta; prss – primary basal submental seta; sm – submentum. Scale = 0.05mm.

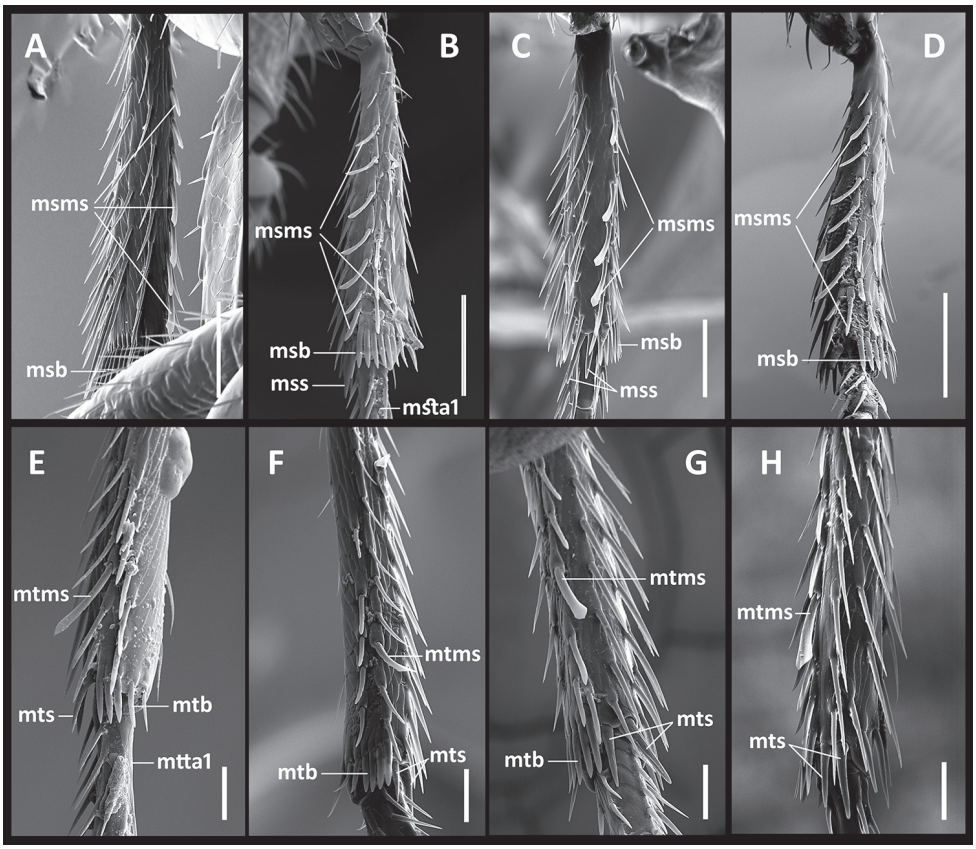
short, subquadrate, with anterior and outer margins of equal length. Metendoventrite linear without lateral arms.

Legs. Moderate in length, not elongate. Prothoracic legs of males with 1st protarsomere not dilated, but with varied setal pattern. In some species (Fig. 6A) tarsomeres 1-4 of males with one to three pairs of slightly dilated adhesive setae (Stork 1980), which are absent from protarsi of females (Fig. 6B); in males of other species, these setae on tarsomeres 2-4 only (Fig. 6C); and in other species, males have adhesive vestiture similar to females (Fig. 6D–E). Protibiae (Fig. 6F–I) with antenna cleaner of type



Figures 6. SEM illustrations of structural features of front legs of *Geocharidius* species. **A–E** protarsi, ventral aspect: **A** right protarsus of *G. jalapensis*, male **B** left protarsus of *G. jalapensis*, female **C** right protarsus of *G. erwini*, male **D** right protarsus of *G. minimus*, female **E** left protarsus of *G. minimus*, male **F–I** protibia: **F** right protibia of *G. andersoni*, dorso-lateral aspect **G** left protibia of *G. lencanus*, lateral aspect **H** left protibia of *G. comayaguanus*, ventral aspect **I** right protibia of *G. erwini*, ventral aspect. Legend: ac – antenna cleaner; as – adhesive seta; asp – anterior spur; asr – anterior setal row; cls – clip seta; psp – posterior spur; psr – posterior setal row; sb – setal band; ta1-ta4 – tarsomeres 1-4. Scale = 0.05mm.

B (Hlavac 1971), with both anterior (asr) and posterior (psr) apical setal rows and concave apico-lateral notch (tbn). Profemora moderately swollen. Mesotibiae (Fig. 7A–D) with two terminal spurs (mss), tibial brush (msb) and a row of modified setae posteriolaterally (msms). Metafemora unmodified, metatibiae (Fig. 7E–H) with two terminal spurs (mts), tibial brush (mtb) and one modified seta (mtms) in posteriolateral setal row. Tarsi pentamerous, last and 1st tarsomeres are the longest, 2-4 tarsomeres of equal length on the tarsi of all legs, 1st tarsomere shorter than combined length of 2-4 tarsomeres. Tarsal claws simple, untoothed.



Figures 7. SEM illustrations of structural features of meso- and metatibia of *Geocharidius* species, various aspects. **A–D** mesotibia: **A** right mesotibia of *G. jalapensis*, ventral aspect **B** left mesotibia of *G. minimus*, medial aspect **C** left mesotibia of *G. longinoi*, ventral aspect **D** left mesotibia of *G. comayaguanus*, medial aspect **E–H** metatibia: **E** right metatibia of *G. zullini*, medial aspect **F** left metatibia of *G. balini*, medial aspect **G** left metatibia of *G. longinoi*, ventral aspect **H** right metatibia of *G. comayaguanus*, ventral aspect. Legend: msb – mesotibial brush; msms – mesotibial modified seta; mss – mesotibial spur; msta1 – mesotarsus 1; mtb – metatibial brush; mtms – metatibial modified seta; mts – metatibial spur; mtta1 – metatarsus 1. Scale = 0.02mm.

Abdominal ventrites. Five visible abdominal ventrites: 2nd ventrite longest, more than 3 times longer than 3rd or 4th, 3rd and 4th equal in length; the last, 5th, approximately 1.5 times longer than 4th. Intercoxal process (ipa) of 2nd ventrite broad (Fig. 3D–F), widely triangular.

Male genitalia. Median lobe of aedeagus anopic, elongate, arcuate and twisted. Internal sac with dorsal copulatory sclerites only, which are long, longer than half of length of the median lobe, except in *G. comayaguanus* male in which they are rather short (Fig. 19K–L, O–P). Sclerites in form of a long plate, rounded or pointed at basal end, and typically tapered into a long flagellum in apical half, in a few species tapered

as a short blade-like structure. Additional spines of internal sac absent. Parameres bisetose. Left paramere large and relatively narrow, mostly with long and narrow apical constriction. Right paramere small and narrow. Ring sclerite (Figs 10, 16, 20) ovate or triangular-ovate with an elongate handle-like extension of varied shape.

Ovipositor. Gonocoxite 1 asetose. Gonocoxite 2 triangular, 1.8–2.0 times longer than its basal width, slightly to moderately curved, with lateral and medial ensiform and two apical nematiform setae. Ensiform setae of similar length and shape. Laterotergite with 5-7 setae.

Female internal genitalia. Spermatheca simple (Figs 11, 17, 21), not bilobate, either unsclerotized fusiform or sclerotized of varied shape, typically fusiform with a bulb-like enlargement apically, straight or bent rectangularly. Parts of spermatheca mostly undifferentiated and named in relation to point of attachment of the spermatecal gland: cornu from point of gland attachment to the apex, and nodulus from point of gland attachment to point of duct attachment (Fig. 11). The ramus, the protruding area of attachment of the spermathecal gland (Maddison 1993), is flat and not developed in the species under consideration here.

Included taxa. The *integripennis* species group includes three previously described species: *G. integripennis* (Bates), *G. zullinii* Vigna Taglianti, *G. gimlii* Erwin, and twelve new species, described below: *G. andersoni*, sp. n., *G. vignatagliantii*, sp. n., *G. erwini*, sp. n., *G. minimus*, sp. n., *G. jalapensis*, sp. n., *G. balini*, sp. n., *G. longinoi*, sp. n., *G. antigua*, sp. n., *G. lencanus*, sp. n., *G. celaquensis*, sp. n., *G. comayaguanus*, sp. n. and *G. disjunctus*, sp. n.

Geographical distribution. The species of this group now are known from mountain ranges of southern Mexico (state of Chiapas), Guatemala and Honduras (Fig. 22).

Way of life. According to label information, specimens of this group were collected from leaf litter within the 2050–2950 m elevation range in the mountains of southern Mexico, within the 1600–3200 m range in the mountains of Guatemala, and within the 1300–2500 m range in the mountains of Honduras. Beetles were extracted from litter in oak, pine, pine-oak, mixed hardwood (without oaks), cloud and lower and upper montane forests. Months of collection include May through September and November.

Relationships. The position of the *integripennis* group species within the genus is unclear at present and awaits further morphological study of the globose representatives of *Geocharidius* and a molecular phylogenetic analysis of all species.

A key for identification of adults of the *integripennis* species group of *Geocharidius* Jeannel

The following key includes all known members of the *integripennis* species group. The key makes use of distributional information because each of the three countries mentioned has its own *Geocharidius* assemblage, the ranges of which are non-overlapping with those of neighboring countries. Our current information on species distributions may prove to be incomplete with additional sampling, so dissection and examination of genitalia should be used for confirmation wherever possible.

1 Body form slightly to moderately convex (Fig. 2A–C) and EITHER with head (Fig. 1A–C) and elytra (Fig. 1G–H) totally covered with microsculpture throughout OR, if only head covered with microsculpture, then elytra subparallel with prominent rounded humeri (Fig. 8C) **2**

– Body forms globose, with markedly convex elytra (Fig. 2D) and EITHER frontal area of head without microsculpture OR, if frontal area with microsculpture, then elytra ovoid with widely rounded humeri (fig. 78, p. 76, Sokolov 2013) ..... **other groups of *Geocharidius***

2 Specimen from Mexico **3**

– Specimen from Guatemala **5**

– Specimen from Honduras **12**

3 Specimen larger (SBL range 1.40–1.61 mm). Habitus as in Fig. 8C. Elytra almost subparallel in basal two-thirds with rectangularly rounded humeri. Microsculpture developed only on head; pronotum and elytra smooth, without evident microscuplture ..... ***G. andersoni* sp. n.**

– Specimen smaller (SBL range 1.18–1.40 mm). Habitus as in Fig. 8A–B. Elytra subparallel only in middle part, humeri broadly rounded. Microsculpture present on head and elytra, only pronotum smooth **4**

4 Specimen from the Chiapas Highlands. Male with shaft of median lobe of male aedeagus (Fig. 9A, D) widened apically and with dorsal sclerites of internal sac compact. Female with spermatheca unsclerotized, long and fusiform (Fig. 11A) ..... ***G. zullinii* Vigna Taglianti**

– Specimen from the Sierra Madre de Chiapas. Male with shaft of median lobe of aedeagus (Fig. 9E) subparallel and with dorsal sclerites of internal sac partitioned. Female with spermatheca sclerotized, short and bean-like (Fig. 11B) ..... ***G. vignatagliantii* sp. n.**

5 Elongate (Fig. 12H), smaller on average (SBL range 1.11–1.24 mm). Pronotum with basal margin narrower (WPa/WPp 1.06±0.024). Pronotum and proepisternum smooth. Male with dorsal sclerites of internal sac in form of a flagellum with basal part slightly widened and bent laterally (Fig. 13G, H). Female with spermatheca as in Fig. 17C ..... ***G. minimus* sp. n.**

– Elongate ovoid (Fig. 12A–G), larger on average (SBL range 1.16–1.57 mm). Pronotum with basal margin wider (WPa/WPp<1.03). If pronotum smooth, then proepisternum with microsculpture. If male with dorsal sclerites of internal sac formed as a long flagellum (Fig. 19A–B), then their base not bent laterally. Spermatheca of female, if fusiform, then with distinct apical bulb-like enlargement (Fig. 17B, D, E) **6**

6 Pronotum wider basally, width between posterior angles greater than between anterior angles (Wm/Wp<0.97) **7**

– Pronotum with narrower basal margin, width between posterior angles equal to that of anterior angles (0.97<Wm/Wp<1.03) **8**

7 Specimen smaller (SBL range 1.26–1.29 mm). Habitus as in Fig. 12G. Male with dorsal sclerites of internal sac formed as a flagellum-like structure apical-

ly, abruptly and markedly widened towards rounded basal part (Fig.19A–B). Female with spermatheca short (Fig. 21A), with swollen nodulus. Specimen from the volcanic chain of the Guatemalan Cordillera..... ***G. antigua* sp. n.**

– Specimen larger (SBL range 1.34–1.51 mm). Habitus as in Fig. 12C. Male with dorsal sclerites of internal sac formed as a wavy, ribbon-like structure (Fig. 13R), of approximately equal width along its entire length. Female with spermatheca elongate, of similar breadth along entire length (Fig. 17F). Specimen from the interior: the Sierra de las Minas range..... ***G. longinoi* sp. n.**

8 Pronotum smooth (as in Fig. 1E). Male with dorsal sclerites of internal sac markedly extended basally through basal orifice (Fig. 13A, D) as a long and narrow plate, widened and rounded basally. Female with spermatheca, if fusiform, then also curved (Fig. 17B) **9**

– Pronotum covered with microsculpture (Fig.1D). Male with dorsal sclerites of internal sac slightly extended basally through basal orifice, EITHER elongate and pointed basally (Figs 13K–L) OR formed as a wide plate (Fig. 13O). Female with spermatheca fusiform and straight, not bent (Fig. 17D–E) ... **11**

9. Specimen smaller on average (SBL range 1.16–1.31 mm). Habitus as in Fig. 12E. Male with dorsal sclerites of internal sac gradually dilated basally to straight basal part (Fig.13D). Spermatheca of female fusiform (Fig. 13B) .... ***G. erwini* sp. n.**

– Specimen larger on average (SBL range 1.33–1.43 mm). Habitus as in Fig. 12A–B. Male with dorsal sclerites of internal sac abruptly dilated basally with enlargement curved ventrally (Figs13A, 15). Female with spermatheca bean-shaped (Fig. 17A) **10**

10. Body form broad, ovoid (Fig. 12A). Pronotum markedly transverse (Wm/Le=1.32) and distinctly constricted posteriorly (Wm/Wp= 1.38). Specimen from the Sierra de los Cuchumatanes (Huehuetenango Department) .... ***G. gimlii* Erwin**

– Body form narrow, elongate ovoid (Fig. 12B). Pronotum less transverse (Wm/Le=1.25±0.009) and less constricted toward base (Wm/Wp= 1.33±0.002). Specimen from the Cerro Maria Tecún (Totonicapán Department)..... ..... ***G. integripennis* (Bates)**

11. Specimen smaller on average (SBL range 1.22–1.34 mm). Habitus as in Fig. 12F. Male with dorsal sclerites of internal sac formed as a wide plate widened basally (Fig. 13O). Female with spermathecal gland short (Fig. 17E).... ..... ***G. balini*, sp. n.**

– Specimen larger on average (SBL range 1.33–1.57 mm). Habitus as in Fig. 12D. Male with dorsal sclerites of internal sac formed as an elongate plate, tapered and pointed basally (Figs 13K–L). Female with spermathecal gland long, longer than spermatheca (Fig. 17D) ..... ***G. jalapensis* sp. n.**

12. Pronotum and proepisternum covered with microsculpture. Male with dorsal sclerites of internal sac long, only slightly widened basally (Fig. 19E, H).

Female with spermatheca slightly dilated in apical fourth and with point of spermathecal gland attachment closer to the apex (Fig. 21B–C).....**13**

– Pronotum and proepisternum smooth, without evident microsculpture. Male with dorsal sclerites of internal sac EITHER short (Fig. 19K–L, O–P) OR, if long, then these abruptly and markedly dilated basally (Fig. 19Q, T). Female with point of spermathecal gland attachment to spermatheca closer to the basal end and EITHER tapered apically OR of similar breadth over apical half (Fig. 21D–E) **14**

13. Specimen larger (SBL range 1.30–1.47 mm). Habitus as in Fig. 18B. Male with apical part of median lobe of aedeagus attenuated (Fig. 19H). Female with spermatheca curved apically (Fig. 21C)..... ***G. lencanus* sp. n.**

– Specimen smaller (SBL range 1.15–1.20 mm). Habitus as in Fig. 18A. Male with apical part of median lobe of aedeagus of average shape (Fig. 19E). Female with spermatheca straight (Fig. 21B) ..... ***G. celaquensis* sp. n.**

14. Male with dorsal sclerites of internal sac short (Figs 19K–L, O–P). Female with spermatheca tapered apically (Fig. 21D) ..... ***G. comayaguanus* sp. n.**

– Male with dorsal sclerites of internal sac long (Figs 19Q, T). Spermatheca of female of similar breadth throughout apical half (Fig. 21E)..... ***G. disjunctus* sp. n.**

Species from Mexico

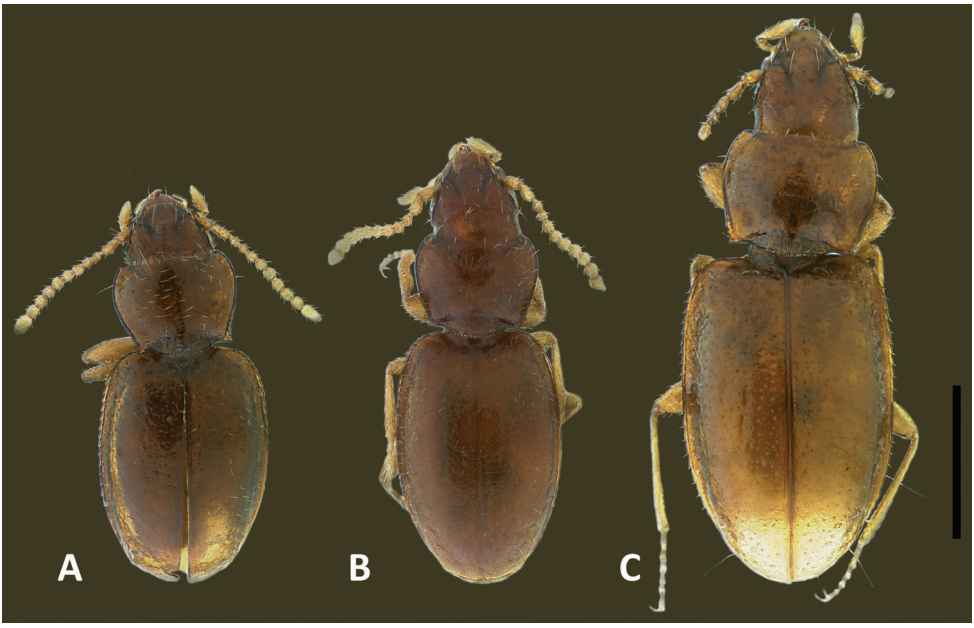
***Geocharidius andersoni* sp. n.**
http://zoobank.org/97465882-51B8-473D-899A-6A0300DDAB82
Figs 1C, F, I, 6F, 8C, 9H–J, 10C, 11C, 22, 23

Type material. HOLOTYPE, a male, in CMNH, point-mounted, dissected, labeled: \ MEXICO: Chiapas, Cerro Huitepec (Pico), ca. 5km W San Cristobal, 2750m, 15 IX 1991, R. Anderson,#91-101, ex: cloud forest litter \ CMNH \ HOLOTYPE *Geocharidius andersoni* Sokolov and Kavanaugh 2014 [red label] \. PARATYPES: A total of 4 specimens (1 male and 1 female were dissected), deposited in CAS and CMNH, labeled same as holotype except for one female, which has an additional label \ *Anillinus* sp. det. D. Shpeley 1997 \.

Type locality. Mexico, Chiapas, Chiapas Highlands, Cerro Huitepec.

Etymology. The specific epithet is a Latinized eponym in the genitive case, and is based on the surname of Robert S. Anderson, Curator of Entomology at the Canadian Museum of Nature, Ottawa, Canada, the collector of the type series of this species.

Recognition. Adults of this new species are distinguished from those of other members of the *integripennis* species group by the following combination of external characters: size large, elytra wide and smooth (without microsculpture); and males are further distinguished by the size and structure of the median lobe (Figs 9H–J, 10) and the form of the ring sclerite (Fig. 10C).



Figures 8. Digital images of habitus, dorsal aspect, of Mexican *Geocharidius* species. **A** *G. zullinii* (MEXICO, Chiapas, Reserva Huitepec) **B** *G. vignatagliantii* (MEXICO, Chiapas, Motozintla), paratype **C** *G. andersoni* (MEXICO, Chiapas, Cerro Huitepec), holotype. Scale = 0.5mm.

Description. *Size*. Large for genus (SBL range 1.40–1.61 mm, mean 1.51±0.077 mm, n=5).

Habitus. Body form (Fig. 8C) moderately convex, elongate ovoid, general proportions (WE/SBL 0.42±0.015) wide, head narrow relative to pronotum (WH/WPm 0.69±0.017), pronotum narrow in comparison with elytra (WPm/WE 0.73±0.028).

Color. Body rufotestaceous, appendages testaceous.

Microsculpture. Mesh pattern of irregularly isodiametric sculpticells distinctly present over dorsal surface of head only. Pronotum, elytra and proepisternum smooth (without evident microsculpture).

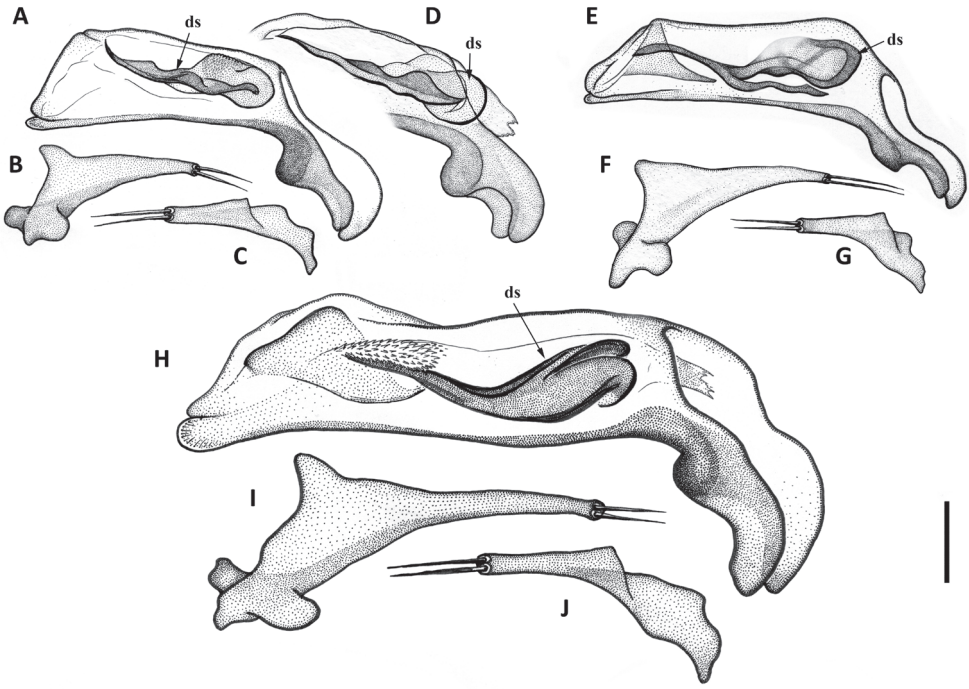
Head, dorsal aspect (Fig. 1C).

Prothorax. Pronotum (Fig. 1F) moderately transverse (WPm/LP 1.29±0.007), with lateral margins slightly constricted posteriorly (WPm/WPp 1.29±0.020). Posterior angles slightly obtuse (100–110°). Width between posterior angles greater than between anterior angles (WPa/WPp 0.94±0.019).

Elytra (Fig. 8C). Moderately convex, slightly depressed along suture, widest in this species group (WE/LE 0.70±0.025), without traces of striae. Humeri distinct, rounded, in outline forming right angle with longitudinal axis of body. Lateral margins subparallel, slightly divergent at basal fifth, evenly rounded to apex in apical third.

Legs. Protibia (Fig. 6F).

Male genitalia. Median lobe (Fig. 9H) with very long subparallel shaft, and moderately enlarged apex, broadly rounded at tip. Ventral margin slightly convex



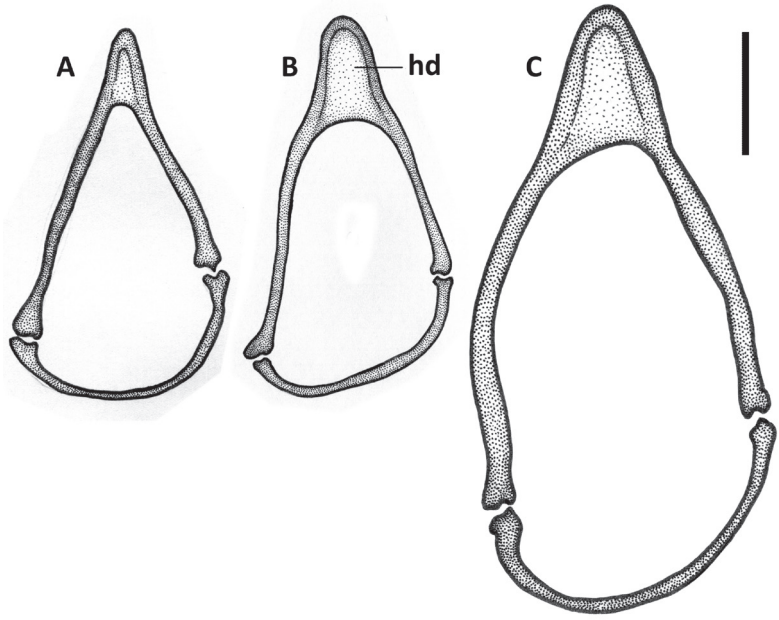
Figures 9. Line drawings of aedeagus of Mexican *Geocharidius* species. *G. zullinii* (MEXICO, Chiapas, Guadalupe Shankala): **A** median lobe, right lateral aspect **B** left paramere, left lateral aspect **C** right paramere, right lateral aspect. *G. zullinii* (MEXICO, Chiapas, Reserva Huitepec): **D** part of median lobe, right lateral aspect. *G. vignatagliantii* (MEXICO, Chiapas, Motozintla), paratype: **E** median lobe, right lateral aspect **F** left paramere, left lateral aspect **G** right paramere, right lateral aspect. *G. andersoni* (MEXICO, Chiapas, Cerro Huitepec), holotype: **H** median lobe, right lateral aspect **I** left paramere, left lateral aspect **J** right paramere, right lateral aspect. Legend: ds – dorsal sclerites. Scale = 0.05mm.

medially. Dorsal sclerite of internal sac in form of a long plate, apically tapered into a short flagellum, and gradually widened basally with basal margin bent ventrally. Membranous field near ostium flag with numerous small scales. Right paramere with long and narrow apical constriction (Fig. 9J). Left paramere with very long and narrow apical constriction (Fig. 9I). Ring sclerite with handle triangular, rounded apically (Fig. 10C).

Female internal genitalia. Spermatheca unsclerotized, fusiform, arcuate, with cornu long and subparallel and nodulus short and tapered basally (Fig. 11C). Length of spermathecal gland less than length of spermatheca. Spermathecal duct loosely wavy, but not coiled.

Geographical distribution. This species is known only from the type locality in the mountains of the Cerro Huitepec, part of the Chiapas Highlands, State of Chiapas, Mexico (Fig. 22, white diamond).

Way of life. Specimens were extracted from cloud forest litter at an elevation of 2750 m.

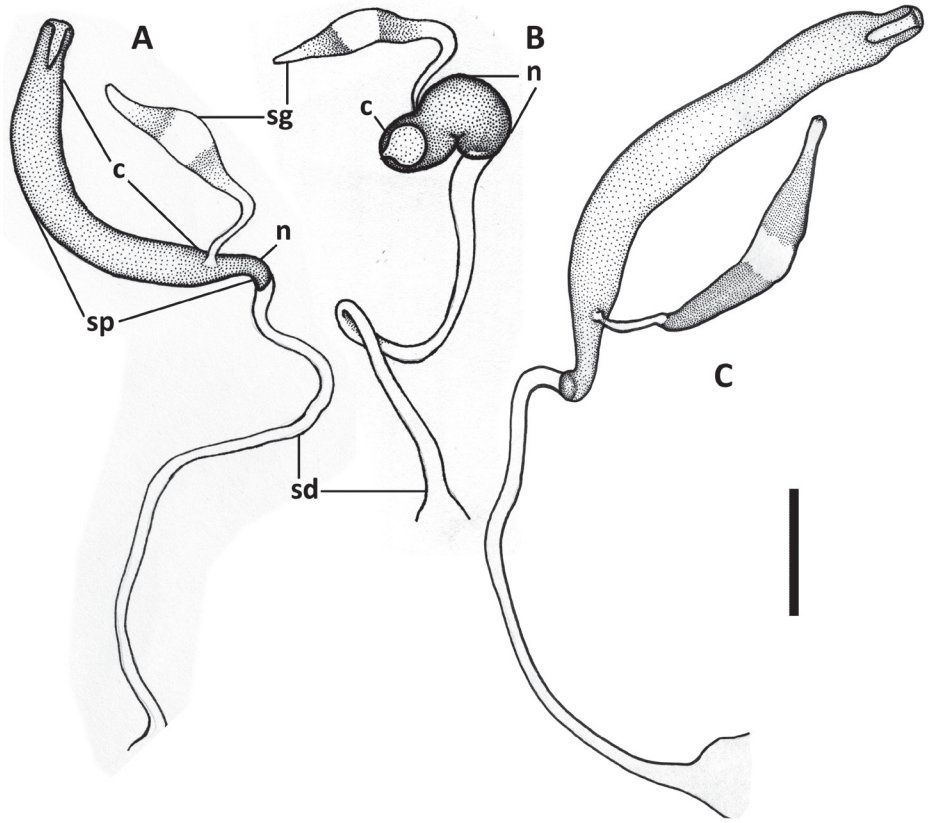


Figures 10. Line drawings of ring sclerite of Mexican *Geocharidius* species, male genitalia, dorsal aspect. **A** *G. zullinii* (MEXICO, Chiapas, Reserva Huitepec) **B** *G. vignatagliantii* (MEXICO, Chiapas, Motozintla), paratype **C** *G. andersoni* (MEXICO, Chiapas, Cerro Huitepec), holotype. Legend: hd – handle of ring sclerite. Scale = 0.1mm.

Relationships. The shape of the spermatheca of females (Fig. 11C) suggests that this species is closely related to the sympatric *G. zullinii* Fig. 11A). Dorsal sclerites in the internal sac of *G. andersoni* males (Fig. 9H) resemble a shortened version of the dorsal sclerites of males of *G. gimlii* (Fig. 13A), which can be considered as a remote relative.

***Geocharidius vignatagliantii* sp. n.**
http://zoobank.org/B1AB6E98-4312-4F87-8B7D-48EE76DB2C82
Figs 8B, 9E–G, 10B, 11B, 22

Type material. HOLOTYPE, a male, in CMNC, point-mounted, labeled: \ MEXICO: Chiapas: Mpio: Motozintla, Benito Juarez, 2050m, 15°22.1'00"N, 92°19'07"W, 28.VII.2005, R. Anderson, oak/pine forest litter 2005-013C \ CMNC \ HOLOTYPE *Geocharidius vignatagliantii* Sokolov and Kavanaugh 2014 [red label] \. PARATYPES: A total of 14 specimens (2 males and 4 females were dissected), deposited in CAS, CMNC and KUNHM; 3 specimens labeled same as holotype; 4 specimens labeled: \ MEXICO: Chiapas: Mpio: Motozintla, Benito Juarez, 2050m, 15°22.1'00"N, 92°19'07"W, 28.VII.2005, R. Anderson, oak/pine forest litter 2005-013A \ CMNC \; 7 specimens labeled: \ MEXICO: Chiapas: Mpio, Motozintla, Benito Juarez



Figures 11. Line drawings of spermatheca of Mexican *Geocharidius* species. **A** *G. zullinii* (MEXICO, Chiapas, Reserva Huitepec) **B** *G. vignatagliantii* (MEXICO, Chiapas, Motozintla), paratype **C** *G. andersoni* (MEXICO, Chiapas, Cerro Huitepec), paratype. Legend: c – cornu; n – nodulus; sd – spermathecal duct; sg – spermathecal gland; sp – spermatheca. Scale = 0.05mm.

15°22.017'N, 92°19.117'W, 2050m, 28.VII.2005, R. Anderson, oak/pine forest litter MEX 1A05-013 \ SM0711461 KUNHM-ENT \.

Type locality. Mexico, Chiapas, Motozintla, Sierra Madre de Chiapas, Benito Juárez.

Etymology. The specific epithet is a Latinized eponym in the genitive case, and is based on the surname of Prof. Augusto Vigna Taglianti, Director of the Museum of Zoology at the Sapienza University of Rome, Roma, Italia, the first reviser of the species of *Geocharidius*.

Recognition. Adults of this new species are practically indistinguishable externally from those of *G. zullinii* but can be distinguished from the latter and from the other members of the *integripennis* species group by the structure of the median lobe of males and the shape of spermatheca of females.

Description. Size. Medium for genus (SBL range 1.27–1.40 mm, mean 1.32±0.038 mm, n=5).

Habitus. Body form (Fig. 8B) moderately convex, elongate ovoid, general proportions (WE/SBL 0.40±0.008), proportions of head (WH/WPm 0.73±0.014) and pronotum (WPm/WE 0.75±0.016) average for group.

Color. Body brunneorufous, appendages testaceous.

Microsculpture. Present over all dorsal surfaces of head and elytra. Pronotum and proepisternum smooth.

Prothorax. Pronotum moderately transverse (WPm/LP 1.26±0.021), with lateral margins moderately constricted posteriorly (WPm/WPp 1.32±0.020). Posterior angles obtuse (110–120°). Widths between anterior and posterior angles of equal length (WPa/WPp 0.99±0.020).

Elytra. Moderately convex, slightly depressed along suture, moderately wide (WE/LE 0.68±0.016), without traces of striae. Humeri broadly rounded, in outline forming right angle with longitudinal axis of body. Lateral margins convex, evenly divergent at basal third, evenly rounded to apex in apical third.

Male genitalia. Median lobe of aedeagus (Fig. 9E) with long subparallel shaft, and small rounded apex. Ventral margin almost straight. Dorsal sclerites of internal sac in form of a long plate, apically tapered into a rather long flagellum, and abruptly widened basally as a semicircular end plate near basal orifice. Right paramere with long and narrow apical constriction (Fig. 9G). Left paramere with long and narrow apical constriction (Fig. 9F). Ring sclerite with handle triangular, widely rounded apically (Fig. 10B).

Female internal genitalia. Spermatheca sclerotized, bean-shaped, arcuate, with cornu short and nodulus long (Fig. 11B). Length of spermathecal gland greater than length of spermatheca. Spermathecal duct not coiled.

Geographical distribution. This species is known only from the type locality in the mountains of the Sierra Madre de Chiapas, located in the municipality of Motozintla, State of Chiapas, Mexico (Fig. 22, white squares).

Way of life. Specimens were collected by sifting oak/pine forest litter at an elevation of 2050 m.

Relationships. Adults of this species closely resemble those of *G. zullinii* from the Chiapas Highlands externally and in the shape of dorsal sclerites of the internal sac (Fig. 9E; cf. Fig. 9A). The shape of the spermatheca of females (Fig. 11B) suggests a relationship with the Guatemalan *G. integripennis* (Fig. 17A) from the Sierra de los Cuchumatanes of the Guatemalan Cordillera.

Geocharidius zullinii Vigna Taglianti

Figs 1B, E, H, 3A, 4A–B, E–F, 5D, 7E, 8A, 9A–D, 10A, 11A, 22, 23

Geocharidius zullinii Vigna Taglianti, 1973: 314.

Holotype. A male, dissected, deposited in A. Vigna Taglianti's private collection [not examined]. Type locality: Mexico, Chiapas, Chiapas Highlands, Comitàn, S of Agostin (Fig. 22, white circle with dot).

Recognition. Adults of this species (Fig. 8A) are practically indistinguishable from the adults of *G. vignatagliantii*, described below, and are distinguished from the latter and from the other members of the *integripennis* species group by structure of the median lobe and shape of spermatheca.

Description. The original description provides a thorough accounting of external features of this species and is absolutely sufficient for species characterization. Below, we add references to illustrations of structural features presented here and descriptions of genitalia, which, for females, has not been done previously.

Head, dorsal aspect (Fig. 1B).

Mouthparts. Mandibles (Figs 4A–B, and 4E–F). Maxillae and labium (Fig. 5D).

Prothorax. Ventral aspect (Fig. 3A). Pronotum, lateral margin (Fig. 1E).

Elytra. Lateral margin (Fig. 1H).

Legs. Metatibia (Fig. 7E).

Male genitalia. Median lobe (Fig. 9A) with shaft long, slightly widened apically, apex small and rounded. Ventral margin almost straight. Dorsal sclerites of internal sac in form of a long plate, tapered apically to a rather long blade, and abruptly widen basally as a semicircular end plate near basal orifice. Specimens from the northern part of the geographical range demonstrate slightly different shape of dorsal sclerites (Fig. 9D). Right paramere with long and narrow apical constriction (Fig. 9C). Left paramere with moderately long and gradually tapered apical constriction (Fig. 9B). Ring sclerite with handle triangular, narrowly rounded apically (Fig. 10A).

Female internal genitalia. Spermatheca unsclerotized, fusiform, arcuate, with cornu long and subparallel and nodulus short and basally tapered (Fig. 11A). Length of spermathecal gland less than length of spermatheca. Spermathecal duct loosely wavy, but not coiled.

Geographical distribution. This species is widely distributed across the Chiapas Highlands, State of Chiapas, Mexico (Fig. 22, white circles). We have examined a total of 15 specimens (6 males and 3 females dissected) from the following localities: 4 specimens labeled: MEXICO: Chiapas: Mpio, Huixtán, Guadalupe Shankala, 16°38'N, 92° 25'W, 2350m, 25.VII.2005, R. Anderson, mixed hardwood (no oaks) forest litter MEX 1A05-007 \ SM0701883 KUNHM-ENT \; 2 specimens labeled: MEXICO: Chiapas: Reserva Huitepec, 16°44.686'N, 92°41.312'W, 2600m, 9-VII-2007 M.G.Branstetter ex. winkler, cloud forest leaf litter LLAMA07 MGB629 \ SM0781461 KUNHM-ENT \; 3 specimens labeled: \ MEXICO: Chiapas: Reserva Huitepec, 16°44.686'N, 92°41.312'W, 2600m, 11-VII-2007 J.Longino ex. winkler, under pines, cloud forest edge, leaflitter LLAMA07 JTL6037-s \ SM0786461 KUNHM-ENT \; 3 specimens labeled: \ MEXICO: Chiapas: Reserva Huitepec, 16°44.686'N, 92°41.312'W, 2600m, 11-VII-2007 J.Longino ex. winkler, cloud forest, leaflitter LLAMA07 JTL6036-s \ SM0786461 KUNHM-ENT \; 1 specimen labeled: \ MEXICO: Chiapas, Mpio, San Cristobal de las Casas, Reserva Huitepec, 2450m, 16°45.84'N, 92°40.70'W, 2600m, 11-VII-2003, R. Anderson, cloud forest

lit., MEX1A03 108 \ SM0477446 KUNHM-ENT \; 1 specimen labeled: \ MEXICO: Chiapas: 15km E San Cristobal 16.74689°N, 92.48985°W, 2500m, 29-V-2008, sifted leaf litter, cloud forest LLAMA08 Wm-A-05-1 \ SM0836667 KUNHM-ENT \; 1 specimen labeled: \ MEXICO: Chiapas: Mpio, Huixtán, Bazóm, 2450m, 16°44'19.0N 92°29', 18.3W, 9-VII-2003, R. Anderson, oak forest litter, MEX1A03 107 \ SMO517781 KUNHM-ENT \.

Way of life. Specimens were sifted from litter in a wide range of different forest types (hardwood without oaks, oak, pine and cloud forests) at elevations of 2350–2600 m.

Relationships. The shape of spermatheca (Fig. 11A) of females suggests that this species is closely related to the sympatric *G. andersoni* (Fig. 11C), described above.

Species from Guatemala

***Geocharidius antigua* sp. n.**
http://zoobank.org/2A03829D-0D34-4608-A5A6-9D8909EAEDC2
Figs 12G, 19A–D, 20A, 21A, 22, 23

Type material. HOLOTYPE, a male, in KUNHM, point-mounted, dissected, labeled: \ GUATEMALA: Sacatepéquez: 5km SE Antigua, 14.52779 -90.68971±200m, 2350m, 10-VI-2009, ex. sifted leaf litter, oak forest LLAMA09 Wm-B-08-2-all \ KUNHM \ HOLOTYPE *Geocharidius antigua* Sokolov and Kavanaugh 2014 [red label] \. PARATYPES: 1 female, dissected, labeled same as holotype (deposited in KUNHM).

Type locality. Guatemala, Sacatepéquez, 5 km SE of Antigua.

Etymology. The specific epithet is a noun in apposition and refers to the city in the vicinity of which the type series was collected.

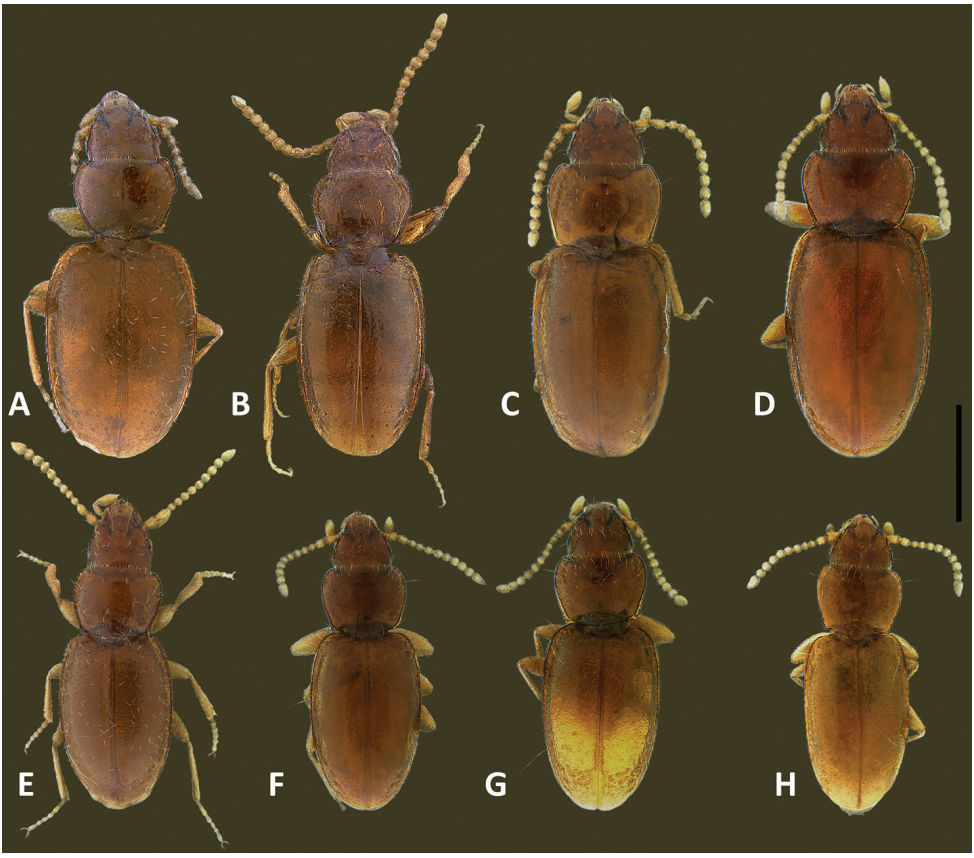
Recognition. Adults of this new species are practically indistinguishable in body shape from those of other Guatemalan species of *Geocharidius* with small body size; but the smooth pronotum and presence of microsculpture on the proepisternum form a basis for distinguishing adults of *G. antigua* from those of sympatric *G. minimus* and allopatric *G. balini*, described below. Males and females of *G. antigua* are distinguished from those of the other members of the *integripennis* species group by the structure of the median lobe and the shape of spermatheca, respectively.

Description. *Size*. Medium for genus (SBL range 1.26–1.29 mm, mean 1.28±0.019 mm, n=2).

Habitus. Body form (Fig. 12G) moderately convex, elongate ovoid, general proportions (WE/SBL 0.39±0.009) and proportions of head (WH/WPm 0.71±0.002) and pronotum (WPm/WE 0.78±0.020) average for group.

Color. Body brunneorufous, appendages testaceous.

Microsculpture. Mesh pattern of irregularly isodiametric sculpticells present over all dorsal surfaces of head and elytra. Pronotum smooth. Proepisternum with evident microsculpture.



Figures 12. Digital images of habitus of Guatemalan *Geocharidius* species. **A** *G. gimlii* (GUATEMALA, Huehuetenango, San Juan Ixcoy), holotype **B** *G. integripennis* (GUATEMALA, Totonicapán, "Totonicapam"), lectotype **C** *G. longinoi* (GUATEMALA, El Progreso, Cerro Pinalón), paratype **D** *G. jalapensis* (GUATEMALA, Jalapa, Mataquescuintla), paratype **E** *G. erwini* (GUATEMALA, Quiché, Los Encuentros), paratype **F** *G. balini* (GUATEMALA, Suchitepéquez, Volcano Atitlán), paratype **G** *G. antigua* (GUATEMALA, Sacatepéquez, Antigua), paratype **H** *G. minimus* (GUATEMALA, Sacatepéquez, Antigua), paratype. Scale = 0.5mm.

Prothorax. Pronotum moderately wide (WPm/LP 1.28±0.011), with lateral margins slightly constricted posteriorly (WPm/WPp 1.29±0.004). Posterior angles slightly obtuse (100–110°). Width between posterior angles greater than between anterior angles (WPa/WPp 0.95±0.022).

Elytra. Moderately convex, slightly depressed along suture, moderately wide (WE/LE 0.67±0.015), without traces of striae. Humeri broadly rounded, in outline forming right angle with longitudinal axis of body. Lateral margins convex, evenly divergent at basal third, evenly rounded to apex in apical third.

Male genitalia. Median lobe of aedeagus (Fig. 19A) with long subparallel shaft, and small rounded apex. Ventral margin almost straight. Dorsal sclerites of internal

sac in form of a long plate, tapered apically as a long flagellum, and abruptly widened basally as a nearly circular complex of structures near basal orifice (Figs 19A–B). Right paramere with short and narrow apical constriction (Fig. 19D). Left paramere with long and narrow apical constriction (Fig. 19C). Ring sclerite with handle triangular, slightly asymmetrical, pointed apically (Fig. 20A).

Female internal genitalia. Spermatheca sclerotized, bulb-shaped, straight, and very wide, with cornu short and nodulus swollen (Fig. 21A). Length of spermathecal gland greater than length of spermatheca. Spermathecal duct loosely coiled.

Geographical distribution. This species is known only from the type locality, situated on the northern slopes of volcano Agua in the volcanic chain of the Guatemalan Cordillera (Fig. 22, yellow quadrangle).

Way of life. Specimens were collected by sifting oak forest litter at an elevation of 2350 m.

Relationships. The shape of dorsal sclerites of the internal sac (Fig. 19A–B) suggests that this species is closely related to the Honduran *G. disjunctus* (Fig. 19Q, T), described below.

Geocharidius balini sp. n.

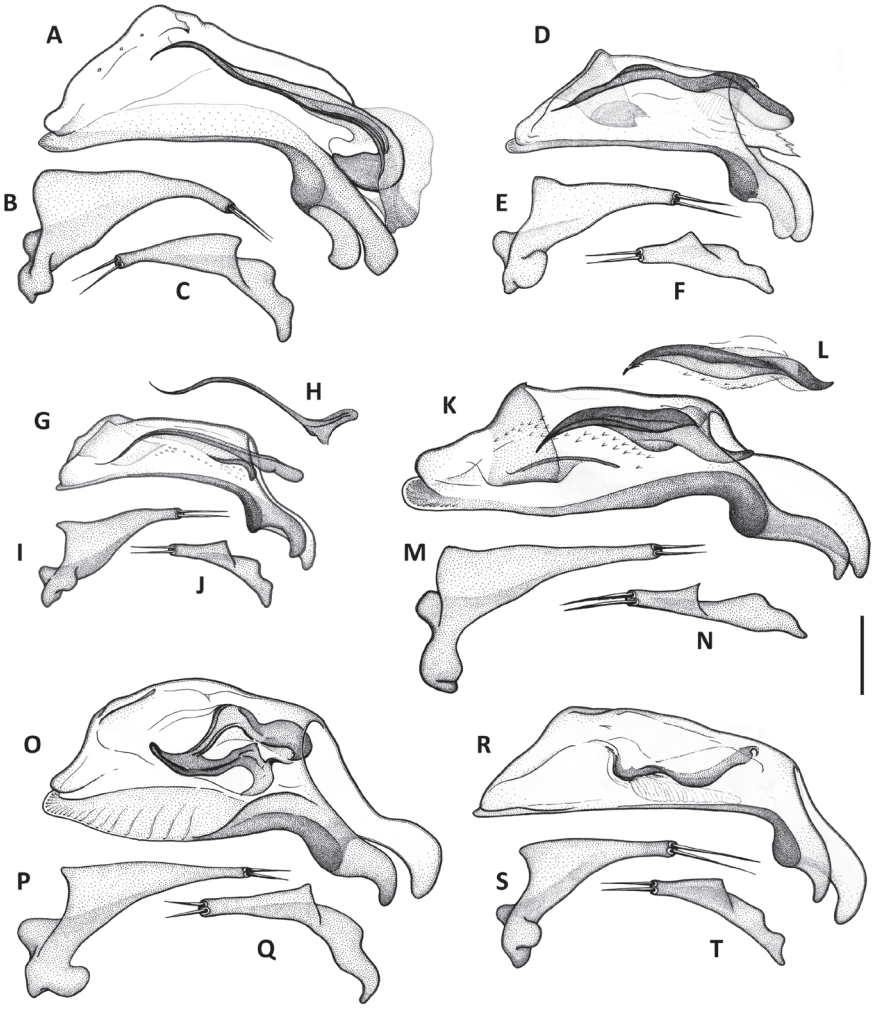
http://zoobank.org/4AC8143D-8FDF-49B2-AC46-0AEBC7FE0D32
Figs 1A, D, G, 5B, 7F, 12F, 13O–Q, 16E, 17E, 22, 23

Type material. HOLOTYPE, a male, in KUNHM, point-mounted, labeled: \ GUATEMALA: Suchitepéquez: 4km S Vol. Atitlán, 14.54915- 91.19055 ±200m, 1625m, 15-VI-2009 ex sifted leaf litter, cloud forest, LLAMA09 Wa-B-09-1-all \ KUNHM \ HOLOTYPE *Geocharidius balini* Sokolov and Kavanaugh 2014 [red label] \. PARATYPES: A total of 117 specimens (3 males and 2 females were dissected), deposited in CAS and KUNHM; 99 specimens labeled same as holotype; 10 specimens labeled: \ GUATEMALA: Suchitepéquez: 4km S Vol. Atitlán, 14.55103- 91.19350 ±306m, 1750m, 15-VI-2009 ex sifted leaf litter, cloud forest, LLAMA09 Wm-B-09-2-01 \ KUNHM \; 7 specimens labeled: \ GUATEMALA: Suchitepéquez: 4km S Vol. Atitlán, 14.55311- 91.19337 ±35m, 1750m, 15-VI-2009 ex sifted leaf litter, cloud forest, LLAMA09 Wm-B-09-2-02 \ KUNHM \; 1 specimen labeled: \ GUATEMALA: Jalapa: 4km E Mataquescuintla, 14.53257 -90.15253 ±200m, 2400m, 1-VI-2009, ex. sifted leaf litter, cloud forest, LLAMA09 Wa-B-07-2-all \ KUNHM \.

Type locality. Guatemala, Suchitepéquez, 4 km S of Volcan Atitlán.

Etymology. The specific epithet is a Latinized eponym in the genitive case, and is based on the given name of the dwarf Balin, a refounder of the underground kingdom of Moria, one of Thorin Oakenshield's Company of Dwarves who had accompanied Bilbo Baggins on the Quest of Erebor in the book "*The Hobbit, or There and Back Again*" by J.R.R.Tolkien.

Recognition. Adults of this new species are distinguished from those of other members of the *integripennis* species group externally by their small size and the pres-



Figures 13. Line drawings of aedeagus of Guatemalan *Geocharidius* species. **A–C** *G. gimlii* (GUATEMALA, Huehuetenango, San Juan Ixcoy), holotype: **A** median lobe with internal sac and dorsal sclerites, right lateral aspect **B** left paramere, left lateral aspect **C** right paramere, right lateral aspect **D–F** *G. erwini* (GUATEMALA, Quiché, Los Encuentros), paratype: **D** median lobe with internal sac and dorsal sclerites, right lateral aspect **E** left paramere, left lateral aspect **F** right paramere, right lateral aspect **G–J** *G. minimus* (GUATEMALA, Sacatepéquez, Antigua), paratype: **G** median lobe with internal sac and dorsal sclerites, right lateral aspect **H** dorsal sclerite of median lobe, dorsal aspect **I** left paramere, left lateral aspect **J** right paramere, right lateral aspect **K–N** *G. jalapensis* (GUATEMALA, Jalapa, Mataquescuintla), paratype: **K** median lobe with internal sac and dorsal sclerites, right lateral aspect **L** dorsal sclerite of median lobe, dorsal aspect **M** left paramere, left lateral aspect **N** right paramere, right lateral aspect **O–Q** *G. balini* (GUATEMALA, Suchitepéquez, Volcano Atitlán), paratype: **O** median lobe with internal sac and dorsal sclerites, right lateral aspect **P** left paramere, left lateral aspect **Q** right paramere, right lateral aspect **R–T** *G. longinoi* (GUATEMALA, El Progreso, Cerro Pinalón), paratype: **R** median lobe with internal sac and dorsal sclerites, right lateral aspect **S** left paramere, left lateral aspect **T** right paramere, right lateral aspect. Scale = 0.05mm.

ence of microsculpture on the pronotum and internally by the structure of the median lobe of males and the shape of spermatheca of females.

Description. *Size*. Small to medium for genus (SBL range 1.22–1.34 mm, mean 1.27±0.040 mm, n=26).

Habitus. Body form (Fig. 12F) moderately convex, elongate ovoid, general proportions (WE/SBL 0.38±0.008) and proportions of head (WH/WPm 0.72±0.013) and pronotum (WPm/WE 0.78±0.017) average for group.

Color. Body brunneorufous, appendages testaceous.

Microsculpture. Mesh pattern of irregularly isodiametric sculpticells present over all dorsal surfaces of head, pronotum and elytra. Proepisternum with evident microsculpture.

Head (Fig. 1A).

Mouthparts. Maxillae and labium (Fig. 5B)

Prothorax. Pronotum (Fig. 1D) moderately transverse (WPm/LP 1.26±0.022), with lateral margins moderately constricted posteriorly (WPm/WPp 1.32±0.021). Posterior angles obtuse (110–120°). Widths between anterior and posterior angles of equal length (WPa/WPp 0.99±0.022).

Elytra (Fig. 1G). Moderately convex, slightly depressed along suture, moderately narrow (WE/LE 0.64±0.018), without traces of striae. Humeri rounded, in outline forming right angle with longitudinal axis of body. Lateral margins convex, evenly divergent at basal third, evenly rounded to apex in apical third.

Legs. Metatibia (Fig. 7F)

Male genitalia. Median lobe (Fig. 13O) with shaft short and broad and apex of moderate size and rounded. Ventral margin greatly enlarged and convex, with numerous poriferous canals. Dorsal sclerites of internal sac of peculiar shape, in form of anastomosing short plates, connected in apical and basal thirds, pointed apically as a short blade. Right paramere long and narrow (Fig. 13Q). Left paramere with long and narrow apical constriction (Fig. 13P). Ring sclerite with handle almost rectangularly rounded, slightly asymmetrical (Fig. 16E).

Female internal genitalia. Spermatheca sclerotized, fusiform with apical bulb enlargement, straight, with cornu long and nodulus short (Fig. 17E). Lengths of spermathecal gland and spermatheca equal. Spermathecal duct not coiled.

Geographical distribution. This species is known only from two localities remote from each other: one situated on the southern slopes of volcano Agua in the Suchitepéquez Department, and the other situated on the northern slopes of a former twinned volcano, remains of which form the caldera of Laguna de Ayarza, in Jalapa Department. Both localities are in the volcanic chain of the Guatemalan Cordillera (Fig. 22, green diamonds).

Way of life. Specimens were collected by sifting cloud forest litter at middle (1600–1750 m) to high elevations (2400 m).

Relationships. The shapes of handle of ring sclerite (Fig. 16E) and of the spermatheca (Fig. 17E) suggest that this species is closely related to *G. jalapensis* (Figs 16D, 17D, described below.

***Geocharidius erwini* sp. n.**
http://zoobank.org/6B696BFC-D7AE-4893-BCBC-80579DFAA5B7
Figs 2A, 3B, 5A, 6C, I, 12E, 13D–F, 16B, 17B, 22

Geocharidius integripennis, Sokolov, 2013:53

Type material. HOLOTYPE, a male, in NMNH, glued on cardboard, labeled: \ Guatemala: QUICHÉ, 7km NE Los Encuentros, 2400m, 18.XI.1991 leg. R.Baranowski \ sifting litter under bushes at roadside pine forest \ Loan from USNMNH 2051867 \ HOLOTYPE *Geocharidius erwini* Sokolov and Kavanaugh 2014 [red label] \. PARATYPES: A total of 45 specimens (4 males and 4 females were dissected), deposited in CAS, CMNC, NMNH; 23 specimens labeled same as holotype; 10 specimens labeled: \ Guatemala: QUICHÉ, 7km NE Los Encuentros, 2400m, 14.XI.1991 leg. R.Baranowski \ sifting litter under bushes at roadside pine forest \ Loan from USNMNH 2051867 \; 8 specimens labeled: \ Guatemala QUICHÉ, 6km S Chichicastenango, 2140m. 16.XI.1991 leg. R.Baranowski \ sifting litter, pine-oak forest \ Loan from USNMNH 2051867 \; 4 specimens labeled: \ Guatemala: QUICHÉ, 5km S Chichicastenango, 2000m. 18.XI.1991 leg. R.Baranowski \ sifting litter, pine-oak forest \ Loan from USNMNH 2051867 \; 1 specimen labeled: \ Guat.: QUEZALTEN. 12km S.E. Zunil, Fuentes Georginas, 2460m, 21.VI.1993, R. Anderson, cloud for. litter 93-10A\ CMNC \; 1 specimen labeled: \ Guat.: QUEZALTEN. 12km S.E. Zunil, Fuentes Georginas, 2460m, 21.VI.1993, R. Anderson, cloud for. litter 93-10E\ CMNC \; 1 specimen labeled: \ Guat.: QUEZALTEN. 12km S.E. Zunil, Fuentes Georginas, 2450m, 19.VI.1993, R. Anderson, cloud for. litter 93-5CC \ CMNC \; 1 specimen labeled: \ Guat.: QUEZALTEN. 12km S.E. Zunil, N.W.face Cerro Zunil, 2700m, 20.VI.1993, R. Anderson, hardwood for. litter 93-8F \ CMNC \; 1 specimenslabeled: \ Guat.: QUEZALTENANGO: 12km SE Zunil, NW face Cerro Zunil, hardwd.for.litter, 2700–2760m, R. Anderson 91-30 28.V.1991. \ CMNC \.

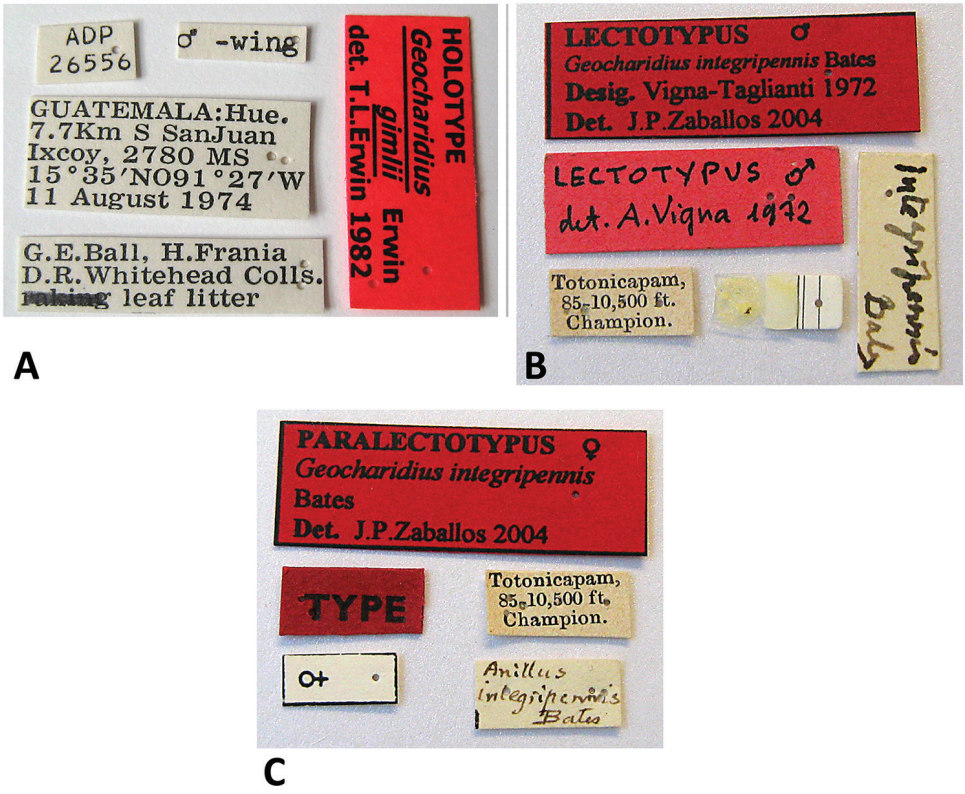
Type locality. Guatemala, Quiché Department, 7 km NE of Los Encuentros.

Etymology. The specific epithet is a Latinized eponym in the genitive case and is based on the surname of Terry L. Erwin, Curator of Entomology at the Smithsonian Institution, United States National Museum of Natural History, Washington, D. C., U.S.A., the first reviser of the Guatemalan Anillina.

Recognition. Adults of this new species are practically indistinguishable from those of other the Guatemalan species of *Geocharidius* with small body size. Males and females of *G. erwini* are distinguished from those of the other members of the *integripennis* species group by the structure of the median lobe of males and the shape of spermatheca of females, respectively.

Description. Size. Small to medium for genus (SBL range 1.16–1.31 mm, mean 1.23±0.057 mm, n=30).

Habitus. Body form (Fig. 12E) moderately convex, elongate ovoid, general proportions (WE/SBL 0.38±0.009) and proportions of head (WH/WPm 0.72±0.012) and pronotum (WPm/WE 0.79±0.015) average for group.



Figures 14. Photographs of labels for type specimens of *Geocharidius* species. **A** *G. gimlii*, holotype **B** *G. integripennis*, lectotype **C** *G. integripennis*, paralectotype.

Color. Body rufotestaceous, appendages testaceous.

Microsculpture. Mesh pattern of irregularly isodiametric sculpticells present over all dorsal surfaces of head and elytra. Pronotum smooth. Proepisternum with evident microsculpture.

Mouthparts. Labium (Fig. 5A).

Prothorax. Pronotum moderately transverse (WPm/LP 1.26±0.019), with lateral margins slightly constricted posteriorly (WPm/WPp 1.31±0.025). Posterior angles slightly obtuse (100–110°). Widths between anterior and posterior angles of equal length (WPa/WPp 1.01±0.025). Ventral aspect (Fig. 3B).

Elytra (Fig. 2A). Moderately convex, slightly depressed along suture, moderately wide (WE/LE 0.67±0.017), without traces of striae. Humeri rounded, in outline forming right angle with longitudinal axis of body. Lateral margins convex, evenly divergent at basal third, evenly rounded to apex in apical third.

Legs. Protibia (Fig. 6I). Protarsus (Fig. 6C).

Male genitalia. Median lobe (Fig. 13D) with shaft moderately long, slightly widened apically, and apex small and rounded. Ventral margin almost straight. Dorsal

sclerites of internal sac (Fig. 13D) in form of a long plate, tapered apically as a long flagellum, and gradually widen towards semicircular basal end extended basally through the basal orifice. Right paramere with short and wide apical consriction (Fig. 13F). Left paramere with long and moderately narrow apical constriction (Fig. 13E). Ring sclerite with almost rectangularly rounded, subparallel, handle (Fig. 16B).

Female internal genitalia. Spermatheca sclerotized, fusiform with bulb enlargement apically, twice bent rectangularly in opposite directions, with cornu long and nodulus short (Fig. 17B). Length of spermathecal gland less than length of spermatheca. Spermathecal duct coiled.

Geographical distribution. This species is known from a few scattered localities in the Quiché and Quetzaltenango Departments of Guatemala (Fig. 22, green circles).

Way of life. Specimens were collected by sifting litter from different habitats: cloud, hardwood, pine and pine-oak forests at elevations of 2140-2760 m.

Relationships. The shape of dorsal sclerites of the internal sac in males suggests a remote relationship with *G. minimus* (Fig. 13G), described below.

Geocharidius gimlii **Erwin**

Figs 12A, 13A–C, 14A, 15B, 16A, 22

Geocharidius gimlii Erwin, 1982: 488.

Holotype. A male, deposited in NMNH, point-mounted, dissected, labeled (Fig. 14A): \ ♂ –wing \ ADP 26556 \ GUATEMALA: Hue. 7.7km S SanJuan Ixcoy, 2780 MS 15 35'N, 091 27'W 11 August 1974 \ G. E. Ball, H. Frania, D.R. Whitehead Colls. leaf litter \. Type locality. Guatemala, Huehuetenango Department, 7.7 km S of San Juan Ixcoy.

Recognition. Males of this species are distinguished from those of other members of the *integripennis* species group by the following combination of characters: pronotum small, transverse, elytra comparatively wide and structure of median lobe of male as in Fig. 13A.

Description. Size. Medium for genus (SBL 1.42 mm).

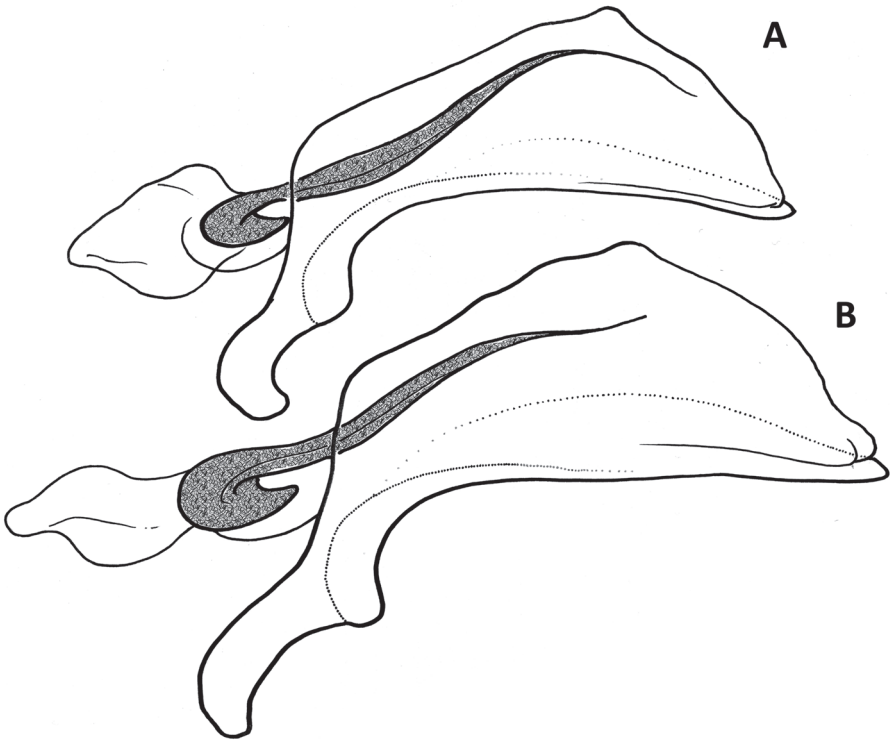
Habitus. Body form (Fig. 12A) moderately convex, broadly ovoid; general proportions (WE/SBL 0.41) rather wide; proportions of head (WH/WPm 0.72) average for group; pronotum narrow (WPm/WE 0.74) relative to elytra.

Color. Body rufotestaceous, appendages testaceous.

Microsculpture. Mesh pattern of irregularly isodiametric sculpticells present over all dorsal surfaces of head and elytra. Pronotum smooth (without evident microsculpture). Proepisternum with microsculpture.

Prothorax. Pronotum transverse (WPm/LP 1.32), with lateral margins markedly constricted posteriorly (WPm/WPp 1.38). Posterior angles obtuse (112°). Widths between anterior and posterior angles equal (WPa/WPp 1.01).

Elytra. Moderately convex, slightly depressed along suture, markedly wide (WE/LE 0.70), without traces of striae. Humeri broadly rounded, in outline forming slightly



Figures 15. Schematic line drawings of median lobe and dorsal sclerites of internal sac of two previously described Guatemalan *Geocharidius* species. **A** *G. integripennis* (GUATEMALA, Totonicapán, "Totonicapam"), holotype **B** *G. gimlii* (GUATEMALA, Huehuetenango, San Juan Ixcoy), holotype, both left lateral aspect.

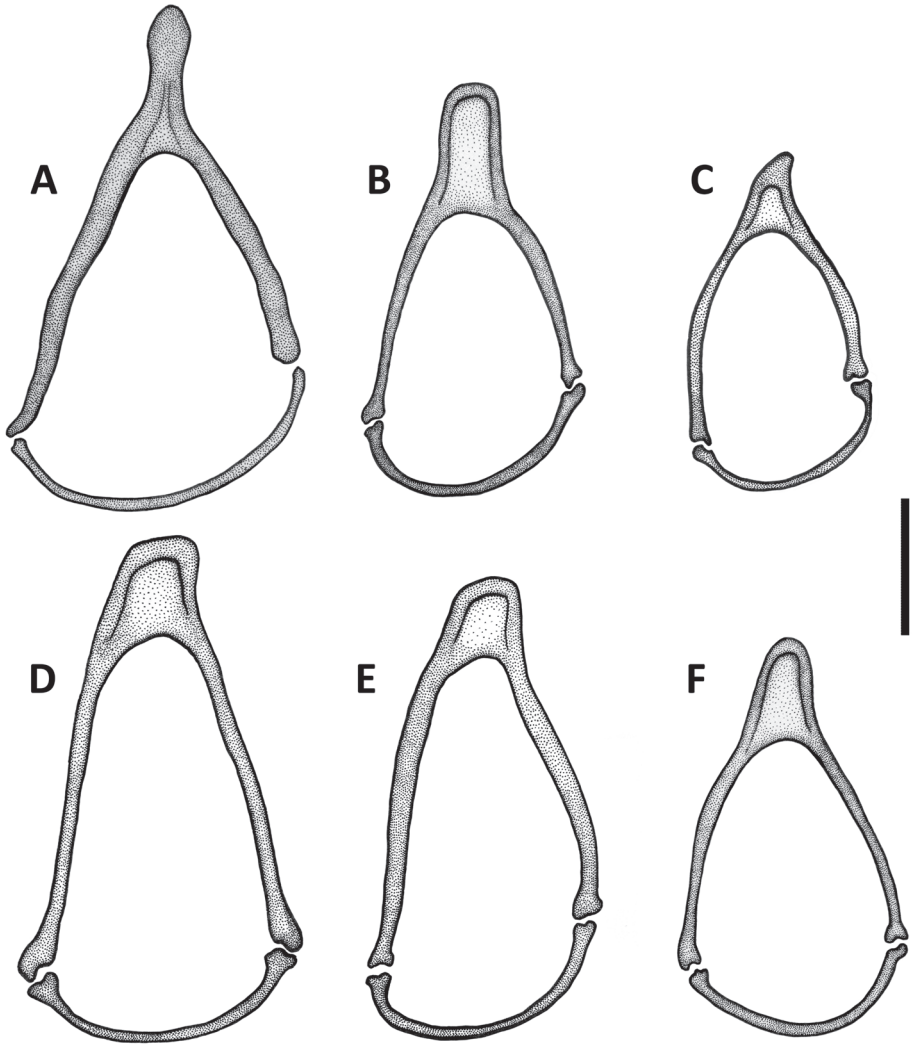
obtuse angle with longitudinal axis of body. Lateral margins convex, evenly divergent at basal half, evenly rounded to apex in apical half.

Male genitalia. Median lobe of aedeagus (Fig. 13A, 15B) with shaft long, widened apically, and apex small and acutely rounded. Ventral margin straight. Dorsal sclerites of internal sac in form of very long plate, protruding from basal orifice, and tapered apically in rather long flagellum, abruptly widened basally as a semicircular dilation, bent ventrally and surrounded by complex of semisclerotized sheaths of peculiar shape. Right paramere with long, narrow apical constriction (Fig. 13C). Left paramere with long, narrow and curved apical constriction (Fig. 13B). Ring sclerite of triangular shape, with sinuations on both sides of long basal handle (Fig. 16A).

Female internal genitalia. Females unknown.

Geographical distribution. This species is known only from the type locality in the mountains of the Sierra de los Cuchumatanes, located in the Huehuetenango Department of Guatemala (Fig. 22, white triangle).

Way of life. The unique type specimen was sifted from leaf litter in Lower Montane Wet Forest (Erwin 1982) at an elevation of 2780 m.



Figures 16. Line drawings of ring sclerite of Guatemalan *Geocharidius* species, male genitalia, dorsal aspect. **A** *G. gimlii* (GUATEMALA, Huehuetenango, San Juan Ixcoy), holotype **B** *G. erwini* (GUATEMALA, Quiché, Los Encuentros), paratype **C** *G. minimus* (GUATEMALA, Sacatepéquez, Antigua), paratype **D** *G. jalapensis* (GUATEMALA, Jalapa, Mataquescuintla), paratype **E** *G. balini* (GUATEMALA, Suchitepéquez, Volcano Atitlán), paratype **F** *G. longinoi* (GUATEMALA, El Progreso, Cerro Pinalón), paratype. Scale = 0.1mm.

Relationships. The shape of the median lobe in the holotype of *G. gimlii* (Fig. 15B) is almost identical to that of the male holotype of *G. integripennis* (Fig. 15A); hence, at least for now, the latter can be considered as its closest relative. The general shape of the dorsal sclerites of the internal sac (namely the apically tapered plate, widened and ventrally bent at the basal end) is also similar to that in *G andersoni* (Fig. 9H) males described above.

***Geocharidius integripennis* (Bates)**
Figs 12B, 14B, 14C, 15A, 17A, 22

Anillus integripennis Bates, 1882: 145.

Lectotype. A male, deposited in MNHN, glued on cardboard, dissected, labeled (Fig. 14B): \ Totonicapam, 85- 10,500 ft. Champion \ *integripennis* Bates \ LECTOTYPUS ♂ det. A. Vigna 1972 \ LECTOTYPUS ♂ *Geocharidius integripennis* Bates Desig. Vigna- Taglianti 1972 Det. J.P. Zaballos 2004\. Paralectotype female, also in MNHN, glued on cardboard, dissected, labeled (Fig. 14C): \ Totonicapam, 85-10,500 ft. Champion \ *Anillus integripennis* Bates \ TYPE \ ♀ \ PARALECTOTYPUS ♀ *Geocharidius integripennis* Bates Det. J.P.Zaballos 2004 \. Type locality: Guatemala, Totonicapán Department, Totonicapam [=Totonicapán].

Geocharidius tagliantii Erwin, 1982: 494; synonymized by Zaballos (2004).

Recognition. Males and females of this species are distinguished from those of other members of the *integripennis* species group (except *G. gimlii*, see Relationships above) by the structure of the median lobe of males and the spermatheca of females. Adults of *G. gimlii* have proportionately much wider elytra than those of *G. integripennis*.

Description. Size. Medium for genus (SBL range 1.33–1.43 mm, mean 1.38±0.070 mm, n=2).).

Habitus. Body form (Fig. 12B) moderately convex, elongate ovoid, general proportions (WE/SBL 0.40±0.002), proportions of head (WH/WPm 0.74±0.022) and pronotum (WPm/WE 0.77±0.026) average for group.

Color. Body rufotestaceous, appendages testaceous.

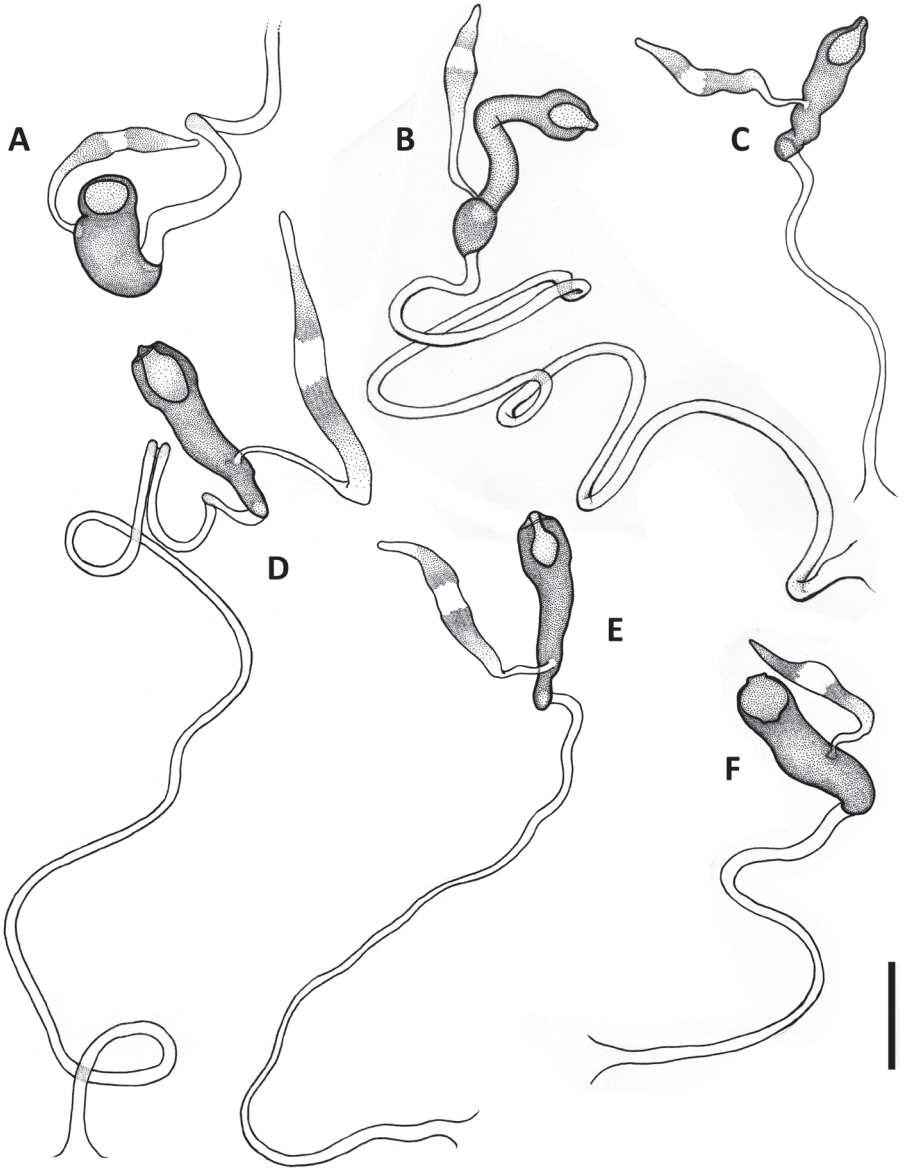
Microsculpture. Mesh pattern of irregularly isodiametric sculpticells present over all dorsal surfaces of head and elytra. Pronotum smooth. Proepisternum with microsculpture.

Prothorax. Pronotum slightly transverse (WPm/LP 1.25±0.009), with lateral margins moderately constricted posteriorly (WPm/WPp 1.33±0.002). Posterior angles slightly obtuse (100-110°). Widths between anterior and posterior angles of equal length (WPa/WPp 0.99±0.018).

Elytra. Moderately convex, slightly depressed along suture, moderately wide (WE/LE 0.67±0.005), without traces of striae. Humeri rounded, in outline forming right angle with longitudinal axis of body. Lateral margins convex, evenly divergent at basal fourth, evenly rounded to apex in apical third.

Male genitalia. Male genitalia of the lectotype are mounted in old gum, covered now with a network of numerous cracks, making the objects inside hard to see. Hence, we could examine only general shape of the median lobe and could not discern details of the inner sac or of the parameres or the round sclerite. Based on what we could see, the median lobe of the aedeagus (Fig. 15A) is very similar to that of the *G. gimlii* holotype.

Female internal genitalia. Spermatheca of the paralectotype sclerotized, bean-shaped, with apical constriction, almost straight, cornu short and nodulus long (Fig. 17A). Length of spermathecal gland greater than length of spermatheca. Spermathecal duct loosely coiled.



Figures 17. Line drawings of spermatheca of Guatemalan *Geocharidius* species. **A** *G. integripennis* (GUATEMALA, Totonicapán, "Totonicapam"), holotype **B** *G. erwini* (GUATEMALA, Quiché, Los Encuentros), paratype **C** *G. minimus* (GUATEMALA, Sacatepéquez, Antigua), paratype **D** *G. jalapensis* (GUATEMALA, Jalapa, Mataquescuintla), paratype **E** *G. balini* (GUATEMALA, Suchitepéquez, Volcano Atitlán), paratype **F** *G. longinoi* (GUATEMALA, El Progreso, Cerro Pinalón), paratype. Scale = 0.05mm.

Geographical distribution. Precise locality at which the type series of this species was collected is unknown. Presumably, the material that was collected by Champion and served as the basis for the Bates' description came from the Cerro Maria Tecún

mountains in the Totonicapán Department of Guatemala (Fig. 22, black and white triangle), as was shown by Ball and Roughley (1982) for *Pterostichus (Percolaus) championi* (Bates), the locality label of which is identical with that of the *G. integripennis* type specimens.

Way of life. The type specimens were collected at an elevation of "10,500 ft." (= 3200 m).

Relationships. Without doubt, the closest relative of *G. integripennis* is *G. gimlii*. In view of the similarity in the shape of the median lobes (Fig. 15B; cf. Fig. 15A) of their males and the range of variation of the median lobes seen among other species of the group, it may seem reasonable to consider these taxa as two subspecies of a single species. However, in the absence of sufficient material for more thorough investigation of variation of the external features and structure of the genitalia, we prefer to preserve the "status quo" and consider *G. gimlii* and *G. integripennis* as close, but separate species.

Geocharidius jalapensis sp. n.

http://zoobank.org/BF792073-053E-4FA8-BA99-759634A24AC7
Figs 2B, 3D, H–I, 4C–D, G–H, 6A–B, 7A, 12D, 13K–N, 16D, 17D, 22, 23

Type material. HOLOTYPE, a male, in KUNHM, point-mounted, labeled: \ GUATEMALA: Jalapa: 4km E Mataquescuintla, 14.52943 -90.14775 ±105m, 2620m, 2-VI-2009, ex. sifted leaf litter, cloud forest, LLAMA09 Wm-B-07-1-06 \ KUNHM \ HOLOTYPE *Geocharidius jalapensis* Sokolov and Kavanaugh 2014 [red label] \. PARATYPES: A total of 78 specimens (4 males and 4 females were dissected), deposited in CAS and KUNHM; 10 specimens labeled same as holotype; 2 specimens labeled: \ GUATEMALA: Jalapa: 4km E Mataquescuintla, 14.53409 -90.15290 ±28m, 2325m, 3-VI-2009, ex. sifted leaf litter, cloud forest, LLAMA09 Wm-B-07-1-10 \ KUNHM \; 1 specimen labeled: \ GUATEMALA: Jalapa: 4km E Mataquescuintla, 14.52950 -90.14802 ±254m, 2600m, 1-VI-2009, ex. sifted leaf litter, cloud forest, LLAMA09 Wm-B-07-1-01 \ KUNHM \; 20 specimens labeled: \ GUATEMALA: Jalapa: 4km E Mataquescuintla, 14.53257 -90.15253 ±200m, 2400m, 1-VI-2009, ex. sifted leaf litter, cloud forest, LLAMA09 Wa-B-07-2-all \ KUNHM \; 23 specimens labeled: \ GUATEMALA: Jalapa: 4km E Mataquescuintla, 14.52780 -90.14671 ±105m, 2655m, 2-VI-2009, ex. sifted leaf litter, cloud forest, LLAMA09 Wm-B-07-1-04 \ KUNHM \; 16 specimens labeled: \ GUATEMALA: Jalapa: 4km E Mataquescuintla, 14.52987 -90.14908 ±200m, 2600m, 1-VI-2009, ex. sifted leaf litter, cloud forest on ridge top, LLAMA09 Wa-B-07-1-all \ KUNHM \; 6 specimens labeled: \ GUATEMALA: Jalapa: 4km E Mataquescuintla, 14.52705 -90.14671 ±105m, 2660m, 2-VI-2009, ex. sifted leaf litter, cloud forest, LLAMA09 Wm-B-07-1-05 \ KUNHM \.

Type locality. Guatemala, Jalapa Department, 4 km E of Mataquescuintla.

Etymology. The specific epithet is a Latinized adjective in the masculine form based on the name Jalapa, the Department of Guatemala in which the type series was collected.

Recognition. Adults of this new species are distinguished from those of other members of the *integripennis* species group by the following combination of external characters: size large and pronotum transverse and fully covered with microsculpture. Males and female of *G. jalapensis* are distinguished from those of other members of the *integripennis* species group by the structure of the median lobe and the shape of spermatheca, respectively.

Description. Size. Medium to large for genus (SBL range 1.33–1.57 mm, mean 1.46±0.081mm, n=25).

Habitus. Body form (Fig. 12D) moderately convex, elongate ovoid, general proportions (WE/SBL 0.39±0.007), proportions of head (WH/WPm 0.71±0.019) and pronotum (WPm/WE 0.76±0.021) average for group.

Color. Body brunneorufous, appendages testaceous.

Microsculpture. Mesh pattern of irregularly isodiametric sculpticells present over all dorsal surfaces of head, pronotum and elytra. Proepisternum with evident microsculpture.

Mouthparts. Mandibles (Figs 4C–D, G–H).

Prothorax. Pronotum markedly transverse (WPm/LP 1.30±0.026), with lateral margins moderately constricted posteriorly (WPm/WPp 1.33±0.029). Posterior angles obtuse (110–120°). Widths between anterior and posterior angles of equal length (WPa/WPp 0.99±0.023).

Pterothorax (Fig. 3D).

Elytra (Fig. 2B). Moderately convex, slightly depressed along suture, moderately wide (WE/LE 0.65±0.009), without traces of striae. Humeri rounded, in outline forming right angle with longitudinal axis of body. Lateral margins convex, evenly divergent at basal third, evenly rounded to apex in apical third.

Legs. Mesotibia (Fig. 7A). Protarsus (Fig. 6A–B).

Abdomen. Ventrites 3-5 (Fig. 3H–I).

Male genitalia. Median lobe (Fig. 13K) with shaft long and apex slightly enlarged and rounded. Ventral margin almost straight. Dorsal sclerites of internal sac in form of a long plate, tapered apically and basally in short extensions (Fig. 13K–L). Right paramere with short and rather wide apical constriction (Fig. 13N). Left paramere with long and narrow apical constriction (Fig. 13M). Ring sclerite with almost rectangularly rounded, slightly asymmetrical, handle (Fig. 16D).

Female internal genitalia. Spermatheca sclerotized, fusiform with apical bulb enlargement, straight, with long cornu and short nodulus (Fig. 17D). Length of spermathecal gland greater than length of spermatheca. Spermathecal duct coiled.

Geographical distribution. This species is known only from type locality, situated on the northern slopes of the former twinned volcano, remains of which form the caldera now filled with the waters of Laguna de Ayarza (Jalapa Department). Physiographically, the region is part of the volcanic chain of the Guatemalan Cordillera (Fig. 22, green triangle).

Way of life. Specimens were collected by sifting cloud forest litter at elevations of 2325–2620 m.

Relationships. The shapes of handle of the ring sclerite (Fig. 16D) and of the spermatheca (Fig. 17D) suggest that this species is closely related to *G. balini* (Figs 13O and 17E), described above.

***Geocharidius longinoi* sp. n.**
http://zoobank.org/2037D9B1-5260-4836-8ED4-0D0AE950111F
Figs 5E, 7C, G, 12C, 13R–T, 16F, 17F, 22

Type material. HOLOTYPE, a male, in KUNHM, point-mounted, labeled: \ GUATEMALA: El Progreso : Cerro Pinalón, 15.08392-89.93013 ±55m, 2750m, 1-V-2009 ex. sifted leaf litter, cloud forest, LLAMA09 Wm-B-01-1-04 \ KUNHM \ HOLOTYPE *Geocharidius longinoi* Sokolov and Kavanaugh 2014 [red label] \. PARATYPES: A total of 13 specimens (2 males and 1 female were dissected), deposited in CAS, CMNC and KUNHM; 5 specimens labeled same as holotype; 7 specimens labeled: \ GUATEMALA: El Progreso : Cerro Pinalón, 15.08411-89.93239 ±57m, 2715m, 1-V-2009 ex. sifted leaf litter, cloud forest, LLAMA09 Wm-B-01-1-05 \ KUNHM \; 1 specimen labeled: \ GUAT.: EL PROGRESO : 19.6km.N.Estancia de la Virgen, 2000m, Finca la Illuciones, 24.VI.1993, R.Anderson, cloud for. litter, 93-13C \ CMNC \.

Type locality. Guatemala, El Progreso Department, Cerro Pinalón.

Etymology. The specific epithet is a Latinized eponym in the genitive case, and is based on the surname of John T. (Jack) Longino, Professor of the Biology Department of the University of Utah, and one of Co-PI's of the LLAMA project, which provided the material on which the description of this species is based.

Recognition. Adults of this new species are distinguished from those of other members of the *integripennis* species group by the large size, distinctive shape of the pronotum with very wide basal margin, and the proepisternum with evident microsculpture. Males and females of *G. longinoi* are distinguished from those of other members of the *integripennis* species group by the structure of the median lobe and the shape of spermatheca, respectively.

Description. Size. Medium to large for genus (SBL range 1.34–1.51 mm, mean 1.41±0.071mm, n=12).

Habitus. Body form (Fig. 12C) moderately convex, elongate ovoid, general proportions (WE/SBL 0.38±0.008) and proportions of head (WH/WPm 0.71±0.012) average for group, pronotum markedly wide compared to elytra (WPm/WE 0.80±0.013).

Color. Body brunneorufous, appendages testaceous.

Microsculpture. Mesh pattern of irregularly isodiametric sculpticells present over all dorsal surfaces of head and elytra. Pronotum smooth (without evident microsculpture). Proepisternum with evident microsculpture.

Mouthparts. Maxillae and labium (Fig. 5E).

Prothorax. Pronotum slightly transverse (WPm/LP 1.25±0.019), with lateral margins slightly constricted posteriorly (WPm/WPp 1.29±0.018). Posterior angles slightly obtuse (100–110°). Width between posterior angles greater than between anterior angles (WPa/WPp 0.94±0.020).

Elytra. Moderately convex, slightly depressed along suture, moderately wide (WE/LE 0.66±0.020), without traces of striae. Humeri rounded, in outline forming right angle with longitudinal axis of body. Lateral margins convex, evenly divergent at basal forth, evenly rounded to apex in apical third.

Legs. Mesotibia (Fig. 7C). Metatibia (Fig. 7G).

Male genitalia. Median lobe (Fig. 13R) with shaft long, apically slightly widened, apex small and narrowly rounded. Ventral margin straight. Dorsal sclerites of internal sac (Fig. 13R) in form of long waved ribbon, tapered apically and slightly dilated basally, where sclerite forms small hook-like extension. Right paramere with short apical constriction (Fig. 13T). Left paramere with rather short and narrow apical constriction (Fig. 13S). Ring sclerite with triangularly rounded handle (Fig. 16F).

Female internal genitalia. Spermatheca sclerotized, elongate, subparallel, almost straight, with long cornu and short nodulus (Fig. 17F). Length of spermathecal gland less than length of spermatheca. Spermathecal duct not coiled.

Geographical distribution. This species is known only from Cerro Pinalón, part of the Sierra de las Minas range of Guatemala (Fig. 22, green squares).

Way of life. Specimens were extracted from cloud forest litter at elevations of 2000–2750 m.

Relationships. The shape of handle of the ring sclerite (Fig. 16F) and the structure of dorsal sclerites of the internal sac (Fig. 13R) suggest a relationship with the Honduran *G. celaquensis* (Figs 20B and 19E), described below.

***Geocharidius minimus* sp. n.**
http://zoobank.org/38CA85F3-81F4-4B3F-B23B-EB29892CEDAD
Figs 3E, G, 5F, 6D–E, 7B, 12H, 13G–J, 16C, 17C, 22, 23

Type material. HOLOTYPE, a male, in KUNHM, glued on cardboard, labeled: \ GUATEMALA: Sacatepéquez: 5km SE Antigua, 14.53577 -90.69428±200m, 2150m, 10-VI-2009, ex. sifted leaf litter, hardwood forest LLAMA09 Wa-B-08-1-all \ KUNHM \ HOLOTYPE *Geocharidius minimus* Sokolov and Kavanaugh 2014 [red label] \. PARATYPES: A total of 121 specimens (6 males and 4 females were dissected), deposited in CAS and KUNHM; 53 specimens labeled same as holotype; 11 specimens labeled: \ GUATEMALA: Sacatepéquez: 5km SE Antigua, 14.53439 -90.69340±36m, 2175m, 11-VI-2009, ex. sifted leaf litter, hardwood forest LLAMA09 Wm-B-08-2-08 \ KUNHM \; 1 specimen labeled: \ GUATEMALA: Sacatepéquez: 5km SE Antigua, 14.53666 -90.69491±255m, 2140m, 10-VI-2009, ex. sifted leaf litter, hardwood forest LLAMA09 Wm-B-08-1-07 \ SEMC0896573 KUNHM-ENT \; 48 specimens labeled: \ GUATEMALA: Sacatepéquez: 5km SE Antigua, 14.53482-90.69398±33m, 2175m, 10-VI-2009, ex. sifted leaf litter, hardwood forest LLAMA09 Wm-B-08-1-04 \ SEMC0888829 KUNHM-ENT \; 4 specimens labeled: \ GUATEMALA: Suchitepéquez: 4km S Vol. Atitlán, 14.55311- 91.19337 ±35m, 1750m, 15-VI-2009 ex sifted leaf litter, cloud forest, LLAMA09 Wm-B-09-2-02 1 \

KUNHM \; 2 specimens labeled: GUATEMALA: Suchitepéquez: 4km S Vol. Atitlán, 14.54915- 91.19055 ±200m, 1625m, 15-VI-2009 ex sifted leaf litter, cloud forest, LLAMA09 Wa-B-09-1-all \ SEMC0889856 KUNHM-ENT \; 2 specimens labeled: \ GUATEMALA: Suchitepéquez: 4km S Vol. Atitlán, 14.55972- 91.18951 ±27m, 2164m, 17-VI-2009 ex sifted leaf litter, cloud forest, LLAMA09 Wm-B-09-2-06 \ SEMC0896573 KUNHM-ENT \.

Type locality. Guatemala, Sacatepéquez Department, 5 km SE of Antigua.

Etymology. The specific epithet is a Latin adjective, *minimus* (superlative of *parvus*), in the masculine form, meaning "*smallest*".

Recognition. Adults of this new species are distinguished from those of other members of the *integripennis* species group by the combination of small size, elongate habitus and smooth proepisternum. Males and females of *G. minimus* are distinguished from those of other members of the *integripennis* species group by the structure of the median lobe and the shape of spermatheca, respectively.

Description. Size. Small for genus (SBL range 1.11–1.24 mm, mean 1.18±0.041 mm, n=26).

Habitus. Body form (Fig. 12H) moderately convex, elongate, general proportions narrow (WE/SBL 0.37±0.009), proportions of head (WH/WPm 0.75±0.016) and pronotum (WPm/WE 0.80±0.015) wide for group.

Color. Body rufotestaceous, appendages testaceous.

Microsculpture. Mesh pattern of irregularly isodiametric sculpticells present over all dorsal surfaces of head and elytra. Pronotum and proepisternum smooth (without evident microscupture).

Mouthparts. Maxillae and labium (Fig. 5F).

Prothorax. Pronotum moderately narrow (WPm/LP 1.24±0.027), with lateral margins markedly constricted posteriorly (WPm/WPp 1.35±0.022). Posterior angles obtuse (110–120°). Width between anterior angles greater than between posterior angles (WPa/WPp 1.06±0.024).

Pterothorax (Fig. 3E).

Elytra. Moderately convex, slightly depressed along suture, moderately narrow (WE/LE 0.64±0.017), without traces of striae. Humeri rounded, in outline forming right angle with longitudinal axis of body. Lateral margins subparallel, evenly divergent at basal fifth, evenly rounded to apex in apical fourth.

Legs. Mesotibia (Fig, 7B). Protarsus (Figs 6D–E).

Abdomen. Ventrites 3-5 (Fig. 3G).

Male genitalia. Median lobe (Fig. 13G) with shaft moderately long, subparallel, apex small and narrowly rounded. Ventral margin almost straight. Dorsal sclerites of internal sac in form of a long plate, tapered apically as a long flagellum, and gradually widen towards narrow and rounded basal end extended through basal orifice and bent laterally (Fig. 13G–H). Right paramere with short apical consriction (Fig. 13J). Left paramere moderately long, with rather short apical constriction (Fig. 13I). Ring sclerite with handle triangular, slightly asymmetrical, pointed apically (Fig. 16C).

Female internal genitalia. Spermatheca sclerotized, fusiform, only slightly dilated apically, straight, with cornu and nodulus of approximately equal length (Fig. 17C). Lengths of spermathecal gland and spermatheca equal. Spermathecal duct not coiled.

Geographical distribution. This species is known from the slopes of two volcanos, Agua and Atitlán, in Sacatepéquez and Suchitepéquez Departments of Guatemala, respectively (Fig. 22, green flowers).

Way of life. Specimens were collected by sifting litter in hardwood and cloud forests at middle and high elevations of 1600 and 2200 m, respectively.

Relationships. The shape of dorsal sclerites of the internal sac (Fig. 13G) of males suggests a distant relationship with *G. erwini* (Fig 13D), described above, whereas the shape of the handle of the ring sclerite (Fig. 16C) of males suggests relationships with the Guatemalan *G. antigua* (Fig. 20A), described above, and the Honduran *G. disjunctus* (Fig. 20E), described below.

Species from Honduras

***Geocharidius celaquensis* sp. n.**
http://zoobank.org/2AE3AACE-E66B-4F68-B8D8-AF5974E29BC6
Figs 18A, 19E–G, 20B, 21B, 22, 23

Type material. HOLOTYPE, a male, in CMNC, point-mounted, dissected, labeled: \ HONDURAS: Lempira Dept., P.N. Celaque, nr. Gracias, Campamiento Naranjo, 2500m, N14°32.7', W88°39.7', 12–13.V.2002, cloud forest litter R. Anderson, 2002-020C \ CMNC \ HOLOTYPE *Geocharidius celaquensis* Sokolov and Kavanaugh 2014 [red label] \. PARATYPES: A total of 2 females (both were dissected), deposited in CAS and KUNHM; labeled same as holotype, except label of the holder: SEMC0… KUNHM-ENT \.

Type locality. Honduras, Lempira Department, Celaque National Park.

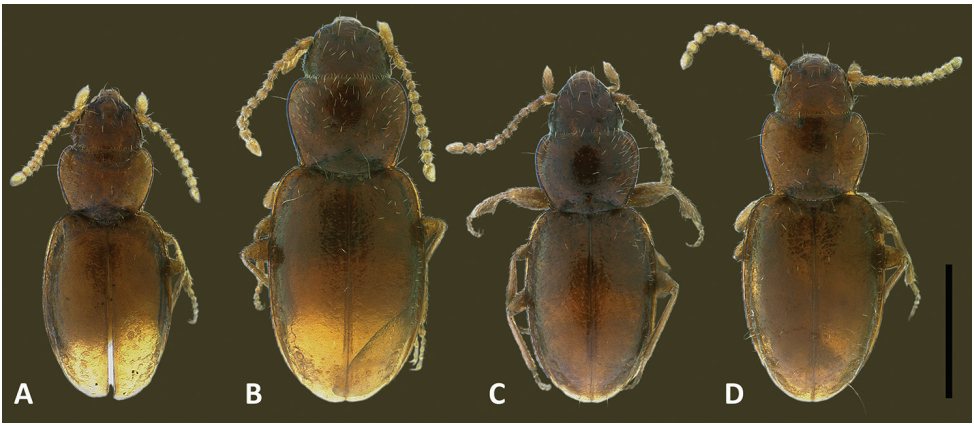
Etymology. The specific epithet is a Latinized adjective in the masculine form based on the name of Celaque National Park, from which the new species is described.

Recognition. Adults of this new species are distinguished from those of other members of the *integripennis* species group by their small size, fully microsculptured dorsal body surface and pronotum with wide basal margin. Males and females of *G. celaquensis* are distinguished from those of the other members of the *integripennis* species group by the structure of the median lobe and the shape of spermatheca, respectively.

Description. Size. Small for genus (SBL range 1.15–1.20 mm, mean 1.18±0.023mm, n=3).

Habitus. Body form (Fig. 18A) moderately convex, ovoid, general proportions (WE/SBL 0.40±0.005), proportions of head (WH/WPm 0.73±0.016) and pronotum (WPm/WE 0.78±0.015) moderately wide.

Color. Body rufotestaceous, appendages testaceous.



Figures 18. Digital images of habitus of Honduran *Geocharidius* species. **A** *G. celaquensis* (HONDURAS, Lempira, Celaque National Park), paratype **B** *G. lencanus* (HONDURAS, Lempira, Celaque National Park), paratype **C** *G. comayaguanus* (HONDURAS, Comayagua, Comayagua), paratype **D** *G. disjunctus* (HONDURAS, Francisco Morazán, La Tigra National Park), holotype. Scale = 0.5mm.

Microsculpture. Mesh pattern of irregularly isodiametric sculpticells present over all dorsal surfaces of head, pronotum and elytra. Proepisternum also with evident microsculpture.

Prothorax. Pronotum markedly transverse (WPm/LP 1.32±0.025), with lateral margins markedly constricted posteriorly (WPm/WPp 1.35±0.002). Posterior angles obtuse (110–120°). Width between posterior angles slightly greater than between anterior angles (WPa/WPp 1.04±0.004).

Elytra. Moderately convex, slightly depressed along suture, moderately wide (WE/LE 0.68±0.015), without traces of striae. Humeri rounded, in outline forming right angle with longitudinal axis of body. Lateral margins convex, evenly divergent at basal third, evenly rounded to apex in apical third.

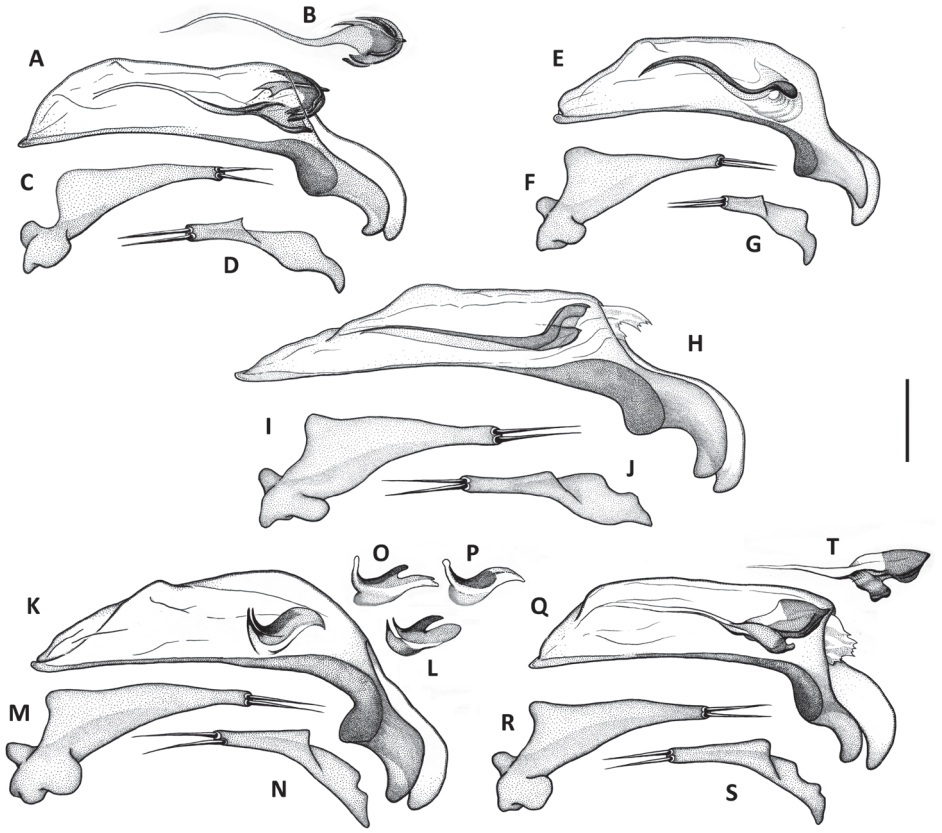
Male genitalia. Median lobe (Fig. 19E) with shaft subparallel, apex small and narrowly rounded. Ventral margin almost straight. Dorsal sclerites of internal sac in form of long, waved ribbon, tapered apically and slightly dilated and narrowly rounded basally. Right paramere with short apical constriction (Fig. 19G). Left paramere with long and narrow apical constriction (Fig. 19F). Ring sclerite with handle triangular, widely rounded at apex (Fig. 20B).

Female internal genitalia. Spermatheca sclerotized, fusiform, slightly dilated apically, straight, with short cornu and long nodulus (Fig. 21B). Length of spermathecal gland less than length of spermatheca. Spermathecal duct not coiled.

Geographical distribution. This species is known only from Celaque National Park, part of the Cerro las Minas range of Honduras (Fig. 22, yellow flower).

Way of life. Specimens were extracted from cloud forest litter at an elevation of 2500 m.

Relationships. The shape of dorsal sclerites of the internal sac (Fig. 19E) in males and the point of the attachment of the spermathecal gland (Fig. 21B) in females suggest



Figures 19. Line drawings of aedeagus of Guatemalan and Honduran *Geocharidius* species. **A–D** *G. antigua* (GUATEMALA, Sacatepéquez, Antigua), holotype: **A** median lobe with internal sac and dorsal sclerites, right lateral aspect **B** dorsal sclerite of median lobe, dorsal aspect **C** left paramere, left lateral aspect **D** right paramere, right lateral aspect **E–G** *G. celaquensis* (HONDURAS, Lempira, Celaque National Park), holotype: **E** median lobe with internal sac and dorsal sclerites, right lateral aspect **F** left paramere, left lateral aspect **G** right paramere, right lateral aspect **H–J** *G. lencanus* (HONDURAS, Lempira, Celaque National Park), paratype: **H** median lobe with internal sac and dorsal sclerites, right lateral aspect **I** left paramere, left lateral aspect **J** right paramere, right lateral aspect **K–N** *G. comayaguanus* (HONDURAS, Comayagua, Comayagua), paratype: **K** median lobe with internal sac and dorsal sclerites, right lateral aspect **L** variation in a shape of dorsal sclerite of internal sac, right lateral aspect **M** left paramere, left lateral aspect **N** right paramere, right lateral aspect **O–P** *G. comayaguanus* (HONDURAS, La Paz, Guajicuiro): variations in a shape of dorsal sclerite of internal sac, right lateral aspect **Q–S** *G. disjunctus* (HONDURAS, Francisco Morazán, La Tigra National Park), holotype: **Q** median lobe with internal sac and dorsal sclerites, right lateral aspect **R** left paramere, left lateral aspect **S** right paramere, right lateral aspect. **T** *G. disjunctus* (HONDURAS, Yoro, Pico Pijol National Park): shape of dorsal sclerite of median lobe, right lateral aspect. Scale = 0.05mm.

that this species is closely related to *G. lencanus* (Figs 19H and 21C), described below, and perhaps also, but more remotely, to the Guatemalan *G. longinoi* (Figs 13R and 17F), described above.

***Geocharidius comayaguanus* sp. n.**
http://zoobank.org/CC2857E4-7428-4FC0-A2BC-CFA5A571E8C3
Figs 2C, 3C, 3F, 6H, 7D, H, 18C, 19K–P, 20D, 21D, 22, 23

Type material. HOLOTYPE, a male, in CMNC, point-mounted, dissected, labeled: \ HONDURAS: Comayagua, 18km ENE Comayagua, 1950m, 20.VIII.1994, S. & J. Peck, wet oak-pine forest litter, S&JPeck 1994-52 \ CMNC \ HOLOTYPE *Geocharidius comayaguanus* Sokolov and Kavanaugh 2014 [red label] \. PARATYPES: A total of 23 specimens (6 males and 2 females were dissected), deposited in CAS, CMNC and KUNHM; 4 specimens labeled same as holotype; 5 specimens labeled: \ HONDURAS: Comayagua, Comayagua (18km E.N.E.), 1950m, 20.VIII.1994, S. Peck wet oak-pine forest litter, SBP 94-52 \ CMNC \; 8 specimens labeled: HONDURAS: La Paz Dept. Tutule, Res. Biol. Guajiquiro, 14°10'N, 87°50'W, 2130m, 7-V-2002, R.Anderson, cloud forest litter, RSA2002-010 \ SM0… KUNHM-ENT \; 1 specimen labeled: HONDURAS: LA PAZ: Tutule, Res. Biol. Guajiquiro, N14°10', W87°50', 2130m, 7.V.2002, R.Anderson, cloud forest litter, 2002-010H \ CMNC \; 1 specimen labeled: \ HONDURAS: LA PAZ: Tutule, Res. Biol. Guajiquiro, N14°10', W87°50', 2130m, 7.V.2002, R.Anderson, cloud forest litter, 2002-010D \ CMNC \; 1 specimen labeled: \ HONDURAS: LA PAZ: Tutule, Res. Biol. Guajiquiro, N14°10', W87°50', 2130m, 7.V.2002, R.Anderson, cloud forest litter, 2002-010E \ CMNC \; 2 specimens labeled: \ HONDURAS: LA PAZ: Tutule, Res. Biol. Guajiquiro, N14°10', W87°50', 2130m, 7.V.2002, R.Anderson, cloud forest litter, 2002-010I \ CMNC \; 1 specimen labeled: \ HONDURAS: Yoro Dept., P.N. Pico Pijol, 1300m, N15°09.4', W87°37.6', 11.V.2002, R. Anderson, upper montane forest litter, 2002-017A\ CMNC.

Type locality. Honduras, Comayagua Department, 18 km ENE of Comayagua.

Etymology. The specific epithet is a Latinized adjective in the masculine form based on the name of the city of Comayagua, from the vicinity of which the new species is described.

Recognition. Adults of this species are practically indistinguishable externally from those of *G. disjunctus*, described below, and are distinguished from the latter, as from those of the other members of the *integripennis* species group, by the structure of the male median lobe and the shape of spermatheca in females.

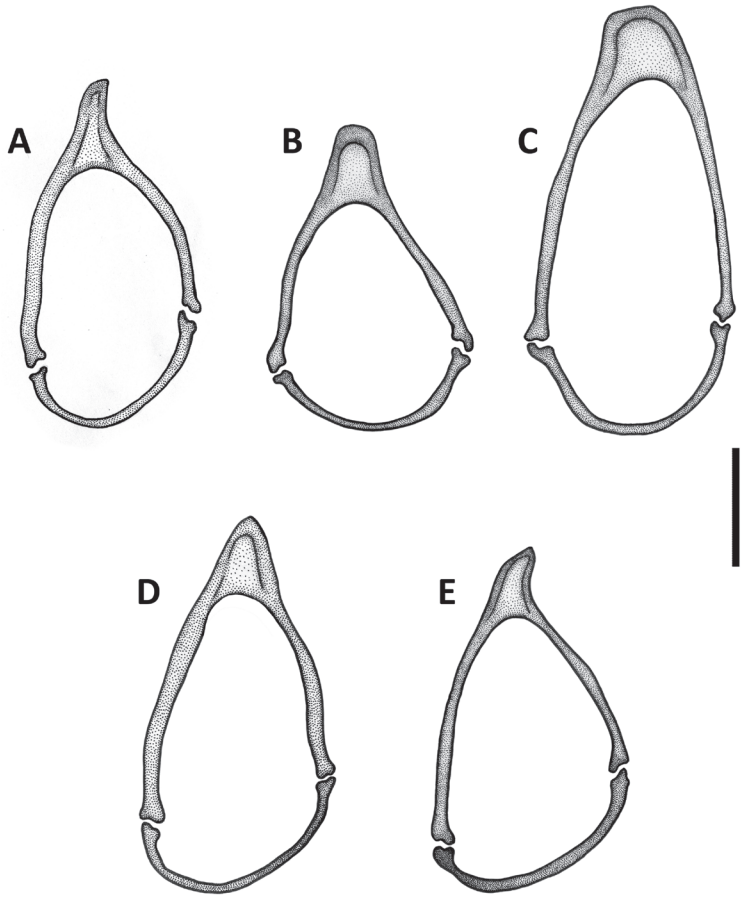
Description. Size. Small to medium for genus (SBL range 1.19–1.34 mm, mean 1.28±0.072mm, n=20).

Habitus. Body form (Fig. 18C) moderately convex, ovoid, general proportions (WE/SBL 0.40±0.011), proportions of head (WH/WPm 0.74±0.017) and pronotum (WPm/WE 0.78±0.018) moderately wide.

Color. Body brunneorufous, appendages testaceous.

Microsculpture. Mesh pattern of irregularly isodiametric sculpticells present over all dorsal surfaces of head and elytra. Pronotum and proepisternum smooth (without evident microsculpture).

Prothorax. Pronotum moderately transverse (WPm/LP 1.29±0.024), with lateral margins markedly constricted posteriorly (WPm/WPp 1.35±0.027). Posterior angles



Figures 20. Line drawings of ring sclerite of Guatemalan and Honduran *Geocharidius* species, male genitalia, dorsal aspect. **A** *G. antigua* (GUATEMALA, Sacatepéquez, Antigua), holotype **B** *G. celaquensis* (HONDURAS, Lempira, Celaque National Park), holotype **C** *G. lencanus* (HONDURAS, Lempira, Celaque National Park), paratype **D** *G. comayaguanus* (HONDURAS, Comayagua, Comayagua), paratype **E** *G. disjunctus* (HONDURAS, Francisco Morazán, La Tigra National Park), holotype. Scale = 0.1mm.

obtuse (110–120°). Width between posterior angles equal to the width between anterior angles (WPa/WPp 1.02±0.026). Ventral aspect (Fig. 3C).

Pterothorax (Fig. 3F).

Elytra (Fig. 2C). Moderately convex, slightly depressed along suture, moderately wide (WE/LE 0.68±0.022), without traces of striae. Humeri rounded, in outline forming right angle with longitudinal axis of body. Lateral margins convex, evenly divergent at basal third, evenly rounded to apex in apical third.

Legs. Protibia (Fig. 6H). Mesotibia (Fig. 7D). Metatibia (Fig. 7H).

Male genitalia. Median lobe (Fig. 19K) with shaft long and dorsally convex, apex small and narrowly rounded. Ventral margin straight. Dorsal sclerites of internal sac small, in form of a short hook-like plate, slightly varied among different populations

(Fig. 19K–L, O–P). Right paramere with long apical constriction (Fig. 19N). Left paramere with long and narrow apical constriction (Fig. 19M). Ring sclerite with handle triangular, pointed at apex (Fig. 20D).

Female internal genitalia. Spermatheca sclerotized, fusiform, slightly tapered apically, straight, with cornu and nodulus of equal length (Fig. 21D). Length of spermathecal gland less than length of spermatheca. Spermathecal duct not coiled.

Geographical distribution. This species is known from La Paz, Comayagua and Yoro Departments, thus having a range that crosses nearly the entire Honduran Interior Highlands from the Pacific to the Antlantic slope (Fig. 22, yellow circles).

Way of life. Specimens were collected in litter samples from cloud, upper montane and wet oak-pine forests at middle and high elevations of 1300 and 2130 m, respectively.

Relationships. This species is unique within the *integripennis* species group in the shape of dorsal sclerites of the internal sac (Fig. 19K) of males and of the spermatheca (Fig. 21D) of females. Hence, *G. comayaguanus* appears to be only remotely related to the other members of the species group.

Geocharidius disjunctus sp. n.

http://zoobank.org/A0E6C548-3EC5-40B6-933F-414125D61068
Figs 18D, 19Q–T, 20E, 21E, 22, 23

Type material. HOLOTYPE, a male, in CMNC, point-mounted, dissected, labeled: \ HONDURAS: FRANC. MOR: P.N. La Tigra, 23.2km N Tegucigalpa, 15.VIII.1994-201A, 2100m, R.Anderson, cloud forest litter berlese \ CMNC \ HOLOTYPE *Geocharidius disjunctus* Sokolov and Kavanaugh 2014 [red label] \. PARATYPES: A total of 2 specimens (both were dissected), deposited in CAS and CMNC ; 1 male labeled: \ HONDURAS: Yoro Dept., P.N. Pico Pijol, 1400m, N15°09.4'W87°37.6', 11.V.2002, R. Anderson, upper montane forest litter, 2002-016C\ CMNC \; 1 female labeled: \ HONDURAS: Yoro Dept., P.N. Pico Pijol, 1300m, N15°09.4'W87°37.6', 11.V.2002, R. Anderson, upper montane forest litter, 2002-017A \ CMNC \.

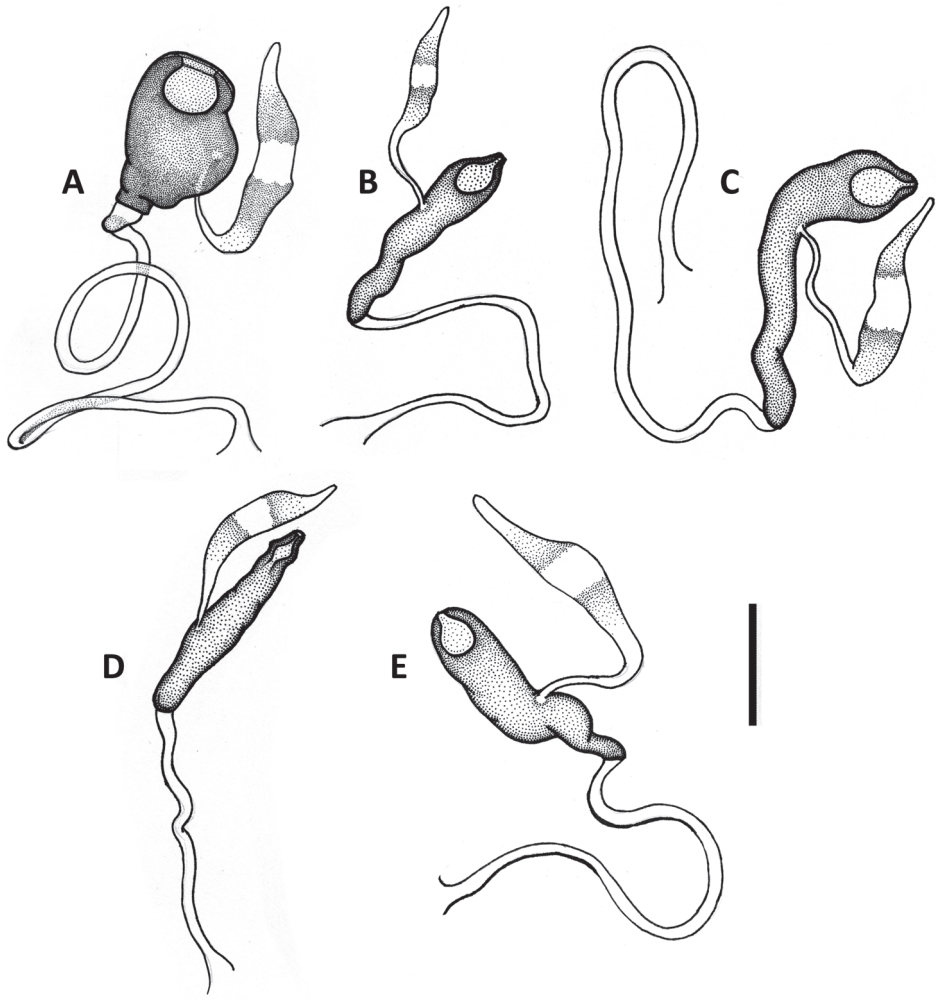
Type locality. Honduras, Francisco Morazán, La Tigra National Park.

Etymology. The specific epithet is a Latin adjective, *disjunctus*, in the masculine form, meaning "*separated*", and refers to the species distinctness from the sympatric *G. comayaguanus*, described above.

Recognition. Adults of this new species are practically indistinguishable from those of the sympatric *G. comayaguanus* in body shape. Males and females of *G. disjunctus* are distinguished from those of the other members of the *integripennis* species group by the structure of the median lobe and the shape of spermatheca, respectively.

Description. Size. Small to medium for genus (SBL range 1.17–1.36 mm, mean 1.28±0.101 mm, n=3).

Habitus. Body form (Fig. 18D) moderately convex, elongate ovoid, general proportions (WE/SBL 0.38±0.005) and proportions of head (WH/WPm 0.74±0.020) and pronotum (WPm/WE 0.78±0.018) average for group.



Figures 21. Line drawings of spermatheca of Guatemalan and Honduran *Geocharidius* species. **A** *G. antigua* (GUATEMALA, Sacatepéquez, Antigua), paratype **B** *G. celaquensis* (HONDURAS, Lempira, Celaque National Park), paratype **C** *G. lencanus* (HONDURAS, Lempira, Celaque National Park), paratype **D** *G. comayaguanus* (HONDURAS, Comayagua, Comayagua), paratype **E** *G. disjunctus* (HONDURAS, Yoro, Pico Pijol National Park). Scale = 0.05mm.

Color. Body brunneorufous, appendages testaceous.

Microsculpture. Mesh pattern of irregularly isodiametric sculpticells present over all dorsal surfaces of head and elytra. Pronotum and proepisternum smooth (without evident microsculpture).

Prothorax. Pronotum moderately transverse (WPm/LP 1.28±0.010), with lateral margins moderately constricted posteriorly (WPm/WPp 1.33±0.004). Posterior angles slightly obtuse (100–110°). Width between posterior angles equal to width between anterior angles (WPa/WPp 1.00±0.022).

Elytra. Moderately convex, slightly depressed along suture, moderately wide (WE/LE 0.65±0.015), without traces of striae. Humeri broadly rounded, in outline forming right angle with longitudinal axis of body. Lateral margins convex, evenly divergent at basal third, evenly rounded to apex in apical third.

Male genitalia. Median lobe of aedeagus (Fig. 19Q) with shaft long and subparallel, apex small and rounded. Ventral margin straight. Dorsal sclerites of internal sac in form of a long plate, tapered apically into a long flagellum, and abruptly widened basally, with a ventral appendix and pointed semicircular enlargement near basal orifice (Fig. 19Q–T). Right paramere with long and narrow apical constriction (Fig. 19S). Left paramere with long and narrow apical constriction (Fig. 19R). Ring sclerite with handle triangular, slightly asymmetrical and pointed apically (Fig. 20E).

Female internal genitalia. Spermatheca sclerotized, fusiform, almost straight, tapered basally, with cornu and nodulus of approximately equal length (Fig. 21E). Length of spermathecal gland greater than length of spermatheca. Spermathecal duct coiled.

Geographical distribution. This species is known only from two remote localities in the Honduran Interior Highlands, situated in Yoro and Francisco Morazán Departments.(Fig. 22, yellow triangles).

Way of life. Specimens were collected by sifting cloud and upper montane forest litter at middle to high elevations (1300–2100 m).

Relationships. The shape of dorsal sclerites of the internal sac (Fig. 19Q) of males suggests that this species is closely related to the Guatemalan *G. antigua* (Fig. 19A), described above

***Geocharidius lencanus* sp. n.**
http://zoobank.org/B41C1418-E0FB-4896-BE0F-827FE08A84D1
Figs 5C, 6G, 18B, 19H–J, 20C, 21C, 22, 23

Type material. HOLOTYPE, a male, in KUNHM, point-mounted, dissected, labeled: \ HONDURAS: Lempira Dept., P.N. Celaque, nr. Gracias, Campamiento Naranjo, 14°32.7'N, 88°39.7'W, 2500m, 12-13-V-2002, cloud forest litter R. Anderson, RSA2002-020 \ SM0… KUNHM-ENT \ HOLOTYPE *Geocharidius lencanus* Sokolov and Kavanaugh 2014 [red label] \. PARATYPES: A total of 6 specimens (3 males and 2 females were dissected), deposited in CAS, CMNC and KUNHM; 4 specimens labeled same as holotype; 2 specimens labeled: \ HONDURAS: Lempira Dept., P.N. Celaque, nr. Gracias, Campamiento Naranjo, 2500m, N14°32.7', W88°39.7', 12–13.V.2002, cloud forest litter R. Anderson, 2002-020E \ CMNC \.

Type locality. Honduras, Lempira Department, Celaque National Park.

Etymology. The specific epithet is a Latinized adjective in the masculine form based on the name of the indigenous people, the *Lenca*, living in the territory of Celaque National Park during historic times.

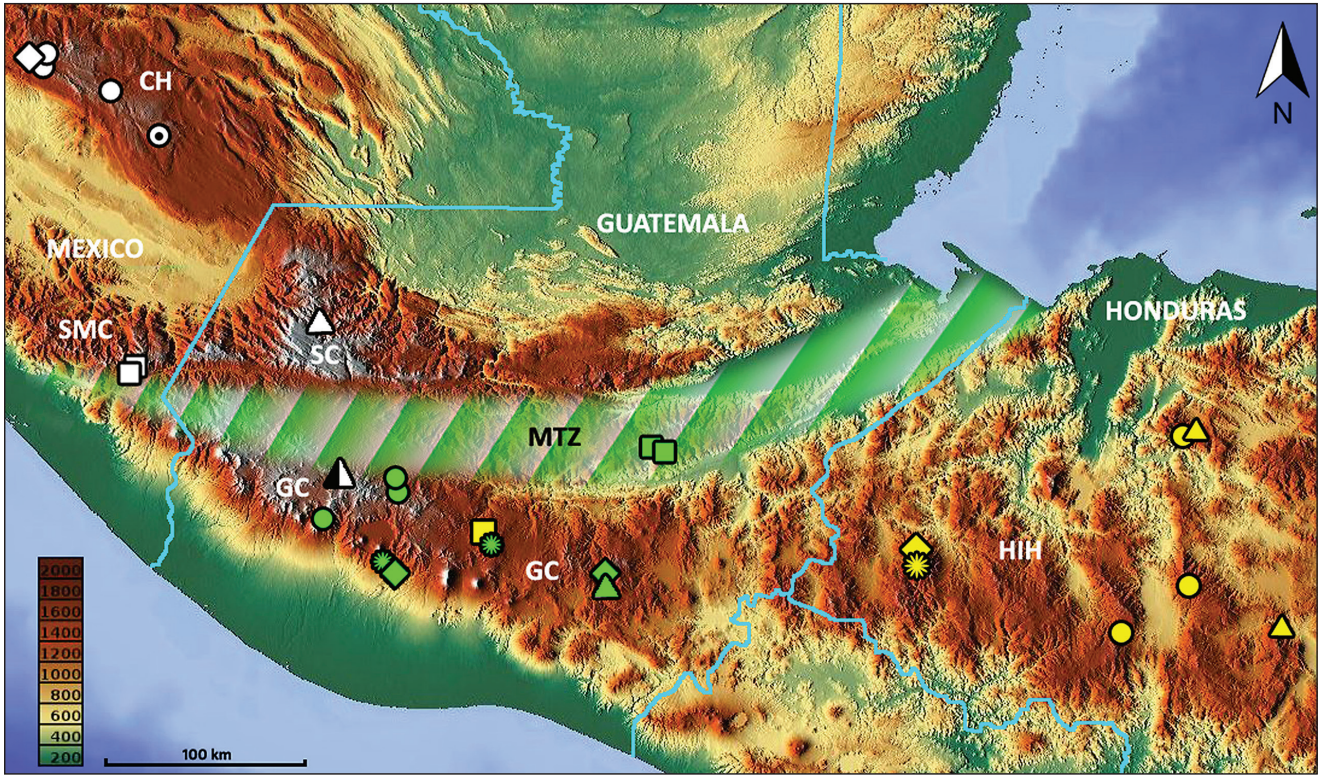


Figure 22. Map of southern Mexico, Guatemala and adjacent part of Honduras, showing positions of locality records for the species of *Geocharidius*: white diamond, *G. andersoni*; white circles (black point in a circle shows "terra typica" for the species), *G. zullinii*; white squares, *G. vignatagliantii*; white triangle, *G. gimlii*; black and white triangle, *G. integripennis*; green squares, *G. longinoi*; green circles, *G. erwini*; green flowers, *G. minimus*; green diamonds, *G. balini*; green triangle, *G. jalapensis*; yellow quadrangle, *G. antigua*; yellow diamond, *G. lencanus*; yellow flower, *G. celaquensis*; yellow triangles, *G. disjunctus*; yellow circles, *G. comayaguanus*. Physiographic features: CH, Chiapas Highlands; GC, Guatemalan Cordillera; HIH, Honduran Interior Highlands; MTZ, Motagua Fault Zone; SC, Sierra de los Cuchumatanes; SMC, Sierra Madre de Chiapas. Elevation scale bar is given in meters.

Recognition. Externally, members of this species represent a larger version of *G. celaquensis* adults, described above. Adults of *G. lencanus* are distinguished from those of other members of the *integripennis* species group by the following combination of external characters: medium to large size, rather wide habitus and fully microsculptured dorsal body surface. Males and females of *G. lencanus* are distinguished from those of the other members of the *integripennis* species group by the structure of the median lobe and the shape of spermatheca, respectively.

Description. Size. Medium to large for genus (SBL range 1.30–1.47 mm, mean 1.39±0.091mm, n=4).

Habitus. Body form (Fig. 18B) moderately convex, ovoid, general proportions (WE/SBL 0.40±0.006), proportions of head (WH/WPm 0.73±0.008) and pronotum (WPm/WE 0.77±0.010) average for group.

Color. Body rufotestaceous, appendages testaceous.

Microsculpture. Mesh pattern of irregularly isodiametric sculpticells present over all dorsal surfaces of head, pronotum and elytra. Proepisternum also with evident microsculpture.

Mouthparts. Maxillae and labium (Fig. 5C).

Prothorax. Pronotum moderately transverse (WPm/LP 1.28±0.009), with lateral margins moderately constricted posteriorly (WPm/WPp 1.34±0.019). Posterior angles slightly obtuse (100–110°). Width between posterior angles nearly equal to the width between anterior angles (WPa/WPp 1.01±0.012).

Legs. Protibia (Fig. 6G).

Elytra. Moderately convex, slightly depressed along suture, markedly wide (WE/LE 0.69±0.013), without traces of striae. Humeri rounded, in outline forming right angle with longitudinal axis of body. Lateral margins convex, evenly divergent in basal fourth, evenly rounded to apex in apical third.

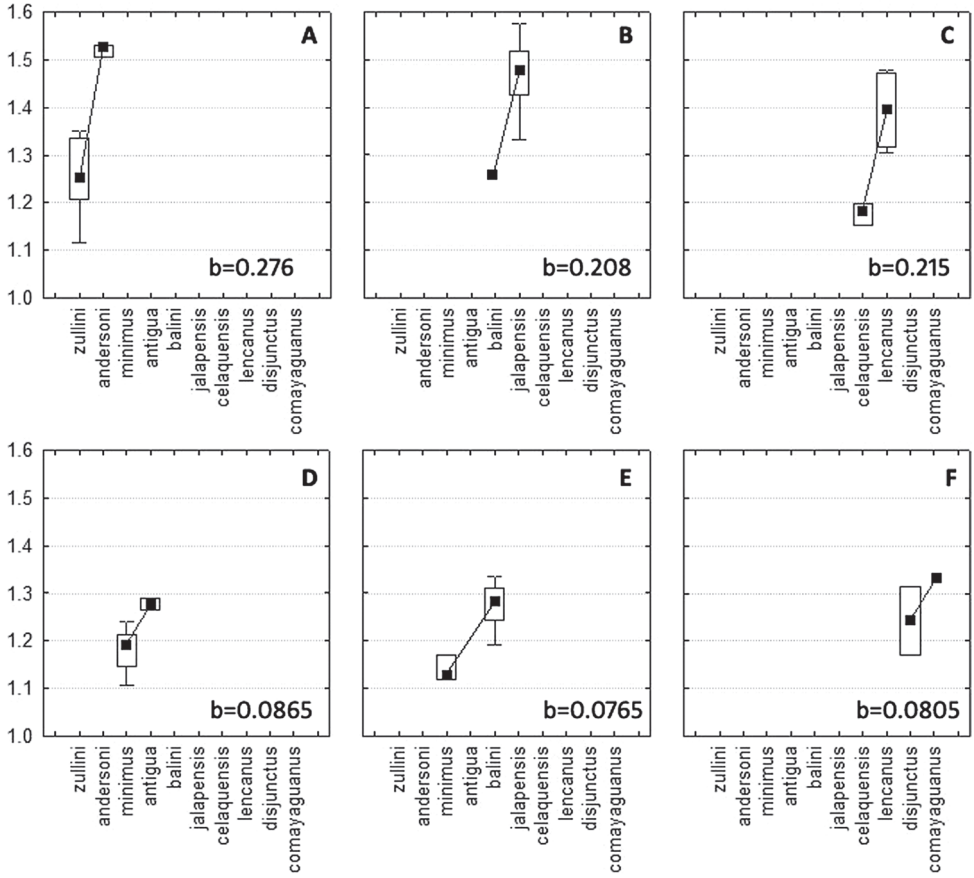
Male genitalia. Median lobe (Fig. 19H) with shaft subparallel with a long attenuated preapical part, apex small and narrowly rounded. Ventral margin almost straight. Dorsal sclerites of internal sac in form of a long narrow plate, flagellum-like in apical two-thirds, and slightly dilated and curved dorsally in basal third. Right paramere with long and narrow apical constriction (Fig. 19J). Left paramere with long and narrow apical constriction (Fig. 19I). Ring sclerite with handle rectangularly rounded (Fig. 20C).

Female internal genitalia. Spermatheca sclerotized, fusiform, slightly dilated and rectangularly bent apically, with short cornu and long nodulus (Fig. 21C). Length of spermathecal gland less than length of spermatheca. Spermathecal duct not coiled.

Geographical distribution. This species is known only from Celaque National Park, in the Cerro las Minas range of Honduras (Fig. 22, yellow diamond).

Way of life. Specimens were collected by sifting cloud forest litter at an elevation of 2500 m.

Relationships. The rectangular shape of the handle of the ring sclerite (Fig. 20C) in males and the shape of spermatheca (Fig. 21C) in females suggest a close relationship with *G. celaquensis* (Figs 20B, 21B), described above.



Figures 23. Diagrams illustrating size variation for sympatric pairs of closely and remotely related species of the *integripennis* group at different geographical localities of Nuclear Central America. Closely related pairs (for shared characters see subchapters on Relationships in the text for corresponding species): **A** Chiapas Highlands, Mexico **B** Mataquescuintla, Guatemala **C** Celaque National Park, Honduras. Remotely related species: **D** Volcano Agua, Guatemala **E** Volcano Atitlan, Guatemala **F** Pico Pijol National Park, Honduras. Legend: black dot – median; box – 25–75% range of values; whiskers – non-outlier range of values; b – coefficient of regression.

Discussion

A comprehensive phylogenetic and biogeographic analysis of *Geocharidius* is postponed until a thorough revision of all species of the genus has been completed. Below we discuss only a few biogeographical and evolutionary issues, raised during our morphological and distributional studies of the *integripennis* group species.

Biogeographical notes

Distributional records of the *integripennis* species group to date are represented in Table 1 and can be summarized as follows: The group includes mostly high elevation species: all 15 species live at elevations greater than 2000m, and only four of these also inhabit the 1300-2000m mid-elevation range. Physiographically (Fig. 22), species of the group inhabit the interior mountain ranges of the Chiapas (CH), Guatemalan (SC+MTZ) and Honduran Highlands (HIH) along with the coastal Sierra Madre de Chiapas (SMC) and its continuation as the Guatemalan Cordillera (GC). Geologically, these territories are part of the Maya Block of the North American and the Chortis Block of the Carribean Tectonic Plates, divided by the Motagua (or Motagua-Polochic) Fault Zone (Marschall 2007). The Motagua Fault Zone (Fig. 22, MTZ) has been identified as the most important physiographic barrier in Nuclear Central America, corresponding to many phylogeographic breaks in the distributions of different vertebrate taxa (Perdices et al. 2005, Conchero Pérez et al. 2006; Castoe et al. 2009, Daza et al. 2010, Hardy et al. 2013). For *Geocharidius* species, this zone separates montane areas with higher species diversity (to the south and east) from those with lower diversity (to the north and west).

Each of the six montane areas has its own unique assemblage of *Geocharidius* species, ranging in number from one to six species; and none of these species are shared between montane areas. Consequently, any faunal connections between them are through sister species rather than through conspecific populations; and this pattern has implications for the timing of past dispersal and vicariance events (i.e., suggesting somewhat greater antiquity for such events). As mentioned above, the Motagua Fault Zone is a major physiographic barrier limiting the present distributions of *integripennis* group species. A second evidently strong barrier is one between the faunas of the Guatemalan Cordillera and the Honduran Interior Highlands, separating the ranges of six and four species endemic to each of these regions, respectively. The headwater valleys of the Rio Paz to the south and Rio Motagua/Rio Shutague to the north, respectively, are linked by gaps in the intervening uplands that do not exceed 900m in elevation, creating a continuous break across these highlands that is 400m lower than the lowest elevations at which any *intergripennis* species in the region has been recorded.

Among *integripennis* group members, six species have quite wide ranges within their own montane area, while the other nine species are known from only one locality or from two very close localities (*G. longinoi*) within their area. Within-group diversity varies markedly between different parts of the region. Four of the six montane areas are inhabited by one or two species, the Honduran Interior Highlands by four species, and the Guatemalan Cordillera volcanic chain (Fig. 22, GC) by six species. Within these areas, such diversity is not based solely on a high number of locally restricted forms. For example, three of the six species of the Guatemalan Cordillera have rather wide ranges for *Geocharidius* species. This distributional pattern results in three cases of sympatry among the species within the Cordillera. MacVean and Schuster (1981) recorded similarly wide ranges for passalid beetle species and sympatry among them on volcanoes of the Guatemalan Cordillera.

Table 1. Montane areas in Nuclear Central America occupied by the species of the *Geocharidius integripennis* species group.

Species	Montane areas						Elevation range (in meters)	Number of localities
	CH	SMC	SC	MTZ	GC	HIH		
G. andersoni	X						2750	1
G. zullinii	X						2350–2600	6
G. vignataglianti		X					2050	1
G. gimlii			X				2780	1
G. longinoi				X			2000–2750	2
G. integripennis					X		3200	1
G. balini					X		1625–2400	2
G. jalapensis					X		2325–2660	1
G. erwini					X		2140–2760	4
G. minimus					X		1625–2175	2
G. antigua					X		2350	1
G. disjunctus						X	1300–2100	2
G. celaquensis						X	2500	1
G. lencanus						X	2500	1
G. comayaguanus						X	1300–2130	3
TOTAL SPP.	2	1	1	1	6	4		

Legend: CH, Chiapas Highlands; GC, Guatemalan Cordillera; HIH, Honduran Interior Highlands; MTZ, Motagua Fault Zone; SC, Sierra de los Cuchumatanes; SMC, Sierra Madre de Chiapas.

Within the range of the *integripennis* species group, the Guatemalan Cordillera occupies a special place and can be characterized by the highest number of the species in total, the highest number of species with wide ranges and the highest number of localities in which sympatry has been recorded. This combination of parameters may indicate that, historically, this region played an important role as a staging area for immigrants and as an intersection of dispersal routes of *integripennis* group species dispersing between different areas.

Two cases of evident similarities in morphology of male and female genitalia between species inhabiting the Cordillera and their relatives outside the region seem to support the above mentioned assertion. The similarity in median lobe structure between the eastern Guatemalan *G. antigua* (Fig. 19A) and the Honduran *G disjunctus* (Fig. 19Q) is unequivocal; and presumably homologous structures in the median lobe of males of *G. integripennis* and *G. gimlii* (Fig. 15) are virtually identical. This leads us to consider these pairs as sister species. These examples connect the Cordilleran fauna (Fig. 22, GC) with faunas of the Honduran Highlands (HIH) and Sierra de los Cuchumatanes (SC), respectively, thus, supporting our evaluation of the role of the Guatemalan Cordillera as important in the dispersal history of the *integripennis* group.

Further, certain morphological similarities can be found between the west Guatemalan pair of species, *G. gimlii*, and *G. integripennis*, and among the Mexican trio of species, *G. andersoni*, *G. zullinii* and*G. vignatagliantii*. Males of all three Mexican species share a similar shape of the dorsal sclerites of the median lobe (Fig. 9), and a

triangular handle of the ring sclerite (Fig. 10). At the same time, females of *G. vignatagliantii* can be connected with those of the west Guatemalan *G. integripennis* by the short, sclerotized, and basally swollen basally spermatheca (Figs 11B, 17A), while the dorsal sclerites of the median lobe of *G. andersoni* males (Fig. 9H) are somewhat similar to the shortened variant of the dorsal sclerites of *G. gimlii* males (Fig. 13A).

These examples suggest that the Sierra de los Cuchumatanes (Fig. 22, SC) may have served as an important dispersal route from the Pacific coastal Guatemalan Cordillera northward to the Chiapas Highlands (CH). Given its proximity to the Guatemalan Cordillera, the Sierra Madre de Chiapas (Fig. 22, SMC) would appear to have been a more likely dispersal route northward, but we have no evidence that this route has been used. It is worth noting that, based on morphology, all species of the group living to the north of the Motagua Fault Zone appear to be rather closely related to each other, whereas the species living to the south and to the east of the Motagua Fault Zone appear to represent several morphologically different lineages. Perhaps the Mexican representatives of the group are descendants of a comparatively recent dispersal event involving one of the southern lineages.

Searching for concordant taxon-area relationships in other taxa reveals other carabids with similar distribution patterns. The distribution pattern for species of the pterostichine subgenus *Percolaus* Bates, as described by Ball and Roughley (1982), is identical to the distribution pattern of the Mexican-west Guatemalan set of *Geocharidius*' species and encompasses the Chiapas Highlands, the Sierra Madre de Chiapas, Cerro Maria Tecún and Sierra de los Cuchumatanes. Interestingly, these authors suggested that *Pterostichus (Percolaus) championi* Bates, from the Cerro Maria Tecún has its closest known relative in the Sierra de los Cuchumatanes, the same relationship we see between *G. integripennis*, presumably collected in the Cerro Maria Tecún, and *G. gimlii* from the Sierra de los Cuchumatanes. Also, the distribution patterns of three Mexican and one western Guatemalan *Geocharidius* (namely *G. andersoni*, *G. zullinii*, *G. vignatagliantii* and *G. gimlii*) correspond perfectly to the distribution pattern of the species of *Platynus jaegeri* group (namely *P. dilatipes* Liebherr, *P. robustus* (Chaudoir) and *P. strictinotum* Liebherr (Liebherr 1988).

Sympatric speciation

One common evolutionary trend among Anillina is syntopic miniaturization, a type of sympatric speciation that produces a number of related species differing in size and descendant from a common ancestor (Sokolov 2013). So, comparing average sizes of adults of *integripennis* group species in localities where sympatry has been recorded presented an interesting test of this idea. As noted above, we recognized six cases of sympatry (Fig. 22) involving the following species pairs (pairs marked by star are syntopic cases): *G. andersoni* – *G. zullinii* (Chiapas, Mexico), *G. antigua* – *G. minimus* (Volcano Agua, Guatemala), *G. minimus* – *G. balini** (Volcano Atitlan, Guatemala), *G. balini* – *G. jalapensis** (Mataquescuintla, Guatemala), *G. lencanus* – *G. celaquensis**

(Celaque National Park, Honduras), and *G. comayaguanus* – *G. disjunctus** (Pico Pijol National Park, Honduras). These pairs of species can be grouped by the number of shared morphological characters into two categories: (1) a group of more closely related species that share two characters of male or female genitalia, namely the shape of the male ring sclerite and the shape of the female spermatheca; and (2) a group of more remotely related species that share only one character from either male or female genitalia. Data on size differences between species in all pairs are presented graphically as box-and-whiskers plots with regression lines (Fig. 23). For all pairs, we recorded the differences in averages of standardized body length between species. Our data support previous observations that the co-occurrence of taxonomically related anilline species in the same habitat is often accompanied by differentiation in their size (body length) (Pérez-Gonzáles and Zaballos 2013, Sokolov 2013). Perhaps the persistent (simultaneous) coexistence of two forms (a "larger" and a "smaller" form) in the litter reflects specific adaptations for living in only grossly overlapping microniches, which differ in some unknown parameters of substrate interspaces and thereby harbor different microbiotas. Hypothetically, slight divergence in niche preferences might result in divergence in target food preferences and decrease the number of contacts between representatives of "larger" and "smaller" forms. This, in turn, which could reduce competition between them and allow each to exploit resources more effectively.

At least in some cases, sympatry among anillines is a result of the dispersal of formerly allopatric taxa, typically in response to historical geological events and/or climate change. Interestingly, difference in sizes between a "larger" and a "smaller" species is evidently greater in pairs of more closely related species than in the pairs of more remotely related species. This difference can be seen visually in the slopes of regression lines and the means of the regression coefficients of these lines (Fig. 23, b). Unfortunately, the low number of observations does not allow us to analyze our data statistically and thereby evaluate how significant the observed differences between groups may be. We can only speculate about the origins and significance of differences between the two groups. For the present, we interpret our findings as reflecting differences in historical time at which each case of sympatry developed and, accordingly, by the length of time during which disruptive selection was occurring. We presume that, in the cases of the closely related species, we are dealing with intraspecific divergence, which was continuing for much longer times than in the cases of remotely related species, sympatry among which we consider a result of postspeciation dispersal, and thus of comparatively recent origin. In the latter case, interspecific divergence occurred over a much shorter time period, resulting in lesser differences in size between co-occuring species.

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RESEARCH ARTICLE

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Longivena, a new robber-fly genus from Brazil (Diptera, Asilidae, Asilinae)

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Abstract

Longivena **gen. n.** and five new species are described and illustrated from caatinga and cerrado habitats from Brazil: *Longivena digitata* **sp. n.,** type–species (Maranhão, Bahia, Minas Gerais and Mato Grosso do Sul states), *L. bilobata* **sp. n.** (Maranhão state), *L. flava* **sp. n.** (Mato Grosso do Sul state), *L. limeiraoliverai* **sp. n.** (Maranhão state), *L. spatulata* **sp. n.** (Maranhão state). An illustrated key is also provided.

Keywords

Asilidae, Neotropical, taxonomy, new genus and species, *Efferia* group

Introduction

There are 178 currently known genera of Asilinae Latreille, 1802, of which 67 are known from the Neotropical region and 19 from Brazil (Vieira 2012a, Artigas and Vieira 2014, Vieira and Ayala 2014). Due to the great similarity found between members of Asilinae, some artificial generic groups have been proposed to fascilitate identification (Artigas and Papavero 1997a). These groups were established based mainly on male and female terminalia, since external characters are insufficient to separate genera.

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For the Nearctic and Neotropical regions, 11 groups have been proposed (Artigas and Papavero 1995a, b, c, d, e, f, g; 1997a, b, c): *Asilus* (Asilini *sensu stricto*) group, *Efferia* group, *Eicherax* group, *Eichoichemus* group, *Glaphyropyga* group, *Lecania* group, *Lochmorhynchus* group, *Mallophora* group, *Myaptex* group, *Ommatius* group and *Proctacanthus* group.

In this paper, a new robber fly genus, *Longivena* gen. n., is proposed. This genus is morphologically similar to the genera of the artificial group *Efferia* and is characterized by the r3 cell closed and petiolate and the long stump vein (supernumerary crossvein) on R_4 reaching the base of R_{2+3}. This paper presents a description, diagnoses, illustrations of a new genus of Asilinae, and comments on related genera.

Material and methods

This study is based on the examination of specimens housed in the following institutions: CZMA – Coleção Zoológica do Maranhão, Universidade Estadual do Maranhão, Caxias, Maranhão state, Brazil (Dr Francisco Limeira-de-Oliveira) and Instituto Nacional de Pesquisas da Amazônia (INPA), Manaus, Amazonas state, Brazil (Dr Marcio Oliveira). Morphological terminology follows Cumming and Wood (2009). Vieira's (2012b) techniques were used to examine the terminalia. After examination and illustration, the detached parts were placed in microvials with glycerin and pinned along the same pin with their respective specimen. Standard measurements were taken utilizing a filar micrometer. Label data is cited in full, with the original spellings, punctuations, and dates. Information presented within square brackets is complementary data not included on the labels. Data for the same specimen but from different labels are separated by slashes (/). The map was generated with software SimpleMappr.

Taxonomy

***Longivena* gen. n.**
http://zoobank.org/49AE8CEA-8129-485B-AAE7-506F03ECC168

Type species. *Longivena digitata* sp. n. (present designation).

Etymology. From Latin, *longi* = long + *vena*= vein, referring to the long stump vein (supernumerary crossvein) on R_4 that reaches the base of R_{2+3}.

Gender. Feminine.

Distribution. Brazil: Maranhão, Bahia, Minas Gerais and Mato Grosso do Sul states (Fig. 50).

Description. Head. Postpedicel oval, small, narrow distally; two to six setae, and two to four ocellar macrosetae; vertex black or yellowish, usually sparsely gold tomentose; face black or yellow, gold tomentose; proboscis black with thin and yellow ventral setae; labial setae yellowish; occipital setae white or yellowish. Thorax: two black no-

topleural macrosetae; one to two black supra-alar macrosetae; two black postalar macrosetae; no anatergal setae; thin, yellowish and black, discal scutellar setae yellowish or black, katatergal macrosetae yellowish; setae on posterior meron + metanepisternum yellowish. Wing: Without costal dilation; bifurcation of R_{4+5} beyond apex of discal cell; R_4 supernumerary crossvein present, complete, reaching R_{2+3}, as long as 1/5–1/6 of R_{2+3} length (Figs 3, 12, 21, 34, 43); microtrichia on posterior wing margin arranged in a single plane. Legs: Femora black or light yellow (Figs 1, 10, 19, 28, 32, 41); fore femur with yellow setae ventrally, occasionally with some black setae. Male abdomen: sternite VIII may be developed medioapically (Figs 9, 23, 45). Male terminalia: oblique to body axis (Figs 1, 10, 19, 32, 41); epandrium divided proximally and halves approximated medially; hypandrium dorsoventrally flatenned medially; hypandrium partially fused to base of epandrium; aedeagus directed dorsally (Figs 5, 17, 26, 39, 48). Female terminalia: Tergite VIII long and slender (Figs 28, 30). Tergite IX + X membranous medioapically; three oval and sclerotized spermathecal capsules (Fig. 31).

***Longivena bilobata* sp. n.**
http://zoobank.org/D228DDAB-CB6A-4A0A-9459-4ED70BAC70B5
Figs 1–9

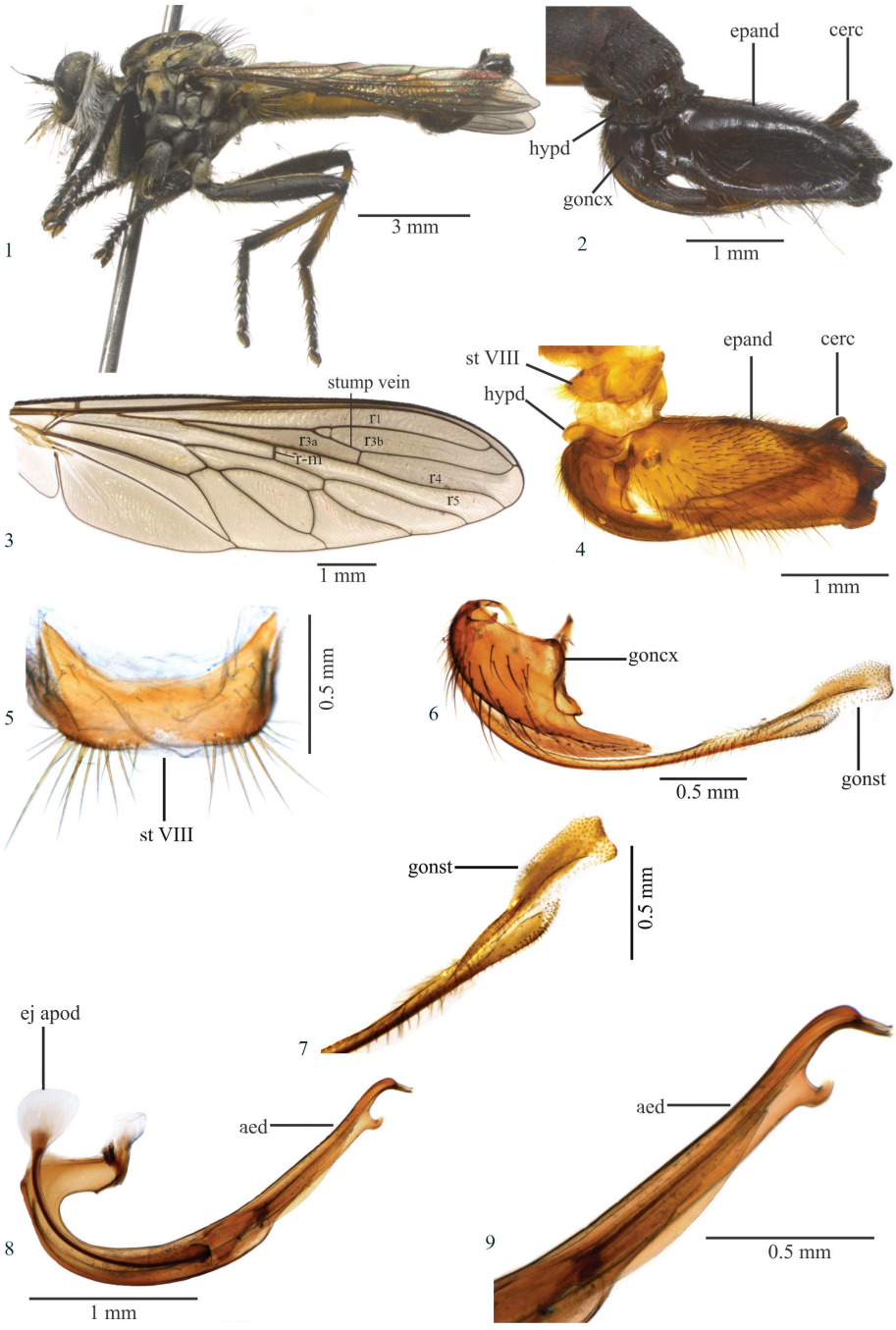
Diagnosis. Femora wholly black (Fig. 1); hind tibia, anteriorly, with basal 4/5 yellow and apical 1/5 black with a brown stripe, and posteriorly with basal 2/3 yellow and apical 1/3 brown; basal margin of epandrium straight, apex bilobate in lateral view (Figs 2, 4); gonocoxite apex rounded (Fig. 6).

Male. Holotype. Head. Antenna black; two setae and two long ocellar macrosetae; vertex, frons and face black, all sparsely golden tomentose; mystax with black and yellow setae; palpus with yellow basal setae and black apical setae; proboscis black with yellow ventral setae; labial setae yellowish; occiput black, silvery tomentose with white setae; ten black postocular macrosetae.

Thorax (Fig. 1). Antepronotum and postpronotum black, gold to brown tomentose; mesonotum black dorsally, golden laterally, with gold tomentose presutural and prescutellar spot; pleuron gray tomentose, except anepisternum gray and golden tomentose; scutellum gold tomentose. Chaetotaxy: Two black notopleural macrosetae; two black supra-alar macrosetae; two black postalar macrosetae; four pairs black presutural dorsocentral macrosetae; no anatergal setae; two black apical scutellar setae; discal scutellar setae black; katatergal macrosetae black; setae on posterior meron + metanepisternum yellowish.

Wing (Fig. 3). Brown. Crossvein r-m passes slightly beyond middle of discal cell; halter yellow.

Legs (Fig. 1). Femora wholly black. Fore tibia black; mid tibia dark brown to black anteriorly and yellow posteriorly; hind tibia, anteriorly, with basal 4/5 yellow and apical 1/5 black with a brown stripe, and with basal 2/3 yellow and apical 1/3 brown posteriorly. Fore femur with yellow ventral setae; mid femur with five black anteroventral



Figures 1–9. *Longivena bilobata* sp. n. Holotype male. **1** Habitus, lateral view **2** Terminalia, lateral view **3** Wing. Obs. The small crosssvein connecting stump vein with R_{2+3} is an anomaly **4** Terminalia, lateral view treated in hot 10% KOH **5** Sternite VIII **6** Gonocoxite and gonostylus **7** Apex of gonostylus **8** Aedeagus **9** Apex of aedeagus. Abbreviations: aed: aedeagus; cerc: cercus; ej apod: ejaculatory apodeme; epand: epandrium; goncx: gonocoxite; gonst: gonostylus; hypd: hypandrium; st VIII: sternite VIII.

setae, with one black apical seta dorsoposteriorly; hind femur with two yellow and one black macrosetae anteriorly, three yellow on basal 1/2 and three black macrosetae on apical 1/2 anteroventrally, and one apical black macrosetae posterodorsally; fore tibia with two black setae posteriorly; mid tibia with one long, black anteroventral seta; hind tibia with three black anterodorsal and two anteroventral setae; tarsomeres with black setae.

Abdomen. Tergites II–V dark brown, gold tomentose apically and laterally; tergites VI–VII golde tomentose; sternites I–V brown tomentose and sternites VI–VII golden tomentose. Sternite VIII not developed medioapically.

Terminalia (Figs 2, 4–9). Dark Brown to black (Fig. 2); epandrium basal margin straight, apex bilobate in lateral view (Figs 2, 4); gonostylus apex subtruncated (Figs 6, 7); gonocoxite apex rounded (Fig. 6); ejaculatory apodeme long and widened proximally in lateral view (Fig. 8); aedeagus with ventral projection directed dorsally and placed before folded apex (Figs 8, 9).

Length. Body 13.4 mm; wing 9.0 mm.

Female. Unknown.

Variations (n= 5). Body length 12.6–15 mm; wing length 8.3–10 mm; eight to nine black postocular macrosetae; two black, apical scutellar macrosetae; black and yellow katatergal macrosetae; one black supra-alar macrosetae; capitulum reddish; hind femur with two yellow setae on basal 1/2 and two black on apical 1/2 anteroventrally.

Etymology. From Latin, *bi* = two + *lobus* = lobe, referring to the bilobate apex of the epandrium.

Holotype conditions. Left detached wing mounted on microslides, terminalia placed in microvial with glycerin and pinned along with the specimen.

Distribution. Brazil: Maranhão (Fig. 50).

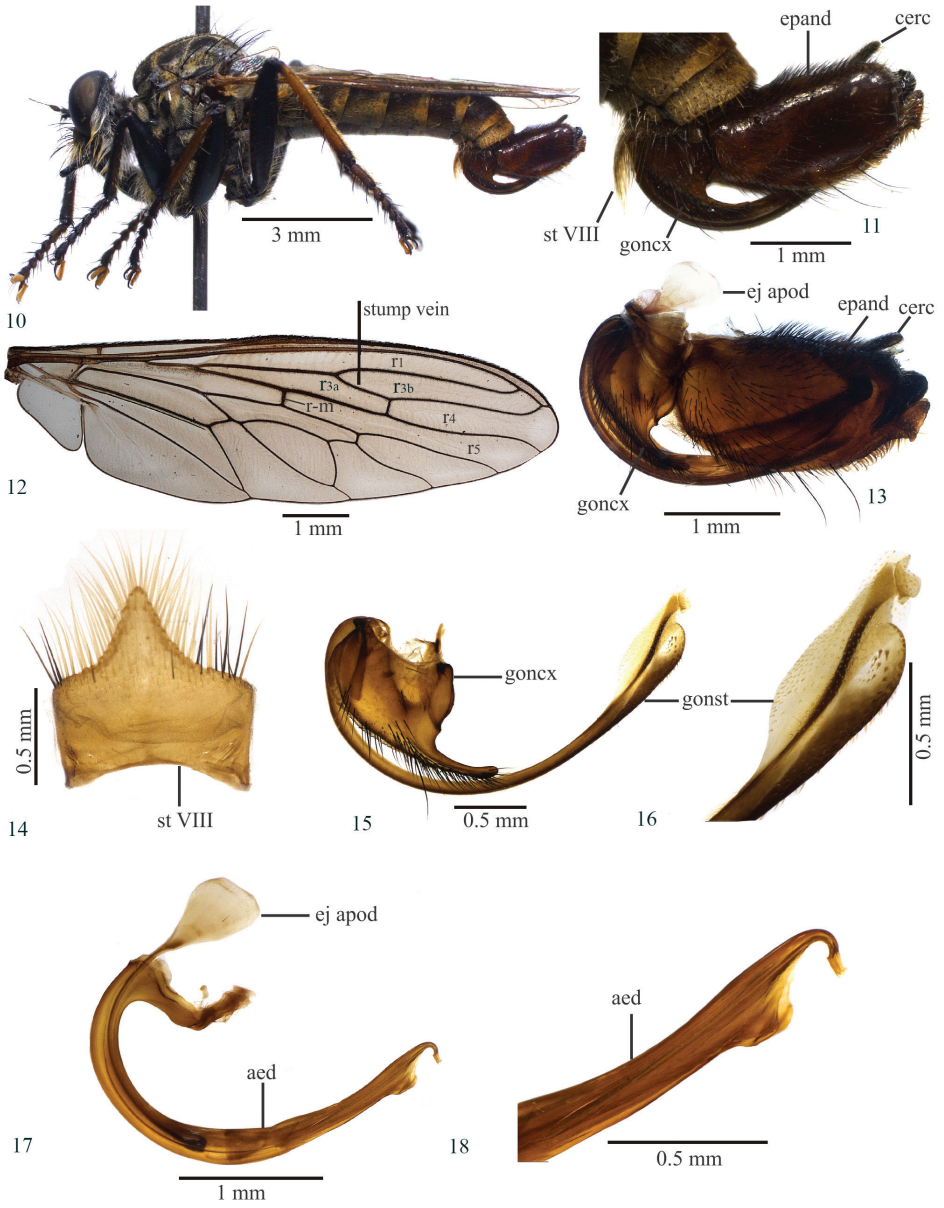
Type material examined. Holotype: BRASIL, MA[ranhão], Mirador, Parque Est.[adual] Mirador, Base do Mosquito [06°43'S 44°58'W] / Armadilha de Malaise, 04–08.ii.2011, F. Limeira–de–Oliveira / Holotype *Longivena bilobata* (♂ INPA).

Paratypes: Same data as holotype / Paratype *Longivena bilobata* (1♂ INPA; 1♂ CZMA); BRASIL, MA[ranhão], Mirador, Parque Est.[adual] Mirador, Base da Geraldina / Armadilha Luminosa, 08–13.iii.2008, F. Limeira–de–Oliveira, J.C. Silva / Paratype *Longivena bilobat*a (1♂ INPA); BRASIL, MA[ranhão], Mirador, Parque Est. [adual] Mirador, Posto avançado do Mel, 06°43'50"S, 44°58'59"W / Armadilha Luminosa 02–08.iv.2001, F. Limeira–de–Oliveira, G.A. Reis & M.S. Oliveira, cols. / Paratype *Longivena bilobata* (1♂ CZMA).

Longivena digitata sp. n.

http://zoobank.org/42183E59-2539-4278-8638-89EBCCBF7F34
Figs 10–22

Diagnosis. Six setae and two ocellar macrosetae; no apical scutellar seta; sternites VI–VIII brown, golden tomentose; tergites I–II with yellow setae laterally; sternite



Figures 10–18. *Longivena digitata* sp. n. Holotype male. **10** Habitus, lateral view **11** Terminalia, lateral view **12** Wing **13** Terminalia, lateral view treated in hot 10% KOH **14** Sternite VIII **15** Gonocoxite and gonostylus **16** Apex of gonostylus **17** Aedeagus **18** Apex of aedeagus. Abbreviations: aed: aedeagus; cerc: cercus; ej apod: ejaculatory apodeme; epand: epandrium; goncx: gonocoxite; gonst: gonostylus; st VIII: sternite VIII.

VIII developed medioapically, with black and yellow setae (Fig. 14); gonocoxite with a digitiform projection (Fig. 15); aedeagus with a trapezoidal process apically (Figs 17, 18). Female: abdominal tergites I–IV brown, golden tomentose laterally; tergite VII

black, golden tomentose laterally; tergite VIII dark brown, long and slender (Figs 19, 21); three spermathecal capsules oval and sclerotized (Fig. 22).

Male. Holotype. Head. Scape and pedicel black, postpedicel dark brown to black; six setae and two ocellar macrosetae; vertex black, sparsely golden tomentose; frons black; face black, golden tomentose; mystax mostly with black macrosetae and a few golden macrosetae on oral margin; palpus with yellow to brown setae; proboscis black with yellow ventral setae; labial setae yellowish; occiput black, sparsely gray tomentose, with yellow setae; eight to nine postocular macrosetae.

Thorax. Antepronotum golden, yellow to brown tomentose; postpronotum golden tomentose; mesonotum black, presutural and prescutellar spot golden and yellow tomentose; pleuron black, gray and golden tomentose. Chaetotaxy: two black notopleural macrosetae; one black supra-alar macrosetae; two black postalar macrosetae; two pairs of presutural and four pairs of postsutural dorsocentral macrosetae; no anatergal, neither apical scutellar setae; discal scutellar setae yellowish and blackish; katatergal macrosetae yellow; setae on posterior meron + metanepisternum yellowish.

Wing (Fig. 12). Brown. Crossvein r-m basal to middle of discal cell; halter yellow.

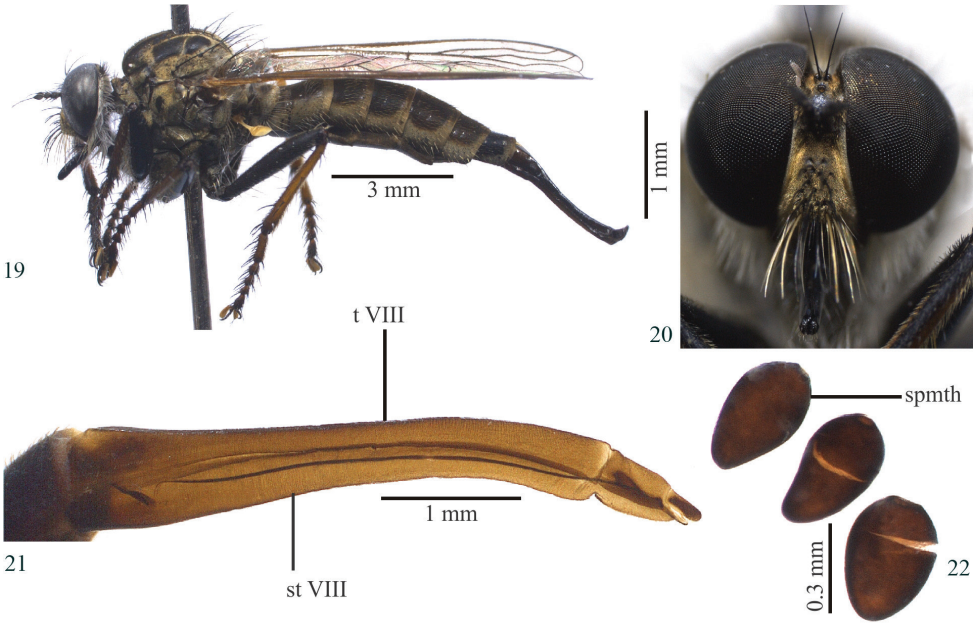
Legs (Fig. 10). Femora black; fore tibia black anteriorly and dorsally, brown ventrally, mixed black and brown posteriorly; mid tibia mostly brown, except for a black stripe anteriorly and black apex dorsally; hind tibia brown, black posteroapically; first tarsomere: fore black, mid dark brown and hind brown. Fore femur with only yellow ventral setae; mid femur with three black apical macrosetae, and yellow and black ventral setae; two yellow, basal and preapical, macrosetae posteriorly; hind femur with two yellow and one black macrosetae anteriorly, four yellow basal and two to three medioapical macrosetae anteroventrally; fore tibia with four yellow posteroventral setae on right leg and three yellow and one black apical setae on left leg; mid tibia with three yellow setae; hind tibia with five yellow setae dorsally, two to three black setae anteriorly, one yellow preapical seta ventrally; fore and mid tarsus with one yellow seta, hind tarsus with one to two yellow setae.

Abdomen. Tergites dark brown, golden tomentose; sternites VI–VIII brown, golden tomentose; sternite VIII developed medioapically, with black and yellow setae; tergites I–II with yellow setae laterally.

Terminalia (Figs 11, 13–18). Brown, except cercus and apex of epandrium black (Fig. 11). Basal margin of the epandrium rounded, apex truncated in lateral view (Figs 11, 13); gonostylus with spiniform setae subapically (Figs 15, 16); gonocoxite with digitiform projection and with black setae ventrally (Fig. 15); ejaculatory apodeme long and wide proximally in lateral view (Fig. 17); aedeagus with trapezoidal projection placed before the curved apex (Figs 17, 18).

Length. Body 12.2 mm; wing 8.1 mm.

Holotype conditions. Two ocellar setae lost; some mystax setae broken; one left dorsocentral macroseta lost; cells r4 and r5 punctured apically; right mid tibia with one seta broken and another lost; right hind femur with two anteroventral setae broken and left hind femur with three anteroventral macrosetae broken. Left detached wing mounted on microslides, terminalia placed in microvial with glycerin and pinned along with the specimen.



Figures 19–22. *Longivena digitata* sp. n. Paratype female: **19** Habitus, lateral view **20** Head, frontal view **21** Ovipositor, lateral view **22** Capsule of spermathecae; Abbreviations: spmth: capsule of spermathecae; t VIII: tergite VIII; st VIII: sternite VIII.

Variation (n= 12): Body length 13.3–14.9 mm, wing 8.4–9.5 mm; three to seven ocellar setae; frons black, golden tomentose; five to seven postocular macrosetae; five pairs of postsutural dorsocentral macrosetae; one macrosetae and one, or two, apical scutellar setae; two black supra-alar macrosetae; halter stem yellow and capitulum reddish; mid femur with a black seta anteriorly; hind femur with three yellow macrosetae anteriorly, and four yellow and one to two anteroventrally; fore tibia with three to four yellow and one black setae posteroventrally; mid tibia with four yellow setae; hind tibia with two yellow setae anteriorly and one preapical ventrally; mid tarsus with black setae; tergites II–IV gray tomentose laterally; sternites II–VI gray tomentose.

Female (Figs 19–22): Similar to male, except for body length: 13.5–17.2 mm, wing 9.3–9.9 mm; six to eight postocular macrosetae; face dark brown, golden tomentose (Fig. 20); three to four pairs of postsutural dorsocentral macrosetae; one to two supra-alar macrosetae; no apical scutellar seta, except in one paratype that has one macroseta and one seta, and another that has only one seta; one paratype with fore basal tarsomere dark brown, mid and hind basal tarsomeres brown. Mid femur with one to three black macrosetae anteriorly (one paratype with three yellow macrosetae); hind femur with at most two yellow and one to two black macrosetae anteriorly (two paratypes with three yellow macrosetae, one of them with an additional black seta); hind femur with at most two black and four to five yellow macrosetae anteroventrally; fore tibia with three to four yellow setae posteroventrally (one

paratype with two yellow and two black setae on left fore tibia); mid tibia with two to four yellow setae; hind tibia with four to five yellow setae dorsally (one paratype specimen with two yellow and one black setae anteriorly, one preapical and one yellow seta medioventrally); tarsomeres with only black setae, except for one paratype that has one yellow seta on fore and mid tarsomeres; hind tarsomere with one to two yellow setae; abdominal tergites I–VI brown, golden tomentose laterally; tergite VII black, golden tomentose laterally; tergite VIII dark brown, long and slender (Figs 19, 21); tergite IX + X membranous posteromedially; three spermathecal capsules oval and sclerotized (Fig. 22).

Etymology: From Latin *digitata* = digitate, finger-like, referring to the shape of the gonocoxite's apex.

Distribution. Brazil: Bahia and Minas Gerais (Fig. 50).

Type material examined. Holotype: BRASIL, BA[hia], Encruzilhada, 15°32'25"S, 40°50'12"W, 10–12.xii.2007 / J.A. Rafael, P.C. Grossi & D.R. Parizotto col.[etores], Armadilha Luminosa, 800m / Holotype Longivena digitata (♂ INPA).

Paratypes: same data as holotype (4♀ INPA); BRASIL, MG [Minas Gerais], Berizal, Fazenda Veredão, 15°39'54"S, 41°39'56"W / 14.xii.2007, J.A. Rafael, P.C. Grossi & D.R. Parizotto col.[etores], Armadilha Luminosa, 850m / Paratype Longivena digitata (1♀ INPA); BRASIL, MG [Minas Gerais], Berizal, Fazenda Veredão, 15°39'54"S, – 41°39'56"W, 11.xii.2012, J.A. Rafael & E.J. Grossi, Arm. Luminosa, 850m / Paratype Longivena digitata (3♂, 1♀ INPA); BRASIL, BA[hia], Encruzilhada, 15°32'25"S, 40°50'12"W, 15.xii.2007 / J.A. Rafael & P.C. Grossi col.[etores], Armadilha Lumisona, 800m / Paratype Longivena digitata (2♂ INPA).

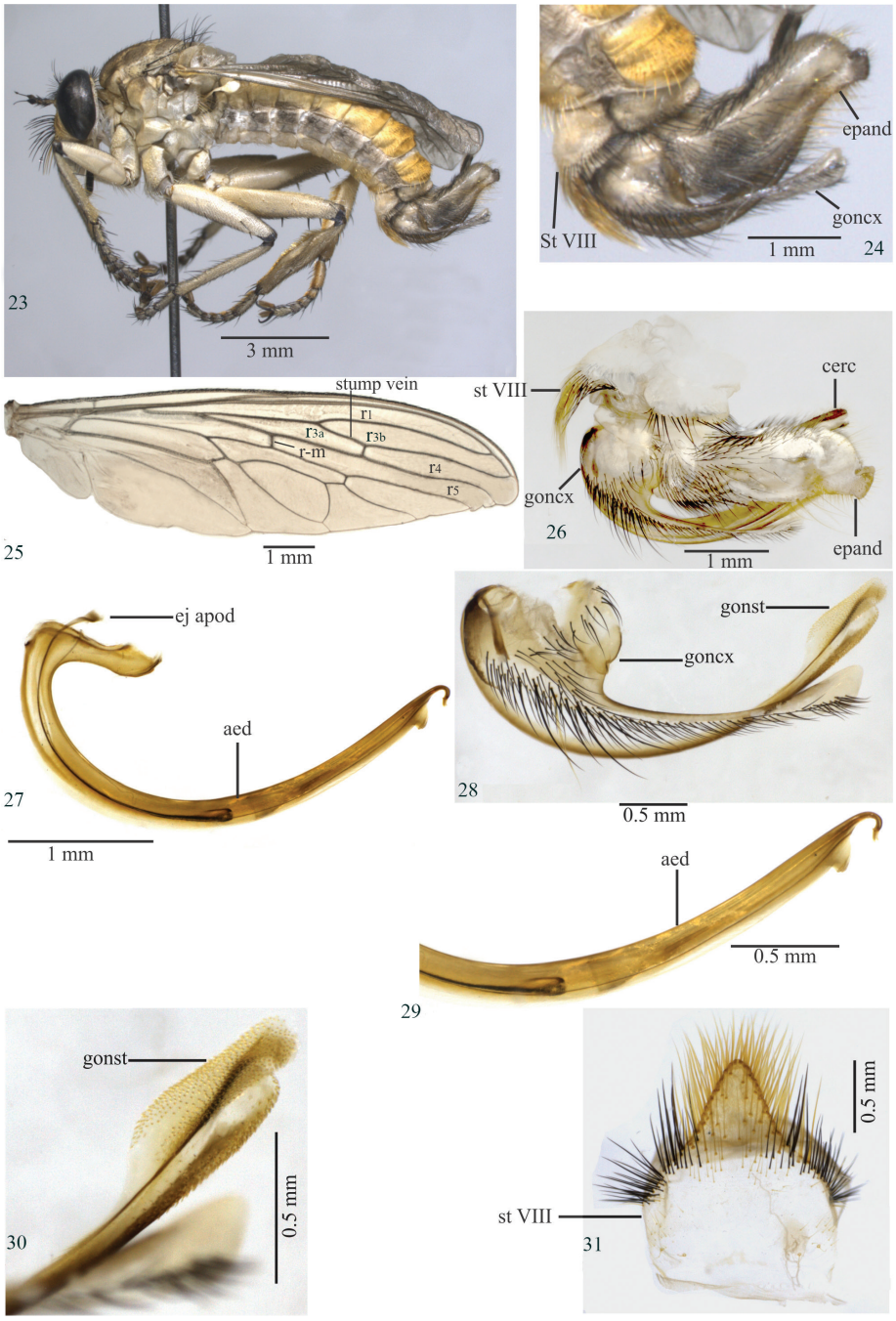
Longivena flava sp. n.

http://zoobank.org/333952F0-A70A-4443-9A16-8A4A5B43A5D5
Figs 23–31

Diagnosis. Antepronotum and postpronotum yellow; mesonotum yellowish (Fig. 23); pleuron yellow, except for black katepimeron (Fig. 23); legs whitish yellow, except for femora with black apex (Fig. 23); tergites yellow, with black dorsal maculae on tergites I–V (Figs 23, 24); sternites whitish to light yellow; male sternite VIII developed medioapically (Fig. 31); terminalia light yellow basally and brown to black on remaining area (Figs 23, 24).

Male. Holotype. Head. Scape yellow with black apex, pedicel yellow, but black dorsally and apically, postpedicel black; two long ocellar macrosetae and seven long setae; vertex yellow, gold tomentose; frons and face yellow, gold tomentose; mystax with black and yellow macrosetae; palpus yellow with black and yellow setae; proboscis black, except for yellow labella with labial setae yellowish; occiput gold tomentose with yellow setae; eight to nine black postocular macrosetae.

Thorax (Fig. 23). Antepronotum and postpronotum yellow; mesonotum yellow; pleuron yellow, except for black katepimeron. Chaetotaxy: two black notopleural mac-



Figures 23–31. *Longivena flava* sp. n. Holotype male. **23** Habitus, lateral view **24** Terminalia, lateral view **25** Wing **26** Terminalia, lateral view treated in hot 10% KOH **27** Aedeagus **28** Gonocoxite and gonostylus **29** Apex of aedeagus **30** Apex of gonostylus **31** Sternite VIII. Abbreviations: aed: aedeagus; cerc: cercus; ej apod: ejaculatory apodeme; epand: epandrium; goncx: gonocoxite; gonst: gonostylus; st VIII: sternite VIII.

rosetae; one to two black supra-alar macrosetae; two black postalar macrosetae; black dorsocentral macrosetae; no anatergal setae; no apical scutellar setae; discal scutellar setae yellowish, except for one black seta; katatergal macrosetae yellowish; setae on posterior meron + metanepisternum yellowish.

Wing (Fig. 3). Crossvein r-m basal to middle of discal cell; halter whitish-yellow.

Legs (Fig. 25). Light yellow, except apex femora black. Fore femur with thin and yellow ventral setae; mid femur with three black anterior setae; hind femur with three yellow anterior setae, two yellow and three black anteroventral setae, and preapical dorsal region with one black anterior macroseta and one yellow posterior macroseta; fore tibia with two to three yellow and one black posterior macrosetae; mid tibia with two long black anteroventral setae; hind tibia with three black and one yellow anterior setae; hind tibia with a group of short, yellow, spiniform setae, in a row from the base of the tibia and continuing until the fourth tarsomere; fore and mid tarsomeres with black setae; hind tarsomeres with mostly black setae, except for two yellow setae apically on the first tarsomere.

Abdomen (Fig. 23). Tergites yellow, with black dorsal maculae on tergites I–V; sternites whitish to light yellow; sternite VIII developed medioapically.

Terminalia (Figs 24, 26–31). Light yellow basally, remaining dark brown to black (Figs 23, 24). Epandrium with a truncate projection in lateral view (Figs 24, 26); gonocoxite with a long projection truncated apically (Fig. 28); gonostylus enlarged apically, with small spiniform setae (Fig. 30); ejaculatory apodeme long and narrow proximally in lateral view (Fig. 27); aedeagus with round ventral projection placed before the curved apex (Figs 27, 29).

Length. Body 12.2 mm; wing 9.2 mm.

Female. Unknown.

Holotype conditions. left wing slightly wrinkled; right katatergite and left posterior basalare sclerite punctured; right mid leg glued onto thorax; hind tibiae crushed medially. Right detached wing mounted on microslides, terminalia placed in microvial with glycerin and pinned along with the specimen.

Etymology. From Latin *flava* = yellow, referring to the specimen's color.

Distribution. Brazil: Mato Grosso do Sul (Fig. 50).

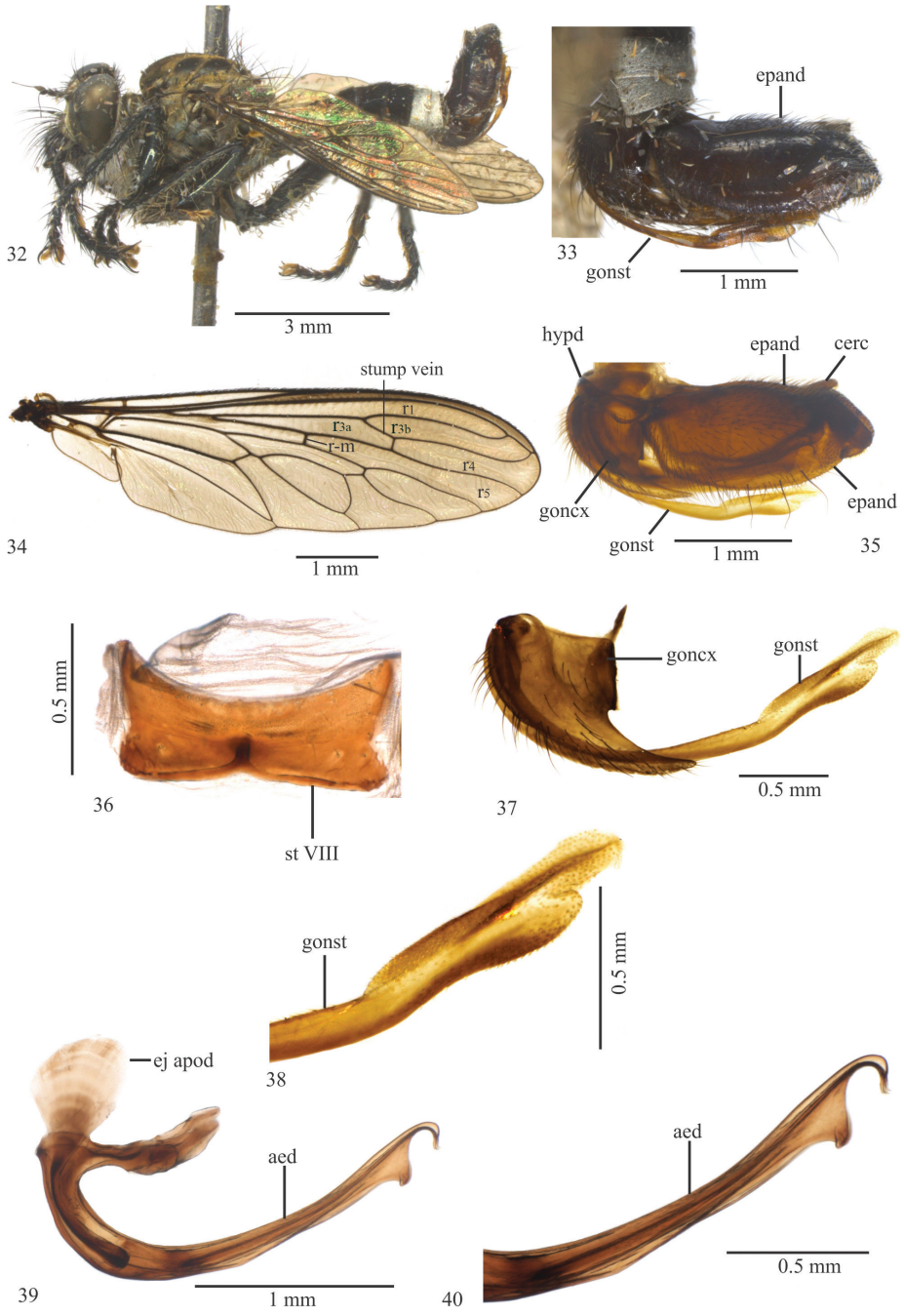
Type material examined. Holotype: BRASIL, Mato Grosso do Sul, Dourados, 22°11'42.2"S, 54°58'35.6"W, 398m, 23.x–06.xi.2012 / Malaise, Teles Col., Amostra 15 / Holotype *Longivena flava* (♂ INPA).

***Longivena limeiraoliverai* sp. n.**

http://zoobank.org/328692B6-E5FA-41BE-8F23-7746142FA8FB

Figs 32–40

Diagnosis. Two setae and four ocellar macrosetae; sternite VIII without projections (Fig. 36); epandrium basal margin rounded, apex subtriangular in lateral view, without projections (Figs 33, 35); gonostylus apex rounded with an apically rounded ventral projection (Figs 36, 37); gonocoxite tapering apically (Fig. 37); aedeagus apex with a subtriangular projection (Figs 39, 40).



Figures 32–40. *Longivena limeiraoliverai* sp. n. Holotype male. **32** Habitus, lateral view **33** Terminalia, lateral view **34** Wing **35** Terminalia, lateral view treated in hot 10% KOH **36** Sternite VIII **37** Gonocoxite and gonostylus **38** Apex of gonostylus **39** Aedeagus **40** Apex of aedeagus. Abbreviations: aed: aedeagus; cerc: cercus; ej apod: ejaculatory apodeme; epand: epandrium; goncx: gonocoxite; gonst: gonostylus; hypd: hypandrium; st VIII: sternite VIII.

Male. Holotype. Head. Antenna black; two setae and four ocellar macrosetae; vertex, frons and face black, golden tomentose; mystax with black macrosetae; palpus with black setae; proboscis black with yellow, ventral setae; labial setae yellowish; occiput black, silver tomentose, sparse; white occipital setae; seven to nine black postocular macrosetae.

Thorax (Fig. 32). Antepronotum black, golden to brown tomentose; postpronotum black, golden tomentose; mesonotum black dorsally, golden laterally, presutural and prescutellar spot golden tomentose; pleuron gray tomentose, except for anepisternum black and sparsely gray tomentose; scutellum golden tomentose. Chaetotaxy: two black notopleural macrosetae; two black supra-alar macrosetae; three pairs black presutural dorsocentral macrosetae; no anatergal setae; three macrosetae and black, apical scutellar setae; black discal scutellar setae blackish; katatergal macrosetae yellow; setae on posterior meron + metanepisternum yellowish.

Wing (Fig. 34). Brown. Crossvein r-m passes slightly beyond middle of discal cell; halter yellow.

Legs (Fig. 32). Wholly black. Fore femur with yellow and black setae ventrally; mid femur with yellow setae ventrally, with one black apical macroseta posterodorsally; hind femur with four black setae and one black macroseta anteroventrally, and three black macrosetae anteriorly; fore tibia with four black setae posteriorly; mid tibia with three yellow setae posteriorly; hind tibia with two black macrosetae posteriorly; tarsomeres with black setae.

Abdomen. Tergites I–II black, gray tomentose on apical margin; tergites II–III with gray tomentose triangular macula; tergites IV–V wholly black and tergites VI–VII gray tomentose (Figs 32, 33); sternites I–V gray and brown tomentose and sternites VI–VII only gray tomentose; sternite VIII without projections (Fig. 36).

Terminalia. Brown to black (Figs 32, 33). Epandrium basal margin rounded, apex subtriangular in lateral view, without projections (Figs 33, 35); gonostylus apex rounded, with an apically rounded ventral projection (Figs 37, 38); gonocoxite tapering apically (Fig. 37); ejaculatory apodeme short and wide proximally in lateral view (Fig. 39); aedeagus with subtriangular process before curved apex (Figs 39, 40).

Length. Body 10.1 mm; wing 6.8 mm.

Holotype conditions. Left detached wing mounted on microslides, terminalia placed in microvial with glycerin and pinned along with the specimen.

Female. Unknown.

Variations (n= 3). Body length 10.1–12.1 mm; wing 6.3–7.5 mm; four pairs black, presutural dorsocentral macrosetae; four macrosetae and two black apical scutellar setae; capitulum reddish brown; hind femur with two black macrosetae anteriorly; hind tibia with three black macrosetae posteriorly.

Etymology. A patronym to the researcher Francisco Limeira–de–Oliveira, PhD at Universidade Estadual do Maranhão.

Distribution. Brazil: Maranhão (Fig. 50).

Type material examined. Holotype: BRASIL, MA[ranhão], Mirador, Parque Est.[adual] Mirador, Povoado Pindaíba (Mel), 06°39'44"S, 45°01'37"W / Armadilha de Malaise, 01–05.vi.2011, F. Limeira–de–Oliveira, M.M. Abreu & J.S. Pinto Júnior / Holotype *Longivena limeiraoliverai* (♂ INPA).

Paratypes: same data as holotype (1♂ INPA); BRASIL, MA[ranhão], Mirador, Parque Est.[adual] Mirador, Base da Geraldina / Armadilha de Malaise, 20.v–02.vi.2007, F. Limeira–de–Oliveira, Cols / Paratype *Longivena limeiraoliverai* (1♂ CZMA); same data as holotype: 07–14.v.2010, J.C. Silva & M.M. Abreu / Paratype *Longivena limeiraoliverai* (1♂ CZMA).

***Longivena spatulata* sp. n.**
http://zoobank.org/8293ED25-CC91-47BC-A821-98AC41243DCB
Figs 41–49

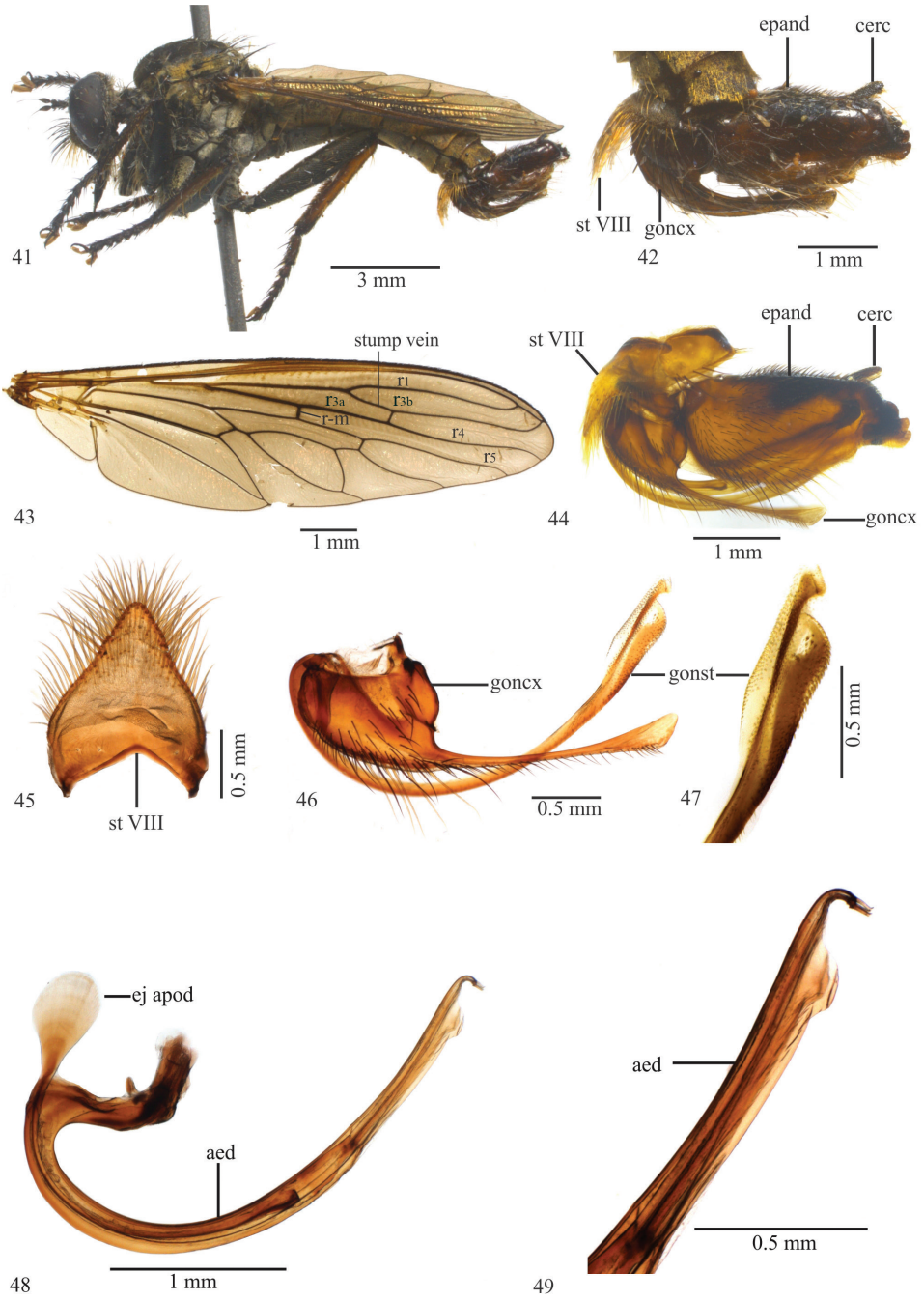
Diagnosis. four setae and two ocellar macrosetae; tergites V–VII brown; sternites I–IV black, gray tomentose; sternite VIII triangular, developed medioapically and with yellow setae (Fig. 45); epandrium basal margin rounded, apex with two truncated projections in lateral view (Figs 42, 44); gonocoxite with a long spatulated projection (Fig. 46).

Male. Holotype. Head. Antenna black; four setae and two ocellar macrosetae; vertex black, sparsely golden tomentose; frons black; face black, golden tomentose; mystax with black setae on dorsal 1/2 of facial swelling and yellow setae on ventral 1/2; palpus with yellow setae on basal 1/2 and black setae on apical 1/2; proboscis black with yellow setae ventrally; yellow labial setae; occiput black, golden tomentose, sparse; yellow occipital setae; seven black and four yellow, thick, postocular macrosetae on each side of the head.

Thorax (Fig. 41). Antepronotum black, golden to brown tomentose; postpronotum black, golden tomentose; mesonotum black dorsally, golden laterally, presutural and prescutellar spot golden tomentose; pleuron gray tomentose, except for anepisternum black, sparsely golden tomentose; scutellum golden tomentose. Chaetotaxy: two black notopleural macrosetae; two black supra-alar macrosetae; two black postalar macrosetae; two pairs black presutural dorsocentral macrosetae; no anatergal setae; one pair of yellow apical scutellar macrosetae; katatergal macrosetae yellow; setae on posterior meron + metanepisternum yellowish.

Wing (Fig. 43). Brown. Crossvein r-m passes slightly beyond middle of discal cell; halter with yellow stem and dark red capitulum.

Legs (Fig. 41). Femora black; fore tibia black anteriorly, brown ventrally, and with basal 1/2 brown and apical 1/2 black posterodorsally; mid tibia with basal 2/3 brown and apical 1/3 black anteriorly, remaining brown (except apex black); hind tibia brown, black posteroapically; tarsomeres brown, except for black apical ones. Fore femur with only yellow setae ventrally; mid femur with a yellow macroseta anteromedially and two black macrosetae apically and one yellow apical seta posterodorsally; hind femur with three yellow macrosetae anteriorly, three yellow setae basally, and three black macrosetae apically, one black preapical macroseta anterodorsally and one yellow preapical macroseta posterodorsally; fore tibia with four yellow setae posteriorly; mid tibia with two black setae anteriorly and three yellow setae posteriorly; hind tibia with



Figures 41–49. *Longivena spatulata* sp. n. Holotype male. **41** Habitus, lateral view **42** Terminalia, lateral view **43** Wing **44** Terminalia, lateral view treated in hot 10% KOH **45** Sternite VIII **46** Gonocoxite and gonostylus **47** Apex of gonostylus **48** Aedeagus **49** Apex of aedeagus. Abbreviations: aed: aedeagus; cerc: cercus; ej apod: ejaculatory apodeme; epand: epandrium; goncx: gonocoxite; gonst: gonostylus; st VIII: sternite VIII.

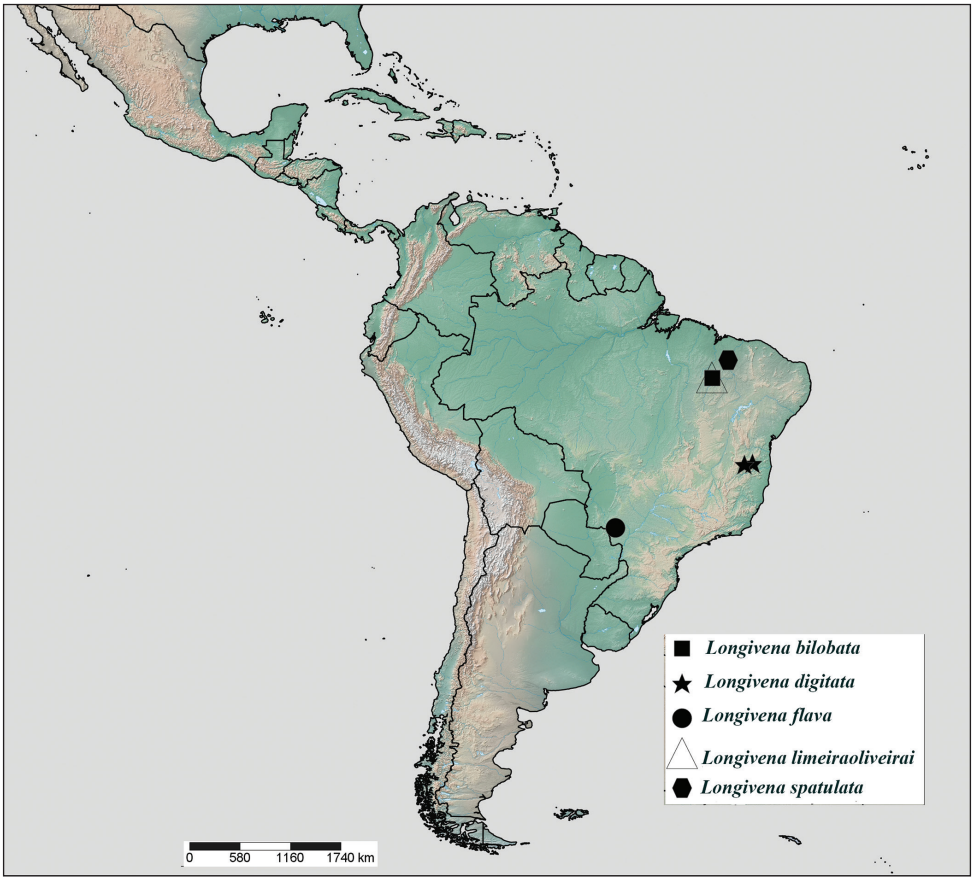


Figure 50. Distribution of *Longivena* gen. n. species.

three yellow setae anteriorly and three posteriorly; tarsomeres with black setae, except for one yellow seta on the first tarsomere of the right mid leg.

Abdomen. Tergites I–IV black, gray tomentose, with brown apical margin, tergites V–VII brown; sternites I–IV black, gray tomentose; sternites V–VII gray and brown tomentose; sternite VIII triangular, medioapically developed and with yellow setae.

Terminalia (Figs 42, 44–49). Brown to black (Figs 41, 42). Epandrium basal margin rounded, apex with two truncated projections in lateral view (Figs 42, 44); gonostylus with apical indentation (Figs 46, 47); gonocoxite with long and spatulated projection, and medial margin with black and yellow setae (Fig. 46); ejaculatory apodeme long and wide proximally in lateral view (Fig. 48); aedeagus apex with trapezoidal projection (Figs 48, 49).

Length. Body 15.3 mm; wing 10.2 mm.

Holotype conditions. Left hind leg lost; part of tergite I separated from thorax. Right detached wing mounted on microslides, terminalia placed in microvial with glycerin and pinned along with the specimen.

Female. Unknown.

Etymology, From Latin *spatulata* = spatulated, referring to the shape of the gonocoxite apex.

Distribution. Brazil: Maranhão (Fig. 50).

Type material examined. Holotype: BRASIL, MA[ranhão], Caxias [4°52'29"S, 43°20'49"W], Res.[erva] Ecol.[ógica] Inhamum, Lençol e Luz mista, 29–31.i.2006, F. Limeira–de–Oliveira / Holotype *Longivena spatulata* (♂ INPA).

Identification key to males of *Longivena* gen. n.

1 Sternite VIII developed medioapically (Figs 14, 31, 45) **2**

– Sternite VIII not developed medioapically (Figs 5, 36) **4**

2 Gonocoxite without a long apical extension (Fig. 15) .... ***L. digitata* sp. n.** (Brazil: Bahia state and Minas Gerais)

– Gonocoxite with a long apical extension (Figs 28, 46) **3**

3 Body mainly light yellow (Fig. 23); sternite VIII with black and yellow setae, lateral and ventral margin somewhat straight (Fig. 31); epandrium apex with one truncated projection in lateral view (Figs 24, 26); ejaculatory apodeme narrow proximally in lateral view (Fig. 27); aedeagus with round ventral projection placed before the apex (Figs 27, 29); tip of aedeagal prongs oriented backwards, hook-like (Figs 27, 29) .... ***L. flava* sp. n.** (Brazil: Mato Grosso do Sul)

– Body mainly brown to black (Fig. 41); sternite VIII with only yellow setae, lateral margin curved rounded and strongly concave anteriorly (Fig. 45); epandrium apex with two truncated projections in lateral view (Figs 42, 44); ejaculatory apodeme wide proximally in lateral view (Fig. 48); aedeagus with trapezoidal ventral projection placed before the apex (Figs 48, 49); tip of aedeagal prongs oriented ventrally (Figs 48, 49) .... ***L. spatulata* sp. n.** (Brazil: Maranhão)

4 Tergites II–III black with a triangular gray tomentose dorsal macula; tergites IV–V wholly black and tergites VI–VII wholly gray tomentose; epandrium basal margin rounded, apex subtriangular in lateral view, without projections (Figs 33, 35); ejaculatory apodeme widened proximally in lateral view (Fig. 39); gonocoxite with tapering apex (Fig. 37); gonostylus apex rounded, with an apically rounded ventral projection (Figs 37, 38) .... ***L. limeiraoliverai* sp. n.** (Brazil: Maranhão)

– Tergites II–V dark brown, golden tomentose apically and laterally; tergites IV–VII dark brown wholly golden tomentose; epandrium basal margin straight, apex bilobate in lateral view (Figs 2, 4); ejaculatory apodeme long and wide proximally in lateral view (Fig. 8); gonocoxite apex rounded (Fig. 6); gonostylus apex subtruncated (Figs 6, 7) .... ***L. bilobata* sp. n.** (Brazil: Maranhão)

Discussion

Longivena gen. n. is morphologically similar to the genera of the artificial *Efferia* group and according to the key published by Artigas and Papavero (1997b), the genus keys with *Diplosynapsis* Enderlein, 1914 (step 4) because both genera possess a closed and petiolate cell r3. The species included in *Longivena* gen. n. are similar to the species of *Diplosynapsis*, but *Diplosynapsis* has a short stump vein (supernumerary crossvein) on R_4, not reaching the base of vein R_{2+3}, and some specimens bear anatergal setae whereas *Longivena* gen. n. has a long stump vein on R_4 reaching the base of R_{2+3}, as long as 1/5–1/6 of R_{2+3} length (Figs 3, 12, 21, 34, 43) and no anatergal setae.

The senior author included only *Longivena* gen. n.**,** but not *Diplosynapsis* (no specimens of both sexes were available for study), in the cladistic analysis of Asilinae (Vieira *et.al*. in prep.). *Longivena* gen. n. forms a clade together with *Albibarbefferia* Artigas & Papavero, 1997, *Aristofolia* Ayala-Landa, 1978, *Carinefferia* Artigas & Papavero, 1997, *Ctenodontina* Enderlein, 1914, *Efferia* Coquillett, 1893, *Eichoichemus* Bigot, 1857, *Eicherax* Bigot, 1857, *Eraxasilus* Carrera, 1954, *Lecania* Macquart, 1838, *Nerax* Hull, 1962, *Pogonioefferia* Artigas & Papavero, 1997, *Porasilus* Curran, 1934 and *Triorla* Parks, 1968: ((*Ctenodontina* (*Lecania* (*Lecania* + *Eraxasilus*))) (*Eicherax* (*Triorla* (*Albibarbefferia* (*Porasilus* (*Carinefferia* (*Longivena* + *Eichoichemus*) (*Nerax* (*Aristofolia* + *Pogonioefferia*) *Efferia*))))))).

Longivena gen. n. and *Eichoichemus* are sister taxa sharing the synapomorphy: suture between labella and prementum strongly appressed, situated dorsally and five additional apomorphic character states: anterior tentorial pits small, slitlike, inconspicuous, ventrally located; presutural acrostichal setae in regular rows; postmetacoxal bridge absent, postmetacoxal area entirely membranous; stump vein supernumerary crossvein on R_4 present, length intermediate (1/5–1/6 of vein R_{2+3}); costal section on between tip of R_5 and tip of M_1 shorter than costal section between tips of R_1 and R_5.

Biology. Little is known about the biology of species of *Longivena* gen. n.. The species were collected with either light or Malaise traps. Only the female of *L. digitata* has been collected to this day. It is expected that with future collecting efforts, new species of *Longivena* gen. n. will be found as well as the females of the species described in this paper.

Distribution. The species of *Longivena* gen. n. were found in the Caatinga (*Longivena digitata* sp. n.) and Cerrado (*L. bilobata* sp. n.**,** *L. flava* sp. n., *L. limeiraoliverai* sp. n. and *L. spatulata* sp. n.) habitats or environments. Caatinga is a region characterized by arboreal or bushy forests, having mainly small trees and bushes which bear spines and some xerophytic characteristics, average annual precipitation below 800 mm and, at most, a 0.5 aridity index (Prado 2003) and Cerrado biomes is a region characterized by a savannah-like vegetation, with a seasonal climate, with heavy rains between the months of October and March and a long dry period between June and September (Harley et al. 2005).

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