

# Two new species of *Megacanthaspis* Takagi (Hemiptera, Sternorrhyncha, Coccoidea, Diaspididae) from China

Jiu-Feng Wei<sup>1,2,†</sup>, Ji-Nian Feng<sup>2,‡</sup>

**1** College of Life Sciences, Northwest A & F University **2** Key Laboratory of Plant Protection Resources and Pest Management, Ministry of Education, Entomological Museum, Northwest A & F University, Yangling, Shaanxi Province, 712100, China

† [urn:lsid:zoobank.org:author:E6F808B7-EC44-4934-8E37-2A8D83FD9BE2](http://urn:lsid:zoobank.org:author:E6F808B7-EC44-4934-8E37-2A8D83FD9BE2)

‡ [urn:lsid:zoobank.org:author:16913882-73AC-47FE-9C89-5B61FC961524](http://urn:lsid:zoobank.org:author:16913882-73AC-47FE-9C89-5B61FC961524)

Corresponding author: Ji-Nian Feng ([jinianf@nwsuaf.edu.cn](mailto:jinianf@nwsuaf.edu.cn))

---

Academic editor: Mike Wilson | Received 12 March 2012 | Accepted 9 July 2012 | Published 24 July 2012

[urn:lsid:zoobank.org/pub:D409EB84-D91B-4EAF-96C3-0731432CE0AF](http://urn:lsid:zoobank.org/pub:D409EB84-D91B-4EAF-96C3-0731432CE0AF)

---

**Citation:** Wei J-F, Feng J-N (2012) Two new species of *Megacanthaspis* Takagi (Hemiptera, Sternorrhyncha, Coccoidea, Diaspididae) from China. ZooKeys 210: 1–8. doi: 10.3897/zookeys.210.3071

---

## Abstract

Two new species of armored scale, *Megacanthaspis hangzhouensis* Wei & Feng, **sp. n.** and *M. hainanensis* Wei & Feng, **sp. n.** are described and illustrated from specimens collected from China. A key to adult female of *Megacanthaspis* species is provided.

## Keywords

Taxonomy, Sternorrhyncha, Hemiptera, armored scale, China

## Introduction

Scale insects or superfamily Coccoidea are a diverse group of mostly sap-sucking insects, with at least 30 families and around 8000 species (Andersen 2010). The most species rich family of scale insects is Diaspididae, with over 2400 described species (Ben-dov 2012). Armoured scale insects (Diaspididae) are mainly diagnosed by the extreme modification of the adult females, including the complete loss of the legs, the reduction of the antennae to a single segment (Andersen 2010) and the modification

of the abdomen into a specialised pygidium for forming the test. The higher classification within the family is uncertain but two of the major subfamilies are the Aspidiotinae and the Diaspidinae.

The genus *Megacanthaspis* is a small group of scale insects and assigned to the subfamily Diaspidinae, mainly feeding on family Lauraceae. As presently known, all species were distributed in the Oriental Region and Palearctic region. The localities of *Megacanthaspis* are mapped on Figure 13.

The genus *Megacanthaspis* was originally established by Takagi (1961) to accommodate a species from Japan. Takagi (1961) characterized the genus as follows: 'It is particularly characterized by having very prominent, conical, glanduliferous processes along the margin of the abdomen.' These features separate the genus *Megacanthaspis* from other genera such as *Mercetaspis* Gomez-Menor, 1927 (Takagi 1961).

Takagi (1970) reported the species *M. litseae* collected from Taiwan of China and later he (1981) revised the genus, added two new species from Japan and transferred the species *Nanmuaspis phoebia* Tang, 1977, collected in China into *Megacanthaspis*.

Recently, two further species of *Megacanthaspis* were found and are described and illustrated herein, bringing the total number of species in the genus to 7 species. A key to all known species of *Megacanthaspis* is provided. Moreover, a new host belongs to Poaceae is record.

## Materials and methods

Slide-mounted specimens, mounted in Canada balsam using the method discussed by Henderson (2011), were studied.

The morphological terminology used in the descriptions mainly follows that of Takagi (1981) which also has illustrations of most of other species included in the genus. The illustrations were drawn from slide-mounted adult females specimens and depicted with the dorsum on the left and venter on the right. All measurements were given in micrometer ( $\mu\text{m}$ ) and were made using NIT-Elements D. All specimens are deposited in the Entomological Museum, Northwest A & F University, Yangling, Shaanxi, China (NWAUFU).

## Checklist of known species of the genus *Megacanthaspis* Takagi

- Megacanthaspis actinodaphnes* Takagi, 1961; Japan.
- Megacanthaspis hangzhouensis* sp. n.; China (Hangzhou).
- Megacanthaspis hainanensis* sp. n.; China (Hainan).
- Megacanthaspis langtangana* Takagi, 1981; Nepal.
- Megacanthaspis leucaspis* Takagi, 1981; Japan.
- Megacanthaspis litseae* Takagi, 1970; China (Taiwan).
- Megacanthaspis phoebia* (Tang, 1977); China (Zhejiang).

## Taxonomy

### Genus *Megacanthaspis* Takagi, 1961

<http://species-id.net/wiki/Megacanthaspis>

*Megacanthaspis* Takagi, 1961: 97. Type species: *Megacanthaspis actinodaphnes* Takagi, original designation.

**Generic diagnosis. Female scale.** Brown to dark brown, elongate, high convex; exuvia apical. **Male scale.** white, approximately parallel sides, slightly convex.

**Adult female.** Body outline elongate, derm membranous. **Cephalothorax.** Antennae each with a long seta and a tubercle. Anterior spiracles each with a group of trilocular pores, some species also with pores near posterior spiracles. **Pygidium.** Pygidium rounded along posterior margin, with a series of serrate processes or plates, none of which are sclerotized enough to call lobes. In certain species, this processes or plates degenerate or invisible. **Marginal gland spines** occurring on the abdomen, each associated with 1 or more microducts. **Gland tubercles** present or absent, if present, near both anterior and posterior spiracles, others occurring submarginally of abdominal segments I–III. **Ducts.** Dorsal macroducts short, 2- barred, with the orifice surrounded by a sclerotized rim, forming obscure segmental rows in some species. Ventral microducts as large as or smaller than dorsal ducts. **Anal opening** situated on centre of pygidium. **Perivulvar pores** quinquelocular, present in an arc, sometimes divided into a median group and two lateral groups.

**Distribution.** Palaearctic and Oriental regions.

### Key to adult female *Megacanthaspis* Takagi

- |   |  |                                |
|---|--|--------------------------------|
| 1 | Marginal gland spines present on segment II .....                                    | 2                              |
| – | Marginal gland spines absent on segment II.....                                      | 3                              |
| 2 | The posteriormost pair appressed together at apex of pygidium .....                  |                                |
|   | ..... <i>M. litseae</i> (Takagi)   |                                |
| – | The posteriormost pair widely separated from each other.....                         |                                |
|   | ..... <i>M. langtangana</i> (Takagi)   |                                |
| 3 | Marginal gland spines present on segment III .....                                   | 4                              |
| – | Marginal gland spines absent on segment III .....                                    | 5                              |
| 4 | The posteriormost pair appressed together at apex of pygidium .....                  |                                |
|   | ..... <i>M. actinodaphnes</i> (Takagi)   |                                |
| – | The posteriormost pair widely separated from each other ... <i>M. phoebia</i> (Tang) |                                |
| 5 | Marginal gland spines absent on segment IV .....                                     | <i>M. hangzhouensis</i> sp. n. |
| – | Marginal gland spines present on segment IV .....                                    | 6                              |
| 6 | Marginal gland spines each associated with 1 microduct .....                         |                                |
|   | ..... <i>M. leucaspis</i> (Takagi)   |                                |
| – | Marginal gland spines each associated with 2–4 microducts .....                      |                                |
|   | ..... <i>M. hainanensis</i> sp. n.   |                                |

***Megacanthaspis hangzhouensis* Wei & Feng, sp. n.**

urn:lsid:zoobank.org:act:C2F9DCB3-51BB-494E-B298-5ABE9A9001A5

[http://species-id.net/wiki/Megacanthaspis\\_hangzhouensis](http://species-id.net/wiki/Megacanthaspis_hangzhouensis)

Figures 1–6

**Material examined. Holotype:** adult female: CHINA, Zhejiang Prov., Hangzhou City, Hangzhou botanical garden, 30°25'N, 120°12'E, 1.5.1982, Chou (NWFU).

Paratypes: 7 adult females: same data as the holotype (NWFU).

**Description, n=8. Adult female.** Appearance in life not recorded. Slide-mounted adult female 552–617  $\mu\text{m}$  long (holotype 598  $\mu\text{m}$  long); 309–362  $\mu\text{m}$  wide (holotype 337  $\mu\text{m}$  wide), body outline oblong oval, with indistinct segmentation. **Cephalothorax.** Antennae each with a long seta and a tubercle. Anterior spiracles with 1-2 trilocular pores, pores absent from posterior spiracles. **Pygidium** marginal processes degenerate. Pygidial lobes absent, without paraphyses and plates. **Marginal gland spines** each 14–19  $\mu\text{m}$  long, in 6 pairs on abdominal V–VIII, 1 pair on abdominal segments VII and VIII and 2 pairs on abdominal segments V and VI, each associated with 1 microduct; posteriormost median pair of gland spines widely separated. **Gland tubercles** absent. Dorsal macroducts forming obscure segmental rows and not obviously divided into marginal, submarginal and submedial groups, with about 17 on each side; without marginal dorsal macroducts at apex of pygidium between the posteriormost gland spines. **Ventral microduct** is smaller than dorsal macroduct, few, scattered on cephalothorax and abdomen, with 4 or 5 near each anterior and posterior spiracles. **Anal opening** separated from apex of pygidium by a space about 82  $\mu\text{m}$  long. **Perivulvar pores** present in an arc, divided in 5 groups, 4–7 median group, 5–8 anterolaterally, and 7–10 posterolaterally, 28–43 in total.

**Diagnosis.** The new species is very close to *M. phoebia* (Tang, 1977) in having 6 pairs marginal gland spines. But differs in having (character-states on *M. phoebia* in brackets): (i) 2 pairs of gland spines on abdominal segments V and VI (only single on segments V & VI); (ii) marginal dorsal macroducts absent from apex of pygidium between median gland spines (present); (iii) gland tubercles absent (present).

**Host.** *Pleioblastus amarus* (Poaceae).

**Etymology.** Named after Hangzhou, the type locality.

**Distribution.** China (Zhejiang).

***Megacanthaspis hainanensis* Wei & Feng, sp. n.**

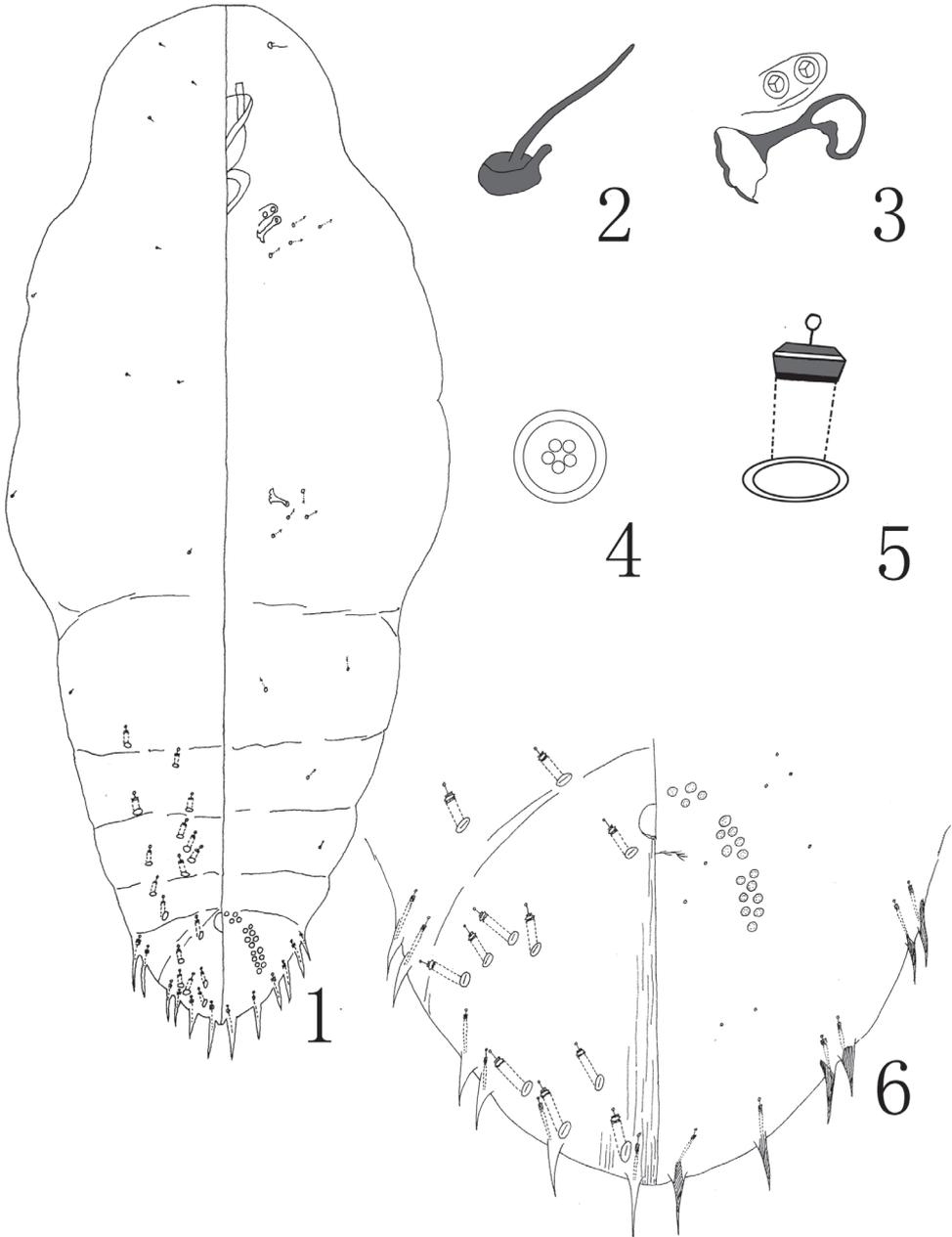
urn:lsid:zoobank.org:act:1B66EA08-618D-47FD-B808-0A3BB90D6901

[http://species-id.net/wiki/Megacanthaspis\\_hainanensis](http://species-id.net/wiki/Megacanthaspis_hainanensis)

Figures 7–12

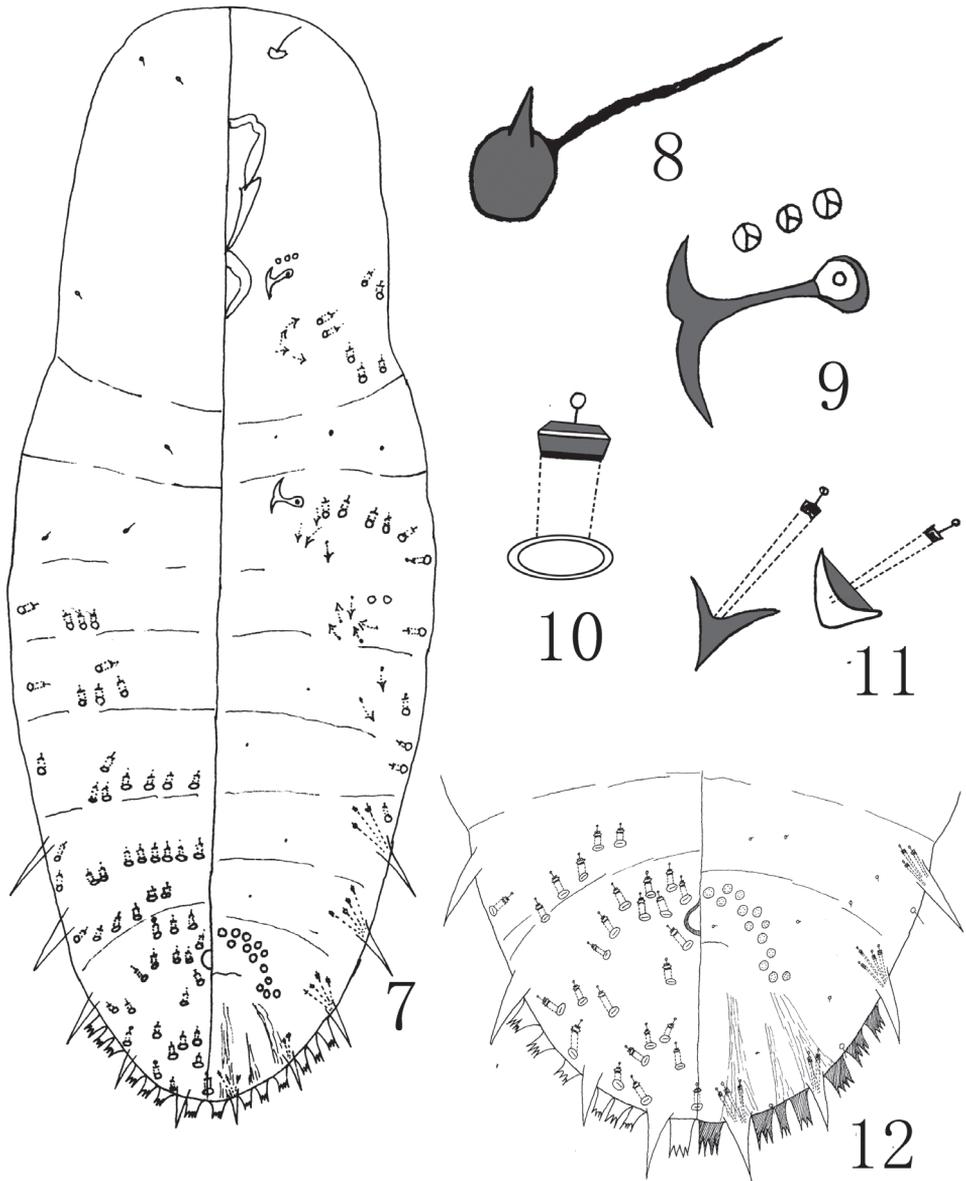
**Material examined. Holotype:** adult female: CHINA, Hainan Prov., Gaotuo mountain, 19.5.1963, Chou (NWFU).

Paratypes: 12 adult females, same data as the holotype (NWFU).



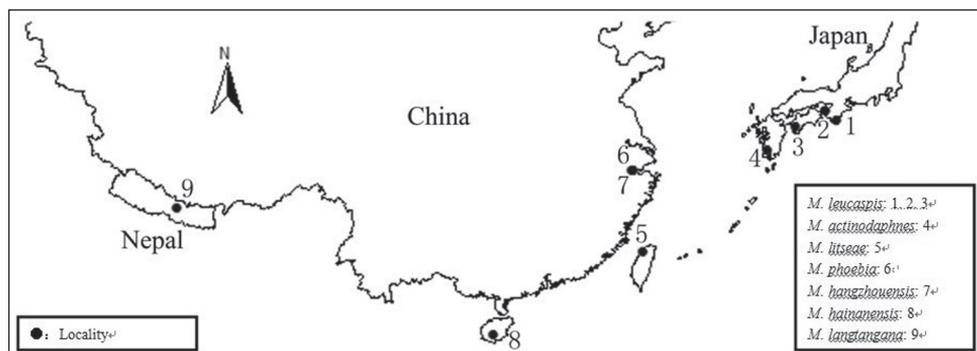
**Figures 1–6.** *Megacanthaspis hangzhouensis* Wei & Feng, sp. n., adult female: **1** habitus **2** detail of antenna **3** detail of anterior spiracle **4** quinquelocular pores **5** dorsal 2-barred duct **6** pygidium.

**Description.** N=13. **Adult female.** Appearance in life was not recorded. Slide-mounted adult female 513–597  $\mu\text{m}$  long (holotype 577  $\mu\text{m}$  long); 199–209  $\mu\text{m}$  wide (holotype 209  $\mu\text{m}$  wide), body outline fusiform, with obscure segmentation. **Cephalo-**



**Figures 7–12.** *Megacanthaspis hainanensis* Wei & Feng, sp. n., adult female: **7** habitus **8** detail of antenna **9** detail of anterior spiracle **10** dorsal 2-barred duct **11** detail of 2 gland tubercles **12** pygidium.

**thorax.** Antennae each with a long seta and a tubercle. Anterior spiracles each with 2–4 trilocular pores; pores absent from posterior spiracles. **Pygidium** with serrate process (plates) on abdominal segments VI–VIII, lobes absent, plates arranged 2, 3, 3 among the marginal gland spines, without paraphyses. **Marginal gland spines** each 9.93–18.9  $\mu\text{m}$  long, in 5 pairs on abdominal IV–VIII, more or less enlarged, each associated with 2–4 microducts, median pair widely separated. **Gland tubercles** present on prothorax, metath-



**Figure 13.** Distribution of *Megacanthaspis*.

rax and abdominal segment I-II, each with 1 microducts. **Dorsal macroducts** present on abdominal segments I-VIII; forming more or less segmental rows on abdominal segments I-VI, but scattered on abdominal segments VII-VIII; with a macroduct between median gland spines. **Ventral macroducts** 2-barred, as big as dorsal macroducts, scattered occurring on lateral body margin on prothorax, metathorax and abdominal segments I-IV. Ventral microducts present on prothorax, metathorax, segments I-IV. **Anal opening** about 68  $\mu\text{m}$  long from apex. **Perivulvar pores** in an arc with a total of 13–25.

**Diagnosis.** The new species is very similar to *M. phoebia*, but can be distinguished by having (character-states on *M. phoebia* in brackets): (i) 5 pairs of marginal gland spines (6 pairs); (ii) a macroduct present medially between the median gland spines (absent).

**Etymology.** Named after Hainan, the type locality.

**Distribution.** China (Hainan).

## Acknowledgements

This study is supported by the National Natural Science Foundation of China (Grant No. 30870324).

## Reference

- Andersen JC, Wu J, Gruwell ME, Gwiazdowski R, Santana SE, Feliciano NM, Morse GE, Normark BB (2010) A phylogenetic analysis of armored scale insects (Hemiptera: Diaspididae), based upon nuclear, mitochondrial, and endosymbiont gene sequences. *Molecular Phylogenetics and Evolution* 57: 992–1003. doi: 10.1016/j.ympev.2010.05.002
- Ben-dov Y (2012) Scalenet. Species in Diaspididae query result. [http://scalenet.info/scale\\_taxon/Diaspididae/](http://scalenet.info/scale_taxon/Diaspididae/) [accessed March 2012]
- Gullan PJ, Cook LG (2007) Phylogeny and higher classification of the scale insects (Hemiptera: Sternorrhyncha: Coccoidea). *Zootaxa* 1168: 413–425.

- Henderson RC (2011) Diaspididae (Insecta: Hemiptera: Coccoidea). Fauna of New Zealand 66. Manaaki Whenua Press, Lincoln, Canterbury, 275 pp.
- Takagi S (1961) A contribution to the knowledge of the Diaspidini of Japan (Homoptera: Coccoidea) Pt. iii. *Insecta Matsumurana* 24(2): 69–103.
- Takagi S (1970) Diaspididae of Taiwan Based on material collected in connection with the Japan-U. S. Co-operative Science Programme, 1965 (Homoptera: Coccoidea). Part II. *Insecta Matsumurana* 33: 1–146.
- Takagi S (1981) The genus *Meganthaspis*, a possible relic of an earlier stock of the Diaspididae (Homoptera: Coccoidea). *Insecta Matsumurana* 25: 1–43.
- Tang FT (1977) The scale insects of horticulture and forests of China. Volume 1. The institute of Gardening, Liaoning, 259 pp.

# A new species of *Pseudaulacaspis* MacGillivray, 1921 from China (Hemiptera, Coccoidea, Diaspididae) with a key to Chinese species

Jiu-Feng Wei<sup>1,2,†</sup>, Ji-Nian Feng<sup>2,‡</sup>

**1** College of Life Sciences, Northwest A & F University **2** Key Laboratory of Plant Protection Resources and Pest Management, Ministry of Education, Entomological Museum, Northwest A & F University, Yangling, Shaanxi Province, 712100, China

† [urn:lsid:zoobank.org:author:E6F808B7-EC44-4934-8E37-2A8D83FD9BE2](https://zoobank.org/urn:lsid:zoobank.org:author:E6F808B7-EC44-4934-8E37-2A8D83FD9BE2)

‡ [urn:lsid:zoobank.org:author:16913882-73AC-47FE-9C89-5B61FC961524](https://zoobank.org/urn:lsid:zoobank.org:author:16913882-73AC-47FE-9C89-5B61FC961524)

Corresponding author: Ji-Nian Feng ([jinianf@nwsuaf.edu.cn](mailto:jinianf@nwsuaf.edu.cn))

---

Academic editor: Mike Wilson | Received 25 March 2012 | Accepted 9 July 2012 | Published 24 July 2012

[urn:lsid:zoobank.org:pub:C91C9813-E74E-4B11-A44A-BFE31AF03706](https://zoobank.org/pub:C91C9813-E74E-4B11-A44A-BFE31AF03706)

---

**Citation:** Wei J-F, Feng J-N (2012) A new species of *Pseudaulacaspis* MacGillivray, 1921 from China (Hemiptera, Coccoidea, Diaspididae) with a key to Chinese species. ZooKeys 210: 9–17. doi: 10.3897/zookeys.210.3122

---

## Abstract

A new species of armored scale, *Pseudaulacaspis zhenyuanensis* Wei & Feng, **sp. n.** is described and illustrated from specimens collected on *Spermadictyon suaveolens* in China. A key to armored scale species known from China is provided.

## Keywords

Hemiptera, armored scale, taxonomy, Diaspididae, new species

## Introduction

The Coccoidea is one of the four superfamilies of the monophyletic suborder Seternorhyncha belongs to the Hemiptera (Gullan and Cook 2007), with at least 30 families and around 8000 species (Andersen 2010). The family Diaspididae is the largest family of the Coccoidea with more than 2400 diaspidid species currently known (Ben-dov 2012). The higher classification within the family is uncertain but two of the major

subfamilies are the Aspidiotinae and the Diaspidinae, and most species can be assigned to one or the other (Miller and Davidson 2005)

The genus *Pseudaulacaspis* was established by MacGillivray (1921) for *Diaspis pentagona* Targioni Tozzetti, 1886 which belongs to subfamily Diaspidinae. When he described it, he referred to it 9 nominal species, which are now considered to represent only 2 species. Since then, many additional species were described and added to *Pseudaulacaspis* by other authors (Chen 1983; Ferris 1953, 1955; Hu 1986; Takagi 1956, 1961, 1966, 1970, 1985; Talng 1986, 1988; Williams and Watson 1988; Hodgson and Lagowska 2011). This genus is large with 68 species (Hodgson and Lagowska 2011) which is a widespread and polyphagous genus infesting a large number of plant (Borchsenius 1966) and occurs in most of zoogeographical regions except Antarctica. Up until now, 32 species have been described from China.

In the present paper, a new species *P. zhenyuanensis* sp. n. is described and illustrated, bringing the number of recognized species in this genus to 69, of which 33 are recorded from China. And a key to species from China is included.

## Materials and methods

The morphological terms for Diaspididae follow those of Henderson (2011). The illustrations of the adult female are drawn from slide-mounted specimens, which depict the dorsum on the left and venter on the right. Enlargements of important characters are shown around the edges of the main illustration. All measurements are given in micrometers ( $\mu\text{m}$ ). Measurements were made using the measurement tools NIT-Elements D. The abbreviations L1, L2, L3 and L4 stand for median and second to fourth pygidial lobes.

All specimens are deposited in the Entomological Museum, Northwest A & F University, Yangling, Shaanxi, China (NWAFU).

## Taxonomy

### Genus *Pseudaulacaspis* MacGillivray, 1921

<http://species-id.net/wiki/Pseudaulacaspis>

*Pseudaulacaspis* MacGillivray, 1921: 305. Type species: *Diaspis pentagona* Targioni Tozzetti, by original designation.

**Generic diagnosis. Female scale.** White, suborbicular or long pyriform. Exuviae terminal. **Male scale.** Same colour as female scale, elongate.

**Adult female.** Body shape varied, fusiform, ovary or elongate; derm membranous except for the marginal of pygidium; mesothorax, metathorax, and abdominal segments I-III produced laterally. **Cephalothorax.** Antennae each with a seta. Anterior spiracles each usually with a cluster of trilocular pores, posterior spiracle each

associate with or without trilocular pores. **Pygidium.** With 2 or 3 pairs of lobes. Median lobes (L1) well-developed, much larger than lobules of lateral lobes, zygotic basally, with a distinct pair of marginal setae between lobes. In general, L1 divide into two types: bark-type, individuals occur on bark and prominent median lobes; leaf-type, those on leaves and sunken into the pygidium. Second lobes (L2) much smaller than the L1, bilobed, divided into inner lobule and outer lobule, outer lobule usually smaller than inner, in some species much reduced. Third lobes (L3) smaller than L2, bilobed or represented by serrations along the body margin in some species. **Gland spines.** Gland spines developed, usually single on abdominal segments VI-VIII, becoming shorter into conical on anterior segments which called gland tubercles. **Ducts.** Dorsum with 2-barred ducts, forming submedial and submarginal rows on abdominal and pygidium, usually as same size as marginal macroducts. Ventral microducts scattered. **Anal opening.** Anal opening close to the base of or situated about the centre of the pygidium. **Perivulvar pores** quinquelocular, in five groups.

**Remarks.** This genus is very closely related to *Chionaspis* Signoret, 1868 and *Aulacaspis* Cockerell, 1893 in feature of pygidial lobes and dorsal ducts present on pygidium and abdomen, but can differ from these genus: presence of a pair of setae between the median lobes in *Pseudaulacaspis*, but absent in *Chionaspis* and *Aulacaspis*.

***Pseudaulacaspis zhenyuanensis* Wei & Feng, sp. n.**

urn:lsid:zoobank.org:act:AB75F5D8-7BDF-42D4-9DA9-13F4DFD1D43F

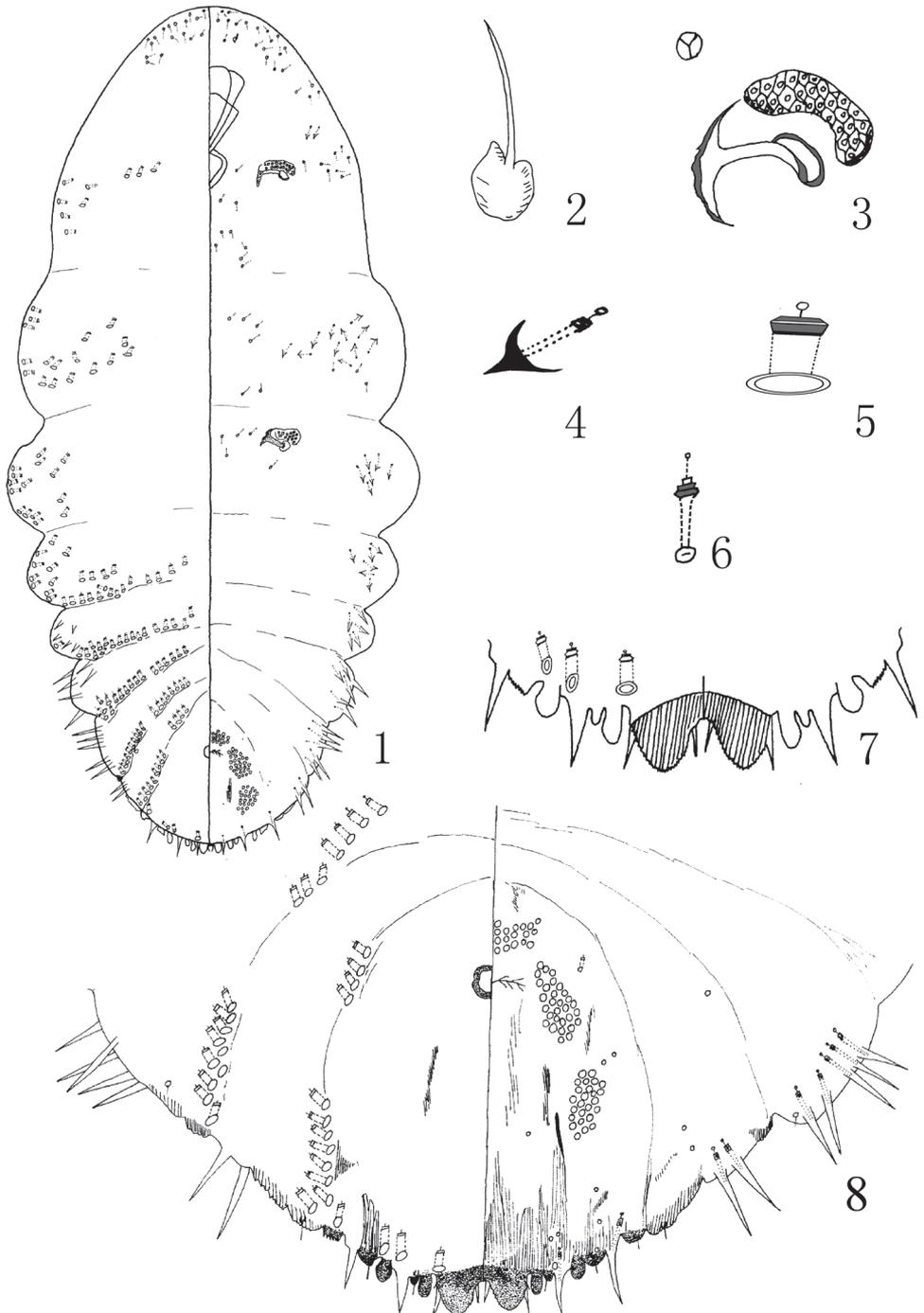
[http://species-id.net/wiki/Pseudaulacaspis\\_zhenyuanensis](http://species-id.net/wiki/Pseudaulacaspis_zhenyuanensis)

Figures 1–8

**Material examined. Holotype:** adult female: CHINA: Guizhou Prov., Zhenyuan County, 13. viii. 1996, Zeng (NWAFU).

Paratypes: 2 adult females: same data as the holotype (NWAFU).

**Description, n=3. Adult female.** Appearance in life not recorded. Slide-mounted adult female 1755-1910  $\mu\text{m}$  long (holotype 1910  $\mu\text{m}$  long); 930-970  $\mu\text{m}$  wide (holotype 931  $\mu\text{m}$  wide), body outline fusiform, derm membranous except for pygidium. Normally widest at metathorax and abdominal segment I, lateral abdominal lobes well-developed, with large gland spines on the margin of prepygidial and pygidial segments. **Cephalothorax.** Antennae each with 1 long fleshy seta, distance between antennae is 111  $\mu\text{m}$ . Anterior spiracle each with 12-31 trilocular pores in a cluster, posterior spiracle each with 11-17 trilocular pores. **Pygidial Lobes.** With 3 pairs of lobes; L1 well-developed, zygotic basally, protruding from pygidial margin, with small serrations along both margins, with a pair of setae between lobes; L2 bilobate, inner lobule rounded, much larger than outer lobule; L3 bilobate, slightly smaller than L2, inner lobule rounded, outer lobule margin serrate; L4 represented by serrations along the body margin. **Gland spines.** Large, arranged singly on pygidial segments VI-VIII but with 2 on segment V, 4-5 on segment IV, 5-6 on segment III, 5 on segment II, anterior spines smallest (on seg-



**Figures 1–8.** *Pseudaulacaspis zhenyuanensis* Wei & Feng, sp. n., adult female: **1** habitus **2** antennae **3** anterior spiracle **4** gland tubercles **5** detail of gland macroduct **6** detail of the duct in the head on the dorsum **7** detail of pygidium **8** pygidium.

ment II). **Gland tubercle** present submarginally, with 2 on prothorax, 9-11 on mesothorax, 5-6 on metathorax, 6 on segment I. **Ducts.** Marginal macroducts, 2-barrel-shaped, 1 present between L1 and L2, 2 on segment VI, 1 on segment V. Dorsal macroducts on pygidium about same size as marginal macroducts, becoming slightly smaller on anterior abdomen, 2-barrel-shaped, arranged segmentally in submedian and submarginal rows; submedian: 3-6 on segment I, 4-5 on II, 4-6 on III, 7-13 on IV, 3-4 on V; submarginal: 11-14 on I, 11-12 on II, 10-11 on III, 10-11 on IV, 8-9 on V. Dorsal ducts scattered on margin of thorax, smaller than those on abdomen, 2-barrel-shaped, with 8 or 9 on prothorax, 15-17 on mesothorax, 14 or 15 on metathorax. Dorsal ducts on head as big as ventral microducts, very smaller than dorsal ducts present on thorax, scattered distribution. Ventral microducts scattered, numerous on head and with several microducts on submargin of pygidium and prothorax and submedian of abdomen, meso- and metathorax. **Anal opening,** small, 15-17 $\mu$ m in diameter, positioned 214  $\mu$ m from posterior margin. **Perivulvar pores** in 5 groups, 31-37 in the median group, 33-44 in the anterolaterally and 45-48 in the posterolaterally.

**Diagnosis.** This species is similar to *P. chinensis* (Cockerell, 1896) in body shape and the number of pygidial lobes, but can be distinguished by the following features (those for *P. chinensis* in brackets): 1) dorsal macroducts absent on abdominal segment VI (present); 2) L1 prominent the pygidium (sunken into the pygidium).

Host: *Spermadictyon suaveolens*.

**Etymology.** The specific epithet is named after Zhenyuan, the type locality.

**Distribution.** China (Guizhou).

### Key to Chinese species of the genus *Pseudaulacaspis*

- 1 Trilocular pores absent near each anterior spiracle .....  
..... *P. manni* (Green & Mann, 1907)
- Trilocular pores present near each anterior spiracle ..... 2
- 2 Body slender, both side nearly parallel .....  
..... *P. dendrobii* Kuwana & Muramatsu, 1931
- Body nonslender..... 3
- 3 Body suborbicular or oval ..... 4
- Body long ovate or furiform ..... 8
- 4 Trilocular pores present near each anterior spiracle, absent near each posterior spiracle..... 5
- Trilocular pores present near anterior spiracle and posterior spiracle..... 7
- 5 With 2 pairs of lobes on pygidium..... *P. canarium* Hu, 1986
- With 3 pairs of lobes on pygidium..... 6
- 6 The eggs white or salmon; with 1 pairs of gland spines between L3 and the traces of L4, each bifurcate..... *P. pentagona* (Targioni Tozzetti, 1886)
- The eggs always salmon; with 2 pairs of gland spines between L3 and the traces of L4, each pointed ..... *P. prunicola* (Maskell, 1895)
- 7 Perivulvar pores in 6 groups ..... *P. mirabilis* Hu, 1986

- Perivular pores in 5 groups ..... *P. ficicola* Tang, 1986
- 8 Anterior spiracle and posterior spiracle both with trilocular pores ..... 9
- Anterior spiracle with trilocular pores, posterior spiracle without trilocular pores ..... 14
- 9 Dorsal macroducts absent on submarginal and submedial area of abdominal segment VI ..... 10
- Dorsal macroducts present on submarginal or submedial area of abdominal segment VI ..... 11
- 10 Submarginal and submedial macroducts present on abdominal segment I ....  
..... *P. zhenyuanensis* sp. n.
- Submarginal and submedial macroducts absent on abdominal segment I.....  
..... *P. ulmicola* Tang & Li, 1988
- 11 Dorsal macroducts absent on submarginal and submedial area of abdominal segment II..... 12
- Dorsal macroducts present on submarginal or submedial area of abdominal segment II..... 13
- 12 Antennae 6 segments in first instar ..... *P. centreesa* (Ferris, 1953)
- Antennae 5 segments in first instar ..... *P. eucalypticola* Tang, 1986
- 13 Dorsal macroducts present on submedial area of abdominal segment VI; anal opening situated at the base of pygidium ..... *P. momi* (Kuwana, 1931)
- Dorsal macroducts present between submarginal or submedial area of abdominal segment VI; anal opening situated on the centre of pygidium .....  
..... *P. loncerae* Tang, 1986
- 14 Dorsal macroducts present on submarginal or submedial area of abdominal segment VI ..... 15
- Dorsal macroducts absent on submarginal and submedial area of abdominal segment VI ..... 23
- 15 Dorsal macroducts present on submarginal and submedial area of abdominal segment VI ..... 16
- Dorsal macroducts only present on submedial area of abdominal segment VI ..... 18
- 16 L2 bilobate, each with a pair of short basal scleroses.....  
..... *P. sasakawai* Takagi, 1970
- L2 bilobate, without basal scleroses..... 17
- 17 With 9-11 trilocular pores near each anterior spiracle .....  
..... *P. camelliae* (Chen, 1983)
- With more than 25 trilocular pores near each anterior spiracle .....  
..... *P. latisoma* (Chen, 1983)
- 18 Dorsal macroducts present on submarginal or submedial area of abdominal segment I ..... 19
- Dorsal macroducts absent on submarginal or submedial area of abdominal segment I ..... 20

19	L3 not obvious, anal opening situated on the centre of pygidium .....	<i>P. takahashii</i> (Ferris, 1955)
–	L3 bilobate, anal opening situated at the base of 2/5 of pygidium.....	<i>P. chinensis</i> (Cockerell, 1896)
20	L3 bilobate .....	21
–	L3 not obvious, present by a prominence.....	22
21	L1 protruding from pygidial margin .....	<i>P. cockerelli</i> (Cooley, 1897)
–	L1 sunk into apex of pygidium .....	<i>P. kentiae</i> (Kuwana, 1931)
22	Only 1 submedial macroduct present on abdominal segment VI .....	<i>P. eugeniae</i> (Maskell, 1892)
–	With 2 submedial macroducts present on abdominal segment VI.....	<i>P. ericeae</i> (Ferris, 1953)
23	Submarginal macroducts present on abdominal segment II, submedial macroducts absent on abdominal segment II.....	24
–	Submarginal and submedial macroducts both present on abdominal segment II .....	26
24	Submedial macroducts absent on abdominal segment III.....	<i>P. subcorticalis</i> (Green, 1905)
–	Submedial macroducts present on abdominal segment III .....	25
25	With more than 30 trilocular pores near each anterior spiracle .....	<i>P. poloosta</i> (Ferris, 1953)
–	With 20 or fewer trilocular pores near each anterior spiracle.....	<i>P. megaloba</i> (Green, 1899)
26	L3 obvious, bilobate .....	27
–	L3 not obvious, present by a shallow prominence .....	28
27	With 2-4 trilocular pores near each anterior spiracle .....	<i>P. subrhombica</i> (Chen, 1983)
–	With 11-14 trilocular pores near each anterior spiracle .....	<i>P. frutescens</i> (Hu, 1986)
28	With 10 or fewer trilocular pores near each anterior spiracle.....	29
–	With more than 15 trilocular pores near each anterior spiracle .....	31
29	L1 protruding from pygidial margin, only with 2 trilocular pores near each anterior spiracle .....	<i>P. taiwana</i> (Takahashi, 1935)
–	L1 sunk into apex of pygidium, with more than 4 trilocular pores near each anterior spiracle .....	30
30	The terminal of L3 arc-shaped, smoothly, with 4-8 trilocular pores near each anterior spiracle .....	<i>P. abbrideliae</i> (Chen, 1983)
–	The terminal of L3 serration, with more than 4 trilocular pores near each anterior spiracle .....	<i>P. brideliae</i> (Takahashi, 1933)
31	Gland tubercles present on prothorax, dorsal ducts present on head, smaller than those present on pygidium and abdomen....	<i>P. syzygicola</i> (Tang, 1986)
–	Gland tubercles absent on prothorax, dorsal ducts absent on head.....	32

- 32 L2 small, bilobulate, with 17-20 submedial macroduct in total.....  
 ..... *P. kuishiensis* (Kuwana, 1909)
- L2 very small, the outer lobule at times almost obsolete, with 4-11 submedial  
 macroduct in total ..... *P. celtis* (Kuwana, 1928)

## Acknowledgements

This study is supported by the National Natural Science Foundation of China (Grant No. 30870324).

## Reference

- Andersen JC, Wu J, Gruwell ME, Gwiazdowski R, Santana SE, Feliciano NM, Morse GE, Normark BB (2010) A phylogenetic analysis of armored scale insects (Hemiptera: Diaspididae), based upon nuclear, mitochondrial, and endosymbiont gene sequences. *Molecular Phylogenetics and Evolution* 57: 992–1003. doi: 10.1016/j.ympev.2010.05.002
- Ben-Dov Y (2012) Scalenet. Species in genus *Pseudaulacaspis* query result. <http://scalenet.info/validname/Pseudaulacaspis/> [Accessed February 2012]
- Borchsenius NS (1966) A catalogue of the armoured scale insects (Diaspidoidea) of the world. Nauka, Moscow, Leningrad, 449 pp. [In Russian]
- Chen FG (1983) The Chionaspidini (Diaspididae, Coccoidea, Homoptera) from China. Science & Technology Publishing House, Sichuan Province, 175 pp.
- Ferris GF (1953) Report upon scale insects collected in China (Homoptera: Coccoidea). Part IV. (Contribution No. 84). *Microentomology* 18: 59–84.
- Ferris GF (1955) The genus *Phenacaspis* Cooley and Cockerell, Part I. (Insecta: Homoptera: Coccoidea) (Contribution No. 93). *Microentomology* 20: 41–82.
- Gullan PJ, Cook LG (2007) Phylogeny and higher classification of the scale insects (Hemiptera: Sternorrhyncha: Coccoidea). *Zootaxa* 1668: 413–425.
- Henderson RC (2011) Diaspididae (Insecta: Hemiptera: Coccoidea). *Fauna of New Zealand* 66. Manaaki Whenua Press, Lincoln, Canterbury, 275 pp.
- Hodgson CJ, Lagowska B (2011) New scale insect (Hemiptera: Sternorrhyncha: Coccoidea) records from Fiji: three new species, records of several new invasive species and an updated checklist of Coccoidea. *Zootaxa* 2766: 1–29.
- Hu JL (1986) Studies on scale insects in the Hainan Island of China (Part I). *Contributions from Shanghai Institute of Entomology* 6: 213–227.
- MacGillivray AD (1921) The Coccidae. Tables for the Identification of the Subfamilies and Some of the More Important Genera and Species, Together with Discussions of Their Anatomy and Life History. Scarab, Urbana, Ill., 502 pp.
- Miller DR, Davidson JA (2005) Armored Scale Insect Pests of Trees and Shrubs. Cornell University Press, Ithaca, 442 pp.

- Morse GE, Normark BB (2006) A molecular phylogenetic study of armoured scale insects (Hemiptera: Diaspididae). *Systematic Entomology* 31: 338–349. doi: 10.1111/j.1365-3113.2005.00316.x
- Takagi S (1956) Notes on the Japanese species of the genus *Pseudaulacaspis* MacGillivray, with description of a new species. *Insecta Matsumurana* 19: 113–116.
- Takagi S (1961) A contribution to the knowledge of the Diaspididini of Japan (Homoptera: Coccoidea) Pt. III. *Insecta Matsumurana* 24: 69–103.
- Takagi S, Kawai S (1966) Some Diaspididae of Japan (Homoptera: Coccoidea). *Insecta Matsumurana* 28: 93–119.
- Takagi S (1970) Diaspididae of Taiwan based on material collected in connection with the Japan-US Cooperative Science Programme, 1965 (Homoptera: Coccoidea). Pt. II. *Insecta Matsumurana* 33: 1–146.
- Takagi S (1985) The scale insect genus *Chionaspis*: A revised concept (Homoptera: Coccoidea: Diaspididae). *Insecta Matsumurana Series Entomology. New Series*, 33: 1–77.
- Tang FT (1986) *The Scale Insects of Horticulture and Forests of China. Volume III*. Shanxi Agricultural University Press, Taigu, Shanxi, 305 pp.
- Tang FT, Li J (1988) *Observations on the Coccoidea of Inner Mongolia in China*. Inner Mongolia University Press, 227 pp.
- Williams DJ, Watson GW (1988) *The Scale Insects of the Tropical South Pacific Region. Pt. 1. The Armoured Scales (Diaspididae)*. CAB International Institute of Entomology, London, 290 pp.



# Notes about morphological features of the Western Hemisphere subtribe Ardistomina, and revision of genus *Semiardistomis* Kult (Coleoptera, Carabidae, Scaritinae, Clivinini)

Pavel Valdés<sup>1,†</sup>

<sup>1</sup> *Gertrudis 365 apto 5 el D'Strampes y Goicuría, Cp 10500, Habana, Cuba*

<sup>†</sup> [urn:lsid:zoobank.org/author:2D4E8B82-208F-49F4-9341-5FFC98778005](https://urn:lsid:zoobank.org/author:2D4E8B82-208F-49F4-9341-5FFC98778005)

Corresponding author: *Pavel Valdés* ([azapata@infomed.sld.cu](mailto:azapata@infomed.sld.cu))

---

Academic editor: *Terry Erwin* | Received 10 April 2012 | Accepted 4 July 2012 | Published 24 July 2012

---

[urn:lsid:zoobank.org/pub:](https://urn:lsid:zoobank.org/pub:)

---

**Citation:** Valdés P (2012) Notes about morphological features of the Western Hemisphere subtribe Ardistomina, and revision of genus *Semiardistomis* Kult (Coleoptera, Carabidae, Scaritinae, Clivinini). *ZooKeys* 210: 19–67. doi: 10.3897/zookeys.210.3042

---

## Abstract

Comparisons of structural features (principally mouthparts, elytral-abdominal locking mechanism, and female genitalia) of the ardistomine genera (*Aspidoglossa* Putzeys, *Ardistomis* Putzeys, and *Semiardistomis* Kult) with those features of members of the subtribe Clivinina (*Clivina* Latreille, *Oxydrepanus* Putzeys, *Schizogenius* Putzeys, *Ancus* Putzeys, *Nyctosyles* Putzeys, and *Obadius* Burmeister) confirm the taxonomic validity of the subtribe Ardistomina. Based on morphological features, the ardistomine genera are postulated to be related as follows: [*Aspidoglossa* [*Ardistomis* + *Semiardistomis*]]. Knowledge of this subtribe is further extended by taxonomic treatment of the genus *Semiardistomis* Kult. Of the 30 valid names of *Semiardistomis* previously recognized, four were proposed as variety names, and are listed as junior synonyms: *Ardistomis labialis picipes* Bates, 1881, *A. l. nanus* Bates, 1881, and *A. l. dilatatus* Bates, 1881; and *A. pallipes caerulea* Putzeys, 1846. Eight names, treated as specific epithets, are junior synonyms, as follows: *Ardistomis (Semiardistomis) balthasari* Kult, 1950 = *Semiardistomis glabratus* (Putzeys, 1866); *A. (S.) emdeni* Kult, 1950 = *S. deletus* (Putzeys, 1846); *A. aenea* Putzeys, 1866, *A. (S.) brittoni* Kult, 1950, and *A. (S.) marani* Kult, 1950 = *S. flavipes* (Dejean, 1831); *A. tuspanensis* Putzeys, 1846 = *S. labialis* (Chaudoir, 1837); *A. (S.) vlastae* Kult, 1950 = *S. subglabra* (van Emden, 1949); and *A. striga* Putzeys, 1866 = *S. pallipes* (Dejean, 1831). Two new species described are *S. expectatus* **sp. n.**

(type locality PERU, Madre de Dios, Rio Manu, 11°56'47"S, 071°17'00"W), and *S. major* **sp. n.** (type locality PERU, Loreto, Rio Samiria, 05°12'S, 75°20'W). The 20 species of *Semiardistomis* are arranged in two species-groups here proposed: the *puncticollis* group, including 12 species; and *labialis* group, including eight species. The species recognized are keyed, described or redescribed, and notes are provided about their Geographical distribution, habitat and activity. Distribution maps show known geographical ranges, from which are inferred patterns of speciation from a center of radiation in northern South America of both lineages.

## Resumen

La comparación de las características estructurales (principalmente partes bucales, mecanismo de cierre élitro- abdominal y genitalia femenina) de los géneros ardistominos (*Aspidoglossa* Putzeys, *Ardistomis* Putzeys, y *Semiardistomis* Kult) con sus similares de miembros de la subtribu Clivinina (*Clivina* Latreille, *Oxydrepanus* Putzeys, *Schizogenius* Putzeys, *Ancus* Putzeys, *Nyctosyles* Putzeys, y *Obadius* Burmeister) confirma la validez taxonómica de la subtribu Ardistomina. Basado en características morfológicas, se postula una relación entre los géneros ardistominos de forma: [*Aspidoglossa* [*Ardistomis* + *Semiardistomis*]]. El tratado taxonómico del género *Semiardistomis* Kult extiende el conocimiento de esta subtribu. De los 30 nombres válidos previamente reconocidos, cuatro estaban propuestos como variedades, y se tratan como sinónimos: *Ardistomis labialis picipes* Bates, 1881, *A. l. nanus* Bates, 1881, y *A. l. dilatatus* Bates, 1881; y *A. pallipes caerulea* Putzeys, 1846. Ocho nombres usados como epítetos específicos resultan los siguientes sinónimos: *Ardistomis (Semiardistomis) balthasari* Kult, 1950 = *Semiardistomis glabratus* (Putzeys, 1866); *A. (S.) emdeni* Kult, 1950 = *S. deletus* (Putzeys, 1846); *A. aenea* Putzeys, 1866, *A. (S.) brittoni* Kult, 1950, y *A. (S.) marani* Kult, 1950 = *S. flavipes* (Dejean, 1831); *A. tuspanensis* Putzeys, 1846 = *S. labialis* (Chaudoir, 1837); *A. (S.) vlastae* Kult, 1950 = *S. subglabra* (van Emden, 1949); y *A. striga* Putzeys, 1866 = *S. pallipes* (Dejean, 1831). Las dos especies nuevas descritas son *S. exspectatus* **sp. n.** (localidad tipo PERU, Madre de Dios, Rio Manu, 11°56'47"S, 071°17'00"W), y *S. major* **sp. n.** (localidad tipo PERU, Loreto, Rio Samiria, 05°12'S, 75°20'W). Las 20 especies de *Semiardistomis* se distribuyen en dos grupos de especies aquí establecidos: el grupo *puncticollis* con 12 especies y el grupo *labialis* con 8. Las especies reconocidas son incluidas en una clave de identificación, se describen o redescriben, y se dan notas a cerca de su distribución, hábitat y actividad. Los mapas de distribución muestran los rangos geográficos conocidos, de los cuales se inferen patrones de especiación a partir de un centro de radiación en el Norte de Suramérica para ambos linajes.

## Keywords

Coleoptera, Carabidae, scaritids, new species

*N'ayant vu qu'un seul individu, j'ignore si ces différences sont constantes et si l'insecte ne constitue pas une variété de l'A. pallipes.*  
(Putzeys, 1846: 646)

*Between these extremes, however, there is, either in the same or other localities, every grade of variation*  
(Bates, 1881: 35)

*The species of this group are very difficult to determine without preparing a key; they form some slightly different subspecies in some localities.*  
(Kult, 1950: 317)

## Introduction

Although the major part of this paper treats the species of *Semiardistomis*, a more general background is provided by a preliminary treatment of the subtribe *Ardistomina* and comparison with other taxa of the tribe *Clivinini*, principally the nominotypical subtribe *Clivinina*. Many scaritid genera were included in the *Ardistomina*, but Bousquet (2006) restricted the subtribe to the genera *Ardistomis*, *Semiardistomis* and *Aspidoglossa* Putzeys; additional evidence presented in this work supports recognition of the group.

The quotations above provide an idea of past taxonomic difficulties regarding members *Semiardistomis*. Interpretations made using non-diagnostic characters from short series of specimens have led to a taxonomic system, mostly useless, in order to identify and correlate beetles of this genus. The first arrangement of the group was made by Putzeys (1866) who recognized common characters to designate his “deuxieme groupe” of genus *Ardistomis* Putzeys. Despite that, he placed the North American species of *Semiardistomis* Kult in a separate group; this structure started recognition of the group as a different entity from its generic origin.

Kult (1950) corroborated Putzeys' taxonomic structure, naming the “deuxieme groupe” as subgenus *Semiardistomis*, which was divided into 8 groups, and the “troisieme groupe” as subgenus *Ardistomiellus*. Kult's structure was built using characters that proved to be superficial, so species with different origin were placed in the same group. This new scheme resulted also in inclusion of some species of the genus *Ardistomis* in *Semiardistomis*, a mistake followed by subsequent authors until Valdes (2009) made the necessary corrections.

Whitehead [in Reichardt (1977)] suggested treating *Semiardistomis* as a distinct genus, but no formal action was taken until Nichols (1988b) did so. The last published list of species names of *Semiardistomis* was compiled by Lorenz (2005).

## Material and methods

Study is based on 1038 specimens examined, provided by, or checked in, the following collections (names of curators or owners at the time of the loan in parentheses).

<b>MHNP</b>	Muséum National d'Histoire Naturelle, Paris, France. (T. Deuve and A. Tagavian).
<b>IRSNB</b>	Institut Royal des Sciences Naturelles de Belgique, Bruxelles, Belgique. (A. Drumont).
<b>CMN</b>	Canadian Museum of Nature, Aylmer, Québec, Canada. (R. S. Anderson and F. Génier).
<b>IES</b>	Instituto de Ecología y Sistemática, Habana, Cuba. (A. Lozada).
<b>MNHNCu</b>	Museo Nacional de Historia Natural de Cuba, Habana, Cuba. (E. Gutiérrez)
<b>PVCCu</b>	P. Valdés Collection, Habana, Cuba.
<b>PBPC</b>	P. Bulirsch Collection. Prague, Czech Republic.
<b>BMNH</b>	British Museum of Natural History. London, UK. (M. Barclay and C. Taylor)
<b>HECO</b>	Hope Entomological Collection, Oxford University, UK. (J. Hogan).
<b>UASM</b>	University of Alberta, Strickland Museum, Edmonton, Alberta, Canada. (G. E. Ball and D. Shpeley).
<b>ADVA</b>	A. Dostal Collection (includes Kult Collection), Vienna, Austria.
<b>CAS</b>	Department of Entomology, California Academy of Sciences, Golden Gate Park, San Francisco, U.S.A. (D. H. Kavanaugh).
<b>FSCA</b>	Florida State Collection of Arthropods, Florida Department of Agriculture, Gainesville, Florida, U.S.A. (P. Skelley).
<b>USNM</b>	National Museum of Natural History, Washington, D.C., U.S.A. (T. L. Erwin).

Dissections of adults were made using standard techniques. The genitalia were preserved in glycerin in a microvial, pinned beneath the specimen from which they were removed. Mouthparts were glued on small cards pinned beneath the specimens. Observations were made using a stereobinocular microscope and a compound microscope. All line drawings were made from digital microphotographs using Corel Draw 13X.

The following measurements were made using an ocular micrometer: head length (**HL**): linear distance from apical margin of clypeus to posterior margin of right eye; length of pronotum (**PL**): linear distance from anterior to posterior margin along the midline; pronotal width (**PW**): greatest linear transverse distance; elytral length (**EL**): linear distance from basal ridge to apex along the suture; elytral width (**EW**): greatest linear transverse distance across both elytra. The standardized body length (**SBL**) is the sum of the lengths of head, pronotum and elytra. Body ratios (**PW/EW**, **PW/PL**, **PL/EL** and **EW/EL**) are given for each species.

Mandible proportion is interpreted from ratio of the length of the transverse line at outer molar point (width) and length of the perpendicular distance from that line to apical edge (length).

Most terms used for structural features are found in previous works on Carabidae: Allen and Ball (1980) for adult microsculpture; Acorn and Ball (1991) for adult mandibles; Liebherr and Will (1998) for female genitalia.

## Taxonomy

### Subtribe *Ardistomina*

<http://species-id.net/wiki/Ardistomina>

**Diagnosis.** Within the Clivinini, the subtribe *Ardistomina* is characterized as follows: Elytron latero-distally (Fig. 22) with a plica (**ep**) and an adjacent abdominal (segment VII) pleural projection (**app**) that together form an elytral-abdominal locking mechanism; ovipositor (Figs 27–30) with an asetose quadranguloid laterotergite, and unsegmented gonocoxa bearing at apex few long setae.

**Included genera.** This subtribe includes *Aspidoglossa* Putzeys, *Semiardistomis* Kult, and *Ardistomis* Putzeys.

**Comparative morphology.** Mandibles, labium, and female genitalia (source of many diagnostic features within the tribe Clivinini) were compared within the ardistomines and between that subtribe and selected members of the nominotypic Clivinina. The latter taxon was represented by Western Hemisphere members of six exemplar genera: *Clivina* Latreille, *Oxydrepanus* Putzeys, *Schizogenius* Putzeys, *Ancus* Putzeys, *Nyctosyles* Putzeys, and *Obadius* Burmeister. Also, mandibles of *Dyschiriodes* Jeannel (subtribe *Dyschiriina*) were included.

**Mandibles:** Compared to those of *Dyschiriina* (Figs, 12A–12D), the mandibles of the clivinines (Figs 9A–9D to 11A–11D) and ardistomines (Figs 6A–6D to 8A–8D) are relatively straight.

For dentition, *Dyschiriodes* exhibits the least number of occlusal teeth. The clivine genera *Clivina* (Figs 9A–9D) and *Oxydrepanus* (Figs 10A–10D), and the ardistomine genera *Aspidoglossa* (Figs 8A–8D) and *Ardistomis* (Figs 7A–7D) have a full complement of occlusal teeth, *Semiardistomis* (Figs 6A–6D) and *Schizogenius* (Figs 11A–11D) lack the premolar tooth.

In values for L/W (a measure of relative length), the mandibles of clivinines, dyschiriines, and the ardistomine *Aspidoglossa* are relatively short (L/W 1.44–1.68), whereas the mandibles of the ardistomine genera *Semiardistomis* (L/W 1.86) and *Ardistomis* (L/W 2.25) are relatively long, with a slender terebra.

**Labium:** In form, the mentum (**m**) is markedly to slightly transverse (L/W 0.43–0.56) among the clivine genera (Figs 17A–21A); among the ardistomine genera (Figs 13A–16A) the mentum is slightly transverse to slightly elongate (L/W 0.57–0.95), a morphocline being *Aspidoglossa*—*Semiardistomis*—*Ardistomis*.

In the Ardistomina, the apex of the lateral lobes (**ll**) is extended distally beyond the apex of the mental tooth (**mt**). This feature is varied among the clivinines: lateral lobes not extended beyond the apex of the mental tooth (*Clivina*, *Oxydrepanus*, and *Nyctosyles*, Figs 17A, 18A, 21A), to slightly extended beyond that line (*Schizogenius* and *Ancus*, Figs 19A, 20A).

The paraglossae (**pg**) are elongate, extended distinctly beyond the apex of the glossal sclerite (**gs**) in most genera of Ardistomina and Clivinina. In the ardistomine *Ardistomis* (Fig. 15B) and clivinine *Nyctosyles* (Fig. 21B) the paraglossae are much shorter than the glossal sclerite.

The glossal sclerite (**gs**) varies appreciably in both subtribes, being very large and rotund in *Semiardistomis* (Figs 13B, 14B), broad with a broad apex in *Nyctosyles* (Fig. 21), and narrower and shorter in the remaining ardistomines and clivinines.

The glossal sclerite in the genus *Semiardistomis* has an extra pair of preapical setae (Figs 13B, 14B, **pas**). All other ardistomine and clivinine genera have a single pair of glossal setae (**as**).

Labial palpomere 3 (**lp3**) is elongate and fusiform in the Ardistomina (Figs 13A–16A). This sclerite varies in the clivinines: fusiform in *Clivina* (Fig. 17A), and variously widened in the remaining clivinine exemplar genera (Figs 18A–21A).

**Female genitalia:** The ovipositor sclerites come in two types, either ardistomine (Figs 27–30) or clivinine (Figs 31A–36A). For clivinine genera *Clivina*, *Nyctosyles* and *Obadius*, the gonocoxa is segmented, each segment designated as a gonocoxite (**gc1**, **gc2**). Gonocoxite 2 is more or less falcate. In ardistomine females, in contrast, the gonocoxa (**gc**) is unsegmented, and slightly curved or essentially straight. The laterotergites (**lt**) of clivinines are more or less triangular, whereas those of ardistomines are rectangular. Further, the laterotergites and gonocoxites of clivinines are setose along their margins, but the apex of gonocoxite 2 is glabrous. In contrast, for ardistomines, the ovipositor sclerites are essentially glabrous, but the apex of the gonocoxa bears a few setae. An unsegmented gonocoxa with reduced number of setae is also seen in *Dyschiriina* (Fedorenko, 1996). Within the ardistomines, the gonocoxae of *Aspidoglossa* and *Ardistomis* are moderately broad (Figs 29, 30), but those of *Semiardistomis* (Figs 27, 28) are slender, virtually rod-like.

Within the Clivinina, the reproductive tract (Figs 31A–36A) is strikingly varied, but the range of variation is about as extensive as, and similar to, that of the Ardistomina, and thus uninformative from a diagnostic perspective at subtribal level. Within each subtribe, the genera are clearly distinguishable from one another. Here, I treat only the ardistomine genera.

In *Aspidoglossa* females (Fig. 30), the spermathecal duct (**spd**) is narrow, elongate, with few loose coils proximally; the spermathecal gland (**spgd**) is relatively short. The female tract of *Ardistomis* (Fig. 29) is narrow, relatively short; the spermatheca (**sp**) is moderately long and markedly expanded distally. For *Semiardistomis* females (Figs 27, 28) the reproductive tracts of the two species-groups are sufficiently different from one another to require separate descriptions. They also

differ markedly from the reproductive tracts of *Aspidoglossa* and *Ardistomis*. For details, see species-group treatments, below.

**Habitat.** The members of the *Ardistomina* are hygrophilous or mesophilous, living in riparian situations, lowland swamp forests, or wet montane tropical forest.

**Relationships.** As indicated above, of the three ardistomine genera, *Aspidoglossa* is most similar to members of subtribe *Clivinina* in mandibular and mental proportions and is more remote from *Ardistomis* and *Semiardistomis* in structure of the female reproductive tract than the latter two genera are from each other. In turn, *Ardistomis* and *Semiardistomis* share elongate mandibles and mentum. Based on these observations, I conclude that relationships of these three genera may be summarized using brackets as follows: [*Aspidoglossa* [*Ardistomis* + *Semiardistomis*]]

**Geographical distribution.** This subtribe is a Western Hemisphere indigenous group. Its range extends in South America east of the Andes mountain range from central Argentina northward through Colombia, Middle America, and the West Indies to temperate North America, principally east of the Mississippi drainage basin.

### Genus *Semiardistomis* Kult, 1950

<http://species-id.net/wiki/Semiardistomis>

*Ardistomis* (*Semiardistomis*) Kult, 1950: 301. Type species: *Clivina labialis* Chaudoir, 1837, designated by Kult (1950: 301).

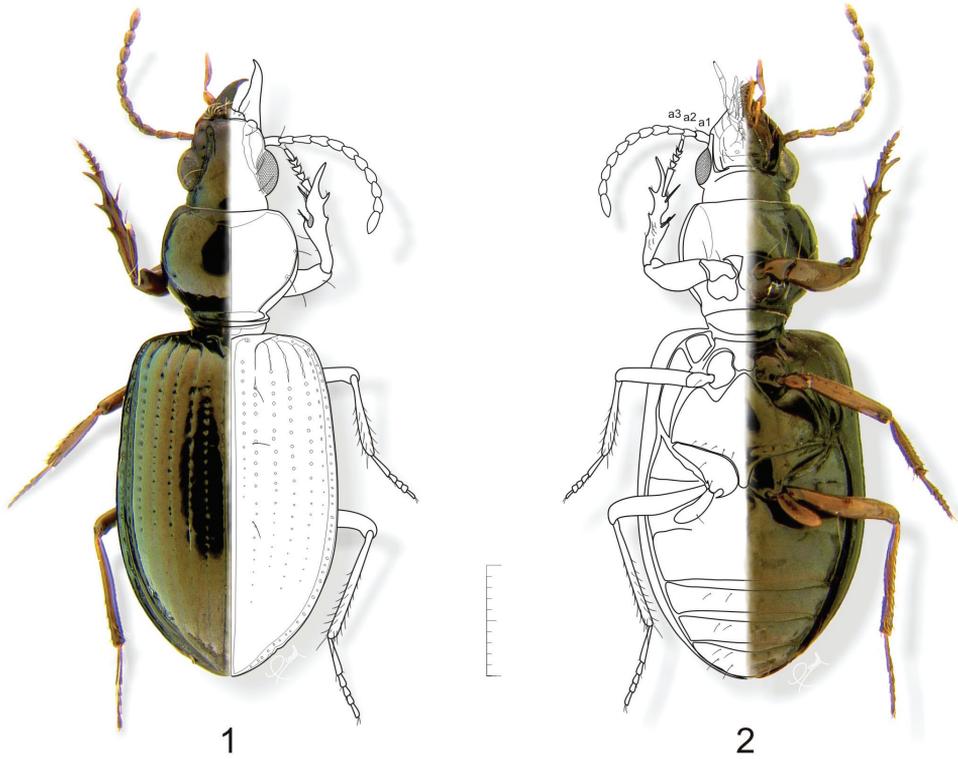
*Ardistomis* (*Ardistomiellus*) Kult, 1950: 303. Type Species: *Ardistomis viridis* Say, 1823, designated by Kult (1950: 303). Synonymy established by Whitehead [in Reichardt] (1977: 392).

*Semiardistomis* Kult. Nichols (1988b: 98); Ball and Bousquet (2001: 45, 74); Bousquet (2006: 10); Valdés (2007: 24); Erwin (2011:233).

**Diagnostic combination.** Features of adults used in recognition of this genus include: antennomere 2 shorter than antennomere 3 (Fig. 1, **a2**, **a3**); glossal sclerite of ligula (Figs 13B, 14B) with a secondary pair of setae; mentum with median carina (Figs 13C, 14C) extended distal in form of an appendiform keel; protibia (Figs 23, 24) with basal half of ventral surface with a group of setae.

**Description. Adult. Body shape, color and size** (Figs 1, 2, 37–41, 44–52): Body pedunculate. Body size small, ranging from 4.0 to 7.5 mm. Body monochromous, dark with metallic greenish and/ or brassy luster, shiny in species without microsculpture; appendages reddish brown. One species, *S. laevistriatus* (Fleutiaux & Sallé), is dark brown a color also found in monticolous brachypterous species of the genus *Ardistomis*.

**Microsculpture:** Frontoclypeus mostly smooth; supraantennal lobes smooth; vertex with mesh pattern isodiametric; gena with mesh pattern isodiametric; gula with mesh pattern transverse. Mandibles smooth; submentum and mentum with mesh pattern isodiametric. Pronotal disc generally smooth or with mesh pattern

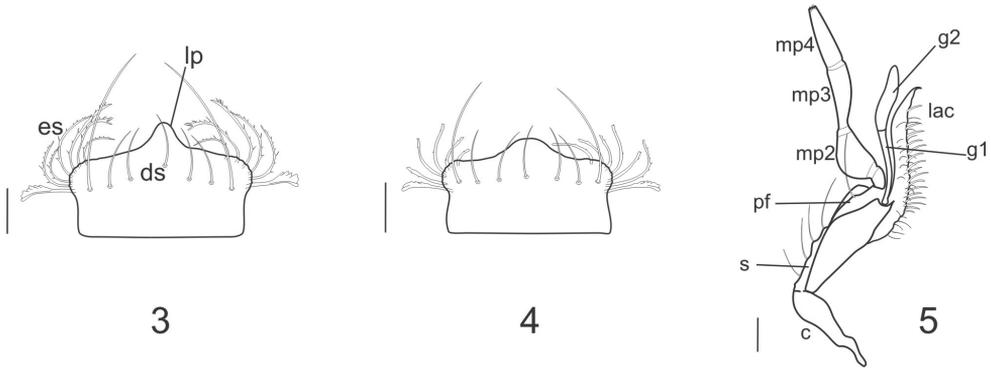


**Figures 1–2.** *Semiardistomis labialis* (Chaudoir). **1** Dorsal aspect **2** Ventral aspect. Legend: **a1 a2 a3** antennomeres 1–3, respectively. Scale bar 1 mm.

isodiametric, microlines very shallow, marginally and smooth at the center; proepisternum smooth or with isodiametric mesh pattern, submarginal band of microsculpture absent; prosternum smooth or with mesh pattern transverse. Metasternum smooth or with mesh pattern transverse. Abdominal sterna smooth or with mesh pattern transverse. Elytra smooth or with isodiametric mesh pattern covering entirely or only part of the disc.

**Chaetotaxy:** Two pair of supraorbital setae (except for *S. puncticollis*); pronotal disc with two pair of marginal setae (except for *S. puncticollis* and *S. viridis*); except for hirsute species, setae on elytral disc located in interval 3 and *S. darlingtoni* (Kult) also in interval 5; abdominal sterna IV–VII with accessory setae.

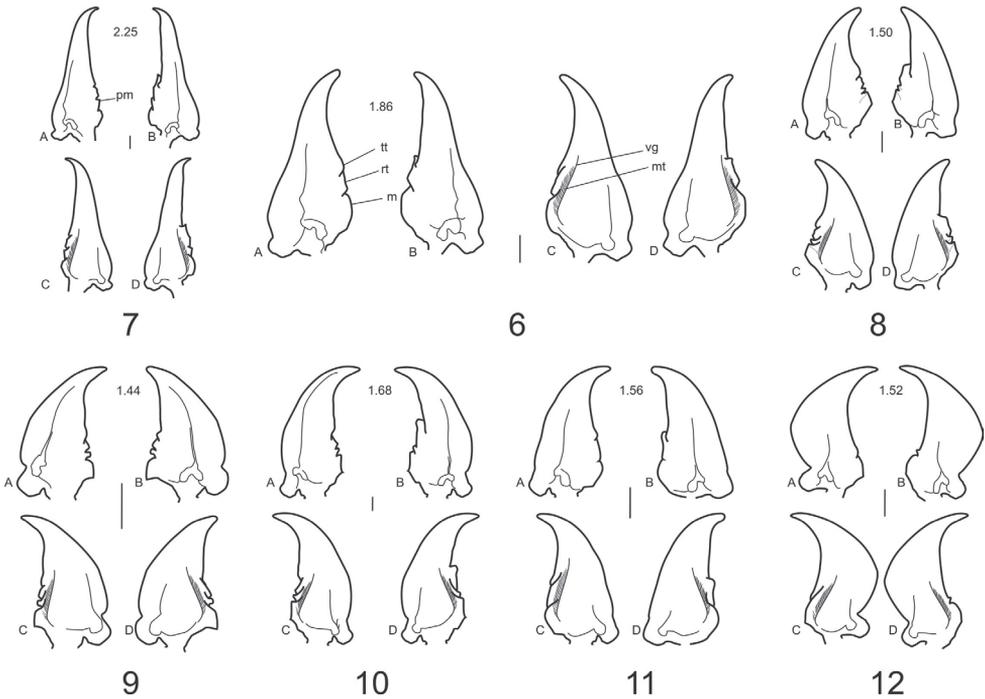
**Head capsule:** Clypeus with anterior margin concave medially; lateral lobes distinct, projected at the same level or below anterior margin. Antennal lobes prominent, sometimes partially sulcate medially in basal half. Frontoclypeus smooth except in *S. rugosus* (Putzeys). Frontal impressions deep and wide from base of antennal lobes to anterior margin of clypeus. Gena with sides subparallel. **Eyes:** Hemispherical, prominent. **Antennae** (Figs 1, 2): Filiform to submoniliform. Antennomere 1 (**a1**) with



**Figures 3–5.** 3–4 Labrum (dorsal aspect) **3** *Semiardistomis glabratus* (Putzeys) **4** *Semiardistomis labialis* (Chaudoir) **5** Right Maxilla (dorsal aspect) of *Semiardistomis labialis* (Chaudoir). Legend: Labrum: **ds** dorsal seta **es** epipharyngeal seta **lp** labral dentiform projection. Maxilla: **c** cardo **g1** galeomere 1 **g2** galeomere 2 **lac** lacinia **mp2** **mp3** **mp4** maxillary palpomeres 2–4 respectively **pf** palpifer **s** stipes. Scale bar 0.1 mm.

single preapical seta. Antennomere 2 (**a2**) with few setae, shorter than antennomere 3 (**a3**). Antennomeres 4–11 densely setose, setae short.

**Mouthparts: Labrum** (Figs 3, 4): anterior margin angulate, dentiform medially (**dp**); dorsal setae (**ds**) 7, as for most Clivinini; apical portion of epipharyngeal setae (**es**) serrulate anteriolaterally. **Maxillae** (Fig. 5) with lacinia (**lac**) apical tooth sharp and curved; galeomere 1 (**g1**) slender, a little longer than galeomere 2 (**g2**), the latter flat, broad and sinuate in outline; palpomere 2 (**mp2**) thick and triangular in outline; palpomere 3 (**mp3**) subequal in length to palpomere 4 (**mp4**); palpomere 4 apically acuminate. Stipes (**st**) with 4 setae, palpifer (**pf**) with one seta. (This structure shows little difference from other clivinines being most similar to that of *Ardistomis*. **Mandibles** (Figs 6A–6D): elongate, about 1.9 times longer than wide; ventral groove (**vg**) moderate in length, with short microtrichia (**mt**); left mandible with terebral ridge curved, the terebral tooth (**tt**) blunt and moderate in size, visible from ventral view, retinaculum (**rt**) broad, premolar tooth (**pm**) absent, the molar tooth (**m**) broad and rounded; right mandible with terebral ridge more or less straight, the terebral tooth small, not visible from ventral view, the retinaculum with acute anterior tooth, premolar tooth absent, and the molar tooth broad and rounded. **Labium** (Figs 13A–C, 14A–C) with mental–submental suture complete; submentum with paramedian projections distinct, two pair of setae; mentum (**m**) trapezoidal, about 1.5 times wider than long; two pair of setae; lateral lobes with anterior margins angulate; mental tooth (**mt**) with distal margin almost straight, about 1/3 length of lateral lobes (**ll**); median carina (**mc**)(13C, 14C) extended distad, or not, beyond anterior margin of lateral lobes; pit organs (**po**) distinct, opened through oval orifices in basal part of mentum or on mental–submental suture; palpomere 3 (**lp3**) subequal in length to palpomere 2, palpomere 2 (**lp2**) bisetose; ligula (Figs 13B, 14B) with glossal sclerite (**gs**) notably wide, its anterior margin with acuminate median projection and two long setae (**as**), two additional small



**Figures 6–12.** Mandibles of Ardistomina, Clivinina and Dyschiriina with length/width ratios: **A** left, dorsal aspect **B** right, dorsal aspect **C** left, ventral aspect and **D** right, ventral aspect) **6** *Semiardistomis labialis* (Chaudoir) **7** *Ardistomis fasciolatus* Putzeys **8** *Aspidoglossa mexicana* (Chaudoir) **9** *Oxydrepanus rufus* (Putzeys) **10** *Clivina dentipes* Dejean **11** *Schizogenius arimao* Darlington **12** *Dyschiriodes larochellei* Bousquet. Legend: Occlusal teeth: **m** molar **pm** premolar **rt** retinacular **tt** terebral. Ventral surface: **vg** ventral groove **mt** microtrichia. Scale bar 0.1 mm.

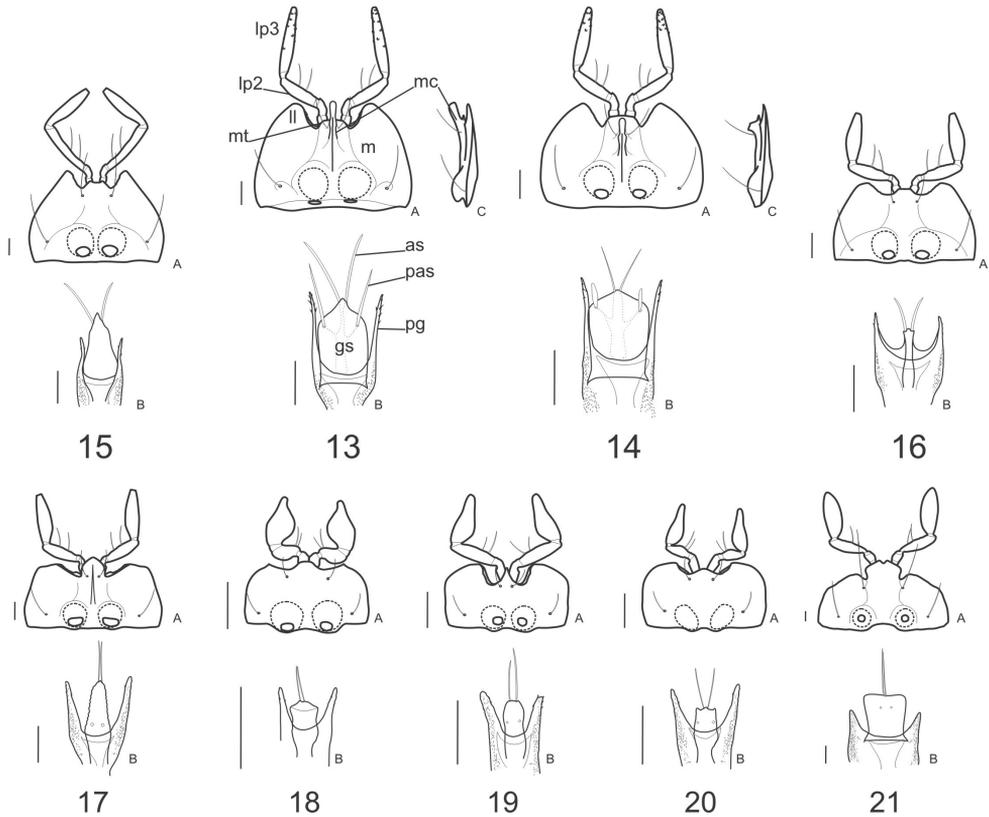
setae (**pas**) located preapically; paraglossae (**pg**) divergent from glossal sclerite and covered with microtrichia dorsally, lobes thin and acuminate, extended distally beyond distal margin of glossal sclerite, apices serrulate.

**Pronotum.** Ovate or cordate, anterior transverse and median longitudinal impressions distinct, proepisternum visible from above, lateral border not extended to base in some specimens. Anterior transverse and median longitudinal impressions distinct. Proepipleura visible from above.

**Elytra.** Oval, convex; striae complete or obliterated to various degrees or absent (stria 1 always complete), punctate or not, punctures shallowly to deeply impressed. Preapical epipleural plica (Fig. 22, **ep**) displaced outward, interrupting outline of elytra.

**Hind wings.** Macropterous or brachypterous.

**Underside** (Fig. 2). Metasternum with a row of setiferous punctures along margin of coxal cavity, median contact with abdomen dividing metacoxae. Suture between abdominal sterna III and IV obliterated at middle. Pleurite VII with small projection (Fig. 22, **app**) fitting into elytral epipleural plica (**ep**).



**Figures 13–21.** Labium of Clivinini (ventral aspects): **A** mentum and palpi **B** ligula **C** mental carina, lateral aspect. **13–14** Genus *Semiardistomis*: **13** *S. glabratus* (Putzeys) **14** *S. labialis* (Chaudoir) **15** *Ardistomis fasciolatus* Putzeys **16** *Aspidoglossa mexicana* (Chaudoir) **17** *Clivina dentipes* Dejean **18** *Oxydrepanus rufus* (Putzeys) **19** *Schizogenius arimao* Darlington **20** *Ancus excavaticeps* (Putzeys) **21** *Nyctosyles planicollis* (Reiche). Legend: **as** apical setae of glossal sclerite **gs** glossal sclerite **lp2** labial palpomere 2 **lp3** labial palpomere 3 **ll** lateral lobes **mc** median carina **m** mentum **mt** mental tooth **pas** preapical seta of glossal sclerite **pg** paraglossa. Scale bar 0.1 mm.

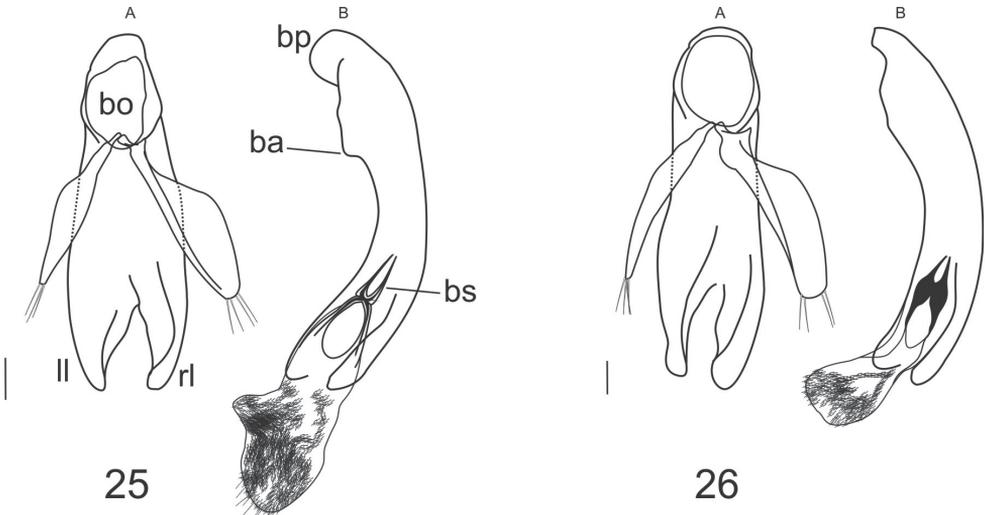
**Legs.** Slender, protibia (Figs 23, 24) with basal half of ventral surface with a group of setae, protarsomeres in males slightly dilated.

**Male genitalia** (Figs 25, 26). Phallus lightly sclerotized; basal bulb with basal orifice (**bo**) oval, wide; basal projection (**bp**) distinct, apical margin curved; basal apophysis (**ba**) moderate; median portion tubular; apical portion formed by two lamellae (**rl** and **ll**). Endophallus pubescent in apical portion; basal sclerite (**bs**) clearly developed. Parameres subequal in length, the right one wider, both with 4–5 apical setae.

**Female genitalia** (Figs 27, 28). Ovipositor: gonocoxa (**gc**) unsegmented, very slender, with a pair of setae at apex, surface with micropores; laterotergites (**lt**) thinly sclerotized, flat and asetose, sclerotized border thin and folded in basal portion with a small anterior part; mediotergite (**mt**) wide, its width delimited by external borders



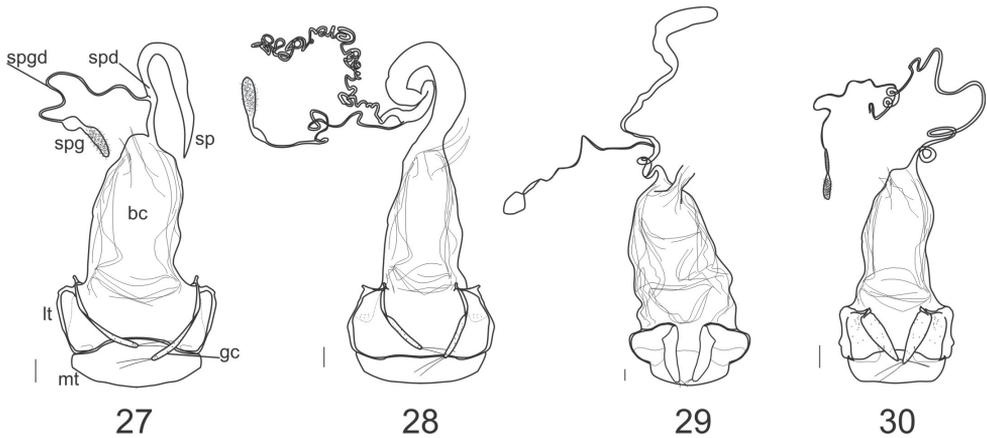
**Figures 22–24.** **22** Body extremity (lateral aspect) of *Semiardistomis labialis* (Chaudoir) **23–24** Protarsus (ventral aspect) of *Semiardistomis* **23** *S. labialis* (Chaudoir) **24** *S. glabratus* (Putzeys). Legend: **app** abdominal epipleural projection of abdominal sternum VII **ep** elytral plica. Scale bar 1 mm.



**Figures 25–26.** Male genitalia of genus *Semiardistomis*: **A** phallus and parameres in dorsal aspect **B** phallus and endophallus everted in lateral aspect **25** *S. labialis* (Chaudoir) **26** *S. glabratus* (Putzeys). Legend: **ba** basal apophysis **bo** basal opening **bp** basal projection **bs** basal sclerite **ll** left lobe **rl** right lobe. Scale bar 0.1 mm.

of laterotergites. Reproductive tract: bursa copulatrix (**bc**) elongate; spermathecal duct (**spd**) = distance from apex of bursa copulatrix to insertion point of spermathecal gland duct (**spgd**) relatively short or long, spermathecal gland duct elongate; spermatheca (**sp**) various in thickness, length, and conformation; see description of this structure for each of the two species-groups.

**Morphological notes. Cuticular sculpture:** The absence of a submarginal band of microsculpture on the proepisternum has been used to differentiate *Semiardistomis*



**Figures 27–30.** Female genitalia (ventral aspect). of *Ardistomina* **27** *Semiardistomis glabratus* (Putzeys) **28** *Semiardistomis labialis* (Chaudoir) **29** *Ardistomis fasciolatus* Putzeys **30** *Aspidoglossa mexicana* (Chaudoir). Legend: **bc** bursa copulatrix **gc** gonocoxa (gonocoxite 1 and 2, fused) **It** laterotergite **mt** mediotergite **sp** spermatheca **spd** spermathecal duct **spg** spermathecal gland **spgd** spermathecal gland duct. Scale bar 0.1 mm.

from *Ardistomis* but the character state is not diagnostic since the band has been lost in at least two lineages of *Ardistomis* (Valdes, 2009).

The microsculpture on the elytral disc has a diagnostic value, the absence of microsculpture being the apotypic state.

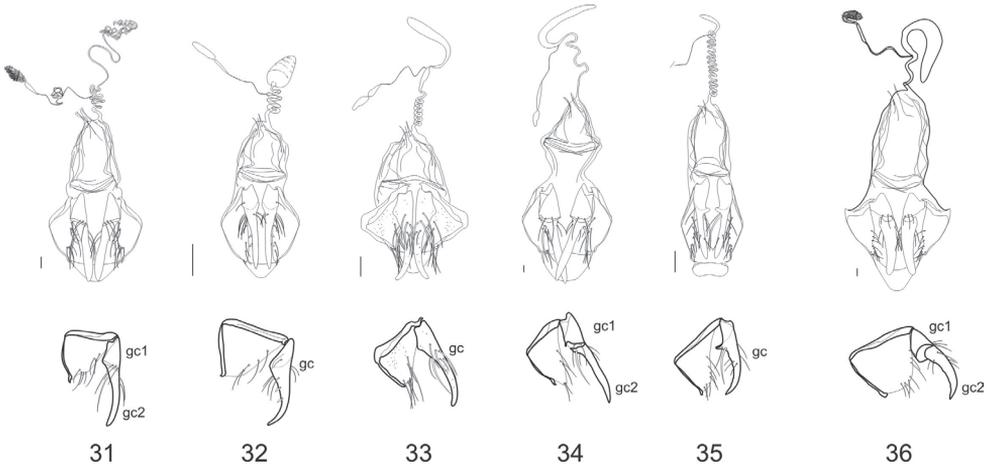
**Vestiture:** Hirsuteness is a common phenomenon in this genus. In the two species groups, this apotypic character state appears, its origin independently developed. In the *puncticollis* group, three species have hirsute structures: *S. puncticollis* from southern U.S.A. (supraorbital area of the head capsule, pronotal disc, elytral disc, profemur and abdominal sternum VII), *S. pilosellus* (Kult) from southern South America (elytral disc and profemur) and *S. subglabra* (van Emden) from South America (profemur). In the *labialis* group, two species have hirsute structures: *S. viridis* from southern U.S.A. (pronotal disc and elytral disc) and *S. propinquus* (Putzeys) from Mexico (elytral disc),

**Elytra:** In this genus, I regard the state of having the striae complete and impunctate as plesiotypic, being present in both species groups.

**Hind wings:** Macropterous except *S. laevistriatus* brachypterous. Nichols (1988a) also reported that *S. puncticollis* is brachypterous.

**Legs:** Protarsomeres in males so slightly dilated that this feature is useless for sex recognition.

**Male genitalia:** Phallic structure enhances definition of the two species groups of *Semiardistomis*. See details, provided in the species-group diagnoses. The differences in the phallic structures are too small to separate the species within each group, a situation also known in other clivinine genera, such as *Schizogenius* Putzeys (see Whitehead 1972).



**Figures 31–36.** Female genitalia (dorsal aspect) and gonocoxites /laterotergites (lateral aspect) of Clivinina **31** *Clivina dentipes* Dejean **32** *Oxydrepanus rufus* (Putzeys) **33** *Schizogenius arimao* Darlington **34** *Nyctosyles planicollis* (Reiche) **35** *Ancus excavaticeps* (Putzeys) **36** *Obadius insignis* Burmeister. Legend: See legend for **Figs 27–30**, except gonocoxite 1 (**gc1**) and gonocoxite 2 (**gc2**) Scale bar 0.1 mm.

**Larvae.** The first instar of *Semiardistomis* was described by Bousquet (2006). It was compared with *Ardistomis* larva by Valdés (2007) who pointed out two notable synapotypic features: absence of the coronal suture and a segmented maxillary palpomere 4.

**Classification.** Based primarily on male and female genitalic features, the species of *Semiardistomis* are arranged in two species-groups designated as the *puncticollis* and *labialis* group, respectively.

**Criteria for species definition.** Of the 20 known species of *Semiardistomis* only those occurring in U.S.A. (*S. viridis* (Say) and *S. puncticollis* (Dejean)) are represented by large series of specimens in collections (Nichols, 1988a; Bousquet, 2006). The species inhabiting Central and South America and the West Indies are represented in collections by few specimens which give only an incomplete picture of the ranges of the species.

Members of this genus are difficult to identify in part because of a shortage of useful external features, and in part because the male and female genitalia, so useful in distinguishing between species groups, are not useful within each group. Moreover, some of the characters traditionally used to separate the species have been found in large samples to vary extensively. Some samples are a mixture of combinations from extreme patterns considered as different species; being impossible to demonstrate if those populations are hybrids or simply polymorphs, while in other putative species, allopatric populations exhibit no evident differences. In the *labialis* group in southern South America, the species limits are especially difficult to assess probably because the group is young and composed of species with a great power of dispersal. Without direct evidence of the state of gene flow between known populations, it is almost impossible to testify in favor of the reproductive isolation of each species described or in other cases to designate subspecies. I will follow a criterion

with a practical value, so maybe for some species, taxonomic determination will denote unintentionally a combination of extreme characters shared by more than one biological species.

**Geographical distribution.** (Figs 57–59) The range of this genus is co-extensive with the range of the *Ardistomina*.

**Key to described species of *Semiardistomis*, based on adult characters**

- 1 Elytral disc plurisetose ..... 2
- 1' Elytral disc with setiferous punctures in interval 3, or sometimes also in interval 5 ..... 5
- 2(1) Profemur plurisetose ..... 3
- 2' Profemur with the usual setae ..... 4
- 3(2) Pronotal disc plurisetose (along margin and on disc). Habitus as in Fig. 48. USA..... *S. puncticollis*(Dejean)
- 3' Pronotal disc with the usual 2 pairs of marginal setae. Habitus as in Fig. 44. South America ..... *S. pilosellus* (Kult)
- 4(2') Pronotal disc plurisetose along margin. Habitus as in Fig. 55. USA..... *S. viridis* (Say)
- 4' Pronotal disc with the usual 2 pairs of marginal setae. Habitus as in Fig. 54. Mexico..... *S. propinquus* (Putzeys)
- 5(1') Elytron with two setiferous punctures on interval 3; humerus rounded; brachypterous. Habitus as in Fig. 47 Guadeloupe..... *S. laevistriatus* (Fleutiaux & Sallé)
- 5' Elytron with three or more setiferous punctures on interval 3; macropterous... 6
- 6(5') Elytron with three setiferous punctures on interval 3 ..... 7
- 6' Elytron with more than three setiferous punctures on interval 3 ..... 12
- 7(6) Elytral striae impunctate. Habitus as in Fig. 52. South America..... *S. pallipes* (Dejean)
- 7' Elytral striae punctate ..... 8
- 8(7') Elytral disc with isodiametric mesh pattern..... 9
- 8' Elytral disc smooth ..... 10
- 9(8) Elytral striae impressed only in basal fifth, punctures deep along three-quarters of elytra, surface completely covered with isodiametric mesh pattern. South America..... *S. deletus* (Putzeys)
- 9' Elytral striae obliterated in apical third, punctures moderately deep, surface with isodiametric mesh pattern, evanescent in central area of elytral disc in some specimens. South America ..... *S. flavipes* (Dejean)
- 10(8') Elytral striae obliterated in apical fifth, punctures moderately deep. Habitus as in Fig. 51. West Indies ..... *S. cyaneolimbatu*s (Chevrolat)
- 10' Elytral striae impressed only in basal fifth ..... 11
- 11(10') Elytral punctures deeply impressed in basal two-thirds of elytra. Habitus as in Figs 1, 2. Central America ..... *S. labialis* (Chaudoir)

- 11' Elytral punctures moderately impressed in basal third of elytra. Southern South America ..... *S. semipunctatus* (Dejean)
- 12(6') Elytral disc surface completely covered with isodiametric mesh pattern. Habitus as in Fig. 46. South America ..... *S. maindroni* (Kult)
- 12' Elytral disc surface smooth..... 13
- 13(12') Elytral striae complete; impunctate ..... 14
- 13' Elytral striae incomplete ..... 17
- 14(13) Front between antennal lobes with transverse rugae. Habitus as in Fig. 50. Southern Brazil..... *S. rugosus* (Putzeys)
- 14' Front between antennal lobes smooth..... 15
- 15(14') Elytron with five setiferous punctures on interval 3; body size more than 7 mm. Habitus as in Fig. 49. Peru ..... *S. major* n. sp.
- 15' Elytron with four setiferous punctures on interval 3; body size less than 6 mm..... 16
- 16(15') Pronotum markedly cordate, 1.25 times wider than long; humeri square, sides subparallel. Habitus as in Fig. 37. Colombia.... *S. cordicollis* (Putzeys)
- 16' Pronotum subcordate, 1.14 times wider than long; shoulders rounded. Habitus as in Fig. 38. South America. .... *S. exspectatus* n. sp.
- 17(13') Elytron with eight setiferous punctures in interval 3 ..... 18
- 17' Elytron with four setiferous punctures in interval 3 ..... 19
- 18(17) Elytron with three setiferous punctures in interval 5. Habitus as in Fig. 39. Brazil ..... *S. darlingtoni* (Kult)
- 18' Elytron with interval 5 asetose. Habitus as in Fig. 40. South America..... *S. subglabra* (van Emden)
- 19(17') Elytral striae 3,4,5 and 6 impressed in basal half of disc, stria 2 present. Body length around 4 mm. Habitus as in Fig. 45. South America..... *S. jedlickai* (Kult)
- 19' Elytral striae 3, 4, 5 and 6 impressed in basal third of disc, stria 2 absent. Body length around 6 mm. Habitus as in Fig. 41. South America ..... *S. glabratus* (Putzeys)

### The puncticollis species-group

This group is defined by the following: mentum with median carina (Fig. 13C) extended slightly distad anterior margin of lateral lobes (except *S. puncticollis* with this structure (putatively) reduced); mental pit organs opened through oval orifices on the mental–submental suture. Males with wide phallus, undefined basal bulb (Fig. 26B) and a prominent, thickly sclerotized endophallic basal sclerite (Fig. 26A).

Female reproductive tract (Fig. 27; cf. Fig. 28) with spermatheca duct (**spd**) relatively short; spermatheca (**sp**) bent in its middle portion, wider from this point and with acute apex.

**Included species**

- S. cordicollis* (Putzeys, 1846)  
*S. darlingtoni* (Kult, 1950)  
*S. exspectatus* sp. n.  
*S. glabratus* (Putzeys, 1866)  
*S. jedlickai* (Kult, 1950)  
*S. laevistriatus* (Fleutiaux & Sallé, 1889)  
*S. maindroni* (Kult, 1950)  
*S. major* sp. n.  
*S. pilosellus* (Kult, 1950)  
*S. puncticollis* (Dejean, 1831)  
*S. rugosus* (Putzeys, 1866)  
*S. subglabra* (van Emden, 1949)

***Semiardistomis cordicollis* (Putzeys, 1846)**

[http://species-id.net/wiki/Semiardistomis\\_cordicollis](http://species-id.net/wiki/Semiardistomis_cordicollis)

Figs 37, 57

*Ardistomis cordicollis* Putzeys, 1846: 646; Lorenz, 2005: 146

*Ardistomus cordicollis* Putzeys: Csiki, 1927: 547; Blackwelder, 1944: 27

*Semiardistomis cordicollis* (Putzeys); Erwin, 2011:233

**Type material.** Holotype at MHNP, pinned, labeled: handwritten “Lectotype *Ardistomis cordicollis* Putz. By Erwin 1976”/ “Lectotype *Clivina labialis* Chd. Des. S.W. Nichols 1984”/ printed in red paper “lectotype”/ handwritten in box “*cordicollis* Putzeys. Nlle Grenade C. Reiche”.

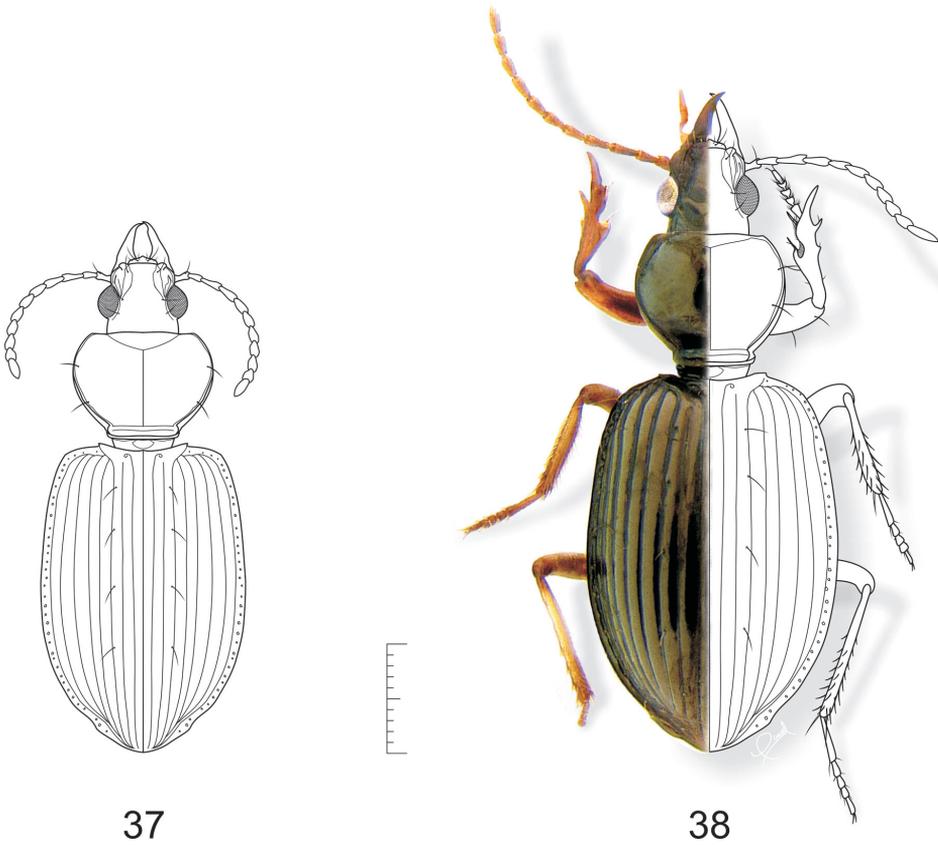
**Type area.** Given by Putzeys (1866: 646) as “Nouvelle Grenade” = Colombia.

**Diagnosis.** Elytral surface smooth, striae complete, impunctate, 4 setiferous punctures in interval 3, humeri square, sides subparallel. Pronotum notably cordiform. Size given by Putzeys as 4.5 mm.

**Habitus.** Fig. 37.

**Note.** The unique type seen appears to be a member of the *puncticollis* group. I have been unable to examine the genitalia, but the general structure is similar to the species of this group (I observed 4 setiferous punctures in interval 3 contrary to Putzeys’ original description which mentions 3 punctures). The species appears to be most similar to *S. exspectatus* sp. n.

**Geographical distribution** (Fig. 57). This species is known only from an unspecified location in Colombia.



**Figures 37–38.** 37 *Semiardistomis cordicollis* (Putzeys) 38 *Semiardistomis expectatus* sp. n. Dorsal aspect. Scale bar 1 mm.

***Semiardistomis darlingtoni* (Kult, 1950)**

[http://species-id.net/wiki/Semiardistomis\\_darlingtoni](http://species-id.net/wiki/Semiardistomis_darlingtoni)

Figs 39, 57

*Ardistomis* (*Semiardistomis*) *darlingtoni* Kult, 1950: 311.

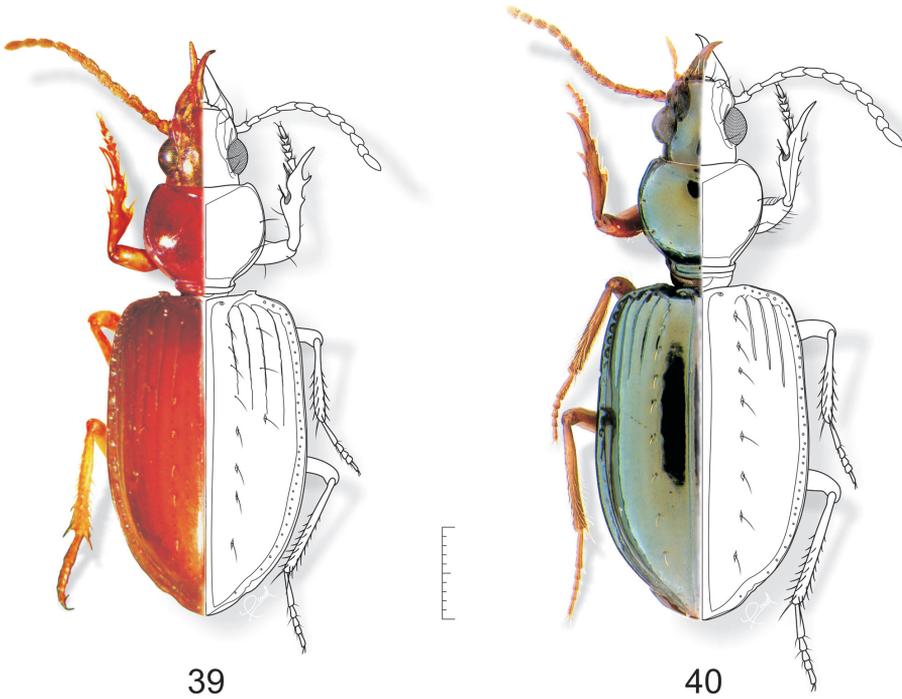
*Semiardistomis darlingtoni* (Kult); Lorenz, 1998: 136.

**Type material.** Holotype male (ADVA), glued on pinned card, genitalia attached in microvial, labeled: handwritten “darlingtoni 57 Det. K. Kult”/ “Darlingtoni Kt. det. K.Kult”/ “ Brasilia Jatahy (Goyas)”/ printed on red paper “TYPE”.

**Type area.** Given by Kult (1950: 312) as “Brasilia, Goyaz”, Brazil

**Diagnosis.** Elytral surface smooth, impunctate, elytral striae impressed in basal third, three setiferous punctures on interval 5 and 8 in interval 3, stria 2 absent, prominent humeral tooth at junction of third stria with marginal channel. Profemur glabrous. Abdominal sternum VII with 5+5 setiferous punctures.

**Habitus.** dorsal aspect, as in Fig. 39.



**Figures 39–40.** **39** *Semiardistomis darlingtoni* (Kult) (teneral) **40** *Semiardistomis subglabra* (van Emden). Dorsal aspect. Scale bar 1 mm.

**Measurements and variation.** Variation of measurements (mm) and ratios for *S. darlingtoni* (n=1) are: HL = 0,70; PL = 1,22; PW = 1,38; EL = 3,42; EW = 2,21; SBL = 5,4; PW/EW = 0,62; PW/PL = 1,13; PL/EL = 0,36; EW/EL = 0,64.

**Geographical distribution** (Fig. 57). Known only from the type area.

**Note.** The holotype is teneral. The species is closely related to *S. subglabra*.

***Semiardistomis expectatus* sp. n.**

urn:lsid:zoobank.org:act:1C3A9901-2441-4E08-9860-9DBE99ADBA6F

[http://species-id.net/wiki/Semiardistomis\\_expectatus](http://species-id.net/wiki/Semiardistomis_expectatus)

Figs 38, 57

**Holotype.** Male (USNM), glued on pinned point, genitalia attached in microvial, labeled: printed "Peru: Madre de Dios Rio Manu, BIOLAT Biol. Sta. Pakitza, 356 m, 24 June 1993 11°56'47"S, 071°17'00"W T. L. Erwin & F. Pfuno"/ "Treading in leaf litter half buried in quick-silt at edge of Que. Trepanatrunco Tr. Tachigali"/ "135 Lot 510"/ "BIOLAT/ COLE 000019005".

**Paratypes.** 19 exemplars (USNM), 2 exemplars (PVCCu) labeled same as the holotype. 14 exemplars (USNM) labeled: printed "Peru: Madre de Dios Rio Manu,

BIOLAT Biol. Sta. Pakitza, 356 m, 11 June 1993 11°56'47"S, 071°17'00"W T. L. Erwin & F. Pfuno" / "Tr. Castañal/ 12.5 Que. Paujil on sand among small stones near stream edge at night Lot 437".

**Type locality.** PERU, Madre de Dios, Rio Manu, 11°56'47"S, 071°17'00"W.

**Etymology.** After have a picture of zoogeographic patterns for some characters from the rest of described species of *Semiardistomis*, appearance of this new form filled a gap in the scenario of the group *puncticollis*. So the specific epithet derived from Latin adjective, meaning expected.

**Diagnosis.** Elytral surface smooth, striae complete, impunctate, 4 setiferous punctures on interval 3, shoulders rounded. Profemur glabrous. Abdominal sternum VII with 4+4 setiferous punctures.

**Habitus.** Fig. 38.

**Measurements and variation.** Variation of measurements (mm) and ratios for *S. expectatus* sp.n. (n=10) are: HL = 0,64–0,68–0,74; PL = 1,09–1,18–1,28; PW = 1,28–1,35–1,44; EL = 3,20–3,37–3,68; EW = 2,14–2,32–2,66; **SBL** = 4,93–5,24–5,70; PW/EW = 0,58; PW/PL = 1,14; PL/EL = 0,35; EW/EL = 0,69.

**Description.** Body piceous with green reflections, mouthparts and antennae testaceous, legs ferrugineous.

Frons, gena, antennal lobes, pronotum, proepisternum and elytra smooth. Prosternum with microsculptural mesh pattern isodiametric. Metasternum and abdominal sterna with microsculpture in form of a shallow transverse mesh pattern.

Anterior marginal setae on pronotal disc equidistant between anterior angles and posterior setae. Elytral disc with 4 setae in interval 3. Abdominal sternum VII with ambulatory setae near base, 2 on each side; inner pair of preapical setae equidistant each other. Profemur glabrous. Ventral surface of protibia with many setae on basal half.

Clypeus with anterior margin concave medially; lateral lobes distinct, projected at the same level of anterior margin. Frontal impressions deep and wide. Supraantennal lobes with median sulci across their length. Eyes prominent. Antennomere 2 shorter than antennomere 3; antennomeres 4–10 about 1.9 times longer than wide.

Mentum with median carina extended distad slightly beyond anterior margin of lateral lobes; pit organs opened through oval orifices to the mental- submental suture.

Pronotum ovate, lateral border reaching base.

Elytra oval, humeri curved, striae complete in their length, impunctate; visible humeral tooth at junction of third stria with marginal channel.

Metathoracic wings macropterous.

Genitalia as described for the *puncticollis* species-group.

**Note.** This species exhibits many plesiotypic character states for the *puncticollis* species-group.

**Geographical distribution** (Fig. 57). Widespread in the northern parts of South America, east of the Andes mountain range.

**Habitat and activity.** Records from labels suggest that the habitat of this species is typical of most species of the genus, living on loose soil adjacent to fresh water bod-

ies. Furthermore the species seems to prefer sandy areas with leaves or stones. Teneral were collected in August.

**Material examined.** In addition to the type material, I have seen 8 specimens from the following localities. ECUADOR. Pichincha Alturiquin Rio Toachi 9–1 Feb 1999 (PBPC, 2). PERU. Loreto. Boca del Rio Samiria 16 Aug 1991 (USNM, 1); Loreto, Hamburgo, Boca del Inglés 150m 23 Aug 1991 (USNM, 1); Loreto, Pithecia 14 Aug 1989 (USNM, 2); Loreto Cmp. Terry 14 May 1990 (USNM, 1). TRINIDAD AND TOBAGO: Trinidad Chatham 17 Jun 1980 (NMNH, 1)

***Semiardistomis glabratus* (Putzeys, 1866)**

[http://species-id.net/wiki/Semiardistomis\\_glabratus](http://species-id.net/wiki/Semiardistomis_glabratus)

Figs 3, 13, 24, 26, 27, 41–43, 57

*Ardistomis glabrata* Putzeys, 1866: 213.

*Ardistomus glabratus* Putzeys: Csiki, 1927: 548; Blackwelder, 1944: 27.

*Ardistomis glabratus* Putzeys: Lorenz, 2005: 146.

*Ardistomis* (*Semiardistomis*) *glabratus* Putzeys: Kult, 1950: 310.

*Ardistomis* (*Semiardistomis*) *balthasari* Kult, 1950: 309. syn. n.

*Semiardistomis glabratus* (Putzeys); Erwin, 2011:235

**Type material.** Lectotype, here designated, female (IRSNB), glued on cardboard pinned, genitalia attached in microvial, labeled: green paper handwritten "A. glabrata Pz. C Mvideo. (A. 21<sup>a</sup>)" / printed "Soc. Ent. Belg. Coll. Putzeys" / printed "Syntype."

Paralectotypes, here designated: one female (IRSNB) labeled as Lectotype; one exemplar (MHNP) labeled: handwritten in box "glabrata Putz. Mvideo".

Holotype of *Semiardistomis balthasari* male (ADVA), glued on cardboard pinned, genitalia attached in microvial, labeled: handwritten "Ardistomis balthasari Kt. Det. K. Kult 1948" / "balthasari Kt. det. K.Kult" / printed in red paper "TYPE" / printed "San Ignacio Missions".

**Type locality.** Given by Putzeys (1866: 213) as "Montevideo", Uruguay.

**Diagnosis.** Body piceous with green brassy reflections. Elytral surface smooth, striae reduced to basal third, impunctate, 4 setiferous punctures on interval 3, stria 2 absent. Profemur glabrous. Abdominal sternum VII with 5+5 setiferous punctures.

**Habitus.** dorsal aspect, as in Fig. 41.

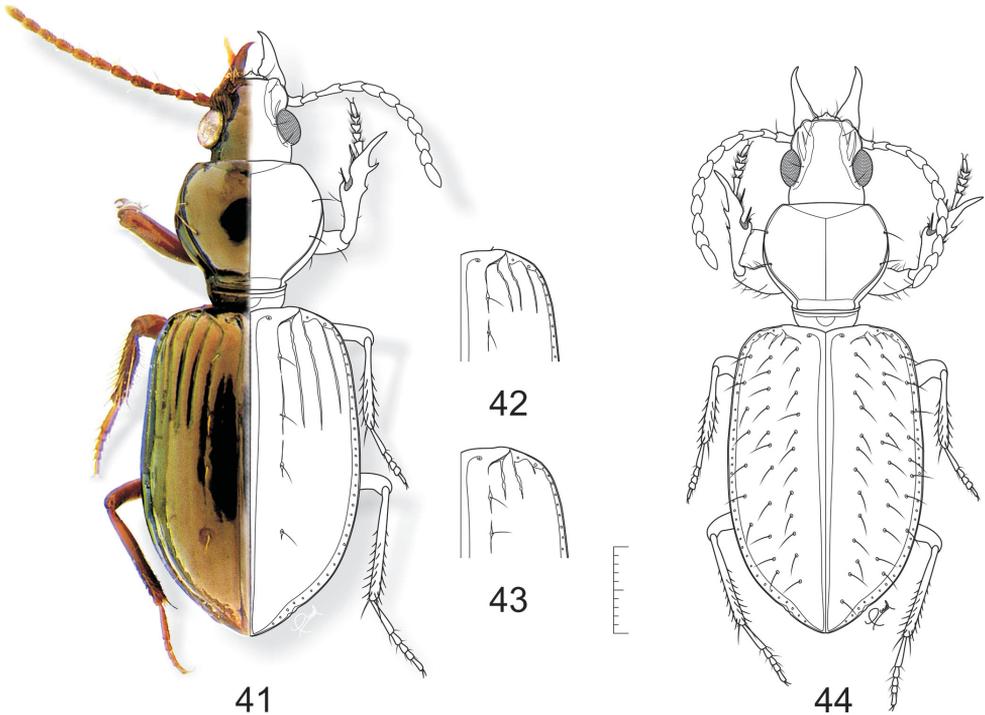
**Mouthparts.** **Labrum**, dorsal aspect, as in Fig. 3. **Labium**, as in Fig. 13A; ligula, enlarged, as in Fig. 13B.

**Legs.** male protarsus as in Fig. 24.

**Male genitalia.** as in Fig. 26.

**Female genitalia.** as in Fig. 27.

**Measurements and variation.** Variation of measurements (mm) and ratios for *S. glabratus* (n=7) are: HL = 0,70–0,76–0,80; PL 1,44–1,51–1,60; PW 1,53–1,68–1,83;



**Figures 41–44.** 41–43 *Semiardistomis glabratus* (Putzeys) 41 exemplar from Peru, Loreto 42 exemplar from Argentina, Misiones 43 exemplar from Uruguay, Montevideo 44 *Semiardistomis pilosellus* (Kult). Dorsal aspect. Scale bar 1 mm.

EL 3,56–3,84–4,13; EW 2,50–2,60–2,73; SBL 5,76–6,11–6,53; PW/EW 0,65; PW/PL 1,11; PL/EL 0,39; EW/EL 0,68.

Variation of measurements (mm) and ratios for *S. glabratus* identified in collections as *S. balthasari* (n= 11) are: HL = 0,67–0,78–0,86; PL 1,12–1,32–1,44; PW 1,34–1,49–1,63; EL 3,33–3,66–3,87; EW 2,08–2,36–2,56; SBL 5,15–5,76–6,11; PW/EW 0,63; PW/PL 1,13; PL/EL 0,36; EW/EL 0,65.

Kult (1950) separated *S. balthasari* from *S. glabratus* on the basis of two character states: differences in body size and length of elytral striae. Measurements show moderate variation in size between the populations studied (see above) but the ratios show no variations in body proportions. After studying different populations across South America, I found that the length of the elytral striae varies between populations from specimens with striae 4, 5 and 6 extended to the second dorsal puncture in interval 3 (Fig. 42) to specimens with striae 4 and 5 almost extended only to the first dorsal pore in interval 3, and stria 6 almost obliterated (Fig. 43). The pattern of variation is clinal from north to south.

**Habitat.** Data from labels suggest that the species lives along standing water bodies and swamps.

**Geographical distribution** (Fig. 57). Widespread in South America, east of the Andes mountain range, from northern Brazil, north of the Equator, to Uruguay, south of the Tropic of Capricorn.

**Material examined.** ARGENTINA. San Ignacio Misiones (ADVA, 2) Rio Salado (IRSNB, 12) Cordoba Argüello Sept 58 (MHNP, 8). BRAZIL. Oberaba (IRSNB, 9). PERU. Loreto 1 km E Hamburgo, Boca del Ingles Camp, 150 m 23 Aug 1991 (USNM, 8). Loreto, Pithecia 14 Aug 1989 (USNM, 5). Madre de Dios Pakitza 07 Oct 1990 (USNM, 5). URUGUAY. Montevideo (IRSNB, 5) (MHNP, 2). VENEZUELA. Amazonas, Dpto Rio Negro 28 Jan 1985 (USNM, 4)

***Semiardistomis jedlickai* (Kult, 1950)**

[http://species-id.net/wiki/Semiardistomis\\_jedlickai](http://species-id.net/wiki/Semiardistomis_jedlickai)

Figs 45, 57

*Ardistomis* (*Semiardistomis*) *jedlickai* Kult, 1950: 313.

*Semiardistomis jedlickai* (Kult): Lorenz, 1998: 136.

**Type material.** Holotype at ADVA, glued on pinned card (specimen without genitalia), labeled: handwritten “*Ardistomis jedlickai* Kt. Det. K. Kult 1948”/ “*jedlickai* Kt. det. K.Kult”/ printed in red paper “TYPE”/ printed “Corumba Matt. Grosso.”

**Type locality.** Given by Kult (1950: 313) as “Brasilia, Matto Grosso, Corumba”, Brazil.

**Diagnosis.** Body piceous with green brassy reflections. Elytral surface smooth, striae distinct in basal half only, impunctate, 4 setiferous punctures on interval three, stria 2 distinct. Profemur glabrous. Abdominal sternum VII with 4+4 setiferous punctures. Size small.

**Habitus.** dorsal aspect, as in Fig. 45.

**Measurements and variation.** Variation of measurements (mm) and ratios for *S. jedlickai* (n=6) are: HL = 0,50–0,51–0,53; PL 0,96–1,00–1,07; PW 0,99–1,17–1,28; EL 2,30–2,55–2,62; EW 1,70–1,82–1,92; **SBL** 3,82–4,07–4,19; PW/EW 0,64; PW/PL 1,16; PL/EL 0,39; EW/EL 0,71.

**Geographical distribution** (Fig. 57). The known range of this species is confined to central South America.

**Material examined.** In addition to holotype: BRAZIL. Matto Grosso Jacare P. N. Xingu at ligh (USNM, 11) PERU. Madre de Dios Pakitza 14 Nov 1990 (USNM, 6). Madre de Dios Rio Manu BIOLAT Pakitza 356m 24 Jun 1993 (USNM, 5).

***Semiardistomis laevistriatus* (Fleutiaux & Sallé, 1889)**

[http://species-id.net/wiki/Semiardistomis\\_laevistriatus](http://species-id.net/wiki/Semiardistomis_laevistriatus)

Figs 47, 57

*Ardistomis laevistriatus* Fleutiaux & Sallé, 1889: 363; Leng & Mutchler, 1914: 395; Kult, 1950: 307; Erwin & Sims, 1984: 427; Lorenz, 2005: 146.

*Ardistomus laevistriatus* Fleutiaux & Sallé: Csiki, 1927: 548; Blackwelder, 1944: 27.

*Semiardistomis laevistriatus* (Fleutiaux & Sallé); Erwin, 2011:236

**Type material.** Lectotype, here designated, male (MHNP), glued on pinned card, labeled: printed “Type”; printed “Guadeloupe Delauney”; handwritten “Ardistomis laevistriata Fleut. & S. type”; “Ardistomis laevistriata Fleut. 47 det. K. Kult type”; “Lectotype *Ardistomis laevistriata* F. & S. des. S. W. Nichols 1984.”

Paralectotype, here designated, female (MHNP), glued on pinned card, genitalia attached in microvial, labeled: handwritten on paper circle “Guadeloupe Delauney”; printed “ex Musaeo A. Sallé 1897”; “Paralectotype *Ardistomis laevistriata* F. & S. des. S. W. Nichols 1984”.

**Type locality.** Given by Fleutiaux & Sallé (1889: 364) as “Les Bains- Jaunes”, Guadeloupe, Lesser Antilles.

**Diagnosis.** Body ferrugineous dark brown. Elytral surface smooth, striae obliterated in apical fifth, impunctate, 2 setiferous punctures on interval 3, stria 2 distinct, shoulders rounded. Metathoracic wings reduced. Profemur glabrous. Abdominal sternum VII with 5+5 setiferous punctures.

**Habitus.** dorsal aspect, as in Fig. 47.

**Measurements and variation.** Variation of measurements (mm) and ratios for *S. laevistriatus* (n=4) are: HL = 0,65–0,68–0,70; PL = 1,13–1,20–1,28; PW = 1,33–1,39–1,45; EL = 2,95–3,05–3,15; EW = 2,00–2,05–2,10; **SBL** = 4,73–4,93–5,13; PW/EW = 0,68; PW/PL = 1,16; PL/EL = 0,39; EW/EL = 0,67.

**Habitat.** Nichols (1988a) reported that adults of *S. laevistriatus* are found under rotting bark. The species is probably associated with wet forest leaf litter.

**Geographical distribution (Fig. 57).** Restricted to the Islands of Guadeloupe in the Lesser Antilles.

**Material examined.** GUADELOUPE. Guadeloupe L. Dufau (ADVA, 1) Bains-Jaunes (USNM, 2). Guadeloupe Marie (MHNP, 1).

### *Semiardistomis maindroni* (Kult, 1950)

[http://species-id.net/wiki/Semiardistomis\\_maindroni](http://species-id.net/wiki/Semiardistomis_maindroni)

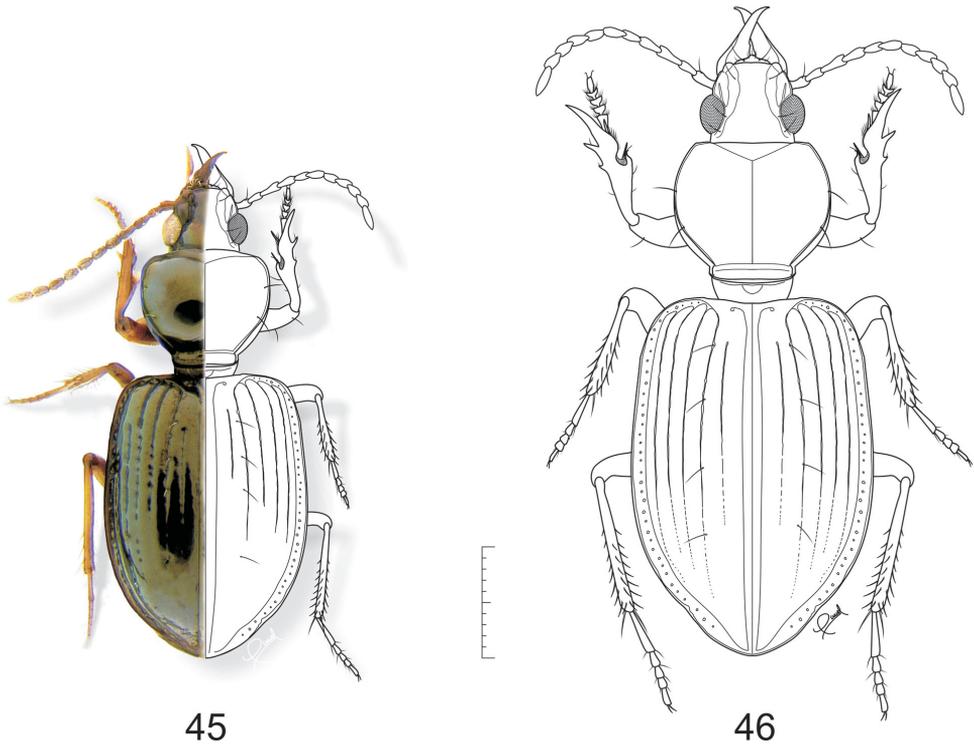
Figs 46, 57

*Ardistomis (Semiardistomis) maindroni* Kult, 1950: 312.

*Semiardistomis maindroni* (Kult 1950): Lorenz, 1998: 136.

**Type material.** Holotype at ADVA, glued on cardboard pinned, genitalia attached in microvial, labeled: handwritten “*Ardistomis maindroni* Kt. Det. K. Kult 1948”/ “maindroni Kt. det. K.Kult”/ printed in red paper “TYPE”/ printed “Cuyaba Matt. Grosso”.

Paratypes. two exemplars labeled as holotype (not checked) designated by Kult in “collection of National Museum of Paris (ex Maindron- Babault)”.



**Figures 45–46.** **45** *Semiardistomis jedlickai* (Kult) **46** *Semiardistomis maindroni* (Kult). Dorsal aspect. Scale bar 1 mm.

**Type locality.** Given by Kult (1950: 312) as “Brasilia, Matto Grosso, Cuyaba”, Brazil.

**Diagnosis.** Body piceous with green reflections. Elytral surface covered with isodiametric mesh pattern, striae obliterated in apical half, impunctate, 4 setiferous punctures on interval 3, stria 2 present. Profemur glabrous. Abdominal sternum VII with 4+4 setiferous punctures.

**Habitus.** dorsal aspect, as in Fig. 46.

**Measurements and variation.** Variation of measurements (mm) and ratios for *S. maindroni* (n=9) are: HL = 0,63–0,66–0,71; PL = 1,18–1,25–1,32; PW = 1,31–1,44–1,57; EL = 3,10–3,38–3,64; EW = 2,02–2,22–2,40; **SBL** = 4,93–5,30–5,60; PW/EW = 0,65; PW/PL = 1,15; PL/EL = 0,37; EW/EL = 0,67.

**Geographical distribution (Fig. 57).** The known range of this species extends from central Brazil southward of the Tropic of Capricorn to central Argentina.

**Material examined.** ARGENTINA. Cordoba Arguello Nov 1958 (MHNP, 5); Tucuman Nov 1951 (MHNP, 6); Chaco prov. Capitán Solari env. 3–7 Feb. 2004 (PBPC, 2). BRAZIL. Porta da Bocca am Laguna de Jigua Pernambuco Jul 1937 (BMNH, 4).

***Semiardistomis major* sp. n.**

urn:lsid:zoobank.org:act:

[http://species-id.net/wiki/Semiardistomis\\_major](http://species-id.net/wiki/Semiardistomis_major)

Figs 49, 57

**Holotype.** Male (USNM), glued on pinned point, genitalia attached in microvial, labeled: printed "Peru: Loreto, Cmp. S. Branch, 11 May 90 75°20'W, 05°12'S T. L. Erwin Coll"/ "Running at night on muddy bank of Rio Samiria–Igapó forest soil organic, grasses"/ "ADP 94456".

**Paratypes.** 8 exemplars (USNM), 2 exemplars (PVCCu) labeled as the holotype.

**Etymology.** The specific epithet is a Latin adjective alluding to the large size of the adults.

**Diagnosis.** Elytral surface smooth, striae complete, impunctate, 4 setiferous punctures on interval 3, shoulders rounded. Profemur glabrous. Abdominal sternum VII with 5+5 setiferous punctures.

**Habitus.** dorsal aspect, as in Fig. 49.

**Measurements and variation.** Variation of measurements (mm) and ratios for *S. major* sp. n. (n=11) are: HL = 0,93–0,97–0,99; PL = 1,50–1,61–1,66; PW = 1,92–1,98–2,02; EL = 4,47–4,71–4,80; EW = 3,13–3,23–3,33; **SBL** = 6,90–7,28–7,46; PW/EW = 0,61; PW/PL = 1,23; PL/EL = 0,34; EW/EL = 0,69.

**Description.** Body piceous with green reflections, mouthparts and antennae testaceous, legs ferrugineous.

Frons, gena, antennal lobes, pronotum, prosternum, proepisternum, elytra, metasternum and abdominal segments smooth.

Anterior marginal setae on pronotal disc closer to posterior setae than to anterior angles. Elytral disc with 5 setae in interval 3. Abdominal sternum VII with setae near base, 2 on each side; distance between inner pair of preapical setae 0.6 times that between inner and outer setae. Profemur glabrous. Ventral surface of protibia with many setae on basal half.

Clypeus with anterior margin concave medially; lateral lobes distinct, behind level of anterior margin. Frontal impressions deep and wide. Supraantennal lobes with median sulci impressed in basal half. Eyes prominent. Antennomere 2 shorter than antennomere 3; antennomeres 4–10 about 1.8 times longer than wide.

Mentum with median carina extended distad slightly beyond anterior margin of lateral lobes; pit organs opened through oval orifices to the mental- submental suture.

Pronotum ovate, lateral border extended to base.

Elytra oblong, humeri square, striae complete in their length, impunctate.

Metathoracic wings macropterous.

Genitalia in both sexes as described for the *puncticollis* species-group.

**Geographical distribution** (Fig. 57). Known only from the region of Loreto, in Amazonian Peru.

**Habitat and activity.** Records from labels suggest that the habitat of *S. major* is typical of most members of the genus, living on loose soil adjacent to fresh water bodies. In this case data indicate a river bank with organic soil. Active at night.

**Material examined.** PERU. Loreto. Rio Samiria Cocha Shinguito near lake margin 25 Aug 1991 (USNM, 1)

***Semiardistomis pilosellus* (Kult, 1950)**

[http://species-id.net/wiki/Semiardistomis\\_pilosellus](http://species-id.net/wiki/Semiardistomis_pilosellus)

Figs 44, 57

*Ardistomis* (*Semiardistomis*) *pilosellus* Kult, 1950: 317.

*Semiardistomis pilosellus* (Kult): Lorenz, 1998: 136.

**Type material.** Holotype female (IRSNB), pinned, genitalia attached in microvial, labeled: green paper handwritten “pilosella. P.”/ green paper handwritten “Mvid Arch.”/ handwritten “Ardistomis pilosella 47 det. K. Kult”/ printed “Soc. Ent. Belg. Coll. Putzeys” red paper printed “TYPE”/ printed “Holotype *Ardistomis pilosella* Kult des. S. W. Nichols 1984”

Paratypes. Male (ADVA), pinned, genitalia attached in microvial, labeled: handwritten “Montevideo leg. Archavaleta”/ green paper handwritten “Mvid Arch.”/ handwritten “Ardistomis pilosella 47 det. K. Kult”/ handwritten “pilosellus Kt det. K. Kult”/ printed “Soc. Ent. Belg. Coll. Putzeys”/ red paper printed “Paratype”.

**Type locality.** Given by Kult (1950: 317) as “Uruguay, Montevideo”

**Diagnosis.** Body piceous with green brassy reflections. Elytral surface smooth, striae 2–6 erased, surface covered with setiferous punctures. Profemur setose. Abdominal sternum VII with 5+5 setiferous punctures.

**Habitus.** dorsal aspect, as in Fig. 44.

**Measurements and variation.** Variation of measurements (mm) and ratios for *S. pilosellus* (n=6) are: HL = 0,70–0,75–0,80; PL = 1,16–1,23–1,31; PW = 1,30–1,35–1,44; EL = 3,40–3,50–3,64; EW = 2,12–2,19–2,27; **SBL** = 5,26–5,48–5,70; PW/EW = 0,62; PW/PL = 1,17; PL/EL = 0,37; EW/EL = 0,64.

**Geographical distribution** (Fig. 57). This species is found south of the Rio de la Plata–Uruguay basin, south of the Tropic of Capricorn.

**Material examined.** ARGENTINA. Pronunciamiento Prov. Entre Rios (MHNP, 12).

***Semiardistomis puncticollis* (Dejean, 1831)**

[http://species-id.net/wiki/Semiardistomis\\_puncticollis](http://species-id.net/wiki/Semiardistomis_puncticollis)

Figs 48, 57

*Clivina puncticollis* Dejean, 1831: 508; Lectotype designated by Bousquet (2006: 14).

*Ardistomis puncticollis* (Dejean): Putzeys, 1846: 647; LeConte, 1857: 80; LeConte, 1879: 32; Blatchley, 1910: 63; Downie and Arnett, 1996: 112.

*Ardistomus puncticollis* (Dejean): Csiki, 1927: 548.

*Semiardistomis puncticollis* (Dejean); Erwin, 2011:238

**Type material.** Lectotype at (MHNP), glued on tip pinned, labeled: printed “Lectotype”; handwritten “36”; “puncticollis Dej. Am. bor. Dej.”; “Lectotype Clivina puncticollis Dej. des. S. W. Nichols 1984.”.

**Type area.** Given by Dejean (1831: 509) as “Amérique septentrionale.”

**Diagnosis.** Body piceous with green reflections. Head with several supraorbital setae. Pronotum with more than two premedial setiferous punctures, pronotal disc with several setiferous punctures. Elytral surface completely smooth, striae absent, punctures deeply impressed, setiferous. Abdominal sternum VII plurisetose. Wing atrophy reported by Nichols (1998a: 193). Body length given by Bousquet (2006: 14) as 4.8–6.5 mm.

**Habitus.** dorsal aspect, as in Fig. 48.

**Geographical distribution** (Fig. 57). Known only from southeastern United States and adjacent northeastern Mexico (Nichols, 1988a; Bousquet, 2006).

**Material examined.** USA. Enterprise, Fla 13 5 (USNM, 2) Crescent City, Fla (USNM, 1). L. Harney, Fla. May (USNM, 2) San Jacinto Co. Tex, Jun 68 (USNM, 3) Etats unis Guer (MHNP, 5).

### *Semiardistomis rugosus* (Putzeys, 1866)

[http://species-id.net/wiki/Semiardistomis\\_rugosus](http://species-id.net/wiki/Semiardistomis_rugosus)

Figs 50, 57

*Ardistomis rugosa* Putzeys, 1866: 210.

*Ardistomus rugosus* Putzeys: Csiki, 1927: 549; Blackwelder, 1944: 27.

*Ardistomis* (*Semiardistomis*) *rugosus* Putzeys: Kult, 1950: 302; Lorenz, 2005: 146.

*Semiardistomis rugosus* (Putzeys); Erwin, 2011:238

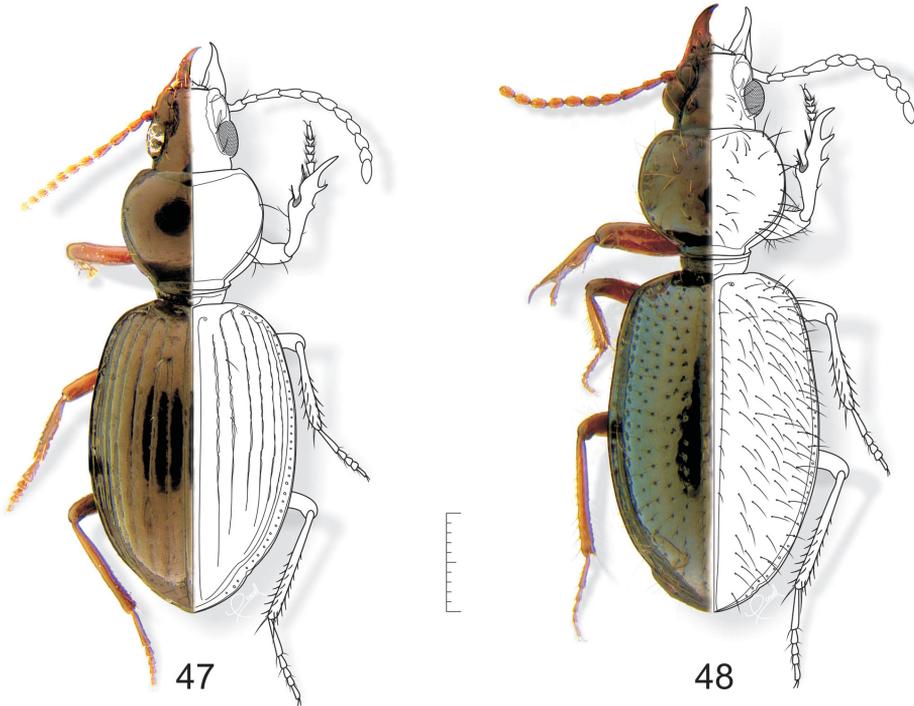
**Type material.** Lectotype, here designated, female (IRSNB), glued on pinned card, head and pronotum missing, genitalia attached in microvial, labeled: green paper handwritten “rugosa. Pz. Sta Cath.(Dhr.)”/ printed “Soc. Ent. Belg. Coll. Putzeys”/ “Syntype”/ “Lectotype *Ardistomis rugosa* Putz. des. S. W. Nichols 1984”.

Putzeys (1866: 211) mentioned two specimens in his description but I have located only one.

**Type locality.** Given by Putzeys (1866: 211) as “Ste Catherine (Colonie Blumenuau)”, Brazil.

**Diagnosis.** Body piceous. Elytral surface smooth, impunctate, elytral striae complete, 4 setiferous punctures on interval 3, stria 2 absent, prominent humeral tooth at junction of third stria with marginal channel. Profemur glabrous. Abdominal sternum VII with 5+5 setiferous punctures.

**Habitus.** dorsal aspect, as in Fig. 50.



**Figures 47–48.** **47** *Semiardistomis laevistriatus* (Fleutiaux & Salle) **48** *Semiardistomis puncticollis* (Dejean). Dorsal aspect. Scale bar 1 mm.

**Measurements and variation.** Variation of measurements (mm) and ratios for *S. rugosus* (n=2) are: HL = 0,71; PL = 1,35; PW = 1,51; EL = 3,72–3,73–3,75; EW = 2,34–2,42–2,50; **SBL** = 5,78; PW/EW = 0,64; PW/PL = 1,12; PL/EL = 0,36; EW/EL = 0,63.

**Geographical distribution** (Fig. 57). Known only for the Santa Catarina region in Brazil.

**Material examined.** BRAZIL. Hansa Humboldt Sta. Catarina 3. 1937 (BMNH, 1).

***Semiardistomis subglabra* (van Emden, 1949)**

[http://species-id.net/wiki/Semiardistomis\\_subglabra](http://species-id.net/wiki/Semiardistomis_subglabra)

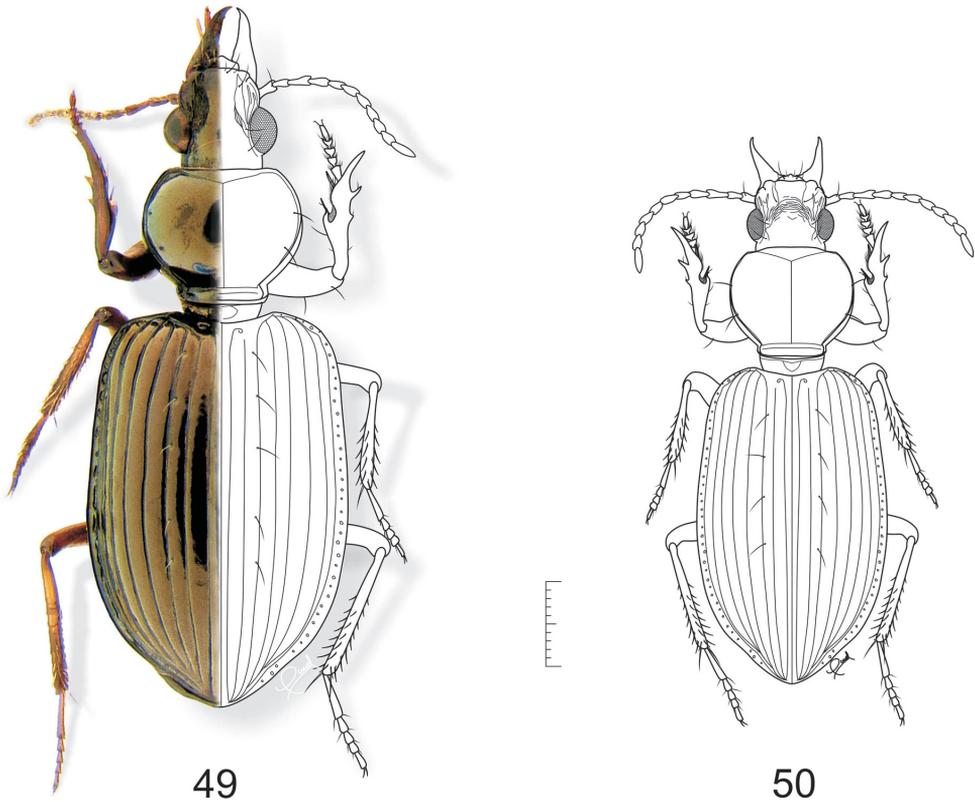
Figs 40, 57

*Ardistomis subglabra* van Emden, 1949: 863; Lorenz, 2005: 146.

*Ardistomis* (*Semiardistomis*) *vlastae* Kult, 1950: 310 **syn. n.**

*Semiardistomis subglabra* (van Emden); Erwin, 2011: 239

**Type material.** Holotype female (BMNH), glued on pinned point, without head, genitalia attached in microvial, labeled: green paper handwritten “subglabra Emd.”/ red paper handwritten “*Ardistomis subglabra* type. Emd.”/ green paper handwritten “amazon”/ printed red circle “Holotype”/ printed “Gesch. 2. 1934 von Prof. Noesske”/



**Figures 49–50.** 47 *Semiardistomis major* sp.n. 50 *Semiardistomis rugosus* (Putzeys). Dorsal aspect. Scale bar 1 mm.

printed “F. van Emden Bequest. B.M. 1960- 129”/ printed “Holotype *Ardistomis subglabra* Emden des. S.W. Nichols 1984”.

Holotype of *Semiardistomis vlastae* male (ADVA), glued on pinned card, genitalia attached in microvial, labeled: handwritten “*vlastae* Kt. det. K.Kult”/ printed in red paper “TYPE”/ printed “Chaco Pilcomayo 5-6 Jan. 1938 Tippmann”.

**Type area.** Given by van Emden (1949: 863) as “Amazonas”, Brazil.

**Diagnosis.** Body piceous with green bluish reflections. Elytral surface smooth, impunctate, striae distinct on basal third only, impunctate, 8 setiferous punctures on interval 3, stria 2 absent. Profemur hirsute. Abdominal sternum VII with 6+6 setiferous punctures.

**Habitus.** dorsal aspect, as in Fig. 40.

**Measurements and variation.** Variation of measurements (mm) and ratios for *S. subglabra* (n=4) are: HL = 0,60–0,70–0,78; PL = 1,12–1,21–1,28; PW = 1,23–1,34–1,44; EL = 3,50–3,64–4,75; EW = 2,05–2,25–2,40; **SBL** = 5,28–5,52–5,78; PW/EW = 0,60; PW/PL = 1,11; PL/EL = 0,33; EW/EL = 0,62.

**Geographical distribution (Fig. 57).** Widespread in South America.

**Material examined.** ARGENTINA. Chaco Pilcomayo 5-6 Jan 1938 (ADVA, 1). BRAZIL. Pantanal Jun 1986 (PBPC, 2).

## The *labialis* species-group

This group is defined by the following: mentum with median carina (Fig. 14C) not extended distad, beyond anterior margin of mental tooth; mental pit organs (Fig. 14A) opened through oval orifices in basal part of mentum; male genitalia with a slender phallus (Fig. 25A) with clearly delineated basal bulb (**bp**) and basal sclerite (**bs**) of the endophallus thin and slightly sclerotized (Fig. 25B); female reproductive tract (Fig. 28; cf. Fig. 27) with spermatheca duct (**spd**) relatively long, wide, bent in its distal portion, spermatheca very narrow, elongate, markedly convoluted in a series of tight twists. The species-group name is based on that of *S. labialis*, the type species of *Semiardistomis*, being this group nominotypical.

## Morphological note

As in the *puncticollis* group, the mental carina shows a reduction pattern northward with this prolongation markedly reduced in *S. viridis*.

## Included species

- S. cyaneolimbatus* (Chevrolat, 1863)
- S. deletus* (Putzeys, 1846)
- S. flavipes* (Dejean, 1831)
- S. labialis* (Chaudoir, 1837)
- S. pallipes* (Dejean, 1831)
- S. propinquus* (Putzeys, 1866)
- S. semipunctatus* (Dejean, 1831)
- S. viridis* (Say, 1823)

## *Semiardistomis cyaneolimbatus* (Chevrolat, 1863)

[http://species-id.net/wiki/Semiardistomis\\_cyaneolimbatus](http://species-id.net/wiki/Semiardistomis_cyaneolimbatus)

Figs 51, 53, 59

*Ardistomis cyaneolimbatus* Chevrolat, 1863: 194; Putzeys, 1866: 211; Leng and Mutchler, 1914: 395; Darlington, 1934: 71; Erwin and Sims, 1984: 427; Lorenz, 2005: 146.

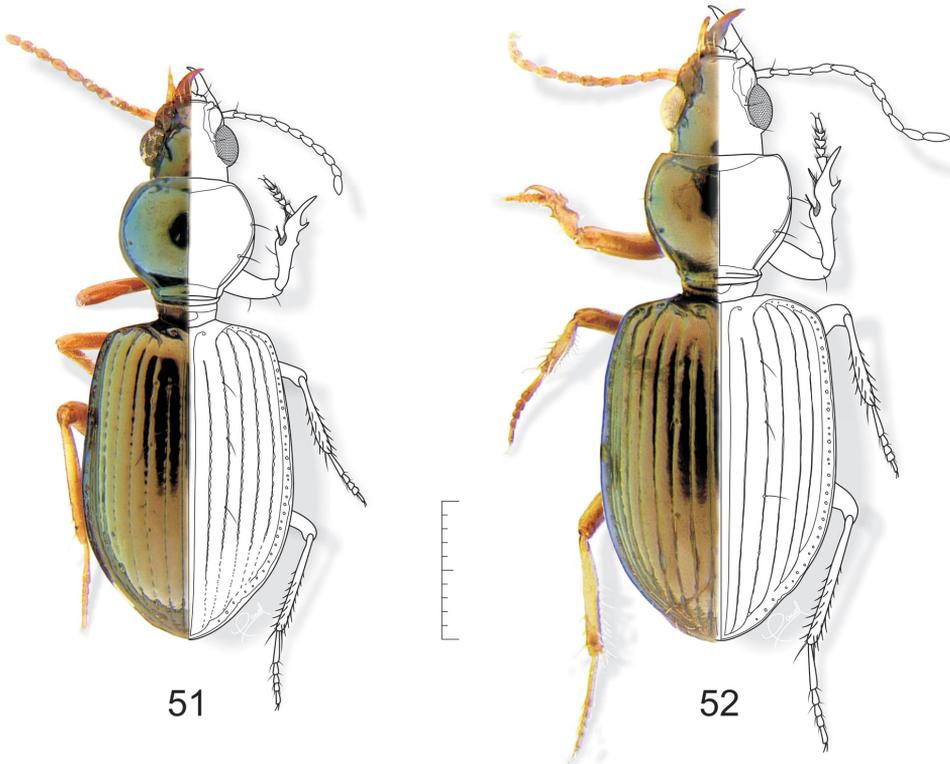
*Ardistomus cyaneolimbatus* Chevrolat: Csiki, 1927: 548; Blackwelder, 1944: 27.

*Ardistomis (Semiardistomis) cyaneolimbatus* Chevrolat: Kult, 1950: 300, 316.

*Ardistomis gundlachii* Putzeys, 1866: 212; Gundlach, 1891: 25. *Nomen nudum*.

*Semiardistomis cyaneolimbatus* (Chevrolat); Erwin, 2011:233

**Type material.** Lectotype, here designated, male (HECO), pinned, labeled: green paper handwritten "Cuba Poey"/ handwritten "Aspidoglossa cyaneolimbata



**Figures 51–52.** 51 *Semiardistomis cyaneolimbatus* (Chevrolat) 52 *Semiardistomis pallipes* (Dejean). Dorsal aspect. Scale bar 1 mm.

Chevt. Type Cuba 1461.”/ printed “Chevrolat Carabidae. Fr. V. d. Poll. Pres. 1909, E. B. Poulton”/ printed “type col: 132 *Ardistomus cyaneolimbata* Chev. Hope Dept. Oxford”/ printed “Lectotype *Ardistomus cyaneolimbatus* Chev. des. S.W. Nichols 1984”..

**Type locality.** Given by Chevrolat (1863: 194) as “environs de la Havane”, Cuba.

**Diagnosis.** Body piceous with green brassy reflections, pronotum with bluish reflections. Elytral surface smooth, striae complete but indistinct at apex, punctures moderately impressed, 3 setiferous punctures on interval 3. Abdominal sternum VII with 4+4 setiferous punctures.

**Habitus.** dorsal aspect, as in Fig. 51.

**Measurements and variation.** Variation of measurements (mm) and ratios for *S. cyaneolimbatus* (n=7) are: HL = 0,52- 0,59- 0,60; PL = 1,00- 1,03- 1,10; PW = 1,10- 1,18- 1,30; EL = 2,44- 2,72- 2,84; EW = 1,60- 1,75- 1,88; **SBL** = 3,96- 4,34- 4,54; PW/EW = 0,67; PW/PL = 1,14; PL/EL = 0,38; EW/EL = 0,64.

**Geographical distribution** (Fig. 59): West Indies: Cuba, Cayman Islands and Haiti, in Hispaniola.

**Habitat and activity.** I collected this species along margins of the river Itabo, Isla de Pinos, Cuba (Fig. 53); the adults were active during the day on wet, organic soil. Other specimens were collected about 8 meters from the river margins under leaf litter in shady gallery forest.

**Material examined.** CUBA. Cuba Rhl (IRSNB, 4); Cuba Chd (MHNP, 1); *gundlachii* Ptz. Cuba Type (MHNP, 1); Isla de Pinos, márgenes del Rio Itabo 23 Feb. 1999 (PVCCu: 14). HAITI. St. Dominique (MHNP, 1).

***Semiardistomis deletus* (Putzeys, 1846)**

[http://species-id.net/wiki/Semiardistomis\\_deletus](http://species-id.net/wiki/Semiardistomis_deletus)

Figure 58

*Ardistomis deleta* Putzeys, 1846: 648; 1866: 213.

*Ardistomus deletus* Putzeys: Csiki, 1927: 548; Blackwelder, 1944: 27.

*Ardistomis deletus* Putzeys: Lorenz, 2005: 146.

*Ardistomis (Semiardistomis) deletus* Putzeys: Kult, 1950: 314, 316.

*Ardistomis (Semiardistomis) emdeni* Kult, 1950: 314 **syn. n.**

*Semiardistomis deletus* (Putzeys); Erwin, 2011:234

**Type material.** Lectotype, here designated, at MHNP, glued on cardboard, labeled: green paper handwritten "Deleta Putz Bresil Reiche"/ handwritten " Lectotype *Ardistomis deleta* Putz. des. S.W. Nichols 1984"/ handwritten on box "Deleta Reiche Brésil Chevrol"/ red paper printed "Lectotype".

Paralectotype, here designated, at HECO, pinned, labeled: green paper handwritten "Campos"/ green paper handwritten "deleta (Reiche) Putz 130, 13 Brasilia type"/ red paper handwritten "deleta"/ printed "Chevrolet Carabidae. Fr. V. d. Poll. Pres. 1909, E. B. Poulton"/ printed "17"/ handwritten "Paralectotype *Ardistomis deleta* Putz. des. S.W. Nichols 1984"/ handwritten "Type col: 805 *Ardistomus deleta* Putzeys".

Holotype of *Semiardistomis emdeni* female (ADVA), glued on pinned card, genitalia attached in microvial, labeled: handwritten "a. emdeni Kt. det. K.Kult, 1948"/ printed on red paper "TYPE"/ printed "Corumba Matt. Grosso".

**Type area.** Given by Putzeys (1846: 648) as "Brésil"

**Diagnosis.** Body piceous with green brassy reflections. Elytral surface with isodiametric mesh pattern, striae impressed in basal eighth, punctures well impressed in basal half, 3 setiferous punctures on interval 3. Abdominal sternum VII with 4+4 setiferous punctures.

**Measurements and variation.** Variation of measurements (mm) and ratios for *S. deletus* (n=17) are: HL = 0,53- 0,63- 0,74; PL = 0,80- 1,06- 1,20; PW = 0,96- 1,19- 1,32; EL = 2,56- 3,11- 3,60; EW = 1,60- 1,93- 2,28; **SBL** = 3,98- 4,80- 5,44; PW/EW = 0,62; PW/PL = 1,12; PL/EL = 0,34; EW/EL = 0,62.

Variation of measurements (mm) and ratios for type series of *S. emdeni* (n=5) are: HL = 0,58-0,61-0,64; PL = 1,02-1,05-1,09; PW = 1,12-1,20-1,28; EL = 2,78-



**Figure 53.** Habitat of *Semiardistomis cyaneolimbatus* (Chevrolat) at Rio Itabo, Isla de Pinos, Cuba.

2,95–3,14; EW = 1,76–1,89–2,02; **SBL** = 4,38–4,61–4,86; PW/EW = 0,64; PW/PL = 1,15; PL/EL = 0,36; EW/EL = 0,64.

Kult (1950) separated *S. emdeni* from *S. deletus* based on differences in body proportions. My measurements indicate that the differences noted are not significant. In fact, it is difficult in this species–group to distinguish any forms based on body proportions since measurements for all species overlap. Diagnostic combination for this species is expressed in an extreme sense, so intermediate forms are found between this point and *S. flavipes* or *S. semipunctatus*.

**Geographical distribution** (Fig. 58). This species is known from southeastern South America, south of the Tropic of Capricorn.

**Material examined.** ARGENTINA. Corrientes, Lago Ibera & Santo Tome 26 Sep 1997 (ADVA, 22); Rio Salado (IRSNB, 3); Misiones, Posadas Nov 1962 (MHNP, 6); Formosa Dec 1953 (MHNP, 11). BRAZIL. Nova Teutonia Dec. 1952 (MHNP, 8); Bresil (MHNP, 9); Sta Catarina Nova Teutonia Nov. 1972 (CAS, 17). PARAGUAY. Paraguari Ybycui, La Rosada 13 Apr. 1980 (USNM, 43); Dep. Central. Caacupé road Arroyo Yagua Resa 10 Apr. 1980 (USNM, 2) URUGUAY. Montevideo (IRSNB, 1).

***Semiardistomis flavipes* (Dejean, 1831)**

[http://species-id.net/wiki/Semiardistomis\\_flavipes](http://species-id.net/wiki/Semiardistomis_flavipes)

Fig. 58

*Clivina flavipes* Dejean, 1831: 510.

*Ardistomis flavipes* (Dejean): Putzeys 1846: 646; Lorenz, 2005: 146.

*Ardistomus flavipes* (Dejean): Csiki, 1927: 548; Blackwelder, 1944: 27.

*Ardistomis aenea* Putzeys, 1866: 212 syn. n.

*Ardistomis* (*Semiardistomis*) *brittoni* Kult, 1950: 316 syn. n.

*Ardistomis* (*Semiardistomis*) *marani* Kult, 1950: 315 syn. n.

*Semiardistomis flavipes* (Dejean); Erwin, 2011:234

**Type material.** Holotype at MHNP, pinned, labeled: handwritten “Holotype *Clivina flavipes* Dej. des. S.W. Nichols 1984”/ handwritten on box “*flavipes* Dej. Brésil C. Dejean”/ red paper printed “Holotype”.

Lectotype of *Semiardistomis aenea*, here designated, at IRSBN, glued on pinned card, labeled: green paper handwritten “R. Jan. Stevens”/ printed “Soc. Ent. Belg. Coll. Putzeys”. Paralectotypes, here designated: 4 at IRSBN labeled as Lectotype. 1 at MHNP labeled as Lectotype.

Holotype of *Semiardistomis brittoni* at ADVA labeled: handwritten “*Ardistomis brittoni* Kt. Det. K. Kult 1948”/ “*brittoni* Kt. det. K.Kult”/ printed in red paper “TYPE”/ handwritten “Argentina Tucuman”.

Holotype of *Semiardistomis marani* at ADVA labeled: handwritten “*Ardistomis brittoni* Kt. Det. K. Kult 1946”/ “*brittoni* Kt. det. K.Kult”/ printed in red paper “TYPE”/ handwritten “Bolivia 450m Sta Cruz Umg Buenavista Steinbach coll”.

**Type area.** Given by Dejean (1831: 510) as “Brésil”.

**Diagnosis.** Body piceous with green brassy reflections. Elytral surface with isodiametric mesh pattern, microlines more or less evanescent toward center of elytral disc, striae obliterated in apical fourth, punctures moderately impressed in basal two-thirds, 3 setiferous punctures on interval 3. Abdominal sternum VII with 4+4 setiferous punctures.

**Measurements and variation.** Variation of measurements (mm) and ratios for *S. flavipes* (n=34) are: HL = 0,42–0,59–0,68; PL = 0,96–1,03–1,20; PW = 0,95–1,15–1,34; EL = 2,10–2,86–3,36; EW = 1,44–1,75–2,00; **SBL** = 3,55–4,48–5,16; PW/EW = 0,66; PW/PL = 1,11; PL/EL = 0,36; EW/EL = 0,61.

Variation of measurements (mm) and ratios for *S. brittoni* (n=3) are: HL = 0,54–0,62–0,67; PL 0,84–1,03–1,09; PW 1,09–1,21–1,28; EL 2,75–3,03–3,20; EW 1,76–1,90–2,02; **SBL** 4,26–4,68–4,96; PW/EW 0,63; PW/PL 1,16; PL/EL 0,34; EW/EL 0,63.

Variation of measurements (mm) and ratios for *S. marani* (n=1) are: HL = 0,58; PL 0,96; PW 1,09; EL 2,62; EW 1,66; **SBL** 4,16; PW/EW 0,65; PW/PL 1,13; PL/EL 0,37; EW/EL 0,63.

Species *S. brittoni* and *S. marani* measurements are a subset of that of *S. flavipes* specimens studied. Variation in this species is found in the microsculpture on the elytral disc which varies from being distinct on the entire surface to being present only marginally, in the extent of the elytral striae, and the size of the punctures. Such variation is seen even within populations from the same locality.

**Geographical distribution** (Fig. 58). The range of this species extends in central South America from western Brazil southward and westward to Paraguay, south of the Tropic of Capricorn.

**Habitat and activity.** Label data indicate that specimens of this species were collected during day at the margins of small water bodies, on sand–slit substrate.

**Material examined.** ARGENTINA. Tucuman (ADVA, 3); Salta Sierra Tartagal 14 Nov. 2006 (ADVA, 6). BOLIVIA. Santa Cruz Buena Vista 20 Feb. 1999 (FSCA, 9) Santa Cruz 450m Buenavista (ADVA, 1). BRAZIL. Mato Grosso, Pantanal 1 Sep. 2000 (PBPC, 2); Rondonia 62 km SW Ariquemes 15–19 May 1996 (FSCA, 9); Mato Grosso Varzea Grande, Cuiaba 5 May 1972 (FSCA, 10); Minas Geraes (HECO, 3); Rio Jan. (IRSNB, 4). PARAGUAY. Rio Confusa 18 Jan. 1937 (IRSNB, 144)

***Semiardistomis labialis* (Chaudoir, 1837)**

[http://species-id.net/wiki/Semiardistomis\\_labialis](http://species-id.net/wiki/Semiardistomis_labialis)

Figs 1, 2, 4–6, 14, 22, 23, 25, 28, 59

*Clivina labialis* Chaudoir, 1837: 18.

*Ardistomis labialis* (Chaudoir): Putzeys, 1846: 648 ; Bates, 1881: 35 ; Lorenz, 2005: 146.

*Ardistomus labialis* (Chaudoir): Csiki, 1927: 548; Blackwelder, 1944: 27.

*Ardistomis (Semiardistomis) labialis* (Chaudoir): Kult, 1950: 301.

var. *picipes* Bates, 1881: 35.

var. *nanus* Bates, 1881: 35.

var. *dilatatus* Bates, 1881: 35.

*Ardistomis tuspanensis* Putzeys 1846: 649 syn. n.

*Semiardistomis labialis* (Chaudoir); Erwin, 2011:235

**Type material.** Lectotype, here designated, at MHNP, glued on point, labeled: green paper handwritten “Labialis Chaud Mexico Dej.”/ handwritten in box “labialis Chaud Mexique Chevrol”/ handwritten “38”/ “Lectotype *Ardistomis labialis* Chd. Det George E. Ball 72”/ “Lectotype *Clivina labialis* Chd. Des. S.W. Nichols 1984”/ printed in red paper “lectotype”/ printed in circle “Lectotype

Paralectotypes, here designated: two exemplars at MHNP labeled: handwritten in box “labialis Chaud Mexique Chevrol”; handwritten “Paralectotype *Clivina labialis* Chd. Des. S.W. Nichols 1984”.

Lectotype of *Ardistomis tuspanensis*, here designated, at IRSNB labeled: green paper handwritten “Tuspanensis Tuspan (Chev.)”/ printed “Soc. Ent. Belg. Coll. Putzeys”/ handwritten “P. Basilewsky *Ardistomus tuspanensis* Putz”.

**Type area.** Given by Chaudoir (1837: 19) as “Mexique”.

**Diagnosis.** Body piceous with green reflections. Elytral surface completely smooth, striae continuously impressed in basal 1/8, punctures deeply impressed in basal 2/3, 3 setiferous pores on interval 3. Abdominal sternum VII with 4+4 setiferous punctures.

**Habitus.** dorsal and ventral aspects, respectively, as in Figs 1, 2.

**Mouthparts.** **Labrum**, dorsal aspect, as in Fig. 4. **Labium**, as in Fig. 14A; ligula, enlarged, as in Fig. 14B..

**Legs:** male protarsus as in Fig. 23.

**Male genitalia:** as in Fig. 25.

**Female genitalia:** as in Fig. 28.

**Measurements and variation.** Variation of measurements (mm) and ratios for *S. labialis* from Mexico (n=11) are: HL = 0,53–0,58–0,68; PL = 0,90–1,11–1,25; PW = 1,00–1,23–1,40; EL = 2,65–3,10–3,40; EW = 1,70–1,94–2,20; **SBL** = 4,10–4,80–5,23; PW/EW = 0,63; PW/PL = 1,10; PL/EL = 0,36; EW/EL = 0,63.

Variation of measurements (mm) and ratios for *S. labialis* from Costa Rica (n=11) are: HL = 0,54–0,60–0,68; PL 1,00–1,07–1,20; PW 1,10–1,21–1,36; EL 2,60–2,86–3,20; EW 1,68–1,86–2,16; **SBL** 4,14–4,54–5,08; PW/EW 0,65; PW/PL 1,13; PL/EL 0,38; EW/EL 0,65.

Variation of measurements (mm) and ratios for *S. labialis* identified in collections as *S. tuspanensis* (included syntypes) (n= 5) are: HL = 0,55–0,60–0,68; PL 1,03–1,08–1,23; PW 1,08–1,18–1,30; EL 2,65–2,80–3,00; EW 1,70–1,75–1,85; **SBL** 4,33–4,48–4,63; PW/EW 0,67; PW/PL 1,09; PL/EL 0,39; EW/EL 0,63.

Bates (1881) pointed the high variability of *labialis* populations in Central America. The polymorphic condition of characters, such as body measurements and punctuation of elytra striae, have arose different designations that includes Bates' varieties and *S. tuspanensis* (Putzeys). Body sizes show little variation between geographic regions and since for each measured sample group, distance between extremes measurements is high, this character is useless to identify forms proposed. About elytra disc punctured striae, forms varies in low grades without following any clear geographic pattern having striae punctures weekly to strongly produced and striae almost disappeared (except stria number one) to moderately impressed.

**Geographical distribution** (Fig. 59). The known range of this species extends in Middle America from central Costa Rica northward to northwestern Mexico (slightly north of the Tropic of Cancer).

**Activity.** Most label data indicate “attracted to lights”. Teneral were collected in November.

**Material examined.** MEXICO. Sinaloa, Culiacán Apr 1969 (USNM, 9) Veracruz, Cordoba Nov. 1966 (USNM, 7) Oaxaca Tehuantepec Dec. 1964 (USNM, 1) Chiapas Tapilulas May 1974 (USNM, 9) Colima Volcano (USNM, 5) Jalapa (IRSNB, 2) Sa. De Durango (IRSNB, 4) Guerrero Chiapas Jul 2005 (PBPC, 2). BELIZE. Sibun River at Gracy Rock Jun 1974 (USNM, 7). GUATEMALA. Alta Verapaz May 1973 (USNM, 40) Sacapulas 4500ft Dec. 1947 (USNM, 3). HONDURAS. Dept. Con-

ayagua Rancho Chiquito May 1964 (UASM, 8), Belize district Jun 1968 (USNM, 18), 5 mi E. Choluteca Jul 1965 (USNM, 22), 16 mi W. Sabana Grande Jul 1965 (USNM, 7), Pespire Jul 1965 (USNM, 7), San Marcus Colon Jul. 1965 (USNM, 10). EL SALVADOR. Ch. Del Guayabo May 1975 (USNM, 1). NICARAGUA. Rivas Rio Canas Gordas Jun 1964 (UASM, 18). COSTA RICA. Guanacaste Santa Rosa NP Jun 2004 (ADVA, 34), Guanacaste NP Jun 1990 (USNM, 9), Guanacaste Santa Cruz Est. Bosque Diria 150- 250 m Nov 1998 (USNM, 18), Guanacaste Santa Rosa 300 m Mar 1990 (USNM, 5).

***Semiardistomis pallipes* (Dejean, 1831)**

[http://species-id.net/wiki/Semiardistomis\\_pallipes](http://species-id.net/wiki/Semiardistomis_pallipes)

Figs 52, 58

*Clivina pallipes* Dejean, 1831: 510

*Ardistomis pallipes* (Dejean): Putzeys, 1846: 645; Lorenz, 2005: 146

*Ardistomus pallipes* (Dejean): Csiki, 1927: 548; Blackwelder, 1944: 27

var. *caerulea* Putzeys, 1846: 646

*Ardistomis striga* Putzeys 1866: 211 syn. n.

*Semiardistomis pallipes* (Dejean); Erwin, 2011:237

**Type material.** Lectotype, here designated, at MHNP, pinned, labeled: handwritten in box “pallipes Dej. Colombie C. Gory”/ handwritten “52”/ “Lectotype *Clivina pallipes* Dej. Des. S.W. Nichols 1984”/ printed in red paper “lectotype”.

Holotype of *Ardistomis striga* at IRSNB, glued on cardboard, genitalia attached in microvial, labeled: green paper handwritten “A. striga My. Panama. (Mky)”/ printed “Soc. Ent. Belg. Coll. Putzeys”/ red paper printed “Type”/ handwritten “P. Basilewsky *Ardistomus striga* Putz”/ Holotype *Ardistomis striga* Putzeys det. DRWhitehead”.

**Type locality.** Given by Dejean (1831: 511) as “from surroundings of Carthagene”, Colombia.

**Diagnosis.** Body piceous with green brassy reflections. Elytral surface with isodiametric mesh pattern, striae complete, punctures absent, 3 setiferous punctures on interval 3. Abdominal sternum VII with 4+4 setiferous punctures.

**Habitus.** dorsal aspect, as in Fig. 52.

**Measurements and variation.** Variation of measurements (mm) and ratios for *S. pallipes* (n=12) are: HL = 0,44–0,54–0,66; PL 0,86–1,01–1,20; PW 0,92–1,10–1,34; EL 2,30–2,74–3,24; EW 1,48–1,72–2,00; SBL 3,70–4,30–5,10; PW/EW 0,64; PW/PL 1,09; PL/EL 0,37; EW/EL 0,63. More western specimens have complete elytral striae, whereas in those from the Amazon Basin the striae are shorter (Fig. 58).

**Geographical distribution** (Fig. 58). The range of this species extends in South America from northern Brazil and eastern Ecuador north to Colombia, and to Panama in Middle America.

**Habitat.** Label data indicate that specimens of *S. pallipes* were collected at margins of water bodies.

**Material examined.** BRAZIL. Pernambuco 4 Jan 1883 (USNM, 30). COLOMBIA. Colombie (MHNP, 9); San Alberto 10 Nov 1968 (MHNP, 8). ECUADOR. Napo Onkone Gare Camp 10 Sep. 1995 (FSCA, 3). PANAMA. Panama Mky (IRSNB, 2). PERU. Madre de Dios Rio Manu 18 Jul 1992 (USNM, 24). VENEZUELA. Venez. (IRSNB, 1)

***Semiardistomis propinquus* (Putzeys, 1866)**

[http://species-id.net/wiki/Semiardistomis\\_propinquus](http://species-id.net/wiki/Semiardistomis_propinquus)

Figs 54, 59

*Ardistomis propinqua* Putzeys, 1866: 214; Bates, 1881: 35.

*Ardistomus propinquus* Putzeys: Csiki, 1927: 548; Blackwelder, 1944: 27.

*Ardistomis propinquus* Putzeys: Lorenz, 2005: 146.

*Ardistomis (Semiardistomis) propinquus* Putzeys: Kult, 1950: 302.

*Semiardistomis propinquus* (Putzeys); Erwin, 2011:237

**Type material.** Lectotype, here designated, male at IRSNB, glued on card, genitalia attached in microvial, labeled: green paper handwritten "A. propinqua Mex. (Sallé) Chd."/ handwritten " Lectotype *Ardistomis propinqua* Putzeys det. DRWhitehead"/ "Ardistomus propinquus Putz P Basilewsky 1955"/ printed "Soc. Ent. Belg. Coll. Putzeys"/ "Syntype".

Paralectotypes, here designated: two specimens at IRSNB labeled as the lectotype. Another 3 paralectotypes at MHNP labeled: handwritten in box "propinqua Chaud. Mexique Las Peras. Sallé".

**Type area.** Given by Putzeys (1866: 214) as "Mexique (Oaxaca)".

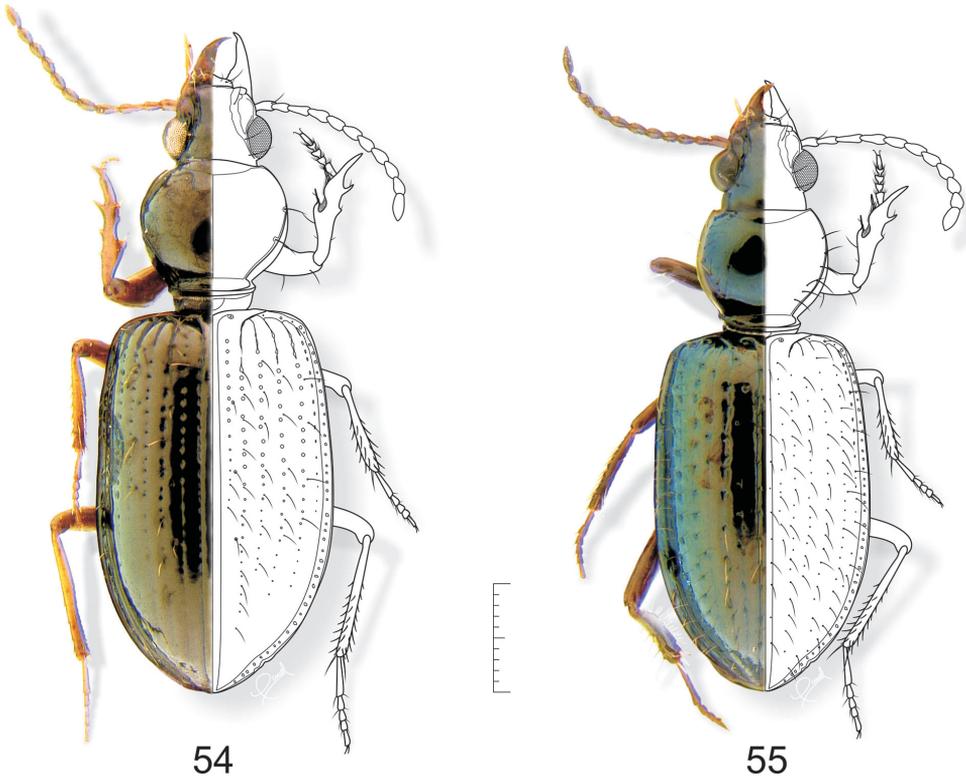
**Diagnosis.** Body piceous with green reflections. Elytral surface completely smooth, striae continuously impressed in basal 1/8, punctures deeply impressed in basal 2/3, most punctures with setae, 3 setiferous punctures on interval 3. Abdominal sternum VII with 4+4 setiferous punctures.

**Habitus.** dorsal aspect, as in Fig. 54.

**Measurements and variation.** Variation of measurements (mm) and ratios for *S. propinquus* from Mexico (n=6) are: HL = 0,60–0,62–0,63; PL 1,03–1,14–1,25; PW 1,03–1,23–1,30; EL 3,31–3,47–3,63; EW 1,88–2,01–2,13; SBL 5,04–5,23–5,44; PW/EW 0,61; PW/PL 1,08; PL/EL 0,33; EW/EL 0,58.

Despite the presence of setiferous punctures (other than the usual three in interval 3) and the proportionally larger elytra, this species is markedly similar to *S. labialis* and is possibly simply a hirsute form of that species. Similar variation has been documented for other Carabidae, including *Agonum decorum* (Say) (Liebherr, 1983).

**Geographical distribution** (Fig. 59). records indicate that this species is restricted to mountains in southern Mexico.



**Figures 54–55.** 54 *Semiardistomis propinquus* (Putzeys) 55 *Semiardistomis viridis* (Say). Dorsal aspect. Scale bar 1 mm.

**Habitat and activity.** Label data indicate that exemplars of this species have been collected during the night at margins of a small pond.

**Taxonomic note.** This species probably constitutes a morph of *S. labialis* (Chauvoir). If this is shown to be so, the name *S. propinquus* will become a junior synonym of the name *S. labialis*.

**Material examined.** In addition to types: MEXICO. Guanajuato (IRSNB, 3) Puebla 20 May 1973 (USNM, 42) Oaxaca Jul. 1964 (USNM, 14) Jalisco S. Guadalupe Jul 1964 (USNM, 4) Michoacan (USNM, 1) Chiapas May 1974 (FSCA, 12) Guerrero Picaya 12 Jun 2004 (CAS, 8) Morelos, Tepoztlan 27 Oct 2004 (CAS, 7).

***Semiardistomis semipunctatus* (Dejean, 1831)**

[http://species-id.net/wiki/Semiardistomis\\_semipunctatus](http://species-id.net/wiki/Semiardistomis_semipunctatus)

Fig. 58

*Clivina semipunctata* Dejean, 1831: 509.

*Ardistomis semipunctata* (Dejean): Putzeys, 1846: 648.

*Ardistomus semipunctatus* (Dejean): Csiki, 1927: 549; Blackwelder, 1944: 27.



**Figure 56.** Habitat of *Semiardistomis viridis* (Say) at Grassy Waters Preserve, West Palm Beach, Florida, USA

*Ardistomis semipunctatus* (Dejean): Lorenz, 2005: 146.

*Ardistomis (Semiardistomis) semipunctatus* (Dejean): Kult, 1950: 316.

*Semiardistomis semipunctata* (Dejean); Erwin, 2011: 238

**Type material.** Lectotype, here designated, at MHNP, pinned, labeled: green paper handwritten "Buenos Ayres Lacordaire"/ handwritten "24"/ "Lectotype Clivina palipes Dej. Des. S.W. Nichols 1984"/ printed on red paper "Lectotype".

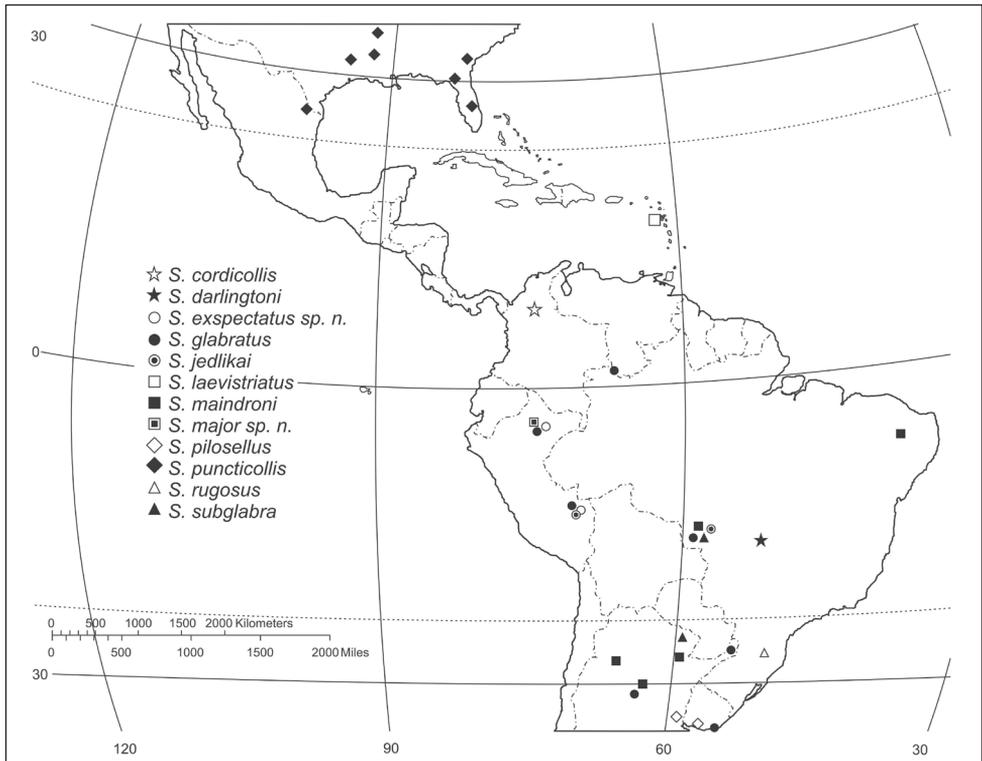
**Type locality.** Given by Dejean (1831: 509) as "parties méridionales de Brésil et dans les environs de Buenos Ayres", Brazil and Argentina

**Diagnosis.** Body piceous with green bluish reflections. Elytral surface completely smooth, striae continuously impressed in basal 1/8, without or with few punctures, 3 setiferous pores on interval 3. Abdominal sternum VII with 4+4 setiferous punctures.

**Measurements and variation.** Variation of measurements (mm) and ratios for *S. semipunctatus* (n=18) are: HL = 0,46–0,58–0,65; PL 0,93–1,07–1,16; PW 0,95–1,14–1,28; EL 2,25–2,78–3,06; EW 1,38–1,69–1,88; SBL 3,70–4,43–4,86; PW/EW 0,68; PW/PL 1,07; PL/EL 0,39; EW/EL 0,61.

Morphological variation is observed in the elytral punctures. In three different samples from Sta Catarina, Nova Teutonia, Brazil, exemplars with this form are mixed with exemplars of *S. deletus* together with intermediate forms.

**Geographical distribution** (Fig. 58). The known range of this species is confined to a South American area south of the Tropic of Capricorn, extending from southeastern Brazil westward to western Argentina, and south to southern Uruguay.



**Figure 57.** Distribution map of members of the *puncticollis* species-group.

**Material examined.** ARGENTINA. Buenos Aires Delta Parana Jan 1943 (IRSNB, 2). BRAZIL. Campos (HECO, 2); Nova Teutonia (IRSNB, 16); Nova Teutonia Sta Catarina Nov 1955 (MHNP, 8); Sta Catarina Nov 1970 (USNM, 21). URUGUAY. Montevideo (IRSNB, 4).

***Semiardistomis viridis* (Say, 1823)**

[http://species-id.net/wiki/Semiardistomis\\_viridis](http://species-id.net/wiki/Semiardistomis_viridis)

Figs 55,56,57

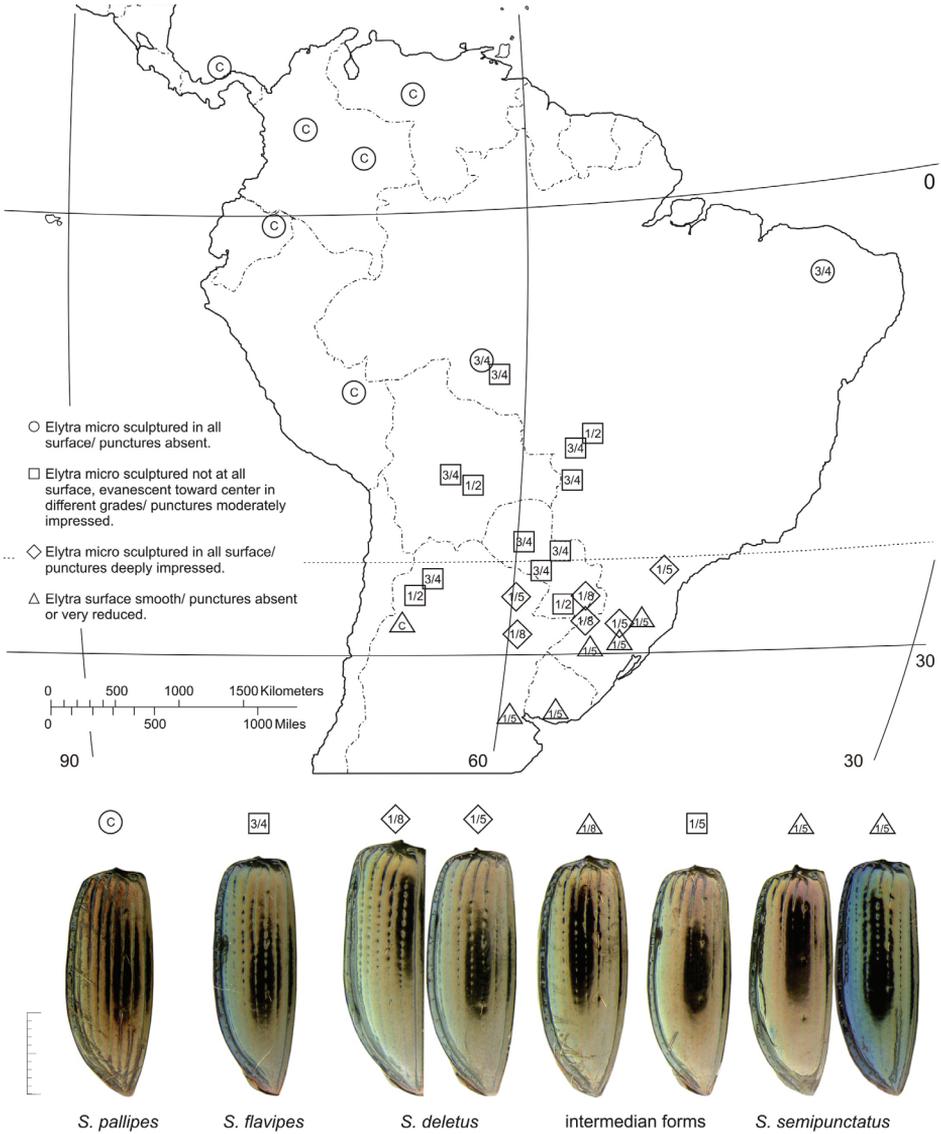
*Clivina viridis* Say, 1823: 21; Lindroth and Freitag, 1969: 334

*Clivina rostrata* Dejean, 1825: 419; Synonymy by LeConte (1857: 80); Lectotype designated by Bousquet (2006: 11).

*Ardistomis vicinus* Putzeys, 1846: 647; Synonymy by LeConte (1857: 80); Lectotype designated by Bousquet (2006: 11).

*Ardistomis rostrata* (Dejean): Putzeys, 1846: 647

*Ardistomis viridis* (Say): LeConte, 1857: 80; Putzeys, 1866: 214; LeConte, 1879: 32; Blatchley, 1910: 63; Downie and Arnett, 1996: 112.



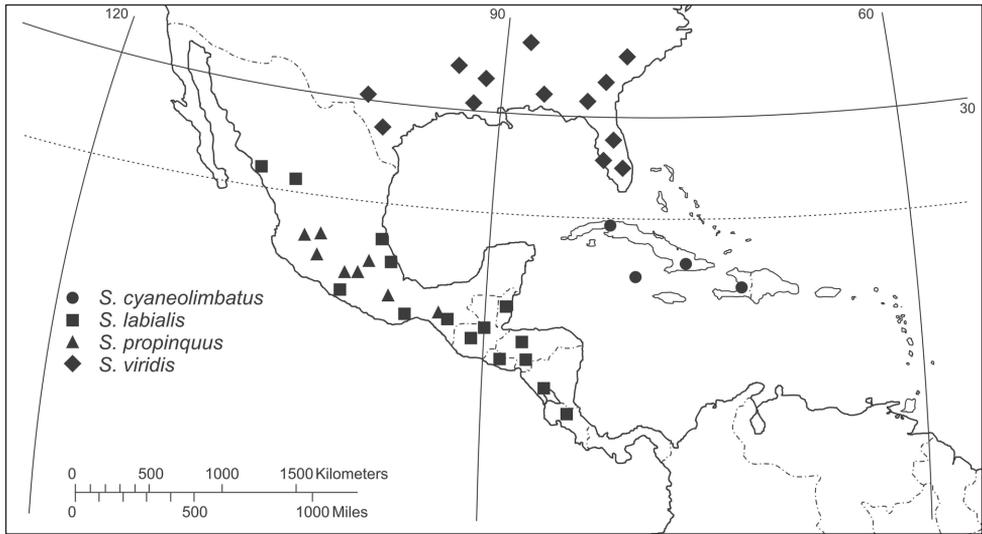
**Figure 58.** Distribution map, illustrations of exemplar left elytra, and variability of members of the *labialis* species-group in South America. Value inside symbol indicates portion of basal elytra in which striae are impressed, (C, complete impressed). Scale bar 1 mm.

*Ardistomus viridis* (Say): Csiki, 1927: 549.

*Ardistomis (Ardistomiellus) viridis* (Say): Kult, 1950: 303.

*Semiardistomis viridis* (Say); Erwin, 2011:238

**Type material.** Neotype, designated by Lindroth and Freitag (1969: 334), at Museum of Comparative Zoology, not examined.



**Figure 59.** Distribution map of members of the *labialis* species-group in Central America.

**Type locality.** Philadelphia Neck, Pennsylvania, U.S.A.

**Diagnosis.** Body piceous with green reflections. Two pairs of supraorbital setae. More than two premedial setiferous punctures on pronotal disc. Elytral surface completely smooth, striae absent, punctures deeply impressed, setiferous. Abdominal sternum VII with 6+6 setiferous punctures. Body length given by Bousquet (2006: 11) as 5.0–6.5 mm.

**Habitus.** dorsal aspect, as in Fig. 55.

**Geographical distribution** (Fig. 59). Known from southeastern United States and Bahama Islands in the West Indies (Nichols, 1988a; Bousquet, 2006).

**Habitat and activity.** I collected this species in the “Eagle trail” at the Grassy Waters Preserve in West Palm Beach on April 2, 2011. Adults were active during the day on sandy margins of a fresh water pond (Fig. 56).

**Material examined.** USA. Marion Co. V 99 Fla (USNM, 2) Jackson Co, Fla XII 97 (FSCA, 4). Sarasota Co, Fla. May 68 (USNM, 2) San Jacinto Co. Tex, Jun 68 (USNM, 4). West Palm Beach, Fla, March 2011 (PVCCu, 12) Etats unis (MHNP, 6).

## A zoogeographic scenario

The distribution of the species of the *puncticollis* group is inadequately known because most of the species have been rarely collected (except for *S. puncticollis* and *S. laevis-triatus*). Nonetheless, some patterns can be inferred. The plesiotypic state for some characters seems to be concentrated in the northern portion of South America, with putatively apotypic character states distributed peripherally in a radial fashion. This pattern is similar for the *labialis* species-group. Since both groups show a similar pat-

tern, I postulate a possible center of origin for the genus and then radiation of descendant lineages from, Northern South America.

The northern radiant of the *puncticollis* species-group reached temperate southern North America through what is now Middle America (Central America + Mexico). That lineage became extinct, except for its northern descendant, *S. puncticollis*. An eastern lineage colonized the West Indian Lesser Antilles, evidence being the extant *S. laevistriatus*, which became a forest-inhabiting brachypterous humicole, confined now to the Island of Guadeloupe (Basse Terre). Incidentally, Guadeloupe houses other clivinines: *Ardistomis atripennis* Putzeys (macropterous) and *A. guadeloupensis* Kult (brachypterous); and two species of the genus *Oxydrepanus*.

Southward, the distributional record is too incomplete to infer patterns. Notably are localities with many sympatric species, evidencing high power of dispersal in this southern assemblage, being Loreto and Madre de Dios in Peru the localities with highest number of sympatric species.

The *labialis* species-group seems to follow a similar zoogeographic structure. Northward from the putative center of radiation (Fig. 59), *S. viridis* is the most derivative form. It is broadly sympatric with *S. puncticollis*, and like that species may be the oldest survivor of an interruption of the ranges of the Central American lineages. But here, contrary to *puncticollis* species-group, a second event arose in *S. labialis* and related forms in Central America, from which source originated the stock that gave rise to the West Indian Greater Antillean *S. cyaneolimbatus*. That stock may have reached the islands by overseas dispersal, or by means of a now foundered land bridge. More recently, the West Indian Bahamas was invaded by *S. viridis*, no doubt by overseas dispersal.

Southward (Fig. 58) in South America, the structurally derivative forms of the *labialis* species-group do not show defined patterns of speciation possibly for several reasons, including the following. First, as far as I can determine, interspecific differentiation is ruled just by some variations in the elytra surface and those variations have shown to be unstable inside localities samples checked. Second, contrary to *puncticollis* species-group, sympatric "species" share every grade of intermediate forms evidencing a continuous flux between populations. Probably gene flow has not been interrupted southward and we just see the result of the polymorphic condition of only one species derivate from a northern ancestor.

In both species-groups some morphological characteristics, like reduction of the prolongation of the median carina of the mentum and hirsutism, have arisen northward from center of radiation following analog ways, suggesting two different paths of evolution to those states under similar evolutionary pressures.

## Checklist of the species names of the genus *Semiardistomis* Kult

### Genus *Semiardistomis* Kult, 1950

#### Species-group *puncticollis*

*Semiardistomis cordicollis* (Putzeys, 1846)

*Semiardistomis darlingtoni* (Kult, 1950)

- Semiardistomis expectatus* sp. n.  
*Semiardistomis glabratus* (Putzeys, 1866)  
*Semiardistomis balthasari* (Kult, 1950)  
*Semiardistomis jedlickai* (Kult, 1950)  
*Semiardistomis laevistriatus* (Fleutiaux & Sallé, 1889)  
*Semiardistomis maindroni* (Kult, 1950)  
*Semiardistomis major* sp. n.  
*Semiardistomis pilosellus* (Kult, 1950)  
*Semiardistomis puncticollis* (Dejean, 1831)  
*Semiardistomis rugosus* (Putzeys, 1866)  
*Semiardistomis subglabra* (van Emden, 1949)  
*Semiardistomis vlastae* (Kult, 1950)

### Species-group *labialis*

- Semiardistomis cyaneolimbatus* (Chevrolat, 1863)  
*Semiardistomis gundlachi* (Putzeys, 1866)  
*Semiardistomis deletus* (Putzeys, 1846)  
*Semiardistomis emdeni* (Kult, 1950)  
*Semiardistomis flavipes* (Dejean, 1831)  
*Semiardistomis aenea* (Putzeys, 1866)  
*Semiardistomis brittoni* (Kult, 1950)  
*Semiardistomis marani* (Kult, 1950)  
*Semiardistomis labialis* (Chaudoir, 1837)  
 var. *picipes* (Bates, 1881)  
 var. *nanus* (Bates, 1881)  
 var. *dilatatus* (Bates, 1881)  
*Semiardistomis tuspanensis* (Putzeys 1846)  
*Semiardistomis pallipes* (Dejean, 1831)  
 var. *caerulea* (Putzeys, 1846)  
*Semiardistomis striga* (Putzeys, 1866)  
*Semiardistomis propinquus* (Putzeys, 1866)  
*Semiardistomis semipunctatus* (Dejean, 1831)  
*Semiardistomis viridis* (Say, 1823)  
*Semiardistomis vicinus* (Putzeys, 1846)  
*Semiardistomis rostrata* (Dejean, 1825)

### Concluding remarks

This revision has added an important part in understanding of the structure of subtribe *Ardistomina*. At this point the road is clear to complete revisions for the rest of *Ardistomina* genera, which are under construction and will help with new elements to a better comprehension of inter generic relationships. Some questions have to be solved inside the genus originated in part by poor representation in collections of material from many

areas mainly from South America. For sure, new samples and DNA studies will contribute to solve unclear specific status. In species–group *labialis* we have most of problems due to polymorphic condition of most species. In Central America *S. propinquus* must be evaluated using consistent genetic data to determinate whether or not it is an isolated species from *S. labialis*. In South America we just will be able to corroborate denominations of species *S. pallipes*, *S. flavipes*, *S. deletus* and *S. semipunctatus* when gaps in distributional records will filled with new material mainly from Amazonian and Central Brazil and meridional half of Argentina; only them, we will have data enough to picture how different characters with taxonomic value behave in relation with geographic position.

## Acknowledgements

I thank Dr. Terry L. Erwin for his assistance during my visit to the Smithsonian Institution, for his suggestions that clarifies my taxonomic interpretations, for reviewing of the manuscript and for general encouragement all this time. I appreciate revisions of the manuscript made by Dr. Yves Bousquet and Dr. George E. Ball. When in Washington DC I thank assistance provide by Charyn Micheli at the Department of Entomology of the Smithsonian Institution as well as the kind hospitality provide by Héctor Malagón and his family. I also thank Dr. Alain Drumont, Dr. Yves Samyn and Dr. Marie–Lucie Susini for their assistance during my visits to Brussels. I acknowledge loans from curators of public or private collections mentioned above. Field work was possible due to assistance of Dr. Luis M. Diaz in Isla de Pinos, Cuba and Corbary Interian in West Palm Beach, Florida. Financial support for revision of material in USA came from grant offered by the Office of Fellowships of the Smithsonian Institution in 2011 and for revision of material in Europe came from the Belgian Development Cooperation and the Royal Belgian Institute of Natural Sciences through the Belgian Focal Point of the Global Taxonomy Initiative held during 2007, 2008 and 2010. Open access to this paper was supported by the Encyclopedia of Life (EOL) Open Access Support Project (EOASP).

## References

- Acorn JH, Ball GE (1991) The mandibles of some adult ground beetles: structure, function, and the evolution of herbivory. *Canadian Journal of Zoology* 69: 638–650. doi: 10.1139/z91-094
- Allen RT, Ball GE (1980) Synopsis of Mexican taxa of the *Loxandrus* series (Coleoptera: Carabidae: Pterostichini). *Transactions of the American Entomological Society* 105: 481–576.
- Ball GE, Bousquet Y (2001) Carabidae Latreille, 1810. In: Arnett RH Jr, Thomas MC (Eds) *American beetles: Archostemata, Myxophaga, Adephaga, Polyphaga: Staphyliniformia*. Volume 1. CRC Press, Boca Raton, 32–132.
- Bates HW (1881) *Insecta, Coleoptera, Carabidae, Cicindelidae*. In: Godman FD, Salvin O (Eds) *Biologia Centrali–Americana. Coleoptera*. Volume 1, Part 1. Taylor and Francis, London, 1–40.

- Blackwelder RE (1944) Checklist of the coleopterous insects of Mexico, Central America, The West Indies, and South America. Part 1. Smithsonian Institution, United States National Museum Bulletin 185: 1–188.
- Blatchley WS (1910) An illustrated descriptive catalogue of the Coleoptera or beetles (exclusive of the Rhynchophora) known to occur in Indiana –with bibliography and descriptions of new species. The Nature Publishing Co, Indianapolis, 1386 pp. doi: 10.5962/bhl.title.56580
- Bousquet Y (2006) Review of the species of *Ardistomina* (Coleoptera: Carabidae: Clivinini) in America north of Mexico. *Zootaxa* 1308: 1–29.
- Chaudoir M de (1837) Genres nouveaux et espèces nouvelles de Coléoptères de la famille des Carabiques. *Bulletin de la Société Impériale des Naturalistes de Moscou* 10: 3–48.
- Chevrolat LAA (1863) Coléoptères de l'île de Cuba. Notes, synonymies et descriptions de espèces nouvelles. *Carabiques. Annales de la Société Entomologique de France* 3(4): 186–199.
- Csiki E (1931) Carabidae: Harpalinae V (Pars 115). In: Junk W, Shenkling S (Eds) *Coleopterorum catalogus. Volume II. Carabidae II*, W. Junk, Berlin, 739–1022.
- Darlington PJ Jr (1934) New West Indian Carabidae, with a list of Cuban species. *Psyche* 41: 66–131.
- Dejean PFMA (1831) *Species général des Coléoptères, de la collection de M. le Comte Dejean. Tome cinquième. Méquignon-Marvis, Paris, 883 pp.*
- Downie NM, Arnett RH Jr (1996) *The beetles of northeastern North America. Volume I: Introduction; suborders Archostemata, Adephaga, and Polyphaga, thru superfamily Cantharoidea. The Sandhill Crane Press, Gainesville, 880 pp.*
- Emden FI van (1949) New and little-known neotropical Carabidae. *The Annals and Magazine of Natural History* 2(12): 861–893.
- Erwin TL (2011) *A Treatise on the Western Hemisphere Caraboidea (Coleoptera): Their classification, distributions, and ways of life Volume III (Carabidae – loxomeriformes, melae-niformes). Pensoft, Sofia-Moscow, 412 pp.*
- Erwin TL, Sims LL (1984) Carabid beetles of the West Indies (Insects: Coleoptera): a synopsis of the genera and checklists of tribes of Caraboidea, and of the West Indian species. *Quaestiones Entomologicae* 20: 351–466.
- Fedorenko DN (1996) *Reclassification of world Dyschiriini, with a revision of the Palaearctic fauna (Coleoptera: Carabidae). Pensoft, Sofia, Moscow, St. Petersburg, 224 pp.*
- Fleutiaux E, Sallé A (1889) Liste de Coléoptères de la Guadeloupe et descriptions d'espèces nouvelles. *Annales de la Société Entomologique de France* 9(6): 351–484.
- Gundlach JC (1891) *Contribución a la Entomología Cubana. Tomo 3. Coleópteros. Imprenta de A. Alvarez, La Habana. 404 pp.*
- Kult K (1950) New Neotropical species of the group *Ardistominina* (Carabidae, Col.). *Arthropoda* 1: 299–325.
- LeConte JL (1857) Synopsis of the species *Clivina* and allied genera inhabiting the United States. *Proceedings of the Academy of Natural Sciences of Philadelphia* 9: 75–83.
- LeConte JL (1879) Synoptic tables: *Ardistomis*, Putz.; *Aspidoglossa*, Putz.; *Clivina*, Latr.; *Schizogenius*, Putz. *Bulletin of the Brooklyn Entomological Society* 2: 32–34.
- Leng CW, Mutchler AJ (1914) A preliminary list of the Coleoptera of the West Indies as recorded to January 1, 1914. *Bulletin of the American Museum of Natural History* 34: 555–601.

- Liebherr JK (1983) Genetic basis for polymorphism in the ground beetle, *Agonum decorum* (Say) (Coleoptera: Carabidae). *Annals of the Entomological Society of America* 76(3): 349–357.
- Liebherr JK, Will KW (1998) Inferring phylogenetic relationships within the Carabidae (Insecta, Coleoptera) from characteristics of the female reproductive tract. In: Ball GE, Casale A, Vigna Taglianti A (Eds) *Phylogeny and classification of Caraboidea (Coleoptera: Adephaga)*. Museo Regionale di Scienze, Atti Torino, 107–170.
- Lindroth CH, Freitag R (1969) North American ground-beetles (Coleoptera, Carabidae, excluding Cicindelinae) described by Thomas Say: designation of lectotypes and neotypes. *Psyche* 76: 326–61.
- Lorenz W (1998) Systematic list of extant ground beetles of the world (Insecta, Coleoptera “Geadephaga”: Trachypachidae and Carabidae incl. Paussinae, Cicindelinae, Rhysodinae). W. Lorenz, Tutzing, Germany, 502 pp.
- Lorenz W (2005) Systematic list of extant ground beetles of the world (Insecta, Coleoptera “Geadephaga”: Trachypachidae and Carabidae, incl. Paussinae, Cicindelinae, Rhysodinae). W. Lorenz, Tutzing, 530 pp.
- Nichols SW (1988a) Systematics and biogeography of West Indian Scaritinae (Coleoptera: Carabidae). Doctoral dissertation, Cornell University, Ithaca, New York, 393 pp.
- Nichols SW (1988b) Kaleidoscopic biogeography of West Indian Scaritinae (Coleoptera: Carabidae). In: Liebherr JK (Ed) *Zoogeography of Caribbean Insects*. Comstock Publishing Associates, Ithaca, 71–120.
- Putzeys JAAH (1846) Monographie des *Clivina* et genres voisins, précédée d’un tableau synoptique des genres de la tribu des scaritides. *Mémoires de la Société Royale des Sciences de Liège* 2: 521–663.
- Putzeys JAAH (1866) Révision générale des clivinides. *Annales de la Société Entomologique de Belgique* 10: 3–242.
- Reichardt H (1977) A synopsis of the genera of Neotropical Carabidae (Insecta: Coleoptera). *Quaestiones Entomologicae* 13: 346–493.
- Say TL (1823) Descriptions of insects of the families of Carabici and Hydrocanthari of Latreille, inhabiting North America. *Transactions of the American Philosophical Society (New Series)* 2 [1825]: 1–109.
- Valdés P (2007) *Ardistomis quixotei* (Coleoptera: Carabidae: Clivinini), a new Middle American species: structural and habitat features of adults, larvae and pupae, comparisons with previously described species, and notes about classification and biogeography. *Zootaxa* 1497: 23–33.
- Valdés P (2009) Seven new Neotropical species of the genus *Ardistomis* Putzeys (Coleoptera: Carabidae: Clivinini): notes about classification and a checklist of the species names of that genus. *Bulletin de l’Institut Royal des Sciences Naturelles de Belgique. Entomologie* 79: 59–72.
- Whitehead DR (1972) Classification, phylogeny, and zoogeography of *Schizogenius* Putzeys (Coleoptera: Carabidae: Scaritini). *Quaestiones entomologicae* 8: 131–348.



# A new species of *Peucoglyphus* Bernhauer from New Guinea (Coleoptera, Staphylinidae, Staphylininae)

Alexey Solodovnikov<sup>1,†</sup>

<sup>1</sup> Zoological Museum, Natural History Museum of Denmark, Universitetsparken 15, Copenhagen 2100, Denmark

† [urn:sid:zoobank.org/author:E56B0FF6-38F5-48D7-A5C1-0EA071EB4A99](https://urn.sid:zoobank.org/author:E56B0FF6-38F5-48D7-A5C1-0EA071EB4A99)

Corresponding author: Alexey Solodovnikov ([asolodovnikov@snm.ku.dk](mailto:asolodovnikov@snm.ku.dk))

---

Academic editor: Volker Asing | Received 16 April 2012 | Accepted 17 July 2012 | Published 24 July 2012

---

[urn:sid:zoobank.org/pub:B9D94C8B-D984-4221-BD14-C4F521320377](https://urn.sid:zoobank.org/pub:B9D94C8B-D984-4221-BD14-C4F521320377)

---

**Citation:** Solodovnikov A (2012) A new species of *Peucoglyphus* Bernhauer from New Guinea (Coleoptera, Staphylinidae, Staphylininae). ZooKeys 210: 69–74. doi: 10.3897/zookeys.210.3241

---

## Abstract

*Peucoglyphus ken* sp. n., a new species from New Guinea is described. Adding the new species, this rare Wallacean genus from the tribe Staphylinini (subtribe Philonthina) currently includes five species. An updated identification key for the genus is provided.

## Keywords

Staphylinini, Philonthina *Peucoglyphus*, new species, New Guinea

## Introduction

*Peucoglyphus* Bernhauer, 1926 is a genus of the rove beetle tribe Staphylinini (subtribe Philonthina) that was enacted for *P. corporaali* Bernhauer, 1926, a species from Buru Island in Indonesia (Bernhauer 1926). Since then nothing at all had been published about *Peucoglyphus* for almost a century until Schillhammer (2011) added three more species: *P. solomonicus* Schillhammer, 2011 from Solomon Islands, *P. celebensis* Schillhammer, 2011 from the island of Sulawesi (Indonesia), and *P. balkei* Schillhammer, 2011 from Irian Jaya. The abovementioned paper also provided an updated diagnosis and notes on the phylogenetic affinities of that rare genus. It immediately allowed me to identify a

puzzling specimen from New Guinea that I had on loan from the Netherlands Centre for Biodiversity (Naturalis) in Leiden, as a new species of *Peucoglyphus*. Here I provide the description of this new species along with some comparative notes, and accordingly update the identification key to species of *Peucoglyphus* of Schillhammer (2011).

## Material and methods

The holotype of the new species is kept at the Netherlands Centre for Biodiversity (Naturalis) at Leiden (NCBN, M.E. Gassó Miracle and A. van Assen). All photographs illustrating the description were taken by Ken Puliafico (Copenhagen) with a Leica DFC 420 camera attached to a Leica MZ16A microscope with the help of Leica Application Suite (Leica Microsystems, 2003–2007) and Automontage Pro (Synoptics Ltd, 1997–2004).

### *Peucoglyphus ken* sp. n.

urn:lsid:zoobank.org:act:DCA914C6-A2E4-4EC1-9E89-7EFBAFD31FBD

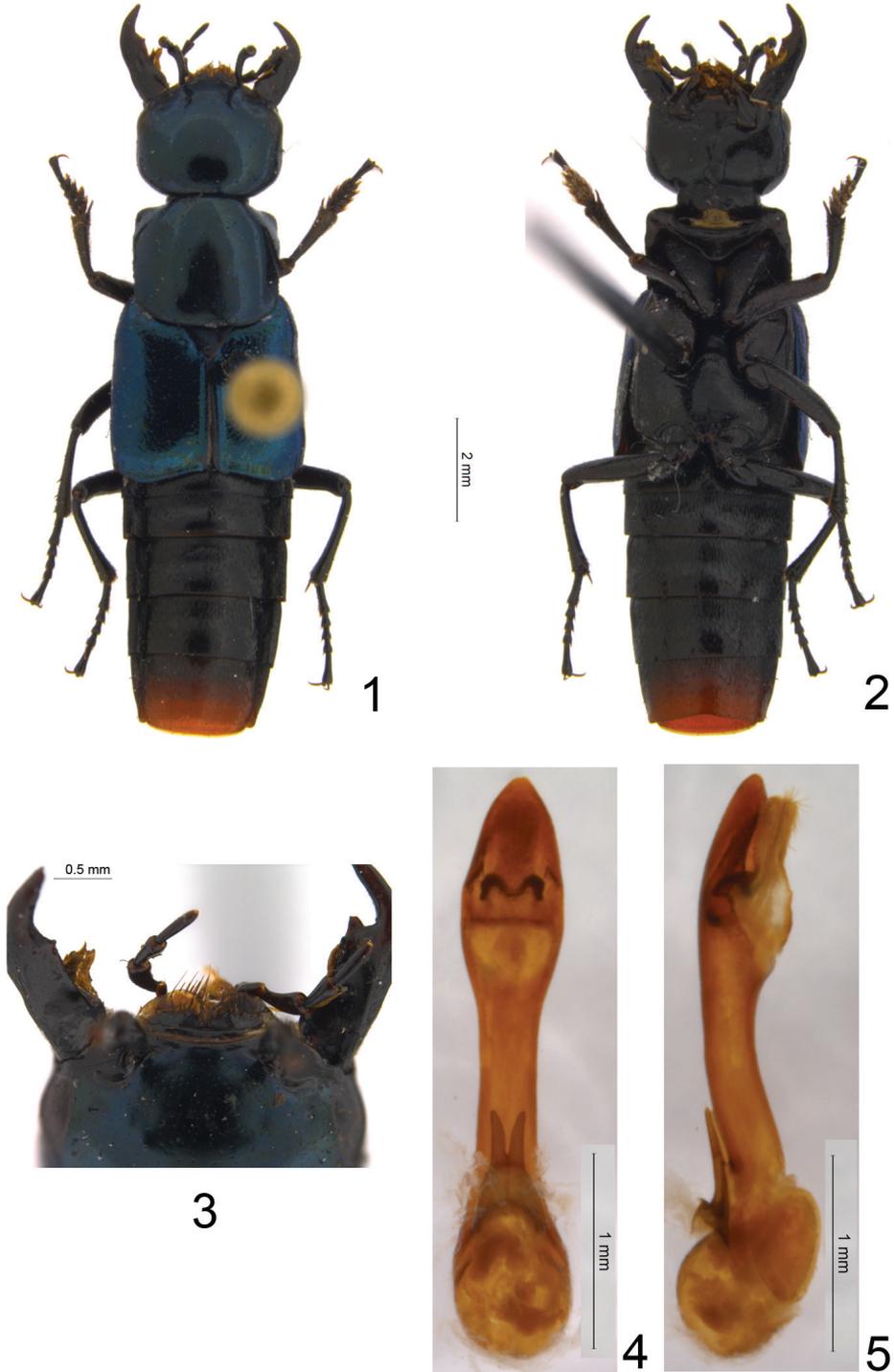
[http://species-id.net/wiki/Peucoglyphus\\_ken](http://species-id.net/wiki/Peucoglyphus_ken)

Figs 1–5

**Type material examined. Indonesia** (West Papua): Holotype [with antennomeres 4–11 and labial palps missing], male, “Neth. Ind. - Amer. New Guinea Exp. 1938 Lake Habbema, 3250–3300 m, Ult. VII-ult. VIII L.J. Toxopeus leg.”/ Defective *Mysolius*? [handwritten label in red ink]/ sec. M. Cameron”/ Holotype *Peucoglyphus ken* sp. n. A. Solodovnikov det. 2012” [here the labels are quoted verbatim, individual labels separated by a slash] (NCBN).

**Description.** 15.5 mm long (measured from apex of opened mandibles to apex of abdomen). Habitus: Figs 1, 2. Black and shiny, head and pronotum with deep dark blue metallic glance, elytra brilliant glossy, with strong metallic blue glance, scutellum brilliant, but darker, with violet glance; mouthparts dark brown to black; legs black, except femora at base dark brown; apex of abdomen beginning from segment VIII reddish-brown.

Head large, with rounded posterior angles, only slightly wider than long (head length from base of labrum to neck 2.5 mm; maximal head width, at eyes 2.7 mm); tempora 1.8 times as long as eyes, eyes posteriorly shifted dorsad; surface of head smooth with micropunctuation faint and sparse at disk, but coarser and denser at tempora; frons with one pair of large setiferous punctures, each located near anterior part of internal margin of eye; other large, possibly setiferous punctures arranged in irregular groups behind eye and along posterior margin of head; tempora with one large setiferous puncture located closer to posterior margin of head than to posterior margin of eye; bilobed labrum with semi-membranous yellowish extension developed along its entire apical margin (Fig. 3). Pronotum slightly transverse (length along midline 2.5



**Figures 1–5.** *Peucoglyphus ken* sp. n.: **1** habitus **2** body in ventral view **3** anterior portion of head **4** aedeagus in parameral view **5** aedeagus in lateral view.

mm, maximal width 2.8 mm), with parallel lateral sides, broadly rounded posterior angles and distinct anterior angles; at sides slightly sinuate in front of base and just posterior to anterior angles; micropunctuation as on disk of head: very sparse and faint; large possibly setiferous punctures are grouped at anterior corners, 2–3 on disk on each side and some along posterior margin. Elytra wider and longer than pronotum (elytral length from base to apical margin 3.5 mm, maximal elytral width 3.7 mm), their surface with faint and sparse micropunctuation and dense microsculpture, slightly longitudinally wrinkled at base and along apical margin; each elytron laterally without carina; scutellum faintly punctate. Metaventrite without conspicuous fold posterolaterally (illustrated in Schillhammer 2011 for *P. balkei* in fig. 4). Abdomen: first five visible tergites (III–VII) medially more or less smooth, impunctate, but laterally and basally with more or less coarse punctuation; all tergites with only one basal carina, tergites IV–VI with more or less deep transversal impression; male sternite VIII with medio-apical emargination; male sternite IX with short slightly asymmetrical poorly sclerotised basal portion, and with slightly bilobed apex.

Aedeagus in parameral view (Fig. 4) with median lobe having massive apical portion that is as wide as basal bulb, in lateral view (Fig. 5) slightly curved, with very short paramere consisting of two symmetrical lobes.

**Bionomics and distribution.** Known from the type locality only. No data about the collecting method or bionomics of the holotype is available.

**Etymology.** With pleasure I dedicate the new species to Kenneth (Ken) Puliatico, currently a digitalization assistant at the Department of Entomology at the Natural History Museum of Denmark. Ken's excellent work as a specimen photographer and database specialist, aiming to digitize thousands of Coleoptera types kept in our collection, is a notable contribution towards the better infrastructure for beetle systematics. The species name "ken" is a noun in apposition.

**Comparison.** Based on the rather small eyes that are shorter than tempora (Fig. 1), the dark legs (Figs 1 and 2), and the distinct nuchal constriction (Fig. 1), *P. ken* can be placed near *P. solomonicus* Schillhammer, 2011, at least diagnostically. However, *P. ken* differs from *P. solomonicus* in proportions of the forebody (cf. Fig 1 and fig. 2 in Schillhammer 2011), in the color of the apex of the abdomen which is reddish brown, in lacking an arcuate row of large setiferous punctures extending from infraorbital area on to tempora, and in the structure of the abdominal tergites having only one basal carina (contrary to two carinae in *P. solomonicus*). Also, from all other congeners with known males *P. ken* strikingly differs in the shape of the aedeagus (cf. Figs 4, 5 and fig. 11 in Schillhammer 2011).

**Remarks.** The new species matches the generic diagnosis of *Peucoglyphus* provided in Schillhammer (2011) in all characters except lacking temporal carina (formed by confluent punctural grooves) and except slightly different configuration of the semi-membranous extension of labrum. Temporal carina is present in all other species of the genus, and the semi-membranous extension of labrum is developed along the entire width of labral lobes in *P. ken* (Fig. 3), but laterally reduced in all other species of the genus. However, the structure of the aedeagus in *P. ken* is remarkably

different from all other species of *Peucoglyphus* with known males. Unlike *P. corporaali*, *P. balkei* and *P. solomonicus*, the aedeagus of *P. ken* has a distinct but strongly reduced paramere, and enlarged (in dorsal or ventral view, Fig. 4) apical portion of the median lobe without the subapical tooth so characteristic for other species of *Peucoglyphus* (cf. Fig. 5 and figs 10–12 in Schillhammer 2011). The shape of the paramere in *P. ken* suggests that in other species of the genus it is even stronger reduced, rather than fused to the median lobe, the condition earlier not clearly understood (Schillhammer 2011). Since the antennae and labial palps are largely missing in the holotype of *P. ken*, the corresponding structures cannot be compared with other congeners. Noteworthy, that the laterally reduced semi-membranous extension of the labrum is among the characters that distinguish *Peucoglyphus* from the closely related genera of Philonthina: *Leucitus* Fauvel, 1878, *Actinus* Fauvel, 1878 and *Mysoilius* Fauvel, 1878, all having such extension fully developed. The fully developed semi-membranous extension of labrum in *P. ken* shared with them, and the structure of its aedeagus that is also rather similar to some species in those genera, confirm the affinities of *Peucoglyphus* noted in Schillhammer (2011).

#### Key to species of *Peucoglyphus* (after Schillhammer 2011, modified to include *P. ken*)

- 1        Eyes small, markedly shorter than tempora ..... 2
- Eyes large, slightly to distinctly longer than tempora..... 4
- 2        Fore legs and mesofemora black or at least very dark brown; nuchal ridge sharp throughout its entire length, nuchal constriction distinct..... 3
- Fore legs and mesofemora reddish; nuchal ridge convex, rather fine, almost obsolete in middle, nuchal constriction indistinct ..... *corporaali*
- 3        Semi-membranous extension of labrum developed along median part of labral lobes only, laterally reduced; temporal carina formed by confluent punctural grooves present ..... *solomonicus*
- Semi-membranous extension of labrum developed along the entire width of labral lobes; temporal carina formed by confluent punctural grooves absent. .... *ken*
- 4        Legs entirely bright reddish. .... *balkei*
- Legs black, pro- and mesofemora bright reddish ..... *celebensis*

#### Acknowledgements

I am very thankful to the above mentioned curators at the Netherlands Centre for Biodiversity (Naturalis) for the loan of interesting material containing this new species. Special thanks go to my friends and colleagues Ken Puliafico (Copenhagen), who made digital photos for the illustrations, and Harald Schillhammer, who shared his opinion about some peculiar characters of this new species.

## References

- Bernhauer M (1926) Fauna Buruana Staphylinidae. Zur Staphylinidenfauna der Molukken. *Treubia* 7(3): 311–327.
- Schillhammer H (2011) A review of *Peucoglyphus* Bernhauer (Coleoptera: Staphylinidae: Staphylininae). *Koleopterologische Rundschau* 81: 125–132.

# A new genus of oak gallwasps, *Zapatella* Pujade-Villar & Melika, gen. n., with a description of two new species from the Neotropics (Hymenoptera, Cynipidae, Cynipini)

Juli Pujade-Villar<sup>1,†</sup>, Paul Hanson<sup>2,‡</sup>, Claudia A. Medina<sup>3,§</sup>,  
Miguel Torres<sup>3,1</sup>, George Melika<sup>4,¶</sup>

**1** Universitat de Barcelona, Facultat de Biologia, Departament de Biologia Animal, Avda. Diagonal 645, 08028-Barcelona, Spain **2** Universidad de Costa Rica. Escuela de Biología. San Pedro, Costa Rica **3** Instituto de Investigación de Recursos Biológicos Alexander von Humboldt, Claustro de San Agustín, Villa de Leyva, Colombia **4** Pest Diagnostic Laboratory, Plant Protection & Soil Conservation Directorate of County Vas, Ambrozy setany 2, Tanakajd 9762, Hungary

† [urn:lsid:zoobank.org:author:94C497E0-C6A1-48BD-819D-FE5A8036BECD](https://zoobank.org/urn:lsid:zoobank.org:author:94C497E0-C6A1-48BD-819D-FE5A8036BECD)

‡ [urn:lsid:zoobank.org:author:0826E20B-DFB4-48D5-A80E-6315C1C184F6](https://zoobank.org/urn:lsid:zoobank.org:author:0826E20B-DFB4-48D5-A80E-6315C1C184F6)

§ [urn:lsid:zoobank.org:author:A4195A74-EBF5-452D-B3E9-AF7E567AD741](https://zoobank.org/urn:lsid:zoobank.org:author:A4195A74-EBF5-452D-B3E9-AF7E567AD741)

| [urn:lsid:zoobank.org:author:CEC17E6B-9D4C-47A7-BF81-D0E87DACA7A7](https://zoobank.org/urn:lsid:zoobank.org:author:CEC17E6B-9D4C-47A7-BF81-D0E87DACA7A7)

¶ [urn:lsid:zoobank.org:author:A6FEF774-3A77-4058-94E5-E670D880ED69](https://zoobank.org/urn:lsid:zoobank.org:author:A6FEF774-3A77-4058-94E5-E670D880ED69)

Corresponding author: *George Melika* ([melikageorge@gmail.com](mailto:melikageorge@gmail.com))

Academic editor: *M. Buffington* | Received 27 February 2012 | Accepted 11 June 2012 | Published 24 July 2012

[urn:lsid:zoobank.org:pub:6719AA7E-3C2B-41AE-9DF5-EBCCB0001345](https://zoobank.org/pub:6719AA7E-3C2B-41AE-9DF5-EBCCB0001345)

**Citation:** Pujade-Villar J, Hanson P, Medina CA, Torres M, Melika G (2012) A new genus of oak gallwasps, *Zapatella* Pujade-Villar & Melika, gen. n., with a description of two new species from the Neotropics (Hymenoptera, Cynipidae, Cynipini). ZooKeys 210: 75–104. doi: 10.3897/zookeys.210.3014

## Abstract

A new genus of cynipid oak gallwasp, *Zapatella* Pujade-Villar & Melika, **gen. n.** (Hymenoptera: Cynipidae: Cynipini), with two new species, *Zapatella grahami* Pujade-Villar & Melika, **sp. n.** and *Z. nievesaldreyi* Melika & Pujade-Villar, **sp. n.**, is described from the Neotropics. *Zapatella grahami*, known only from the sexual generation, induces galls in acorns of *Quercus costaricensis* and is currently known only from Costa Rica. *Zapatella nievesaldreyi*, known only from the asexual generation, induces inconspicuous galls in twigs of *Q. humboldtii*, and is known only from Colombia. Diagnostic characters for both new species are given in detail. Five Nearctic species are transferred from *Callirhytis* to *Zapatella*: *Z. cryptica* (Weld), **comb. n.**, *Z. herberti* (Weld), **comb. n.**, *Z. oblata* (Weld), **comb. n.**, *Z. quercusmedullae* (Ash-

mead), **comb. n.**, *Z. quercusphellos* (Osten Sacken), **comb. n.** (= *Z. quercussimilis* (Bassett), **syn. n.**). A key based on adults for the species belonging to *Zapatella* is also given. Generic limits and morphological characteristics of *Zapatella* and closely related genera are discussed.

### Keywords

Cynipini, *Zapatella*, *Callirhytis*, Colombia, Costa Rica, taxonomy, morphology, distribution, biology

### Introduction

The cynipid gallwasp fauna (Hymenoptera, Cynipidae) of the Neotropical region is very poorly known. Recently it was updated to include 6 tribes, 21 genera and 45 species, of which 41 are native and 4 have been introduced into the region; the native fauna includes 17 described species of oak gallwasps and 15 associated inquiline species (Medianero and Nieves-Aldrey 2011b). The Neotropics, particularly southern Mexico, harbours the greatest diversity of oak species in the New World. Some species are widespread from Mexico to Costa Rica and Panama. At least one clade of red oaks (Section Lobatae of *Quercus* subg. *Quercus* L.) is common in Central America and Colombia (Govaerts and Frodin 1998, Nixon 2006). In Mexico, gallwasps were reported from 11 different red oak species (Pujade-Villar et al. 2009; Melika et al. 2009a, 2011a; Pujade-Villar et al. 2011), and on all oaks 157 gallwasp species on 33 oak species are mentioned (Pujade-Villar et al. 2009). A large diversity of oak gallwasps is also known from Panama, where 65 different cynipid galls were found on oaks, and from 45 of these galls, adult gallwasps were reared: *Andricus* Hartig (12 species), *Neuroterus* Hartig (9), *Dryocosmus* Giraud (7), *Cynips* L. (4), *Amphibolips* Reinhard (3), *Disholcaspis* Dalla Torre & Kieffer, *Loxaulus* Mayr and *Odontocynips* Kieffer (with two species each), *Callirhytis* Förster and *Bassetia* Ashmead (with one species each) (Medianero and Nieves-Aldrey 2011b). Ten of these species have been described (Medianero and Nieves-Aldrey 2010a, b, 2011a, Medianero et al. 2011a, b). Thus far, only four oak gallwasp species have been described from Costa Rica: *Odontocynips hansonii* (Pujade-Villar 2009), *Andricus costaricensis* (Melika et al. 2009b), *Disholcaspis costaricensis* (Melika et al. 2011b) and *Coffeikkokos copeyensis* (Pujade-Villar et al. 2012); however, there might be more than 30 species in total (Fergusson 1995, Pujade-Villar and Hanson 2006). Another six species are known from Guatemala (Cameron 1883, Kinsey 1936, Weld 1952) and one species from the southern part of Mexico (Kinsey 1937).

The evaluation of the Neotropical gallwasp fauna cannot be done without a thorough examination of the Nearctic species, especially in the case of establishing new gallwasp genera. The current morphology-based taxonomy of the Nearctic Cynipini, with the last review of genera by Melika and Abrahamson (2002), needs a major revision at both the genus and species levels. Sets of character states used to identify genera/species are often not appreciable for taxonomic purposes; in many genera

plesiomorphic characters were used instead of synapomorphies or autapomorphies, and thus the majority of current Cynipini genera in the Nearctic are polyphyletic, instead of being monophyletic. The new data recently obtained on the phylogeny, phylogeography, evolutionary conservatism of host shifts were not considered in the previous reviews and revisions (Liljeblad et al. 2008, Stone et al. 2009).

The validity of some Nearctic species of *Callirhytis* and their taxonomic position are discussed.

## Material and methods

Adult gallwasps of an undescribed species were reared from acorn galls collected on *Quercus costaricensis* by the second author (PH) in Costa Rica; specimens belonging to yet another species were reared from galls collected on *Q. humboldtii* by the first author (JPV) together with Claudia A. Medina and Miguel Torres in Colombia.

We follow the current terminology of morphological structures (Liljeblad and Ronquist 1998, Melika 2006). Abbreviations for forewing venation follow Ronquist and Nordlander (1989), cuticular surface terminology follows that of Harris (1979). Measurements and abbreviations used here include: F1–F12, 1st and subsequent flagellomeres; POL (post-ocellar line) is the distance between the inner margins of the posterior ocelli; OOL (ocellar-ocular line) is the distance from the outer edge of a posterior ocellus to the inner margin of the compound eye; LOL (lateral ocellar line), the distance between lateral and frontal ocelli. The width of the forewing radial cell is measured from the margin of the wing to the Rs vein.

Digital images of wasp anatomy were produced with a digital Nikon Coolpix 4500 camera attached to a Leica DMLB compound microscope, followed by processing in CombineZP (Alan Hadley) and Adobe Photoshop 6.0 by the last author (GM). The SEM pictures were taken with a Stereoscan Leica-360 by Palmira Ros-Farré (Barcelona University, Spain) at a low voltage (15KV) and with gold coating; the forewing of *Z. nievesaldreyi* was taken by JPV with a digital camera Cannon SX-210-IS, attached directly to the ocular of a stereomicroscope. Gall images of *Z. grahami* were taken by P. Hanson; galls of *Z. nievesaldreyi* by the fourth author (MT).

The type material is deposited in the following institutions:

- UB** University of Barcelona, Spain (J. Pujade-Villar);
- PDL** Pest Diagnostic Laboratory (the former Systematic Parasitoid Laboratory, SPL), Tanakajd, Hungary (G. Melika);
- MZUCR** Museum of Zoology, University of Costa Rica, San Pedro Costa Rica (Paul Hanson);
- IAvH** Instituto Alexander von Humboldt, Villa de Leyva, Colombia (Claudia Medina).

## Results

### *Zapatella* Pujade-Villar & Melika, gen. n.

urn:lsid:zoobank.org:act:D093C259-5DB1-43AE-A999-0AD53B8F4EA4

<http://species-id.net/wiki/Zapatella>

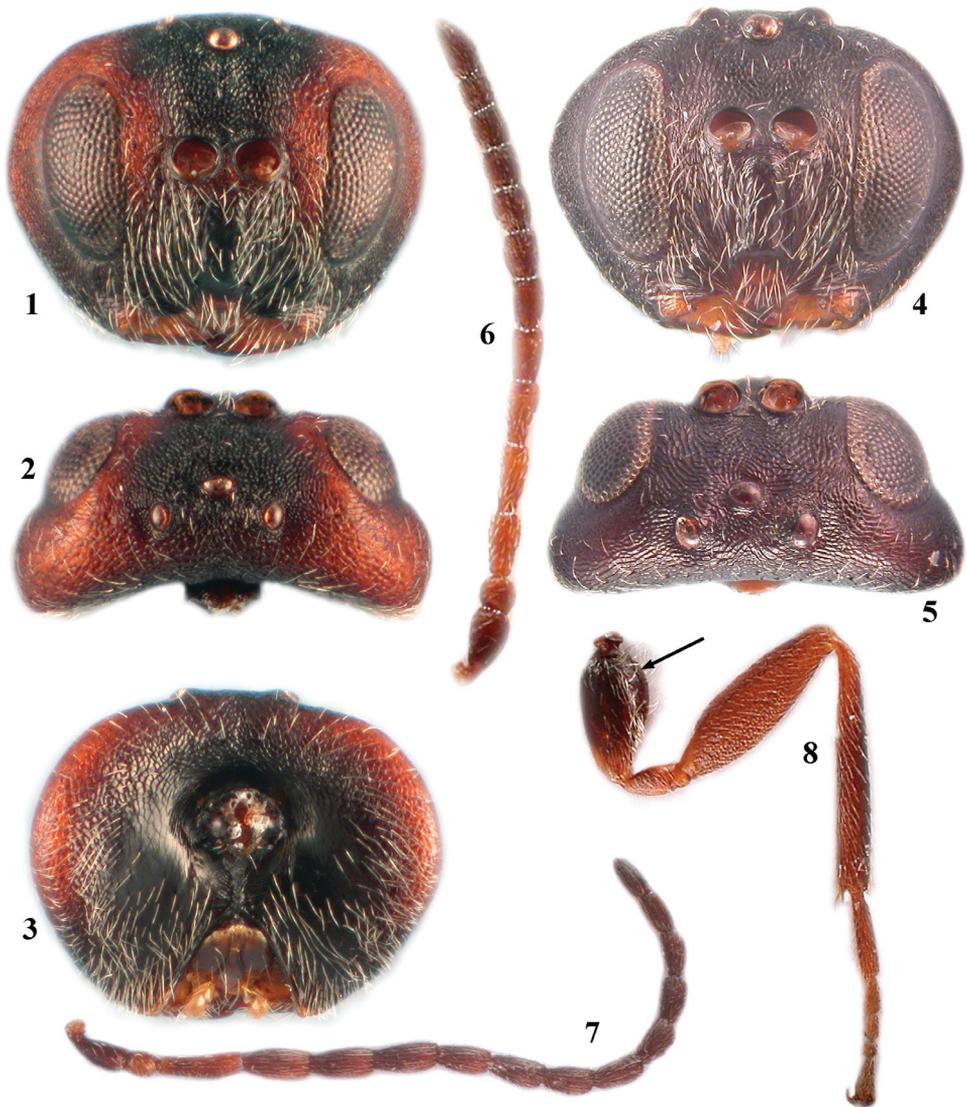
Figures 1–62

**Type species.** *Zapatella grahami* Pujade-Villar & Melika, sp. n. by present designation.

**Diagnosis.** Partially resembles *Callirhytis*, *Bassetia* and *Plagiotrochus*. However, in *Zapatella*, the malar sulcus is absent; mesosoma strongly arched, short, as long as high in lateral view; mesoscutum with numerous fine short, interrupted transverse striae with numerous longitudinal anastomosis connecting transverse striae and together forming a net-like, delicately reticulate, irregular sculpture; the pronotum laterally delicately reticulate; the metascutellum rugoso-reticulate; the metanotal trough and the lateral area of the propodeum with dense white setae. In *Callirhytis* a distinct malar sulcus is present; the mesosoma less arched, always at least slightly longer than high in lateral view; the transversely orientated rugae on the mesoscutum are much stronger with much fewer anastomoses between them; the pronotum with distinct strong rugae laterally; the metascutellum rugose, never reticulate; the metanotal trough and the lateral area of the propodeum without or with very few setae. In *Bassetia* the mesosoma is strongly compressed dorsolaterally, distinctly longer than broad; the head always more massive from above and nearly rounded in anterior view, broader than the mesosoma. In *Plagiotrochus* the sculpture of the mesopleuron, the shape of propodeal carinae and the length of the prominent part of the ventral spine of the hypopygium are quite different. The most striking characters that differentiates *Zapatella* from the above-mentioned genera are the long prominent part of the ventral spine of the hypopygium, which is 6.0–8.5 times longer than broad; hind coxae with dense white setae on the dorsoposterior surface, while in the other mentioned genera the prominent part of the ventral spine of the hypopygium is very short, at most 2–3 times longer than broad, and hind coxae without dense setae. For more details see also the Discussion.

**Description.** Body, including antennae and legs, predominantly chestnut brown; in some species head partially, mesoscutellum and stripes on mesoscutum dark brown to black. Head 1.3–1.5 times as broad as high in anterior view, massive from above and slightly broader than mesosoma. Gena broadened behind eye, as broad as transverse diameter of eye; malar sulcus absent. Antenna with 11 flagellomeres in female, 13 in male.

Mesosoma strongly arched, short, as long as high in lateral view. Pronotum delicately reticulate laterally; mesoscutum with numerous fine interrupted short transverse striae with numerous longitudinal anastomosis connecting transverse striae and together forming a net-like, delicately reticulate, irregular sculpture. Notauli complete (only in *Z. herberti*) or incomplete, extending to 1/2–2/3 length of mesoscutum, converging, deep and broad posteriorly [in some species, on first view, notauli seem to be complete; however, these are just darker lines, not impressed notauli, e.g. *Z. quercusmedullae*]. Anterior parallel lines extending to 1/2 length of mesoscutum;



**Figures 1–8.** *Zapatella grahami* **1** head, female (anterior view) **2** head, female (dorsal view) **3** head, female (posterior view) **4** head, male (anterior view) **5** head, male (dorsal view) **6** antenna, female **7** antenna, male **8** hind leg, female (arrow indicates the dense white setae on dorsoposterior surface of coxa).

parapsidal lines distinct and broad, starting from posterior margin and extending to 1/2 length of mesoscutum; median mesoscutal line present or absent. Mesoscutellum 0.5 times as long as mesoscutum, as long as broad, not or only slightly overhanging metanotum, center of disk reticulate, sides and posterior 1/3–2/3 dull rugose; scutellar foveae present, indistinctly delimited posteriorly. Mesopleuron uniformly delicately reticulate, smooth and shiny basally. Metascutellum rugoso-reticulate; metanotal trough and lateral propodeal area with dense setae. Central propodeal area delimited

by distinct subparallel or slightly bented outwards lateral propodeal carinae. Dorsoposterior surface of hind coxa with dense white setae. Tarsal claws simple, without basal lobe. Forewing venation pale yellow, indistinct, R1 inconspicuous, hardly traceable; wing margin without cilia. 2nd metasomal tergite with felt-like dense ring of white setae, interrupted dorsally and few setae scattered on lateral surface of tergite; narrow posterior band on 2<sup>nd</sup> metasomal tergite and all subsequent tergites with very delicate dense micropunctures. Prominent part of ventral spine of hypopygium very long, 6.0–8.5 times longer than broad, with very few short white setae in two rows, directed ventrally; subapical setae absent.

**Etymology.** Based on a word-play in football, a joke often used between some coauthors and prof. Graham N. Stone (Edinburgh University), in honour of whom one of the species is named.

**Gender.** Feminine.

**Biology.** According to the emergence dates of adults obtained from the collected galls, both sexual and asexual forms are present in the newly described genus. However, the emergence periods of alternate generations are overlapping. Moreover, no morphological differences have been observed between sexual and asexual females. The duration of life cycle is probably more than one year. In the Neotropical area the sexual form (*Z. grahami* Pujade-Villar & Melika, sp. n.) is obtained from acorn galls, while the asexual form (*Z. nievesaldreyi* Melika & Pujade-Villar, sp. n.) from twig galls; in the Nearctic area the asexual forms are obtained from twig and bud galls (*Z. cryptica* (Weld), comb. n., *Z. herberti* (Weld), comb. n., *Z. quercusmedullae* (Ashmead), comb. n.), *Z. oblata* (Weld), comb. n., while the sexual form, *Z. quercusphellos* (Osten Sacken) comb. n. (= *quercus-similis* (Bassett), syn. n. from twig galls. A detailed study of the biological cycles is necessary to solve this problem, which might be partially similar to that found in *Plagiotrochus amenti* Kieffer which has two reproductive modes: a heterogonic life cycle with alternation of generations in the circum-Mediterranean region, and an asexual, parthenogenetic life cycle in North America (Garbin et al. 2008), but the most important aspect is that in the Mediterranean area *P. amenti* has a partially overlapping emergence of the asexual and sexual forms (Benia et al. 2009). The same heterogenetic life cycle was also found in another Western Palaearctic gallwasp, *Andricus quadrilimeatus* Hartig (Folliot 1961, 1964).

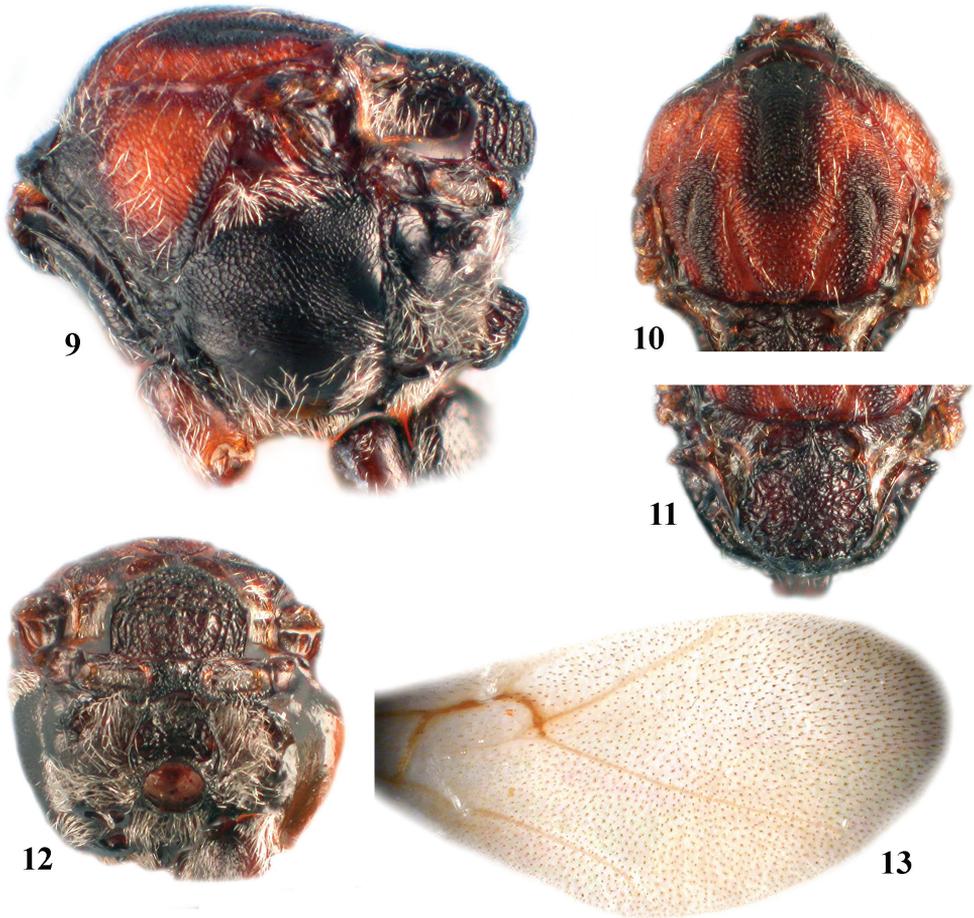
**Distribution.** Currently known from the Neotropics (Costa Rica and Colombia) and the Nearctic (USA, from California, through Texas to Florida and along the Atlantic coast, up to New York state), after transferring 4 *Callirhytis* species.

***Zapatella grahami* Pujade-Villar & Melika, sp. n.**

urn:lsid:zoobank.org:act:B802BBE3-E4BF-4971-9569-96266500DBE4

[http://species-id.net/wiki/Zapatella\\_grahami](http://species-id.net/wiki/Zapatella_grahami)

**Type material.** HOLOTYPE female (deposited in UB): “COSTA RICA, Cartago-Jose, Cerro de la Muerte, 3000 m, 2.X.1988. Col. Hanson” (white label), “*Quercus costaricensis*, fruit (acorn) galls” (white label), Holotype of *Zapatella grahami* ♀ Pujade-



**Figures 9–13.** *Zapatella grahami*, female **9** mesosoma (lateral view) **10** mesoscutum (dorsal view) **11** mesoscutellum (dorsal view) **12** metascutellum and propodeum (posterodorsal view) **13** forewing.

Villar & Melika n. gen & n. sp. design. JP-V 2012” (red label). PARATYPES (5 males and 20 females): 3 males and 14 females with the same data as the holotype and 1 male and 1 female with the similar data, only the collecting date is II.1988. 2 males and 10 females are deposited in UB, 1 male and 5 females in PDL, 1 male and 3 females in MZUCR, 1 male and 2 females USNM.

**Diagnosis.** In *Zapatella* three species, *Z. oblata*, *Z. grahami* sp. n. and *Z. nievesaldreyi* sp. n., have the head and mesosoma partially dark brown to black. *Z. oblata* differs from the two other mentioned species by a very long median mesoscutal line which extending to 2/3 of the mesoscutum length, while in *Z. grahami* and *Z. nievesaldreyi* the median mesoscutal line is absent or present in a form of a very short triangle. In *Z. grahami* the females are much darker, POL 1.4 times as broad as OOL (Fig. 2), bottom of scutellar foveae with rugae (Fig. 11), and the prominent part of the ventral spine of the hypopygium 7.5–8.5 times as long as broad (Figs 14, 16). In

*Z. nievesaldreyi* the females are lighter, POL equal OOL (Fig. 20), bottom of scutellar foveae smooth and without rugae (Fig. 22), and the prominent part of the ventral spine of the hypopygium 6.0–7.0 times as long as broad (Figs 28–29).

**Description.** Female (Figs 1–3, 6, 8, 9–16).

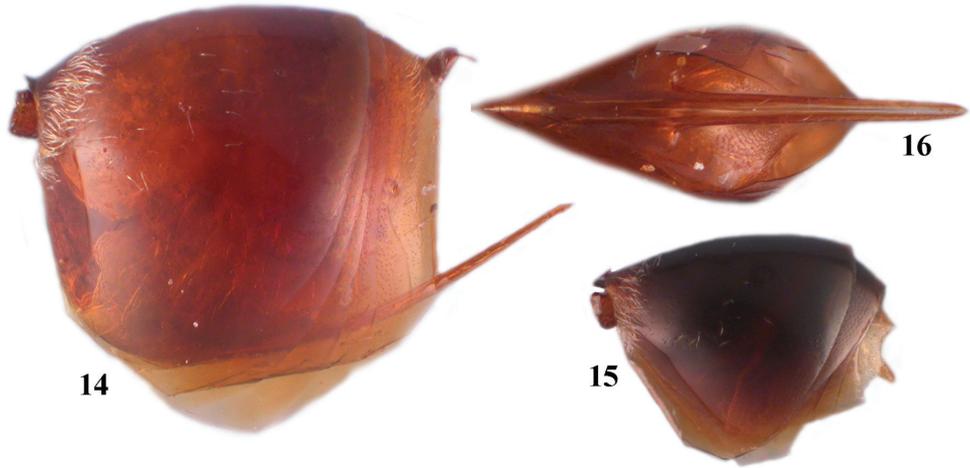
**Length.** 2.6–3.2 mm (n=15).

**Coloration.** Body, including antennae and legs predominantly dark to chestnut brown. Head, brown with more or less extensive black areas on lower face, basal part of genae, central part of frons and vertex; posteriorly head dark brown to black. Antenna uniformly dark brown, F1–F5 lighter; mesosoma laterally black, except brown dorso-lateral area of pronotum; propleura black; mesoscutum brown, with black stripes along anterior parallel and parapsidal lines; mesoscutellum dark brown to black, with slightly lighter scutellar foveae. Propodeum uniformly black; axillula yellowish; legs uniformly brown, with darker hind legs; metasoma brown, anterodorsally darker.

**Head** (Figs 1–3). Uniformly and delicately reticulated, with few white setae, 1.8–2.0 times as broad as long from above, 1.3–1.5 times as broad as high in frontal view and slightly broader than mesosoma. Gena broadened behind eye, as broad as transverse diameter of eye; malar space 0.35–0.4 times as long as height of eye, with delicate striae radiating from clypeus and nearly reaching eye margin, malar sulcus absent. POL 1.4 times as long as OOL; OOL 2.5 times as long as length of lateral ocellus and 1.8 times as long as LOL. Transfacial distance nearly 1.2 times as broad as height of eye; diameter of antennal torulus around 3.8 times as great as distance between them, distance between torulus and inner margin of eye equal to or slightly longer than diameter of torulus; inner margins of eyes parallel; lower face delicately coriaceous, with dense white setae, the median elevated area smooth. Clypeus small, squared, smooth, impressed in basal part, ventrally straight; anterior tentorial pits, epistomal sulcus and clypeo-pleurostomal line indistinct. Frons, vertex, interocellar area and occiput delicately reticulate. Postocciput alutaceous and shiny, smooth and impressed around occipital foramen; posterior tentorial pits large; height of occipital foramen as long as height of postgenal bridge; hypostomal carina emarginate, not going around oral foramen, continuing into gular sulcus. Labial palpus 3-segmented, terminal peg distinct, all three segments densely setose; maxillary palpus 5-segmented, terminal peg distinct, three terminal segments densely setose.

**Antenna** (Fig. 6). With 11 flagellomeres (14: 9×8: 15×8: 19: 15: 14: 13: 11: 10: 10: 9: 8: 16); longer than head+mesosoma (48:34); pedicel globose, as long as broad; F1 as long as scapus; F2 1.2–1.3 times as long as F1; F1=F3; F4–F5 subequal and shorter, F6–F10 shorter and progressively shortening in length; F11 twice as long as F10; placodeal sensilla distinct on F6–F11, indistinct but present on F4–F5, absent on F1–F3.

**Mesosoma** (Figs 9–12). 1.2–1.3 times as long as high in lateral view, with few white setae. Mesoscutum as long as broad, or only slightly longer than broad in dorsal view; with sparse scattered setae and transverse, delicate, interrupted striae which connect with longitudinally orientated weak striae, forming an irregular network of striae, and an irregularly reticulate surface sculpture. Notauli incomplete, extending at most to half length of mesoscutum; converging, deep and broad posteriorly. Anterior parallel lines extending to ½ length of mesoscutum; parapsidal



**Figures 14–18.** *Zapatella grahami* **14** metasoma, female (lateral view) **15** metasoma, male (lateral view) **16** ventral spine of hypopygium (ventral view) **17–18** gall.

lines distinct and broad, starting from posterior margin and extending to  $\frac{1}{2}$  length of mesoscutum; median mesoscutal line very short or absent. Mesoscutellum 0.5 times as long as mesoscutum, as long as broad, not overhanging metanotum, center of disk reticulate, sides and posterior  $\frac{1}{3}$  dull rugose; scutellar foveae present, ovate, not delimited posteriorly, bottom shiny, with some rugae; median carina broad. Mesopleuron uniformly delicately reticulate, smooth and shiny basally; mesopleural triangle conspicuously setose; dorsal axillar area coriaceous with numerous setae, lateral axillar area reticulo-carinate, without setae; axillula smooth, with white setae; subaxillular bar smooth, shiny, narrower than height of metanotal trough; postalar process long, strong, reticulate; metapleural sulcus reaching mesopleuron in upper  $\frac{2}{3}$  of its height. Metascutellum strongly reticulate, rectangular. Metanotal trough with short white setae; ventral impressed area at least twice as narrow as height of metascutellum, delicately reticulate. Propodeum setose laterally, glabrous centrally;

central propodeal area smooth, shiny, with many irregular wrinkles and rugae, lateral propodeal carinae weak, diverging anteriorly and converging in posterior 1/3. Nucha with irregular wrinkles and rugae.

**Legs** (Fig. 8). Tarsal claws simple, without basal lobe; hind coxae with dense white setae on the dorsoposterior surface.

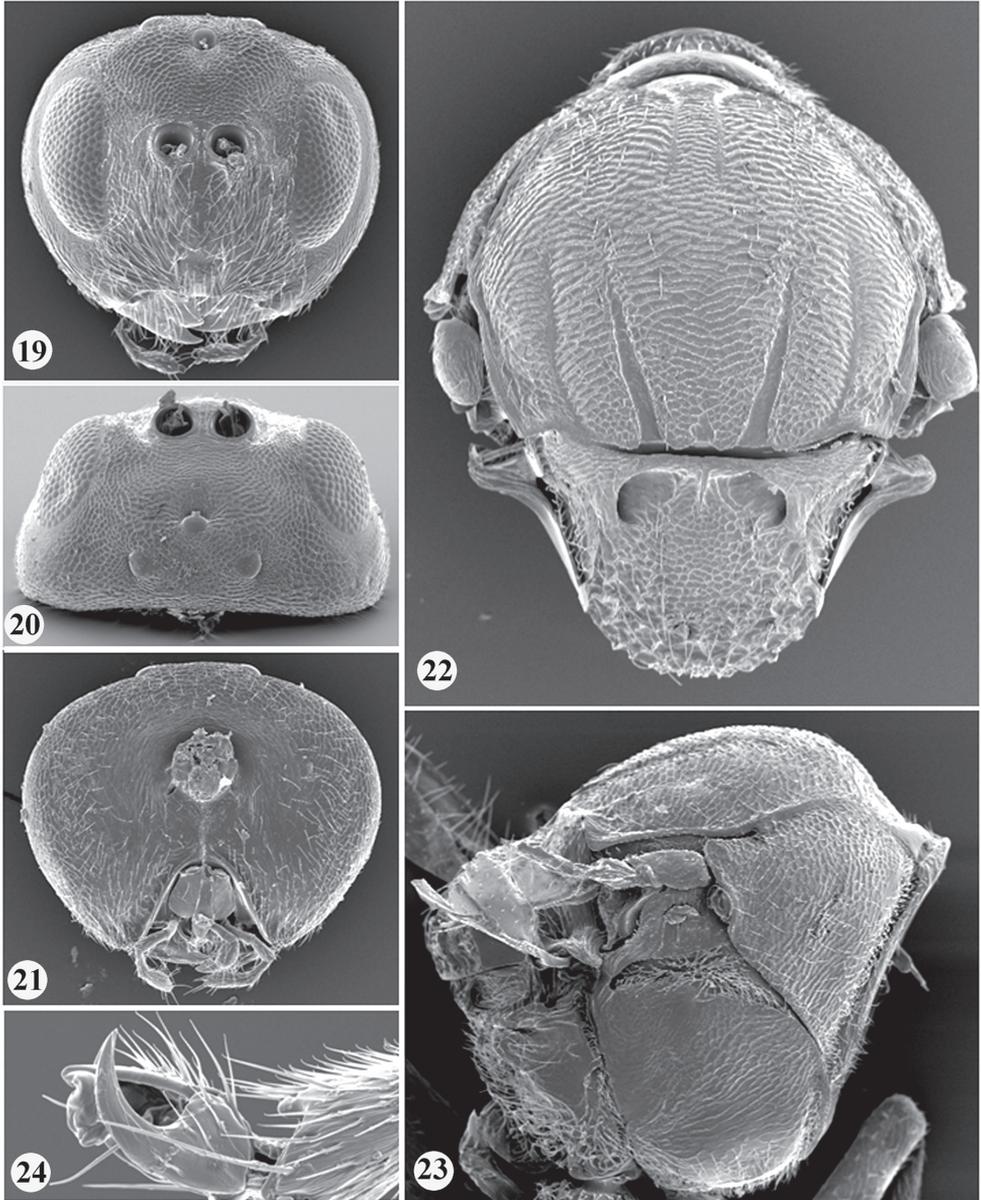
**Forewing** (Fig. 13). Longer than body, hyaline, without cilia on margin; radial cell 3.3 times as long as broad; 2r distinct; R1 absent or hardly visible, Rs very inconspicuous, nearly straight; areolet absent or very indistinct. Rs+M indistinct, reaching basalis at half of its height.

**Metasoma** (Figs 14, 16). Shorter than head+mesosoma, slightly higher than long in lateral view; base of 2nd metasomal tergite with felt-like dense ring of white setae, interrupted dorsally and few setae scattered on lateral surface of tergite. Narrow posterior band on 2<sup>nd</sup> metasomal tergite and all subsequent tergites with very delicate dense micropunctures. Prominent part of ventral spine of hypopygium needle-like, tapering to apex, 7.5–8.5 times as long as broad, with two parallel rows of short white scattered setae which do not extend beyond the apex of spine.

**Male** (Figs 4–5, 7, 15). Length 2.3–2.5 mm (n=4). Similar to female, except in the following characters: predominantly black with few brown areas; head 2.0 times as broad as long from above, 1.2 times as broad as high and broader than mesosoma in frontal view; malar space 0.3 times as long as height of eye; POL 2.0 times as broad as OOL; OOL 2.0 times as long as length of lateral ocellus and 1.3 times as long as LOL. Antennae with 13 flagellomeres (6: 4×4: 11×3.5: 10: 9: 9: 8: 8: 7: 7: 6: 6: 6: 6: 7); longer than body (101:93); pedicel as long as broad; F1 slightly longer than F2, distinctly curved, dorsally flattened and excavate; subsequent flagellomeres progressively shorter in length; F13 longer than F12; placodeal sensilla on all flagellomeres.

**Gall** (Figs 17–18). Acorn galls. Individual chambers located in the acorn cup, often between the cup and the seed. Usually there is one gall per acorn, but sometime two or three.

**Biology.** Only the sexual generation is known and it induces galls on *Quercus costaricensis*. Galls were collected in February and later in October in forests located above 3000 m altitude, adults emerged immediately after the galls were collected, in February and October. This very unusual emergence of adults in two periods may be due to the sporadic nature of the collecting and to the peculiar phenology of *Q. costaricensis*. In the area where the galls were collected, Camacho and Orozco (1998) observed the flowering and fruiting phenology for a four year period (July 1986 to July 1990). The female flowers were present for ten months of the year, starting in the rainy season, with a flowering peak in the dry season. Male flowers were present for seven months, with a flowering peak from October to January, the period from the end of the rainy season and continuing to the beginning of the dry season. During the four years of observation there was only one fruiting period, which was synchronous, very productive, and extended for eight months (August 1988 to March 1989); this is one year after the initial production of female flowers and six months after the end of male flower production.



**Figures 19–24.** *Zapatella nievesaldreyi*, female **19** head (anterior view) **20** head (dorsal view) **21** head (posterior view) **22** mesosoma (dorsal view) **23** mesosoma (lateral view) **24** tarsal claw.

**Distribution.** Currently known only from Costa Rica (Cerro de la Muerte).

**Etymology.** In recognition of the continuing contribution of our friend, prof. Graham N. Stone (Institute of Evolutionary Biology, University of Edinburgh, Edinburgh, Scotland) to research on oak gallwasps.

***Zapatella nievesaldreyi* Melika & Pujade-Villar, sp. n.**

urn:lsid:zoobank.org:act:7D783313-C344-41D4-BD4A-1D2E3E6EE4BB

[http://species-id.net/wiki/Zapatella\\_nievesaldreyi](http://species-id.net/wiki/Zapatella_nievesaldreyi)

**Type material.** HOLOTYPE female (deposited in IAvH): “COLOMBIA, Boyacá, Villa de Leyva, Vereda sabana, Sector Chaina,, 05°41'05.1"N, 73°29'17.3"W, 2468 m. En Agallas en ramas de *Q. humboldti*, (13 May 2010) May-2010. leg. J. Pujade-Villar, C. Medina, M. Torres” (white label), Holotype of *Zapatella nievesaldreyi* ♀ Melika & Pujade-Villar n. sp. design. JP-V 2012” (red label). PARATYPES (93 females) with the same data as the holotype. 17 paratypes are deposited in UB, 8 in PDL and 70 in IAvH.

**Additional material examined.** 95 females with the same data as the holotype.

**Diagnosis.** See Diagnosis of *Z. grahami* above. It also resembles the Nearctic *Calirhytis medularis* Weld (see Discussion).

**Description** (Figs 19–30). Asexual form.

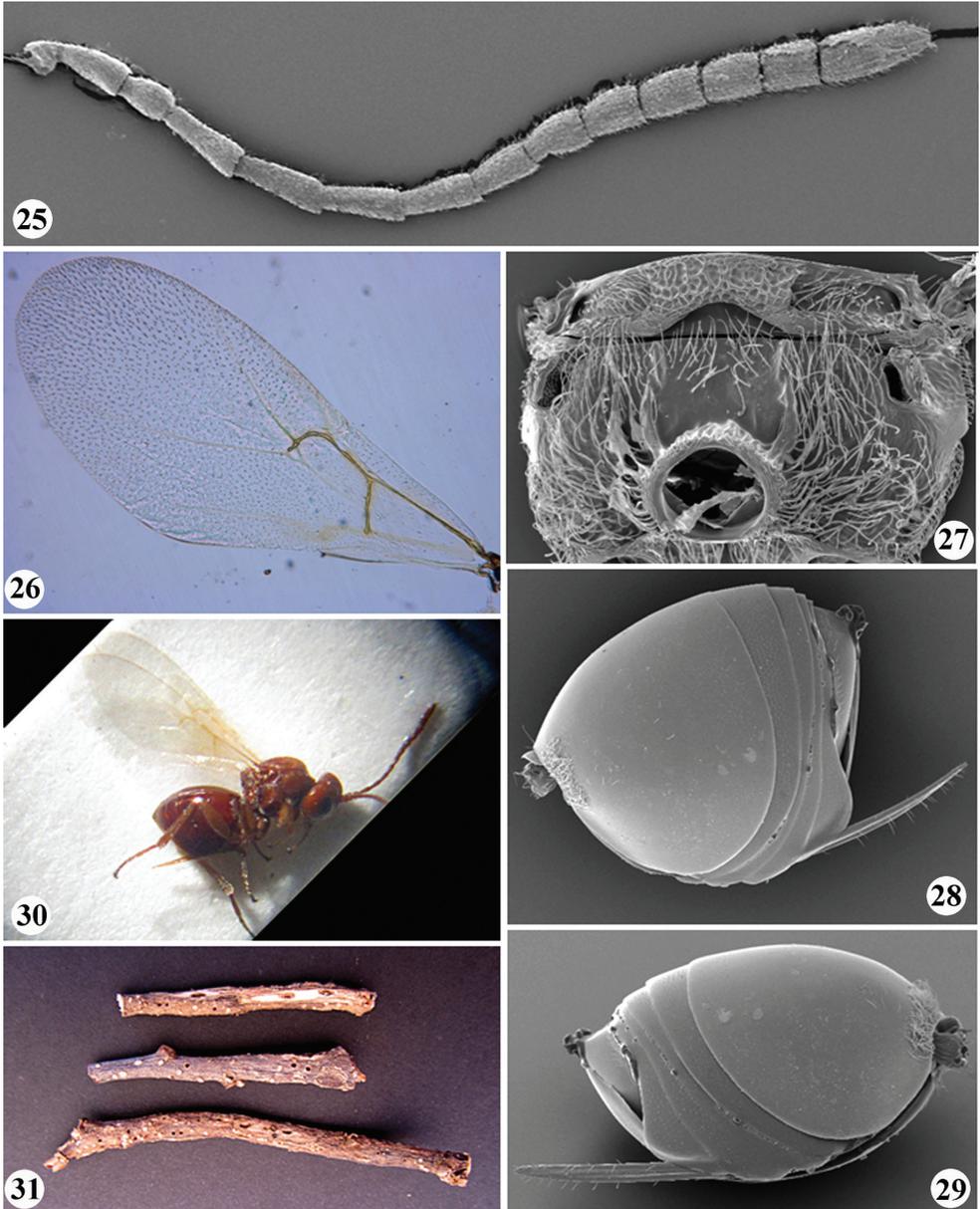
**Length.** Female 1.7–2.8 mm (n = 50).

**Coloration.** Body, antennae and legs uniformly reddish brown, only tips of mandibles, postocciput, propleura and tarsal claws always darker; in some specimens 3<sup>rd</sup> and subsequent tergites darker.

**Head** (Figs 19–21). Slightly broader than mesosoma, with few white sparse, short inconspicuous setae, more dense on lower face. Head very slightly transverse, only 1.2–1.3 times as broad as high in anterior view and massive from above, only 1.6–1.8 times as broad as long in dorsal view; gena broadened behind eye, broader than transverse diameter of eye, delicately uniformly reticulate; malar space without sulcus, 0.4–0.5 times as long as eye height, with striae radiating from clypeus and nearly reaching eye margin. Lower face delicately coriaceous, without elevated area medially. Clypeus slightly impressed, setose, alutaceous, rounded and slightly emarginate ventrally, medially not incised, anterior tentorial pits small, indistinct; epistomal sulcus and clypeopleurostomal line distinct. POL = OOL, OOL 2.5 times as long as length of lateral ocellus and 1.5 times as long as LOL, interocellar area microreticulate, not elevated; frons, vertex and occiput microreticulate; postocciput and postgenae alutaceous. Labial palpus 3-segmented, terminal peg distinct, all three segments densely setose; maxillary palpus 5-segmented, terminal peg distinct, three terminal segments densely setose.

**Antenna** (Fig. 25). 11 flagellomeres, slightly longer than combined length of head and mesosoma; pedicel slightly longer than broad; F1 length nearly equal to length of F2 and slightly longer than F3; F6–F10 shorter and broader than preceding segments; F11 2.0 times as long as F10; placodeal sensilla on F5–F11, hardly traceable or invisible on F1–F4.

**Mesosoma** (Figs 22–23, 27). 1.4 times as long as high, mesoscutum dorsally concave in later view. Pronotum setose, with uniformly delicately reticulate sides, without carinae posterolaterally. Mesoscutum slightly broader than long in dorsal view, with sparse scattered setae; with transverse, delicate interrupted striae which are connected with longitudinally orientated weak striae forming an irregular network of striae, together forming an irregular reticulate surface sculpture. Notauli extending nearly to half length of mesoscutum, deep and broad posteriorly, narrowing toward anterior end, with smooth



**Figures 25–31.** *Zapatella nievesaldreyi*, female: **25** antenna **26** forewing **27** metascutellum and propodeum (posterodorsal view) **28** metasoma (lateral view) **29** metasoma with ventral spine of hypopygium (lateral view) **30** female habitus (lateral view) **31** twigs with galls.

bottom; median mesoscutal line absent or present in a form of short triangle; parapsidal lines distinct, extending to half length of mesoscutum; anterior parallel lines distinct, extending to 1/3 length of mesoscutum. Mesopleuron uniformly reticulate. Mesoscutellum as broad as long in dorsal view, centrally delicately coriaceous, dull rugose along sides

and in posterior 1/3; scutellar foveae transversely ovate, with smooth and shiny bottom, distinctly separated medially by elevated coriaceous area. Metascutellum rugose, higher than height of smooth, shiny ventral impressed area of metanotum; metanotal trough smooth, shiny, with numerous white setae. Propodeum coriaceous, with dense white setae laterally; with smooth, shiny central propodeal area, delimited by distinct parallel lateral carinae, which slightly converge in posterior 1/3; anterior half of central propodeal area with dense white setae, posterior half without setae. Nucha with longitudinal rugae.

**Forewing** (Fig. 26). Nearly as long as body, pubescent, without cilia on margins; radial cell open, around 3.5 times as long as broad; veins very light, hardly traceable; areolet indistinct, usually invisible; vein Rs+M points slightly below midway along basalis; R1 and Rs never reach wing margin, very inconspicuous, often invisible or absent.

**Legs** (Fig. 24). Tarsal claws simple, without basal lobe, but with broad base; hind coxae with dense white setae dorsoposteriorly.

**Metasoma** (Figs 28–29). As long as head and mesosoma together, slightly longer than high; all metasomal tergites smooth and shiny; base of 2nd metasomal tergite with felt-like dense ring of white setae, interrupted dorsally, and a few scattered setae on lateral surface of tergite. Narrow posterior band on 2<sup>nd</sup> metasomal tergite and all subsequent tergites with very delicate, dense micropunctures. Prominent part of ventral spine of hypopygium needle-like, tapering to apex, 6.0–7.0 times as long as broad, with two parallel rows of short, white, scattered setae.

**Gall** (Fig. 31). Inconspicuous galls in twigs, without visible enlargement (swelling) of the infested twig (branch). The larval cells, 2×1 mm, are nested in the wood parallel one to another.

**Biology.** Only females are known to induce galls hidden in twigs on *Quercus humboldtii*. Twigs with galls were collected in May and adult wasps immediately emerged in the same month.

**Distribution.** Currently known only from Colombia, Boyaca, from deciduous mixed broad-leaved forests located about 2000 m altitude.

**Etymology.** In recognition of the continuing contribution of Dr. José Luis Nieves-Aldrey (Museo Nacional de Ciencias Naturales-CSIC, Departamento de Biodiversidad y Biología Evolutiva, Madrid, Spain) to research on oak gallwasps.

**Species transferred to *Zapatella*.** Five Nearctic *Callirhytis* species possess the same character set as the above two species and thus they are transferred to *Zapatella*.

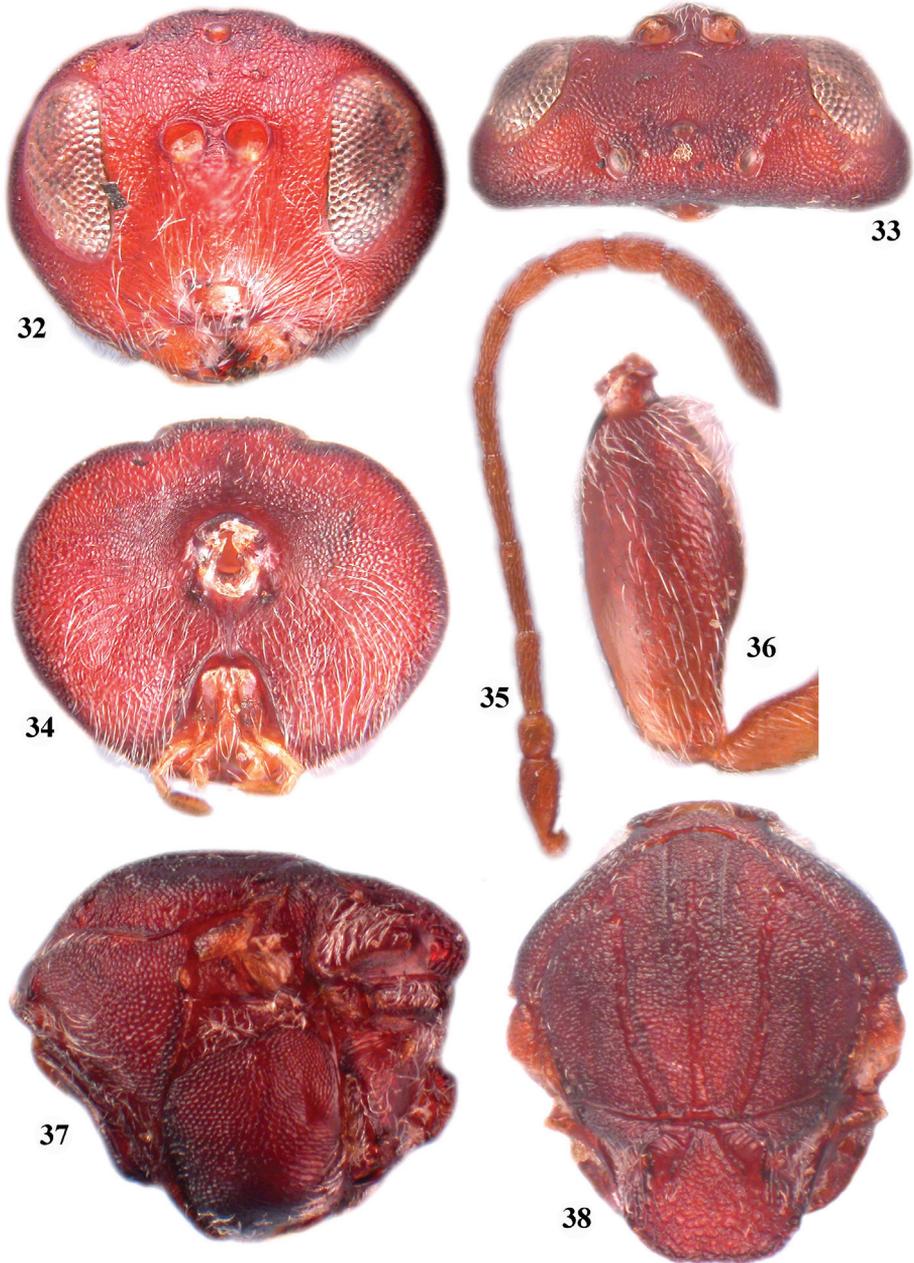
### *Zapatella cryptica* (Weld), comb. n.

[http://species-id.net/wiki/Zapatella\\_cryptica](http://species-id.net/wiki/Zapatella_cryptica)

Figures 32–38, 59, 61

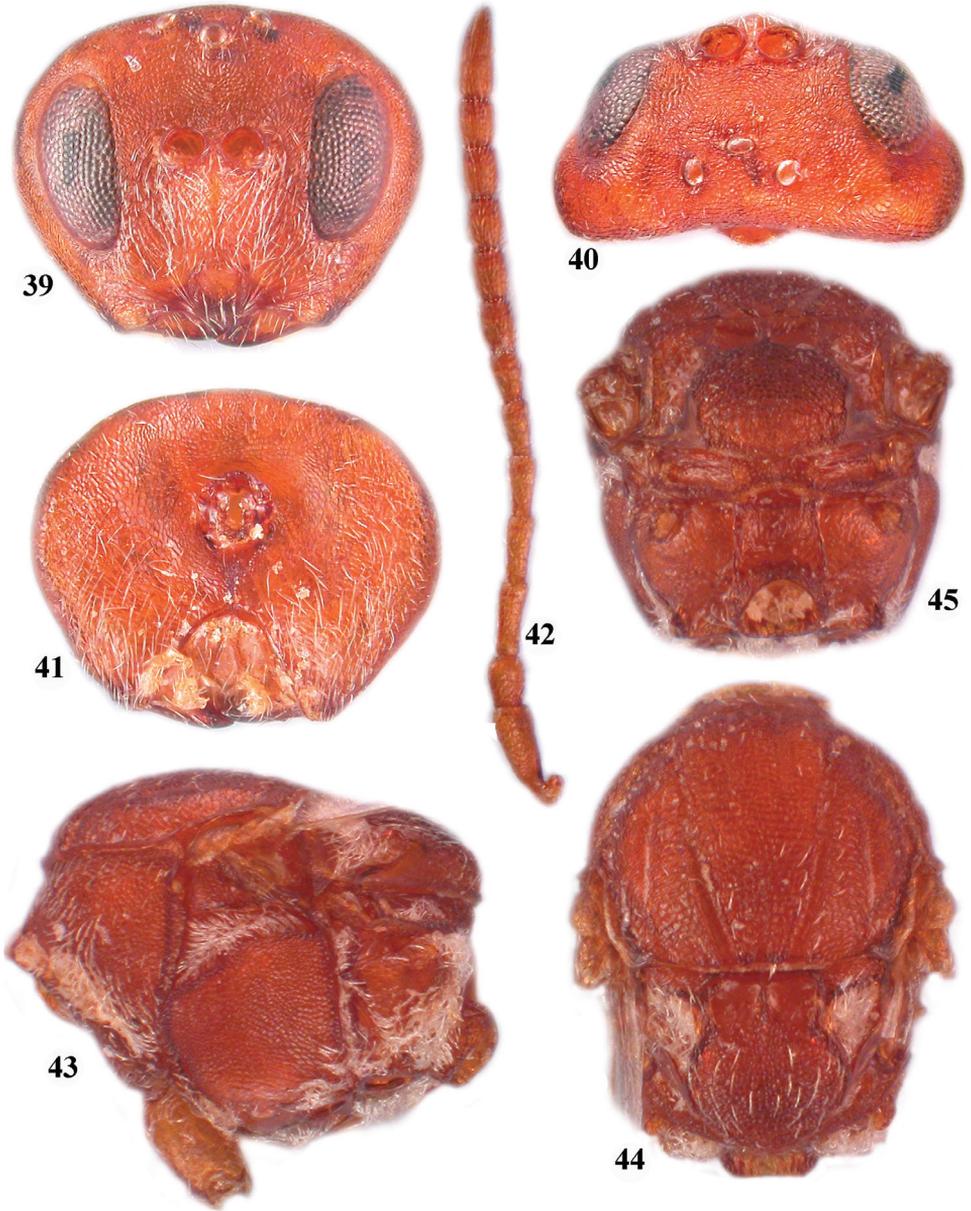
*Callirhytis cryptica* Weld, 1922b (female, galls).

**Material examined.** One paratype female: ‘Dolhan, Ala, May; *Q. digitata*; 1188; Paratype No. 24725 USNM’.



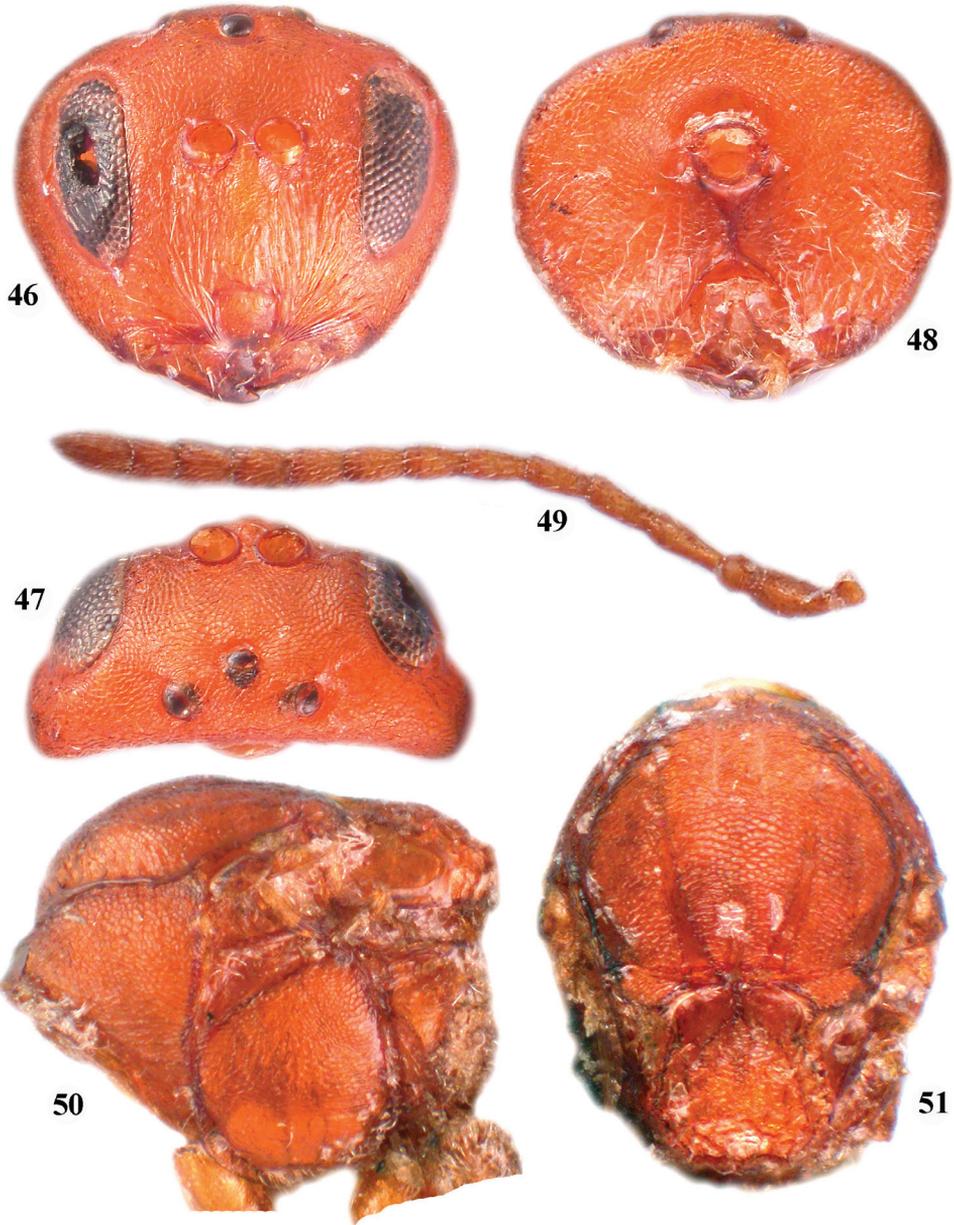
**Figures 32–38.** *Zapatella cryptica*, female **32** head (anterior view) **33** head (dorsal view) **34** head (posterior view) **35** antenna **36** hind coxa **37** mesosoma (lateral view) **38** mesosoma (dorsal view).

Only the asexual generation is known. It induces bud galls on *Q. myrtifolia* Willd. and *Q. falcata* Michx. in the USA (Florida and Alabama) (Weld 1922b, Burks 1979).



**Figures 39–45.** *Zapatella herberti*, female **39**, head (anterior view) **40** head (dorsal view) **41** head (posterior view) **42** antenna **43** mesosoma (lateral view) **44** mesosoma (dorsal view) **45** metascutellum and propodeum (posterodorsal view).

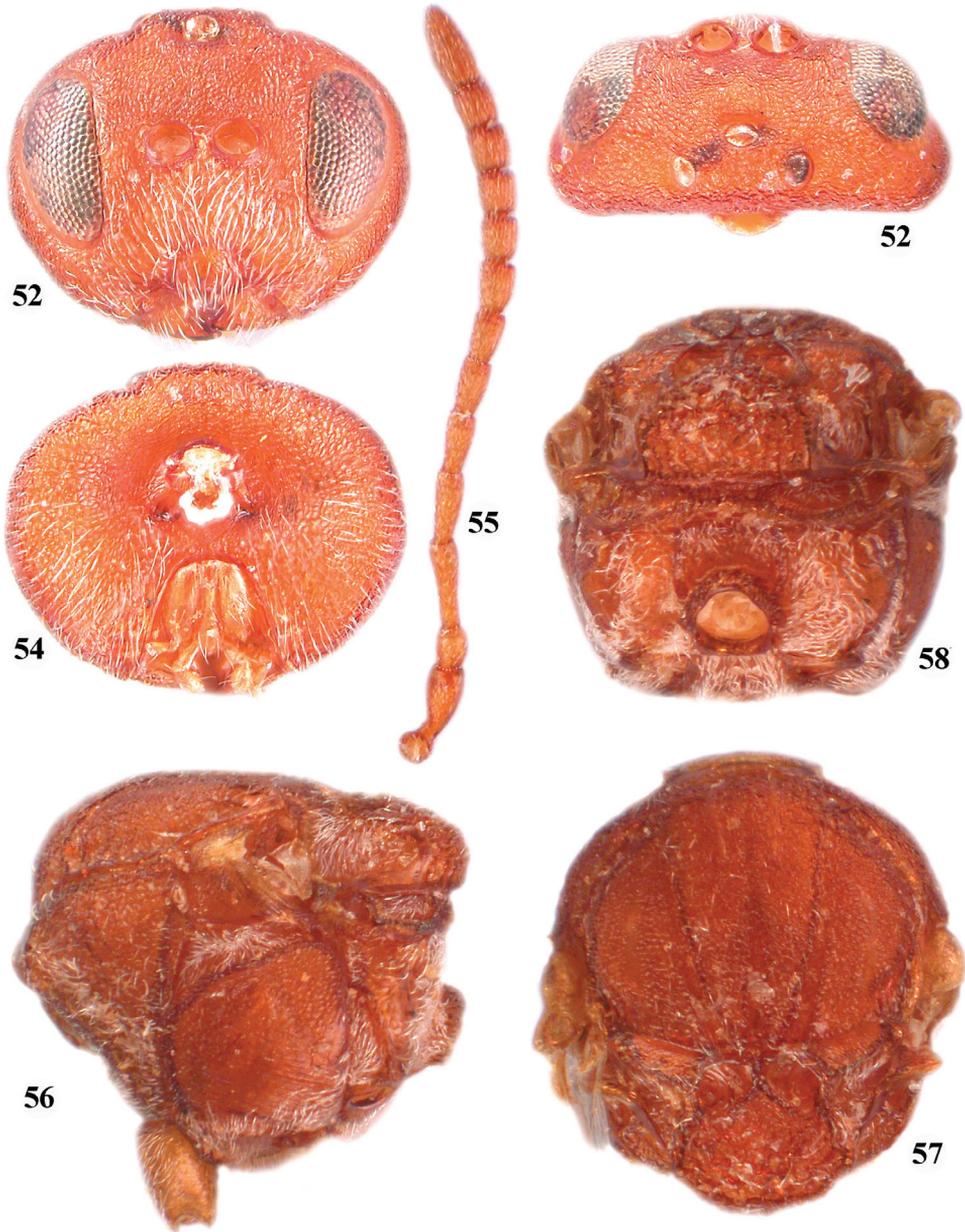
Type galls were collected in October and adults emerged the next year in May (Weld 1922). The affected terminal bud cluster becomes enlarged, one or two green leaves sometimes grow out beyond the bud scales, and later the bud turns brown; the



**Figures 46–51.** *Zapatella quercusmedullae*, female **46** head (anterior view) **47** head (dorsal view) **48** head (posterior view) **49** antenna **50** mesosoma (lateral view) **51** mesosoma (dorsal view).

gall is completely hidden within the bud and is conical, with a thin-walled cell and a tuft of hairs near the apex (Weld 1922b).

The female is entirely uniformly reddish brown and the notauli are incomplete, reaching to  $3/4$  of the mesoscutum length, but darker lines that look like notauli reach



**Figures 52–58.** *Zapatella quercusphellos*, female **52** head (anterior view) **53** head (dorsal view) **54** head (posterior view) **55** antenna **56** mesosoma (lateral view) **57** mesosoma (dorsal view) **58** metascutellum and propodeum (posterodorsal view).

the anterior margin of the mesoscutum; the median mesoscutal line is impressed and reaches the pronotum; the prominent part of the ventral spine of the hypopygium is 6.3 times as long as broad. See also the *Zapatella* species key.

***Zapatella herberti* (Weld), comb. n.**

[http://species-id.net/wiki/Zapatella\\_herberti](http://species-id.net/wiki/Zapatella_herberti)

Figures 39–45

*Eumayria herberti* Weld, 1926 (females, galls). *Bassetia herberti* (Weld) (Burks 1979).

*Callirhytis herberti* (Weld) (Melika and Abrahamson 2007).

**Material examined.** Two paratype females: ‘Placerville Cal., May 21’18; 1615; Paratype No. 27223 USNM; *Eumayria herberti*’ and ‘Placerville Cal.; cut out May 13; 1615; Paratype No. 27223 USNM; *Eumayria herberti*’.

Only the asexual generation is known. It induces stem swelling galls on *Q. agrifolia* Née, *Q. kelloggii* Newb., *Q. wislizeni* A.DC in California (USA) (Weld 1926, Burks 1979). Larval chambers (cells) are nested in the peripheral layer of wood, just under the bark of vigorous shoots 2cm or less in diameter. Adults emerge in late May (Weld 1926).

The female is uniformly reddish brown, including the metasoma. The notauli are complete, always reaching pronotum, deeply impressed; the median mesoscutal line is short, extending to 1/4 of the mesoscutum length, beyond which it is indicated by a dark line only. The metasoma has a ring of very dense white setae at the base of the 2nd metasomal tergite, interrupted dorsally; the metasoma is slightly higher than long in lateral view. The 2nd metasomal tergite is smooth, shiny, without punctures, while the next tergites have micropunctures. The ventral spine of the hypopygium is hidden under the tergites, its prominent part 6.1 times as long as broad ventrally. See also the key to *Zapatella* species.

***Zapatella quercusmedullae* (Ashmead), comb. n.**

[http://species-id.net/wiki/Zapatella\\_quercusmedullae](http://species-id.net/wiki/Zapatella_quercusmedullae)

Figures 46–51

*Cynips quercusmedullae* Ashmead, 1885 (females, galls). *Andricus* (*Andricus*) *medullae* Ashmead, 1885. *Callirhytis quercusmedullae* (Ashmead) (Burks 1979). *Andricus cryptus* Ashmead, 1887 (synonym in Dailey and Menke 1980).

**Material examined.** One paratype female: ‘Jacksonville; collector Ashmead; Paratype No. 1497; *Andricus medullae* Ashm. (handwritten label)’.

Only the asexual generation is known. It induces stem swelling galls, in spring, on *Q. incana* Bartram (= *Q. cinerea* Raf.), *Q. marilandica* (L.) Münchn. and *Q. myrtifolia* in the USA (Florida, Alabama, Georgia, Mississippi, Texas) (Burks 1979). The adults emerge the following year in February and March (Ashmead 1885a, b; Weld 1959).

The female, like the previous species, has the notauli incomplete, extending to half of the mesoscutum length, with darker lines that resemble notauli reaching the anterior margin of the mesoscutum. The median mesoscutal line is absent. The prominent part of the ventral spine of the hypopygium is 6.2 times as long as broad ventrally. See also the key to *Zapatella* species.

***Zapatella quercusphellos* (Osten Sacken), comb. n.**

[http://species-id.net/wiki/Zapatella\\_quercusphellos](http://species-id.net/wiki/Zapatella_quercusphellos)

Figures 52–58, 60, 62

*Cynips quercusphellos* Osten Sacken, 1861. *Callirhytis quercusphellos* (Osten Sacken ) (Burks 1979).

*Cynips quercussimilis* Bassett, 1864, syn. n. *Callirhytis quercussimilis* (Bassett) (Burks 1979).

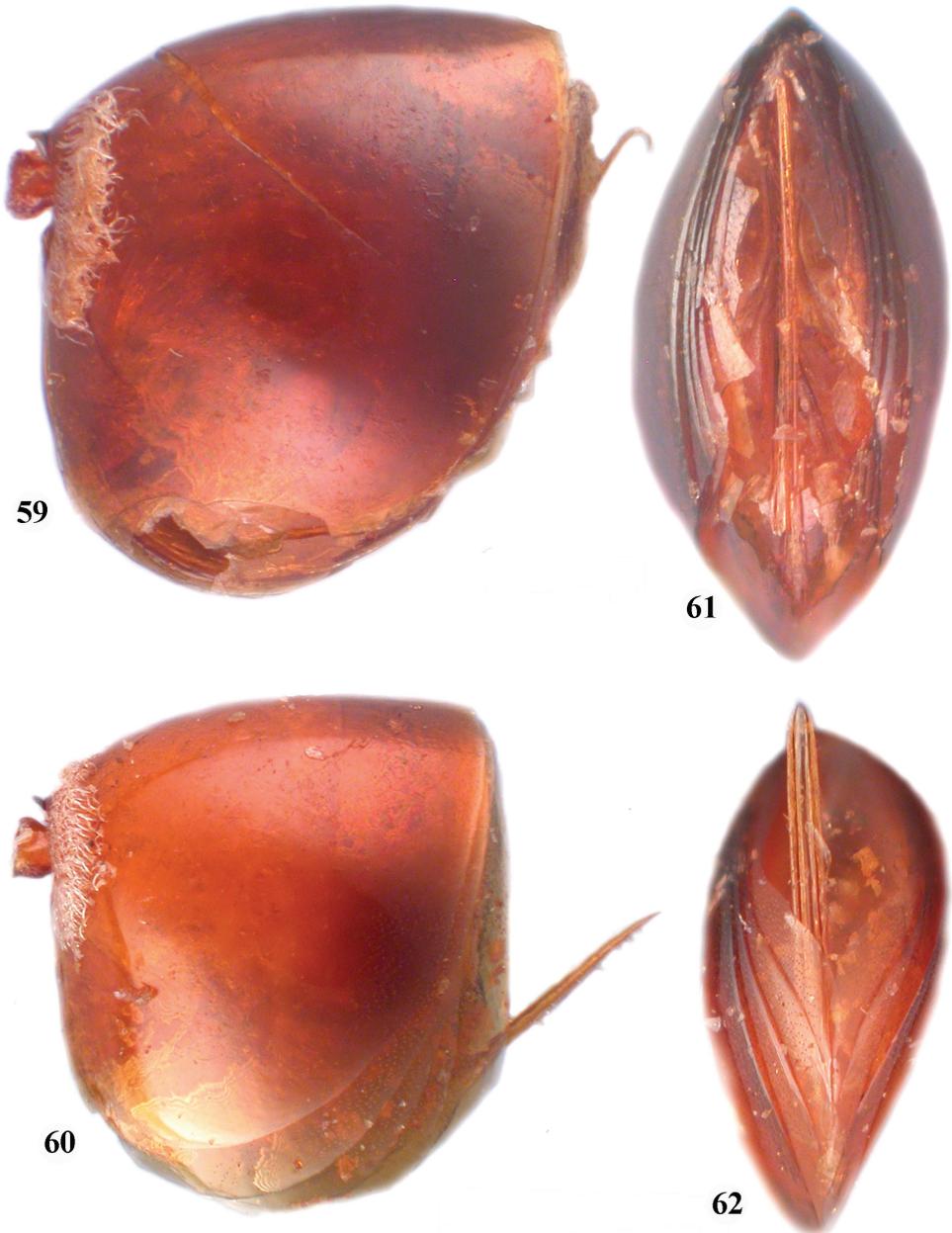
**Material examined. For *Cynips quercusphellos*:** One paratype female: Osten-Sacken coll.; Type (red); Paratype 24684, USNM (red); *Cynips quercus-phellos* OS from M.C.Z 1921 exchange. One female: Mnt Vernon, Va., 16, 1916, WLMaCtee collector. *Callirhytis phellos* (OS) det. Weld, 1942 (Weld's handwriting labels); other female: Alachua Co., Fl., Gainesville, III.27.1924. T.H.Hubbell. *Callirhytis quercusphellos* (OS) det. Weld, 1925 (Weld's handwriting label). The two specimens were compared by GM to the Osten Sacken's cotype, deposited at the USNM (Washington, DC) and obtained by L.H. Weld from the Museum of Comparative Zoology by exchange (Weld 1922b) and they appeared to be identical with that specimen (cotype). **For *Cynips quercussimilis*:** Three female and one male paratypes: 'Waterbury, Ct., H.F.Bassett Coll.; Type; Beut. Coll rec'd 1935'.

*Callirhytis* (*Cynips*) *quercussimilis* (sexual form) was known, inducing stem swelling galls on *Q. incana*, *Q. falcata*, *Q. ilicifolia* Wangenh., *Q. imbricaria* Michx., and *Q. myrtifolia* along the Atlantic coast, from Florida to New York state (Burks 1979). The galls are club-shaped swellings if they form on terminal twigs, with 1–4 cells (Weld 1959). Green and fleshy galls develop in May, and later turn woody (become lignified). Adults emerge in June to the beginning of July (Bassett 1864, Weld 1959).

The author of *Callirhytis quercusphellos* (Osten Sacken 1861) collected greenish rounded woody swellings at the tip of the twigs of *Q. phellos* (L.) in Virginia, near Potomac river in June; four sexual females emerged by the end of June Osten Sacken (1865) mentioned that his species somehow resembles *Callirhytis quercussimilis* (Bassett), however, differs from it. Dalla Torre and Kieffer (1910) treated them as different species. Weld (1922b) erroneously synonymised *Cynips similis* Bassett to *Callirhytis quercusphellos* (O.S.). Later, the two species were treated as different species (Weld 1926, 1928, 1951, 1959; Burks 1979). Weld (1922b) observed galls absolutely similar to those of *Z. quercusphellos* on *Q. falcata*, *Q. incana*, *Q. texana* Buckley, *Q. laurifolia* Michx. and *Q. myrtifolia*.

*Zapatella quercusphellos* was collected also at Rosslyn, Virginia from *Q. imbricaria* in June and *Q. phellos* in May, adults emerged in late June. In both cases the greenish fresh galls were similar terminal enlargements on new growths, inconspicuous, only 5 mm long; after maturation galls were 8–10 mm in diameter (Weld 1926).

A detail examination of specimens of *C. quercusphellos* and *C. quercussimilis*, mentioned above, showed no appreciable morphological differences and thus, *C. quercussimilis* is a syn. n. of *C. quercusphellos* and here in the species transferred to the *Zapatella* genus, *Z. quercusphellos*, comb. n. Females are uniformly dark reddish brown;



**Figures 59–62.** 59 *Zapatella cryptica*, metasoma, female (lateral view) 60 *Z. quercussimilis*, metasoma, female (lateral view) 61 *Z. cryptica*, ventral spine of hypopygium 62 *Z. quercussimilis*, ventral spine of hypopygium.

the notauli are incomplete, extending to half the mesoscutum length, with darker lines reaching the anterior margin of the mesoscutum; the median mesoscutal line extending to 1/2 of the mesoscutum length, further indicated by a dark line only; the prominent part of the ventral spine of the hypopygium is 6.2 times as long as

broad ventrally. The male is much darker than the female, with a dark brown head and mesosoma, while the metasoma is slightly lighter (otherwise quite similar to *Z. grahami*). See also the key to *Zapatella* species.

Only the sexual generation is known. It induces stem swelling galls on *Q. incana*, *Q. falcata*, *Q. ilicifolia* Wangenh. , *Q. imbricaria*, *Q. myrtifolia* and *Q. phellos* along the Atlantic coast, from Florida to New York state (Burks 1979).

***Zapatella oblata* (Weld), comb. n.**

[http://species-id.net/wiki/Zapatella\\_oblata](http://species-id.net/wiki/Zapatella_oblata)

Figures 63–71

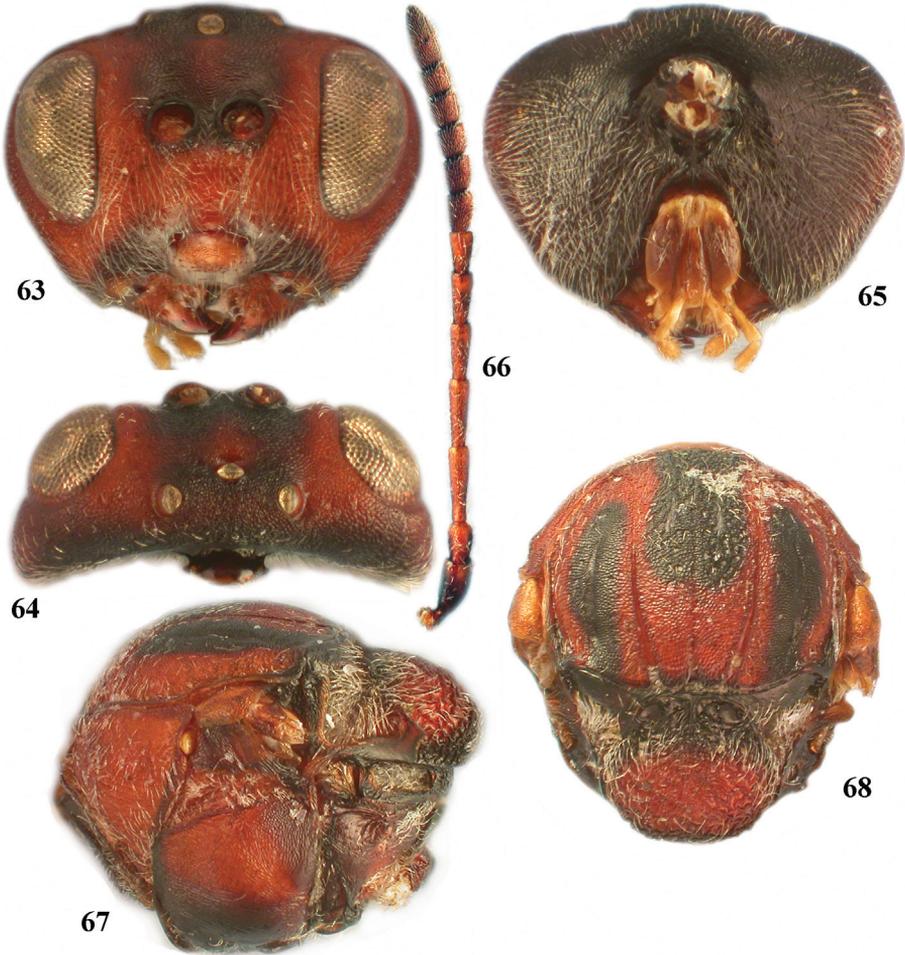
*Callirhytis oblata* Weld, 1952.

**Material examined.** Paratype female: Vienna, Va., March 21’46. *Q. coccinea*, 558, Paratype 60128, *Callirhytis oblata* Weld.

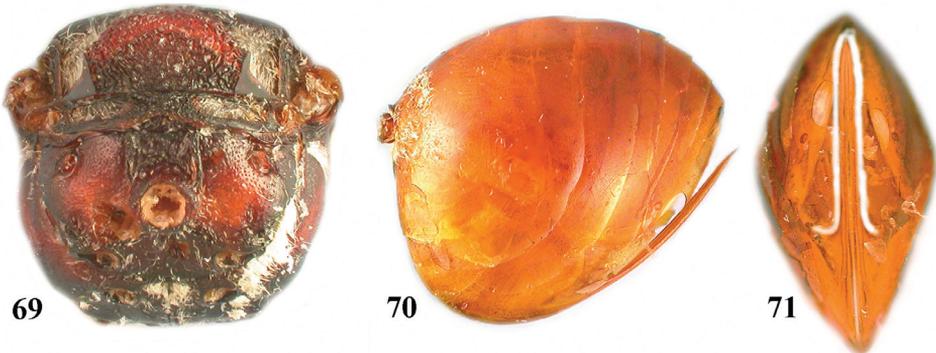
Only the asexual generation is known. It induces bud galls on *Q. coccinea* Muench. and *Q. falcata* in Virginia, USA (Weld 1952). The frons, vertex and head posteriorly are dark brown to black, the mesoscutum along and between anterior parallel lines and along parapsidal lines is black, scutellar foveae and the central propodeal area are also dark brown; the rest of the body is reddish brown. Notauli are complete, the median mesoscutal line extending to 2/3 of the mesoscutum length, scutellar foveae transverse; the prominent part of the ventral spine of the hypopygium is very long, about 8.5 times as long as broad from ventral view.

**Key to *Zapatella* species**

- 1 Female, antenna with 11 flagellomeres..... 2
- Male, antenna with 13 flagellomeres..... 8
- 2 Median mesoscutal line extending to 1/3–2/3 of mesoscutum length, deeply impressed (Figs 38, 57) ..... 3
- Median mesoscutal line very short or absent (Figs 10, 22, 51) ..... 5
- 3 Median mesoscutal line impressed to 1/2 of mesoscutum length, indicated beyond this by dark line; prominent part of ventral spine of hypopygium 6.2 times as long as broad in ventral view (Figs 60, 62). Stem swelling galls..... *quercusphellos*
- Median mesoscutal line extending to 2/3 of mesoscutum length; prominent part of ventral spine of hypopygium at least 8.0–8.5 times as long as broad in ventral view (Figs 59, 61, 71). Bud galls..... 4
- 4 Head and mesosoma uniformly reddish brown (Figs 32–38); scutellar foveae quadrangular, as long as broad (Fig. 38)..... *cryptica*



**Figures 63–68.** *Zapatella oblata*, female **63** head (anterior view) **64** head (dorsal view) **65** head (posterior view) **66** antenna **67** mesosoma (lateral view) **68** mesosoma, (dorsal view).



**Figures 69–71.** *Zapatella oblata*, female **69** metascutellum and propodeum (posterodorsal view) **70** metasoma (lateral view) **71** ventral spine of hypopygium (ventral view).

- Head and mesosoma with large dark brown to black patches (Figs 63–68); scutellar foveae transverse, broader than high (Fig. 68)..... ***oblata***
- 5 Body darker, head and mesosoma always with large dark brown to black spots (Figs 1, 2, 4, 5, 9, 10, 12); POL 1.4 times as broad as OOL (Fig. 2); bottom of scutellar foveae with rugae (Fig. 11); prominent part of ventral spine of hypopygium 7.5-8.5 times as long as broad (Figs 14, 16). Acorn galls (Figs 17–18)..... ***grabami***
- Body entirely and uniformly light reddish brown, without or with very few darker spots; POL equal to OOL (Fig. 20, 40); bottom of scutellar foveae smooth, without rugae (Fig. 22, 44); prominent part of ventral spine of hypopygium 6.0–7.0 times as long as broad (Figs 29–30). Galls in twigs..... **6**
- 6 Notauli complete, always reaching pronotum, deeply impressed (Fig. 44). Stem swelling galls with larval chambers nested in the peripheral layer of wood ..... ***herberti***
- Notauli incomplete, extending to 1/2 of mesoscutum length, never reaching pronotum (Figs 22, 51). Galls in twigs with larval chambers nested in the wood ..... **7**
- 7 Head in anterior view ovate (Fig 46), less robust and transverse from above (Fig. 47); scutellar foveae separated by very thin, line-like median carina (Fig 51); lateral propodeal carinae subparallel, extending the entire length (as in Fig. 58). Stem swelling galls ..... ***quercusmedullae***
- Head in anterior view rounded (Fig 19), robust and less transverse (Fig 20); scutellar foveae separated by broad bar (Fig 51); lateral propodeal carinae slightly bent outwards in posterior 1/3 (Fig. 27). Inconspicuous galls in twigs (Fig. 31)..... ***nievesaldreyi***
- 8 Gena width nearly equal to transverse diameter of eye; scutellar foveae not separated by median carina, not delimited posteriorly, with reticulate bottom. Acorn galls (Figs 17–18) ..... ***grabami***
- Gena width no more than 1/3 of transverse diameter of eye; scutellar foveae separated by distinct median carina, well-delimited all around, with smooth shiny bottom. Stem swelling galls ..... ***quercusphellos***

**Discussion**

Although the newly described genus *Zapatella*, somewhat resembles *Bassettia*, *Loxaulus*, and *Plagiotrochus* (see Diagnosis to *Zapatella* and Table 1), it most closely resembles *Callirhytis* ‘sensu lato’ (Weld 1952). The genus *Callirhytis*, with morphological generic limits given by Weld (1952), and widely used by many researchers over many decades, is a problematic one. Originally *Callirhytis* was erected for the European species by Förster (1869) and the main generic diagnostic characters he proposed were the transversely striate mesoscutum and the presence of the malar sulcus. Later, several authors (Mayr 1881, Ashmead 1885a, Cameron 1893, Kieffer 1897-1901; among others)

**Table 1.** Generic characteristics of *Zapatella* and allied genera (exclusive generic characters of *Zapatella* are in bold)

Characters	<i>sLoxaulu</i>	<i>aBassetti</i>	<i>sPlagiotrochu</i>	<i>sCallirhyti</i>	<i>aZapatell</i>
Malar sulcus	present	absent	absent	present	absent
Mesoscutum sculpture	reticulate	reticulate	transversely coriaceous or rugose	transversely strongly carinated	reticulate
Pronotum sculpture	reticulate	reticulate	fine striae	strong striae	reticulate
Metascutellum sculpture	rugoso-reticulate	reticulate	rugoso-reticulate	rugose	rugoso-reticulate
Metanotal trough	glabrous	glabrous	glabrous	glabrous	<b>pubescent</b>
Ventral spine	short (<2.5)	short (<2.0)	short (<3.0)	short (<4.0)	<b>long (&gt;6.0)</b>
Head fom above	massive	massive	oblong/lunate	oblong/lunate	massive
Sculpture of mesopleuron	uniformly reticulate	uniformly reticulate	with transverse sculptured band only	glabrous or coriaceous	with transverse sculptured band only
Propodeal carinae	subparallel	subparallel	strongly bent outwards	subparallel	subparallel
Hind coxae dorsoposterior surface	glabrous	glabrous	glabrous	glabrous	<b>pubescent</b>
Forewing margin	variable	no cilia	with cilia	no cilia	no cilia
F1 in male incised	yes	no	yes	yes	yes
R1 and Rs veins	conspicuous	conspicuous	conspicuous	conspicuous	<b>inconspicuous</b>
Scutellar foveae	anterior impression, not separated	present, posteriorly undefined	present, posteriorly undefined	present, posteriorly undefined	present, well-delimited posteriorly
2nd metasomal tergite, lateral setae	glabrous, few setae	glabrous, few setae	glabrous, few setae	glabrous, few setae	<b>with dense ring of setae</b>
3rd metasomal tergite	smooth	smooth	smooth	smooth	<b>punctate</b>

considered it as a subgenus of *Andricus*, where they placed species with simple tarsal claws, while the subgenus *Andricus* (*Andricus*) included species in which the tarsal claws possess a basal lobe (toothed tarsal claw). Mayr (1902) restored the generic status of *Callirhytis*. Nieves-Aldrey (1992), in his revision of the European species, showed that different *Callirhytis* species, in different alternate generations, vary in the presence or absence of toothed tarsal claws. Weld (1922a, 1922b, 1926, 1952) included many species in *Callirhytis* and established particular species groups, but neglected the diagnostic characters of *Callirhytis* given by Förster (1869), and as the result, the concept of *Callirhytis* became very chaotic. As a consequence, the Nearctic *Callirhytis* is a polyphyletic group what was already shown earlier (Nylander 2004, Liljeblad et al. 2008) and many North American species assigned to *Callirhytis* (Weld 1952, Burks 1979), in fact, are not *Callirhytis* ‘sensu stricto’ (Melika and Abrahamson 2002, Melika et al. 2009a). Seven species of *Callirhytis* ‘sensu stricto’ are known from the Western Palaearctic Region (Melika 2006).

Melika and Abrahamson (2002) stated that of the 115 described Nearctic *Callirhytis* species (Burks 1979), only 15 are true *Callirhytis* ‘sensu stricto’: *C. cedrosensis* Dailey & Sprenger, *C. corrugis* (Bassett) (= *defecta* Kinsey), *C. eldoradensis* (Beutenmueller), *C. electrea* Weld, *C. flora* Weld (= *C. milleri*), *C. fructicola* Ashmead, *C. fructuosa* Weld,

*C. intersita* Weld, *C. lapillula* Weld, *C. medularis* Weld, *C. morrisoni* (Ashmead), *C. perrugosa* Weld, *C. petrina* Weld, *C. petrosa* Weld, and *C. quercusmedullae* (Ashmead). Melika & Abrahamson (2002) also transferred some *Andricus* and *Bassettia* species to *Callirhytis* 'sensu stricto': *C. albobalani* (Weld), *C. chrysobalani* (Weld), *C. coortus* (Weld), *C. coronus* (Beutenmueller), *C. montezuma* (Beutenmueller), *C. rhizoxenus* Ashmead, *C. wheeleri* (Beutenmueller), *C. ceropteroides* Bassett, and *C. herberti* (Weld). In this study, *C. quercusmedullae* and *C. herberti*, are transferred to *Zapatella* genus, and probably some other listed species also form different monophyletic groups.

The newly established *Zapatella*, with the two described neotropical species and five transferred *Callirhytis* species, is the first contribution to this 'reorganization' of the Nearctic *Callirhytis* 'sensu lato'. Some *Callirhytis* species (*C. balanaspis* Weld, *C. corrugis* (Bassett), *C. glomerosa* Weld, and *C. medularis* Weld) partially resemble *Zapatella* in their host plant associations, morphology of adults and/or galls they induce, and thus need some explanation.

*Callirhytis balanaspis* Weld (only the asexual generation is known) induces acorn galls on red oaks, also has a very pale venation, R1 invisible, the malar sulcus absent, the mesoscutum with delicate, net-like reticulate transverse sculpture, as in *Zapatella*. However, the ring of very dense white setae at the base of the 2<sup>nd</sup> metasomal tergite is absent and the prominent part of the ventral spine of the hypopygium is only 3.0–3.5 times as long as broad. This species is definitely not a *Callirhytis* 'sensu stricto', it closely resembles *Zapatella*, and form a discrete unit within *Callirhytis* 'sensu lato'.

In *Callirhytis corrugis* (Bassett), which induces acorn galls on red oaks (Burks 1979), the forewing venation is pale, with some veins invisible, but the mesoscutum is coarsely transversely rugose, the malar sulcus is present, POL is shorter than OOL, the female antenna has 12 flagellomeres, the ring of very dense white setae at the base of the 2<sup>nd</sup> metasomal tergite is absent, and the prominent part of the ventral spine of the hypopygium is less than 2.0 times as long as broad. It is a true *Callirhytis* as noted in Melika and Abrahamson (2002).

In *Callirhytis glomerosa* Weld, which induces bud galls on red oaks, the malar sulcus is absent, the ring of very dense white setae at the base of the 2<sup>nd</sup> metasomal tergite is present, the hind coxae have dense white setae on the dorsoposterior surface as in *Zapatella*; the mesoscutum is very finely transversely rugose and the prominent part of the ventral spine of the hypopygium is much shorter, as in *Callirhytis*. However, it differs from both genera in the trapezoid head in anterior view (much shorter from above) and the female antenna with 12 flagellomeres. This species is definitely not a *Callirhytis* 'sensu stricto', closely resembles *Zapatella*, and forms a discrete unit within *Callirhytis* 'sensu lato'.

*Callirhytis medularis* Weld induces stem swelling galls on red oaks and is only known from the sexual generation. However, in *C. medularis*, the female antenna has 12 flagellomeres, the head is more massive from above, much broader than the mesosoma; the mesoscutum is dull rugose, with strong transverse ridges, the mesoscutellum broader than long, the metanotal troughs and hind coxae without dense white setae, the 2<sup>nd</sup> metasomal tergite without a ring of dense white setae at the base; the ventral spine of

the hypopygium is much shorter. This species is definitely not a *Callirhytis* 'sensu stricto', closely resembles *Zapatella*, and forms a discrete unit within *Callirhytis* 'sensu lato'.

Preliminary morphological analysis (GM and JPV, *unpublished data*) also showed that some Nearctic *Callirhytis* species that induce stem swelling galls on different sections of oaks, form distinct morphological and phylogenetic units. Thus, some of these discrete morphological groups form distinct genera, which might be monophyletic groups.

## Acknowledgements

We thank Palmira Ros-Farré (Barcelona University, Spain) for taking the SEM pictures included in this study; Matthew Buffington (USNM, Washington, DC, USA) for providing the possibility of working with material in the USNM.

## References

- Ashmead WH (1885a) On the cynipidous galls of Florida with descriptions of new species. Transactions of the American Entomological Society 12: 5–9.
- Ashmead WH (1885b) Studies in North American Chalcididae, with descriptions of new species from Florida. Transactions of the American Entomological Society 12: 11–19.
- Bassett HF (1864) Descriptions of several new species of Cynips and a new species of *Diastrophus*. Proceedings of the Entomological Society of Philadelphia 3: 679–691.
- Benia F, Khelil M, Pujade-Villar J (2009) *Plagiotrochus amenti*, una espèce gallicole potentiellement dangereuse pour la chêne-liège (*Quercus suber* L.) trouvée pour la première fois en Algérie (Hymenoptera, Cynipidae). Nouvelle Revue d'Entomologie 25(4): 291–296.
- Burks BD (1979) Superfamily Cynipoidea. In: Krombein KV, Hurd PD Jr, Smith DR, Burks BD (Eds) Catalog of Hymenoptera in America North of Mexico. Vol. 1. Symphyta and Apocrita. Smithsonian Institution Press, Washington, DC, 1045–1107.
- Cameron P (1883) Zoology. Insecta. Hymenoptera. Biologia Centrali-Americana 1: 1–497.
- Camacho M, Orozco L (1998) Patrones fenológicos de doce especies arbóreas del bosque montaño de la Cordillera de Talamanca, Costa Rica. Revista de Biología Tropical 46(3): 533–542.
- Dailey DC, Menke AS (1980) Nomenclatorial notes on North American Cynipidae (Hymenoptera). The Pan-Pacific Entomologist 56(3): 170–174.
- Dalla Torre KW, Kieffer JJ (1910) Cynipidae. Das Tierreich, 24. Berlin, Friedlander & Sohn, 891 pp.
- Fergusson NDM (1995) The cynipoid families. In: Hanson PE, Gauld ID (Eds) The Hymenoptera of Costa Rica. Oxford, New York, Tokyo, Oxford University Press, 247–265.
- Folliot R (1961) Sur le regroupement des espèces *Andricus quadrilineatus* Hartig et *Andricus marginalis* Schlechtendal. Comptes Rendus des Sciences de l'Académie des Sciences 253: 3050–3052.
- Folliot R (1964) Contributions a l'étude de la biologie des Cynipides gallicoles (Hymenoptera, Cynipoidea). Annales des Sciences Naturelles, Zoologie 6: 409–564.

- Förster A (1869) Ueber die Gallwespen. Verhandlungen der Zoologische-botanische Gesellschaft Wien 19: 327–370.
- Garbín L, Díaz NB, Pujade-Villar J (2008) Experimental study of the reproductive cycle of *Plagiotrochus amenti* Kieffer, 1901 (Hymenoptera, Cynipoidea, Cynipidae), with comments on its taxonomy. Boletín de la Asociación Española de Entomología 32(3/4): 341–349.
- Govaerts R, Frodin DG (1998) World Checklist and Bibliography of Fagales. Royal Botanic Gardens, Kew, 408 pp.
- Harris R (1979) A glossary of surface sculpturing. State of California, Department of Food and Agriculture, Occasional Papers in Entomology 28: 1–31.
- Kieffer JJ (1897–1901) Monographie des Cynipides d'Europe et d'Algérie. Ibalynae et Cynipinae. Librairie Scientifique A. Hermann, Paris.
- Kinsey AC (1936) The origin of the higher categories in Cynips. Indiana University, Publication of Science Series 4: 1–334.
- Kinsey AC (1937) New Mexican gall wasps (Hymenoptera, Cynipidae). II. Revista de Entomología 7: 428–471.
- Liljeblad J, Ronquist F (1998) A phylogenetic analysis of higher-level gall wasp relationships (Hymenoptera: Cynipidae). Systematic Entomology 23: 229–252. doi: 10.1046/j.1365-3113.1998.00053.x
- Liljeblad J, Ronquist F, Nieves-Aldrey J-L, Fontal-Cazalla F, Ros-Farré P, Gaitros D, Pujade-Villar J (2008) A fully web-illustrated morphological phylogenetic study of relationships among oak gall wasps and their closest relatives (Hymenoptera: Cynipidae). Zootaxa 1796: 1–73.
- Mayr G (1881) Die Genera der gallenbewohnenden Cynipiden. Jahresberichte der Communal-Oberrealschule im I. Bezirke, Wien 20: 1–38.
- Mayr G (1902) Ueber Nordamerikanische Cynipiden. Verhandlungen der k.k. zoologisch-botanischen Gesellschaft in Wien 52: 287–290.
- Medianero E, Nieves-Aldrey JL (2010a) The genus *Amphibolips* Reinhard (Hymenoptera: Cynipidae: Cynipini) in the Neotropics, with description of three new species from Panama. Zootaxa 2360: 47–62.
- Medianero E, Nieves-Aldrey JL (2010b) Description of the first Neotropical species of *Bassettia* Ashmead (Hymenoptera: Cynipidae: Cynipini) from Panama. Graellsia 66(2): 213–220.
- Medianero E, Nieves-Aldrey JL (2011a) First record of the genus *Disholcaspis* Dalla Torre & Kieffer (Hymenoptera: Cynipidae: Cynipini) in the Neotropics, with description of two new species from Panama. Zootaxa 2802: 23–33.
- Medianero E, Nieves-Aldrey JL (2011b) Primer estudio de las avispa de las agallas de la República de Panamá, incluyendo una lista actualizada de los cinípidos neotropicales (Hymenoptera, Cynipoidea, Cynipidae). Boletín de la Sociedad Entomológica Aragonesa (SEA) 48: 89–104. doi: 10.3989/graellsia.2010.v66.029
- Medianero E, Nieves-Aldrey JL, Melika G (2011a) Two new neotropical species of oak gall wasps of the genus *Loxaulus* Mayr (Hymenoptera: Cynipidae: Cynipini) from Panama. Zootaxa 2811: 37–46.

- Medianero E, Nieves-Aldrey JL, Pujade-Villar J (2011b) The genus *Odontocynips* Kieffer (Hymenoptera: Cynipidae: Cynipini) in Panama, with redescription of *Cynips championi* Cameron, 1883. *Graellsia* 67: 35–46. doi: 10.3989/graeellsia.2011.v67.033
- Melika G (2006) Gall Wasps of Ukraine. Cynipidae. *Vestnik zoologii*, supplement 21(1/2): 1–644.
- Melika G, Abrahamson WG (2002) Review of the world genera of oak cynipid wasps (Hymenoptera: Cynipidae, Cynipini). In: Melika G, Thuróczy C (Eds) *Parasitic Wasps: Evolution, Systematics, Biodiversity and Biological Control*. Agroiinform, Budapest, 150–190.
- Melika G, Abrahamson WG (2007) Review of the Nearctic gall wasp species of the genus *Bassettia* Ashmead, 1887, with description of new species (Hymenoptera: Cynipidae: Cynipini). *Acta Zoologica Academiae Scientiarum Hungaricae* 53(2): 131–148.
- Melika G, Cibrián-Tovar D, Cibrián-Llenderal VD, Tormos J, Pujade-Villar J (2009a) New species of oak gallwasp from Mexico (Hymenoptera: Cynipidae: Cynipini) – a serious pest of *Quercus laurina* (Fagaceae). *Dugesiana* 16(2): 67–73.
- Melika G, Pérez-Hidalgo N, Hanson P, Pujade-Villar J (2009b) New species of oak gallwasp from Costa Rica (Hymenoptera: Cynipidae: Cynipini). *Dugesiana* 16(1): 35–39.
- Melika G, Equihua-Martínez EG, Estrada-Venegas D, Cibrián-Tovar VD, Cibrián-Llenderal VD, Pujade-Villar J (2011a) New *Amphibolips* gallwasp species from Mexico (Hymenoptera: Cynipidae). *Zootaxa* 3105: 47–59.
- Melika G, Hanson P, Pujade-Villar J (2011b) A new species of *Disholcaspis* Dalla Torre and Kieffer oak gallwasp from Costa Rica (Hymenoptera: Cynipidae: Cynipini). *Dugesiana* 18(1): 17–22.
- Nieves-Aldrey JL (1992) Revision of the European species of the genus *Callirhytis* Förster (Hymenoptera, Cynipidae). *Graellsia* 48: 171–183.
- Nixon K (2006) Global and Neotropical Distribution and Diversity of Oak (genus *Quercus*) and Oak Forests. *Ecological Studies* 185: 3–13. doi: 10.1007/3-540-28909-7\_1
- Nylander JAA (2004) Bayesian Phylogenetics and the evolution of gall wasps. PhD Thesis, Acta Universitatis Upsaliensis, Uppsala.
- Osten Sacken CR von (1861) On the Cynipidae of the North American oaks and their galls. *Proceedings of the Entomological Society of Philadelphia* 1-3: 47–72.
- Osten Sacken CR von (1865) Contributions to the Natural History of the Cynipidae of the United States and of their Galls. Article 4th. *Proceedings of the Entomological Society of Philadelphia* 4: 331–380.
- Pujade-Villar J, Hanson P (2006) Familia Cynipidae (las avispa cecidógenas). In: Hanson P, Gauld IA (Eds) *Hymenoptera de la Región Neotropical*. *Memoirs of the American Entomological Institute* 77: 293–302.
- Pujade-Villar J (2009) Description of *Odontocynips hansonii* n. sp., from Costa Rica (Hymenoptera: Cynipidae). *Dugesiana* 15(2): 79–85. doi 10.1590/S1519-566X2009000600015
- Pujade-Villar J, Equihua-Martínez A, Estrada-Venegas EG, Chagoyán-García C (2009) Estado de conocimiento de los Cynipini en México (Hymenoptera: Cynipidae), perspectivas de estudio. *Neotropical Entomology* 38(6): 809–821.
- Pujade-Villar J, Equihua-Martínez A, Estrada-Venegas EG, Serrano-Muñoz M, Lomeli-Flores JR (2011) Una nueva especie mexicana del género *Andricus* con caracteres muy peculiares:

- A. georgei* Pujade-Villar n. sp. (Hymenoptera, Cynipidae). Boletín de la Sociedad Entomológica Aragonesa (SEA) 49: 27–32.
- Pujade-Villar J, Hanson P, Melika G (2012) A new genus of oak gallwasp, *Coffeikokkos* Pujade-Villar & Melika, gen. n., with a description of a new species from Costa Rica (Hymenoptera, Cynipidae). ZooKeys 168: 19–29. doi: 10.3897/zookeys.168.2030
- Ronquist F, Nordlander G (1989) Skeletal morphology of an archaic cynipoid, *Ibalia rufipes* (Hymenoptera: Ibaliiidae). Entomologica Scandinavica, supplement 33: 1–60.
- Stone GN, Hernandez-Lopez A, Nicholls JA, di Pierro E, Pujade-Villar J, Melika G, Cook JM (2009) Extreme host plant conservatism during at least 20 million years of host plant pursuit by oak gallwasps. Evolution 63: 854–869. doi: 10.1111/j.1558-5646.2008.00604.x
- Weld LH (1922a) Notes on American Gallflies of the family Cynipidae producing galls on acorns, with descriptions of new species. Proceedings of the United States National Museum 61(19): 1–32. doi: 10.5479/si.00963801.61-2440.1
- Weld LH (1922b) Notes on Cynipid Wasps, with descriptions of new North American Species. Proceedings of the United States National Museum 61(18): 1–29.
- Weld LH (1926) Field Notes on Gall-inhabiting Cynipid Wasps with descriptions of new species. Proceedings of the United States National Museum 68(10): 1–131. doi: 10.5479/si.00963801.68-2611.1
- Weld LH (1928) Cynipidae. In: Leonard L (Ed) Insects of New York. 967–974.
- Weld LH (1951) Superfamily Cynipoidea. In: Muesebeck, Krombein, Townes et al. (Eds) Hymenoptera in America north of Mexico. Synoptic Catalogue. US Department of Agriculture. Agricultural Monograph No. 2, 594–654.
- Weld LH (1952) Cynipoidea (Hym.) 1905-1950 being a Supplement to the Dalla Torre and Kieffer monograph the Cynipidae in Das Tierreich, Lieferung 24, 1910 and bringing the systematic literature of the world up to date, including keys to families and subfamilies and list of new generic, specific and variety names. Privately printed, Ann Arbor, Michigan, privately printed, 351 pp.
- Weld LH (1959) Cynipid galls of the Eastern United States. Ann Arbor, Michigan, privately printed, 124 pp.