

A new genus and species of termites (Isoptera, Termitidae, Nasutitermitinae) from the rainforest of northern Peru

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Academic editor: M. Engel | Received 2 November 2011 | Accepted 6 December 2011 | Published 23 December 2011

[urn:lsid:zoobank.org:pub:5EB9B6AA-7898-4E04-969D-401A46DC08B0](https://doi.org/urn:lsid:zoobank.org:pub:5EB9B6AA-7898-4E04-969D-401A46DC08B0)

Citation: Cuezco C, Nickle DA (2011) A new genus and species of termites (Isoptera, Termitidae, Nasutitermitinae) from the rainforest of northern Peru. ZooKeys 159: 1–9. doi: 10.3897/zookeys.159.2311

Abstract

A new genus and species of nasutitermitine termites are described and illustrated, based on soldier and worker characters. *Sinqasapatermes* **gen. n.**, can be distinguished from all other nasutitermitine genera by its singular worker gut coiling and enteric valve characters: distal margin of the enteric valve not everted into the paunch but bending towards the ileum, that is, directed against the flow of food; enteric valve armature with one ring of six equal subtriangularly-shaped ridges, each ridge with short spines on the entire surface; enteric valve armature situated on external face of cone, facing the internal ileum wall; enteric valve seating tri-lobed and separated from remaining portion of the paunch; paunch subdivided. *Sinqasapatermes sachae* **sp. n.**, was collected on a tree in a very narrow flattened tunnel that was well concealed beneath lichens in a northern Peru rainforest (Arcadia, Loreto Province).

Keywords

Taxonomy, *Subulitermes*-group, enteric valve configuration, gut coiling, Peruvian rainforest

Introduction

The subfamily Nasutitermitinae is a monophyletic group, currently worldwide represented by 81 living genera and 575 living species (Constantino 2011). It is the second largest subfamily in terms of generic and specific diversity within Termitidae. New World representatives of the subfamily Nasutitermitinae account for approximately a third of the total generic and specific diversity, being the dominant group of termites in South America.

Although Nasutitermitinae was never formally subdivided into minor taxonomic hierarchies, several authors (Kovoor 1969; Noirot 2001) have recognized three groups of genera within this subfamily based on gut morphology: the *Nasutitermes*-group, the *Subulitermes*-group, and the *Syntermes*-group. Recently, Engel and Krishna (2004) raised the *Syntermes*-group to the subfamilial level, named Syntermitinae.

Currently, there are 21 genera described as part of the *Subulitermes*-group, with 11 genera occurring in the Neotropical region (Holmgren 1910; Emerson 1925; Snyder 1926; Araujo 1970; Fontes 1979, 1982; Constantino 1990, 1991; Canello and Noirot 2003), two genera in the Australian region (Emerson 1960a; Miller 1984), and eight genera in the Ethiopian region (Emerson 1960b; Coaton 1971; Sands 1965, 1998).

In this study, an unusual termite sample collected from the rainforest of northern Peru is described and assigned to a new neotropical nasutitermitine genus and species, *Sinqasapatermes sachae* gen. n. and sp. n. The systematic position of the new genus is determined according to an evaluation of the internal morphology. Such characters provide enough evidence to place *Sinqasapatermes* gen. n., in the *Subulitermes*-group and also to distinguish it substantially from other known nasutitermitine genera within this group. The phylogenetic relationships among members of the *Subulitermes*-group remain unresolved (Inward et al. 2007), and it is well known that the taxonomic validity of some neotropical genera is questionable (Roisin 1995; Canello and Noirot 2003). We do not intend to resolve the systematic relationships within the *Subulitermes*-group, but to contribute to a better understanding of this important lineage by describing this singular new genus and species.

Material and methods

The sample was subdivided and deposited in the Isoptera Collection of the Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima, Peru (MUSM), the National Museum of Natural History, Washington, DC, USA (USNM) and the Museu de Zoologia da Universidade de Sao Paulo, Brazil (MZUSP).

Morphometric characters used in this study and their correspondence with Roonwall's system (Roonwall 1970) are indicated in parentheses as follows: LH, length of head with nasus (12); LH_p, length of head to apex of postclypeus (14, but in profile); WH, width of head (17); HH, height of head excluding postmentum

(21); WP, width of pronotum (68); and LT, length of hind tibia (85). Left mandible index was not calculated; instead the distance between the apical tooth to M1+2 was measured.

Description of the digestive tube morphology follows Noirot (2001), and those of the Malpighian tubules follow Sands (1998). Worker mandible descriptions are based on terminology used by Fontes (1987). The terms “bristles” and “hairs” are defined as follows: “long bristles”, longer than length of first antennal article; “short hairs”, visible at about 12× magnification; “microscopic hairs”, visible at 50× magnification.

Drawings were made with a camera lucida attached to a stereomicroscope.

Taxonomic treatment

Sinqasapatermes gen. n.

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

Type-species. *Sinqasapatermes sachae* sp. n.

Diagnosis. The new genus is distinguished from other nasutitermitine genera by the unique combination of the following characteristics from the worker digestive tube: distal margin of the enteric valve (P2) not everted into the paunch (P3) but bending towards the ileum (P1), that is, directed against the flow of food; armed with one ring of six equal subtriangularly-shaped ridges, each ridge with short spines on entire surface (Fig. 14); enteric valve armature situated on external face of cone, facing P1 internal wall (Fig. 15); enteric valve seating tri-lobed and separated from remaining portion of P3; P3 subdivided.

Description. *Imago.* Unknown.

Soldier. Monomorphic. In dorsal view, head capsule with a constriction behind base of antenna. Maximum width behind constriction, at middle of posterior lobe. In profile, dorsal margin of head capsule nearly straight to base of nasus; weakly depressed at base of nasus. Nasus narrow, conical in dorsal view; about same length as head capsule; slanted slightly upward in profile. Mandibles vestigial, without points. Postclypeus moderately arcuate, in profile. Labrum wider than long, with rounded antero-lateral corners. Antenna with 11 articles. Pronotum shallowly saddle-shaped, anterior margin rounded, not emarginate. Tibial spurs 2:2:2.

Worker. Head capsule trapezoidal in dorsal view; maximum width of head capsule at base of mandibles. Fontanelle area depressed, situated at posterior third of head capsule. Postclypeus short and moderately inflated; median line weakly defined. Antenna with 12 articles. Pronotum shallowly saddle-shaped, anterior margin rounded, not emarginate. Tibial spurs 2:2:2.

Mandibles. Left mandible (Fig. 5) with apical tooth slightly as prominent as or slightly more prominent than M1+2, posterior margin of apical tooth weakly concave or truncate; right or acute angle between posterior margin of apical tooth and anterior

margin of M1+2; posterior margin of M1+2 straight or slightly sinuous; third marginal tooth reduced to a vestigial node; molar tooth visible at V-shaped gap but apex hidden beneath molar prominence; molar prominence with very weakly-defined ridges. Right mandible (Figs 6–7) with apical tooth slightly more prominent than first marginal tooth, second marginal tooth not visible or vestigial (as a minute prominence); molar plate concave with very weakly defined ridges; basal notch well defined.

Digestive tube (Figs 8–15). Coiling gut *in situ* forming a short, broad mass. Crop (C) voluminous, partially visible in dorsal view; positioned to left half of abdomen. Gizzard (G) with a strong musculature; well separated from crop; partially visible in ventral view. Mesenteron (M) passing through right side but not reaching medial line in ventral view. Mesenteric-proctodeal junction circular (mixed segment absent); visible in right lateral view. Malpighian tubules (TM) slightly dilated to form an ampulla at base, arranged in adjacent pairs with a common base at mesenteric-proctodeal junction on inner face. Ileum or first proctodeal segment (P1) tubular; shorter than mesenteron length. Enteric valve (P2) lying beneath P1, conical with distal margin not everted into P3 but bending towards P1, i.e., directed against the flow of food (Fig. 15); armed with one ring of six equal subtriangularly-shaped ridges, each ridge with short spines on entire surface (Fig. 14); enteric valve armature situated on external face of cone, facing P1 internal wall (Fig. 15). P2 in same axis as paunch (P3). Enteric valve seating, tri-lobed and separated from remaining portion of P3 by a constriction; another subdivision visible at P3 before protruding through mesenteric ring; distal part of P3 very prominent in dorsal view and joining colon (P4) on left side; isthmus conspicuous. Dorsal torsion well developed. P4 “U-turn” dilated. Distal colon tubular.

Etymology. From Quechua, indigenous South American language, *sinqa* = nose and *sapa* = big, and Latin *termes* = termite, meaning termite with a big nose.

Comparisons. Among soldiers of neotropical genera, the long, narrow nasus and reduced number or absence of bristles on head capsule and thoracic nota are shared characters among species of *Cyranotermes* Araujo, *Anhangatermes* Constantino and *Sinqasapatermes*, but *Cyranotermes* and *Anhangatermes* species have antenna with 13 articles and a rounded head capsule. Soldiers of the latter two genera are also significantly larger than those of *Sinqasapatermes*. *Agnathotermes* Snyder and *Paraconvexitermes* Cancellato & Noirot also have a conical nasus and antenna with 11 articles, but they differ from *Sinqasapatermes* by their chaetotaxy and head shape of the soldier. Soldiers of species of *Angularitermes* Emerson, *Araujotermes* Fontes, *Atlantitermes* Fontes, *Coatitermes* Fontes, *Convexitermes* Holmgren, *Ereymatermes* Constantino and *Subulitermes* Holmgren are genera that can be separated from *Sinqasapatermes* on the basis of different chaetotaxy arrangement and head capsule shape.

Among workers of neotropical genera, the third marginal tooth of left mandible and second marginal tooth of right mandible absent or vestigial are shared characters among species of *Cyranotermes* and *Anhangatermes*, however, molar area differs in *Sinqasapatermes* by having no ridges and being more concave. Reduced ridges on molar areas are found in *Araujotermes*, *Atlantitermes*, *Coatitermes*, *Convexitermes*, *Ereymatermes*, *Paraconvexitermes*, and *Subulitermes*, but none of these genera have lost the

marginal teeth. The worker gut coiling and enteric valve features of *Sinqasapatermes* do not match any member of the *Subulitermes*-group (Kovoor 1969; Fontes 1987; Constantino 1990, 1991; Roisin 1995; Sands 1998; Canello and Noirot 2003).

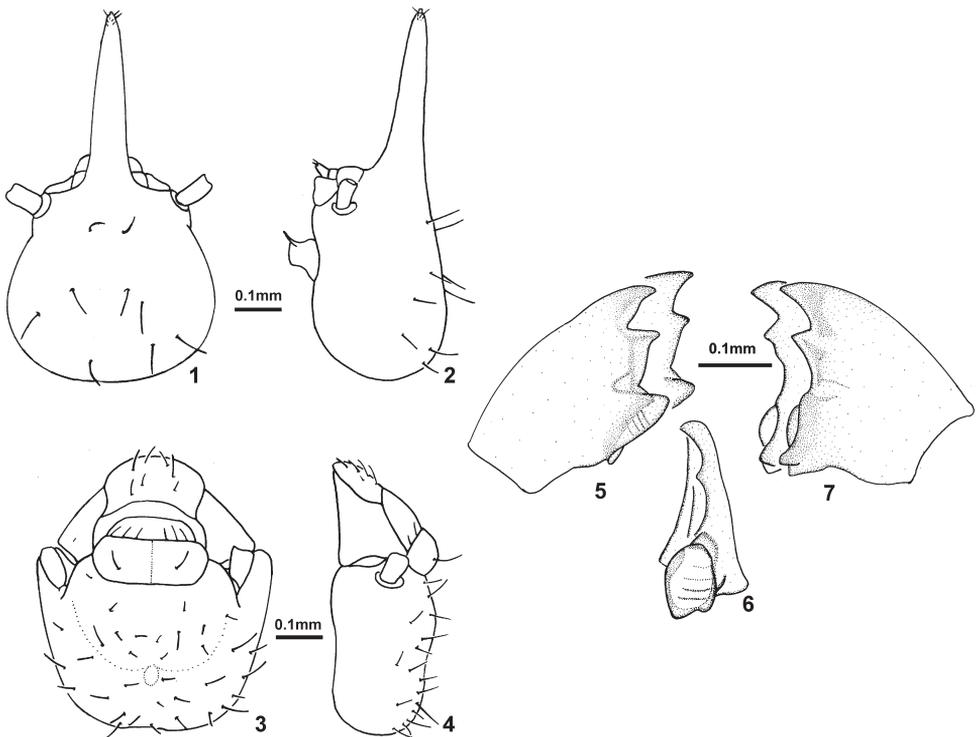
***Sinqasapatermes sachae* sp. n.**

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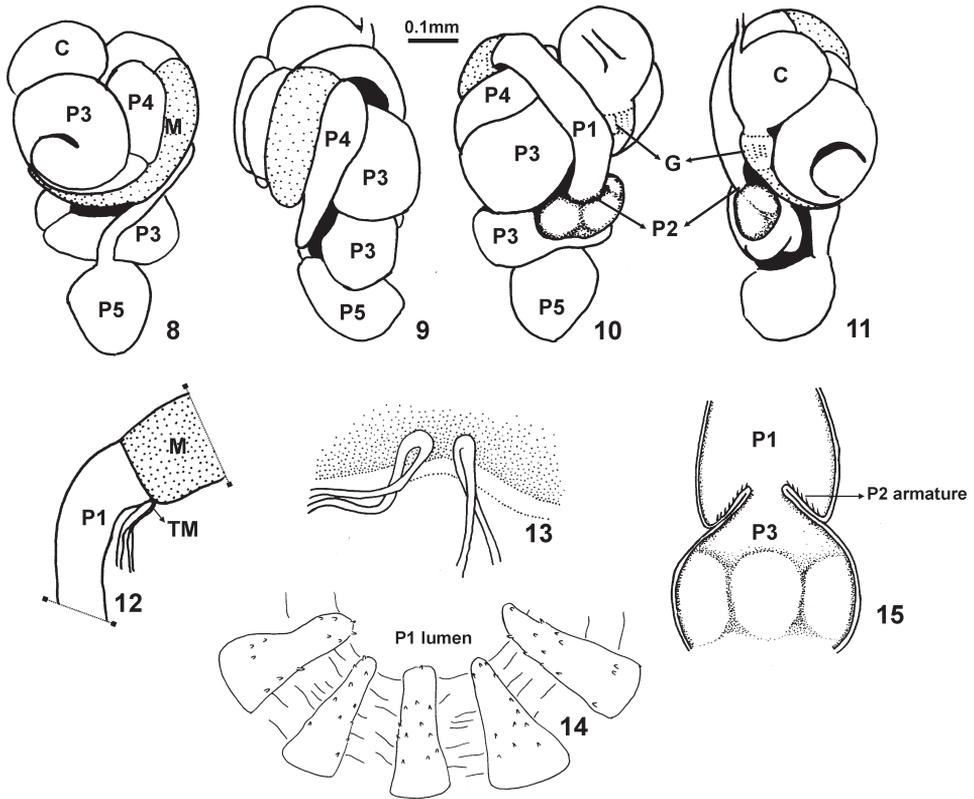
<http://species-id.net/wiki/>

Figs 1–15

Type material. Holotype soldier, in alcohol, separate in a microvial. Original typewritten label: "PERU, Loreto, Arcadia, 0°59.37'S, 75°18.55'W, 150m, 31 Oct-10 Nov. 1993 leg., D.A. Nickle & J. Lewis; Castana 227; E66". Holotype will be deposited at the Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima, Peru (MUSM). Paratypes: 12 soldiers and 14 workers with same data as holotype. Paratypes will be deposited as follows: five soldiers and six workers at the MUSM, five soldiers and six workers as part of lot no. USNM 10601 at the USNM; two soldiers and two workers as part of lot no. MZUSP 13095 at the MZUSP.



Figures 1–7. *Sinqasapatermes sachae* 1 soldier head in dorsal view 2 soldier head in profile 3 worker head in dorsal view 4 worker head in profile 5 worker left mandible in dorsal view 6 worker right mandible, showing molar plate in frontal view 7 worker right mandible in dorsal view.



Figures 8–15. *Singasapatermes sachae*. **8–11** worker gut *in situ* respectively from dorsal, right, ventral and left views **12–13** Malpighian tubules attachment **14** worker enteric valve armature **15** scheme of worker enteric valve configuration. **C** crop **G** gizzard **M** mesenteron, stippled **P1** first proctodeal segment **P2** enteric valve **P3** paunch **P4** colon **P5** rectum **TM** Malpighian tubules.

Type locality. PERU, Loreto Province: Arcadia, 0°59.37'S, 75°18.55'W, 190m. Type material was collected on a tree in a very narrow flattened tunnel that was well concealed beneath green/white lichens at the rainforests of northern Peru. The tunnel was not obvious.

Diagnosis. Monotypic genus – see generic diagnosis.

Description. *Imago*. Unknown.

Soldier (Figs 1–2). Head capsule with scattered long bristles and a few short hairs. Nasus with four shorter bristles and a few microscopic hairs near apex. Labrum with four short hairs. Postclypeus and postmentum glabrous. Thoracic nota and abdominal tergite I glabrous. Tergite II with a few long bristles at posterior margin; tergites III–X with several long bristles at posterior margin; IX–X tergites with bristles and hairs distributed on entire surface. Sternites with more bristles than tergites. Legs with two long bristles, first proximal and second at middle on external surface of all tibiae; short hairs on internal surface of all tibiae. Head capsule yellow; nasus reddish; antenna

yellow with articles III–IV reddish; thoracic nota pale yellow; digestive tube visible through abdominal sclerites. Measurements (mm) of six soldiers are given as ranges, followed by holotype values in parentheses: LH, 0.85–0.90 (0.88); LHp, 0.46–0.49 (0.48); WH, 0.43–0.48 (0.48); HH, 0.30–0.32 (0.32); WP, 0.25–0.27 (0.26); LT, 0.48–0.51 (0.49). Ratios: LH/WH, 1.83–1.98 (1.83); LH/LT, 1.74–1.80; LHp/LT, 0.94–0.98 (0.98).

Worker (Figs 3–15). Head capsule with numerous erect bristles and few short hairs over entire surface. Postclypeus with six bristles at anterior margin; labrum with numerous bristles. Pronotum with few short hairs on both margins; mesonotum with four bristles and metanotum with six bristles. Tergites with decumbent bristles over surface plus few erect bristles toward posterior margin. Sternites with decumbent bristles over surface plus erect ones at posterior margin. Legs with two long bristles, first proximal and second at middle on external surface of all tibiae among shorter ones. Head capsule and thoracic nota whitish; digestive tube visible through abdominal sclerites. Mandibles and digestive tube, under genus description. Measurements (mm) of seven workers are given as ranges: WH, 0.48–0.50; DA–M1+2, 0.05–0.06; LT, 0.44–0.48. Ratio: WH/LT, 1.04–1.14.

Etymology. Noun in apposition taken from Quechua, *sacha*, meaning forest.

Remarks. Figs 5 and 7 illustrate two sets of mandibles, which represent variation among workers of *Sinqasapatermes sachae* from the same sample. Those workers have not differentiation in coloration, pilosity, size or any other morphological characteristic to assume they belong to different instars.

Acknowledgments

This work was supported by Project grants Nos. 87–008, 89–163, 90–010, 92–032 from the Earthwatch Institute to DAN to conduct field research on termites in Peru. Additional support was provided by grants from the Department of Entomology, U.S. Museum of Natural History to DAN and J. E. Lewis to participate in the Amazon Expeditions Project, which helped further continuous work on Peruvian termites. DAN thanks the government of Peru for hosting scientists from USNM and SEL, USDA to study in Loreto Province, Peru. CC received support from PIP CONICET No. 6502, The Linnean Society through an SRF Award and a doctoral scholarship from CONICET. Thanks are extended to SEL, USDA, for providing space and equipment during a one-month visit in 2008. We are indebted to Eliana M. Canello, MZUSP, who provided valuable advice regarding the taxa herein described, Lelia I. Albarracín de Alderetes, ADILQ (Asociación de Investigadores en Lengua Quechua) for confirming the meaning of words in the Quechua language, and J. E. Lewis, SEL, USDA, for helping with field work.

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Sinosciapus from Taiwan with description of a new species (Diptera, Dolichopodidae)

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Academic editor: T. Dikow | Received 15 October 2011 | Accepted 12 November 2011 | Published 23 December 2011

[urn:lsid:zoobank.org:pub:0E70FE75-39AD-4D54-8CFB-7B62F0EF4FBA](https://doi.org/urn:lsid:zoobank.org:pub:0E70FE75-39AD-4D54-8CFB-7B62F0EF4FBA)

Citation: Yang D, Zhu Y (2011) *Sinosciapus* from Taiwan with description of a new species (Diptera: Dolichopodidae). ZooKeys 159: 11–18. doi: 10.3897/zookeys.159.2252

Abstract

Sinosciapus liuae sp. n. is newly described from Taiwan. The genus *Sinosciapus* is discussed and a key to the three known Oriental species is provided.

Keywords

Diptera, Dolichopodidae, *Sinosciapus*, new species

Introduction

Sinosciapus Yang, 2001 is a small genus of the family Dolichopodidae with only two previously known Oriental species from Southwest China and South China (Yang et al. 2006; Yang et al. 2011). The genus is characterized by the following features: eyes in both sexes narrowly separated; vertex in both sexes with strong vertical bristle; arista subapical, slightly shorter than width of head; lateral scutellar bristle strong, about 2/3 as long as apical one; fore tarsomere 5 with an elongated spine-like claw (Yang 2001; Yang et al. 2011).

In the present paper, the genus *Sinosciapus* is newly recorded from Taiwan with one new species, based on specimens collected by Ms. Xiaoyan Liu in Taiwan in 2011. An updated key to the three known species of *Sinosciapus* is given.

Material and methods

The type specimens are deposited in the Entomological Museum of China Agricultural University, Beijing (CAU). The following abbreviations are used: acr = acrostichal, ad = anterodorsal, dc = dorsocentral, h = humeral, npl = notopleural, oc = ocellar, ph = posthumeral, psa = postalar, pvt = postvertical, sa = supraalar, su = sutural, sc = scutellar, vt = vertical.

Taxonomy

Genus *Sinosciapus* Yang, 2001

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

Sinosciapus Yang, 2001: 432. Type species: *Sinosciapus tianmushanus* Yang, 2001 (monotypy).

Diagnosis. Eyes in both sexes narrowly separated, frons and face rather narrow (face less than 1/2 as wide as one eye, frons narrower than one eye). Vt strong. Clypeus apically separated from inner margin of eyes. Cheeks of females posteriorly with 1 black spine-like bristle. First flagellomere subtrapezoid or semicircular; arista subapical, slightly shorter than width of head. 5 strong dc, anterior 3 dc somewhat shorter; 5–7 irregularly paired acr very short and hair-like; scutellum with two pairs of strong sc, basal pair 2/3 as long as apical pair. Fore coxa with 3 bristles in male, with 3–4 spine-like bristles and many short spine-like bristles on inner surface in female. Wing: m-cu straight. Male genitalia rather small with well developed cercus like in *Condylostylus*.

Remarks. *Sinosciapus* is an Asian genus, with three known species from subtropical or tropical forests of Southwest China and South China (Fig. 5). It is similar to *Amblypsilopus* in following points: arista rather short, shorter than head width; tibial chaetotaxy often weak, especially in males; m-cu usually straight. But it can be separated from the latter by the following features: eyes in both sexes narrowly separated, frons and face rather narrow (frons narrower than one eye); both sexes with strong vt; lateral sc strong, about 2/3 as long as apical one; fore tarsomere 5 with 1 elongated spine-like claw. In *Amblypsilopus*, the eyes in both sexes are widely separated, the frons and face are rather wide (frons wider than one eye), the male vertex has vt weak or lost; the lateral sc is always reduced to the weak hairs or lost; the claws on fore tarsomere 5 are normal (Bickel 1994; Yang et al. 2011).

Key to world species (males) of the genus *Sinosciapus*

- 1 First flagellomere as long as wide; cercus weakly or distinctly curved; epandrium with apical margin not truncate in lateral view..... 2

- First flagellomere longer than wide, trapezoid; cercus (except base) straight; epandrium with truncate apical margin in lateral view. ***S. tianmushanus* Yang**
- 2 Thorax and abdomen mostly metallic green; antenna blackish; first flagellomere semicircular; cercus distinctly curved; all tarsomeres 4-5 distinctly shortened; epandrium with lower apical corner acute in lateral view.....
..... ***S. yunlonganus* Yang & Saigusa**
- Thorax and abdomen mostly yellow; antenna yellow except first flagellomere dark yellow; first flagelloemre nearly trapezoid; fore tarsomere 4 shortened, mid tarsomere 5 shortened, and hind tarsomeres 4-5 shortened and thickened; cercus weakly curved; epandrium with upper apical corner acute in lateral view
..... ***S. liae* sp. n.**

***Sinosciapus tianmushanus* Yang, 2001**

http://species-id.net/wiki/Sinosciapus_tianmushanus

Sinosciapus tianmushanus Yang, 2001: 432. Type locality: Zhejiang, Tianmushan.

Diagnosis. Thorax and abdomen chiefly yellow. Antenna yellow. First flagellomere longer than wide, nearly trapezoid. Epandrium with truncate apical margin in lateral view; cercus (except base) straight; aedeagus with thickened apical portion long and paralleled. Fore tarsomere 4 not shortened, mid tarsomere 5 distinctly shortened, and hind tarsomere 4 slightly shortened.

Specimens examined. Holotype ♂, Zhejiang, Tianmushan, Sanliting, 640 m, 30°26'N, 119°34'E, 1998. V. 30, Hong Wu (CAU). Paratypes 3♂♂3♀♀, same data as holotype (CAU).

Distribution. Zhejiang.

Remarks. This species distinctly differs from other two species of the genus in following features: first flagellomere longer than wide, trapezoid; cercus (except base) straight; epandrium with truncate apical margin in lateral view.

***Sinosciapus yunlonganus* Yang & Saigusa, 2001**

http://species-id.net/wiki/Sinosciapus_yunlonganus

Sinosciapus yunlonganus Yang & Saigusa, 2001: 180. Type locality: Yunnan, Yunlong.

Amblypsilopus dirinus Wei & Song, 2006: 310. Type locality: Guizhou, Chishui.

Diagnosis. Thorax and abdomen mostly metallic green. Antenna blackish. First flagellomere as long as wide, semicircular. All legs with tarsomeres 4-5 distinctly shortened. Epandrium with lower apical corner acute in lateral view; cercus distinctly curved upward.

Specimens examined. Holotype ♂, Yunnan, Yunlong, 24°52'N, 101°35'E, 1996. VI. 4, T. Saigusa (CAU). Paratype 1♂, Yunnan, Pingbian, Daweishan Mountain, 1800–2000 m, 22°58'N 103°41'E, 1996. V. 24, T. Saigusa (CAU).

Distribution. Yunnan, Guizhou.

Remarks. This species is easily separated from *S. tianmushanus* Yang by the thorax and abdomen being mostly metallic green, and first flagellomere as long as wide and semicircular.

***Sinosciapus liuae* sp. n.**

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http://species-id.net/wiki/Sinosciapus_liuae

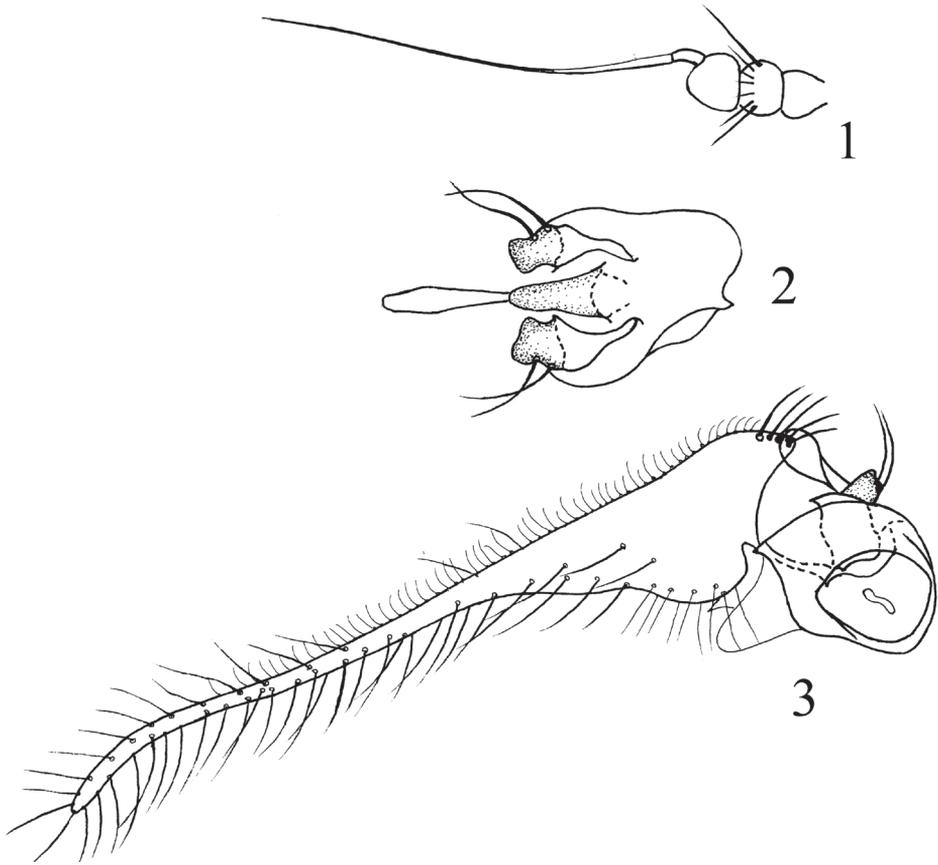
Figs 1–3, 4

Diagnosis. Thorax and abdomen mostly yellow. Antenna yellow except first flagellomere dark yellow; first flagellomere as long as wide. Palpus and proboscis yellow. Legs yellow except tarsi brown to dark brown apically. Fore tarsomere 4 shortened, mid tarsomere 5 shortened, and hind tarsomeres 4–5 shortened and thickened.

Description. Male. Body length 3.0–3.7 mm, wing length 3.6–3.7 mm.

Head metallic green except clypeus dark yellow, with pale gray pollen. Hairs and bristles on head black, except middle and lower postoculars (including postero-ventral hairs) pale yellow. Ocellar tubercle distinct, with pair of long oc and 2 very short posterior hairs. 1 vt on slope shorter than oc; 1 pvt at the end of postoculars row nearly as long as vt. Antenna yellow except first flagellomere dark yellow; first flagellomere nearly trapezoid in lateral view, as long as wide; arista subapical, blackish with blackish pubescence, shorter than head width. Palpus yellow, with pale hairs and 1 blackish apical bristle. Proboscis yellow, with short pale hairs.

Thorax mostly yellow with pale gray pollen, except pronotum pale metallic green medially, mesonotum mostly metallic green with large antero-lateral area including humerus and small postero-lateral area including postalar callus yellow, scutellum entirely metallic green, postnotum narrowly metallic green at middle. Hairs and bristles on thorax black. 5–6 short irregularly paired acr; 5 strong dc. 1 short hair-like h, 1 ph, 1 su, 2 sa, 1 psa, 2 npl; scutellum with pair of long apical sc and pair of short lateral sc (about 2/3 as long as apical sc). Legs yellow, but fore tarsomere 5 dark brown, mid tarsomeres 3–4 brown and tarsomere 5 dark brown, hind tarsomere 3 pale brown and tarsomeres 4–5 dark brown. Hairs and bristles on legs black. Fore coxa with 4 bristles apically; mid coxa with 3 bristles apically; hind coxa with 1 exterior bristle at basal 1/3. Fore tibia with 3 weak bristles only at tip; mid tibia with 1 short ad at base and 3 bristles at tip; hind tibia with 3 bristles only at tip. Fore tarsomere 4 shortened, tarsomere 5 with two rows of ventral spines and 1 long hook-like claw. Mid tarsomere 5 shortened. Hind tarsomeres 4–5 shortened and thickened. Relative length ratio of tibiae and tarsomeres: LI 5.5 : 4.0 : 1.2 : 0.9 : 0.4 : 0.8; LII 7.7 : 5.9 : 1.3 : 1.2 : 0.8 : 0.35; LIII 11.1 : 5.1 : 1.6 : 1.0 : 0.4 : 0.6. Wing hyaline, slightly tinged with brownish,



Figures 1–3. *Sinosciapus liuae* sp. n. (male) **1** antenna, lateral view **2** genitalia excluding cerci, ventral view **3** genitalia, lateral view.

veins dark brown. Vein M_1 with strongly curved basal portion nearly geniculate, vein M_2 reduced but only visible at base. Crossvein m-cu nearly straight. Squama dark yellow, with long brown hairs. Halter dark yellow.

Abdomen partly metallic green with pale gray pollen, except tergites 2–5 with anterior and lateral portions yellow, sternites 1–5 yellow except posterior margin of sternite 5 brown. Hairs and bristles on abdomen black and weak, but hairs on sternites 1–5 pale yellow. Hypopygium black except cerci and hypandrium brownish.

Male genitalia (Figs. 2–3). Epandrium somewhat quadrate, nearly as long as wide, and with oblique apical margin and upper apical corner acute in lateral view. Surstylus short and wide with 2 long bristles. Cercus very long, about 4 times as long as epandrium, basally very thick, apically long finger-like, slightly curved. Hypandrium long conical. Phallus with short thick apical portion slightly narrowed toward extreme tip in ventral view.



Figure 4. *Sinosciapus liuae* sp. n. (female).

Female. Body length 3.3–5.0 mm, wing length 3.6–4.4 mm. Similar to male, but different in following points: mesonotum yellow with a large metallic green mid-posterior spot nearly triangular and two small pale metallic green lateral spots nearly semicircular. Mid coxa with a brown outer stripe. Fore coxa with 4 long spine-like

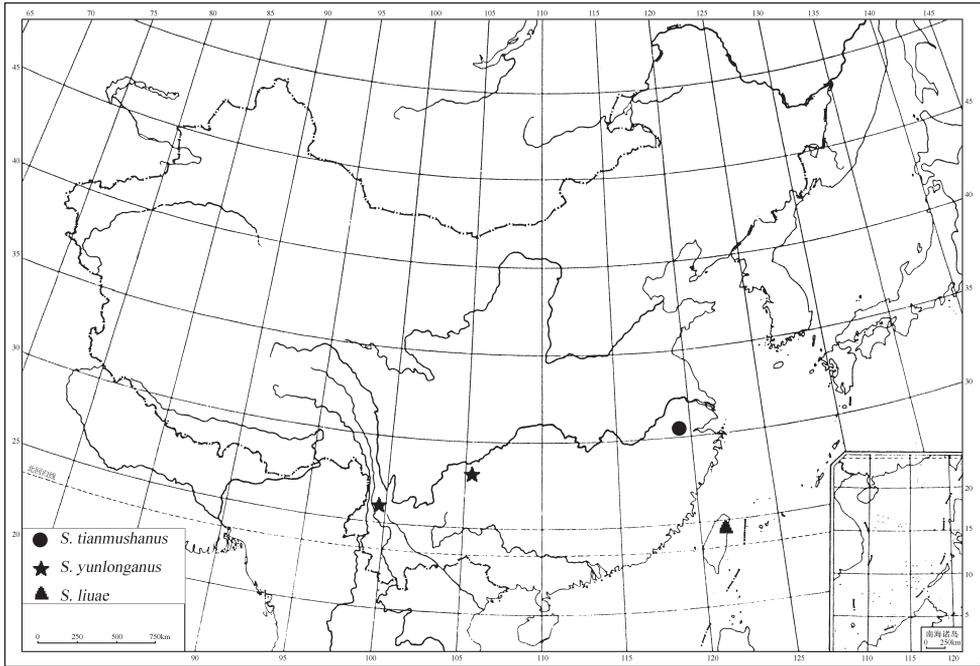


Figure 5. Distribution of *Sinosciapus*.

apical bristles and several very short spine-like anterior bristles. Abdominal tergite 1 also yellow except posterior margin metallic green. Legs with only tarsomere 5 short. Relative length ratio of tibiae and tarsomeres: LI 5.8 : 5.1 : 1.7 : 1.2 : 0.8 : 0.55; LII 7.9 : 6.8 : 1.35 : 1.2 : 0.8 : 0.4; LIII 11.1 : 5.2 : 1.75 : 1.2 : 0.8 : 0.4.

Type material. Holotype ♂, Taiwan, Ilan County, Mingchin Forest Recreation Area, 1130 m, 24°45'N, 121°44'E, 2011. VI. 13, Xiaoyan Liu (CAU). Paratypes 1♂10♀♀, same data as holotype (CAU); 1♂3♀♀, Taiwan, Hualien County, Pulu, Shenmu, 2150 m, 23°59'N, 121°36'E, 2011. VI. 20, Xiaoyan Liu (CAU).

Distribution. Taiwan.

Etymology. The specific name refers to the collector Ms. Xiaoyan Liu.

Remarks. The new species is somewhat similar to *Sinosciapus yunlonganus* Yang *et* Saigusa, 2001 in having the first flagellomere as long as wide and epandrium with the oblique apical margin in lateral view. But it can be separated from the latter in the following features: thorax and abdomen mostly yellow, first flagelloemre nearly trapezoid, cercus weakly curved, epandrium with upper apical corner acute in lateral view; in *Sinosciapus yunlonganus*, thorax and abdomen mostly metallic green, first flagellomere semicircular, cercus distinctly curved, epandrium with lower apical corner acute in lateral view (Yang and Saigusa 2001; Yang *et al.* 2001).

Acknowledgements

Our sincere thanks are due to Prof. Shen-Horn Yen (National Sun Yat-Sen University, Kaohsiung) for his help during the survey in Taiwan in 2011 and 2012. We are grateful to Dr. Xiaoyan Liu (Beijing) for collecting specimens. Two anonymous reviewers are thanked for providing useful comments on an earlier draft of this paper. The research was funded by the National Natural Science Foundation of China (Nos. 30970395, 31061160186), Beijing Natural Science Foundation (No. 5092014), the Doctoral Program of Higher Education of China (20090008110016) and Chinese Universities Scientific Fund (No. 2009-2-08).

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Revision of the world species of *Zambion* (Hymenoptera, Ichneumonidae, Tryphoninae)

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Academic editor: *G. Broad* | Received 7 October 2011 | Accepted 14 December 2011 | Published 23 December 2011

urn:lsid:zoobank.org:pub:0D96B0D0-3AA1-4EF9-8722-29100C3A06D4

Citation: Bennett AMR, Barnes DI (2011) Revision of the world species of *Zambion* (Hymenoptera, Ichneumonidae, Tryphoninae). ZooKeys 159: 19–48. doi: 10.3897/zookeys.159.2219

Abstract

The world species of *Zambion* Kasparyan (Hymenoptera: Ichneumonidae: Tryphoninae) are revised including re-descriptions of *Z. monodon* Kasparyan and *Z. hirtum* Delobel. Five new species are described: *Z. kasparyani* **sp. n.**, *Z. rogeri* **sp. n.**, *Z. eileenae* **sp. n.**, *Z. wahli* **sp. n.** and *Z. broadi* **sp. n.** A key to species is provided. The genus is endemic to Africa (Angola to Kenya) and is one of only three genera of the tribe Tryphonini recorded from the Afrotropical region.

Keywords

Zambion, Ichneumonidae, Tryphoninae, Afrotropical, revision

Introduction

The tribe Tryphonini is poorly represented in the Afrotropical region with only 3 of 21 extant genera recorded (Yu et al. 2009; Bennett 2002): *Boethus* Förster (Scaramozzino 1991) and two endemic genera: *Ibornia* Seyrig (Seyrig 1935) and *Zambion* Kasparyan (Kasparyan 1993). In total, there are only eight described species of Tryphonini recorded from the Afrotropical region: two species each of *Boethus* and *Zambion* and four

species of *Ibornia* (Yu et al. 2009). It was speculated by Gauld (1987) that a reason for the lack of ctenopelmatine ichneumonids from tropical regions is because their hosts (sawflies) are rare in the tropics in terms of species and biomass. The same hypothesis could explain the low number of species of Afrotropical Tryphonini because almost all known host records for the tribe are from sawflies (Gauld et al. 1997). The hosts of *Ibornia* and *Zambion* are not known, but they likely parasitize tenthredinid sawflies based on the known host range of related genera (e.g., *Dyspetes* Förster and *Otoblastus* Förster) (Gupta 1983; Kasparyan 1973). Of the 10 genera of Tryphonini for which hosts are known, only two have been reared from hosts other than Tenthredinidae: *Boethus* species have been consistently reared from Argidae (Hymenoptera) (Gauld et al. 1997) and some species of *Grypocentrus* Ruthe have been reared from Eriocraniidae (Lepidoptera) (Jordan 1998) (most rearing records of *Grypocentrus* are from Tenthredinidae) (Kasparyan 1973).

Apart from the presumed lower number of potential hosts, another factor that definitely contributes to the small number of species of Afrotropical Tryphonini (and Ichneumonidae in general) is the relatively little amount of taxonomic research on the ichneumonids of the region. In other regions such as the Neotropical, recent active research programmes have greatly elucidated the ichneumonid fauna (e.g., Gauld 1991; Gauld et al. 1997, 2000, 2002). In the Afrotropical region, some excellent work has been done in the past, for example, Seyrig (1932, 1934, 1935, 1952) on various sub-families, Heinrich (1967a, b, c, 1968a, b) on Ichneumoninae, and Gauld and Mitchell (1978) on Ophioninae, but recently, taxonomic studies including Afrotropical species have been uncommon. For example, Yu et al. (2009) listed only 8 taxonomic papers that included Afrotropical species published between 2000 and 2008 (compared to 65 for the Neotropical region and 46 for the Oriental). In terms of described species, the Afrotropical ichneumonid fauna is not as speciose as the Neotropical and Oriental regions (1,946 described species in the Afrotropical compared to 3,803 in the Neotropical and 3,595 in the Oriental) (Yu et al. 2009). But based on examination of unidentified material at the American Entomological Institute, Canadian National Collection of Insects and the Natural History Museum, London, there are large numbers of undescribed species in the Afrotropical region, especially from the tropics and South Africa. Without additional taxonomic studies of the fauna, well-founded assessments of species diversity and biological patterns for sub-Saharan Africa will be difficult to achieve. The purpose of this paper is to revise the genus *Zambion* including description of five new species. It is hoped that the revision of such a beautiful and morphologically distinct genus will encourage other researchers to spend much-needed time working on this interesting, but under-studied fauna.

Methods

All terms of ichneumonid morphology follow Townes (1969) with the following modifications: hypostomal carina for 'oral carina', supra-antennal area for 'frons', supracl-

ypeal area for ‘face’, gena for ‘temple’, occiput for ‘postocciput’, malar space for ‘cheek’, epicnemial carina for ‘prepectal carina’, laterotergites for ‘epipleura’, gonoforceps for ‘claspers’, and hypopygium for ‘subgenital plate’. The term ‘mesosoma’ is used for the body region that includes the thorax and first abdominal segment (the propodeum). The term ‘metasoma’ is used for the apparent abdomen, with MS1, MS2, etc. referring to metasomal segments 1, 2, etc., T1, T2, etc. referring to the tergites of metasomal segments 1, 2, etc. and S1 referring to the sternite of metasomal segment 1. The term T2+ refers to tergite 2 and all tergites posterior to T2. Terms of relative position of the body follow Goulet and Huber (1993). Wing venation terms follow the Comstock-Needham system as updated by Ross (1936) and incorporate the recommendations of Goulet and Huber (1993) except for naming of the vein that forms the distal edge of fore wing cell 1+2Rs (the ‘areolet’ of Townes 1969). This vein is of uncertain origin and is here referred to as ‘vein 3rs-m’ in conformity with Wahl and Gauld (1998). The following terms for specialized structures are defined: epomia: a raised ridge (carina) on pronotum (Figs 30–31); glymma: lateral depression sub-basally on T1; notaulus: longitudinal groove sublaterally on mesoscutum (Fig. 29); sternaulus: longitudinal groove subventrally on mesopleuron; ventral transverse carina of propodeum: a carina that extends from the metasomal foramen of the propodeum to the pleural carina (Fig. 35).

Measurements for particular structures were made as follows: supraclypeal width was measured at midheight compared to height in the middle (laterally); horn length measured in dorsal view versus pedicel width at middle in lateral view; gena width measured at lower (narrowest) point versus transverse width of eye at midheight (both in lateral view); length of scutellar carina measured from base of scuto-scutellar groove to apex of scutellum; point of union of posterior transverse carina of propodeum (ptc) and pleural carina (pc) was estimated by measuring the distances shown in Figs 35–37: from the propodeal spiracle to the ptc and from the ptc to the ventral transverse carina (vtc) (or in *Z. monodon* and *Z. kasparyani*, where the vtc would be, if present); hind femur dimensions were calculated by dividing the maximum length including the distal trochantellus by the height at midpoint; length of T1 measured in lateral view compared to width of T1 measured in dorsal view at posterior edge. Measurements of holotypes are shown in parentheses after range. Characters listed in the generic description are those deemed relevant to distinguish *Zambion* from all other genera of Tryphonini as defined by Kasparyan (1973), Kasparyan and Tolkanitz (1999) and Bennett (2002).

Specimens are deposited at the following institutions (acronyms according to Evenhuis 2011):

Canadian National Collection of Insects (CNC); The Natural History Museum, London (NHM); Muséum national d’Histoire naturelle, Paris (MNHN), Finnish Museum of Natural History, Helsinki (MZH), California Academy of Sciences, San Francisco (CAS). Label data for holotypes is reported *verbatim* from the labels, with our comments about the labels indicated in square brackets. Locality data for other specimens are provided in a standardized format.

Digital photos were taken using a Leica MZ16 stereomicroscope with motorized focus drive attached to a Leica DFC420 digital camera. Photos were combined and edited

using Leica Application Suites Montage Multifocus software V3.8, Auto-Montage Pro 5.01 and Adobe Photoshop CS4. Authorship of all species is by Bennett and Barnes.

Taxonomy

Zambion Kasparyan

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

Zambion Kasparyan, 1993: 86. Type: *Zambion monodon* Kasparyan. By monotypy.

Diagnosis. Differentiated from other genera of Tryphoninae by combination of both of the following characters: 1) unidentate mandibles (Fig. 22); 2) supra-antennal area with a medial horn (not a vertical lamella) slightly ventral to medial ocellus (Figs 16–21, 24–27). *Zambion* would most easily be mistaken for *Ibornia* Seyrig, but *Ibornia* has a supra-antennal vertical lamella instead of a horn and T1 and T2 are fused (not fused in *Zambion*).

Description. Adult. Fore wing length 4.9 to 7.2 mm. Clypeus separated from supra-clypeal area by a strong groove (most species) (Fig. 11) or weakly separated in *Z. hirtum* Delobel (Fig. 10); strongly convex or moderately flat in profile; not divided into dorsal and ventral faces by a transverse line (most species) (Fig. 11) or divided (Fig. 12). Apical edge of clypeus not projecting ventroanteriorly in lateral view, truncate to slightly convex medially in anterior view, without a pair of medial denticles. Mandible unidentate (Fig. 22), outer face (anterior surface) basally flat and coarsely punctate (not inflated and impunctate as in *Ctenochira*). Glossa slightly to strongly elongated (Fig. 15). Posterior mandibular condyles separated by greater width than inner margins of eyes at level of clypeal foveae. Malar space 0.4 to 0.7 times basal width of mandible. Occipital carina present only dorsally (between inner margins of eyes), therefore not joining hypostomal carina, the latter not directed posteriorly into a tooth. Supra-antennal area with or without a glabrous depression, if present then just as a deep dimple directly ventral to medial ocellus, not an elongate groove as in *Cosmoconus* Förster. Supra-antennal area with a medial horn (Figs 16–21, 24–27). Vertex posterior to medial ocellus without a rounded, conical protuberance. Distance between inner edges of toruli 0.1 to 0.4 times width of one torulus.

Dorsal edge of pronotum (seen in dorsal view) strongly thickened laterally (Fig. 28). Epomia present only as a slight sharpening of ventroanterior ridge of pronotum (not crossing pronotal groove) (Figs 30–31). Notaulus weak (Fig. 29) or absent. Subtegular ridge slightly protruding laterally, not extending dorsally as a vertical lamina that nearly touches tegula, without a posterior longitudinal slot. Epicnemial carina not joined by an auxiliary carina that extends from anterior edge of mesopleuron. Vertical portion of epicnemial carina close to anterior edge of mesopleuron and dorsally curving anteriorly to meet anterior edge of mesopleuron (Figs 32–33). Longitudinal carinae of mesopleuron and mesoscutum (as in *Ibornia*) absent. Sternaulus weak and wide

to 0.2 to 0.3 length of mesopleuron. Angular flange on posterolateral edges of mesoscutum and associated 'axillary tongue' both present and strongly angulate. Scutellum completely black (most species), completely yellow (*Z. hirtum* and *Z. kaspariyani*) or black with yellow apically (*Z. monodon*), lateral carinae present only basally or up to 0.5. Propodeum with all carinae present except anterior transverse carina completely absent in all species (Fig. 34), medial longitudinal carinae absent anteriorly in *Z. wahl*i and *Z. broadi* and posterior transverse carina interrupted medially in the males of *Z. wahl*i and *Z. broadi*. Posterior transverse carina angulate where it intercepts medial longitudinal carinae (Fig. 34). Foretibia with a strong tooth on apex of anterior side or tooth weak to absent. Trochantelli not fused on middle and hind legs. Hind tarsal claws stoutly pectinate in basal 0.4 to 0.6. Fore wing vein 3rs-m present. Cell 1 + 2Rs subrectangular or subrhombic, width not greater than 1.4 times height, petiolate anteriorly. Fore wing vein 2m-cu with an angulation (zig-zag) that is strong in most species (Figs 38–39) or weak (Fig. 7) and with one wide or two narrowly spaced bullae. Fore wing hyaline basally and infumate apically (Figs 38–39) or completely moderately infumate (Figs 7–8).

T1 gradually widening from anterior to posterior, 1.2 to 1.8 times as long as posterior width, with moderate anterolateral projections (as seen in dorsal view). Glymma present as a depression ventral to anterolateral projections. Dorsal longitudinal carinae of T1 present basally or extending up to 0.7 of segment. Dorsolateral longitudinal carinae of T1 present (most species) or absent; if present, not extending posterior to spiracle (Figs 40, 41) or extending up to 0.7 of segment, not bifurcated into two branches above and below spiracle. Spiracle of T1 just anterior to middle. T1 and T2 not fused. T2 without a postmedial transverse groove or grooves that delineate anterolateral corners. T2 to T4 completely yellow/orange, completely black, or black with yellow at posterior of each segment. Laterotergites wide (Fig. 42), of MS3 divided from tergite by a crease, of MS4 not divided. T7 and T8 not turned anteriorly under metasoma. Ovipositor straight, about equal to apical height of metasoma or a little shorter, carrying one egg (Figs 5, 45) or no eggs, dorsal valve tapered to a sharp point (Fig. 44). Ovipositor sheath in profile, widest basally, gradually tapering from base to apex, flexible from 0.3 to 0.6.

Body polished, face and supraclypeal area coarsely punctate (Figs 10–15); pronotum, mesopleuron and metapleuron with fine, sparse, but distinct punctures (Figs 30–33); all other body regions almost impunctate (Figs 34–37, 40–43). Body covered in dense setae, particularly long on supraclypeal area, shorter on pleura of mesosoma and metasomal tergites.

Mature larva. Unknown.

Egg. (Fig. 45): Stalk apical, anchor unknown, surface reticulate. Egg known only for *Z. monodon* (holotype).

Hosts. Unknown, but probably parasitoids of tenthredinoid sawflies (Hymenoptera) (see Introduction).

Distribution. Afrotropical (Republic of Congo, Uganda, Kenya, Zambia and Angola).

Species included. *Z. monodon*, *Z. hirtum* Delobel and five new species described below.

Comments. *Zambion*, *Ibornia* and *Thibetoides* are all closely related based on seven synapomorphies, especially the thickened dorsoposterior corner of the pronotum and the supra-antennal prominence (Bennett 2002). Kasparyan (1993) speculated that *Zambion* and *Ibornia* must be sister genera because of the unidentate mandibles and because they are both Afrotropical, but Bennett (2002) found that *Ibornia* and *Thibetoides* are sister taxa based on seven characters including the fusion of T1 and T2 and the ventral curving of T7 and T8 under the metasoma which makes *Zambion* the sister of these two genera.

Key to the world species of *Zambion*

- 1 Longitudinal lamella present between toruli (Fig. 23). Mesosoma yellow to orange (Fig. 4) AND head with dark markings dorsally (Fig. 16) ***Z. hirtum* Delobel**
- Lamella absent between toruli. Mesosoma with dark markings (Figs 5–9), OR if mesosoma completely yellow to orange (Fig. 46), then head also yellow to orange, without dark markings dorsally near ocelli and horn (Fig. 47) **2**
- 2(1) Propodeum lacking a ventral transverse carina extending from metasomal foramen to pleural carina (Figs 36, 48) **3**
- Propodeum with a ventral transverse carina extending from metasomal foramen to pleural carina (Figs 35, 37) **4**
- 3(2) Mesopleuron with dorsal half black and ventral half yellow (Fig. 5). Notaulus weak, but present ***Z. monodon* Kasparyan**
- Mesopleuron completely yellow (Fig. 46). Notaulus absent ***Z. kasparyani* sp. n.**
- 4(2) Propodeum with medial longitudinal carinae absent or incomplete anterior to posterior transverse carina. Supra-antennal area with a long, sub-parallel-sided/ weakly tapering horn in dorsal view (Figs 20, 21), length 1.2 to 1.3 times width of pedicel at midheight in lateral view (Fig. 27) **5**
- Propodeum with medial longitudinal carinae strong and complete anterior to posterior transverse carina (Fig. 34). Supra-antennal area with a short triangular horn in dorsal view (Figs 18, 19) length 0.3 to 0.5 times width of pedicel at midheight in lateral view (Fig. 26) **6**
- 5(4) Propodeum black (Fig. 8). Clypeus black, except brown at extreme apical edge (Fig. 14). Lateral abscissa of posterior transverse carina of propodeum roughly straight, meeting pleural carina at right angle at about midpoint between propodeal spiracle and posterior end of pleural carina (similar to Fig. 36) ***Z. wabli* sp. n.**
- Propodeum orange except brown basolaterally (Fig. 9). Clypeus with apical half orange and basal half black (Fig. 15). Lateral abscissa of posterior transverse carina of propodeum strongly curving posteriorly where it meets pleural

- carina at an acute angle near posterior 0.2 of pleural carina (Fig. 37)
 ***Z. broadi* sp. n.**
- 6(4) Legs completely dark brown (Fig. 7). Tergites 3 to 7 completely brown (Fig. 7). Malar space 0.7 times basal width of mandible. Carina extending from pleural carina of propodeum to propodeal spiracle complete.....
 ***Z. eileenae* sp. n.**
- Fore and mid legs orange, hind coxa, trochanter and femur orange, hind tibia and tarsus dark brown, except yellow at base of hind tibia (Fig. 6). Tergites 3 to 7 with medioposterior ivory bands (Fig. 6). Malar space 0.4 to 0.5 times basal width of mandible. Carina extending from pleural carina of propodeum to propodeal spiracle absent ***Z. rogeri* sp. n.**

***Zambion monodon* Kasparyan**

http://species-id.net/wiki/Zambion_monodon

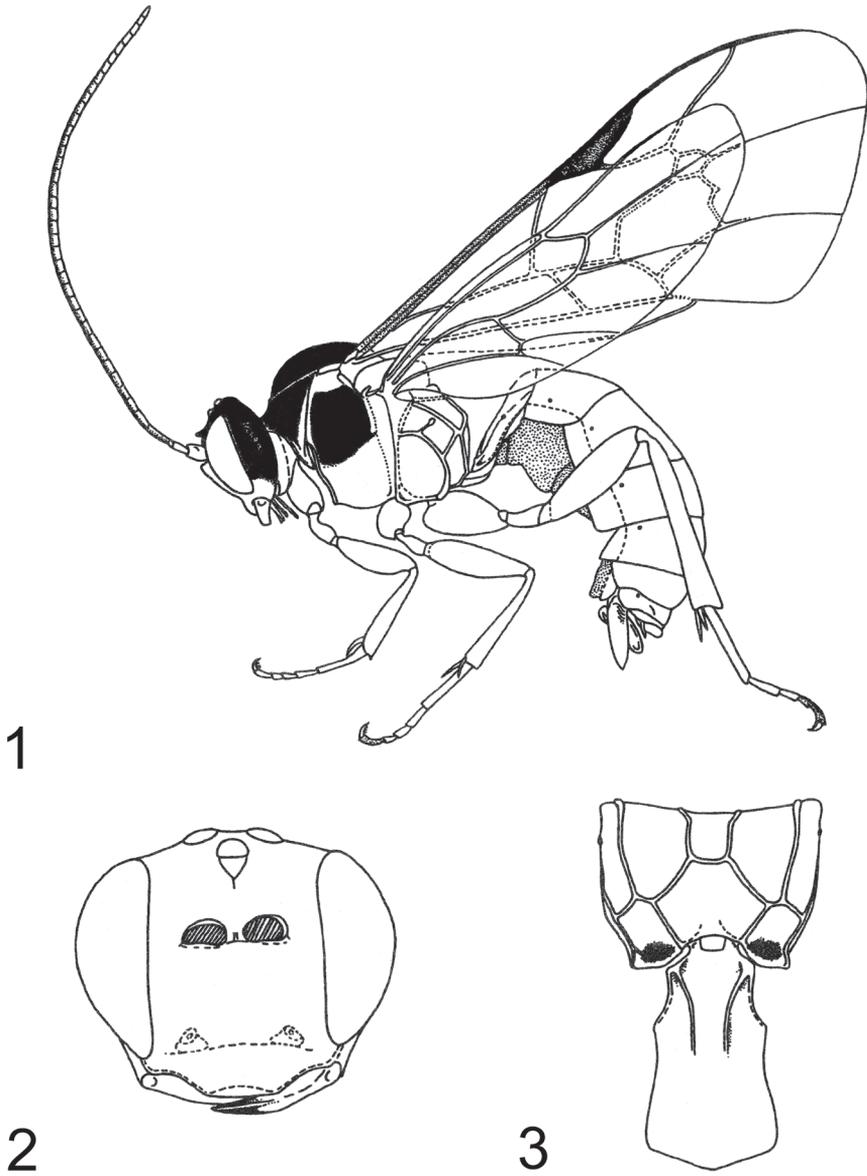
Figs 1–3, 5, 11, 17, 25, 36, 41, 42, 45

Zambion monodon Kasparyan, 1993: 86.

Diagnosis. *Zambion monodon* can be distinguished from all other *Zambion* spp. by having the mesopleuron approximately half black (dorsally) and half yellow (ventrally) (Fig. 5) (all other species are concolourous on mesopleuron – either all brown to black or all yellow to orange). *Z. monodon* is unusual in *Zambion* in that it lacks the ventral transverse carina of the propodeum extending from the metasomal foramen to the pleural carina (Fig. 36). The only other species of *Zambion* that lacks this carina is *Z. kasparyani*, but the latter species has a mesopleuron that is completely yellow to orange (Fig. 46).

Description. Adult. Female (based on holotype only – see comments below). Fore wing length 7.2 mm. Clypeus separated from supraclypeal area by a strong groove (Fig. 11). Malar space 0.5 times basal width of mandible. Supraclypeal area 2.0 times as wide as high (Fig. 11), dorsomedially without a short, narrow, longitudinal lamella between the antenna. Supra-antennal horn moderately long and triangular in dorsal view (Fig. 17), about equal in length to width of pedicel at midheight in lateral view (Fig. 25). Ocello-ocular distance 1.4 times ocellar diameter. Gena 0.6 times transverse diameter of the eye. Antennal flagellum with 37 segments.

Notaulus present, but weak. Epicnemial carina medially curving slightly away from anterior edge of mesopleuron near ventral corner of pronotum (intermediate between *Z. rogeri* shown in Fig. 32 and *Z. wabli* shown in Fig. 33). Scutellum with lateral carinae 0.4 length of scutellum. Medial longitudinal carinae of propodeum complete and strong anterior to posterior transverse carina (Fig. 3). Carina extending from pleural carina to spiracle complete (Fig. 36). Posterior transverse carina of propodeum with lateral abscissa roughly straight, joining pleural carina at about 0.4 distance from posterior end of pleural carina to propodeal spiracle (Fig. 36). Ventral transverse carina extending



Figures 1–3. *Zambion monodon*, holotype female **1** habitus **2** head, anterior view **3** propodeum and first metasomal segment, dorsal view. Figure reproduced from Kasparyan (1993).

from metasomal foramen to pleural carina absent (Fig. 36). Fore tibia with a strong apical point on dorsal surface. Hind femur 3.4 times as long as medial width (Fig. 1). Hind tarsal claw pectinate to about 0.5. Angulation of fore wing vein 2m-cu strong (Fig. 1).

Tergite 1 of metasoma 1.7 times as long as apical width. Dorsal longitudinal carinae of T1 extending posterior to spiracle (0.6 length of tergite), dorsolateral longitudinal carinae extending about half way to spiracle (0.3 distance of T1) (Fig. 41 of male, similar to female).

Yellow. Legs and metasoma become slightly darker yellow apically/ posteriorly. Scape, pedicel except apically, supra-antennal area except orbits ventral to medial ocellus, vertex, gena dorsal to ventral edge of eye, occiput, apex of mandibles, pronotum dorsal to furrow, mesoscutum, dorsal half of mesopleuron except subtegular ridge and scutellum except basolaterally black/ dark brown. Apex of pedicel, flagellum and distal tarsomere of hind leg brown. Entire membrane of fore wing moderately infumate (Fig. 5). Body covered with dense golden setae.

Male (based only on single male paratype noted by Kasparyan 1993): As female except fore wing length 7.0 mm. Malar space 0.4 times basal width of mandible. Width of supraclypeal area 1.7 times medial height. Ocello-ocular distance 1.2 times ocellar diameter. Gena 0.7 times transverse diameter of eye. Lateral abscissa of posterior transverse carina of propodeum joining pleural carina at 0.3 distance from posterior end of pleural carina. (Both antennae missing or incomplete).

Material examined. Holotype: ♀, Label 1: ZAMBIA, Kitwe, Chati, 27.3.1979, K. Löyttyniemi leg. Label 2: window trap with *Eucalyptus*. Label 3: Holotypus *Zambion monodon* Kasparyan. Label 4: coll. Dept. Agr. Forest. Zool. Univ. Helsinki. [MZH]. Condition: intact except missing distal tarsomere of right foreleg and left mid leg detached and glued to top locality label. Paratypes: ♂, same data as holotype, except 8.iii.1979; ♀ same data except 15.iii.1979. (♀ paratype strongly damaged by Dermestidae).

Comments. *Z. monodon* appears related to *Z. kasparyani* and *Z. hirtum* on the basis of the similar moderately long, triangular-shaped supra-antennal horn (Figs 16, 17, 47). Within this grouping, *Z. monodon* and *Z. kasparyani* both lack the ventral transverse carina of the propodeum (Figs 36, 48). Outgroup comparison with *Ibornia* and *Thibetoides* spp., reveals that this character varies between species within these two genera as well, therefore its polarity (and phylogenetic utility) in *Zambion* is unclear. *Zambion monodon* is the only species of *Zambion* for which the egg is known. Kasparyan (1993) stated that the dermestid damaged paratype was a female. Because the metasoma posterior to T3 is missing, it is difficult to confirm the sex; however, the length of T1 (1.8 times posterior width) and ocellar-ocular distance (1.2 times ocellar diameter) suggest that this specimen may be a male based on comparison with the dimensions of these structures in the female holotype and male paratype.

***Zambion kasparyani* sp. n.**

urn:lsid:zoobank.org:act:C1C0F597-7D1C-4591-9E8C-4705AAE8F0AB

http://species-id.net/wiki/Zambion_kasparyani

Figs 46–48

Diagnosis. *Zambion kasparyani* can be distinguished from all other *Zambion* spp. by combination of both of the following characters: 1) absence of a ventral transverse



Figures 4–5. Habitus **4** *Zambion hirtum*, holotype female **5** *Zambion monodon*, holotype female.

carina on the propodeum extending from the metasomal foramen to the pleural carina (Fig. 48) (contrast with condition in *Z. hirtum* shown in Fig. 35); 2) mesosoma completely yellow to orange (Fig. 46) (no dark colour).

Description. Adult. Female unknown.

Male: Fore wing length 5.8 mm. Clypeus separated from supraclypeal area by a strong groove. Malar space 0.4 times basal width of mandible. Supraclypeal area 1.7 times as wide as high, dorsomedially without a short, narrow, longitudinal lamella between the antenna. Supra-antennal horn moderately long and triangular in dorsal view (Fig. 47), about equal in length to width of pedicel at midheight in lateral view. Ocello-ocular distance 1.2 times ocellar diameter. Gena 0.8 times transverse diameter of the eye. Antennal flagellum with 32 segments.

Notaulus absent. Epicnemial carina mostly straight medially, not curving away from anterior edge of mesopleuron near ventral corner of pronotum (similar to *Z. rogeri* shown in Fig. 32). Scutellum with lateral carinae extending 0.4 length of scutellum. Medial longitudinal carinae of propodeum complete and strong anterior to posterior transverse carina (as in Fig. 3). Carina extending from pleural carina to spiracle complete (Fig. 48). Posterior transverse carina of propodeum with lateral abscissa roughly straight, joining pleural carina at about 0.4 distance from posterior end of pleural carina to propodeal spiracle (Fig. 48). Ventral transverse carina extending from metasomal foramen to pleural carina absent (Fig. 48). Fore tibia with a moderately strong apical point on dorsal surface. Hind femur 3.6 times as long as medial width. Hind tarsal claw pectinate to about 0.5. Angulation of fore wing vein 2m-cu strong.

Tergite 1 of metasoma 1.6 times as long as apical width. Dorsal longitudinal carinae of T1 extending to spiracle (0.4 length of tergite), dorsolateral longitudinal carinae extending just over half way to spiracle (0.3 distance of T1).

Yellow. Legs and metasoma slightly darker yellow apically/ posteriorly. Vertex and supra-antennal area medially, scape and mesoscutum orange. Pedicel and apex of mandible dark brown. Flagellum medium brown except base of first flagellomere orange. Entire membrane of fore wing moderately infumate (Fig. 46). Body covered with dense golden setae.

Material examined. Holotype ♂, Label 1: KENYA: Rift Valley Province. Marich Pass Field Studies Centre, 1°32.2'N, 35°27.4'E, 13–14 June 2000. Label 2: M.H. Bourbin, V.H. Lee & W.J. Pulawski collectrs [CAS]. Condition: intact.

Etymology. This species is named in honour of Dr. Dmitriy Kasparyan (Zoological Institute, Russian Academy of Sciences, St. Petersburg) for his contributions to ichneumonid taxonomy especially being the first to recognize and describe the genus *Zambion*.

Comments. see comments for *Z. monodon* and *Z. hirtum*.

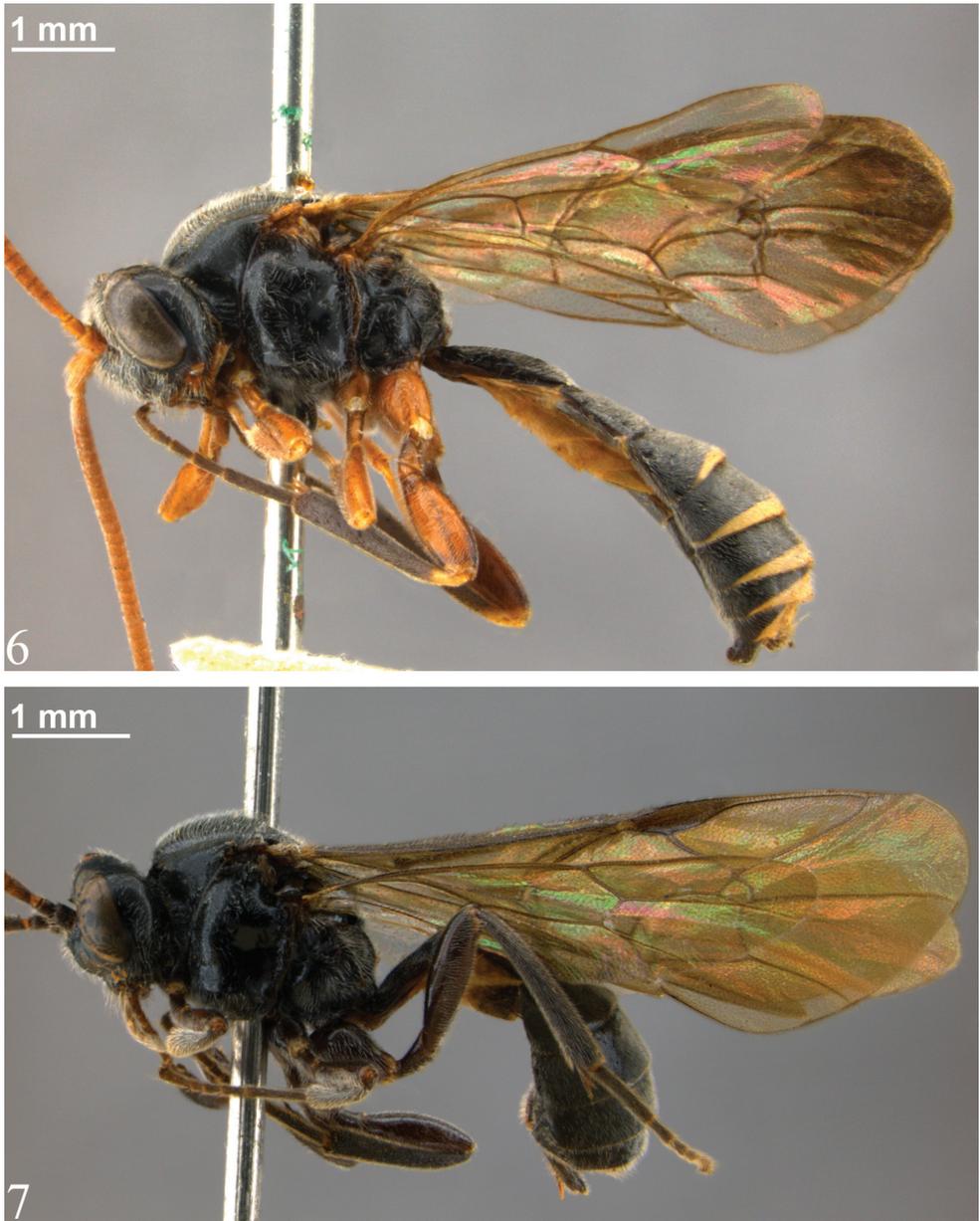
Zambion hirtum Delobel

http://species-id.net/wiki/Zambion_hirtum

Figs 4, 10, 16, 22–24, 30, 34–35, 38–40, 43–44

Zambion hirtum Delobel, 1993: 267.

Diagnosis. *Zambion hirtum* can be distinguished from all other *Zambion* spp. in that the supraclypeal area dorsomedially has a short, longitudinal lamella between the an-



Figures 6–7. Habitus **6** *Zambion rogeri*, holotype male **7** *Zambion eileenae*, holotype female.

tennae (Fig. 23) (lamella absent in all other species). In addition, *Z. hirtum* is the only species that has the following colour combination: mesosoma and metasoma completely light coloured (yellow or orange) (Fig. 4) AND head yellow with black markings dorsally (Fig. 16).

Description. Adult. Female (only holotype known). Fore wing length 7.1 mm. Clypeus separated from supraclypeal area by a weak groove (Fig. 10). Malar space 0.5 times basal width of mandible. Supraclypeal area 1.7 times as wide as high (Fig. 10), dorsomedially with a short, narrow, longitudinal lamella between the antenna (Fig. 23). Supra-antennal horn triangular in dorsal view (Fig. 16), 1.0 times as long as width of pedicel at midheight in lateral view (Fig. 24). Ocello-ocular distance 1.6 times ocellar diameter. Gena 0.7 times transverse diameter of the eye. Antennal flagellum with 40 segments.

Notaulus absent. Epicnemial carina mostly straight medially (similar to *Z. rogeri* shown in Fig. 32), not curving away from anterior edge of mesopleuron near ventral corner of pronotum. Scutellum with lateral carinae at base only. Medial longitudinal carinae of propodeum strong and complete anterior to posterior transverse carina (Fig. 34). Carina extending from pleural carina to spiracle absent. Posterior transverse carina of propodeum with lateral abscissa roughly straight (Fig. 34), point of union with pleural carina at about 0.2 distance from posterior end of pleural carina to propodeal spiracle. Ventral transverse carina extending from metasomal foramen to pleural carina present (Fig. 35). Fore tibia with a weak apical point on dorsal surface. Hind femur 3.2 times as long as medial width (original description = 3.8). Hind tarsal claw pectinate to 0.6 times length of claw. Angulation of fore wing vein 2m-cu strong (Fig. 38).

Tergite 1 of metasoma 1.6 times as long as apical width. Dorsal longitudinal carinae of T1 extending close to spiracles (about 0.4 times length of tergite), dorsolateral longitudinal carina extending just over half way to spiracles (similar to Fig. 40 of male *Z. hirtum*).

Yellow. Pedicel, medial 0.5 of supra-antennal area except dorsomedial part of horn (Fig. 16) and medial 0.3 of occiput black to dark brown. Flagellum and dorsomedial area of supra-antennal horn brown. Medial 0.5 of vertex posterior to ocelli, mesoscutum and apical 2 tarsomeres of fore and mid legs and apical 3 tarsomeres of hind leg brownish yellow. Membrane of fore wing hyaline, except slightly infumate in apical 0.3 (Fig. 38). Body covered with dense golden setae.

Male: as female except fore wing length 4.9 to 7.1 mm. Malar space 0.4 times basal width of mandible. Width of supraclypeal area 1.7 to 2.0 times height. Ocello-ocular distance 1.7 to 1.9 times ocellar diameter. Gena 0.6 times transverse diameter of eye. Flagellum with 36 to 40 segments. Notaulus weak anteriorly in some specimens. Lateral abscissa of posterior transverse carina of propodeum slightly sinuous (Fig. 35) or completely straight (Fig. 34), joining pleural carina at 0.2 to 0.4 distance from posterior end of pleural carina. Hind femur length 3.0 to 3.4 times medial width. Hind tarsal claw pectinate in basal 0.4 to 0.5 of claw. Tergite 1 1.3 to 1.7 times as long as apical width. Dorsolateral longitudinal carina of T1 extending less than half way to spiracle (Fig. 40) or a little bit more than half. Colour as female except, in some specimens medial 0.5 of vertex light brown to dark brown and occiput more extensively brown (up to medial 0.5). Supra-antennal horn completely black to dark brown in some specimens.

Material examined. Holotype: ♀, Label 1: CONGO, Brazzaville, Centre ORSTOM, 8 novembre 1986, A. DELOBEL coll. Label 2: Holotype. Label 3: *Zambion*



Figures 8–9. Habitus **8** *Zambion wabli*, holotype female **9** *Zambion broadi*, holotype male.

hirtum A. DELOBEL det 1993. Label 4: Muséum Paris EY6006. [MNHN]. Condition: intact except left antenna missing distal 12 flagellomeres and right mid leg missing distal tarsomere. Paratypes: 3 ♂, same data as holotype except: 18.i.1987 [EY 6008]; 17–24.v.1987 [EY6009] and 21.xii.1986 [EY6011] [MNHN]; ♂ same data as

holotype except: 17–24.v.1987 [EY 6012] [CNC]. Non-type material: ♂, ANGOLA: Quirimbo. v.1934. K. Jordan. B.M. 1934–1935 [NHM].

Comments. *Z. hirtum* is a mostly pale-coloured species, most similar in colour to *Z. kaspanyani*, although the latter species is completely yellow to orange dorsomedially on the head (Fig. 47), whereas *Z. hirtum* is extensively black in this area (Fig. 16). *Zambion hirtum* is the species with the most known specimens (eight) and is the only species known from two countries. Note that only six of the eight specimens were examined in this study. Also note that the supraclypeal longitudinal lamella of *Z. hirtum* is not homologous with the supra-antennal lamella of *Ibornia*. The latter is positioned much more dorsally on the head (extending nearly to the medial ocellus) and its dorsal margin is strongly thickened with a longitudinal groove (Townes, 1969).

***Zambion rogeri* sp. n.**

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http://species-id.net/wiki/Zambion_rogeri

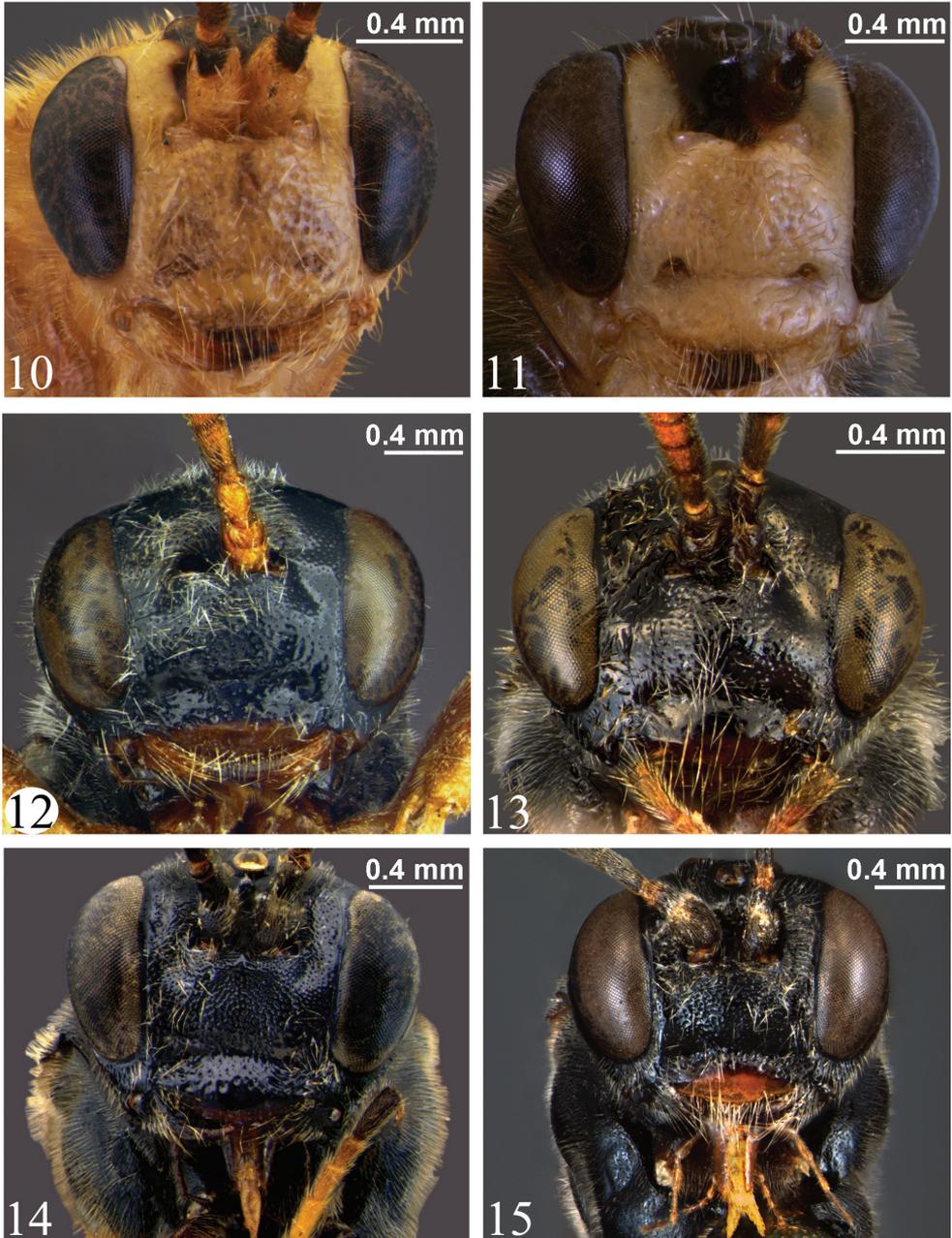
Figs 6, 12, 18, 32

Diagnosis. *Zambion rogeri* can be distinguished from all other *Zambion* spp. by having tergites 3 to 7 of metasoma black with ivory bands in posterior 0.1 to 0.2 (Fig. 6). No other species have banded metasomal segments.

Description. Adult. Female: Unknown.

Male: Fore wing length 6.4 to 7.0 (6.4) mm. Clypeus separated from supraclypeal area by a strong groove (Fig. 12). Malar space 0.4 to 0.5 (0.5) times basal width of mandible. Supraclypeal area 1.7 to 1.9 (1.7) times as wide as high (Fig. 12), dorsomedially without a short, narrow, longitudinal lamella between the antenna. Supra-antennal horn short and broadly triangular in dorsal view (Fig. 18), 0.3 to 0.5 (0.3) times as long as width of pedicel at midheight in lateral view. Ocello-ocular distance 1.8 to 2.3 (1.8) times ocellar diameter. Gena 0.6 to 0.7 (0.6) times transverse diameter of the eye. Flagellum with 35 to 37 (35) segments.

Notaulus absent. Epicnemial carina mostly straight medially, not curving away from anterior edge of mesopleuron near ventral corner of pronotum (Fig. 32). Scutellum with lateral carinae 0.4 to 0.5 (0.5) length of scutellum. Medial longitudinal carinae of propodeum complete and strong anterior to posterior transverse carina (as in *Z. hirtum* shown in Fig. 34). Carina extending from pleural carina to propodeal spiracle absent. Posterior transverse carina of propodeum with lateral abscissa roughly straight, point of union with pleural carina at about 0.4 distance from posterior end of pleural carina to propodeal spiracle (similar to *Z. monodon* shown in Fig. 36). Ventral transverse carina extending from metasomal foramen to pleural carina present (as in Fig. 35). Fore tibia with a weak apical point on dorsal surface. Hind femur 3.5 to 3.7 (3.6) times as long as medial width. Hind tarsal claw pectinate to 0.4 times length of claw. Angulation of fore wing vein 2m-cu moderate.



Figures 10–15. Head, anterior view **10** *Zambion hirtum*, paratype male **11** *Zambion monodon*, paratype male **12** *Zambion rogeri*, paratype male **13** *Zambion eileenae*, holotype female **14** *Zambion wahlhi*, paratype male **15** *Zambion broadi*, holotype male.

Tergite 1 of metasoma 1.6 to 1.8 (1.6) times as long as apical width. Dorsal longitudinal carinae of T1 extending to about the level of spiracle or a bit beyond, 0.4 to 0.6 (0.6) times length of T1, dorsolateral longitudinal carinae extending to

spiracle, or in holotype to at least 0.7 times length of T1 (posterior to this, present as a rounded ridge).

Black to dark brown. Extreme apex of hind femur, basal 0.2 of hind tibia and posterior 0.2+ of T3–T7 ivory (the ivory bands longer medially than laterally and increasing in length from T3 to T7) (Fig. 6). Scape, pedicel and flagellum ventrally, mandibles except at apex, palpi, pronotal collar medially, tegula, posterior of subtegular ridge, fore leg, mid leg, hind coxa, trochanter and femur orange (middle and hind trochanters and femora brownish orange, especially medial surface of hind trochanter and femur). Flagellum dorsally, apical 0.8 of hind tibia and all of hind tarsus brown (flagellum darkening from base to apex). Membrane of fore wing slightly infumate except moderately infumate in apical 0.3 (Fig. 6). Body covered with dense silver setae.

Material examined. Holotype: ♂, Label 1: BRIT, E, AFRICA [KENYA], Masai Reserve, 29.i.1914, Cap. A.O.Luckman. Label 2: 1919-10. [NHM]. Condition: intact except left antennal flagellum missing all but basal 24 flagellomeres. Paratypes: ♂, BRIT. E. AFRICA [KENYA], 30 miles from Magadi Junc., iv.1912. F.G. Hamilton [NHM]; ♂, BRIT. E. AFRICA [KENYA], Mogorr River, v.1913 [CNC].

Etymology. This species is named in honour of the senior author's father, Dr. Roger Bennett, for his support and encouragement during the long (and sometimes dark) journey towards becoming a systematic entomologist.

Comments. *Zambion rogeri* is most closely related to *Z. eileenae* on the basis of the similar short triangular horn of the supra-antennal area and the length of the longitudinal carinae of T1. Even though *Z. rogeri* is only known from males, and *Z. eileenae* from a single female, it is highly unlikely that they are conspecific. *Zambion rogeri* has extensive yellow colouration on the legs and ivory bands on the metasoma, whereas *Zambion eileenae* is completely dark. In the three species of *Zambion* for which both males and females are known, there are minimal sex-related colour differences and this is also the case for species in the related genera *Ibornia* (Seyrig 1935) and *Thibetoides* (Kasparyan 1973). In addition, the malar space of *Z. rogeri* is 0.4 to 0.5 times the basal width of the mandible compared to 0.7 for *Z. eileenae*. *Zambion rogeri* also lacks the carina extending from the pleural carina to the propodeal spiracle, whereas this carina is complete in *Z. eileenae*.

Zambion eileenae sp. n.

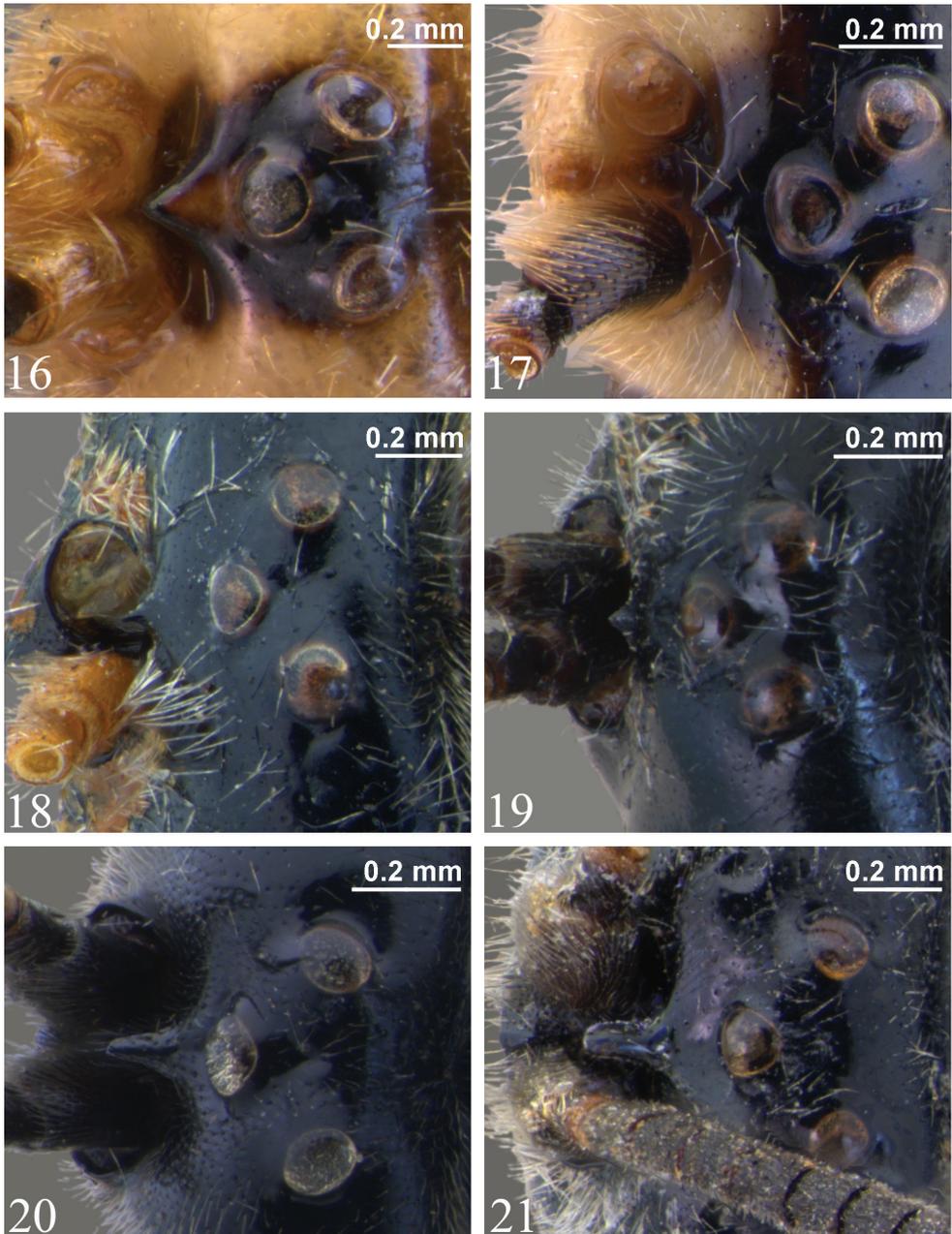
urn:lsid:zoobank.org:act:E90E33CB-A2B1-4B1C-8A80-E0FCC2CD187

http://species-id.net/wiki/Zambion_eileenae

Figs 7, 13, 19, 26

Diagnosis. *Zambion eileenae* can be distinguished from all other *Zambion* spp. by having all legs completely dark (brown or black), without any orange or yellow (Fig. 7). All other species have some orange or yellow in some parts of the legs.

Description. Adult. Female. Fore wing length 6.0 mm. Clypeus separated from supraclypeal area by a strong groove (Fig. 13). Malar space 0.7 times basal width of



Figures 16–21. Vertex showing supra-antennal horn, dorsal view **16** *Zambion hirtum*, paratype male **17** *Zambion monodon*, paratype male **18** *Zambion rogeri*, paratype male **19** *Zambion eileenae*, holotype female **20** *Zambion wahl*, holotype female **21** *Zambion broadi*, holotype male.

mandible. Supraclypeal area 1.9 times as high as wide (Fig. 13), dorsomedially without a short, narrow, longitudinal lamella between the antenna. Supra-antennal horn short and triangular in dorsal view (Fig. 19), 0.3 times as long as width of pedicel at

midheight in lateral view (Fig. 26). Ocello-ocular distance 1.8 times ocellar diameter. Gena 0.8 times transverse diameter of the eye. Flagellum with 29 segments on left, 28 on right.

Notaulus absent. Epicnemial carina mostly straight medially, not curving away from anterior edge of mesopleuron near ventral corner of pronotum (similar to *Z. rogeri* shown in Fig. 32). Scutellum with lateral carinae extending 0.5 length of scutellum. Medial longitudinal carinae of propodeum complete and strong anterior to posterior transverse carina (as in *Z. hirtum* shown in Fig. 34). Carina running from pleural carina to propodeal spiracle complete. Posterior transverse carina of propodeum with lateral abscissa roughly straight, point of union with pleural carina at about 0.4 distance from posterior end of pleural carina to propodeal spiracle (similar to *Z. monodon* shown in Fig. 36). Ventral transverse carina extending from metasomal foramen to pleural carina present (as in Fig. 35). Fore tibia without an apical point on dorsal surface. Hind femur 3.6 times as long as medial width. Hind tarsal claw pectinate to about 0.5 times length of claw. Angulation of fore wing vein 2m-cu weak.

Tergite 1 of metasoma 1.8 times as long as apical width. Dorsal longitudinal carinae of T1 extending to 0.7 length of T1, dorsolateral longitudinal carinae extending beyond spiracles up to 0.7 length of segment.

Black. Legs, metasomal sternites and ovipositor sheaths at base brown, the legs lightening from base to apex except hind leg with tibia and tarsus darker brown. Flagellomere 1 at extreme base and flagellomeres 2+ on ventral surface yellow brown, gradually lightening towards apex, dorsal surface of flagellum brown, lightening to yellow brown apical to middle. Apical 0.3 of clypeus orange-brown. Membrane of fore wing strongly infumate (Fig. 7), slightly less infumate basally. Body covered with dense silver setae.

Male: unknown.

Material examined. Holotype: ♀, Label 1: UGANDA, Ruwenzori Range [Rwenzori Mountains], xii.1934-i.1935., B.M. E. Afr. Exp. B.M. 1935-203. Label 2: Namwamba Valley, 6,500 ft., F.W. Edwards. [NHM]. Condition: intact.

Etymology. This species, collected in the “Mountains of the Moon”, is named in honour of the senior author’s mother, Mrs. Eileen Bennett, for her support and understanding, especially when finding dead caterpillars and grasshoppers in jars or worse (live ones wandering through the house).

Comments. See comments for *Zambion rogeri*.

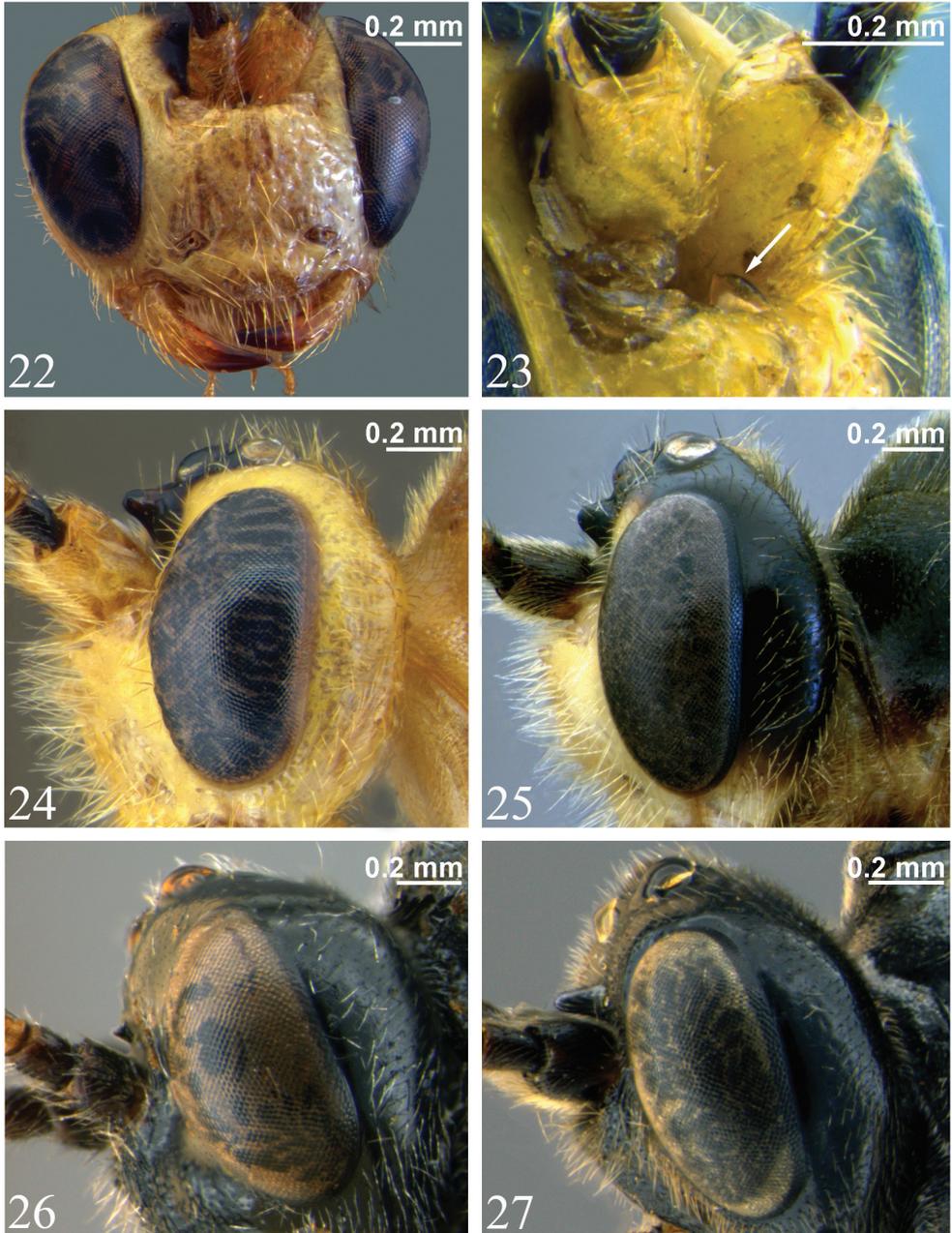
Zambion wahli sp. n.

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http://species-id.net/wiki/Zambion_wahli

Figs 8, 14, 20, 27, 28, 31, 33

Diagnosis. *Zambion wahli* can be distinguished from all other *Zambion* spp. by combination of all of the following characters: 1) mesopleuron completely black (no yel-



Figures 22–27. **22** Head, anterior view, *Zambion hirtum*, paratype male showing unidentate mandible **23** Supraclypeal area, anterolateral view, *Zambion hirtum*, male (non-type) (arrow points to longitudinal lamella between antennae) **24–27** head, lateral view **24** *Zambion hirtum*, paratype male **25** *Zambion monodon*, holotype female **26** *Zambion eileenae*, holotype female **27** *Zambion wahli*, holotype female.

low) (Fig. 8); 2) supra-antennal horn long and sub-parallel-sided in dorsal view (Fig. 20), 1.2 to 1.3 times as long as pedicel at midheight in lateral view (Fig. 27); 3) propodeum completely black (Fig. 8) (not orange).

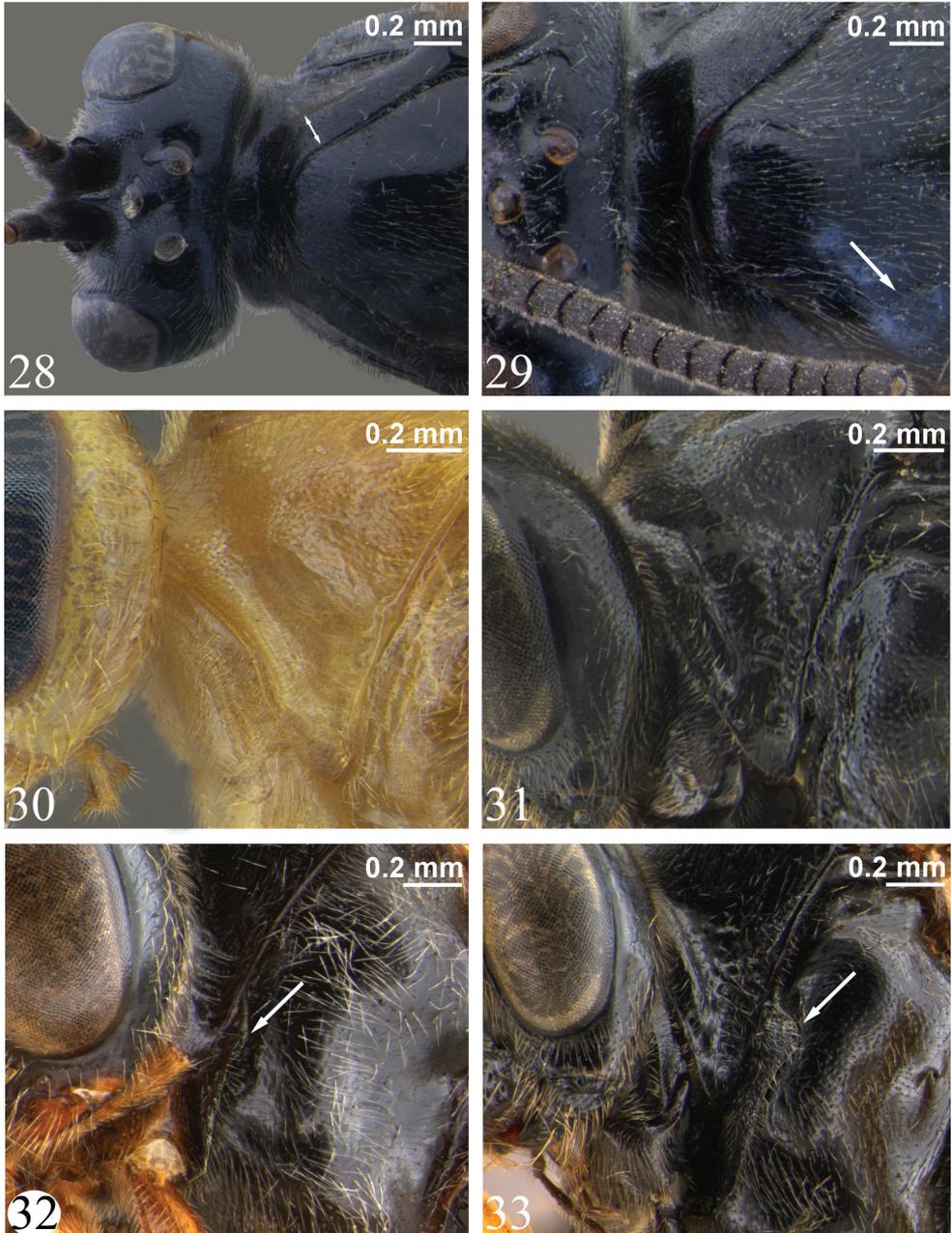
Description. Adult. Female. Fore wing length 6.1 mm. Clypeus separated from supraclypeal area by a strong groove (Fig. 14). Malar space 0.5 times basal width of mandible. Supraclypeal area 2.1 times as wide as high (Fig. 14), dorsomedially without a short, narrow, longitudinal lamella between the antenna. Supra-antennal horn long and sub-parallel-sided in dorsal view (Fig. 20), 1.2 times as long as width of pedicel at midheight in lateral view. Ocello-ocular distance 1.6 times ocellar diameter. Gena 0.8 times transverse diameter of the eye. Antenna incomplete (see Material examined).

Notaulus present, but weak. Epicnemial carina medially curving away from anterior edge of mesopleuron near ventral corner of pronotum (Fig. 33) (not mostly straight medially as in Fig. 32). Scutellum with lateral carinae to 0.3 length of scutellum. Medial longitudinal carinae of propodeum incomplete anterior to posterior transverse carina (present between posterior transverse carina and the level of the propodeal spiracles, but absent anterior to this point). Carina running from pleural carina to spiracle absent. Posterior transverse carina of propodeum with lateral abscissa roughly straight, point of union with pleural carina at about 0.4 distance from posterior end of pleural carina to propodeal spiracle (similar to *Z. monodon* shown in Fig. 36). Ventral transverse carina extending from metasomal foramen to pleural carina present (as in *Z. hirtum* shown in Fig. 35). Fore tibia with a moderately strong apical point on dorsal surface. Hind femur 3.8 times as long as medial width. Hind tarsal claw with pectination not known (both distal tarsomeres missing). Angulation of fore wing vein 2m-cu strong.

Tergite 1 of metasoma 1.2 times as long as apical width. Dorsal longitudinal carina of T1 extending to about level of spiracle (0.4 length of segment), dorsolateral longitudinal carina absent (no obvious carina visible between anterior part of dorsal longitudinal carina and spiracle).

Black. Distal trochantelli of fore and middle legs, hind trochanter except at base, all femora and tibiae except apical 0.1 of hind tibia, fore tarsomeres 1 - 4, middle tarsomeres 1 - 3, basal 0.8 of hind basal tarsomere, T1 - 4, T5 sublaterally, T6 except anteriorly and all sternites yellow. Palpi, glossa, basal trochantelli of fore and middle legs, base of hind basal trochantellus, apical 0.1 of hind tibia, distal tarsomere of fore and middle leg, all of hind tarsus except basal 0.8 of basal tarsomere, T5 medially and laterally, T6 anteriorly and ovipositor sheaths brown. Membrane of fore wing moderately uniformly infumate (Fig. 8). Body covered with dense, golden setae.

Male as female except: Fore wing length 6.2 to 6.3 mm. Malar space 0.4 to 0.5 times basal width of mandible. Supraclypeal area 1.9 to 2.0 times as wide as high. Supra-antennal horn 1.3 times width of pedicel at middle. Ocello-ocular distance 1.8 to 2.0 times ocellar diameter. Gena 0.8 to 0.9 times transverse diameter of eye. Flagellum with 27 segments. Hind femur length 3.7 to 3.8 times medial width. Hind tarsal



Figures 28–33. 28–29 Head, pronotum and anterior of mesoscutum, dorsal view **28** *Zambion wabli*, holotype female (double arrow shows widening of pronotum) **29** *Zambion broadi*, holotype male (arrow shows weak notaulus) **30–31** Pronotum, lateral view **30** *Zambion hirtum*, paratype male **31** *Zambion wabli*, holotype female **32–33** Mesopleuron, lateral view (arrow points to dorsal part of epicnemial carina) **32** *Zambion rogeri*, holotype male **33** *Zambion wabli*, holotype female.

claw pectinate to 0.5 to 0.6 length of claw. Posterior transverse carina of propodeum incomplete in middle. Tergite 1 1.3 to 1.4 times as long as apical width. Dorsal longitudinal carina extending to just anterior to spiracles or to level of spiracles (0.3 to 0.4 length of T1). Dorsolateral longitudinal carina of T1 absent or present as a thin, weak ridge that extends half way to spiracle. Colour as female except apical 0.2 of hind tibia, apical 0.5 to 0.9 of hind basal tarsomere brown. Tergites 1 to 4 yellow brown with irregular brown mottling, especially medially and anteriorly on each segment. Tergite 5 yellow laterally. Gonoforceps basally yellow, apically brown.

Material examined. Holotype: ♀, Label 1: A43. Label 2: AFRICA, UGANDA, Mt. Elgon, Butandiga, 7,000 ft. Label 3: J. Ford, B.M.1935-459. [NHM]. Condition: intact except both antenna with only basal flagellomere attached, right flagellomeres 2 to 14 glued to double-mount block, left hind leg missing distal 3 tarsomeres, right hind leg missing distal tarsomere, apical half of right ovipositor sheath missing. Paratypes: 2 ♂, same data as holotype except: A47 on upper label [NHM, CNC].

Etymology. This species is named in honour of Dr. David Wahl (American Entomological Institute) (AEIC) for his contributions to ichneumonid taxonomy and his hospitality to the senior author during many visits to the AEIC.

Comments. *Zambion wahl* is most closely related to *Z. broadi* on the basis of the long, sub-parallel-sided horn (Figs 20, 21), the curved epicnemial carina (Fig. 33) and the lack of a complete medial, longitudinal carina of the propodeum anterior to the posterior transverse carina. See comments under the latter species for distinction of these two species.

***Zambion broadi* sp. n.**

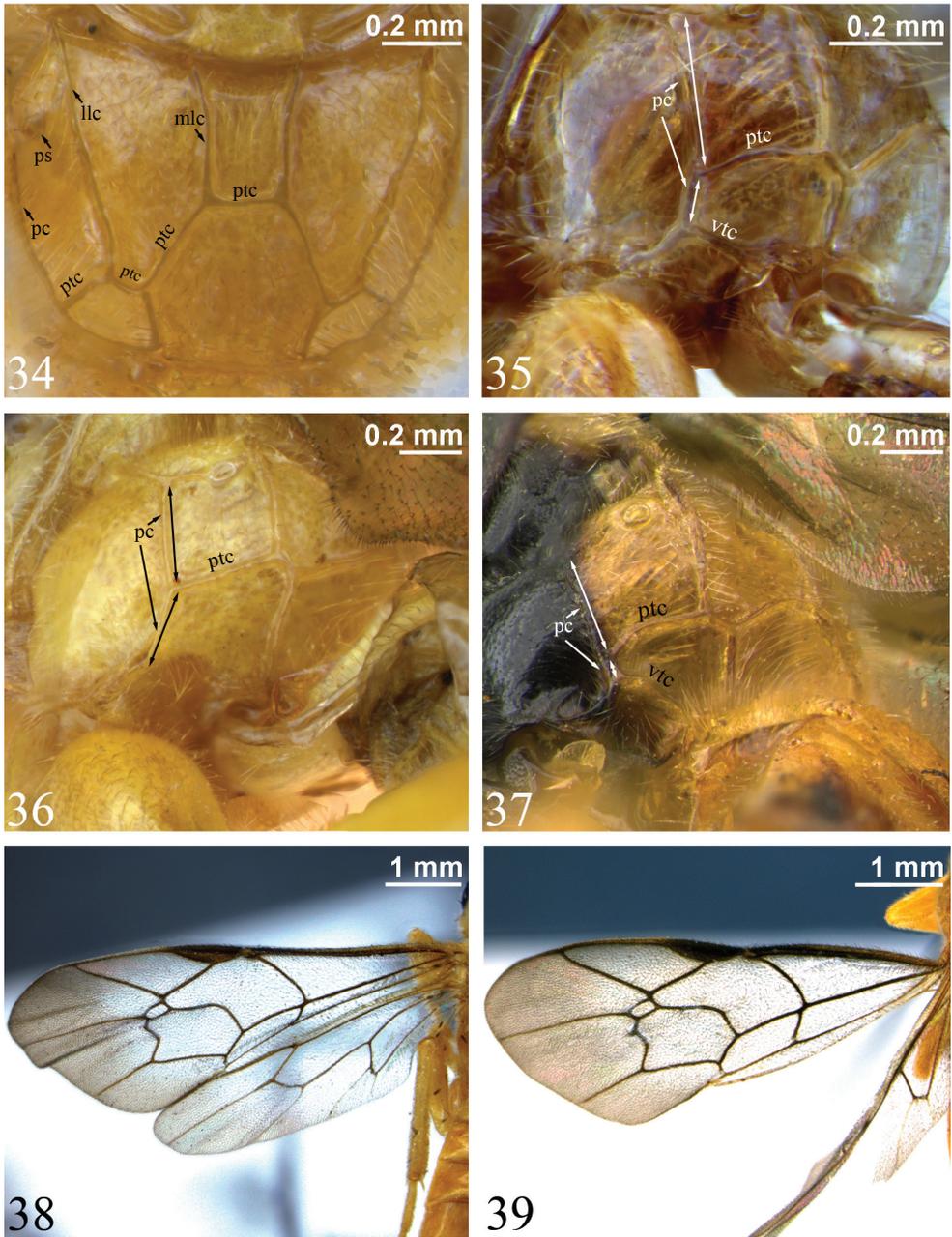
urn:lsid:zoobank.org:act:920ECA3B-CC89-4A2E-B959-DD852CD33D7E

http://species-id.net/wiki/Zambion_broadi

Figs 9, 15, 21, 29, 37

Diagnosis. *Zambion broadi* can be distinguished from all other *Zambion* spp. by combination of all of the following characters: 1) mesopleuron completely black (without yellow) (Fig. 9); 2) supra-antennal horn long and sub-parallel-sided in dorsal view (Fig. 21), 1.2 times as long as pedicel at midheight in lateral view; 3) propodeum orange (not black) (Fig. 9).

Description. Adult. Male. Fore wing length 6.4 mm. Clypeus separated from supraclypeal area by a strong groove. Malar space 0.4 times basal width of mandible. Supraclypeal area 1.9 times as wide as high (Fig. 15), dorsomedially without a short, narrow, longitudinal lamella between the antenna. Supra-antennal horn long and sub-parallel-sided in dorsal view (Fig. 21), 1.2 times as long as width of pedicel at midheight in lateral view. Ocello-ocular distance 2.1 times ocellar diameter. Gena 0.6 times transverse diameter of the eye. Flagellum with 30 segments.



Figures 34–39. **34** Propodeum, dorsal view. *Zambion hirtum*, holotype female **35–37** Propodeum, dorsolateral view (double-headed arrows indicate length of pleural carina anterior and posterior to point of union with posterior transverse carina) **35** *Zambion hirtum*, paratype male **36** *Zambion monodon*, holotype female (note lack of ventral transverse carina) **37** *Zambion broadii*, holotype male **38–39** Fore wing **38** *Zambion hirtum*, holotype female **39** *Zambion hirtum*, paratype male. **llc** – lateral longitudinal carina, **mlc** – medial longitudinal carina, **pc** – pleural carina, **ptc** – posterior transverse carina, **ps** – propodeal spiracle, **vtc** – ventral transverse carina.

Notaulus present, but weak (Fig. 29). Epicnemial carina medially curving away from anterior edge of mesopleuron near ventral corner of pronotum (similar to *Z. wahl*i shown in Fig. 33). Scutellum with lateral carinae at base only. Medial longitudinal carinae of propodeum absent anterior to posterior transverse carina. Posterior transverse carina incomplete medially. Carina extending from pleural carina to propodeal spiracle absent. Posterior transverse carina of propodeum with lateral abscissa strongly curving posteriorly where it joins pleural carina, point of union at about 0.2 distance from posterior end of pleural carina to propodeal spiracle (Fig. 37). Ventral transverse carina extending from metasomal foramen to pleural carina present (Fig. 37). Fore tibia apical point not examined (both fore tibiae absent). Hind femur 3.6 times as long as medial width. Hind tarsal claw pectinate to 0.4 times length of claw. Angulation of fore wing vein 2m-cu strong.

Tergite 1 of metasoma 1.2 times as long as apical width. Dorsal longitudinal carinae of T1 extending to about level of spiracle (0.4 length of tergite), dorsolateral longitudinal carinae present only as a short stub bifurcating near base of dorsal longitudinal carina.

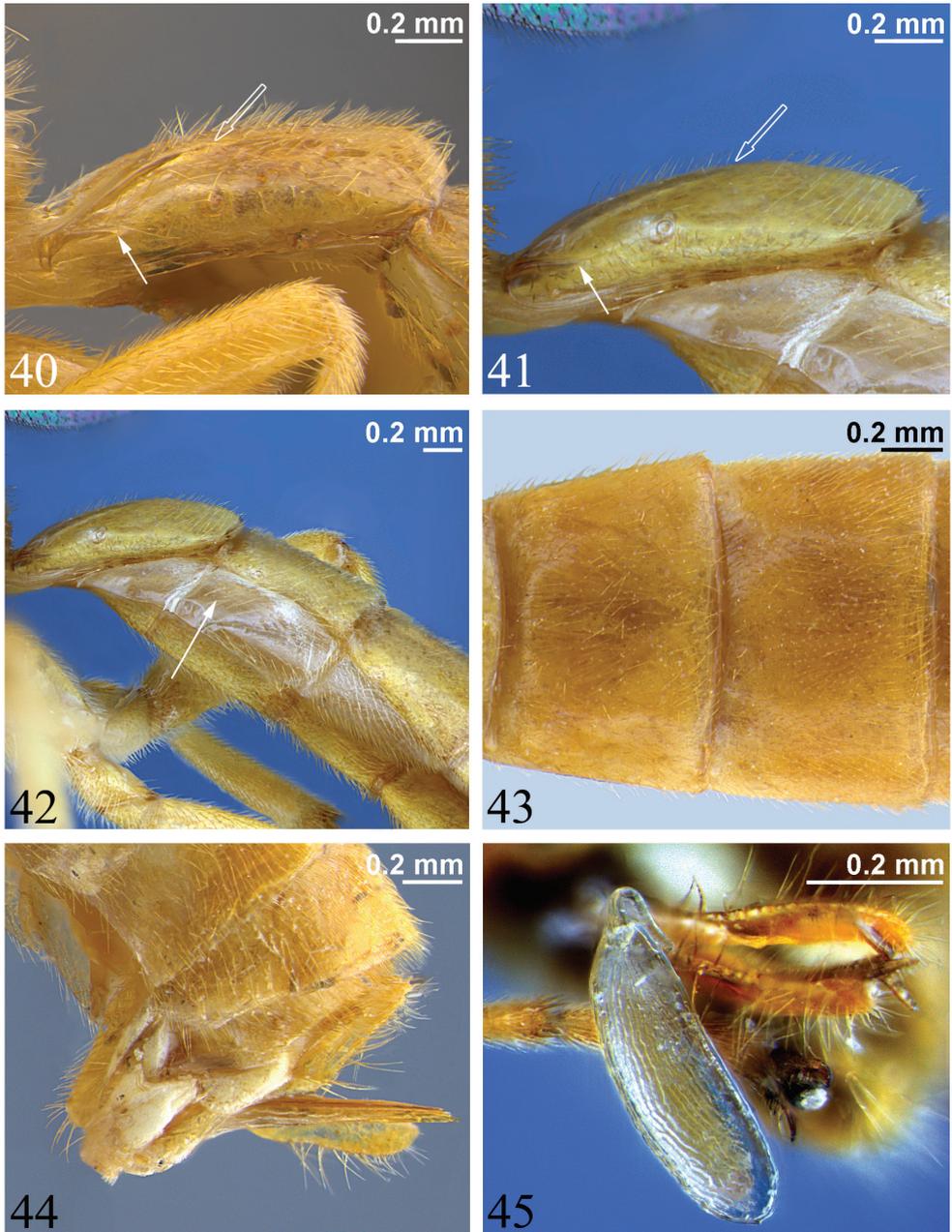
Black. Apical half of clypeus, glossa, apex of scutellum, propodeum, metasoma, except as noted below, orange. Tegula, coxae, apical 0.2 of hind tibia, hind tarsus except basal 0.3 of basal tarsomere, T2+ in spots laterally and sublaterally, T5 to T6 medially and hypopygium brown. Palpi, hind trochanter, femur, basal 0.8 of hind tibia and basal 0.3 of basal tarsomere, sternites and gonoforceps brownish yellow. Note that the distinction between orange and brownish yellow is not always clear. The hind leg is slightly more yellowish than the propodeum, the latter being slightly more yellow (and slightly less orange) than the scutellum and tergites. Membrane of fore wing uniformly, moderately infumate (Fig. 9). Body covered with dense golden setae.

Female: unknown.

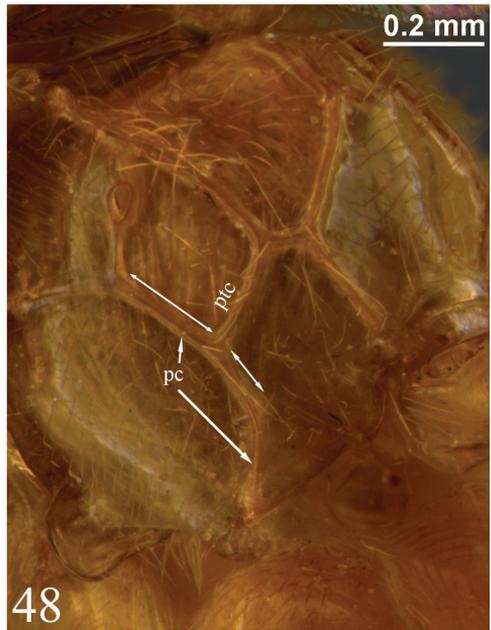
Material examined. Holotype: ♂, Label 1: BRIT. E. AFRICA [KENYA], 30 miles from Magadi Junc., April.1912, F.G. Hamilton. Label 2: 1915-98. [NHM]. Condition: right flagellum with only basal 15 flagellomeres, left flagellum with basal 5 flagellomeres attached, fore and middle legs missing except for coxae, left flagellomeres 6 to 15 and right hind leg glued on card below specimen.

Etymology. This species is named in honour of Dr. Gavin Broad (NHM) in recognition of his contributions to ichneumonid taxonomy and for finding the type specimen of this species within the unidentified ichneumonids of the Natural History Museum, London.

Comments. *Zambion broadi* is most closely related to *Z. wahl*i as noted under the comments for that species. The differences are the colour of the propodeum (compare Figs 8 and 9), the shape and location of the lateral abscissa of the posterior transverse carina of the propodeum, and the complete lack of the medial longitudinal carina dorsal to the posterior transverse carina of the propodeum in *Z. broadi* (present, but incomplete in *Z. wahl*i). It is possible that *Z. broadi* is conspecific with *Z. wahl*i, but we think this unlikely given the difference in both colour and propodeal carination. When both of these characters differ in related taxa, it is a good indicator that two species are present (e.g., in *Dyspetes* Förster) (He and Wan 1987).



Figures 40–45. 40–41 First metasomal segment, lateral view (hollow arrow marks posterior end of dorsal longitudinal carina, solid arrow denotes posterior end of dorsolateral longitudinal carina) **40** *Zambion hirtum*, paratype male **41** *Zambion monodon*, paratype male **42** Anterior of metasoma, lateral view, *Zambion monodon*, paratype male (arrow points to laterotergite of second metasomal segment) **43** Tergites 2 and 3, dorsal view, *Zambion hirtum*, holotype female **44** Posterior of metasoma, lateral view showing ovipositor, *Zambion hirtum*, holotype female **45** Egg, lateral view, *Zambion monodon*, holotype female.



Figures 46–48. *Zambion kasparyani*, holotype male **46** Habitus **47** Head, dorsal view **48** Propodeum, dorsolateral view (note lack of ventral transverse carina similar to *Z. monodon* in Fig. 36).

Acknowledgements

The authors would like to thank the curators of the following institutions for loan of specimens: Dr. C. Villemant (MNHN); Dr. P. Malinen, (MZH), Dr. R. Zuparko (CAS) and Dr. G. Broad (NHM), the latter, especially, because of sorting through decades of unidentified specimens to find additional material for this study. Dr. L. Masner (CNC) hand-carried specimens to MNHM. Dr. D. Kasparyan (Zoological Institute, Russian Academy of Sciences, St. Petersburg) and Dr. N. Bogutskaya (Zoosystematica Rossica) provided permission to copy line drawings of *Z. monodon*. Ms. J. Read (Agriculture and Agri-Food Canada) and Ms. Bonnie O'Halloran (Leica Microsystems) were invaluable in helping with preparation of digital photographs.

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Euglossa williamsi, a new species of orchid bee from the Amazon Basin of Ecuador and Peru, with notes on its taxonomic association and biogeography (Hymenoptera, Apidae)

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Academic editor: *M. Obl* | Received 11 October 2011 | Accepted 18 November 2011 | Published 23 December 2011

[urn:lsid:zoobank.org:pub:5116F2FD-B3D0-4CC3-93F4-FEFEA087CC18](https://doi.org/10.3897/zookeys.159.2239)

Citation: Hinojosa-Díaz IA, Engel MS (2011) *Euglossa williamsi*, a new species of orchid bee from the Amazon Basin of Ecuador and Peru, with notes on its taxonomic association and biogeography (Hymenoptera, Apidae). ZooKeys 159: 49–63. doi: 10.3897/zookeys.159.2239

Abstract

Euglossa williamsi sp. n. is here described from the lowland Amazonian region in Ecuador and Peru, and as part of a small species assemblage within *Euglossa* consisting of *E. dodsoni* Moure and *E. obtusa* Dressler. An identification key to the males of the group is provided plus detailed figures of the new species and representative illustrations for the others. A brief discussion of the taxonomic and biogeographical implications of the new species is provided. New records in Honduras and Nicaragua are provided for the related *E. dodsoni*.

Keywords

Apodea, Anthophila, Euglossini, *Euglossa*, new species, taxonomy, orchid bees

Introduction

With about 130 species (Nemésio and Rasmussen 2011), *Euglossa* Latreille (Apinae, Euglossini) is the most diverse of the five euglossine genera, all of them commonly known as orchid bees. The male orchid bees display a characteristic array of secondary sexual morphological features, most of them involved in the collection and handling of aromatic compounds, mainly from orchids (Dressler 1982a; Michener 2007), which are presumably used as mating attractants (Eltz et al. 2005). These same secondary sexual characters have been the basis of the taxonomic distinction among species, species groups, and the current subgeneric classification of *Euglossa* (Dressler 1978b, 1982b, c, d; Moure 1989). Despite being a taxonomically well known group of bees, as detailed revisions continue and access to newly collected material expands, particularly for infrequently visited regions, new species have continued to be discovered and described in recent years (e.g., Hinojosa-Díaz and Engel 2007, 2011; Hinojosa-Díaz et al. 2011; Nemésio 2007, 2011a-b; Parra et al. 2006; Ramírez 2005, 2006, Rasmussen and Skov 2006). Here we present the description of a new species from the Amazonian area of Ecuador and Peru and closely related to *Euglossa dodsoni* Moure and *E. obtusa* Dressler, representing an interesting biogeographic expansion for this small cluster of species. Both *E. dodsoni* and *E. obtusa* are found in Central America and the western side of the Andes in Colombia. It is therefore interesting to discover a close relative on the opposing side of the Andes. An identification key to the three species is provided as well as illustrations and a discussion of their subgeneric status and the biogeographic implications of the new species.

Material and methods

The holotype for the description of the new species belongs to the Florida Museum of Natural History, University of Florida, Gainesville, Florida, USA, while the paratype and most specimens studied of the two allied species belong to the Division of Entomology, University of Kansas Natural History Museum, Lawrence, Kansas, USA. Label data for specimens examined is provided as a detailed description of the label, with the information for each enclosed by quotation marks (“ ”), individual labels separated by double slash symbols (/), and every row on individual labels separated by a semicolon in italics (;).

Morphological terminology in general follows that of Engel (2001), Michener (2007), and Hinojosa-Díaz (2008), while some procedures for establishing metrics (e.g., clypeal protuberance) follow those of Brooks (1988). The species descriptions follow the overall format for other *Euglossa* species as presented by Hinojosa-Díaz and Engel (2007, 2011) and Hinojosa-Díaz et al. (2011). Photomicrographs were prepared using a Cannon EOS 7D digital camera and an Infinity K-2 long-distance microscope lens. Multilayer images were produced by using the software CombineZP.

Systematics

Euglossa williamsi Hinojosa-Díaz & Engel, sp. n.

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http://species-id.net/wiki/Euglossa_williamsi

Figs 1–14

Holotype. ♂, labeled: “ECUADOR, Napo; September 1987; Dressler, Wille,; Whitten, Williams // caryophyllene; oxide”. The holotype is in the Florida Museum of Natural History, University of Florida, Gainesville, Florida.

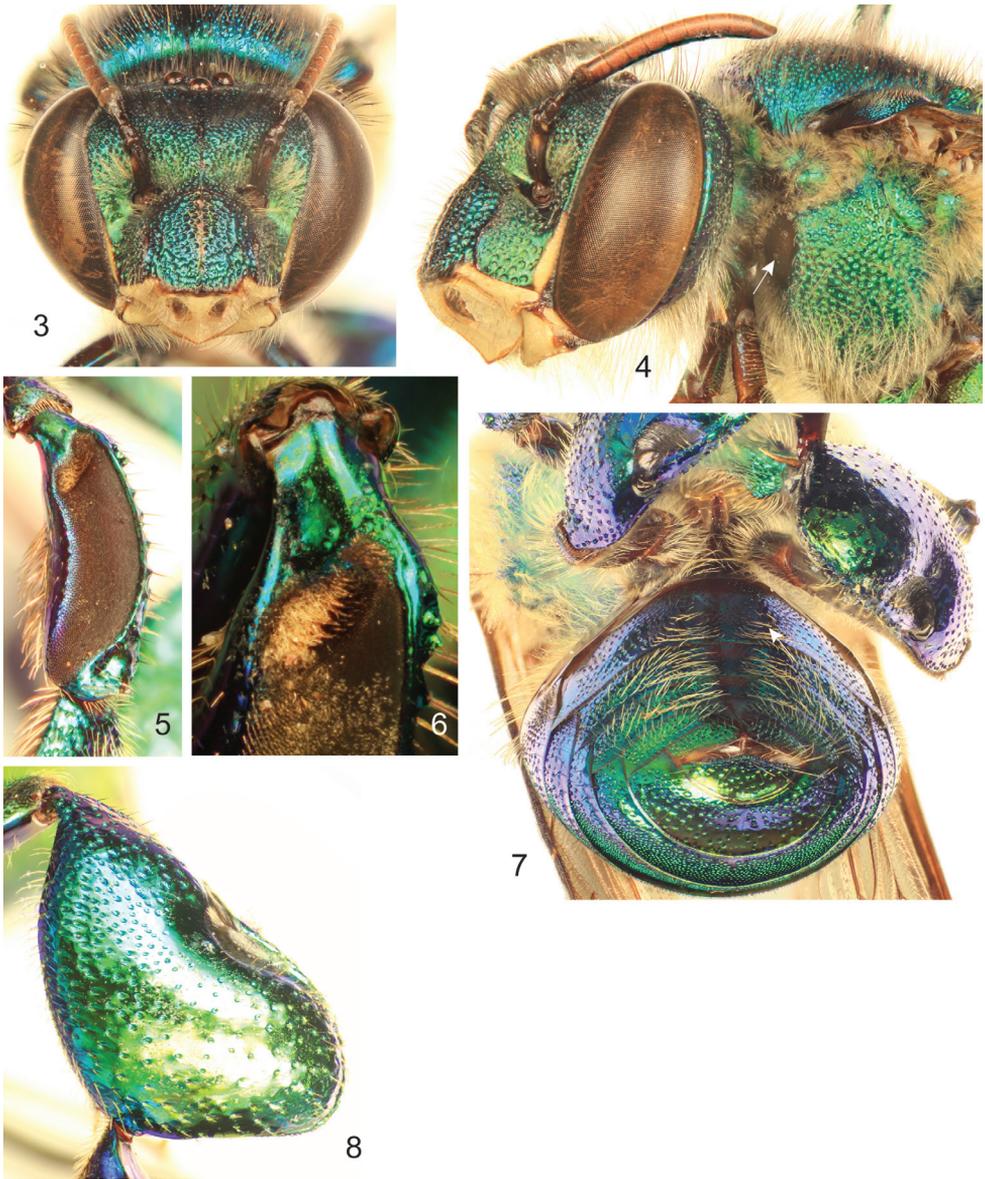
Paratype. ♂, labeled: “PERU: Pasco Dept.; Villa Rica-Puerto Bermudas [Bermúdez] Rd.; 910 m. 10°34'18"S, 75°5'30"W; 17 OCT 1999, D.Brzoska; D.Velasquez, PERU 1B99 047; ex: methyl salicylate // [barcode]; SM0148018; KUNHM-ENT // *Euglossa*; spp.; det. R. W. Brooks 19 [first two lines handwritten, year missing last two digits]”. The paratype is in the Division of Entomology, University of Kansas Natural History Museum, Lawrence, Kansas.

Diagnosis. Labiomaxillary complex in repose reaching sixth metasomal sternum; entire body with a dominant blue-green (teal) coloration, green iridescence, and some purple highlights (Figs 1–4, 7–8); paraocular ivory marks narrow, restricted to laterally-facing areas contiguous to compound eyes; ivory spot on antennal scape greatly reduced, present laterally on upper half of scape (Figs 3–4); anterior mesotibial tuft oblong, composed of pale, plumose setae getting darker posteriorly; posterior tuft reduced, semicircular, appearing as a continuation of anterior tuft (although differentiated from it) (Fig. 6); metatibia trapezoidal (distal third of posterodorsal margin parallel to anterior margin) (Fig. 8); second metasomal sternum with no integumental modifications (Fig. 7); punctuation of mesal area of mesoscutellum, postero-ventral outer surface of metatibia, and mesal area of last two metasomal terga composed of large punctures separated by more than two puncture diameters (Figs. 1, 7–8); eighth metasomal sternum of male with posterior section triangular (lateral edges straight) (Fig. 10); dorsal process of gonocoxite broader than long; posterior margin of apical process of gonocoxite oblique (inner-posterior corner displaced posteriad) (Fig. 12); lateral area of gonostylar process of gonocoxite pronged; lateral section of gonostylus large, concave surface facing inwards and covered with dense, minutely-branched setae, gonostylar ventral lobe only differentiated apically as an acute apex (Figs. 12–14).

Description. ♂: *Structure.* Total body length 10.00 mm; labiomaxillary complex in repose reaching sixth metasomal sternum. Head length 2.85 mm, width 4.30 mm; upper interorbital distance 2.00 mm; lower interorbital distance 2.00 mm; upper clypeal width 1.11 mm; lower clypeal width 1.95 mm; clypeal protuberance 0.78 mm; medial clypeal ridge well developed, paramedial clypeal ridges undistinguishable (obscured by punctuation); labrum square, slightly wider than long, length 1.04 mm, width 1.11 mm; medial labral ridge sharp; paramedial labral ridges weak, oblique, almost reaching distal margin of labrum; labral windows ovoid, occupying proximal half of labrum; interocellar distance 0.30 mm; ocellocular distance 0.68 mm; first

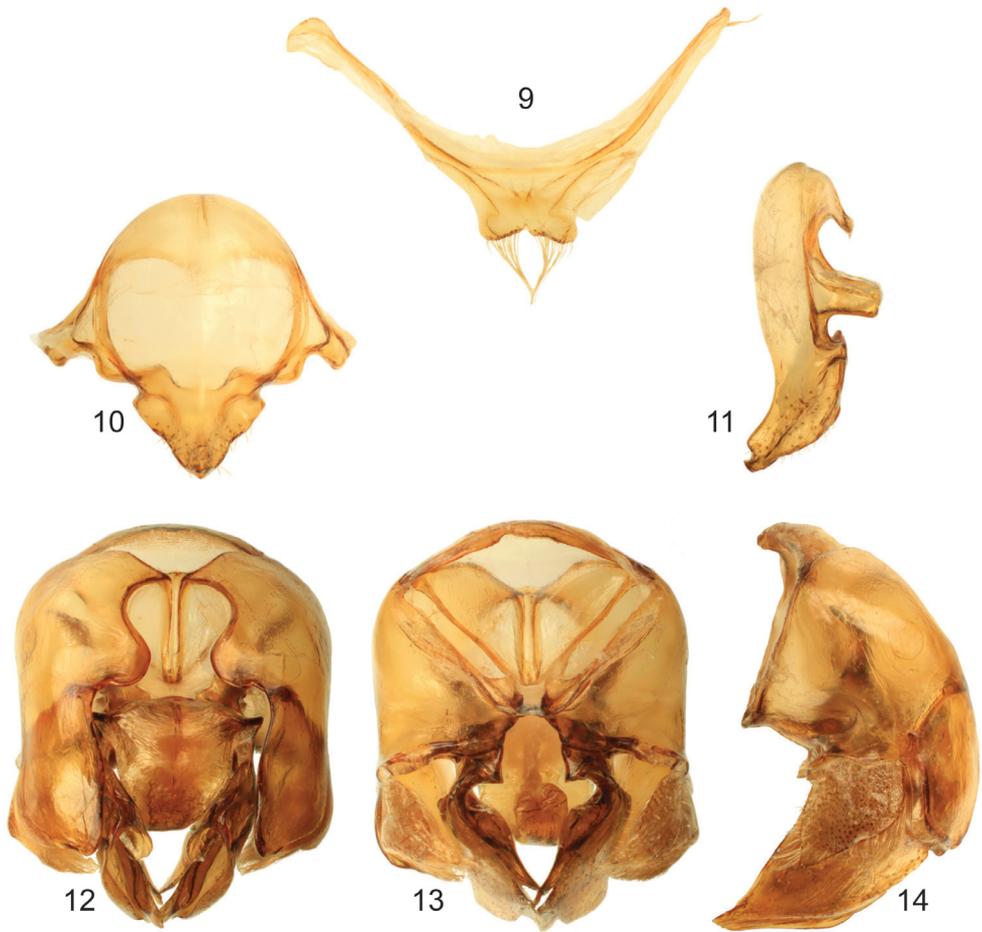


Figures 1–2. *Euglossa williamsi* Hinojosa-Díaz and Engel sp. n., male holotype **1** Dorsal habitus **2** Lateral habitus.



Figures 3–8. *Euglossa williamsi* Hinojosa-Díaz and Engel sp. n. male holotype **3** Facial aspect **4** Lateral aspect of mesepisternum showing *premaular spot* (arrow) **5** Outer surface of mesotibia **6** Mesotibial tufts **7** Ventral view of metasoma showing the absence of integumental modifications on second sternum (arrow) **8** Outer view of metatibia.

flagellomere as long (0.33 mm) as second and third flagellomeres combined (0.33 mm); length of malar area 0.15 mm. Mandible bidentate. Pronotal dorso-lateral angle slightly obliquely truncate; upper section of premaular area with a noticeable brown, flat, polished oval surface contiguous to pronotal lobe (*premaular spot*) (Fig. 4); interregal distance 3.93 mm; mesoscutal length 2.48 mm; mesoscutellar length 1.26 mm;



Figures 9–14. Male genitalic features of *Euglossa williamsi* Hinojosa-Díaz and Engel sp. n. **9** Seventh metasomal sternum, ventral aspect **10** Eighth metasomal sternum, ventral aspect **11** Eighth metasomal sternum, lateral aspect **12** Genitalic capsule, dorsal aspect **13** Genitalic capsule, ventral aspect **14** Genitalic capsule, lateral aspect.

mesal area of mesoscutum concave; posterior margin of mesoscutellum weakly convex (Fig. 1); mesotibial length 2.00 mm; mesobasitarsal length 1.93 mm, width 0.67 mm (as measured at proximal posterior keel), posterior keel projected in a rounded obtuse angle; metatibial shape trapezoidal (distal third of posterodorsal margin parallel to anterior margin) (Fig. 8), metatibial anterior margin length 3.11 mm, ventral margin length 2.22 mm, postero-dorsal margin length 3.93 mm, maximum metatibial thickness 1.11 mm; metatibial organ slit narrow, basal section oval, small (length 0.37 mm), distal section spur-shaped, separated from ventral margin by its own length, maximum width occupying about one-fifth of metatibial outer surface width (Fig. 8); metabasitarsal length 1.93 mm, mid-width 0.89 mm; metabasitarsal ventral margin oblique (forming obtuse angle with anterior margin). Forewing length 8.00 mm; jugal comb

with 13 blades; hind wing with 18 hamuli. Maximum metasomal width 4.07 mm; second metasomal sternum lacking integumental modifications (Fig. 7).

Coloration. Head with a combination of blue-green (teal) and green areas as follows: frons and clypeal disc blue-green, antennal depressions green, paraocular areas mainly green fading into blue-green along epistomal sulcus, vertex dark blue-green anteriorly, green on posterolateral sections, gena green fading into blue-green along narrow margin of compound eye and smooth lower third; hypostoma green; epistomal sulcus and medial clypeal ridge very dark, this last with faint coppery hue; paraocular ivory marks narrow, restricted to laterally-facing areas contiguous to compound eyes, ivory color surrounded by thin brown margin; lower lateral parts of clypeus ivory, amber-translucent at edge; labrum ivory; labral anterior and posterior edges as well as labral windows amber-translucent; malar area mainly ivory (brown on narrow areas of anterior and posterior extremes); mandible ivory on outer surface, teeth and ridges brown; antennal scape, pedicel and first flagellomere dark brown, remaining flagellomeres light brown on anterior surface, dark brown on posterior surface; scape with greatly reduced ivory spot, present laterally on upper half (Figs 3–4). Pronotum green/blue-green iridescent, appearing mainly blue-green on anterior section of dorsum and dark blue-green on anterior-facing surface of pronotal lobe; mesoscutum, mesoscutellum, and tegula blue-green with green iridescence (Figs 1–2); lateral-facing surface of mesepisternum mainly green with blue-green iridescence (mainly blue-green on upper area contiguous to pronotal lobe) (Fig. 4); preomalar area with a large brown oval-shaped area (preomalar spot) on upper half (Fig. 4), otherwise blue-green; metepisternum and propodeum green with blue-green iridescence; pro- and mesocoxa and pro- and mesotrochanter brown with strong blue-green iridescence; profemur, protibia and probasitarsus with dominant blue-green iridescence; mesofemur with some purple iridescence on anterior surface otherwise with blue-green, mesotibia similarly colored except purple coloration stronger, mesobasitarsus blue-green on outer surface; hind leg with all podites (except metatarsomeres beyond metabasitarsus) blue-green on outer surfaces and few purple highlights; tarsomeres beyond basitarsi of all legs brown, pretarsal claws with yellow shaft and brown tips (Fig. 2); wings hyaline with brown veins and light green and coppery hue (Figs 1–2). First to fourth metasomal terga blue-green with green iridescence; fifth to seventh terga mainly green, all with faint purple highlights (highlights stronger on ventrolateral sections of first metasomal tergum) (Figs 1–2); sterna green with blue-green iridescence mesally and golden iridescence laterally (Fig. 7).

Sculpturing. Face densely areolate-punctate, areole-punctures strong, about one-third median ocellar diameter on clypeal disc, smaller on frons (nearly one-tenth of median ocellar diameter) (Fig. 3); vertex on anterior ocellar area smooth with scattered round punctures; gena shallowly areolate, smooth on a narrow streak close to compound eye (except for scattered large punctures on upper margin) and particularly on lower area close to hypostoma. Mesoscutum and mesoscutellum punctate, mesoscutal puncture size about one-quarter of median ocellar diameter on anterolat-

eral corners and posterior margin, where they are also denser (contiguous), punctures smaller (about one-eighth of median ocellar diameter) and sparser (separated by at least one puncture diameter) on mesal area along median mesoscutal line, intermixed with some very minute punctures (Fig. 1); mesoscutellar punctures of two sizes, most as big as about one-third of median ocellar diameter, intermixed with scarcer minute punctures, punctuation denser along posterior margin (contiguous punctures), and sparse on mesal area of mesoscutellar disc where punctures are separated by more than two puncture diameters leaving large smooth areas (Fig. 1); mesepisternal lateral-facing surface with sculpturing similar to that on lower frons or clypeal disc, punctures becoming slightly larger towards venter (Figs 2, 4); preomalar area with shallow punctures on metallic integument (not on preomalar spot), preomalar spot with polished edge and smooth-minutely imbricate main central area (Fig. 4); metatibial punctures equivalent in size to those on mesoscutellar central area, denser (separated by no more than a puncture diameter) along anterior margin, getting sparser (separated by two to three puncture diameters) towards posterior area, such that there is smooth integument on contact area with metatibial organ slit (Fig. 8). First metasomal tergum with anterolateral corners sculpturing comparable to that on anterolateral corners of mesoscutum, quarter along anterior margin punctures as on mesoscutellar disc, posterior three-quarters densely punctate, punctures shallow, slightly smaller than those on median area of mesoscutum, leaving a narrow smooth area along posterior margin, ventrolateral sections polished; second to fourth terga with punctuation as on posterior three-quarters of first tergum except larger and sparser punctures on lateral bending areas; anterior portion of fifth tergum with punctuation as on preceding terga, punctures becoming progressively larger posteriorly, mesal section with median longitudinal smooth area; sixth and seventh terga punctures considerably larger and sparser, punctuation comparable to that on mesoscutellum (Fig. 7); first metasomal sternum smooth; second metasomal sternum with anterolateral and lateral areas next to margins of contacting terga smooth, otherwise punctuation comparable to that on sixth tergum, except mesally where punctures become smaller and shallower, posterior margin with smooth band all along; remaining sterna similarly punctuate, except denser punctures (Fig. 7).

Vestiture. Frontal fringe composed of two kinds of dense setae, some dark brown, minutely serrate, others fulvous, plumose, both evenly combined and about as long as two mid-ocellar diameters; clypeus and labrum with scattered, shorter brown and light setae, appearing simple, mandibular outer surface with similar setae but shorter; paracocular areas with moderately dense, pale, minutely-branched setae, becoming longer towards epistomal sulcus, area contiguous to upper section of epistomal sulcus with moderately dense, dark brown, minutely-serrate setae, as long as fringe setae; antennal depressions with dense, appressed, fulvous, plumose setae; vertex with scattered, fulvous, simple, minute setae on smooth area anterior to ocelli, some scattered, dark, simple setae on lateral areas contiguous to compound eye margin, central area of ocellar triangle and posterior section of vertex with moderately dense, dark, minutely-serrate, long setae, those on posterior margin nearly twice as long as those on fringe

and intermixed with some shorter, fulvous, simple setae; gena with dense, fulvous, plumose setae, appearing simple on upper posterior area and increasing in size towards lower genal section, continuous with simpler setae along ventral mandibular margin, some scattered, dark, simple, short setae along compound eye margin; antennal scape and pedicel with scattered, dark, short, simple setae; flagellum covered with dense, fulvous, simple, minute setae (Figs 3–4). Mesoscutum and mesoscutellum covered with combination of setae similar to that of frontal fringe, slightly sparser and distributed in same pattern described for punctation; pronotal lobes densely covered by fulvous, plumose setae as long as those on fringe, intermixed with dark, minutely-serrate setae; lateral-facing surface of mesepisternum, metepisternum and propodeum covered by, dense, fulvous, plumose setae as long as those on frontal fringe, preomalar area uncovered on preomalar spot, otherwise with dense, fulvous, plumose setae shorter than those on lateral areas of mesosoma (Fig. 4); foreleg with moderately dense fulvous setae from procoxa to protibia, short and appearing simple on most surfaces, except posterior surfaces of profemur (especially) and protibia, where setae are of same nature as on lateral areas of mesosoma; basitarsus with dense, yellowish, sturdier setae on inner surface; chemical gathering tufts on second through fourth protarsomeres made of dense, orange, long, setae; mid- and hind legs with general vestiture similar to foreleg except as follows: coxae with dense plumose setae; basitarsi with dense, brownish, sturdy clothing on inner surfaces (mesobasitarsus with three major wavy setae); mesotibia with dense, simple, yellowish setae directed downwards on anterior surface, shorter scattered setae on posterior surface, microtrichia on outer mesotibial surface (velvety area) composed of dense, fulvous, simple, minute setae; anterior margin of velvety area concave, anterior mesotibial tuft oblong, diagonally oriented, composed of dense, pale, plumose setae becoming darker posteriorly; posterior tuft reduced, appearing as a semicircular posterior continuation of anterior tuft (although differentiated from it) (Fig. 6); metatibia with rather scattered setae on outer surface; metatibial organ slit closed with brown setae (Fig. 8). Metasomal terga appearing bare, but covered with dense, fulvous, simple minute setae with some scattered, dark sturdier setae, anterolateral corners of first tergum, lateral sections of second and third terga, and posterior margin of seventh tergum with long setae; second to sixth metasomal sterna covered with moderately dense, fulvous, simple, long setae, as long as those on frontal fringe, becoming sparser towards mesal area (Fig. 7).

Terminalia. Seventh metasomal sternum with posterior invagination bearing a fringe of simple setae on each side of invaginated area (Fig. 9); eighth metasomal sternum with posterior section triangular (dorsal or ventral view), lateral edges of posterior section straight or at most very shallowly invaginated (Fig. 10); posterior section covered with scattered, short, simple setae; dorsal surface of posterior section strongly convex (Fig. 11). Dorsal process of gonocoxite broader than long, appearing more like a semicircle; posterior margin of apical process of gonocoxite oblique (inner-posterior corner displaced posteriad) (Fig. 12); lateral area of gonostylar process of gonocoxite pronged; spatha surface with transversal-diagonal striae; lateral section of gonostylus large, extended with a concave surface facing inwards and covered with dense, mi-

nutely-branched setae, gonostylar ventral lobe not very well differentiated from whole lateral section, but extended apically as an acute apex (Figs 12–14).

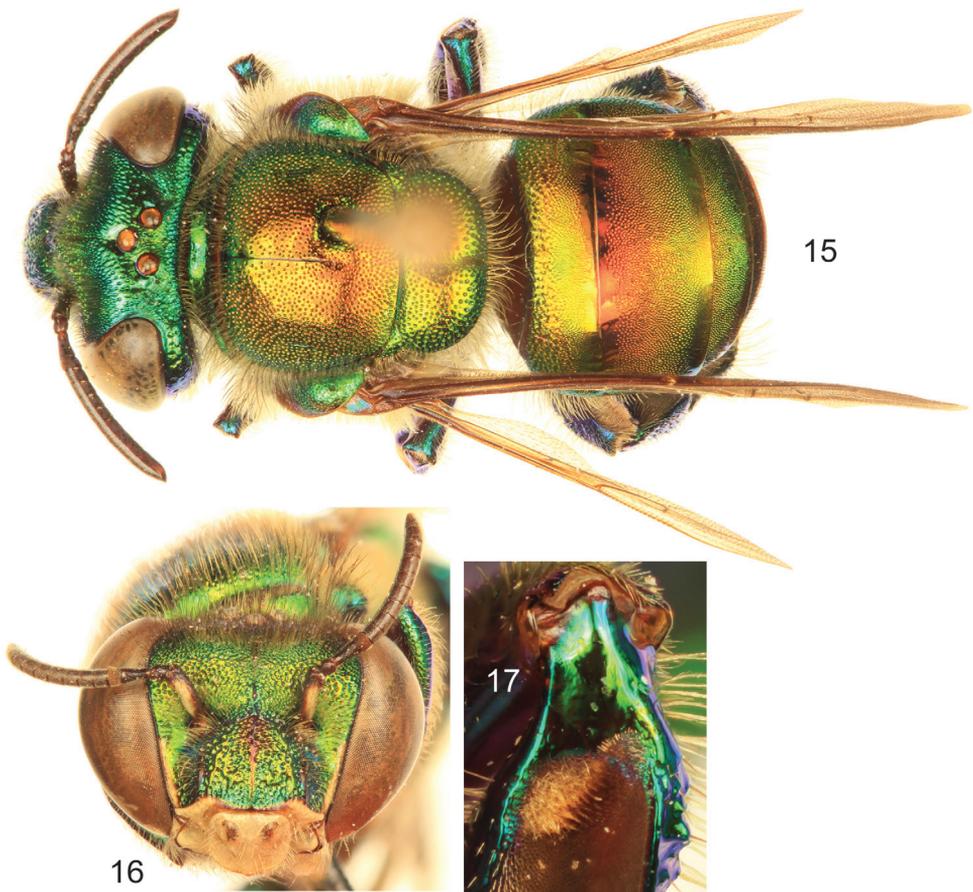
♀: Unknown.

Etymology. The specific epithet is a patronym honoring Dr. Norris Williams, curator at the Florida Museum of Natural History, who granted access to the holotype and was also part of the team that collected it, and in recognition of his numerous contributions toward understanding the euglossine fauna.

***Euglossa dodsoni* Moure**

http://species-id.net/wiki/Euglossa_dodsoni

New records. 1♂, labeled: “NICARAGUA: Rio San Juan Dept.; 60 km SE San Carlos, Refugio; Bartola, 100m, 10°58.40'N, 84°20.30'W; 28-V-2002, R. Brooks, Z. Fallin.; S. Chatzimanolis ex. methyl salicylate/; eucalyptus oil baits, NIC1BFC02111 //

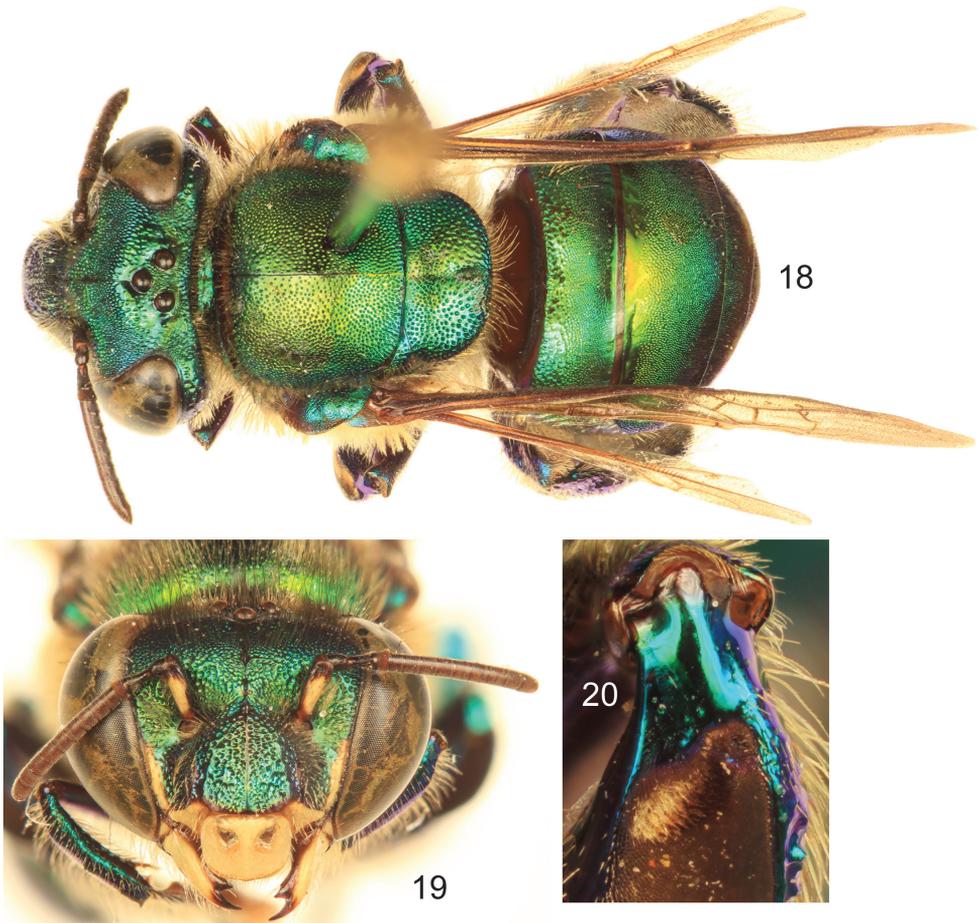


Figures 15–17. *Euglossa dodsoni* Moure, male. **15** Dorsal habitus **16** Facial aspect **17** Mesotibial tufts.

[barcode]; SM0534510; KUNHM-ENT // *Euglossa*; *dodsoni*; Moure; Det. I. Hinojosa-Díaz 2004 [specific epithet and author handwritten]". 1♂, labeled, "HONDURAS: G.a Dios; Krausirpi; 15°03'N, 84°52'W; 21–24.V.1994; B.D. Gill // *Euglossa*; *dodsoni* ♂; Moure; det. R.W. Brooks 1995 [all handwritten except determiner and first two digits of year]. 2♂♂, locality label as in preceding specimen, determination label: "*Euglossa*; *dodsoni*; Moure; Det. I. Hinojosa-Díaz 2011 [specific epithet and author handwritten]". All deposited in the Division of Entomology, University of Kansas Natural History Museum, Lawrence, Kansas.

Key to Species Allied to *E. dodsoni* (males only)

- 1 Ivory spot on antennal scape greatly reduced, present laterally on upper half of scape (Figs 3–4); mesoscutellum with sparse punctures on mesal area (punctures separated by at least three puncture diameters), leaving large smooth integumental portions among punctures (Fig. 1); entire body with dominant



Figures 18–20. *Euglossa obtusa* Dressler, male. **18** Dorsal habitus **19** Facial aspect **20** Mesotibial tufts

- blue-green (teal) coloration (Figs 1–2) (Amazonian Ecuador & Peru)
 ***E. williamsi* sp. n.**
- Ivory spot on antennal scape well developed, occupying most of antero-lateral surface of scape (Figs 16, 19); mesoscutellum with moderately dense to dense punctures on mesal area (punctures separated by no more than two puncture diameters) (Figs 15, 18); body coloration either green with strong coppery-reddish iridescence or mainly green..... **2**
- 2 Body coloration green but with a strong coppery-reddish iridescence, particularly on mesoscutum, mesoscutellum, and anterior two-thirds of metasomal terga (Fig. 15) (Honduras to Pacific lowlands of Ecuador)
 ***E. dodsoni* Moure**
- Body coloration green, at most with some faint coppery iridescence mainly on mesoscutum and anterior half of second metasomal tergum (Fig. 18) (Southern Mexico and Belize) ***E. obtusa* Dressler**

Discussion

Euglossa williamsi is closely related to both *E. dodsoni* and *E. obtusa* as evidenced by the basically identical morphology of the mesotibial tufts, metatibial shape, and genitalic structures in all three species, as well as by the absence of integumental modifications on the second metasomal sternum and the noticeable preomalar spot (integumental area on the preomalar area of the mesepisternum), features that can be considered as diagnostic for the small species assemblage. Moure (1965) originally described *E. dodsoni* as a species in *Euglossa* s. str. and alluded to a close relationship of this species with *E. purpurea* Friese. Moure's assertion must be seen in the context of the subgeneric classification of *Euglossa* s. lat. at the time, although the association of *E. dodsoni* to *E. purpurea* was most likely based exclusively on coloration given that both species belong to rather distinct and separate lineages within the genus. Dressler (1978a) described *E. obtusa* as part of the subgenus *Glossura* Cockerell, again in agreement with the subgeneric classification of the genus at that time. Dressler (1978a) also noted that *E. obtusa* was closely related to *E. dodsoni*, from which he distinguished it mainly on coloration and sculpturing while leaving open the possibility that they were conspecific. The subgeneric placement of *E. dodsoni* and *E. obtusa* was redefined to its present usage by Dressler (1982c) and as part of the subgenus *Glossurella* Dressler, which was established to encompass a complex and diverse species group [*i.e.*, those species allied to *E. bur-sigera* Moure and originally recognized as an informal group in Dressler's original infrageneric classification (Dressler 1978b)]. In accordance with the currently employed system of subgenera, assignment of *E. williamsi* would be to *Glossurella*. However, recent phylogenetic treatments of the genus based both on morphology (Hinojosa-Díaz 2010, in prep.) and on DNA sequence (Ramírez et al. 2010) evidence recovers *Glossurella* as paraphyletic. Despite the non-monophyletic nature of *Glossurella*, *E. dodsoni* and *E. obtusa* are recovered as sisters in both phylogenetic analyses. Because *Glossurella*,

as it is currently understood, is not a natural group in either analysis its usage under a phylogenetically congruent classification should be avoided, and as such we prefer to view *E. williamsi*, as well as *E. dodsoni* and *E. obtusa*, as *incertae sedis* in regard to subgeneric assignment within *Euglossa*.

Euglossa dodsoni and *E. obtusa* are very similar, including in their male terminalia, only differentiated on the basis of body coloration and puncture density (although this last feature is somewhat dubious and not so evident) as asserted by Dressler (1978a). Given the few features distinguishing the two Dressler (1978a) cautioned that it was possible that they were conspecific. We prefer to treat them here as separate species based on the stable expression of the body coloration pattern across the distributional range of both taxa.

The presence of the rather large preocular spot constitutes an additional morphological feature shared by the three species (*E. dodsoni*, *E. obtusa*, and *E. williamsi*) that can be used to easily characterize their males. Interestingly, despite the large and conspicuous nature of this trait, it was not mentioned in the original or any subsequent descriptions of *E. dodsoni* or *E. obtusa* (Dressler 1978a; Moure 1965). This distinctive preocular area occurs widely in euglossines but is typically very small, only being expanded so within this small species group.

The two previously known species of this small group are distributed from southern Mexico to Colombia. The northernmost species, *E. obtusa*, is known from a few localities in the lowlands of southeastern Mexico and Belize, both from literature records (Dressler 1978a) and specimens reviewed by the authors, while *E. dodsoni* was described originally by Moure (1965) from Costa Rica and Panama, but is mentioned to occur also in Colombia (Bonilla-Gómez and Nates-Parra 1992; Ramírez et al. 2002; Roubik and Hanson 2004) and Ecuador (Ramírez et al. 2002). For this last species we reviewed specimens from Costa Rica, Panama, Nicaragua, and Honduras, extending the distributional records of this species northwards (based on these last two countries, *vide supra*). The distribution of *E. dodsoni* in northwestern South America is here inferred to follow the lowlands along the Pacific Coast, west of the Andes. Ramírez et al. (2002) mention this species to be found in the Colombian Pacific region, in accordance with the aforementioned distributional range, and, although we cannot be completely certain, the Ecuadorian records mentioned by these authors most likely follow the same pattern (*i.e.*, present on the Pacific Coast, absent on the Amazonian side of the country). Some other species groups within *Euglossa s. lat.* have a similar distributional pattern (as do some Meliponini), specifically the group of species allied to *E. (Euglossella) cyanura* Cockerell (Hinojosa-Díaz and Engel in prep.). The locality data for the holotype of *E. williamsi* does not give enough information beyond the province in Ecuador where it was collected, Napo, which at the time of the collecting event included the current provinces of Sucumbios and Orellana. A survey of the entire database of orchids collected at about the same time and from the same place present in the Florida Museum of Natural History revealed similar label data and no further insights into a more precise location. Despite the challenge of assigning the

specimen to a more specific locality, it is certain that it was collected on the eastern side of the Andes since the Provinces of Napo, Sucumbios, and Orellana are all on the Amazonian side of Ecuador (east of the Andes). Given that the paratype was captured in the Amazonian lowlands of Peru suggests the same was likely the case for the Ecuadorian holotype. This is an interesting addition to the overall distribution of this small species group as it represents the presence of one taxon within a different larger biogeographic unit.

Acknowledgements

We are grateful to Norris Williams who allowed access to the holotype used in this study, and to two anonymous reviewers for their insightful comments. This is a contribution of the Division of Entomology, University of Kansas Natural History Museum.

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New species of the Eastern Hemisphere genera *Afroheriades* and *Noteriades* (Hymenoptera, Megachilidae), with keys to species of the former

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Academic editor: M. Engel | Received 31 October 2011 | Accepted 6 December 2011 | Published 23 December 2011

urn:lsid:zoobank.org:pub:F5A593B1-BA1C-48A7-A561-2353C7238073

Citation: Griswold T, Gonzalez VH (2011) New species of the Eastern Hemisphere genera *Afroheriades* and *Noteriades* (Hymenoptera, Megachilidae), with keys to species of the former. ZooKeys 159: 65–80. doi: 10.3897/zookeys.159.2283

Abstract

New species of the rarely encountered megachilid genera *Afroheriades* Peters from South Africa, *A. hyalinus* sp. n., and *Noteriades* Cockerell from Myanmar and Thailand, *N. jenniferae* sp. n. and *N. spinosus* sp. n., are described and illustrated. The species are described to make their names available for forthcoming publications on phylogenetic studies of the family Megachilidae. Taxonomic notes and a comparative diagnosis for each genus are presented. *Afroheriades hennigi* (Peters) and *A. reicherti* (Brauns) are new junior synonyms of *A. dolichocephalus* (Friese). A key to the known species of *Afroheriades* is provided.

Keywords

Anthophila, Apoidea, Megachilinae, taxonomy

“Even in the case of species which I myself described, it frequently happens that I have not looked at them for a long time, perhaps a quarter of a century; and in addition, they now have to be differentiated from numerous related species, more recently made known.”
(Cockerell 1942: 136)

Introduction

The purpose of this paper is to describe three new species of rarely encountered Eastern Hemisphere megachilid bees, one species of *Afroheriades* Peters from South Africa, and two species of *Noteriades* Cockerell from Southeast Asia. Specimens of these undescribed species have been used in recent molecular analyses (i.e., Praz et al. 2008; Cardinal et al. 2010; Litman et al. 2011); herein we describe them to make their names available for use in forthcoming publications on the phylogeny of Megachilidae. New synonyms and revised comparative diagnoses for both genera are also presented.

Afroheriades and *Noteriades* consist of small heriadiform or hoplitiform bees (< 10 mm in body length) whose biologies are largely unknown (a species of *Noteriades* was observed entering a hole in an upright log). Each genus contains a small number of species, although several new species have been recognized by one of us (TG) in the past few years. *Afroheriades* is known only from South Africa, whereas *Noteriades* is found in tropical and subtropical regions of sub-Saharan Africa, India, and Southeast Asia (Table 1). Both taxa are currently included in the *Heriades* group of genera of the tribe Osmiini (Michener 2007) but little is yet known about their phylogenetic relationships; *Afroheriades* has been thought to be related to *Pseudoheri-*

Table 1. Summary of species currently included in *Noteriades*. Species distribution according to Griswold (1995), Ascher & Pickering (2011), and specimens deposited in the U.S. National Pollinating Insects Collection, Bee Biology and Systematics, Logan, Utah. * = Generic assignment unconfirmed.

Species	Known distribution
<i>N. argentatus</i> (Gerstäcker, 1857)	Mozambique, Angola, Namibia, South Africa
<i>N. bicornutus</i> (Friese, 1904)	Botswana, Congo, Zimbabwe, Zaire, Mozambique, South Africa
<i>N. capensis</i> (Friese, 1922)	Zimbabwe, South Africa
<i>N. chapini</i> (Cockerell, 1933)	Congo
<i>N. chypeatus</i> (Friese, 1904)	South Africa
<i>N. heterostictus</i> (Cockerell, 1936)	Zimbabwe
<i>N. himalayensis</i> Gupta & Simlote, 1993*	India
<i>N. infasciatus</i> Simlote & Gupta, 1993*	India
<i>N. jenniferae</i> sp. n.	Thailand, Myanmar
<i>N. pulchripes</i> (Cameron, 1897)	India, Myanmar
<i>N. quinquecostatus</i> (Strand, 1912)	Zaire, Equatorial Guinea, Gabon, Central African Republic, Ivory Coast
<i>N. spinosus</i> sp. n.	Thailand
<i>N. striolatus</i> (Cameron, 1906)*	India
<i>N. tergofasciatus</i> Simlote & Gupta, 1993*	India
<i>N. tricarinatus</i> (Bingham, 1903)	Congo, Zaire, South Africa
<i>N. zulu</i> (Strand, 1919)	South Africa

ades Peters while *Noteriades* has been considered related to *Heriades* Spinola. In fact, *Afroheriades* was originally described as a distinctive monotypic subgenus of *Pseudoheriades* (Peters 1970) whereas *Noteriades* was described as a subgenus of *Heriades* (Cockerell 1931).

A recent comprehensive molecular analysis of the Osmiini (Praz et al. 2008) challenges these ideas regarding the taxonomy and relationships of *Afroheriades* and *Noteriades*. The molecular analysis supported the long suspected non-monophyly of Osmiini (e.g., Michener 2007), with *Afroheriades*, *Noteriades*, *Pseudoheriades*, and *Ochreriades* Mavromoustakis, excluded from the tribe (Praz et al. 2008). *Afroheriades* and *Pseudoheriades* formed a well-supported clade, but their phylogenetic position remained unclear; depending on the method employed in the analysis, they were either sister to the Anthidiini (parsimony analysis) or Megachilini + *Noteriades* (Bayesian analysis). *Noteriades* was consistently found to be the sister group of Megachilini (Praz et al. 2008). Such a relationship to Megachilini was first suggested by Griswold (1985) based on the presence of two apical spines on the outer surfaces of the fore and middle tibiae, and the modified hairs on the fifth sternum of the male. Except for the position of *Noteriades*, an on-going morphological phylogenetic analysis of Megachilidae (Gonzalez et al. in prep) is not concordant with the molecular analysis of Praz et al. (2008). In fact, *Afroheriades*, *Pseudoheriades*, and *Ochreriades* appear close to other “Osmiini” within a clade of most of the *Heriades* group (Gonzalez et al. in prep). Pending completion of that morphological analysis both genera are retained in the Osmiini.

Material and methods

Morphological terminology follows that of Michener (2007). Photomicrographs were taken using a Keyence® VHX-500F Digital Imaging System. Measurements were made with an ocular micrometer attached to a Leica® MZ12 stereomicroscope. Measurements in descriptions are for the holotype, with values for paratypes in parentheses. The abbreviations F, S, and T are used for antennal flagellomere, and metasomal sternum and tergum, respectively.

Institutional acronyms used herein are:

- AMNH** American Museum of Natural History, New York, NY, USA (J. Rozen, J. Ascher)
- BBSL** U.S. National Pollinating Insects Collection, Bee Biology and Systematics Laboratory, Utah State University, Logan, UT, USA
- BPBM** Bernice P. Bishop Museum, Department of Entomology Collection, Honolulu, HI, USA (N. Evenhuis)
- CAS** California Academy of Sciences, San Francisco, CA, USA (W. Pulawski, V. Lee)
- CUIC** Cornell University Insect Collection, Ithaca, NY, USA (B. Danforth)
- MCSN** Museo Civico di Storia Naturale “Giacomo Doria”, Genova, Italy (R. Poggi)

SAM	South Africa Museum, Cape Town, South Africa (V. Whitehead, M. Cochrane)
SANC	South African National Collection of Insects, Pretoria, South Africa (C. Eardley)
TMP	Transvaal Museum, Pretoria, South Africa (M. Scoble)
UCDC	University of California, R.M. Bohart Museum of Entomology, Davis, CA, USA (L. Kimsey)
ZMB	Museum für Naturkunde, Humboldt-Universität zu Berlin, Berlin, Germany (F. Koch)

Systematics

Tribe Osmiini Newman

Genus *Afroheriades* Peters, 1970

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

Pseudoheriades (*Afroheriades*) Peters, 1970: 157. Type species: *Pseudoheriades primus* Peters, 1970, by original designation.

Archeriades Peters, 1978: 337. Type species: *Eriades larvatus* Friese, 1909, by original designation.

Diagnosis. *Afroheriades* can be distinguished from all other Osmiini by the combination of posterolateral angle of scutum with marginal ridge non-carinate, with dense patch of long hairs laterally (Fig. 11) and T1 with juncture between anterior and dorsal faces not carinate. *Afroheriades* is morphologically similar to *Pseudoheriades* sharing a two-segmented maxillary palpus, female T6 with distinct apical hyaline flange, male T7 quadrately surrounded by T6, and male S3 with gradulus projecting into thin, basal hyaline lamella. In addition to the characters that distinguish it from all other Osmiini, *Afroheriades* differs from *Pseudoheriades* in: pronotal lobe and omaulus rounded; and male S3 without midapical spine. In *Pseudoheriades* the pronotal lobe and omaulus are distinctly lamellate; marginal ridge of posterolateral angle of scutum carinate, without dense patch of long hairs; T1 with distinct carina separating anterior and dorsal surfaces; and male S3 with midapical spine.

Comments. Two species groups can be recognized in *Afroheriades*: one includes a rather robust form with the basal area of propodeum well below the level of the scutellum [*A. primus* (Peters)]; the other includes the remaining species, which have a more elongate mesosoma and the base of the propodeum at the same plane as the scutellum. If a phylogenetic analysis shows that these two groups are natural, they could be subgenerically separated as *Afroheriades* s.str. and *Archeriades*, as suggested by Michener (2007). For now, we treat them as species groups. Below are the species currently recognized in *Afroheriades*; the synonyms presented here are based on the study

of the types by the senior author. *Afroheriades capensis* Griswold, in Michener (2007: 452), is a *nomen nudum*.

***Afroheriades dolichocephalus* (Friese)**

Osmia dolichocephala Friese, 1925: 505 (Holotype: AMNH; ♀, Cape Province, South Africa)

Archeriades hennigi Peters, 1978: 340 (Holotype: SAM; ♀, Cape Province, South Africa), new junior synonym.

Eriades reicherti Brauns, 1929: 140 (Lectotype: TMP; ♀, Cape Province, South Africa), new junior synonym.

***Afroheriades geminus* (Peters)**

Archeriades geminus Peters, 1978: 339 (Holotype: SAM; ♀, Cape Province, South Africa)

***Afroheriades larvatus* (Friese)**

Eriades larvatus Friese, 1909: 316 (Lectotype: ZMB; ♂, Cape Province, South Africa)

***Afroheriades primus* (Peters)**

Pseudoheriades primus Peters, 1970: 157 (Holotype: SAM; ♂, Cape Province, South Africa)

***Afroheriades hyalinus* sp. n.**

urn:lsid:zoobank.org:act:96738138-486E-431A-B1A8-3E23707C941D

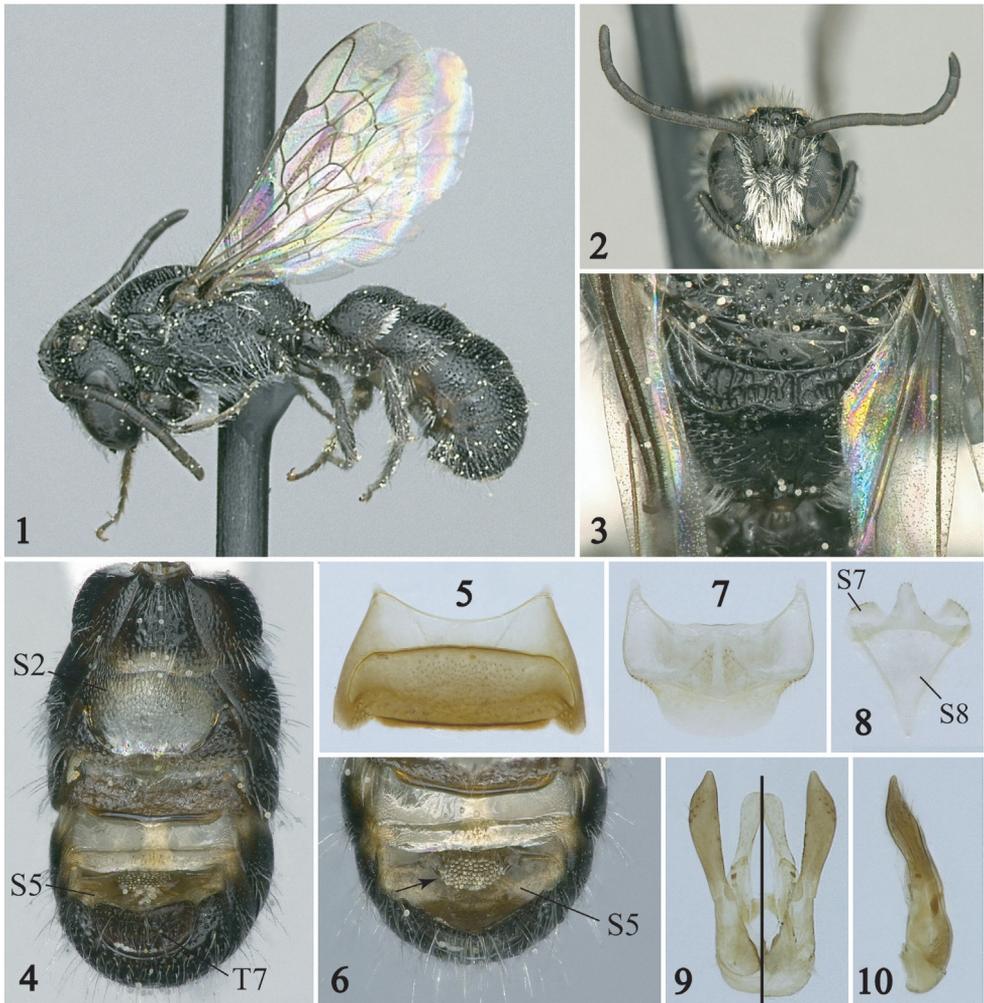
http://species-id.net/wiki/Afroheriades_hyalinus

Figs 1–13

Cardinal et al. (2010): Fig. S1, Table S1, S3 [supporting online information]

Holotype. ♂ (Fig. 1), SOUTH AFRICA, [Northern Cape]: Studer's Pass (km 23), -30.4288°, 18.0592°, 806 m, 17 Sep 2007, T.L. Griswold (SAM).

Paratypes. 10♂, 4♀, same data as holotype; 1♂, same data except *Lebeckia* sp.; 1♂ Concordia, 6 km N, -29.4859°, 17.9445°, 14 Sep 2007, T. L. Griswold; 10♂ 3♀, De Kruis, 14 km S, -30.503°, 18.1367°, 17 Sep 2007, T. L. Griswold; 2♀, Nieuwoudtville Falls, 6.5 km N of Nieuwandtville, -31.3197°, 19.1174°, 18 Sep 2007, T. L. Griswold; 1♀, Namaqualand, Bowedorp, Sept 1941; 1♂, Garies, Namaqualand, June 1930. Western Cape: 1♂, Hoek se Berg, -32.1159°, 19.1734°, 20 Sep 2007, T. L. Griswold; 1♀, Pakhuis Pass, NE, -32.0922°, 19.0673°, 20 Sep 2007, T. L. Griswold; Worcester, IX-25-75, R.M. Bohart; 2♂, 1♀, Pakhuis Pass, 32.08S, 19.02E, 7.ix.1987, C. D. Eardley; 2♀, 5 km E Montagu, X 10 [19]75, R. M. Bohart; 2♀, 16 km E Clanwilliam, Pakhuis Pass, 700 m, 32°08.1'S, 18°59.7'E, 8 Sept 2001; 2♀, 7 km W Nieuwoudtville, 31°22.60'S, 19°01.16'E, 830m 9/X/2002, pantrap, F. D. Parker, M. E. Irwin; 1♀, Stradfontein, W of Muizenberg, 25 m, 34°04.86'S, 18°32.47'E, 7/X/2002,



Figures 1–10. Male of *Afroberidiades hyalinus*, sp. n. (paratypes except holotype in Fig. 1) **1** Lateral habitus **2** Facial view **3** Metanotum and pitted propodeal base bounded posteriorly by a carina **4** Ventral view of metasoma; note the large hyaline lamella of S2 **5** S3 **6** Detail of S4 and S5 with arrow pointing to erect, oval tuft of bristles **7** S6 **8** S7 and S8 **9, 10** Genital capsule in dorsal (left half), ventral (right half), and profile views.

F. D. Parker, M. E. Irwin; 1♂, Cape Peninsula, Hout Bay, 18-IX-1967, E. S. Ross & A. R. Stephen (BBSL, CUIC, DZUP, SAM, SANC, SEMC, UCDC).

Diagnosis. The male of *A. hyalinus* is unique among *Afroberidiades* in the S5 with erect, oval tuft of bristles (Figs. 4, 6). In addition, males can be recognized by the combination of: antennal flagellum unmodified (Fig. 2); T7 without a lateral spine (Fig. 4); basal zone of the propodeum bounded posteriorly by a carina (Fig. 3); and anterior-facing surface of T1 with fine, sparse, punctures smaller than those on dorsal face. The female can be easily recognized by the combination of: head about as long as broad (Fig. 12); clypeus sparsely punctate, not produced ventrally; hypostomal carina with



Figures 11–13. Female of *Afroheriades hyalinus*, sp. n. **11** Lateral habitus **12** Facial view **13** Ventral view of head showing anterior and posterior limbs of hypostomal carina. **al** = anterior limb or portion of carina curving towards posterior margin of mandibular socket; **pl** = posterior limb.

anterior limb (i.e., portion of carina curving towards posterior margin of mandibular socket) longer than the straight, posterior limb (Fig. 13); basal zone of propodeum horizontal, scarcely longer than length of metanotum, broader laterally than medially; and anterior face of T1 very finely, sparsely punctate.

Description. Male. Body length 4.4 mm (3.7–4.4 mm); forewing length 2.9 mm (2.6–2.9 mm). Head length equal to width (Fig. 2); ocellocular distance greater than ocellular diameter; ocelloccipital distance equal to ocellular diameter; compound eyes converging ventrally; antennal scape not enlarged, tapered; length of F2 twice length of F1, F1–F4 not expanded laterally, F2–F10 not roundly produced ventrally, F7 longer than wide; mouthparts in repose slightly exceeding fossa. Mesosoma elongate, cylindrical; pronotum roundly produced laterally; scutellum flat; metanotum horizontal in lateral view, midline length in dorsal view equal to length of basal zone of propodeum; propodeum with basal zone horizontal, surface pitted, bounded posteriorly by carina (Fig. 3). T6 roundly emarginate apically, apicolaterally rounded; apical margin of T7 convex, laterally without elongate spine (Fig. 4); S1 without subapical carina; S2 not thickened basally, with gradulus projecting into a thin, hyaline lamella apically reaching nearly to margin of segment (Fig. 4); S3 with margin transverse (Fig. 5); S6–S8, and genital capsule as in figures 7–10.

Integument smooth and shiny between punctures; punctation on interantennal area moderate, approximately one puncture width apart; on scutum moderate, approximately one puncture width apart; on disc of T3 sparse, more than one puncture width apart.

Body black except flagellomeres, tegula, legs dark brown. Wings hyaline with weak green and coppery highlights; veins, stigma, prestigma dark brown.

Pubescence white; dense, appressed, obscuring surface on clypeus, interantennal area, paraocular area; lower gena covered with sparse, loosely plumose hair; S2 with short, wedge-shaped fringe; S4 without median longitudinal hair tuft or carina; S5 with erect, oval tuft of bristles on disc (Fig. 6).

Female: As in male except: Body length 3.5–4.4 mm; forewing length 2.7–3.3 mm. Ocellocular distance 0.6–0.7 times interocellar distance; ocelloccipital distance 0.9–1.0 times interocellar distance; clypeus sparsely punctate, with margin truncate, crenulate; mandible tridentate, ventral margin not angled basally; gena ventrally without longitudinal carina, long curled hair, or ventral impunctate region; hypostomal carina higher posteriorly, curving towards posterior margin of mandibular socket, with anterior limb (curved portion) longer than posterior limb (straight portion), angle between limbs obtuse, area anterior to anterior limb of hypostomal carina raised (Fig. 13); labrum with medial area punctate, apical margin upturned; stipes without ventral fringe of long curled bristles. Dense pubescence restricted to paraocular area; hairs on fore tarsomeres simple, with tips wavy. S1 at most with preapical hump.

Etymology. The specific epithet makes reference to the thin, hyaline lamella of S2 that projects from the gradulus distally nearly to the posterior margin of the sternum.

Keys to species of *Afroheriades*

Males

- 1 F2–F10 roundly produced ventrally.....*A. geminus* Peters
- F2–F10 not produced ventrally..... 2
- 2(1) F1–F4 expanded laterally; basal zone of propodeum sloping posteriorly; mouthparts in repose not exceeding fossa; scutellum slightly convex.....*A. primus* (Peters)
- F1–F4 not expanded laterally; basal zone of propodeum horizontal; mouthparts in repose slightly exceeding fossa; scutellum flat 3
- 3(2) Apical margin of T7 laterally with elongate spine; S4 with longitudinal carina medioapically; inner eye orbits parallel; ocelloccipital distance greater than ocellar diameter*A. dolichocephalus* (Friese)
- Apical margin of T7 laterally without elongate spine; S4 without longitudinal carina; inner eye orbits converging ventrally; ocelloccipital distance equal to ocellar diameter 4
- 4(3) Basal zone of propodeum bounded posteriorly by carina (Fig. 3); F2 twice as long as F1*A. hyalinus* sp. n.
- Basal zone of propodeum not bounded posteriorly by carina; F2 no longer than F1*A. larvatus* (Friese)

Females

- 1 Gena ventrally with longitudinal carina fringed by long curled hair delimiting smooth impunctate ventral region; stipes with ventral fringe of long, curled

- bristles; clypeus closely punctate except sometimes along midline; area anterior to anterior limb of hypostomal carina not raised.....***A. primus* (Peters)**
- Gena ventrally without longitudinal carina, long curled hair, or smooth impunctate ventral region; stipes without ventral fringe of long, curled bristles; clypeus sparsely punctate; area anterior to anterior limb of hypostomal carina raised **2**
- 2(1) Distance between middle and upper teeth of mandible at least two and a half times distance between lower and middle teeth; clypeal margin produced ventrally ***A. geminus* Peters**
- Distance between middle and upper teeth of mandible at most one and a half times distance between lower and middle teeth; clypeal margin not produced ventrally..... **3**
- 3(2) Hypostomal carina with obtuse angle, anterior limb equal in length to posterior limb (Fig. 13); inner eye orbits converging below; clypeal margin minutely crenulate; lateral ocelli approximately one ocellar diameter from occipital carina **4**
- Hypostomal carina with right angle, anterior limb shorter than posterior limb; inner eye orbits parallel; clypeal margin smooth; lateral ocelli approximately one ocellar diameter from occipital carina ***A. dolichocephalus* (Friese)**
- 4(3) Basal zone of propodeum almost twice as long as metanotum, not bounded posteriorly by a carina; anterior face of T1 virtually impunctate.....
- ***A. larvatus* (Friese)**
- Basal zone of propodeum scarcely longer than metanotum, bounded posteriorly by a carina (Fig. 3); anterior face of T1 distinctly, though finely, punctate ***A. hyalinus* sp. n.**

Genus *Noteriades* Cockerell

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

Heriades (*Noteriades*) Cockerell, 1931: 332. Type species: *Megachile tricarinata* Bingham, 1903, by original designation.

Noteriades: Michener 1938: 514; Griswold 1994: 26; Michener 2007: 475.

Diagnosis. *Noteriades* can be easily separated from all other megachilid genera by the following combination of characters: small (4.5–10 mm), compact, hoplitiform bees with arolia present on all legs in both sexes; preoccipital carina complete; malar space linear; clypeus slightly projecting over clypeal-labral articulation; clypeus and usually supraclypeus with median longitudinal carina; pronotal lobe and omaulus carinate; scutellum carinate posteriorly; and propodeum vertical, without subhorizontal basal zone. *Female*. Mandible quadridentate, without differentiated cutting edges; T6 nearly vertical, except for apical hyaline flange. *Male*. Mandible bidentate; T1–T4 exposed dorsally, T5 and T6 curved ventrally, covering T7, S3 and remaining sterna; T6 with-

out preapical carina; S1 subapically produced over its apical margin, forming a double carina; volsella distinct, with well-developed digitus and cuspis, and heavily sclerotized teeth resembling those of short-tongued bee families and within the Megachilidae, *Pararhophites* (Fideliinae).

Comments. Griswold (1985; 1994) provided the first synoptic list of species of *Noteriades*, transferring most of them from *Heriades*. The species list presented in Table 1 is provisional; an on-going revision of the genus by the authors has revealed several undescribed species as well as new synonyms.

***Noteriades jenniferae* sp. n.**

urn:lsid:zoobank.org:act:F7D908F5-97FE-4DB0-89E8-7A254F4FA639

http://species-id.net/wiki/Noteriades_jenniferae

Figs 14–23

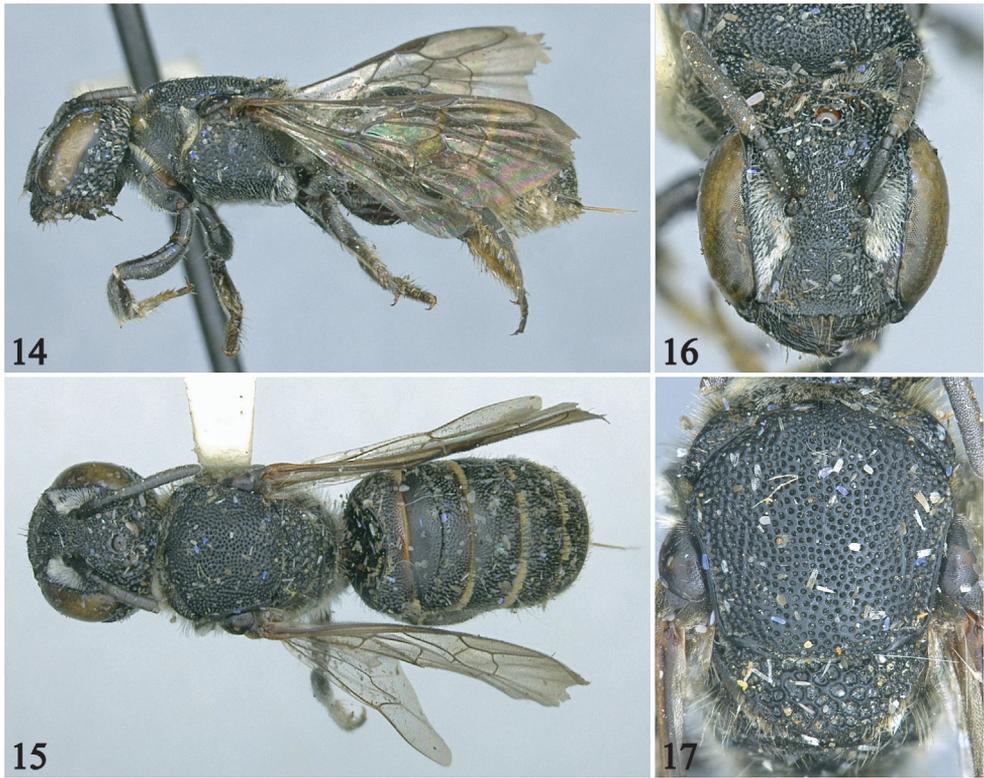
Holotype. ♀ (Figs. 14–17), THAILAND: NW. Chiangmai Prov. Chiangdao; 450 m. IV-5-11-1958 / T. C. Maa, Collector, No. 321 (BPBM).

Paratypes. 6♂, same data as holotype, except one by “native collector” (BBSL, BPBM, CAS); 1♀ with the following label data: [MYANMAR, see comments below] Carin Asciiui Chebá, 900–1000 m, L. Fea, IV-[18?]88/ Mus. Civ. Genova (MCSN).

Diagnosis. This species is most similar to *N. spinosus*, sharing with it the following characters: clypeus with median longitudinal carina extending onto supraclypeal area; juxtantennal carina absent (Fig. 16); and scutum with unmodified posterolateral angle, not spined or sharply angled, without tomentum obscuring integument (Fig. 17). It can be easily separated from *N. spinosus* by: larger body size; head slightly broader than long (Fig. 16); and scutellum with posterior margin rounded, not projecting laterally into small, curved spine.

Description. *Female:* Body length 9.0 mm (8.0 mm); forewing length 5.6 mm (5.4 mm). Head slightly broader than long (Fig. 16); compound eyes subparallel, about 2.4 times longer than broad, 1.3 times wider than gena in profile; interantennal distance 1.9 times median ocellar diameter, 1.6 times antennocular distance; interocellar distance 1.4 times median ocellar diameter, shorter than ocellocular distance; ocell-occipital distance slightly longer than median ocellar diameter; clypeus about twice as broad as long, flat in profile, distal margin crenulate, median longitudinal carina distinct, extending onto supraclypeal area; juxtantennal carina absent; scape 2.4 times longer than wide, pedicel 1.3 times longer than broad, about twice as long as F1, F1 broader than long, about as long as F2, remaining flagellomeres progressively increasing in length, apical flagellomere longer than broad. Scutum with posterolateral angle not spined or sharply angled (Fig. 17); scutellum with posterior margin broadly rounded, without lateral spine.

Mandible and labrum with outer surfaces dull, minutely roughened, irregularly punctate, punctures slightly coarser on basal half of mandible, condylar and outer ridges smooth and shiny; clypeus with small (one-sixth to one-fifth times median ocel-



Figures 14–17. Female holotype of *Noteriades jenniferae*, sp. n. **14** Lateral habitus **15** Dorsal habitus **16** Facial view **17** Detail of mesosoma in dorsal view.

lar diameter), contiguous punctures, smaller, denser on disc, smooth, shiny between punctures; supraclypeus with punctures as on sides of clypeus, punctures becoming larger (one-fourth times median ocellus diameter), slightly sparser on frons and superior paraocular area; inferior paraocular area with dense punctures smaller than on clypeus; vertex and gena with large (one-third to one-half times median ocellar diameter), coarse punctures, largest on gena; hypostomal area with punctures shallow, faint, separated by two puncture widths or less, integument smooth and shiny between punctures as on face. Mesosoma somewhat dull, imbricate between punctures except smooth and shiny on anterior surface of mesepisternum, metepisternum and most segments of legs; scutum uniformly punctate, punctures nearly contiguous, small (one-fourth to one-fifth times median ocellar diameter); axilla and scutellum with large (one-third to one-half times median ocellar diameter), coarse punctures as on gena (Figs. 15, 17); pronotum with punctures smaller than on scutum; anterior surface of mesepisternum minutely and densely punctate dorsally, impunctate ventrally; mesepisternum with large (one-fourth times median ocellar diameter) punctures separated by a puncture width or more, punctures becoming smaller and denser ventrally; metepisternum with small, contiguous punctures as on lateral surface of pronotum;



Figures 18–23. Male of *Noteriades jenniferae*, sp. n. **18** Lateral habitus **19** Facial view **20** S5 and S6 **21** S8 **22, 23** Genital capsule in dorsal (left half), ventral (right half), and profile views.

metanotum and propodeal triangle shagreened, punctures faint, sparse on metanotum, remaining areas of propodeum with small, contiguous punctures; coxae finely, densely punctate, remaining areas of legs with large impunctate areas, punctures larger, sparser on hind legs. Metasomal terga and sterna smooth and shiny to finely imbricate, punctures smaller, denser than on scutum, punctures coarser, contiguous on distal terga (particularly T6), smaller, scattered on anterior face of T1.

Integument black throughout except tegula, legs, and metasomal sterna largely dark reddish brown. Wings light brownish with weak green or coppery highlights; veins, stigma, prestigma dark brown.

Pubescence in general short, sparse, white except yellowish on labrum, mandible, clypeal margin, and inner surfaces of tarsi; mandible and labrum with outer surfaces covered by dense, minute, erect hairs; paraocular area, dorsal surface of pronotum, pronotal lobe, lateral surfaces of coxae and propodeum with long, minutely branched hairs obscuring integument or nearly so; T1–T4 (also on T5 in paratype) with apical hair bands, medially interrupted on T1 and T2.

Male: As in female except longer and denser body pubescence, apical hair bands present on basal two terga only, coarser punctation, stronger median longitudinal carina of clypeus, and the following: Body length 8.0 mm; forewing length 5.1 mm. Head 1.2 times broader than long (Fig. 19); compound eyes converging below, 1.4 times wider than gena in profile; interantennal distance about twice as long as median ocellar diameter and antennocular distance; interocellar distance 1.6 times median ocellar diameter, subequal to ocellocular distance; clypeus 1.6 times broader than long, with distal margin not as crenulate as in female; antennal flagellum long, surpassing distal

margin of scutellum, scape robust, 1.6 times longer than wide, pedicel broader than long, longer than F1, F1 about one-third length of F2, remaining flagellomeres much longer than broad. S5, S6 and S8, and genital capsule as in figures 20–23.

Etymology. This species is named after Mrs. Jennifer Lyman Strange, for her courage.

Comments. The locality of the female paratype, Carin Chebá, is now known to be Karen Hills, Kayin (or Karan) State, Myanmar, a mountainous region about 40 km NE of Toungoo; the approximate coordinates are 19°13'N, 96°35'E (Jendek 2000: 189). The year this specimen was collected is not clear; it seems likely that it was 1888.

***Noteriades spinosus* sp. n.**

urn:lsid:zoobank.org:act:3396D3F8-3E2D-4F38-B8E5-CC5C2032688B

http://species-id.net/wiki/Noteriades_spinosus

Figs 24–27

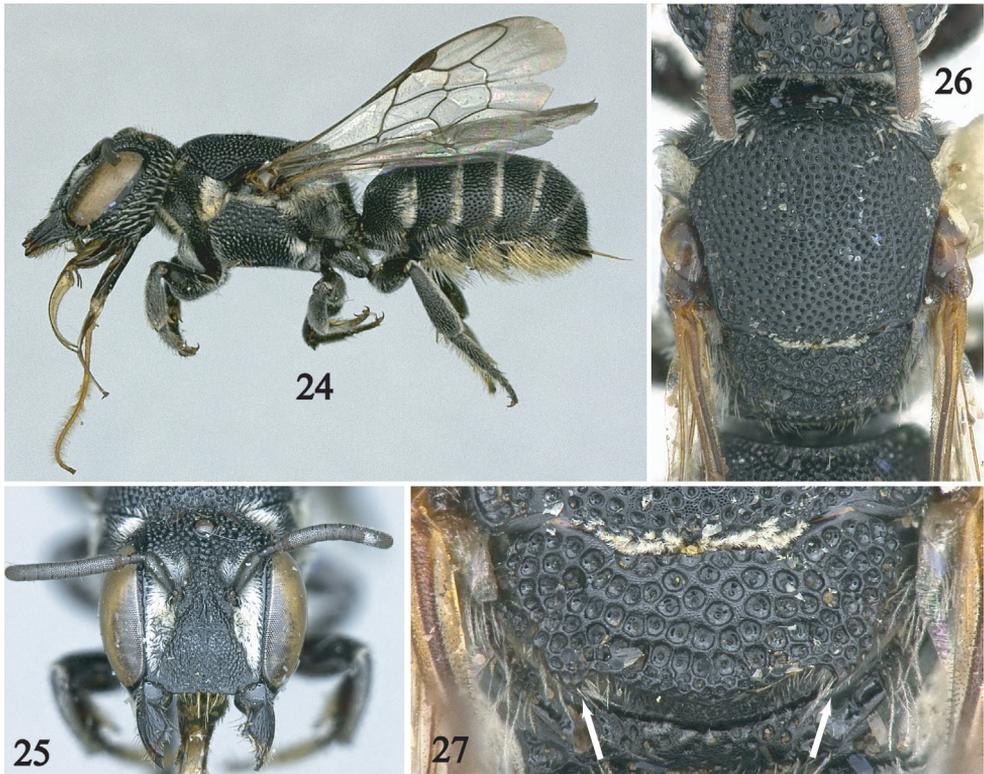
Holotype. ♀ (Fig. 24), THAILAND: Chiangmai Prov [sic], Doi Inthanon Nat. Park, Mae Ya waterfall / 28 March 1993, Leg. G. R. Ballmer (BBSL).

Paratypes. ($n = 9♀$) THAILAND: 7♀, Chiang Mai, 23 April 1988, W. J. Pulawski cllr; 2♀, NW Chiangmai Prov., Chiangdao, 450 m, iv-5-11-1958 [April 5-11, 1958] / T.C. Maa, Collector, No. 320, 336 (BBSL, BPBM, CAS).

Diagnosis. This species is most similar to *N. jenniferae* (see above). It can be easily separated from that species and all other *Noteriades* by the combination of: relatively small body size, head shape (about as long as broad, Fig. 25), and posterior margin of scutellum with small, curved spine laterally (Fig. 27).

Description. *Female.* Body length 7.8 mm (7.1–7.8 mm); forewing length 4.8 mm (4.2–4.8 mm). Head about as long as broad (Fig. 25); compound eyes subparallel, about 2.4 times longer than broad, 1.3 times wider than gena in profile; interantennal distance about twice as long as median ocellar diameter, 1.5 times antennocular distance; interocellar distance 1.6 times median ocellar diameter, about as long as ocellocular distance; ocellocipital distance 1.6 times median ocellar diameter; clypeus 1.7 times broader than long, flat in profile, distal margin crenulate, slightly projecting over clypeal-labral articulation, median longitudinal carina distinct on basal half, absent on distal half (thin but extending along clypeal length in some paratypes), extending onto supraclypeal area; juxtantennal carina absent; scape 2.6 times longer than wide, pedicel 1.4 times longer than broad, about twice as long as F1, F1 broader than long, about as long as F2, remaining flagellomeres progressively increasing in length, apical flagellomere longer than broad. Scutum with posterolateral angle not spined or sharply angled; scutellum with posterior margin rounded, laterally with small, curved spine (Fig. 27).

Mandible and labrum with outer surfaces dull, minutely roughened, irregularly punctate, punctures coarser on basal half of mandible, condylar and outer ridges smooth and shiny; clypeus with small (one-sixth to one-fifth times median ocellar diameter), rather shallow, contiguous punctures, smaller on disc, smooth, shiny between punctures; supraclypeus with coarser punctures than on clypeus, punc-



Figures 24–27. Female of *Noteriades spinosus*, sp. n. (paratypes except holotype in Fig. 24) **24** Lateral habitus **25** Facial view **26** Detail of mesosoma in dorsal view **27** Detail of scutellum with arrows pointing to spines.

tures becoming larger (one-third times median ocellus diameter) on frons, superior paraocular area, and vertex; inferior paraocular area with dense, shallow, smaller punctures than on clypeus; gena with large (one-half to two-thirds times median ocellar diameter), coarse punctures; hypostomal area with punctures small (about one-third times median ocellar diameter), shallower than on gena. Mesosoma weakly shiny, weakly imbricate between punctures except smooth and shiny on anterior surface of mesepisternum, metepisternum, propodeum and most segments of legs; scutum uniformly punctate (Fig. 26), punctures contiguous, small (one-fourth to one-third times median ocellar diameter); axilla as on scutum; scutellum with large (one-half times median ocellar diameter), coarse punctures; pronotum with smaller punctures than on scutum; anterior surface of mesepisternum minutely and densely punctate dorsally, impunctate ventrally; mesepisternum with small (one-third times median ocellar diameter) punctures separated by a puncture width or more, integument becoming shinier with smaller and denser punctures ventrally; metepisternum with coarse, contiguous punctures as on scutum; metanotum imbricate with sparse, coarse punctures; propodeal triangle smooth and shiny, impunctate, except

imbricate and sparsely punctate basally; lateral and posterior surfaces of propodeum weakly shiny, with punctures contiguous, small (about-fifth times median ocellar diameter or less), faint; coxae finely, densely punctate, remaining areas of legs with large impunctate areas, punctures larger, sparser on hind legs. Metasomal terga and sterna weakly shiny, finely imbricate, punctures smaller, denser than on scutum, punctures coarser, contiguous on distal terga (particularly on T6), smaller, scattered on anterior face of T1.

Integument black throughout except tegula, legs, and metasomal sterna largely dark reddish brown. Wings light brownish with weak green or coppery highlights; veins, stigma, prestigma dark brown.

Pubescence in general short, sparse, white except yellowish on labrum, mandible, clypeal margin, and inner surfaces of tarsi; mandible and labrum with outer surfaces covered by dense, minute, erect hairs; paraocular area, dorsal surface of pronotum, pronotal lobe, mesepisternum near wing bases, lateral surfaces of coxae, and lateral surface of propodeum with long, minutely branched hairs obscuring integument or nearly so; T1–T4 with apical hair bands, medially interrupted on T1 and T2.

Male: Unknown.

Etymology. The specific epithet makes reference to the curved posterolateral spine of the scutellum that distinguishes this species.

Comments. Specimens of this species were used in the molecular analysis of the *Osmiini* by Praz et al. (2008).

Acknowledgements

We are greatly indebted to each of the curators, collection managers and staff from the collections that we visited or from which we borrowed specimens (indicated in Material and Methods); Molly Rightmyer, Jason Gibbs, Christophe Praz, Michael S. Engel, and an anonymous reviewer for comments and suggestions that improved this manuscript. This study was supported in part by National Science Foundation grant DEB-0742998.

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Review of *Anhoplocampa* Wei (Hymenoptera, Tenthredinidae), with description of a new species and a new combination

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Academic editor: S. Blank | Received 3 August 2011 | Accepted 6 December 2011 | Published 23 December 2011

urn:lsid:zoobank.org/pub:F7DA805F-BB46-4FA5-94A2-FEB367215FD2

Citation: Wei M, Niu G (2011) Review of *Anhoplocampa* Wei (Hymenoptera, Tenthredinidae), with description of a new species and a new combination. ZooKeys 159: 81–90. doi: 10.3897/zookeys.159.2476

Abstract

Anhoplocampa is redescribed based on new material. *Anhoplocampa bicoloricornis* **sp. n.** from China is described. *A. yunnanensis* (Haris & Roller, 1999), **comb. n.** is transferred from *Trichiocampus*. A key to species of *Anhoplocampa* is provided. The differences between *Anhoplocampa* and *Trichiocampus* Hartig, 1837, *Priophorus* Dahlbom, 1835, *Hoplocampa* Hartig, 1837 and *Renonerva* Wei & Nie, 1998 are briefly discussed.

Keywords

Hymenoptera, Tenthredinidae, *Anhoplocampa*, new species, new combination, China

Introduction

Wei (1998) described *Anhoplocampa* and its type species *Anhoplocampa fumosa* from China based on a single female. The genus is quite peculiar from other taxa of Nematinae by with the presence of a distinct smoky band below pterostigma in the forewing; mese-

pisternum with a deep, broad and strongly curved furrow along the anterior and dorsal margins of the mesepisternum, and the epicnemium long, narrow, and strongly elevated.

Specimens of *Anhoplocampa* are rarely collected in the field. Except for the holotype of the type species, which was collected from Sichuan Province in 1983, one specimen was collected in Henan Province in 2001 and one in Yunnan Province in 2004. The two specimens represent two additional species of the genus.

In 1999, Haris and Roller described *Trichiocampus yunnanensis* from Yunnan, China based on a female specimen. Examination of the holotype shows that it is a species of *Anhoplocampa* and identical to the specimen collected from Yunnan in 2004.

Anhoplocampa is redescribed based on new material. A new species is described and a new combination is proposed below.

Material and methods

Terminology of sawfly genitalia follows Ross (1945). Wing venation is shown in Fig. 7 with names of cells on the right side and names of veins on the left side.

The images were obtained using a Nikon D2x digital camera and Motic BA400 microscope and further processed with Helicon Focus 5.1 (©HeliconSoft) and Adobe Photoshop CS2 software.

Abbreviations used are: OOL = distance between the eye and outer edge of lateral ocellus; POL = distance between the mesal edges of the lateral ocelli; OCL = distance between a lateral ocellus and the occipital carina or hind margin of the head.

Rules for spelling Chinese personal and place names follow GB/T 16159-1996 and ISO 7098: 1991: “Chinese people’s names are to be written separately with the surname first, followed by the personal name written as one word, with the initial letters of both capitalized.”. “Chinese place names should be alphabetized according to the “Spelling Rules for Chinese Geographical Place Names,” document no. 17 (1984) of the State Committee on Chinese Geographical Place Names.”

Specimens examined are deposited in the Insect Collection of the Central South University of Forestry and Technology, Changsha, P. R. China (CSCS) and the Hungarian Natural History Museum, Budapest, Hungary (HNHM).

Taxonomy

Anhoplocampa Wei, 1998

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

Anhoplocampa Wei, 1998: 14. Type species: *Anhoplocampa fumosa* Wei, 1998, by original designation.

Description. Body length 7–11 mm. Clypeus flat, anterior margin emarginated (Fig. 10); malar space about as long as diameter of lateral ocellus; eyes small, distance between eyes at level of antennal sockets (toruli) $1.2\text{--}1.8 \times$ greatest diameter of eye; supraantennal area distinctly protruding between antennal sockets; frontal area surrounded by strong carinae (Figs 2, 8, 16), upper margin of lateral fovea carinate; occipital carina absent; left mandible in lateral view with swollen base, narrowing to thin blade-like apex (similar to Benson, 1958, fig. 380). Head weakly dilated behind eyes in dorsal view (Figs 2, 8, 16). Antenna long and slender, basal two antennomeres short, much broader than long, third antennomere clearly shorter than fourth antennomere, other flagellomeres subequal in length. Prepectus lanceolate, distinct, about $3 \times$ longer than wide (Fig. 3); epicnemium narrow, strongly elevated, furrow between epicnemium and mesepisternum deep and broad in entire length, strongly curved in upper part across upper 0.10 of mesepisternum (Figs 3, 9). Inner tibial spur of front leg bifid apically, much longer than outer spur. Hind tibia with longitudinal furrow on outer side, tibial spurs short, $1.1\text{--}1.3 \times$ apical breadth of tibia; hind tarsus about $0.8 \times$ length of hind tibia; metabasitarsus about $1.1 \times$ length of following 3 tarsomeres together; claw without basal lobe, inner tooth large, slightly shorter than or about as long as outer tooth (Figs 4, 11, 15). Forewing with a distinct dark band below pterostigma, vein R+M longer than cu-a, Sc slightly basad apex of vein 1M; vein 2r1 absent; vein 1M strongly convergent toward pterostigma with 1m-cu; cell 2Rs subequal to 1Rs in length and about $2 \times$ as long as broad; 2m-cu joining cell 2Rs at basal 0.20–0.25; cell 1R1 about as long as broad, cell 2M longer than broad; vein 2A+3A meeting 1A at basal 0.3, basal anal cell closed; cu-a meeting cell 1M at about middle to basal 0.4 (Figs 1, 7, 14). Hind wing with cells Rs and M closed, anal cell closed, petiole of anal cell as long as width of anal cell and subequal to vein cu-a (Figs 1, 7). Cerci usually slender (Figs 5, 12, 17). Ovipositor sheath not longer than middle tibia, apical section of sheath with 3 processes in dorsal view, scopae distinct (Figs 5, 12, 17). Lancet with or without ctenidia, without stout annular setae, serrulae without denticles (Figs 6, 13, 18).

Distribution. China (Yunnan, Sichuan, Henan).

Remarks. *Anhoplocampa* Wei, 1998 is similar to *Trichiocampus* Hartig, 1837 and *Priophorus* Dahlbom, 1835 but differs from those two genera by the very narrow and strongly elevated epicnemium; presence of a broad, deep furrow between the epicnemium and mesepisternum, strongly curved in the upper part of the mesepisternum; prepectus distinct; front wall and upper margin of the lateral fovea strongly carinate; left mandible in lateral view with a swollen base and a thin blade-like apex; vein R+M in forewing longer than cu-a; apical sheath with large scopae; cerci long and slender; forewing with a dark band below pterostigma; petiole of hind anal cell as long as width of anal cell; as well, in *Trichiocampus* and other Cladiini the vein 1M meets vein R close to the point where Rs+M meets R+M; vein 1M is far removed from that point in *Anhoplocampa*.

Anhoplocampa differs from *Hoplocampa* Hartig, 1837 by the much larger body; antenna longer than the abdomen with the scape and pedicel much broader than long; forewing with a dark band below pterostigma and vein 2r absent; petiole of anal cell of hind wing not longer than cu-a; left mandible in lateral view with a swollen base and a thin blade-like apex; epicnemium very narrow and strongly elevated, with a broad and deep furrow between the epicnemium and mesepisternum, strongly curved in the upper part of the mesepisternum; supraclypeal area strongly protruding between antennal sockets and distance between antennal sockets distinctly narrower than the inner orbit at the same level; frontal walls strongly carinate; and ovipositor sheath shorter than middle tibia and with distinct scopae.

Anhoplocampa is also somewhat similar to *Renonerva* Wei & Nie (Wei and Nie 1998) sharing the narrow and strongly elevated epicnemium with a deep and broad furrow between epicnemium and mesepisternum, but *Anhoplocampa* differs from the latter by the robust body and stout antenna; the distinctly emarginated clypeus; malar space about as long as diameter of middle ocellus; prepectus distinct; cerci not linear; forewing with a dark band below pterostigma, vein 2r1 absent, 2A+3A on forewing straight and the basal anal cell open; the hind basitarsus longer than the following three tarsomeres together; ovipositor sheath with distinct scopae; lancet not strongly reduced and lamnium not shorter than radix.

Anhoplocampa differs from *Hemichroa* Stephens, 1835 in the very narrow and strongly elevated epicnemium; presence of a broad, deep furrow between the epicnemium and mesepisternum, strongly curved in the upper part of the mesepisternum; front wall and upper margin of the lateral fovea strongly carinate; left mandible in lateral view with a swollen base and a thin blade-like apex; apical sheath with large scopae; forewing with a dark band below pterostigma, vein 2r1 absent and the middle petiole of anal cell on forewing shorter than vein R+M.

Anhoplocampa also shares some characters with *Pristiphora* Latreille, 1810, for example the bladelike mandibles and the apical sheath with distinct scopae. But *Anhoplocampa* differs from *Pristiphora* by the very narrow and strongly elevated epicnemium; presence of a broad, deep furrow between the epicnemium and mesepisternum; front wall and upper margin of the lateral fovea strongly carinate; the forewing with a dark band below pterostigma, the vein 2A+3A curved up and meeting 1A and therefore the basal anal cell closed.

Three species of *Anhoplocampa* are now known. They can be identified with the following key.

Key to species of *Anhoplocampa* Wei

- 1 Clypeus deeply incised to about 0.5 × length of clypeus (Fig. 10); postocellar area and temple flat (Fig. 8); cerci not extending to end of sheath in dorsal view (Fig. 12); forewing with a not strongly defined cross band posterior of pterostigma (Fig. 7); head, antenna, mesothorax dorsally, ab-

- domen entirely, and all tibiae and tarsi reddish brown; cu-a of fore wing meeting cell 1M at about middle (Fig. 7); upper half of mesepisternum distinctly microsculptured (Fig. 9); lateral furrows of postocellar area deep and broad (Fig. 8); lancet slender, with 16 serrulae and 14 annuli, annuli without ctenidia (Fig. 13). Yunnan.....*A. yunanensis*
- Clypeus shallowly incised to about $0.25 \times$ length of clypeus; postocellar area declined posteriorly, temple distinctly convex (Figs 2, 16); apex of cercus extending clearly beyond apex of sheath in dorsal view (Figs 5, 17); cross band posterior of pterostigma dark, sharply defined (Figs 1, 14); at least apical half of antenna, most of mesothorax dorsally, abdomen except 2nd tergite, hind tibia and tarsus entirely black; cu-a of fore wing meeting cell 1M at about basal 0.4 (Figs 1, 14); mesepisternum strongly shiny, without microsculpture (Fig. 3); lateral furrows of postocellar area very fine or narrow (Figs 2, 16); lancet short, with 9 serrulae and 8 annuli, annuli with ctenidia (Figs 6, 18).....**2**
- 2 Antenna entirely black (Fig. 14); labrum, supraclypeal area and frons black; prescutum entirely black; middle tibia and middle tarsus pale brown; posterior half of postocellar area strongly declined (Fig. 16); frontal basin longer than broad, deep, $0.5 \times$ as deep as width of basin; distance between eyes at level of antennal sockets $1.5 \times$ wider than greater diameter of eye; anterior part of the deep brown band on forewing almost as broad as length of pterostigma (Fig. 14); lancet with teeth of 1st ctenidium obtuse (Fig. 18). Sichuan.....*A. fumosa*
- Antenna with basal half reddish brown, apical half black (Fig. 1); head orange except for obscure dark band across postocellar area (Fig. 2); anterior 0.6 of prescutum reddish brown (Fig. 1); middle tibia and tarsus black brown; posterior half of postocellar area weakly declined; frontal basin broader than long, very shallow, $0.13 \times$ as deep as width of basin (Fig. 2); distance between eyes at level of antennal sockets $1.2 \times$ wider than greater diameter of eye; anterior part of the deep brown band on forewing about as broad as $0.5 \times$ length of pterostigma (Fig. 1); lancet with teeth of 1st ctenidium acute (Fig. 6). Henan..... *A. bicoloricornis*

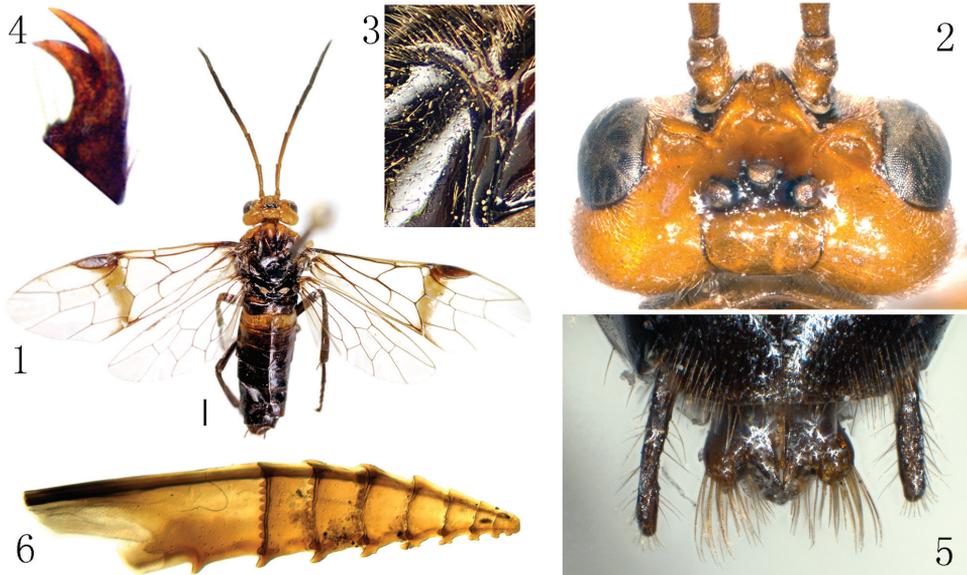
***Anhoplocampa bicoloricornis* sp. n.**

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http://species-id.net/wiki/Anhoplocampa_bicoloricornis

Figs 1–6

Description. Female (holotype, Fig. 1). Body length 9 mm (excluding antenna, cerci and sheath). Head orange, extreme narrow margin of antennal socket and a transverse band over ocelli black, apical half of antenna black; thorax and abdomen black, pronotum except lower corners, anterior 0.6 of prescutum and anterior corner of lateral lobe of scutum orange; 2nd abdominal tergite entirely and a spot near spiracle of 3rd tergite pale brown;



Figures 1–6. *A. bicoloricornis* sp. n., holotype **1** Adult female, dorsal view (scale bar = 1mm) **2** Head, dorsal view **3** Prepectus, epicnemium and dorsal part of mesepisternum **4** Claw **5** Cerci and apical sheath, dorsal view **6** Lancet

legs black, tibia and tarsus of fore leg yellow brown. Wings hyaline, vein C except for both ends pale brown, other veins and pterostigma black brown, anterior breadth of sharply defined smoky macula on forewing about half length of pterostigma. Body hairs brown.

Body shiny, without distinct punctures and microsculptures. Clypeus shallowly and roundly emarginated to about 0.25 length of clypeus; malar space slightly longer than diameter of lateral ocellus; postocellar area $2 \times$ as broad as long, with a shallow and broad middle furrow, posterior half of postocellar area weakly declined; postocellar furrow distinct; lateral furrows very shallow, weakly curved; temple weakly bulged; frontal basin shallow, $1.3 \times$ broader than long, with depth about $0.13 \times$ breadth of basin; frontal walls broad, strongly elevated (Fig. 2); distance between eyes at level of antennal sockets $1.2 \times$ wider than greater diameter of eye. Antenna slender, as long as body, slightly tapering towards apex (Fig. 1). Prepectus, epicnemium and dorsal part of mesepisternum as Fig. 3. Claw with inner tooth hardly shorter and distinctly broader than outer tooth (Fig. 4). Forewing: cell 2Rs slightly longer than 1Rs, vein cu-a joining cell 1M at basal 0.43. Cerci and apical sheath in dorsal view as Fig. 5, cerci about $5.5 \times$ as long as broad. Lancet with 8 annuli and 9 serrulae, 1st annulus with distinct annular teeth (Fig. 6).

Male. Unknown.

Distribution. China (Henan Province).

Etymology. The new species is named after the color of the antenna.

Holotype. ♀, China: Henan Province, Songxian, Baiyunshan, 1800 m, 2001. VI.2, Zhong Yihai leg. (CSCS).

Remarks. See above key for differences between the three species of the genus.

***Anhoplocampa yunanensis* (Haris & Roller, 1999), comb. n.**

http://species-id.net/wiki/Anhoplocampa_yunanensis

Figs 7–13

Trichiocampus yunanensis Haris & Roller, 1999: 231–232.

Description. Female (Fig. 7). Body length 7 mm (excluding antenna, cerci and sheath). Body orange, extreme narrow margin of antennal socket, propleuron, parapsis of mesothorax largely, narrow posterior margin of mesoscutellum, parapsis of metanotum, posterior of metascutellum, ventral half of mesopleuron, ventral margin of metapleuron, black; legs black, apical 1/3 of fore femur, all tibiae and tarsi yellow brown. Wings hyaline, apical third weakly infuscate, vein C pale brown, other veins and pterostigma black brown, anterior breadth of a feebly defined smoky macula about half length of pterostigma. Body hairs silver brown.

Body shiny, dorsal side of pronotum distinctly punctured, dorsal half of mesopleuron distinctly microsculptured (Fig. 9). Clypeus distinctly and roundly emarginated to about half length of clypeus (Fig. 10); malar space about $1.15 \times$ diameter of lateral ocellus; postocellar area flat, $2.2 \times$ as broad as long, with a deep middle fovea and a shallow middle furrow, posterior of postocellar area not declined; postocellar furrow broad and shallow; lateral furrows deep and very broad, weakly divergent backwards; temple flat; frontal basin shallow, $1.1 \times$ as broad as long, with depth about $0.13 \times$ breadth of basin; frontal walls distinctly elevated, not very sharp (Fig. 8); distance between eyes at level of antennal sockets $1.8 \times$ wider than greater diameter of eye. Antenna stout, $1.2 \times$ length of abdomen, much shorter than thorax and abdomen together, tapering towards apex (Fig. 7). Prepectus, epicnemium and dorsal part of mesepisternum as Fig. 9. Claw with inner tooth clearly shorter and slightly broader than outer tooth (Fig. 11). Forewing: cell 2Rs slightly shorter than 1Rs, vein cu-a joining cell 1M at middle. Cerci and apical sheath in dorsal view as Fig. 12, cerci about $3.5 \times$ as long as broad, not beyond apex of sheath. Lancet slender, with 14 annuli and 16 serrulae, annuli simple, without annular teeth (Fig. 13).

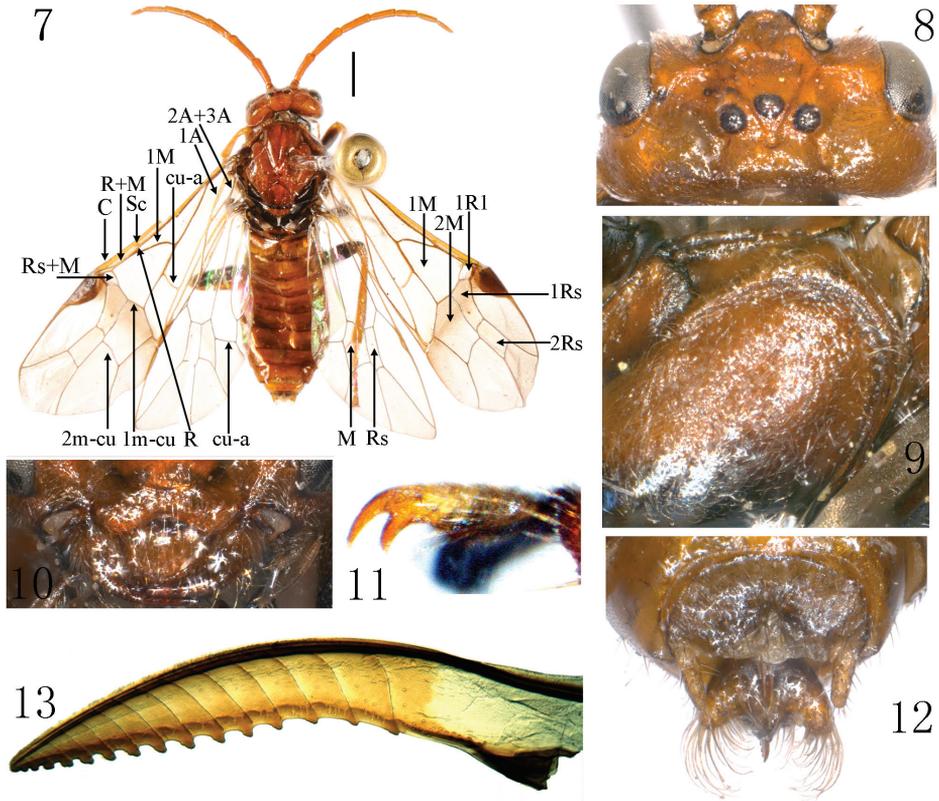
Male. Unknown.

Distribution. China (Yunnan).

Specimens examined. 1 ♀, holotype: “China, Yunan [Yunnan], 24–29. VI. 93, 50 km N. of Lijieng [Lijiang], Yulongshan, Nat. Res., E. Jednek, O. Sausa leg.” (HNHM); 1 female, “Xiaozhongdian, Shangri-La, Yunnan, China, alt. 3000m, 19 July 2004, Xiao Wei coll.” (CSCS).

Remarks. This species is easily separated from the other *Anhoplocampa* species by the orange body; antenna stout and much shorter than body; forewing with a weak cross band below pterostigma; postocellar area not declined and with deep and broad lateral furrows; the upper half of mesopleuron distinctly microsculptured; cerci shorter; clypeus deeply incised; claw with inner tooth clearly shorter than outer tooth; cu-a of fore wing meeting cell 1M at about middle; and female lancet slender with 14 simple annuli.

Haris and Roller (1999) placed this species in *Trichiocampus*. However, left mandible in lateral view bearing a strongly swollen base and narrowing to a thin blade-like



Figures 7–13. *A. yunanensis* (Haris et Roller, 1999) comb. n., specimen from Xiaozhongdian, Yunnan **7** Adult female, dorsal view (scale bar = 1mm) **8** Head, dorsal view **9** Prepectus, epicnemium and dorsal part of mesepisternum **10** Clypeus **11** Claw **12** Cerci and apical sheath, dorsal view **13** Lancet

apex, the long vein R+M, the narrow and strongly elevated epicnemium with a deep and strongly curved furrow, and the distinctly carinate frontal walls show that it is member of *Anhoplocampa* and does not belong to *Trichiocampus*.

The weak cross-band of the forewing, the comparatively short antenna, the short cerci, the slender lancet with simple annuli, the flat temple and postocellar area of *A. yunanensis* show that it is morphologically remote from *A. bicoloricornis* and *A. fumosa*.

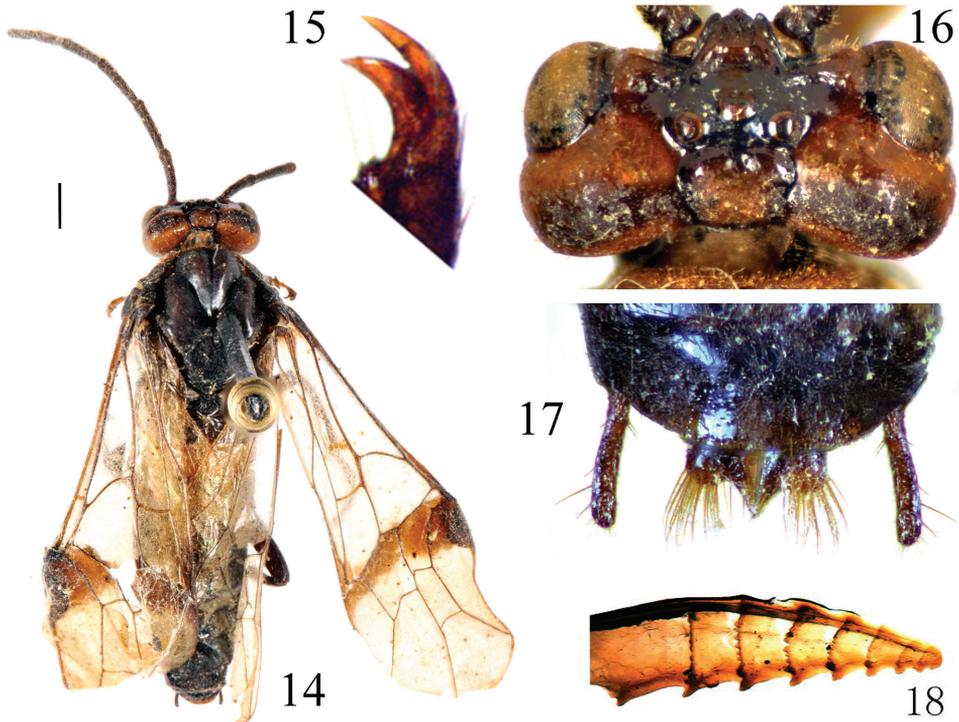
Anhoplocampa fumosa Wei, 1998

http://species-id.net/wiki/Anhoplocampa_fumosa

Figs 14–18

Anhoplocampa fumosa Wei, 1998: 15.

Description. Female (holotype, Fig. 14). Body length 11 mm (excluding antenna, cerci and sheath). Head dark orange, narrow margin of antennal socket, frons and ocel-



Figures 14–18. *A. fumosa* Wei, 1998, holotype **14** Adult female, dorsal view (scale bar = 1mm) **15** Claw **16** Head, dorsal view **17** Cerci and apical sheath, dorsal view **18** Lancet

lar area, a broad transverse band along posterior margin of head black; antenna entirely black; thorax and abdomen black, middle half of pronotum orange; 2nd abdominal tergite largely pale brown; legs black, fore tibia and tarsus yellow brown, middle tibia and tarsus pale brown. Wings hyaline, apical third of forewing weakly infuscate, veins and pterostigma black brown, anterior breadth of a sharply defined smoky band below pterostigma about as long as pterostigma. Body hairs brown.

Body shiny, without distinct punctures and microsculptures. Clypeus shallowly and roundly emarginated to about $0.25 \times$ length of clypeus; malar space slightly longer than diameter of lateral ocellus; postocellar area $2 \times$ as broad as long, with a shallow middle fovea, posterior half of postocellar area strongly declined; postocellar furrow distinct; lateral furrows shallow but distinct, weakly curved; temple distinctly bulged; frontal basin long and deep, $1.2 \times$ longer than broad, with depth about $0.5 \times$ breadth of basin; frontal walls broad, strongly elevated (Fig. 16); distance between eyes at level of antennal sockets $1.5 \times$ wider than greater diameter of eye. Antenna slender, $1.3 \times$ length of abdomen, not tapering towards apex (Fig. 14). Prepectus, epicnemium and dorsal part of mesepisternum similar to Fig. 3. Claw with inner tooth hardly shorter and distinctly broader than outer tooth (Fig. 15). Forewing: cell 2Rs slightly longer than 1Rs, vein cu-a joining cell 1M at basal 0.4. Cerci and apical sheath in dorsal view

as Fig. 17, cerci about $5.5 \times$ as long as broad, middle tooth of sheath acute and much longer than roundish lateral teeth. Lancet with 8 annuli and 9 serrulae, 1st annulus with obscure annular teeth (Fig. 18).

Male. Unknown.

Distribution. China (Sichuan Province).

Specimens examined. 1 ♀, holotype: “China, Sichuan, Baoxing, 2200 m, 27 June, 1983, Xiong Jiang leg.” (CSCS).

Acknowledgements

Our thanks are due to Dr. Sándor Csósz, the curator of Hungarian Natural History Museum, for allowing study of Haris’ type. This work is supported by the National Natural Science Foundation of China (no.31172142 and 30771741) and the Graduate’s Scientific Research Foundation of Central South University of Forestry and Technology (2009bx02).

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