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# Review of the millipede genus *Eutrichodesmus* Silvestri, 1910, in China, with descriptions of new cavernicolous species (Diplopoda, Polydesmida, Haplodesmidae)

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## Abstract

The *Eutrichodesmus* fauna of mainland China, by far the largest genus in the Indo-Australian family Haplodesmidae, is reviewed and shown to encompass 23 species (of a total of 45), all keyed. The following nine new species, all presumed troglobites, are described: *E. triangularis* **sp. n.**, from Sichuan, *E. lipsae* **sp. n.**, from Guangxi, *E. tenuis* **sp. n.**, *E. trontelji* **sp. n.**, *E. latellai* **sp. n.**, *E. obliteratus* **sp. n.** and *E. troglobius* **sp. n.**, all from Guizhou, *E. sketi* **sp. n.**, from Hunan, and *E. apicalis* **sp. n.**, from Hubei.

## Keywords

Diplopoda, Haplodesmidae, *Eutrichodesmus*, taxonomy, new species, cave, China

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## Introduction

The millipede family Haplodesmidae Cook, 1895, which has only seven component genera basically occurring (except for a few pantropical introductions) in South, East and Southeast Asia, as well as the southwestern Pacific region and Australia, has recently been reviewed (Golovatch et al. 2009a, 2009b, 2010, Golovatch and VandenSpiegel 2014). The most speciose genus is *Eutrichodesmus* Silvestri, 1910, which contains 36 described species and ranges from southern Japan in the north, through Taiwan, southern China and Indochina, to Vanuatu, Melanesia in the south. Mainland China alone supports the following 14 species, mostly from caves (Zhang and Wang 1993, Zhang 1995a, 1995b, Golovatch et al. 2009a, 2009b, 2010; Makhan 2010, Liu and Tian 2013):

*E. anisodentus* (Zhang, 1995), from Mt. Wuyi, Fujian Prov. (Zhang 1995b, Golovatch et al. 2010);
*E. arcicollaris* Zhang in Zhang & Wang, 1993, from Cave Huayu Dong, Hekou County, Yunnan Prov. (Zhang and Wang 1993, Golovatch et al. 2009a, 2009b);
*E. digitatus* Liu & Tian, 2013, from Cave Mi Dong, Jintan Town, Qingyuan City, Guangdong Prov. (Liu and Tian 2013);
*E. distinctus* Golovatch, Geoffroy, Mauriès & VandenSpiegel, 2009, from Cave 4, Bapen, Fushui County, Guangxi Prov. (Golovatch et al. 2009b);
*E. dorsiangulatus* (Zhang in Zhang & Wang, 1993), from Cave Baoniujiao Dong, Mengla County, Yunnan Prov. (Zhang and Wang 1993, Golovatch et al. 2009a, 2009b);
*E. incisus* Golovatch, Geoffroy, Mauriès & VandenSpiegel, 2009, from caves near Hong Lin, Qianxi County, Guizhou Prov. (Golovatch et al. 2009a);
*E. latus* Golovatch, Geoffroy, Mauriès & VandenSpiegel, 2009, from caves in Yachang Nature Reserve, Guangxi Prov. (Golovatch et al. 2009a);
*E. monodentus* (Zhang in Zhang & Wang, 1993), from Cave Caiyun Dong, Mengla County, Yunnan Prov. (Zhang and Wang 1993, Golovatch et al. 2009a, 2009b);
*E. pectinatidentis* (Zhang, 1995), from Mt Tianmu, Lin'an County, Zhejiang Prov. (Zhang 1995a, Golovatch et al. 2010);
*E. planatus* Liu & Tian, 2013, from Cave Zhenzhuyan Dong, Liujia Town, Hechi City, Guangxi Prov. (Liu and Tian 2013);
*E. similis* Golovatch, Geoffroy, Mauriès & VandenSpiegel, 2009, from several caves in Mulun Nature Reserve, Huanjiang County, Guangxi Prov. (Golovatch et al. 2009a, Liu and Tian 2013);
*E. simplex* Liu & Tian, 2013, from Cave Taoyuan Dong, Fenyi County, Jiangxi Prov. (Liu and Tian 2013);
*E. soesilae* Makhan, 2010, from Mt. Jinyun, Beibei, Chongqing Municipality (Makhan 2010, Golovatch et al. 2010);
*E. spinatus* Liu & Tian, 2013, from Sidu Caves, Sidu Town, Hunan Prov. (Liu and Tian 2013).

The present paper puts on record another nine new species of *Eutrichodesmus* from Chinese caves, being concluded by a key to all 23 species of the genus currently known to occur in mainland China.

### Abbreviations used

**MNHN** Muséum national d'Histoire naturelle, Paris, France
**SEM** Scanning electron microscopy

## Material and methods

The material serving as the basis for the present contribution derives from subterranean collections made in China by Josiane Lips (Villeurbanne, France), Leonardo Latella and Daniele Avesani (both from the Museo Civico di Storia naturale, Verona, Italy), as well as Boris Sket, Peter Trontelj and their collaborators (all from the University of Ljubljana, Slovenia). All material, including the holotypes, has been deposited in MNHN. The term "doratodesmoid" is used hereafter only in its vernacular meaning, in order to concisely characterize a body shape, i.e. capable or nearly capable of volvation.

SEM micrographs were taken using a JEOL JSM-6480LV scanning electron microscope.

After examination, SEM material was removed from stubs and returned to alcohol, all such samples being kept at MNHN.

## Systematics

***Eutrichodesmus triangularis* Golovatch, Geoffroy, Mauriès & VandenSpiegel, sp. n.**
http://zoobank.org/642BEA4E-D3AA-49FE-B829-8DEA0478E2B4
Figs 1, 2

**Type material.** Holotype ♂ (MNHN JC 367), China, Sichuan Prov., Beichuan County, Cave Yan Dong, 18.VIII.2004, leg. J. Lips (No. 1583).

**Name.** To emphasize the prominent, triangular, distofemoral process (**dp**) of the gonopod; adjective.

**Diagnosis.** Differs from congeners by the prominent, triangular, distofemoral process of the gonopod (see also Key below).

**Description.** Length ca 7.0 mm, width 0.9 and 1.5 mm on midbody pro- and metazonae, respectively. Coloration uniformly very light brown with pallid antennae, clypeolabral region, prozonae, venter, legs and metatergal tuberculations (Fig. 1).

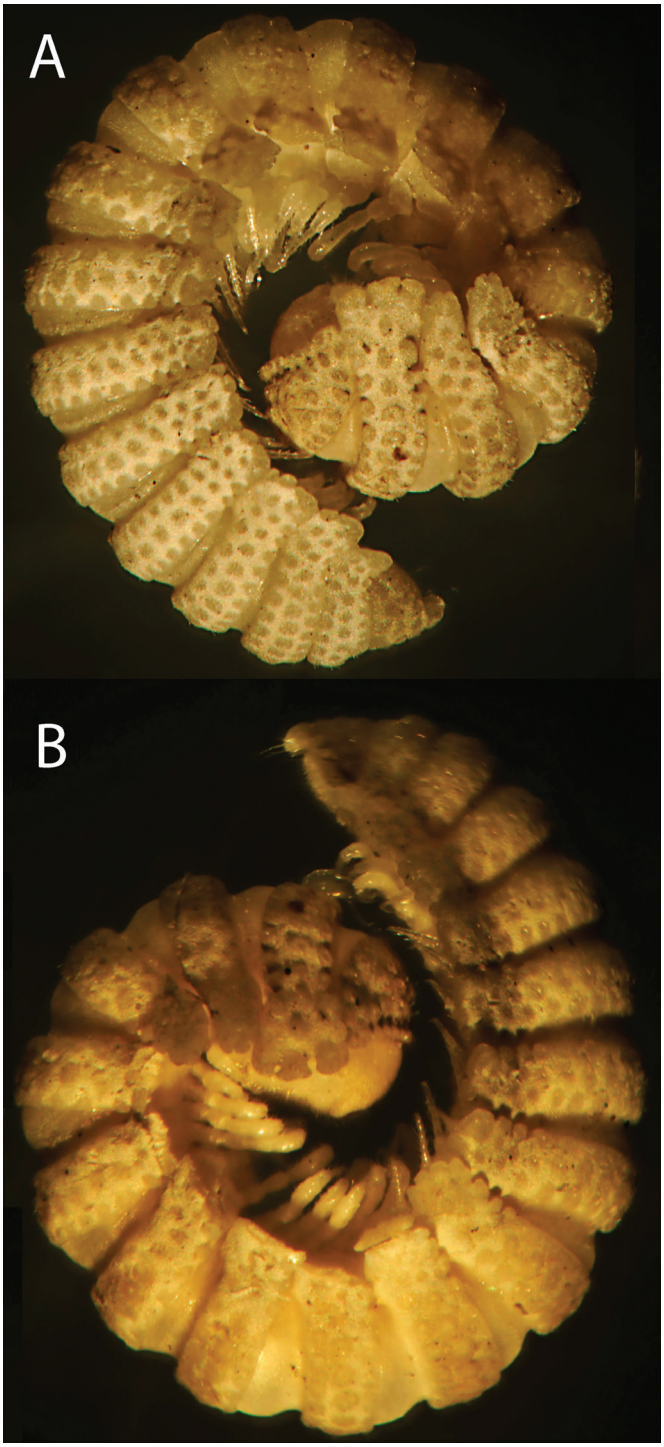


**Figure 1.** *Eutrichodesmus triangularis* sp. n., ♂ holotype; **A, B** habitus, sublateral and lateral views, respectively. Pictures by A. Kirejtshuk, not taken to scale.

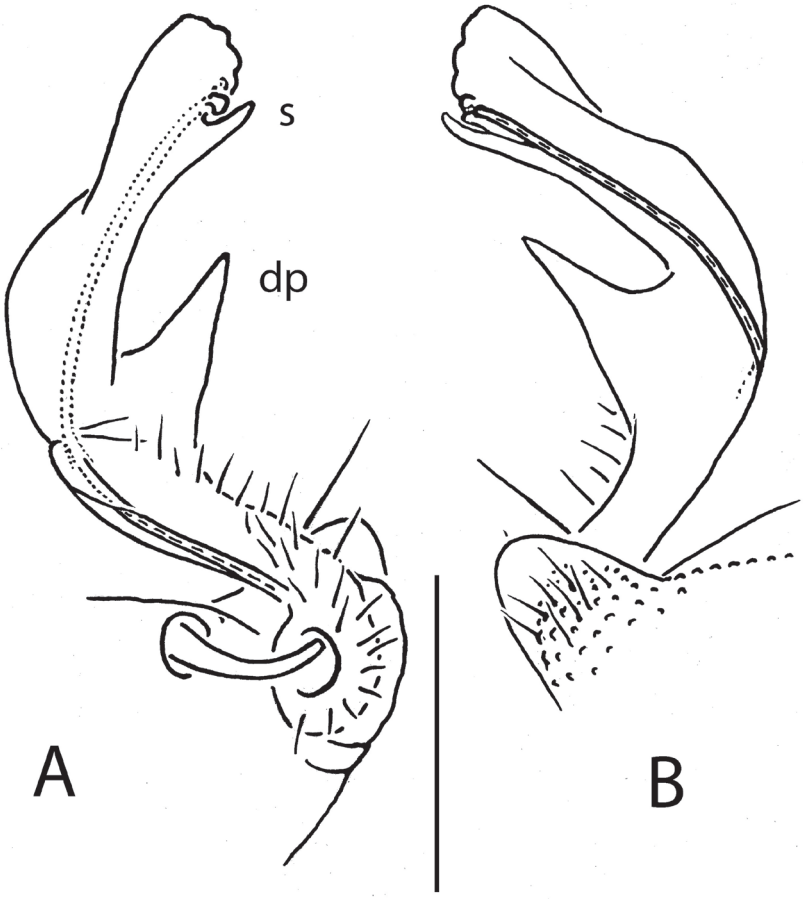


**Figure 2.** *Eutrichodesmus triangularis* sp. n., ♂ holotype; **A, B** left gonopod, mesal and lateral views, respectively. Scale bar: 0.2 mm. Designations in text.

Body with 19 segments (♂) (Fig. 1), conglobation pattern typical of "doratodesmoids", volvation apparently being complete because of strongly declivous and relatively narrow paraterga. Tegument dull, meta- and paraterga with a cerategument layer. Antennae short and clavate. Head with a paramedian pair of small, but distinct, rounded tubercles above antennal sockets. Collum not covering the head from above, fore margin slightly elevated, with 4-5 transverse rows of flat tuberculations, first two and caudalmost rows being regular (Fig. 1). Metaterga behind collum with three transverse, rather irregular, mixostictic (= not regularly longitudinal) rows of similarly flat, rounded, obviously setigerous tuberculations extending onto paraterga, usually about 11-12+11-12 per row (Fig. 1); limbus microcrenulate. Paraterga with evident shoulders anteriorly, strongly declivous, directed ventrolaterad at about 45° to subvertical sides above paraterga, broad, tips about level with venter, dis-

tinctly trilobate laterally, without anterolaterals, but with 2-3 rounded caudolaterals (Fig. 1). Paraterga 2 rather strongly enlarged, directed ventrolaterad, lateral margin especially deeply trilobate, caudal margin with a row of lobules extending across dorsum, both schism and hyposchism small; paraterga 3 and 4 slightly shorter than others. Pore formula normal, ozopores indistinct, located dorsally between middle and caudolateral lobulations. Pleurotergal carinae wanting. Epiproct fully exposed in dorsal view, rather strongly flattened, dorsally also tuberculate, with several incisions at lateral edge, directed ventrocaudad, with the usual four cones just below tip (Fig. 1). Hypoproct subtrapeziform.

Sterna usually with a deep and narrow depression between coxae. Legs short, crassate except for slender tarsi, about as long as body height.

Gonopods (Fig. 2) simple. Coxae subquadrate, large, microtuberculate and abundantly setose ventrolaterally, with a conspicuous round lobe caudolaterally. Telopodite considerably longer than coxite, but not too slender, subfalcate, distinctly curved ventrad, setose not only in its basal half, including mesal face at base of a prominent, triangular, acuminate, distofemoral process (**dp**), the latter situated at about midway along telopodite, more distally with a lobe-shaped, rounded, distad slightly enlarged acropodite showing a short, distoventral, subapical spine (**s**); seminal groove terminating subapically, devoid of a hairpad.

**Remarks.** The presence of only 19 body segments is rare in *Eutrichodesmus*, but generally quite common in Haplodesmidae (Golovatch et al. 2009a). Among congeners, the above new species seems to share this feature only with *E. asteroides* Golovatch, Geoffroy, Mauriès & VandenSpiegel, 2009, from a cave in Vietnam (Golovatch et al. 2009b).

More information on the location of the cave can be found at http://www.groupe-speleo-vulcain.com/explorations/expeditions-a-letranger/

### *Eutrichodesmus lipsae* Golovatch, Geoffroy, Mauriès & VandenSpiegel, sp. n.

http://zoobank.org/36DDFFFF-ACC7-40D2-A056-C1A904393C38
Figs 3, 4

**Type material.** Holotype ♂ (MNHN JC 368), China, Guangxi Prov., Guilin County, Grotte des Squelettes, 22.VII.1992, leg. J. Lips (No. B1-2).

Paratypes: 1 ♂ (SEM), 1 juv. (MNHN JC 368), same data, together with holotype.

**Name.** In honour of Josiane Lips, the collector.

**Diagnosis.** Differs from congeners by clearly elevated mid-dorsal regions of most metaterga, coupled with a slender, suberect gonopod telopodite which shows a rather narrowly gapped apical pincer (see also Key below).

**Description.** Length of adults ca 7.0 mm, width 1.0 and 1.95 mm on midbody pro- and metazonae, respectively (♂). Coloration entirely pallid.

All characters as in *E. triangularis* sp. n., except as follows.

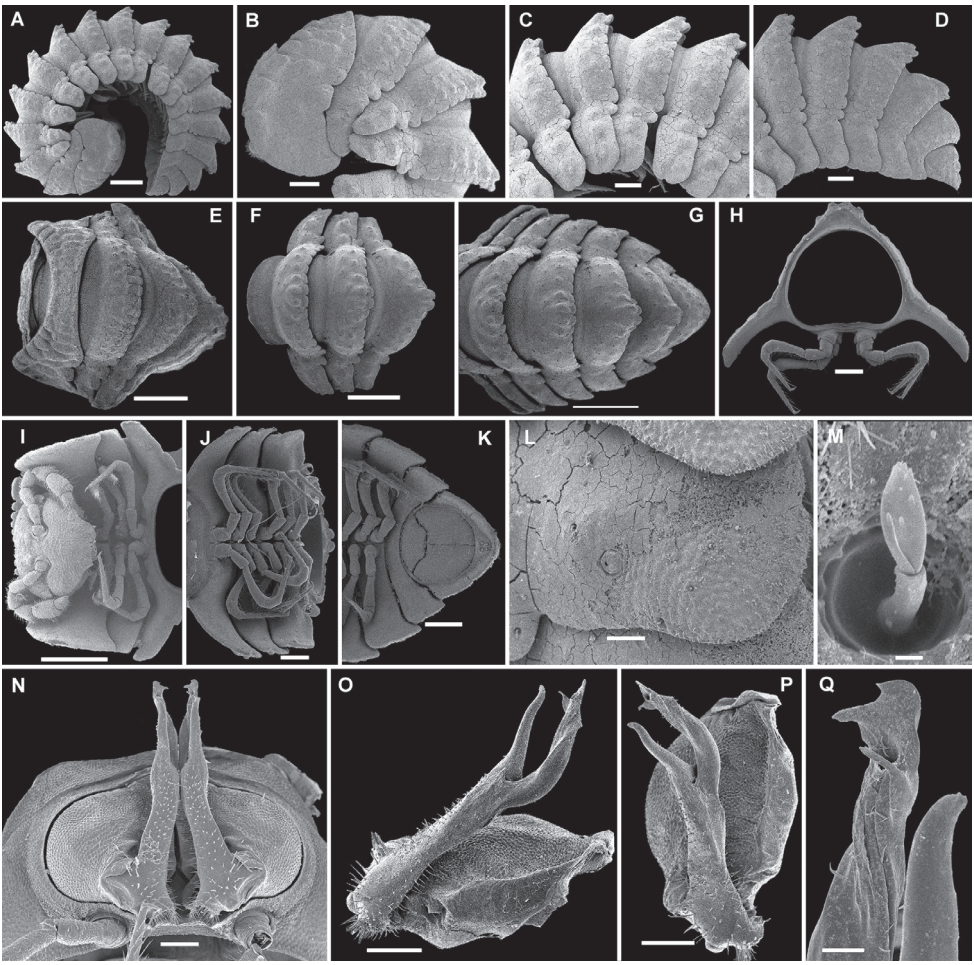


**Figure 3.** *Eutrichodesmus lipsae* sp. n., ♂ paratype; **A** habitus, lateral view **B, E, I** anterior part of body, lateral, dorsal and ventral views, respectively **C, F, J** midbody segments, lateral, dorsal and ventral views, respectively **D, G, K** posterior part of body, lateral, dorsal and ventral views, respectively **H** cross-section of a midbody segment, caudal view **L** poriferous midbody paratergite, lateral view **M** tergal seta, subdorsal view **N** both gonopods in situ, ventral view **O, P** right gonopod, mesal and ventromesal views, respectively **Q** tip of right gonopod, subventral view. Scale bars: 0.5 mm (**A, E–G, I**), 0.2 mm (**B–D, H, J, K**), 0.1 mm (**N–P**), 0.05 mm (**L**), 0.02 mm (**Q**), 0.002 mm (**M**).

Body with 20 segments (♂) (Fig. 3A), conglobation pattern typical of "doratodesmoids", volvation apparently being complete because of strongly declivous and relatively narrow paraterga. Antennae short and clavate (Fig. 3I). Collum not covering the head from above, fore margin clearly lobulate, with 4-5 transverse rows of very flat tuberculations/bosses. Metaterga behind collum with three transverse, rather irregular, mixostictic rows of similarly flat, rounded, often obliterate, obviously setigerous bosses extending onto paraterga, usually about 9-10+9-10 per row (Fig. 3A–G); starting with

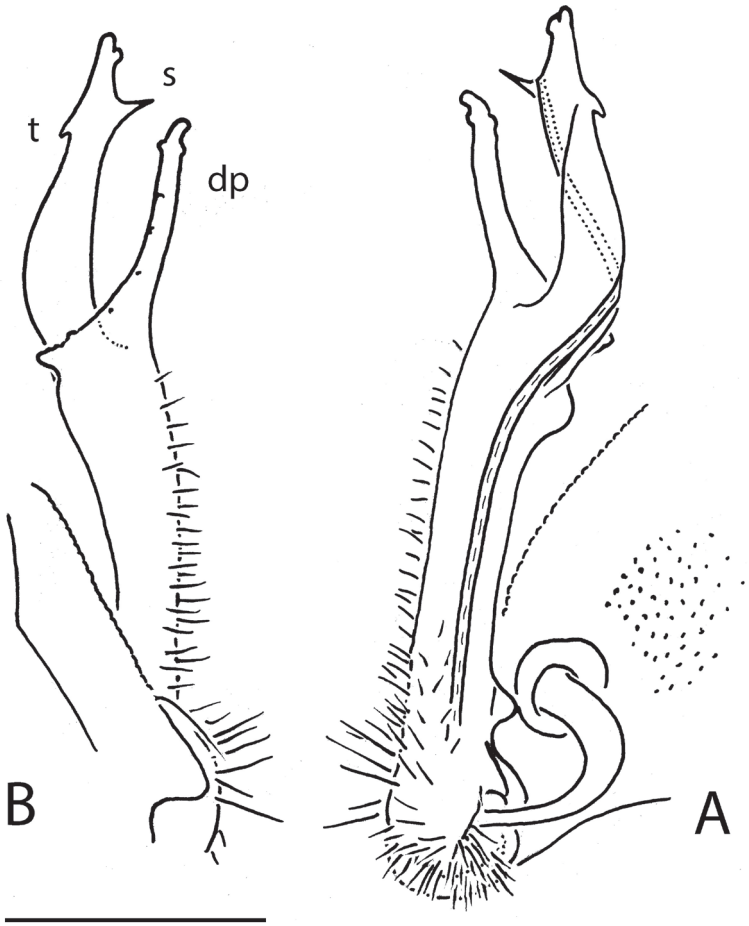


**Figure 4.** *Eutrichodesmus lipsae* sp. n., ♂ holotype; **A, B** right gonopod, mesal and lateral views, respectively. Scale bar: 0.2 mm.

segment 3, middle and caudal rows clearly enlarged and elevated mid-dorsad, increasingly clearly so towards segment 15 or 16 as well (Fig. 3A–G); caudomarginal lobulations evident across dorsum; limbus microcrenulate. Paraterga with evident shoulders anteriorly, strongly declivous, directed ventrolaterad at about 45° to only slightly less strongly declined sides above paraterga, broad, tips lying clearly below level of venter, usually vaguely bilobate laterally, without anterolaterals, but with well-developed rounded caudolaterals at and above base (Fig. 3A–D, L). Paraterga 2 strongly enlarged, directed ventrad (Fig. 3A, B, I), lateral margin broadly rounded, with numerous, very small lobulations, caudal margin with a row of lobules extending across dorsum, both schism and hyposchism small. Tergal setae very short, 2-segmented, apical part phylloid (Fig. 3M). Pore formula normal, ozopores indistinct, located dorsally at about anterior 1/3 of paratergite and well removed from lateral margin (Fig. 3L). Hypoproct subtrapeziform (Fig. 3K).

Sterna usually with a rather deep, narrow depression between coxae (Fig. 3I, J). Legs long and slender, about 1.1-1.2 times as long as body height.

Gonopods (Figs 3N-Q, 4) simple. Coxae subquadrate, large, micropapillate, but not setose, with only a small round lobe caudolaterally. Telopodite considerably longer than coxite, slender, suberect, setose over its basal 2/3 until base of a prominent, finger-shaped, poorly papillate, distofemoral process (**dp**), the latter situated in distal 1/4 of telopodite, more distally with a rather narrow, twisted, subacuminate, slightly longer acropodite forming a rather narrowly gapped pincer together with **dp** and showing a short, distoventral, subapical spine (**s**) and a small, distodorsal, subapical tooth (**t**); seminal groove terminating at base of **s**, devoid of a hairpad.

**Remark.** More information on the location of the cave can be found at http://www.groupe-speleo-vulcain.com/explorations/expeditions-a-letranger/

***Eutrichodesmus tenuis* Golovatch, Geoffroy, Mauriès & VandenSpiegel, sp. n.**
http://zoobank.org/B7247170-99F8-4A4F-AED5-440344A4E881
Figs 5, 6

**Type material.** Holotype ♂ (MNHN JC 369), China, Guizhou Prov., Guanling County, Yong Ning Town, Cave Yun Dong (Cloud Cave), 01.VIII.2005, leg. L. Latella & D. Avesani.

Paratypes: 1 ♀, 2 subadult ♀ (MNHN JC 369), 1 subadult ♀ (SEM), same data, together with holotype.

**Name.** To emphasize the relatively slender body due to subvertical paraterga; adjective.

**Diagnosis.** Differs from congeners by the large body size, clearly elevated mid-dorsal regions of most metaterga, coupled with narrow, strongly declivous, subvertical paraterga and a simple, falcate gonopod telopodite carrying a long, spiniform, distofemoral process (see also Key below).

**Description.** Length of adults ca 14–15 mm, width 1.8 and 2.5 mm (♂ holotype) or 1.6 and 2.1 mm (♀ paratype) on midbody pro- and metazonae, respectively. Coloration entirely pallid, sometimes (♀ paratype) with traces of reddish earth material on metaterga.

All characters as in *E. triangularis* sp. n., except as follows.

Body with 20 segments (♂, ♀), conglobation pattern typical of "doratodesmoids", volvation apparently being complete because of particularly strongly declivous and short paraterga. Antennae short and clavate (Fig. 5H, K). Collum not covering the head from above, fore margin clearly lobulate and slightly elevated, with 4-5 transverse rows of small, but evident tuberculations, only frontal- and caudalmost rows being regular. Metaterga behind collum with three transverse, rather irregular, mixostictic rows of similarly evident, rounded, setigerous tuberculations extending onto paraterga, usually about 10-11+10-11 per row (Fig. 5A–G); starting with midbody segments, middle rows clearly enlarged and elevated mid-dorsad, increasingly clearly so towards segment 18 as well (Fig. 5A–D); a few caudomarginal lobulations evident only on paraterga

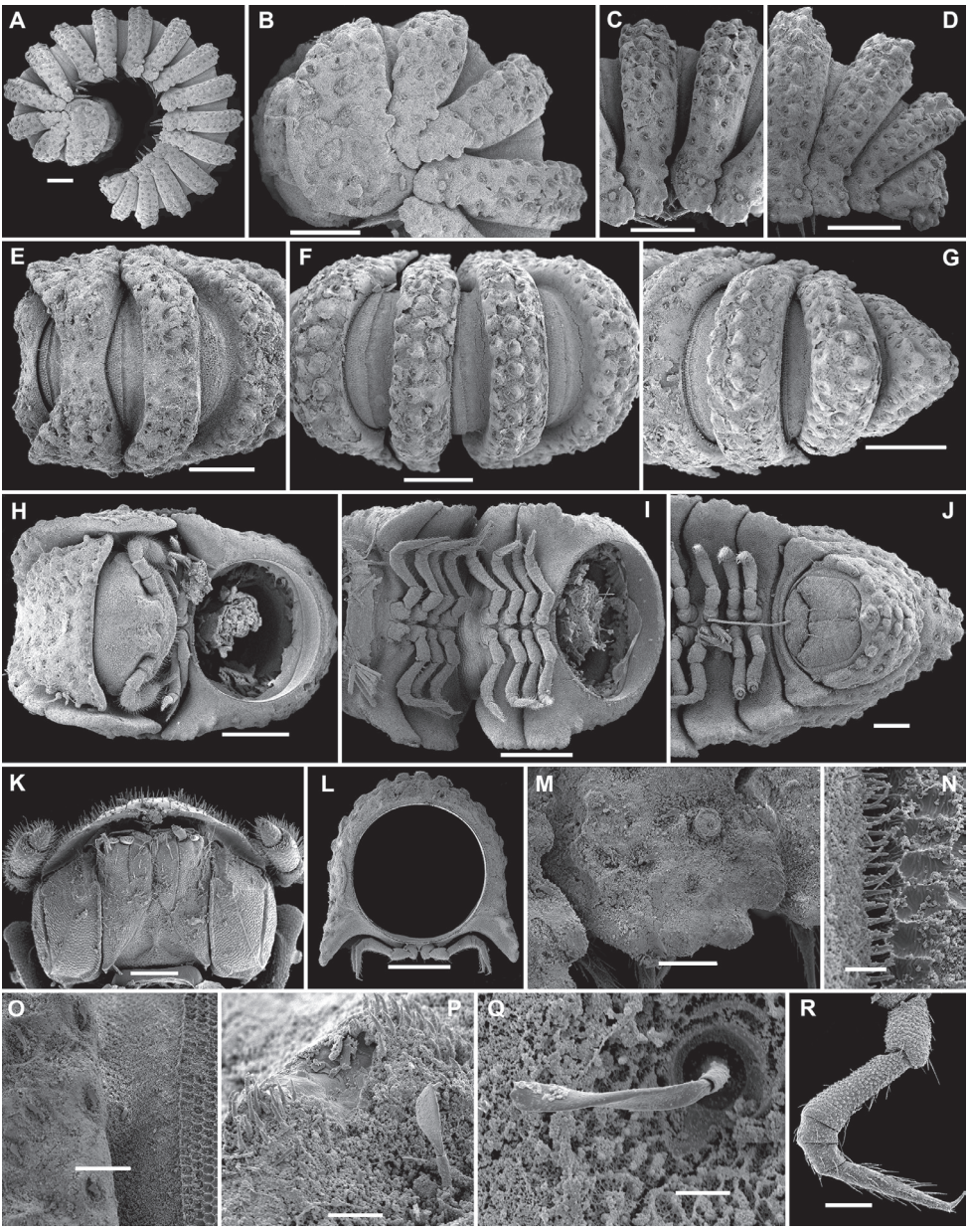


**Figure 5.** *Eutrichodesmus tenuis* sp. n., subadult ♀ paratype; **A** habitus, lateral view **B, E, H** anterior part of body, lateral, dorsal and ventral views, respectively **C, F, I** midbody segments, lateral, dorsal and ventral views, respectively **D, G, J** posterior part of body, lateral, dorsal and ventral views, respectively **K** head, ventral view **L** cross-section of a midbody segment, caudal view **M** poriferous midbody paratergite, lateral view **N** limbus, lateral view **O, P, Q** tergal setae, various views **R** midbody leg. Scale bars: 0.5 mm (**A–I, L**), 0.2 mm (**J, K**), 0.1 mm (**M, O, R**), 0.02 mm (**N, P**). 0.01 mm (**Q**).

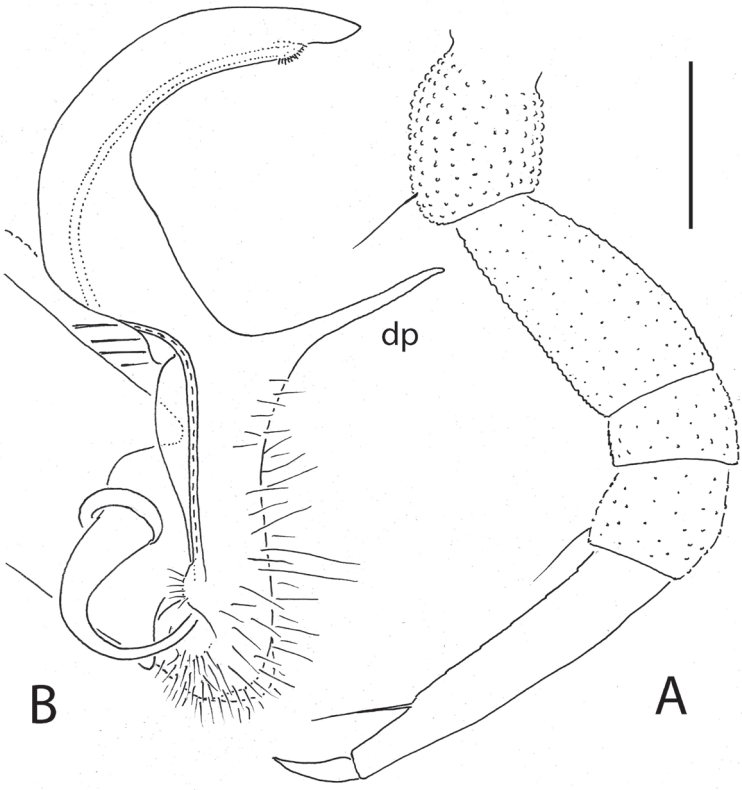


**Figure 6.** *Eutrichodesmus tenuis* sp. n., ♂ holotype; **A** leg 9, lateral view **B** left gonopod, mesal view. Scale bar: 0.2 mm. Designation in text.

(Fig. 5A–D); limbus microcrenulate (Fig. 5N). Paraterga with evident shoulders anteriorly, very strongly declivous, subvertical, directed ventrolaterad at about 75–80° to even more strongly declined sides above paraterga (Fig. 5L), broad, tips lying clearly below level of venter, usually rather vaguely tri- or quadrilobate laterally, without anterolaterals (Fig. 5A–D, M). Paraterga 2 strongly enlarged, directed ventrad (Fig. 5A, B, E, I), lateral margin broadly rounded, with numerous, very small lobulations, caudal margin with a few lobes located near schism, both schism and hyposchism being small (Fig. 5B). Tergal setae very short, 2-segmented, apical part usually phylloid (Fig. 5P, Q). Pore formula normal, ozopores distinct, located dorsally on small porosteles in posterior 1/3 of paratergite and well removed from lateral margin (Fig. 5A–D, M). Epiproct finger-shaped, densely tuberculate (Fig. 5D, G, J). Hypoproct subtrapeziform (Fig. 5J).

Sterna usually with a rather deep, narrow depression between coxae (Fig. 5I). Legs short and crassate, about half as long as body height (Fig. 5L), all podomeres except tarsi finely micropapillate (Figs 5R, 6A).

Gonopods (Fig. 6B) very simple. Coxae subquadrate, large, micropapillate and rather densely setose on lateral face, with only a small round lobe caudolaterally. Telopodite considerably longer than coxite, suberect, setose over its basal half until base of a prominent, spiniform, simple, distofemoral process (**dp**), the latter situated at about halfway along telopodite, acropodite strongly falcate, twisted, subacuminate, simple, devoid of outgrowths; seminal groove terminating subapically at base of a hairpad.

**Remark.** More information on this cave and its fauna can be found in Latella and Hu (2008) and in Latella and Zorzin (2008).

### *Eutrichodesmus trontelji* Golovatch, Geoffroy, Mauriès & VandenSpiegel, sp. n.

http://zoobank.org/7016E520-525A-4D21-A47D-83A850193D51
Figs 7–11

**Type material.** Holotype ♂ (MNHN JC 370), China, Guizhou Prov., Libo County, Libo, Cave Feng Dong, 07.III.1995, leg. P. Trontelj.

Paratypes: 1 ♂, 1 juv. ♀ (MNHN JC 370), 1 ♂ (SEM), same data, together with holotype.

Non-types: 1 ♂, 2 ♀, 11 subadult ♀ or juv. (MNHN JC 370), 1 ♂ (SEM), China, Guizhou Prov., Libo County, Shuipa, Cave Shui Jiang Dong – Cave Shuipu Da Dong, 28.II.1995, leg. P. Trontelj; 1 ♂ (MNHN JC 370), 1 ♂ (SEM), Guizhou Prov., Libo County, Jia Ban, Cave La Tai Dong, 06.III.1995, leg. P. Trontelj.

**Name.** In honour of Peter Trontelj, the collector.

**Diagnosis.** Differs from congeners by the particularly broad and moderately declivous paraterga which are set at about 45° to the vertical axis and continue the outline of the sides above paraterga, coupled with mostly 4-5 irregular rows of flat setigerous tubercles/bosses per metatergum, the calyx-shaped tergal setae, and the fairly complex gonopod (see also Key below).

**Description.** Length of adults ca 8-9 mm, width 1.2 and 2.2 mm (♂ paratype and one ♀ non-type from Shui Jiang Dong) to 1.5 and 2.5 mm (♂ holotype and other non-types) on midbody pro- and metazonae, respectively. Coloration entirely pallid, except some traces of reddish earth material on paraterga.

All characters as in *E. triangularis* sp. n., except as follows.

Body with 20 segments (♂, ♀), conglobation pattern typical of "doratodesmoids", volvation apparently being incomplete because of particularly broad and only moderately declivous paraterga. Antennae rather long and poorly clavate (Figs 7I, 9H, 11I). Collum not covering the head from above, fore margin clearly lobulate and slightly elevated, with abundant flat tubercles/bosses arranged in regular rows only at anterior and posterior margins. Metaterga behind collum with three transverse, rather irregular, mixostictic rows of similarly evident, rounded, setigerous tuberculations extending onto paraterga, usually about 10-11+10-11 per row (Figs 7A–G, 9A–F, 11A–G); middorsal regions of metaterga not elevated; caudomarginal lobulations numerous, usually evident across the dorsum (Figs 7A–D, 9A–C, 11A–D); limbus microcrenulate (Figs

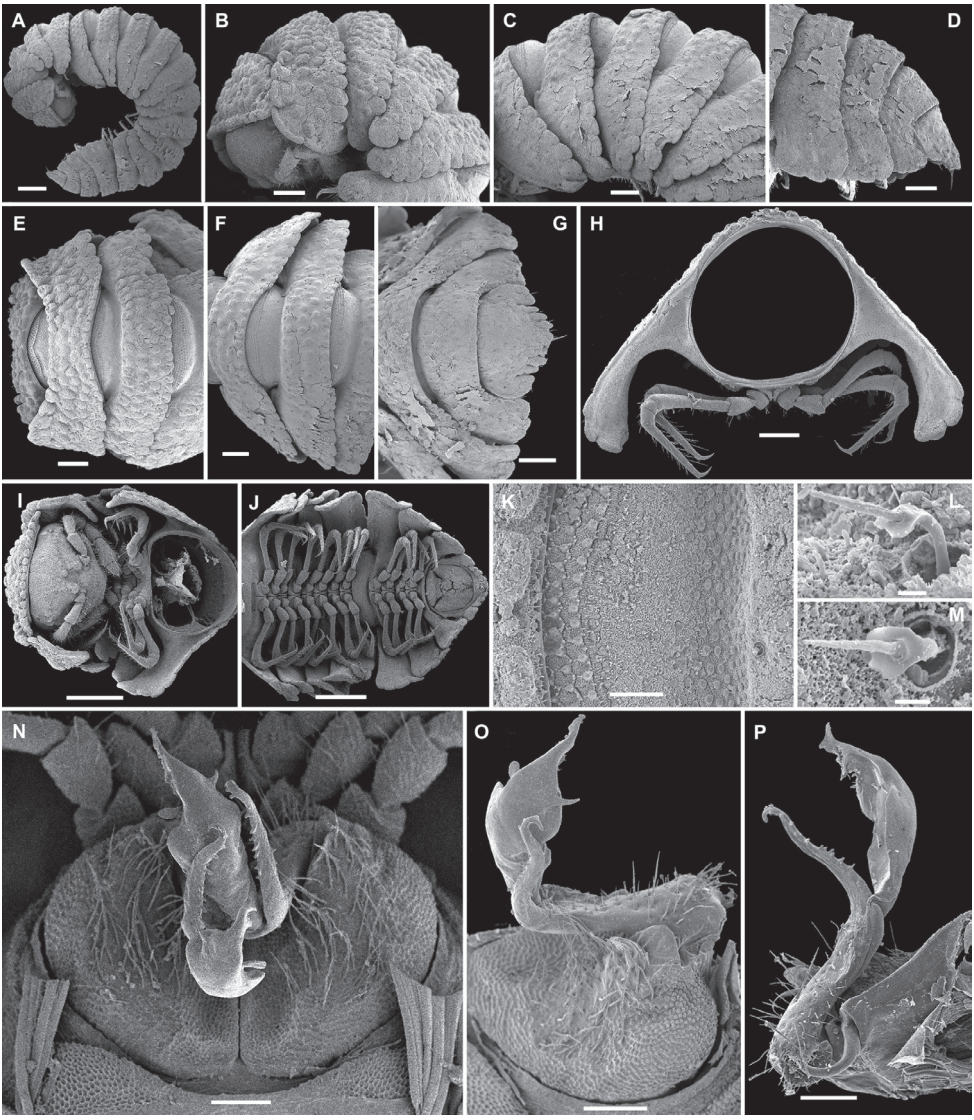


**Figure 7.** *Eutrichodesmus trontelji* sp. n., ♂ paratype; **A** habitus, lateral view **B, E, I** anterior part of body, lateral, dorsal and ventral views, respectively **C, F** midbody segments, lateral and dorsal views, respectively **D, G, J** posterior part of body, lateral, dorsal and ventral views, respectively **H** cross-section of a midbody segment, caudal view **K** limbus, prozonite texture and tergal setae, dorsal view **L, M** tergal seta, dorsolateral and subdorsal views, respectively **N** both gonopods in situ, ventral view **O, P** right gonopod, lateral and mesal views, respectively. Scale bars: 0.5 mm (**A, I, J**), 0.2 mm (**B–H**), 0.1 mm (**N–P**), 0.05 mm (**K**), 0.005 mm (**L, M**).

7K, 9N, 11K). Paraterga with evident shoulders anteriorly, very broad, moderately declivous, directed ventrolaterad at about 45° to similarly declined sides above paraterga (Figs 7H, 9K, 11H), tips lying very clearly below level of venter, usually rather vaguely

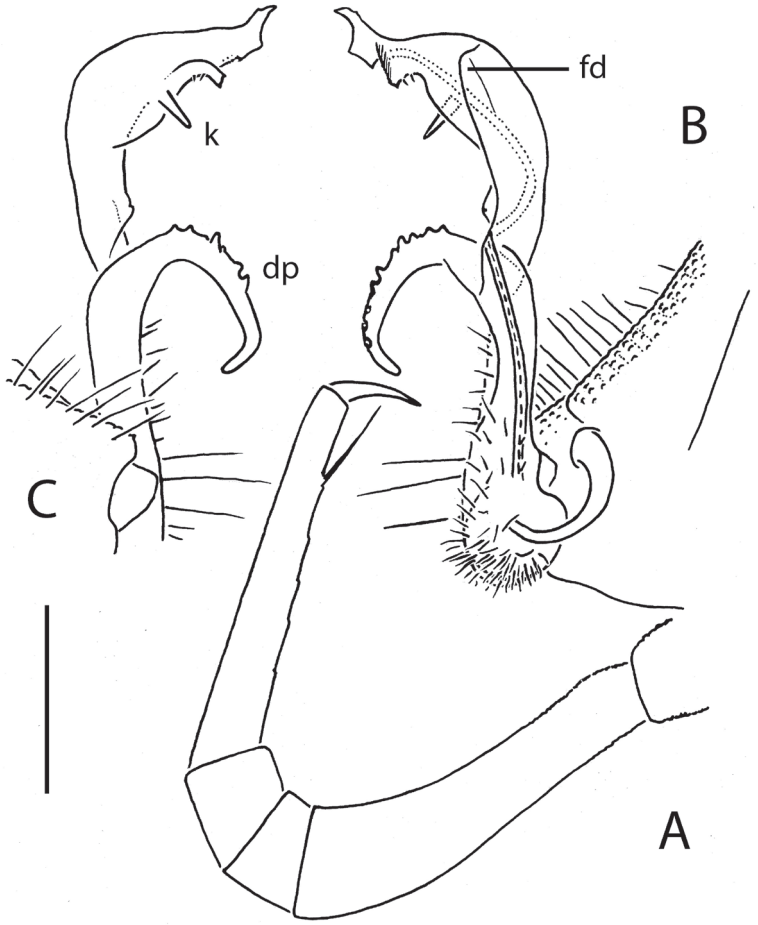


**Figure 8.** *Eutrichodesmus trontelji* sp. n., ♂ paratype; **A** leg 9, lateral view **B, C** right gonopod, mesal view. Scale bar: 0.2 mm. Designations in text.

uni- to quadrilobate laterally, gradually increasing in number towards paraterga 19; anterolaterals usually wanting, but evident on segment 2 (Figs 7A-D, 9A-C, 11A-D). Paraterga 2 strongly enlarged, directed ventrad (Figs 7A, B, E, I, 9A, D, H, 11A, B, E, I), lateral margin broadly rounded, with few, but evident lobulations; a full row of caudolaterals located above schism, both schism and hyposchism being small (Figs 7B, 9A, 11B). Tergal setae short, 2-segmented, calyx-shaped, apical part setoid (Figs 7L, M, 9L–O, 11L). Pore formula normal, ozopores indistinct, located at about halfway of paratergite and well removed from lateral margin. Epiproct strongly flattened dorsoventrally, densely tuberculate (Figs 7A, D, G, J, 9C, F, J, 11A, D, G, J). Hypoproct subtrapeziform (Figs 7J, 9J, 11J).

Sterna usually with a rather deep, narrow depression between coxae (Figs 7I, J, 9I, 11I, J). Legs long and slender, about 1.1–1.2 times as long as body height (Figs 7H, J, 9I, K, 11H–J), only coxae and basal parts of prefemora finely micropapillate (Fig. 8A).


**Figure 9.** *Eutrichodesmus trontelji* sp. n., ♂ non-type from Shui Jiang Dong; **A, D, H** anterior part of body, lateral, dorsal and ventral views, respectively; **B, E, I,** midbody segments, lateral, dorsal and ventral views, respectively **C, F, G, J** posterior part of body, lateral, dorsal, caudal and ventral views, respectively **K** cross-section of a midbody segment, caudal view **L-P** limbus, prozonite texture and tergal setae, dorsal views **Q** both gonopods in situ, ventral view **R** right gonopod, mesal view **S** distal half of right gonopod, mesal view. Scale bars: 0.5 mm (**E, I**), 0.2 mm (**A–D, F, H, K**), 0.1 mm (**G, J, Q, R**), 0.05 mm (**P, S**), 0.02 mm (**L–N**), 0.005 mm (**O**).

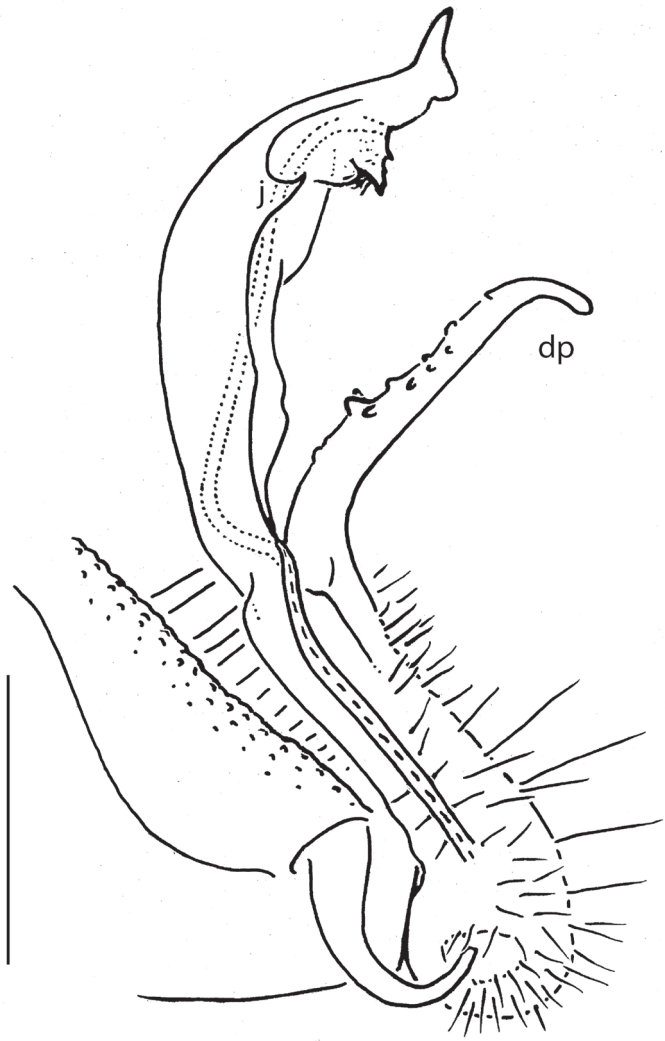


**Figure 10.** *Eutrichodesmus trontelji* sp. n., ♂ non-type from Shui Jiang Dong, left gonopod, mesal view. Scale bar: 0.2 mm. Designations in text.

Gonopods (Figs 7N–P, 8B, C, 9Q–S, 10, 11M–O) complex. Coxae subquadrate, large, micropapillate and densely setose on lateral face, with only a small round lobule caudolaterally. Telopodite considerably longer than coxite, moderately curved ventrad, setose over its basal 1/3 until base of a prominent, subspiniform, microtuberculate, sometimes clearly curved, distofemoral process (**dp**), the latter situated at about halfway of telopodite, acropodite twisted, with a longitudinal mesal fold (**fd**) only sometimes extended into an apical tooth (**j**) (non-types), and with (holo- and paratype) or without (non-types) a small ventral tooth (**k**) at about midway; tip acuminate and axe-shaped; seminal groove terminating subapically on an indistinct hairpad.

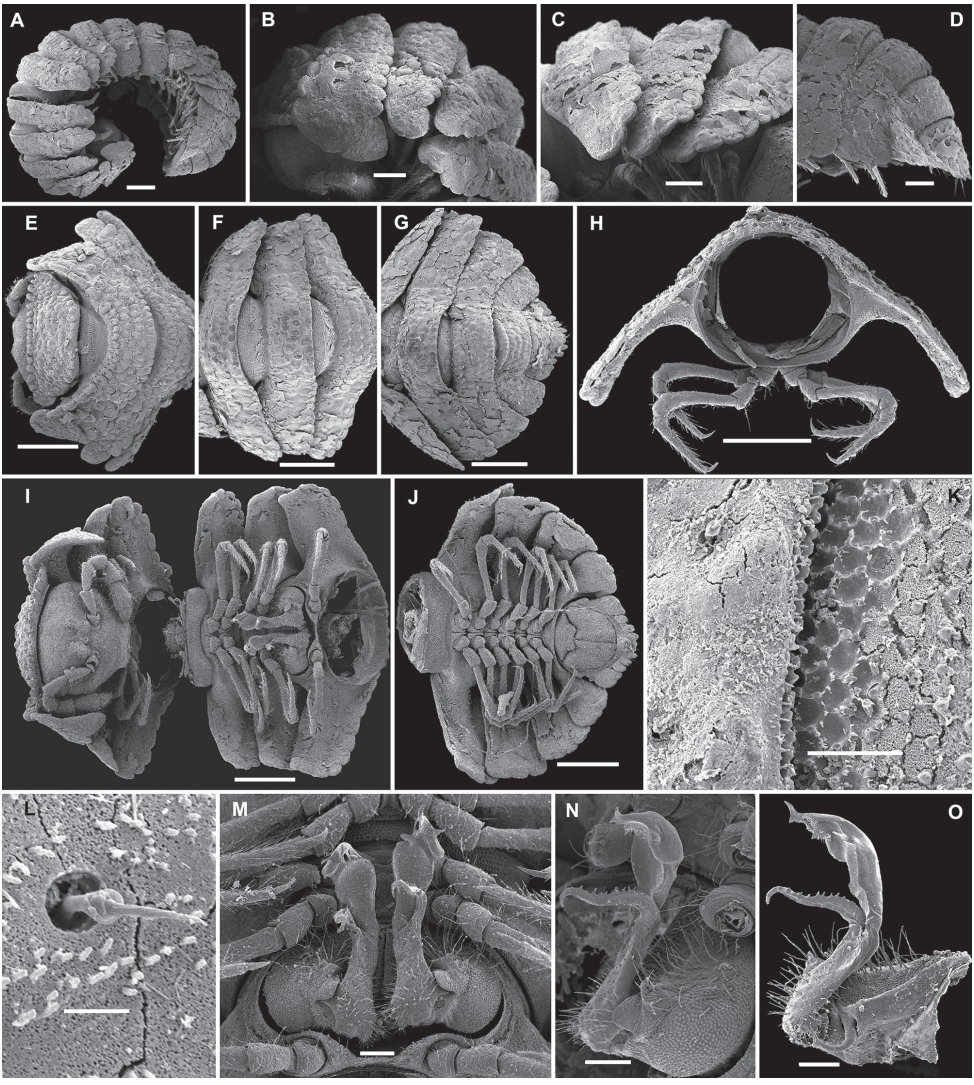


**Figure 11.** *Eutrichodesmus trontelji* sp. n., ♂ non-type from La Tai Dong; **A** habitus, lateral view **B, E, I** anterior part of body, lateral, dorsal and ventral views, respectively **C, F** midbody segments, lateral and dorsal views, respectively **D, G, J** posterior part of body, lateral, dorsal and ventral views, respectively **H** cross-section of a midbody segment, caudal view **K** limbus, prozonite texture and tergal setae, dorsal view **L** tergal seta, subdorsal view **M** both gonopods in situ, ventral view **N** left gonopod, lateral view **O** right gonopod, mesal view. Scale bars: 0.5 mm (**A, E–J**), 0.2 mm (**B–D**), 0.1 mm (**M–O**), 0.05 mm (**K**), 0.01 mm (**L**).

**Remarks.** The conspecificity of the non-type samples with *E. trontelji* sp. n. is documented in Figs 9–11. It is also corroborated by provenance from the same karst in Libo County, Guizhou Province. Small variations seem to only concern gonopod structure, i.e. the presence in the gonopods of the types of a small tooth **k** and the absence of a tooth **j**.

Interestingly, calyx-shaped tergal setae among *Eutrichodesmus* are also observed only in two cavernicolous species from Guangxi: *E. latus* and *E. similis* (see Golovatch et al. 2009a).

### *Eutrichodesmus latellai* Golovatch, Geoffroy, Mauriès & VandenSpiegel, sp. n.

http://zoobank.org/301C4BE2-3354-44DD-95CA-E58E7C830236
Figs 12, 13

**Type material.** Holotype ♂ (MNHN JC 371), China, Guizhou Prov., Zhen Feng County, Bei Pan Jiang Town, Cave Shui Chi Dong (Water Pool Cave), ca. 1060 m a.s.l., 31.VII.2005, leg. L. Latella & D. Avesani.

Paratypes: 1 ♂, 2 ♀ (MNHN JC 371), 1 ♀ (SEM), same data, together with holotype.

**Name.** In honour of Leonardo Latella, one of the main collectors.

**Diagnosis.** Differs from congeners by the broad and moderately declivous paraterga which are set at about 45° to the vertical axis and almost continue the outline of the sides above paraterga, coupled with three irregular rows of flat setigerous bosses per metatergum, and the especially simple gonopod (see also Key below).

**Description.** Length of adults ca 12–13 mm, width 1.1–1.2 and 2.8–3.0 mm on midbody pro- and metazonae, respectively (♂, ♀). Holotype ca 12 mm long, 1.2 and 3.0 mm wide on midbody pro- and metazonae, respectively. Coloration entirely pallid, except some traces of reddish earth material on terga.

All characters as in *E. triangularis* sp. n., except as follows.

Body with 20 segments (♂, ♀), conglobation pattern typical of "doratodesmoids", volvation apparently being incomplete because of particularly broad and only moderately declivous paraterga. Antennae rather long and poorly clavate (Fig. 12H). Collum not covering the head from above, fore margin clearly lobulate and slightly elevated, with abundant flat bosses arranged in regular rows only at anterior and posterior margins. Metaterga behind collum with three transverse, rather irregular, mixostictic rows of similarly flat, often obliterate and longitudinally oblong, setigerous bosses extending onto paraterga, usually about 15-16+15-16 per row (Fig. 12A–F); mid-dorsal regions of metaterga not elevated; caudomarginal lobulations numerous, usually evident across the dorsum (Fig. 12A–F, H, I); limbus microcrenulate (Fig. 12L). Paraterga with evident shoulders anteriorly, very broad, moderately declivous, directed ventrolaterad at about 45° to similarly declined sides above paraterga (Fig. 12A–G), tips lying clearly below level of venter, usually rather distinctly tri- to quadrilobate laterally, gradually increasing in number towards paraterga 19; anterolaterals usually wanting, but very evident on segment 2 (Fig. 12A, D). Paraterga 2 strongly enlarged, directed ventrad (Fig. 12A, D, H), lateral margin broadly rounded, with few, but very evident lobulations; a full row of caudolaterals located above schism, both schism and hyposchism being small (Fig. 12A). Tergal setae short, 2-segmented, apical part setoid (Fig. 12K). Pore

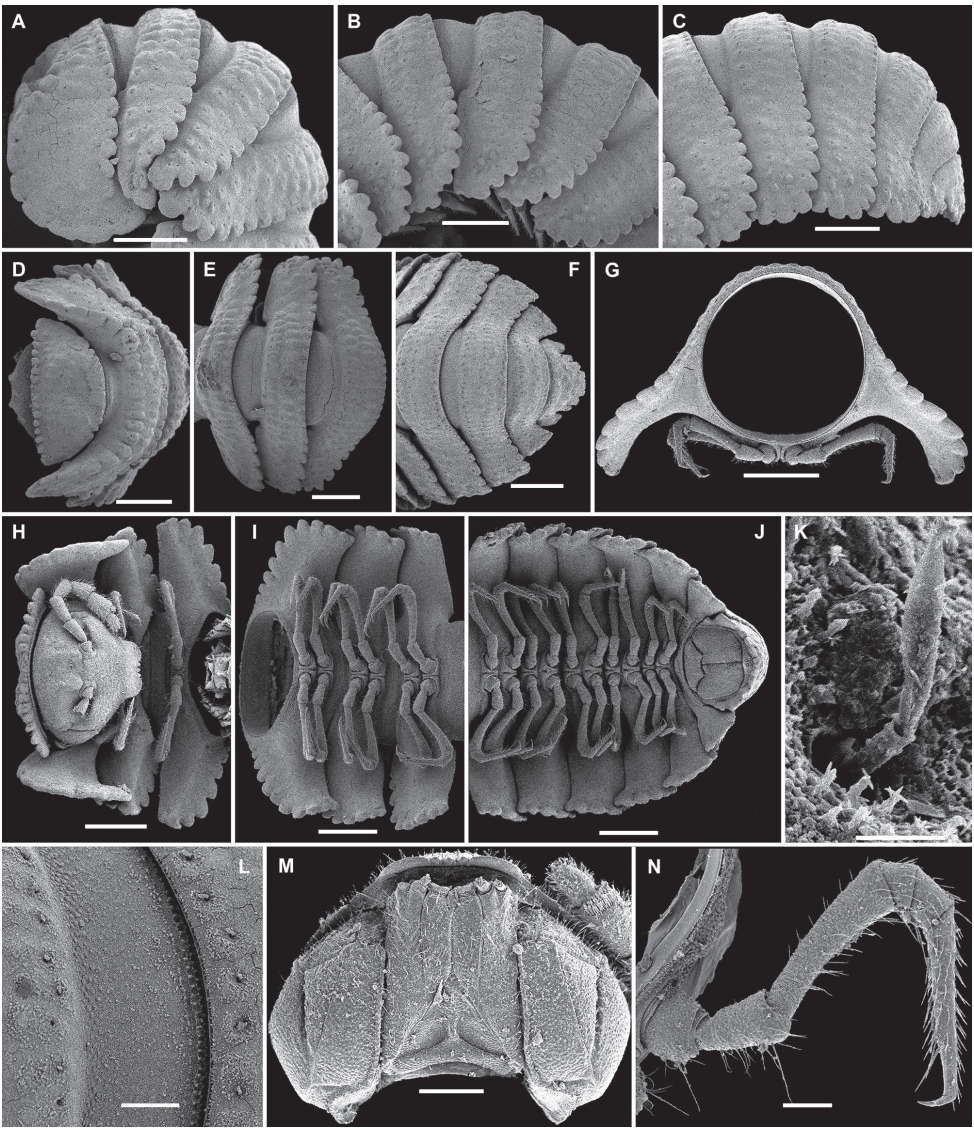


**Figure 12.** *Eutrichodesmus latellai* sp. n., ♀ paratype; **A, D, H** anterior part of body, lateral, dorsal and ventral views, respectively **B, E, I** midbody segments, lateral, dorsal and ventral views, respectively **C, F, J** posterior part of body, lateral, dorsal and ventral views, respectively **G** cross-section of a midbody segment, caudal view **K** tergal seta, subdorsal view **L** limbus, prozonite texture and tergal setae, dorsal views **M** head, ventral view **N** midbody leg, lateral view. Scale bars: 0.5 mm (**A–J**), 0.2 mm (**M**), 0.1 mm (**L, N**), 0.01 mm (**K**).

formula normal, ozopores indistinct, located on top of small knobs at about middle of paratergite and well removed from lateral margin (Fig. 12A–C). Epiproct strongly flattened dorsoventrally (Fig. 12C, F, J). Hypoproct subtrapeziform (Fig. 12J).

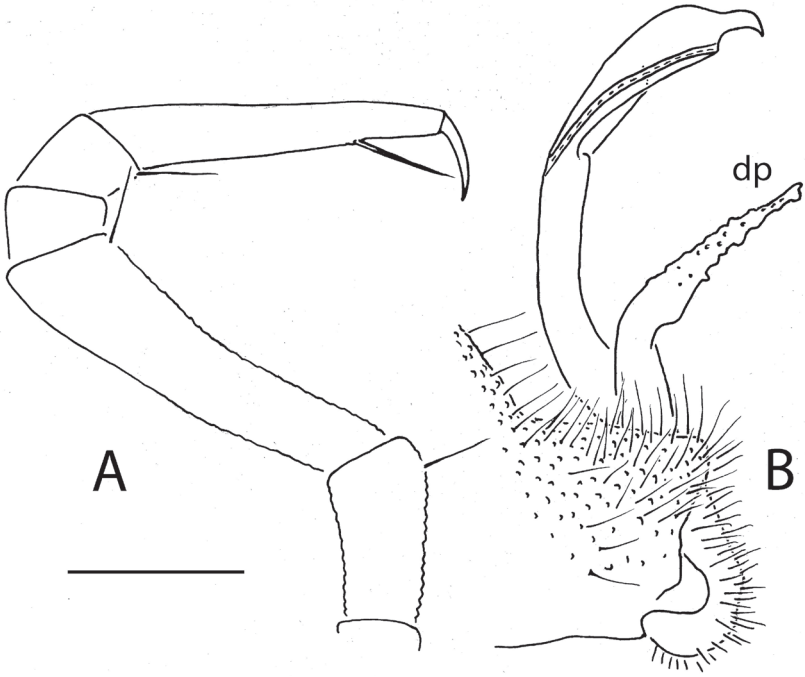


**Figure 13.** *Eutrichodesmus latellai* sp. n., ♂ paratype; **A** leg 9, lateral view **B** right gonopod, lateral view. Scale bar: 0.2 mm. Designation in text.

Sterna usually with a rather deep, narrow depression between coxae (Fig. 12I, J). Legs long and slender, about as long as body height (Fig. 12G–J), only coxae and most surface of of prefemora finely micropapillate (Figs 12N, 13A).

Gonopods (Fig. 13B) simple. Coxae subquadrate, large, micropapillate and densely setose on lateral face, with only a small round lobule caudolaterally. Telopodite considerably longer than coxite, moderately curved ventrad, setose over its basal 1/3 until base of a prominent, subspiniform, microtuberculate, distofemoral process (**dp**), the latter situated at about basal 1/3 of telopodite, acropodite twisted, devoid of any outgrowths; tip acuminate and beak-shaped; seminal groove terminating subapically; a hairpad wanting.

**Remark.** More information on this cave and its fauna can be found in Latella and Hu (2008) and in Latella and Zorzin (2008).

***Eutrichodesmus obliteratus* Golovatch, Geoffroy, Mauriès & VandenSpiegel, sp. n.**
http://zoobank.org/41C92D05-2DF5-4365-8F2D-170EA2D3EB5D
Figs 14, 15

**Type material.** Holotype ♂ (MNHN JC 372), China, Guizhou Prov., Guanling County, Huajiang Town, Cave Huashiban Dong (Slippery Cave), 26.VII.2005, leg. L. Latella & D. Avesani.

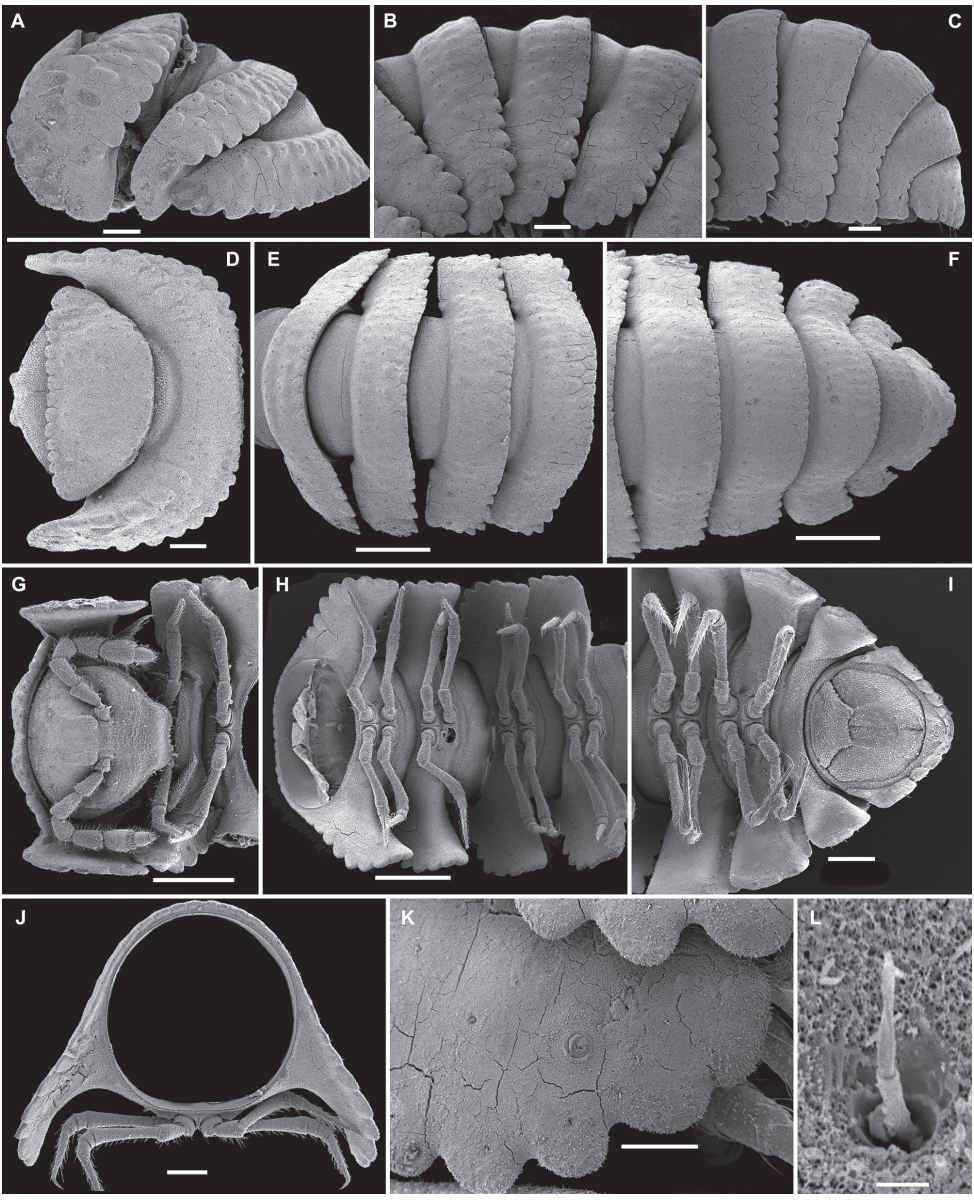


**Figure 14.** *Eutrichodesmus obliteratus* sp. n., ♀ paratype; **A, D, G** anterior part of body, lateral, dorsal and ventral views, respectively **B, E, H** midbody segments, lateral, dorsal and ventral views, respectively **C, F, I** posterior part of body, lateral, dorsal and ventral views, respectively **J** cross-section of a midbody segment, caudal view **K** paratergite with ozopore, lateral view **L** tergal seta, subdorsal view. Scale bars: 0.5 mm (**E–H**), 0.2 mm (**A–D, I, J**), 0.1 mm (**K**), 0.005 mm (**L**).

Paratypes: 1 ♂ (MNHN JC 372), 1 ♀ (SEM), same data, together with holotype.
**Name.** To emphasize the mostly obliterate metatergal tuberculation; adjective.

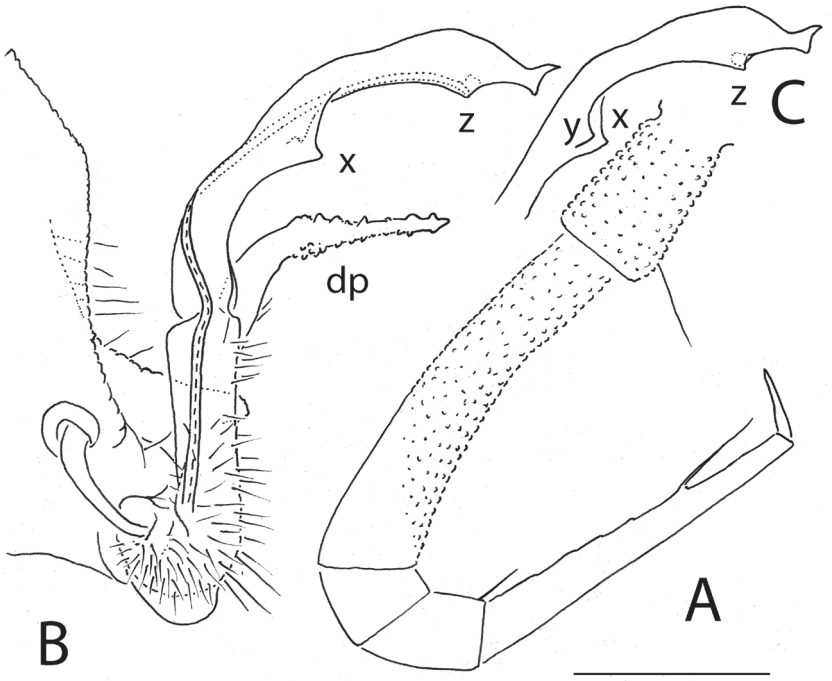


**Figure 15.** *Eutrichodesmus obliteratus* sp. n., ♂ paratype; **A** leg 9, lateral view **B** right gonopod, mesal view **C** mirrored distal half of right gonopod, lateral view. Scale bar: 0.2 mm. Designations in text.

**Diagnosis.** Differs from congeners by the largely obliterate metatergal tuberculation (even those at the fore margin of metetergum 2), the rather broad and strongly declivous paraterga which are set at about 30° to the vertical axis and continue the outline of the sides above paraterga, coupled with three irregular rows of very flat setigerous bosses per metatergum, and the fairly complex gonopod telopodite (see also Key below).

**Description.** Length of adults ca 10 mm, width 1.0–1.1 and 2.1–2.2 mm on midbody pro- and metazonae, respectively (♂, ♀). Holotype ca 1.1 and 2.2 mm wide on midbody pro- and metazonae, respectively. Coloration entirely pallid.

All characters as in *E. triangularis* sp. n., except as follows.

Body with 20 segments (♂, ♀), conglobation pattern typical of "doratodesmoids", volvation apparently being incomplete because of broad and only rather strongly declivous paraterga. Antennae rather long and poorly clavate (Fig. 14G). Collum not covering the head from above, fore margin clearly lobulate and slightly elevated, with abundant, flat, mostly obliterate bosses arranged in a regular row of lobulations only at anterior margin (Fig. 14A, D, G). Metaterga behind collum with three transverse, rather irregular, mixostictic rows of similarly flat, largely obliterate, longitudinally oblong, setigerous bosses extending onto paraterga, usually about 13-14+13-14 per row (Fig. 14A–F); mid-dorsal regions of metaterga not elevated; caudomarginal lobulations numerous, usually evident across the dorsum (Fig. 14A–F); limbus microcrenu-

late. Paraterga with evident shoulders anteriorly, very broad, rather strongly declivous, directed ventrolaterad at about 70° to similarly declined sides above paraterga (Fig. 14J), tips lying clearly below level of venter, usually rather distinctly tri- to quadrilobate laterally, gradually increasing in number towards paraterga 19; anterolaterals usually wanting, even on segment 2 rather vague (Fig. 14A, G). Paraterga 2 strongly enlarged, directed ventrad (Fig. 14A, D, H), lateral margin broadly rounded, with few, rather vague lobulations; a full row of caudolaterals located above schism, both schism and hyposchism being small (Fig. 14A). Tergal setae short, 2-segmented, apical part setoid (Fig. 14L). Pore formula normal, ozopores indistinct, open flush on surface and located at about caudal 1/3 of paratergite and well removed from lateral margin (Fig. 14K). Epiproct strongly flattened dorsoventrally (Fig. 14C, F, I). Hypoproct subtrapeziform (Fig. 14I).

Sterna usually with a rather deep, narrow depression between coxae (Fig. 14G–I). Legs long and slender, about as long as body height (Figs 14G–J, 15A), only coxae and most surface of prefemora finely micropapillate (Fig. 15A).

Gonopods (Fig. 15B, C) rather complex. Coxae subquadrate, large, micropapillate and densely setose on lateral face, with only a small round lobe caudolaterally. Telopodite considerably longer than coxite, moderately curved ventrad, setose over its basal 1/3 until base of a prominent, subspiniform, abundantly microtuberculate, distofemoral process (**dp**), the latter situated at about basal 1/3 of telopodite, acropodite twisted, in basal 1/3 with two small, flat, subtriangular teeth, one, larger, mesal (**x**), the other, smaller, lateral (**y**); tip acuminate and axe-shaped; seminal groove terminating subapically on another low, subtriangular tooth (**z**); a hairpad wanting.

**Remark.** More information on this cave and its fauna can be found in Latella and Hu (2008) and in Latella and Zorzin (2008).

### *Eutrichodesmus sketi* Golovatch, Geoffroy, Mauriès & VandenSpiegel, sp. n.

http://zoobank.org/2CA87D80-05A2-4BF9-A70E-1DAB4C79E1A7
Figs 16, 17

**Type material.** Holotype ♂ (MNHN JC 373), China, Hunan Prov., Longshan County, Huaoyan, Cave Feihu Dong (33a), 13.IV.1997, leg. B. Sket, Cao & R. Verovnik.

Paratype: 1 subadult ♀ (SEM), same data, together with holotype.

**Name.** In honour of Boris Sket, one of the main collectors.

**Diagnosis.** Differs from congeners by the relatively narrow and strongly declivous paraterga which are set low on the body at about 30° to the vertical axis and nearly continue the outline of the sides above paraterga, the low, but distinct, rounded, metatergal bosses arranged in three transverse irregular rows, and the rather simple gonopod (see also Key below).

**Description.** Length of holotype ca 7 mm, width 1.0 and 1.7 mm on midbody pro- and metazonae, respectively. Coloration entirely pallid.

All characters as in *E. triangularis* sp. n., except as follows.

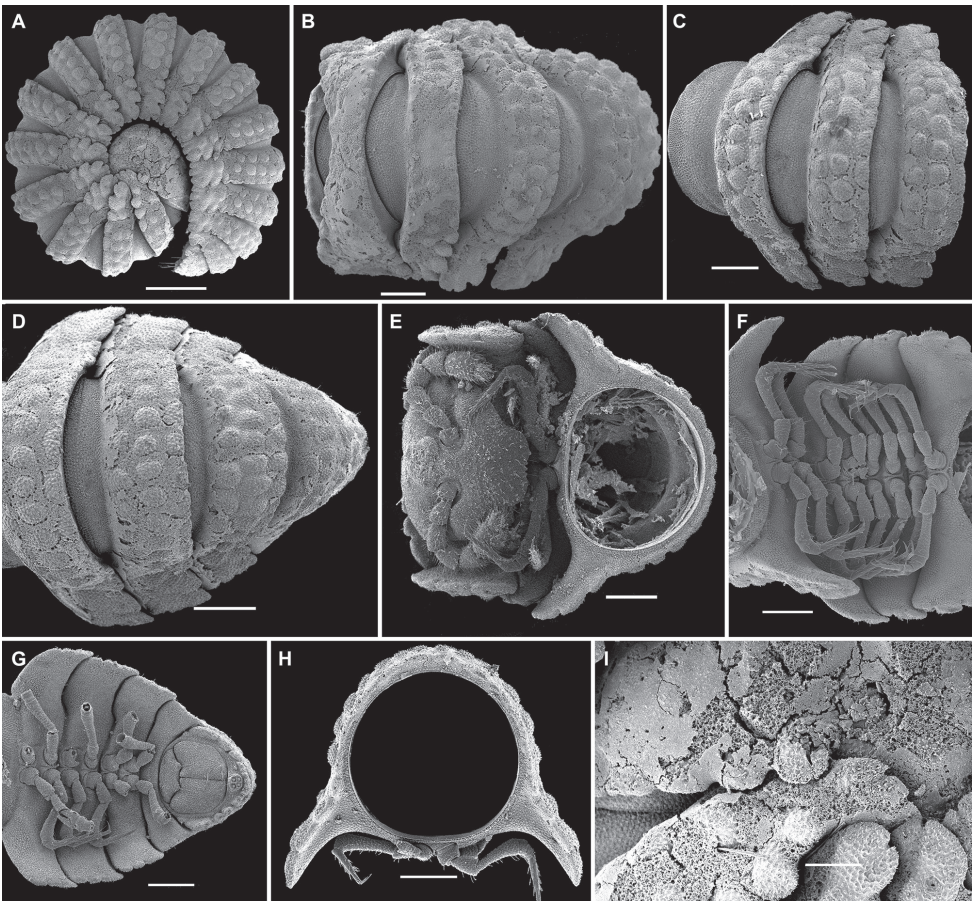


**Figure 16.** *Eutrichodesmus sketi* sp. n., subadult ♀ paratype; **A** habitus, lateral view **B, E** anterior part of body, dorsal and ventral views, respectively **C, F** midbody segments, dorsal and ventral views, respectively **D, G** posterior part of body, dorsal and ventral views, respectively **H** cross-section of a midbody segment, caudal view **I** schism and hyposchism region, lateral view. Scale bars: 0.5 mm (**A**), 0.2 mm (**B–H**), 0.1 mm (**I**).

Body with 20 segments (♂), conglobation pattern typical of "doratodesmoids", volvation apparently being complete because of narrow and strongly declivous paraterga. Antennae rather short and clavate (Fig. 16E). Collum not covering the head from above, fore margin clearly lobulate and slightly elevated, with abundant, flat, mostly obliterate bosses arranged in a regular row of lobulations only at anterior margin. Metaterga behind collum with three transverse, rather irregular, mixostictic rows of similarly flat, but rather distinct, rounded, setigerous bosses extending onto paraterga, usually about 9-10+9-10 per row (Fig. 16A); mid-dorsal regions of metaterga not elevated; caudomarginal lobulations numerous, usually evident across the dorsum (Fig. 16A–D); limbus microcrenulate. Paraterga with evident shoulders

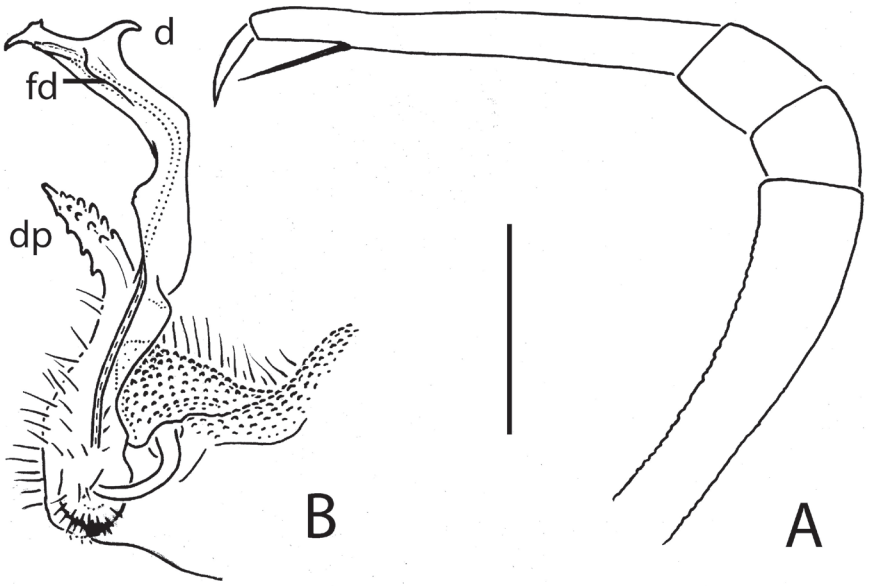


**Figure 17.** *Eutrichodesmus sketi* sp. n., ♂ holotype; **A** leg 9, lateral view **B** right gonopod, mesal view. Scale bar: 0.2 mm. Designations in text.

anteriorly, rather narrow, strongly declivous, directed ventrolaterad at about 70° to even more strongly declined sides above paraterga (Fig. 16E, H), tips lying clearly below level of venter, usually distinctly trilobate laterally; anterolaterals evident only in segment 2 (Fig. 16A). Paraterga 2 strongly enlarged, directed ventrad (Fig. 16A, E), lateral margin broadly rounded, with few, rather distinct lobulations; a full row of caudolaterals located above schism, both schism and hyposchism being small (Fig. 16A, I). Tergal setae short, 2-segmented, apical part setoid (Fig. 16I). Pore formula normal, ozopores indistinct, open flush on surface and located at about caudal 1/3 of paratergite above caudal lobulation and well removed from lateral margin (Fig. 16A, I). Epiproct strongly flattened dorsoventrally (Fig. 16D, G). Hypoproct subtrapeziform (Fig. 16G).

Sterna usually with a rather deep, narrow depression between coxae (Fig. 16G–I). Legs long and slender, about as long as body height (Fig. 16F, G), only coxae and most surface of prefemora finely micropapillate (Fig. 17A).

Gonopods (Fig. 17B) rather simple. Coxae subquadrate, large, micropapillate and densely setose mostly on lateral face, with only a small round lobe caudolaterally. Telopodite considerably longer than coxite, moderately curved ventrad, setose over its basal 1/3 until base of a prominent, subspiniform, stout, abundantly microtuberculate, distofemoral process (**dp**), the latter situated at about basal 1/3 of telopodite, acropodite twisted, distal 1/3 with a small mesal fold (**fd**) and a strong, recurved, ventral tooth (**d**); tip acuminate and axe-shaped; seminal groove terminating subapically; a hairpad wanting.

***Eutrichodesmus apicalis*** **Golovatch, Geoffroy, Mauriès & VandenSpiegel, sp. n.**
http://zoobank.org/3A82B084-C569-477F-AF3A-C305E8C37745
Figs 18, 19

**Type material.** Holotype ♂ (MNHN JC 374), China, Hubei Prov., Yishang Yichang County, Grotte des Araignées, 15.VIII.1992, leg. J. Lips (K1-2).

Paratype: 1 ♂ (SEM), same data, together with holotype.

**Name.** To emphasize the apical termination of the seminal groove; adjective.

**Diagnosis.** Differs from congeners by the relatively narrow and strongly declivous paraterga which are set low on the body at about 40° to the vertical axis and distinctly discontinue the subvertical outline of the sides above paraterga, coupled with narrow paraterga which only slightly overreach the level of the venter, the low, but distinct, rounded, metatergal tuberculations arranged in three transverse irregular rows, and the rather complex gonopod (see also Key below).

**Description.** Length of holotype ca 7 mm, width 0.6 and 1.0 mm on midbody pro- and metazonae, respectively. Coloration entirely pallid.

All characters as in *E. triangularis* sp. n., except as follows.

Body with 20 segments (♂), conglobation pattern typical of "doratodesmoids", volvation apparently being complete because of narrow and strongly declivous paraterga. Antennae rather short and clavate (Fig. 18G, J). Collum not covering the head from above, fore margin clearly lobulate and slightly elevated, with abundant, mostly distinct bosses or tuberculations arranged in regular rows of lobulations only at anterior and posterior margins. Metaterga behind collum with three transverse, rather irregular, mixostictic rows of similarly distinct, rounded, setigerous tuberculations extending onto paraterga, usually about 6-7+6-7 per row (Fig. 18A–F); middorsal regions of metaterga not elevated; caudomarginal lobulations few, usually evident only near bases of paraterga (Fig. 18A–C); limbus microcrenulate (Fig. 18M). Paraterga with evident shoulders anteriorly, rather narrow, strongly declivous, directed ventrolaterad at about 40° to even more strongly declined, subvertical sides above paraterga (Fig. 18K), tips lying only slightly below level of venter, usually distinctly trilobate laterally; anterolaterals evident only in segment 2 (Fig. 18A, D). Paraterga 2 strongly enlarged, directed ventrad (Fig. 18A, D, G), lateral margin broadly rounded, with few, rather distinct lobulations; a full row of caudolaterals located above schism, both schism and hyposchism being small (Fig. 18A). Tergal setae short, apparently 2-segmented. Pore formula apparently normal, ozopores indistinct. Epiproct strongly flattened dorsoventrally (Fig. 18C, I). Hypoproct subtrapeziform (Fig. 18I).

Sterna usually with a rather deep, narrow depression between coxae (Fig. 18H). Legs rather short, but slender, nearly as long as body height (Fig. 18H, K), only coxae and most surface of prefemora finely micropapillate.

Gonopods (Figs 18N, O, 19) rather complex. Coxae subquadrate, large, micropapillate and setose on lateral face, with a small, truncate, setigerous tooth caudolater-

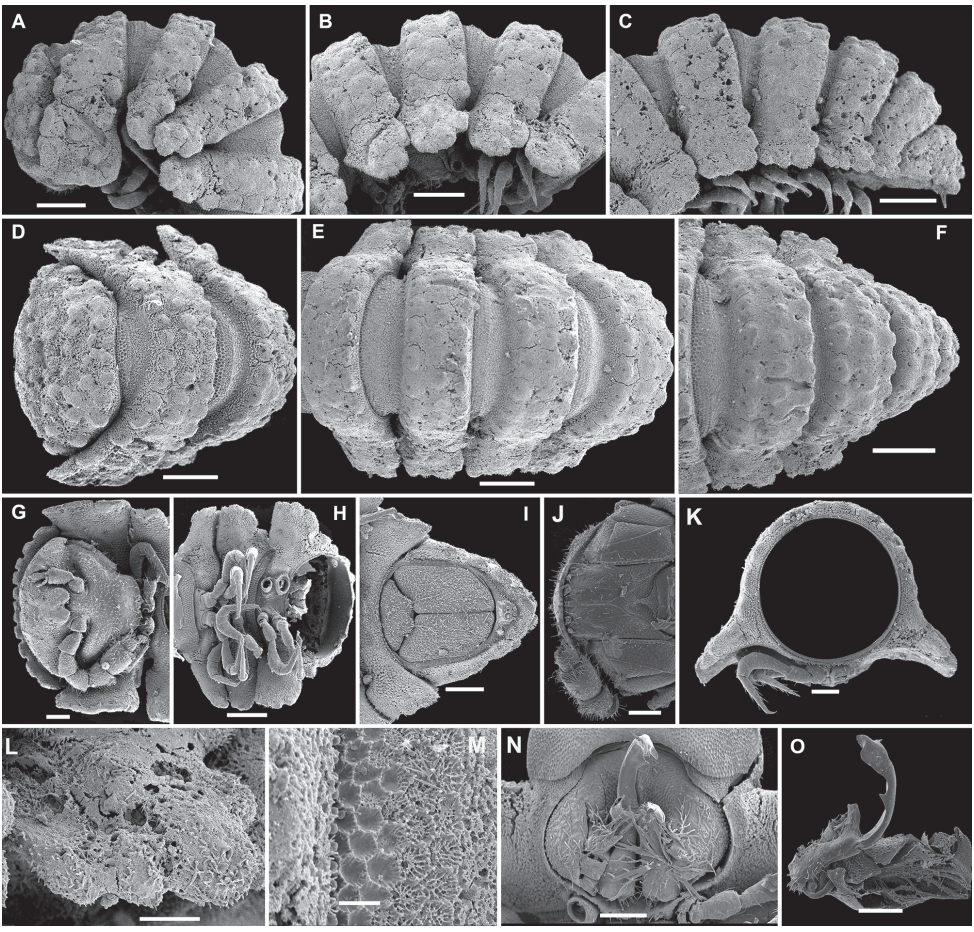


**Figure 18.** *Eutrichodesmus apicalis* sp. n., ♂ paratype; **A, D, G** anterior part of body, lateral, dorsal and ventral views, respectively **B, E, H** midbody segments, lateral, dorsal and ventral views, respectively **C, F, I** posterior part of body, lateral, dorsal and ventral views, respectively **J** head, ventral view **K** cross-section of a midbody segment, caudal view **L** midbody paratergite, lateral view **M** limbus and prozonite texture, dorsal view **N** both gonopods in situ, ventral view **O** right gonopod, mesal view. Scale bars: 0.2 mm (**A–F, H**), 0.1 mm (**G, I–K, N, O**), 0.05 mm (**L**), 0.02 mm (**M**).

ally. Telopodite considerably longer than coxite, moderately curved ventrad, setose nearly over its basal half until base of a prominent, subspiniform, microtuberculate, subapically micropilose, distofemoral process (**dp**), the latter situated at about basal 1/3 of telopodite, acropodite twisted, with a small, midway, dorsomesal (**x**) and a stronger, subapical, ventral tooth (**d**), the latter located opposite a rounded lobe (**z**); tip subtruncate; seminal groove terminating apically; a hairpad wanting.

**Remark.** More information on the location of the cave can be found at http://www.groupe-speleo-vulcain.com/explorations/expeditions-a-letranger/

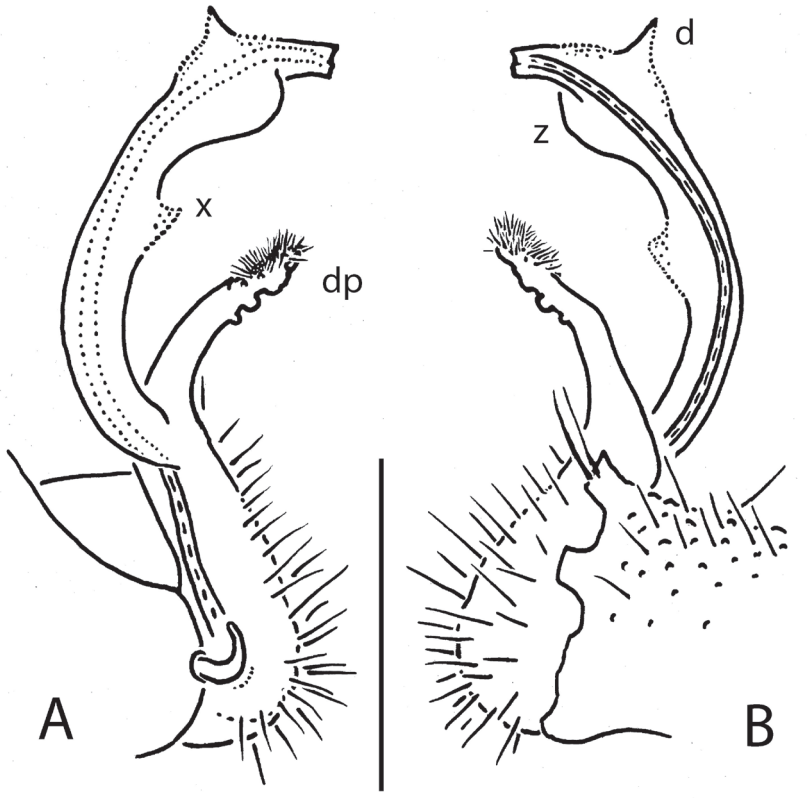


**Figure 19.** *Eutrichodesmus apicalis* sp. n., ♂ holotype; **A, B** left gonopod, mesal and lateral views, respectively. Scale bar: 0.2 mm. Designations in text.

***Eutrichodesmus troglobius* Golovatch, Geoffroy, Mauriès & VandenSpiegel, sp. n.**
http://zoobank.org/BA529FEC-19CB-46E2-867D-B3621667978E
Figs 20, 21

**Type material.** Holotype ♂ (MNHN JC 375), China, Guizhou Prov., Kaiyang, Cave Xianyan Dong, 19.II.2004, leg. S. Prevorčnik & B. Sket.

Paratypes: 1 ♂, 2 ♀, 2 subadult ♀ (MNHN JC 375), 1 ♀ (SEM), same data, together with holotype.

**Name.** To emphasize cavernicoly; adjective.

**Diagnosis.** Differs from congeners by the relatively broad and modestly declivous paraterga which are set low on the body at about 45° to the vertical axis and distinctly discontinue the more strongly declined outline of the sides above paraterga, coupled with low, but distinct, mostly longitudinally oblong, metatergal tuberculations arranged in three transverse irregular rows, and the rather simple gonopod acropodite which only shows a small distodorsal tooth (see also Key below).

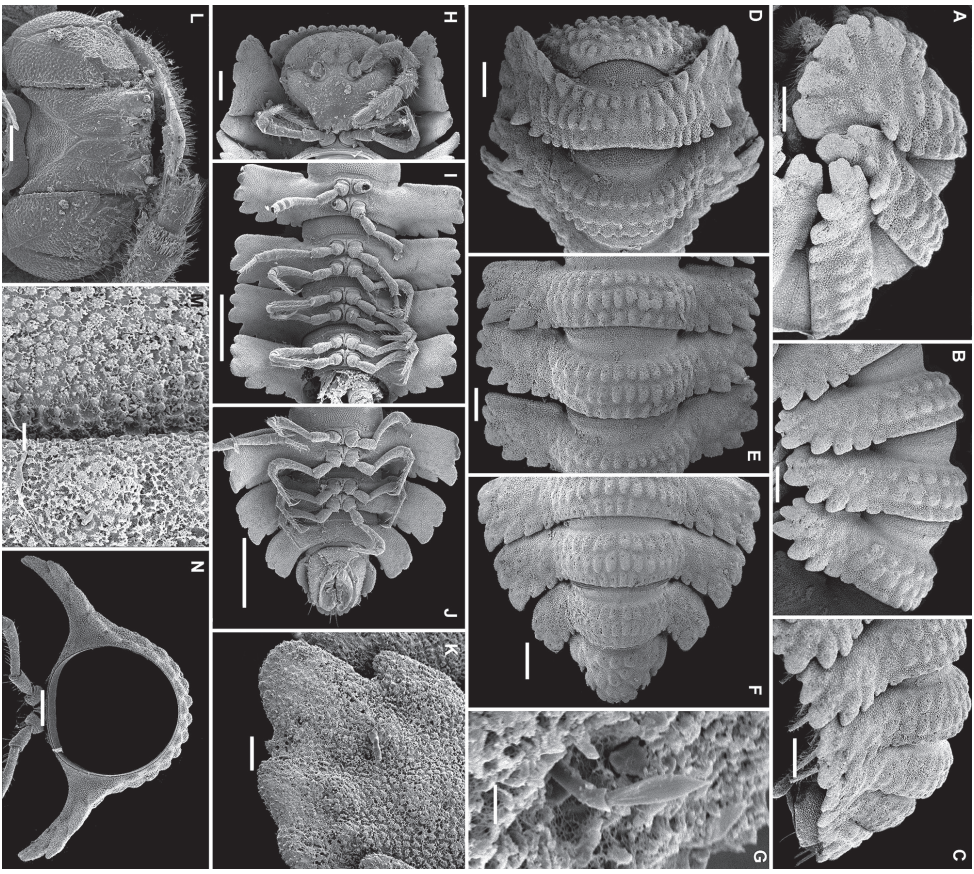


**Figure 20.** *Eutrichodesmus troglobius* sp. n., ♀ paratype; **A, D, H** anterior part of body, lateral, dorsal and ventral views, respectively **B, E, I** midbody segments, lateral, dorsal and ventral views, respectively **C, F, J** posterior part of body, lateral, dorsal and ventral views, respectively **G** tergal seta, subdorsal view **K** midbody paratergite, lateral view **L** head, ventral view **M** limbus and prozonite texture, dorsal view **N** cross-section of a midbody segment, caudal view. Scale bars: 0.5 mm (**I, J**), 0.2 mm (**A–F, H, N**), 0.1 mm (**L**), 0.02 mm (**M**).

**Description.** Length of adults ca 8–9 mm, width 1.0 and 1.9–2.0 mm on midbody pro- and metazonae, respectively. Holotype ca 9 mm long, 1.0 and 2.0 mm wide on pro- and metazonae, respectiverly. Coloration entirely pallid.

All characters as in *E. triangularis* sp. n., except as follows.

Body with 20 segments (♂, ♀), conglobation pattern typical of "doratodesmoids", volvation apparently being incomplete because of broad and modestly declivous paraterga. Antennae rather long and poorly clavate (Fig. 20H, L). Collum not covering the head from above, fore margin clearly lobulate and slightly elevated, with abundant distinct tuberculations arranged in regular rows, but lobulations observed only at anterior margin. Metaterga behind collum with three transverse, rather irregular, mixostictic

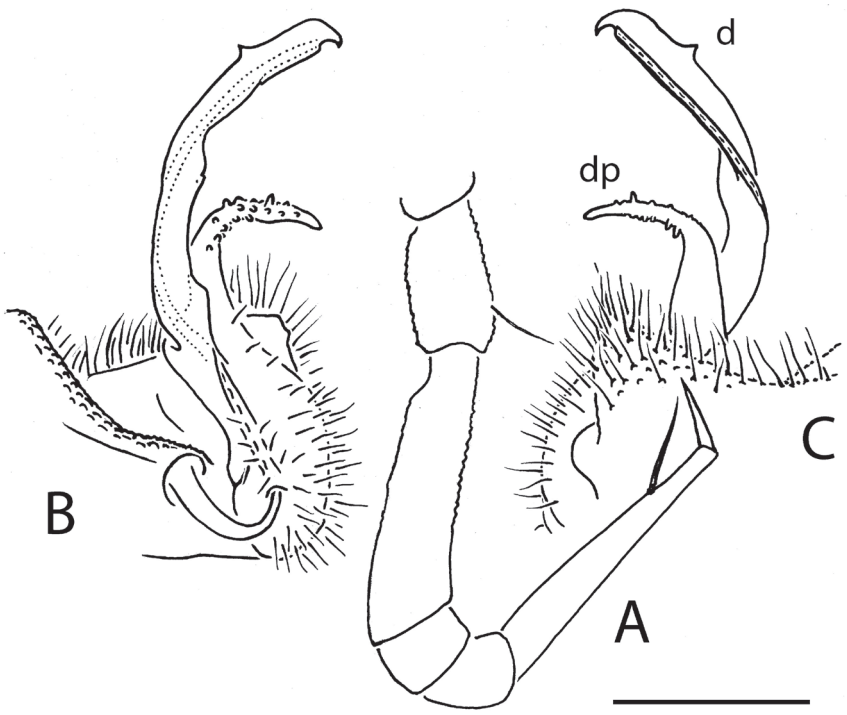


**Figure 21.** *Eutrichodesmus troglobius* sp. n., ♂ paratype; **A** leg 9, lateral view **B, C** left gonopod, mesal and lateral views, respectively. Scale bar: 0.2 mm. Designations in text.

rows of similarly distinct, longitudinally oblong, setigerous tuberculations extending onto paraterga, usually about 8-10+8-10 per row (Fig. 20A–F); mid-dorsal regions of metaterga not elevated; caudomarginal lobulations numerous, 2-3 more evident ones only on paraterga (Fig. 20A–F); limbus microcrenulate (Fig. 20M). Paraterga with evident shoulders anteriorly, broad, modestly declivous, directed ventrolaterad at about 45° to even more strongly declined sides above paraterga (Fig. 20N), tips lying clearly below level of venter, usually distinctly trilobate laterally; anterolaterals evident only in segment 2 (Fig. 20A, D). Paraterga 2 strongly enlarged, directed ventrad (Fig. 20A, D, H), lateral margin broadly rounded, with few, but very distinct lobulations; a full row of similarly large caudolaterals located above schism, both schism and hyposchism being small (Fig. 20A). Tergal setae short, 2-segmented, apical part setoid (Fig. 20G). Pore formula apparently normal, ozopores indistinct. Epiproct strongly flattened dorsoventrally and tuberculate dorsally (Fig. 20C, F, J). Hypoproct subtrapeziform (Fig. 20J).

Sterna usually with a rather deep, narrow depression between coxae (Fig. 20I, J). Legs long and slender, 1.1-1.2 times as long as body height (Fig. 20I, J, N), only coxae and most surface of prefemora finely micropapillate (Fig. 21A).

Gonopods (Fig. 21B, C) rather simple. Coxae subquadrate, large, micropapillate and setose mostly on lateral face, with a small, subtriangular, setigerous tooth caudola-

terally. Telopodite considerably longer than coxite, moderately and regularly curved ventrad, setose nearly over its basal half until base of a prominent, curved, subspiniform, abundantly microtuberculate, distofemoral process (**dp**), the latter situated at about basal 1/3 of telopodite, acropodite twisted, with a small, subapical, ventral tooth (**d**); seminal groove terminating subapically; a hairpad wanting.

## Conclusion

The nine new species described here are presumed to be troglobites, as all were collected in caves and all are troglonorphic as evidenced by unpigmented teguments. Their discovery supports the ideas that *Eutrichodesmus* is one of the most speciose millipede genera in China, that the true cavernicoles among *Eutrichodesmus* species are mainly confined to southern China's karsts, and that many more Chinese *Eutrichodesmus* species are yet to be collected and described.

**Key to *Eutrichodesmus* species currently known to occur in mainland China**

1 Each postcollum metatergum with only two transverse rows of tuberculations or bosses ..... **the *peculiaris*-group, 2**

– Each postcollum metatergum with at least three transverse rows of tuberculations or bosses ..... **4**

2 1+1 mid-dorsal tubercles only slightly higher than others and located only in 2nd row on segments 4-6(7). Zhejiang Province ..... ***E. pectinatidentis***

– Mid-dorsal tubercles much higher than others and located in both rows at least on segments 4-16(17) ..... **3**

3 Most of tuberculations on collum obliterated, retained only near lateral edge. Mid-dorsal tubercles on penultimate segment low, but evident, like a small crest. Chongqing Municipality ..... ***E. soesilae***

– Almost entire collum covered with tuberculations. Mid-dorsal tubercles on penultimate segment nearly wanting, flat, not crest-shaped. Fujian Province .. ..... ***E. anisodentus***

4 Adult body with 19 segments (Fig. 1). Distofemoral process (**dp**) of gonopod triangular and acuminate (Fig. 2)..... ***E. triangularis* sp. n.**

– Adult body with 20 segments. Distofemoral process of gonopod not triangular and acuminate ..... **5**

5 At least some metaterga increasingly strongly elevated mid-dorsally towards segment 17 or 18, with 1-2 outgrowths, projections or a ridge (e.g. Figs 3A–H, 5A–G). Three transverse rows of tuberculations or bosses per metatergum .... **6**

– No metaterga elevated mid-dorsally over others. Three or more transverse rows of tuberculations or bosses per metatergum ..... **10**

6 Mid-dorsal regions of metaterga increasingly strongly elevated towards segment 17 due to enlarged tubercles of middle row, thereafter smaller (Fig. 3A–H). Gonopod distofemoral process (**dp**) held subparallel to acropodite (Figs 3N–Q, 4) ..... ***E. lipsae* sp. n.**

– Mid-dorsal regions of metaterga increasingly strongly elevated towards segment 18. Gonopod distofemoral process held subrectangular to acropodite, gap between **dp** and acropodite being considerably wider ..... **7**

7 Metaterga 7-18 each with an increasingly evident mid-dorsal outgrowth/crest, bimodal due to clearly enlarged 1st and 2nd rows of tuberculations. Distofemoral process of gonopod microtuberculate ..... ***E. distinctus***

– Mid-dorsal crests on metaterga unimodal, subtriangular due to only 2nd row of tuberculations being clearly enlarged. Distofemoral process of gonopod a simple long spine ..... **8**

8 Paraterga narrow, subvertical (Fig. 5L). Gonopod acropodite strongly falcate, seminal groove terminating on a small, but evident hairpad (Fig. 6B). Guizhou ..... ***E. tenuis* sp. n.**

– Paraterga considerably broader, directed ventrolaterad. Gonopod acropodite only slightly curved ventrad, devoid of a hairpad. Yunnan ..... **9**

9 Metatergal tuberculations very small knobs. Gonopod acropodite clearly enlarged relative to distofemoral process, devoid of a distodorsal tooth ..... ***E. dorsiangulatus***

– Metatergal tuberculations mostly distinct. Gonopod acropodite slender, with a distodorsal tooth ..... ***E. monodentus***

10 At least some metaterga with tuberculations/bosses arranged in 4-5 transverse irregular rows ..... **11**

– All metaterga with only three transverse rows of tuberculations or bosses... **13**

11 Metaterga 2-13 each with four, following ones with five, rows of tuberculations or bosses,. Guangdong ..... ***E. digitatus***

– Metaterga with 3-5 rows of tuberculations or bosses, pattern of increase different ..... **12**

12 Each postcollum metatergum with 4-5 irregular rows of bosses (Figs 7A–G, 9A–F, 11A–G). Gonopod distofemoral process (**dp**) long and microtuberculate, acropodite with a mesal fold (**fd**), the latter sometimes extended into an apical tooth (**j**) (Figs 8B, C, 10) ..... ***E. trontelji* sp. n.**

– Metaterga with 3-4 rows of tuberculations or bosses. Gonopod distofemoral process (**dp**) short and simple, but acropodite enlarged, bipartite and more elaborate ..... ***E. planatus***

13 Paraterga narrow, set low on body, rather strongly declined ventrolaterad and more or less clearly discontinuing the outline of sides above paraterga ..... **14**

– Paraterga broad to very broad, set higher on body to (almost) continue the outline of sides above paraterga ..... **17**

14 Distofemoral process of gonopod a simple, strong, ventrobasally setose hook directed dorsad. Yunnan ..... ***E. arcicollaris***

– Distofemoral process of gonopod more elaborate ..... **15**

15 Seminal groove terminating apically, distofemoral process (**dp**) of gonopod micropilose apically (Fig. 19). Hubei ..... ***E. apicalis* sp. n.**
– Seminal groove terminating subapically, distofemoral process of gonopod devoid of micropilosity ..... **16**
16 Distofemoral process of gonopod bipartite, long and complex. Guizhou ..... ..... ***E. incisus***
– Distofemoral process (**dp**) of gonopod unipartite, short and microtuberculate (Fig. 17B). Hunan ..... ***E. sketi* sp. n.**
17 Paraterga very broad, each about as wide as prozonite. Guangxi..... **18**
– Paraterga considerably narrower than prozonite width..... 19
18 Collum devoid of a row of lobulations at fore margin ..... ***E. latus***
– Collum with a row of distinct lobulations at fore margin ..... ***E. similis***
19 Gonopod simple, but unusually strongly falcate. Hunan ..... ***E. spinatus***
– Gonopod only slightly to moderately curved ..... **20**
20 Distofemoral process of gonopod strongly appressed to a simple acropodite. Jiangxi ..... ***E. simplex***
– Distofemoral process of gonopod not appressed to often a more elaborate acropodite, gap between both parts being considerable. Guizhou ..... **21**
21 Gonopod acropodite complex, with a number of teeth (**x**, **y**, **z**), but without distodorsal tooth **d** (Fig. 15B, C) ..... ***E. obliteratus* sp. n.**
– Gonopod acropodite simple, at most with a small tooth **d**..... **22**
22 Gonopod acropodite with a small tooth **d** (Fig. 21B, C)....***E. troglobius* sp. n.**
– Gonopod acropodite devoid of considerable outgrowths (Fig. 13B)..... ..... ***E. latellai* sp. n.**

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RESEARCH ARTICLE

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# Corophiine amphipods of the genera *Chelicorophium* and *Paracorophium* from the lower Gulf of Thailand (Crustacea, Amphipoda, Corophiidae, Corophiinae)

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## Abstract

Two species of corophiine amphipods from Songkhla Lake, in the lower Gulf of Thailand, are described and illustrated. *Chelicorophium madrasensis* (Nayar, 1950), found in the mangrove forest, has not previously been observed in Thai waters. *Paracorophium angsupanichae* **sp. n.** is characterized by its chelate male gnathopod 2, obtuse palm with subrectangular distomedial elevation, and urosomites 1-3 free. This is the first record of the genus *Chelicorophium* and *Paracorophium* in Thai waters. All specimens are deposited in the Princess Maha Chakri Sirindhorn Natural History Museum, Prince of Songkla University, Thailand and the Museum für Naturkunde, Berlin.

## Keywords

Crustacea, Amphipoda, new species, taxonomy, Thai waters

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## Introduction

The subfamily Corophiinae was established by Bousfield and Hoover in 1997 and is defined by its gnathopods 1 and 2, together forming a sieving structure with dense sieving setae on the posterior margins of the carpus and ischium. Corophiinae are world wide distributed, most of them living in brackish or freshwater (Myers 2009). In Thai waters, only *Monocorophium acherusicum* (Costa, 1853) has been recorded in Songkhla Lake, the largest natural lagoon located in Southern Thailand (Angsupanich and Kuwabara 1995). This study focuses on the hitherto poorly known gammarid amphipods in the Gulf of Thailand. The first is a new corophiine species of *Paracorophium angsupanichae*, which was found in Songkhla Lake. The second is *Chelicorophium madrasensis* (Nayar, 1950), which has not been previously recorded in Thai waters. Figures and descriptions of both species are provided.

## Material and methods

Amphipods were collected from Songkhla Lake (Figure 1). The sites were visited at low tide, and amphipods were collected using a 20 × 20 cm Ekman grab. The amphipod specimens were sorted and fixed in formalin for one week and then stored in 70% alcohol. In the laboratory, the specimens were transferred from alcohol into glycerol for study. The drawings of body parts were accomplished using a drawing tube attached to an Olympus CH30 light microscope. The pencil drawings were scanned and digitally inked using a WACOM bamboo CTH-970 graphics board, following the method described in Coleman (2003). The following abbreviations are used: A, antenna; G, gnathopod; HD, head; LL, lower lip; MD, mandible; MX, maxilla; MP, maxilliped; P, pereopod; Pl, pleopod; T, telson; U, uropod; UR, urosome; UL, upper lip; r, right; l, left; ♂, male; and ♀, female. Specimens of different species were deposited in the Prince of Songkla University Zoological Collection (PSUZC) and the Museum für Naturkunde, Berlin (ZMB).

## Results

### Systematics

### Corophiidae Leach, 1814

### Corophiinae Leach, 1814

*Paracorophium* Stebbing, 1899.

**Diagnosis.** Labrum symmetrically incised, labium normal,with innerlobes. Maxilla 1: inner lobe small, palp 2-articulate. Maxilliped: inner margin of outer lobe with

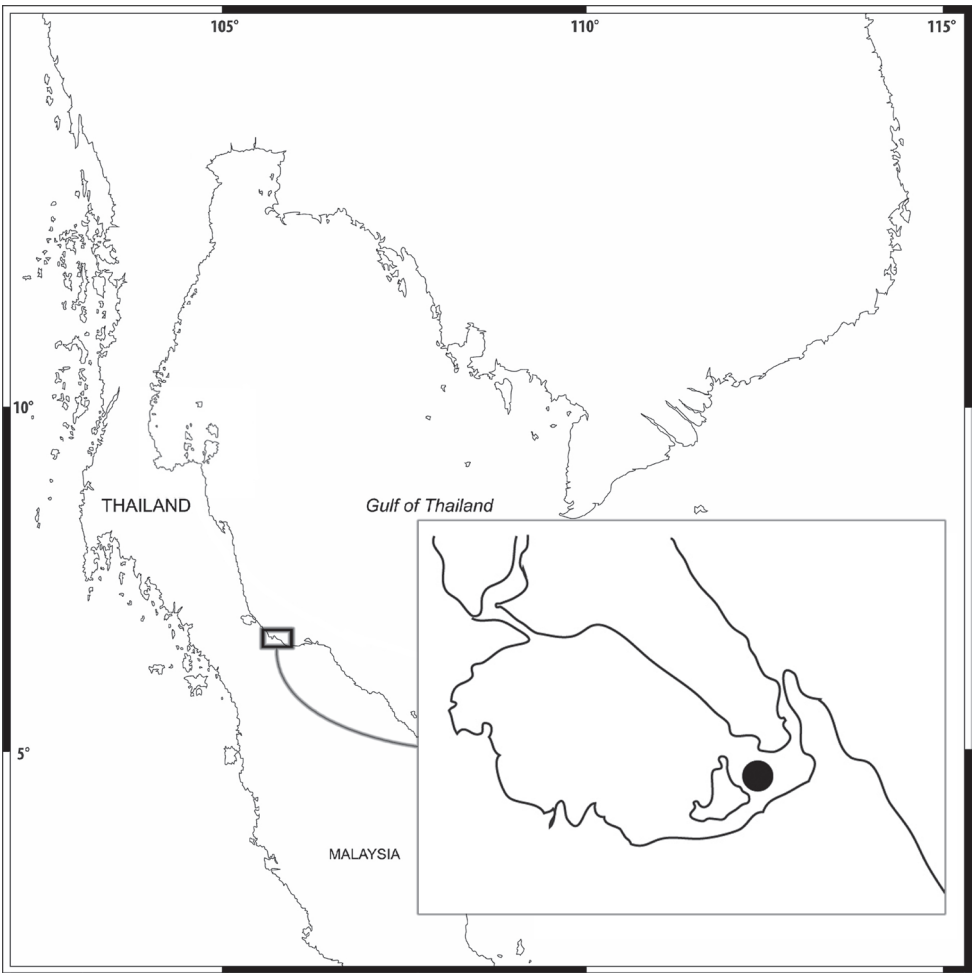


**Figure 1.** Map of the sampling area.

several slender spines. Mandible: molar triturative, incisor toothed, palp 3-articulate. Rostrum short, coxa 4 without distoposterior lobe, coxa 5 as long as coxa 4. Accessory flagellum absent. Gnathopod 1 subchelate, gnathopod 2 merochelate, distally chelate, parachelate or subchelate. Basis of pereopods 5-7 not lobed. Peduncle of uropod 1 with distoventral strong tooth. Uropod 3 very short, biramous, rami unisegmented. Telson short, fleshy, entire, bearing 2 distal corner teeth. Oostegyts narrow, coxal gills simple. Sexual dimorphism present (gnathopod 2).

**Type species.** *Corophium excavatum* Thomson, 1884 (type by monotypy)

**Species composition.** *Paracorophium excavatum* (G.M. Thomson, 1884); *Paracorophium lucasi* Hurley, 1954; *Paracorophium chelatum* (G. Karaman, 1979); *Paracorophium hartmannorum* Andres, 1979; *Paracorophium chilensis* Varela, 1983; *Paracorophium brisbanensis* Chapman, 2002; *Paracorophium nana* Myers, 2009. *Paracorophium angsupanichae* sp. n. (this study).

***Paracorophium angsupanichae* sp. n.**
http://zoobank.org/172494B3-14BB-4487-A9FA-1EB9DFEC1E66
Figs 2–6

**Material examined.** Holotype. ♂, THAILAND, Lower Gulf of Thailand, Middle Songkhla Lake (7°28'36"N, 100°24'6"E), 23 October 2014, leg. K. Wongkamhaeng, PSUZC-CR-0350. Allotype, ♀ collected with holotype; PSUZC-CR-0351; Paratypes, collected with holotype PSUZC-CR-0352 (5♂; 5♀) and ZMB28473 (3 ♂;3♀)

**Description.** Based on male holotype. Body length 1.75 mm (from tip of rostrum to apex of telson). *Body* compressed, smooth, urosomites 1-3 free. *Head*, lateral cephalic lobe rounded. *Antenna 1* sparsely setose, short, one third of body length, ratios of peduncular articles 1—3 5:6:3; accessory flagellum absent; primary flagellum 7-articulate, bearing 4-6 aesthetascs. *Antenna 2,* sparsely setose; flagellum 6-articulate. *Upper lip* (labrum) symmetrically incised distally. *Lower lip* (labium), inner lobes well developed. *Mandible*, both similar, left incisor 3-dentate, right incisor 4-dentate; left and right lacinia mobilis armed with 3 and 4 teeth respectively; ratios of palp article 1-3 5:8:6. *Maxilla 1*, inner plate short; outer plate with 9 bifid robust setae; palp 2-articulate, second article with 9 distal robust setae. *Maxilla 2*, inner lobe with distal and marginal plumose setae; outer lobe with 13 fine setae. *Maxilliped*, inner plate exceeding palp article 1, oblique, with 8 basal setae, 7 apical plumose setae and 2 apical robust setae; outer plate not reaching apex of palp article 2, with 9 marginal robust setae and 2 fine apical setae; palp 4-articulate; ratios of peduncular articles 1-4 3:7:4:2.

**Pereon.** *Gnathopod 1* subchelate, smaller than gnathopod 2; coxal plate trapezium-shaped, produced anteriorly with 7 fine setae on anteroventral corner and 2 robust setae on posterior margin; length ratio of articles from basis to dactylus 3:1:1:3:2:1; basis slender, broader distally, with anterodistal setae and posteromarginal setae; ischium short, subrectangular; merus subtriangular with posteromarginal setae; carpus long, with plumose setae on both margins; propodus subtriangular, palm oblique with a defining robust seta. *Gnathopod 2* chelate; coxal plate subquadrate; length ratio of articles from basis to dactylus 8:3:7:6:12:6; basis robust, expanded distally; merus subtriangular, distal angle produced with a group of very long plumose setae on anterior margin; carpus medially expanded, bearing dense setae on posterior margin; propodus suboval, narrowing distally with a weak subdistal excavation on posterior margin, anterior margin sparsely setose, palm obtuse with subrectangular distomedial elevation bearing 4 robust setae; dactylus overlapping palm, expanded medially with 3 fine setae and 1 distal seta. *Pereopod 3* slender; coxal plate deeper than long, slightly expanded ventrally, beset with marginal setae; length ratio of articles from basis to dactylus 6:2:6:2:5:2; basis slender; ischium short; merus slightly produced anterodistally, anterior margin lined with 9 long setae and short posterodistal setae; carpus and propodus slender, lined with marginal setae on both sides; dactylus curved. *Pereopod 4* similar to pereopod 3; length ratio of articles from basis to dactylus 6:2:4:2:3:1 ; basis slender, with long fine setae

on posterior margin; merus slightly produced anterodistally; carpus suboval with a weak subdistal excavation, with setae on both margins; propodus long and narrow, sparse setae; dactylus long and thin with one seta. *Pereopod 5–7* progressively longer, in the length ratio 2:3:4. *Pereopod 5* coxa bilobed; length ratio of articles from basis to dactylus 8:2:4:3:4:1; basis oval, sparsely setose; merus and carpus subequal with anteromarginal setae; propodus slender with 3 marginal robust setae; dactylus curved. *Pereopod 6* coxa bilobed; length ratio of articles from basis to dactylus 9:2:4:4:5:1; basis oval, posterodistally excavated, lined with 10 plumose setae; merus subrectangular with a median robust seta and distal setae; carpus subrectangular with distal robust setae; propodus slender with 3 marginal setae; dactylus long and curved. *Pereopod 7* coxa subtriangular; basis suboval, posterodistally excavated; merus – propodus slender with marginal and distal robust setae; dactylus tapering to pointed tip.

**Pleon.** *Pleopods 1–3* well developed; peduncles subrectangular with 2 retinaculae, longer than broad; rami unequal, inner ramus longer than outer ramus. *Epimeron* 1–3 subquadrate; epimeron 2 bearing 7 plumose setae. *Uropod 1* not extending beyond ends of other uropods; peduncle longer than rami, fringed with robust setae, peduncular apex bearing a posteroventral process; outer and inner ramus subequal, both rami lined with a row of robust setae, distal margins rounded and bearing several robust setae. *Uropod 2* peduncle subequal to rami; outer ramus slightly longer than inner one, both rami with apical robust setae and outer ramus bearing medial robust setae. *Uropod 3*, peduncle subequal to rami subequal to outer ramus, which is slightly longer than inner one, bearing 4 apical setae; inner ramus with 2 fine apical setae and 1 robust seta. *Telson* subtrapezoidal, broader than long, each distal margin with distal spine.

**Female** (*allotype*). Total body length 2.6 mm (from tip of rostrum to apex of telson). Sexually dimorphic characters: *Antenna 1* flagellum with 5 articles, last 2 articles bearing aesthetascs. *Gnathopod 2* coxa much deeper than wide; basis elongate, expanded distally; merus subtriangular with a long plumose setae on anterior margin; carpus subrectangular, bearing long plumose setae on posterior margin; propodus elongate with posterior plumose marginal setae, palm poorly developed with 2 robust setae; dactylus curved.

**Etymology.** The species is named in honor of Professor Dr. Saowapa Angsupanich of Prince of Songkla University, Thailand, who contributed to the study of the ecosystem in Songkhla Lake.

**Remarks.** *Paracorophium angsupanichae* sp. n. is characterized by male gnathopod 2 chelate and shares this character with *Paracorophium chelatum* in the Palau Islands, in the southern Pacific Ocean, east of the Philippines. Both amphipods inhabit freshwater environments above tidal influence. However, *P. chelatum* has the following characters (Karaman 1979): 1) its maxilliped lacks the distinctive rows of long setae on the basal segment (present in *P. angsupanichae*), 2) its male gnathopod 2 palm is smooth (palm is obtuse with subrectangular distomedial elevation bearing 4 robust setae), and 3) its urosomites 1–2 are fused (urosomites 1–3 are free in *P. angsupanichae*).

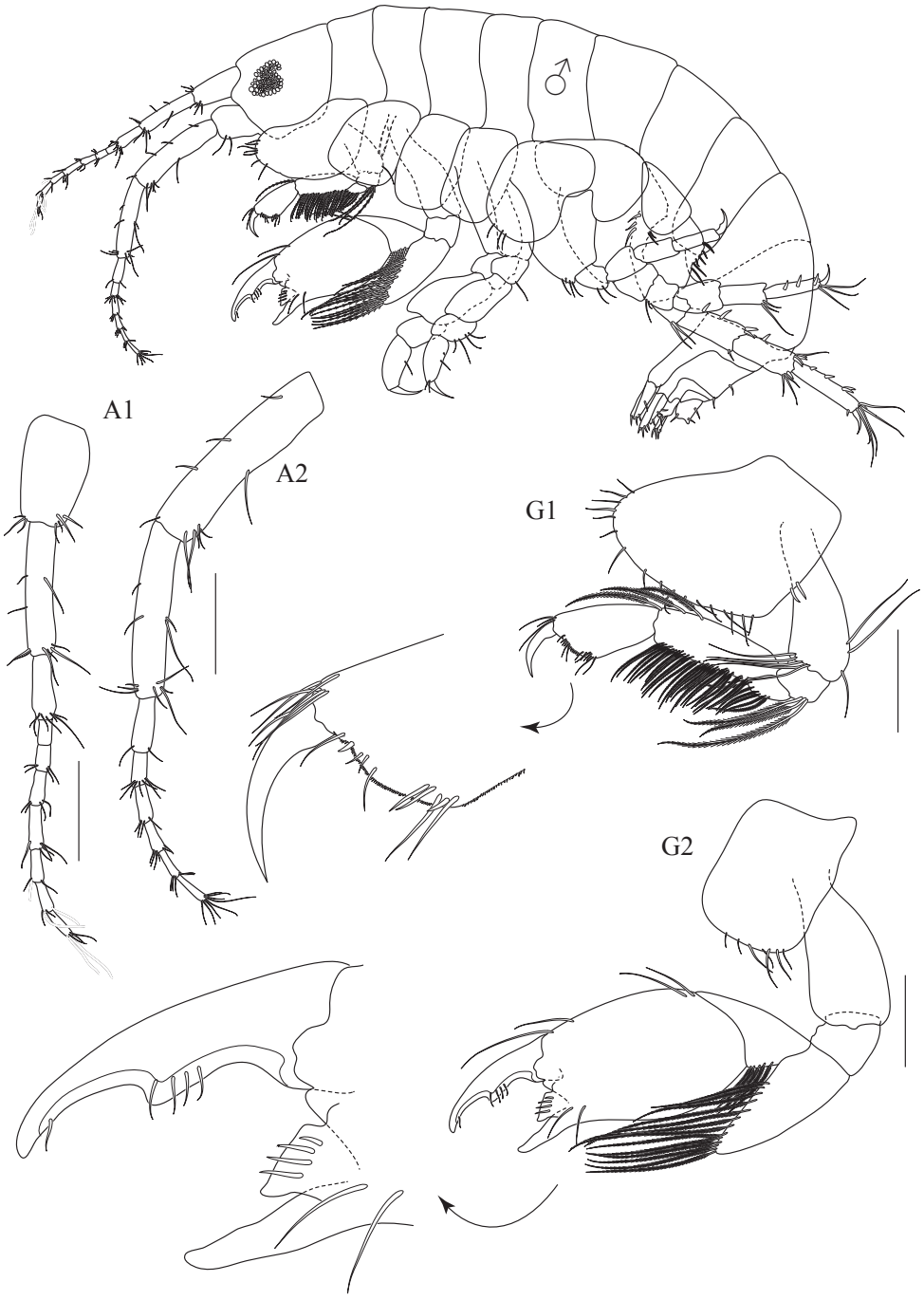


**Figure 2.** *Paracorophium angsupanichae* sp. n. holotype, male (PSUZC-CR-0350), 1.75 mm. Middle Songkhla Lake, Lower Gulf of Thailand. All scale bars represent 0.2 mm.

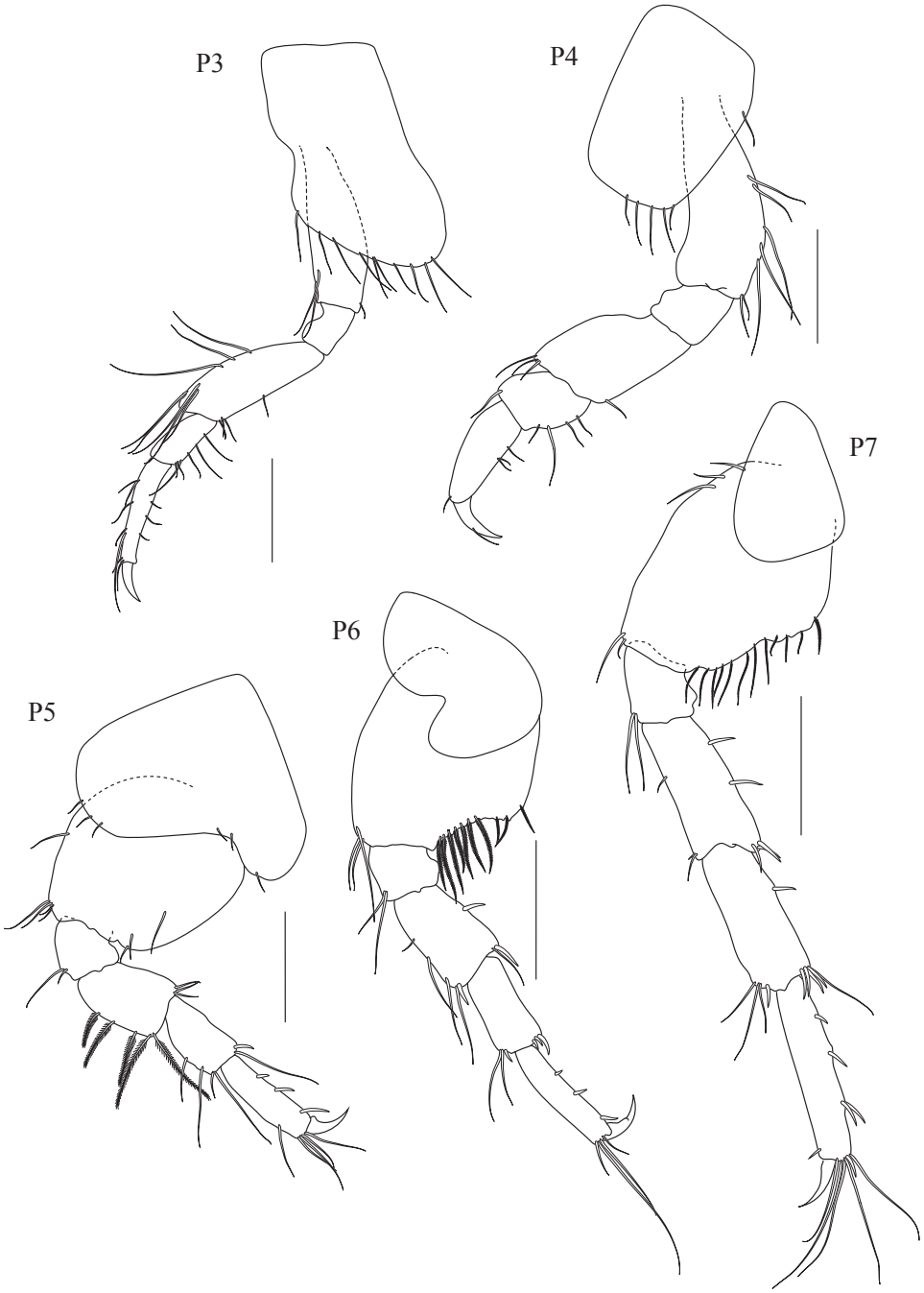


**Figure 3.** *Paracorophium angsupanichae* sp. n. holotype, male (PSUZC-CR-0350), Middle Songkhla Lake, Lower Gulf of Thailand. The scale bars for P3-5 represent 0.2 mm and scale bars for P6-7 represent 0.5 mm.

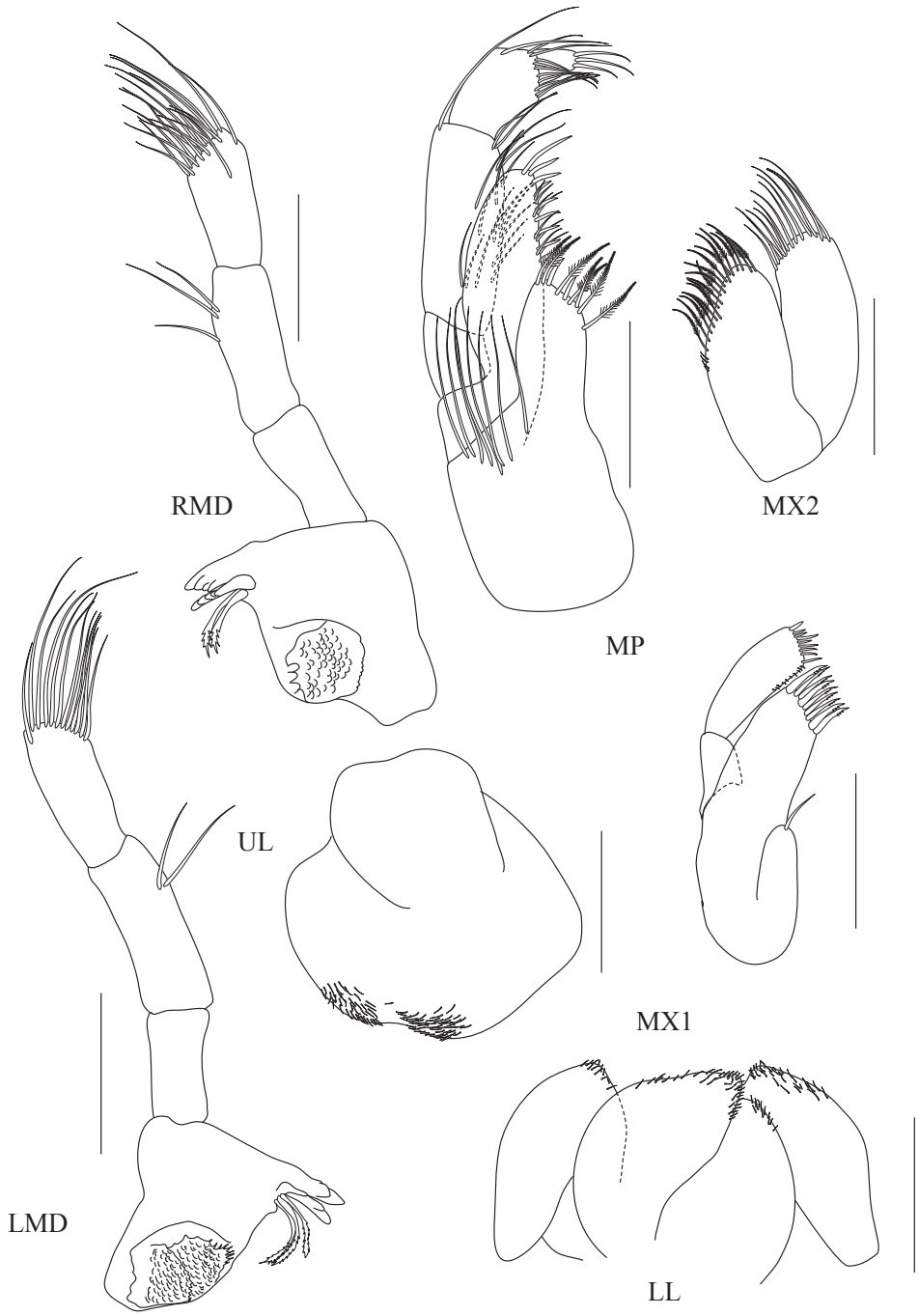


**Figure 4.** *Paracorophium angsupanichae* sp. n. holotype, male (PSUZC-CR-0350), Middle Songkhla Lake, Lower Gulf of Thailand. All scale bars represent 0.1 mm.

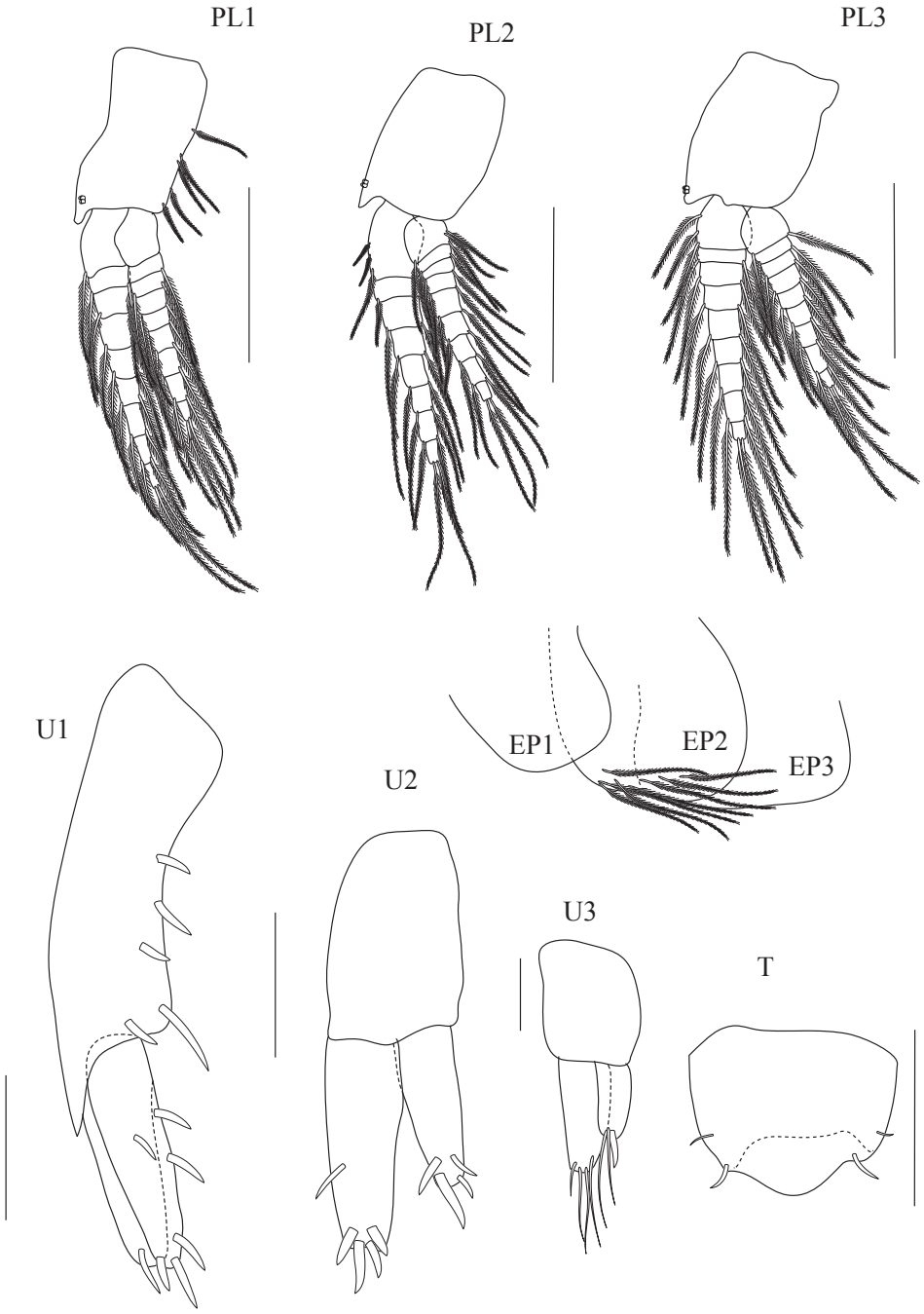


**Figure 5.** *Paracorophium angsupanichae* sp. n. holotype, male (PSUZC-CR-0350), Middle Songkhla Lake, Lower Gulf of Thailand. The scale bars for U1-U3, PL1-3 represent 0.2 mm, but 0.1 mm for T.


**Figure 6.** *Paracorophium angsupanichae* sp. n. allotype, female (PSUZC-CR-0351), 2.6 mm, Middle Songkhla Lake, Lower Gulf of Thailand. All scale bars represent 0.2 mm.

### *Chelicorophium* Bousfield & Hoover, 1997

**Diagnosis.** (modified from Bousfield and Hoover 1997) Epistome produced. Lower lip, mandibular lobes medium. Mandibular palp basic (type PI of Hirayama 1987). Maxilla 1, palp sublinear, longer than outer plate. Maxilliped, inner plate short, apex subacute, inner margin with basal spine; outer plate regular, inner margin strongly setose; palp segment 2 medium to long. Rostrum short. Antenna 2 strongly pediform and well developed (clasping) in both sexes; peduncular segment 4 with strong bidentate posterodistal process; segment 5 short, usually with median tooth near mid-point. Gnathopod 1 subchelate. Gnathopod 2 propod slender, not longer than combined merus and carpus; dactyl short, typically tridentate. Urosome segments not coalsed. Uropods 1 and 2 medium, peduncles broadening distally; rami short, straight; inner and outer margins often spinose or setose, apex little out-curved. Uropod 3, ramus longer than peduncle, slightly broadened, setose apically. Telson short, broad, spinose hooks at hind comers and dorsally. Coxal gills medium broad, sac-like, on pereopods 3-6. Brood lamellae short, sublinear, marginal setae not elongate.

### *Chelicorophium madrasensis* Nayar, 1950

**Material examined.** Lower Gulf of Thailand, Songkhla Lake (09°18'39.5"N, 99°46'46.4"E), mangrove forest, 1 Feb 2012, leg. R. Puttapreecha, PSUZC-CR-0353 (4♂; 5♀), ZMB28474 (2♂; 2♀)

**Type locality.** Madras Coast, India.

**Description.** *Body* subcylindrical; urosomites 1–3 free. *Head*, rostrum short, not exceeding anterior head lobes; inferior antennal sinus deeply regressed. *Antenna 1* slender, one third of body length; peduncle article 1 setose; primary flagellum 12-articulate. *Antenna 2* strongly developed in both sexes, much longer than antenna 1; peduncle setose along ventral margin; peduncular segment 4 with strong bidentate posterodistal process; segment 5 shorter, without median tooth; flagellum 3-articulate;

*Lower lip* (Labium), inner lobe well developed, mandibular lobes medium. *Mandible* both similar, incisor 3 dentate; left and right lacinia mobilis armed with 2 and 3 dentate respectively; first article of palp with long pilous seta. *Maxilla 1*, palp longer than outer plate. *Maxilla 2*, inner lobe shorter than outer lobe; both bearing distal and marginal plumose setae; *Maxilliped*, inner plate short, apex subacute, inner margin with marginal setae; outer plate reaching apex of palp article 2, setose along both sides; palp segments 2-4 with marginal setae.

**Pereon.** *Gnathopod 1* subchelate-rectipalmate; merus and carpus bearing posteriomarginal plumose setae. *Gnathopod 2* merus as long as carpus, with long plumose setae along posterior margin; dactylus tridentate. *Pereopods 3 and 4* alike, basis broad (glandular); dactylus subequal to propodus. *Pereopod 5* short, basis setose along posterior margin; carpus short, bearing two rows of robust setae along posterior margin. *Pereopod 6* basis sparsely setose; carpus short not elongate, bearing two rows of robust setae

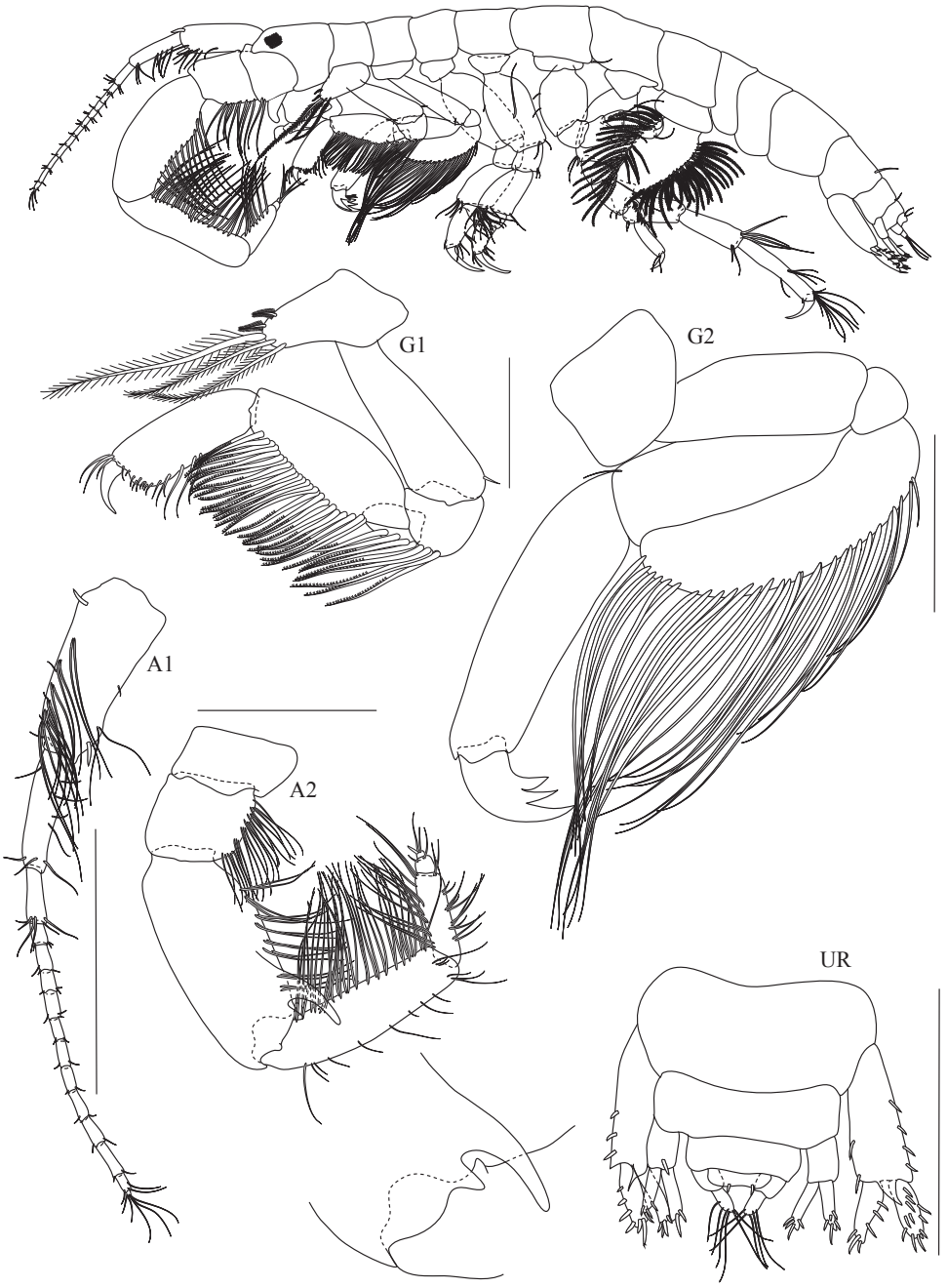


**Figure 7.** *Chelicorophium madrasensis* male (PSUZC-CR-0353), Lower Songkhla Lake, Lower Gulf of Thailand. All scale bars represent 0.2 mm.

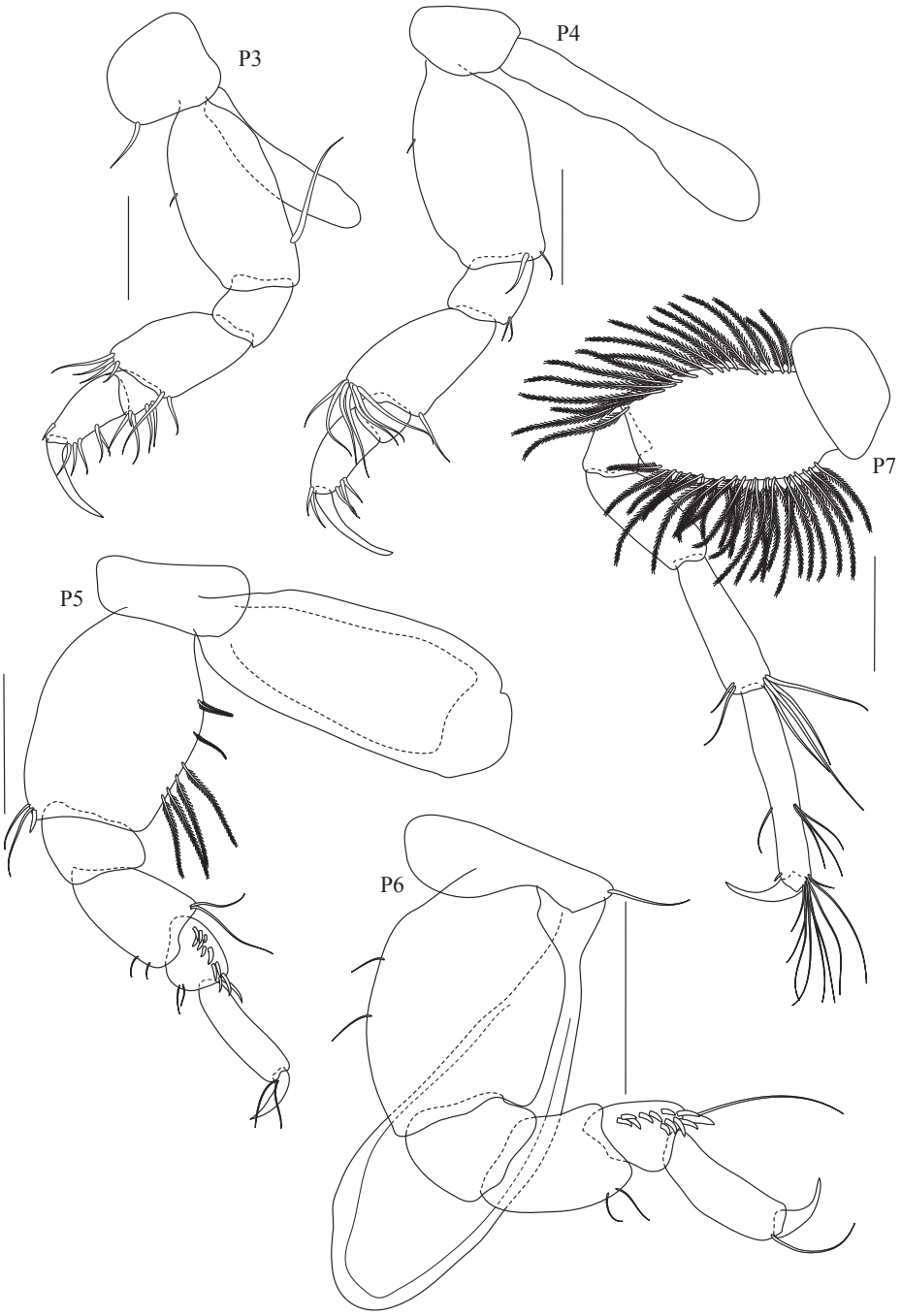


**Figure 8.** *Chelicorophium madrasensis* male (PSUZC-CR-0353), Lower Songkhla Lake, Lower Gulf of Thailand. All scale bars represent 0.2 mm.

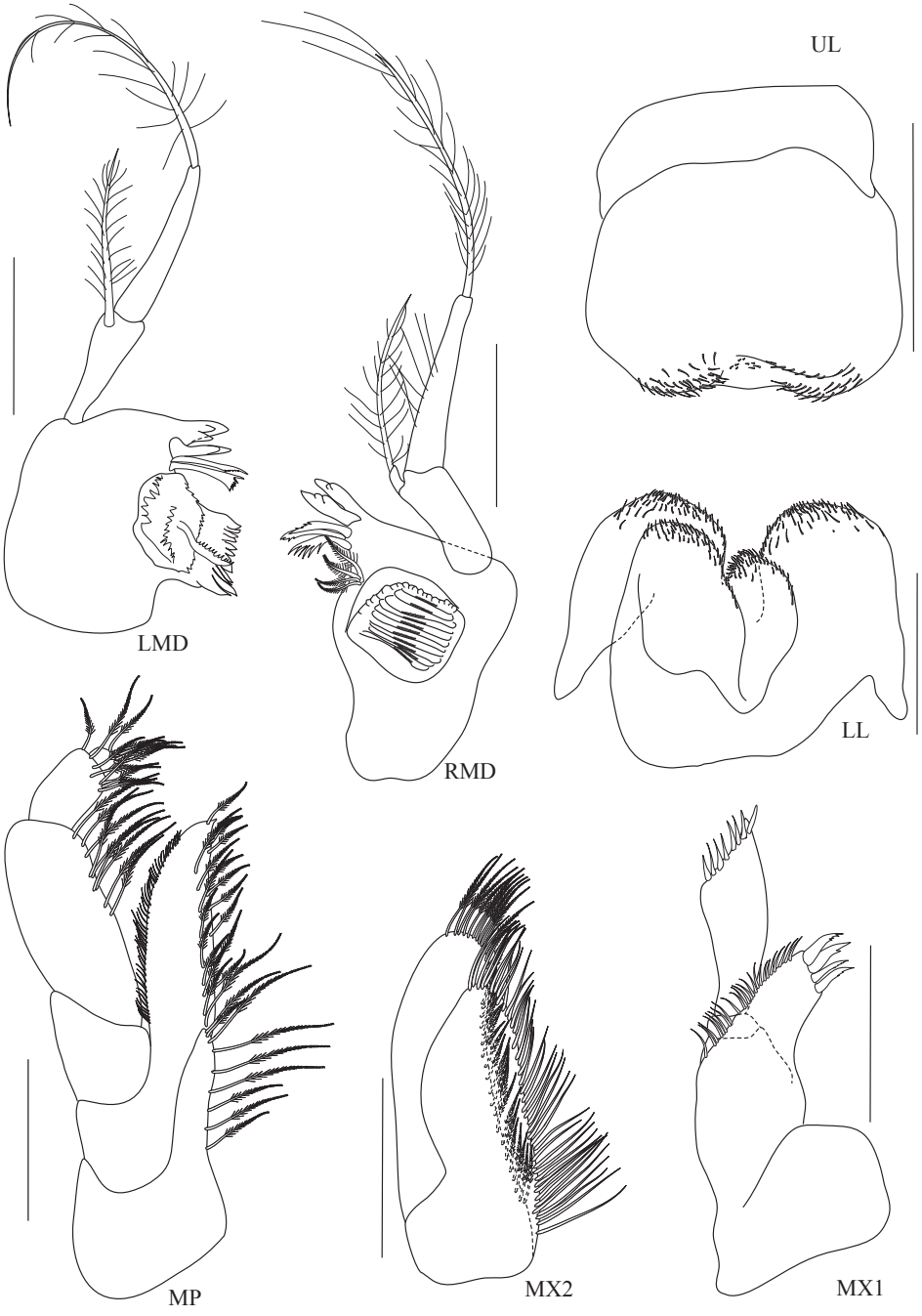


**Figure 9.** *Chelicorophium madrasensis* male (PSUZC-CR-0353), Lower Songkhla Lake, Lower Gulf of Thailand. All scale bars represent 0.1 mm.

along posterior margin; dactyl short. *Pereopod 7* elongate; basis posteriorly strongly setose on both margins; ischium – carpus sparsely setose; propodus with marginal and distal setae.

**Pleon.** *Urosomites* 1-3 free. *Uropods 1 and 2* peduncles slightly broadening distally; rami short, straight; outer ramus beset with robust setae. *Uropod 3*, ramus subequal to peduncle, apically setose. Telson short, truncate, broader than long.

**Female.** No sexual differences.

**Remarks.** Nayar (1950) described *Chelicorophium madrasensis* from the Madras Coast, India, which is characterized by antenna 2 article 4 inner surface with 2 proximal spines and epimeron 1 smooth and naked. The specimens from the current study are similar to those of Nayar, but the telson is truncated, whereas it is pointed in *C. madrasensis*.

**Distribution.** Indian Ocean and Songkhla Lake (current study).

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The authors would like to thank Mrs. Ratchanee Puttapreecha (Southern Marine and Coastal Resources Research Center) for providing specimens for this study. We are grateful to the Marine and Coastal Resources Institute for the use of their laboratory facilities. The senior author would also like to thank Professor Dr. Saowapa Angsupanich, as she has been a source of inspiration for this work. In addition, we would also like to thank Dr. Azman Abdul Rahim for producing the map. This work was supported by the Prince of Songkla University Research Fund (National Budget) year 2013 (COR5805635).

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RESEARCH ARTICLE

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# New synonyms of two Arabian ants of the genus *Monomorium* Mayr, 1855 (Hymenoptera, Formicidae)

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## Abstract

Synonymy of two Arabian *Monomorium* Mayr, 1855 species is proposed: *M. exiguum* Forel, 1894 = *M. desertorum* Collingwood & Agosti, 1996, **syn. n.**; *M. subopacum* Smith, 1858 = *M. mintiribe* Collingwood & Agosti, 1996, **syn. n.** A lectotype for *M. venustum* Smith, 1858 is designated. Information on nesting habits of *M. exiguum* and *M. venustum* in the Kingdom of Saudi Arabia are provided for the first time. Recently collected records for *M. exiguum*, *M. subopacum*, and *M. venustum* from the Kingdom of Saudi Arabia and United Arab Emirates are listed.

## Keywords

Arabian Peninsula, Middle East, Saudi Arabia, United Arab Emirates, synonymy, taxonomy, new designation

## Introduction

The first published work on the ant genus *Monomorium* Mayr, 1855 for the Kingdom of Saudi Arabia (KSA) was by Collingwood (1985), who listed and keyed 20 species from the country. The genus was subsequently treated comprehensively for the Arabian

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Peninsula by Collingwood and Agosti (1996). The authors reported 53 species, 32 of which were described as new, (including 15 from the KSA, 10 from Oman, five from Yemen, and two from Kuwait). Collingwood et al. (2011) treated the myrmecofauna of the United Arab Emirates (UAE) and reported 29 *Monomorium* species. Three species were recorded from Socotra Island (Collingwood et al. 2004) and a new species, *M. nimihil* Collingwood, 2004 was described.

Recently the *Monomorium* fauna of KSA has received renewed attention, with the first record of *M. exiguum* Forel, 1894 (Aldawood and Sharaf 2009) and descriptions of three new species, *M. moathi* Sharaf & Collingwood, 2010 (Aldawood et al. 2010); *M. dryhimi* Aldawood & Sharaf, 2011 (Aldawood and Sharaf 2011) and *M. sarawatensis* Sharaf & Aldawood, 2013 (in El-Hawagry et al. 2013). During two visits to the World Museum, Liverpool, United Kingdom, two new synonyms were discovered for Arabian *Monomorium*.

## Materials and methods

### Abbreviations of museums

**BMNH** The Natural History Museum, London, United Kingdom.
**MHNG** Museum d'Histoire Naturelle, Geneva, Switzerland.
**NHMB** Naturhistorisches Museum, Basel, Switzerland.
**WMLC** World Museum Liverpool, Liverpool, United Kingdom.

The numbers between parentheses in material examined refer to individual workers.

## Results and discussion

***Monomorium exiguum* Forel, 1894**
Figs 1–4

For full synonymy see Heterick (2006), pp. 115–116.

*Monomorium exiguum* Forel, 1894: 85. (lectotype worker) Ethiopia. Afrotropic. "Ethiopia, Sudabessinien." (MHNG), http://www.antweb.org/specimen/CASENT0101870 [Image of type specimen examined].

*Monomorium desertorum* Collingwood & Agosti, 1996: 344 (w.) Saudi Arabia. Afrotropic." (WMLC), http://www.antweb.org/specimen/CASENT0906343. Syntype worker [examined], Syn. n.

**Material examined.** Saudi Arabia, Baha, Dhi Ayn Archeological Village, 18.v.2010, 20.132°, 41.004°, 741m, (M. R. Sharaf, leg.) (21); Saudi Arabia, Riyadh, Oyaina, 28.iv.2010; 25.011°, 46.493°, 749m, (M. R. Sharaf, leg.) (3); Saudi Arabia, Riyadh, Qarina Valley, 5.xi.2009, 25.273°, 46.289°, 761m, (M. R. Sharaf, leg.) (3); Saudi Arabia, Baha,


**Figures 1–4.** *Monomorium exiguum* (worker), CASENT0101870. **1** Body in profile **2** Body in dorsal view **3** Head in full-face view **4** specimen label. Photo Zach Lieberman, http://antweb.org/

Dhi Ayn Archeological Village, 20.ix.2011, 20.132°, 41.004°, 744m, (M. R. Sharaf, leg.) (10); Saudi Arabia, Almajardah, wadi Khat, 10.xi.2012, 19.001°, 41.016°, 513m, (M. R. Sharaf, leg.) (6); Saudi Arabia, wadi Shahdan (Jizan), 13.xi.2012, 17.472°, 42.856°, 200m, (M. R. Sharaf, leg.) (8); Saudi Arabia, Wadi Aljora near Abadan, 12.xi.2012, 17.005°, 43.001°, 465m, (M. R. Sharaf, leg.) (6); Saudi Arabia, Baha, Wadi Elzaraeb, 9.v.2011, 20.073°, 41.387°, 2086m, (M. R. Sharaf, leg.) (1); Saudi Arabia, Abu Arish, 10.iv.2012, 17.013°, 42.802°, 90m, (M. R. Sharaf, leg.) (6); Saudi Arabia, Dhi Ayn Archeological Village, 11.v.2011, 19.929°, 41.442°, 741m, (M. R. Sharaf, leg.) (3); Saudi Arabia, Baha, Dhi Ayn Archeological Village, 7.iv.2013, 19.929°, 41.442°, 744m, (M. R. Sharaf, leg.) (4); Saudi Arabia, AlUrdiyah gov., Wadi Gonouna, 12.v.2011, 19.429°, 41.605°, 353m, (M. R. Sharaf, leg.) (20); Saudi Arabia, Al Bahah, Wadi Turabah, AlMandaq, 14.v.2011, 20.211°, 41.288°, 1793m, (M. R. Sharaf, leg.) (7); Saudi Arabia, Dhi Ayn Archeological Village, 15.v.2011, 19.929°, 41.442°, 741m, (M. R. Sharaf, leg.) (1); Saudi Arabia, Al Bahah, Wadi Turabah, AlMandaq, 10.v.2011, 20.211°, 41.288°, 1793m, (M. R. Sharaf, leg.) (1); Saudi Arabia, Riyadh, Hawtet Bani Tamim, 20.i.2014, 23.480°, 46.844°, 597m, (M. R. Sharaf, leg.) (3); Saudi Arabia, Al Qatif, El Naft, 23.iii.2012, 26.510°, 49.969°, 30m, (M. R. Sharaf, leg.) (2); UAE, Khor al-Khwair, 25.57.56.03, 8.iii.2007, (M. Hauser et al.) (1); UAE, Sharjah, 25.21.55.24, 28.ii–12.iv.2011, (M. Hauser et al.) (1); UAE, Wadi Bih dam, 25.48.56.04, 16–31.xii.2009, (M. Hauser et al.) (1).

**Remarks.** Only a single paratype specimen with the same data as the holotype exists at WMLC. The holotype and other paratypes are considered lost.

The description of *M. desertorum* in Collingwood and Agosti's (1996) indicated that the eyes are located anterior to the midlength of head, the scapes when retracted back do not reach the posterior margin of head, the antennae are 11 segmented, and the body is not sculptured except for the metanotal cross-ribs. Comparison was made of the single available paraype worker of *M. desertorum* with the lectotype worker of *M. exiguum* was carried out. We here treat *M. desertorum* as a junior subjective synonym of *M. exiguum*.

**Habitat.** The vast majority of *M. exiguum* nests that were collected in KSA were found to be associated with leaf litter and topsoil layers where workers foraged. Frequently nests were directly in the soil. The nesting habits of *M. exiguum* however, are diverse. In a site located in the southwestern mountains of the KSA, the species was found nesting in loose sandy soil with high moisture content and among roots of small *Portulaca oleracea* L. (Portulacaceae) plants beneath a date palm tree, *Phoenix dactylifera* L. (Arecaceae). Several worker series were nesting in a humid clay soil under banana trees. Other worker series were collected under a rock next to *Juniperus procera* Hochst. ex Endlicher (Cupressaceae) and *Acacia* spp. (Mimosaceae) trees. Another nest was found in thick layer of leaf litter under a large and old *Ficus benghalensis* L. (Moraceae) tree where the soil was rich in decayed organic matter. Some nests were found in leaf litter under *Calotropis procera* (Aiton) W.T.Aiton (Asclepiadaceae) and next to a mango tree (*Mangifera* sp., Anacardiaceae).

### *Monomorium subopacum* (Smith, 1858)

Figs 5–8

For full synonymy, see Heterick (2006), p. 103.

*Myrmica subopaca* Smith, 1858: 127 (w.q.) (paralectotype worker, designated by B. E. Heterick, September, 2004) Portugal (Madeira Is.). Afrotropic. "Portugal (Madeira Island), coll. T.V. Wollaston. (BMNH), http://www.antweb.org/specimen/CASENT0010949 [Image of type specimen examined].

*Monomorium mintiribe* Collingwood & Agosti, 1996: 350, fig. 23 (w.q.m.) Oman. Palearctic. Bilad Ban. 17.i.1986, coll. W. Buttiker. (WMLC), Paratype worker [examined]. Syn. n.

**Material examined.** UAE, Ar-Rafah, 25.43.55.52, 1–8.iii.2011, (M. Hauser et al.) (1); UAE, Ar-Rafah, 25.43.55.52, 1.ii–31.iii.2010, (M. Hauser et al.) (1); UAE, Ar-Rafah, 25.18.56.07, 22.vi–2.vii.2010, (M. Hauser et al.) (1); UAE, Jebel Jibir, 25.39.56.07, 11–13.iv.2011, (M. Hauser et al.) (1).

**Remarks.** The holotype and 10 paratypes of *M. mintiribe* seem to be lost. Extensive searches at both WMLC and NHMB failed to locate type material except for a single paratype specimen labeled in red at the WMLC. In addition, despite the fact that the label information for the paratype specimen in WMLC does not exactly match the in-

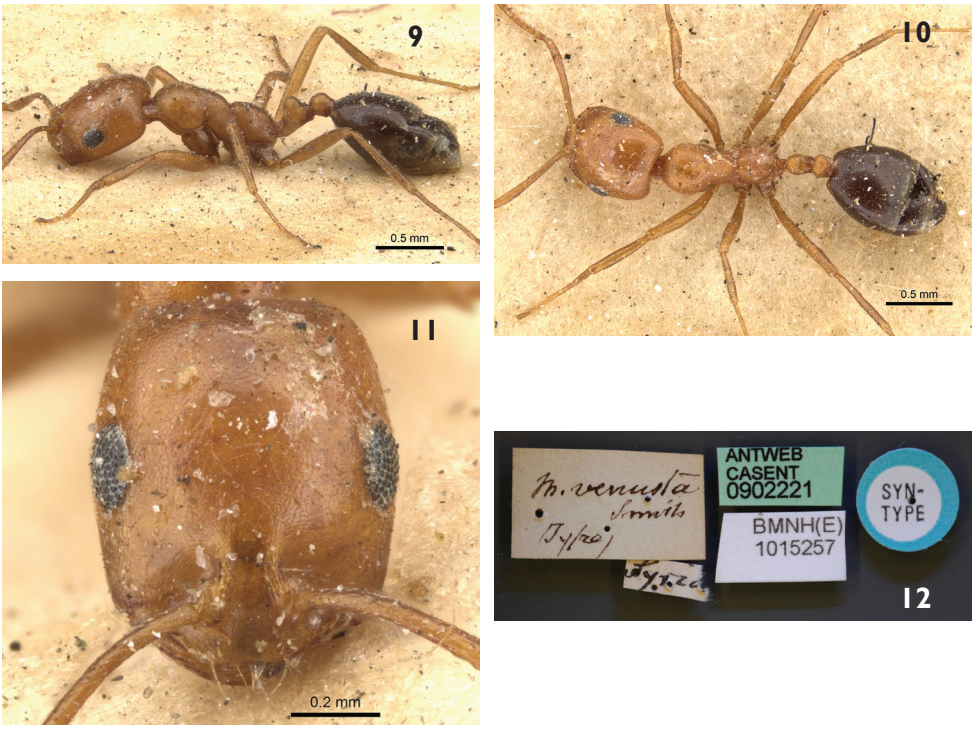

**Figures 5–8.** *Monomorium subopacum* (paralectotype worker), CASENT0010949. **5** Body in profile **6** Body in dorsal view **7** Head in full-face view **8** specimen label Photo April Nobile, http://antweb.org/

formation in Collingwood and Agosti (1996), we consider this specimen as part of the original type series. Collingwood and Agosti (1996) indicated the following paratypes: 1 male, 2 queens, 2 workers, "Oman, Bilad Bani, 20°03'N, 59°17'E, coll. W. Buttiker", whereas the data on the paratype specimen in WMLC is "Bilad Ban, Oman, W. Buttiker, 17.i.1986." The second author (C. A. Collingwood) confirms that the single remaining specimen is an originally designated paratype. The original description of *M. mintiribe* did not compare this taxon with related congeners. The single paratype is identical to the paralectotypes of *M. subopacum* and the original description agrees with this. Therefore, *M. mintiribe* is treated here as a junior subjective synonym of *M. subopacum*.

### ***Monomorium venustum*** **(Smith, 1858)**

Figs 9–12

*Myrmica venusta* Smith, 1858: 126 (w.) (lectotype worker) Syria. Palaearctic. (BMNH "E" 1015257) [**new designation**].




**Figures 9–12.** *Monomorium venustum* (Lectotype worker), CASENT0902221. **9** Body in profile **10** Body in dorsal view **11** Head in full-face view **12** specimen label. Photo Will Ericson, http://antweb.org/

**Material examined.** Saudi Arabia, Al Atawla (Baha-Taif RD), Wadi Bawah, 8.xi.2012, 21.004°, 41.247°, 1310m, (M. R. Sharaf, leg.) (10); Saudi Arabia, Baha, Wadi Elzaraeb, 9.v.2011, 20.073°, 41.387°, 2086m, (M. R. Sharaf, leg.) (3); Saudi Arabia, Riyadh, Dirad, 30.xii.2009, 24.409°, 46.662°, 588m, (M. R. Sharaf, leg.) (6); Saudi Arabia, Al Bahah, Wadi Turabah, AlMandaq, 19.ix.2011, 20.242°, 41.262°, 1751m, (M. R. Sharaf, leg.) (6); Saudi Arabia, Riyadh, Alhota, 19.iv.2008, (M. R. Sharaf, leg.) (7); Saudi Arabia, Riyadh, Wadi Hanifa, 11.iv.2013, 24.671°, 46.595°, 641 (M. R. Sharaf, leg.) (14); Saudi Arabia, Al Bahah, Wadi Turabah, AlMandaq, 10.v.2011, 20.211°, 41.288°, 1751m, (M. R. Sharaf, leg.) (4).

**Remarks.** Originally, *M. venustum* was described based on syntypes of the worker caste from Syria. Here we designate a lectotype with the following data, "*M. venusta* Smith, type, BMNH (E), 1015257". The Lectotype is deposited at BMNH.

**Habitat.** Workers of *M. venustum* build nests directly into the ground under stones and rocks, directly into the ground. This species apparently prefers to nest in soil with high moisture content as observed in many locations in KSA. In the southwestern mountains of the KSA, nests were constructed next to *Juniperus procera* Hochst. ex Endlicher (Cupressaceae) and *Acacia* spp. (Mimosaceae) trees. In addition, the species

is usually foraging in areas with dense green flowering grasses that covering the ground. A single nest was found existing next to *Mentha longifolia* (L.) Huds. (Lamiaceae). Myrmecophilous arthropods (e.g. small beetles, isopods and millipedes) were found inside some nests.

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# Redescription of *Crematogaster cypria* Santschi, 1930, new status, with description of two new related species from Greece and Turkey (Hymenoptera, Formicidae)

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## Abstract

*Crematogaster* (*Crematogaster*) *jehovae* var. *cypria* Santschi, 1930 is raised to species rank. Two new, related species are described from the north-eastern part of the Mediterranean Basin: *Crematogaster* (*Crematogaster*) *erectepilosa* **sp. n.** (Dodecanese, Greece) and *Crematogaster* (*Crematogaster*) *gullukdagensis* **sp. n.** (Antalya Prov., Turkey). These three species are well distinguished from other species of the subgenus *Crematogaster* of the north-eastern part of the Mediterranean Basin in their first gastral tergite bearing numerous erect setae. Colour photographs of all taxa are provided, a key to the species of *Crematogaster cypria* group and species groups of the *Crematogaster* s. str. from the north-eastern Mediterranean region are given and a list of *Crematogaster* s. str. described from this region is provided (see Appendix).

## Keywords

Mediterranean Subregion, Crematogastrini, Cyprus, Greece, Turkey, taxonomy, *Crematogaster*

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## Introduction

The genus *Crematogaster* Lund, 1831, a member of the subfamily Myrmicinae, is one of the most speciose ant genera. The most recent catalogue lists 487 valid extant species (with fifty-three synonyms, five homonyms and five unavailable names) and 296 valid subspecies, one fossil species was also described (Bolton 2015). Twenty-four species from two subgenera (twenty-two species in *Crematogaster* s. str. and two in *Orthocrema* Santschi) have been so far recorded from Europe and the Mediterranean. In addition, many infraspecific valid names have also been proposed, some of them likely representing distinct taxa whose status needs revision (Borowiec 2014). Mediterranean species of the nominotypical subgenus are mostly similar morphologically and demonstrate a tendency to form local and geographical variations. As a result of that, the differences among species are often not well expressed and correct determination is hindered. Hitherto no key to all European and Mediterranean species has been published, except the outdated key by Santschi (1937), and only local keys exist (Collingwood 1978, Agosti and Collingwood 1987, Cagniant 2005, Seifert 2007, Karaman 2008, Taylor 2010).

During our studies on the ants of Balkans and Cyprus we collected numerous *Crematogaster* samples and concluded that this group is more speciose than local catalogues and keys suggested. We also found some novel characters useful in distinguishing closely related taxa. In this paper we revise a small group of species well distinguished from all taxa of the region by having the first gastral tergite bearing numerous erect setae. This character has never been observed in taxa from the north-eastern part of the Mediterranean Basin but occurs in some North African species, e.g. *Crematogaster oasium* Santschi and some taxa of *Crematogaster laestrygon* complex (our unpublished data).

## Material and methods

Specimens were compared using standard methods of comparative morphology. Photographs were taken using a Nikon SMZ 1500 stereomicroscope, Nikon D5200 photo camera and Helicon Focus software.

All given label data are in their original spelling; a vertical bar (|) separates data on different rows and double vertical bar (||) separates labels. Additional information about the labels or explanatory notes are given in square brackets.

### Abbreviations to collections

**CASC** California Academy of Sciences, San Francisco, California, USA;
**DBET** Department of Biodiversity and Evolutionary Taxonomy, University of Wrocław, Poland;

**MNHW** Museum of Natural History, University of Wrocław, Poland;
**SSC** Sebastian Salata collection (Wrocław, Poland);
**TU** Biological Department, Trakya University, Edirne, Turkey.

**Measurements and indices:**
**Measurements**

**HL** head length; measured in straight line from mid-point of anterior clypeal margin to mid-point of occipital margin; in full face view;
**HW** head width; measured in full-face view, directly above the eyes;
**EL** eye length; measured along the maximum diameter of eye;
**EW** eye width; measured along the maximum width of eye perpendicular to EL;
**SL** scape length; maximum straight-line length of scape;
**PNW** pronotum width; maximum width of pronotum in dorsal view;
**ML** mesosoma length; measured as diagonal length from the anterior end of the neck shield to the posterior margin of the propodeal lobe (equivalent with Weber's length);
**MH** mesosoma heigh; measured from the upper edge of mesonotum to the lowest point of the mesopleuron margin; in profile view;
**SDL** spiracle to declivity length; minimum distance from the center of the propodeal spiracle to the propodeal declivity;
**PSL** propodeal spine length; measured from the center of the propodeal spiracle to the top of the propodeal spine in lateral view;
**PH** petiole height; maximum height of petiole in lateral view;
**PL** petiole length; maximum length of petiole in lateral view;
**PW** petiole width; maximum width of petiole in dorsal view;
**PPH** postpetiole height; maximum height of postpetiole in lateral view;
**PPL** postpetiole length; maximum length of postpetiole in lateral view;
**PPW** postpetiole width; maximum width of postpetiole in dorsal view;
**LHT** hind tibia length; maximum length of hind tibia.
Example of measurements: 1.617 ± 0.135 (1.073-1.717) = average measurement ± standard deviation (range of variation).

**Indices**

**CI** cephalic index: HW/HL × 100;
**SI1** scape index 1; SL/HL × 100;
**SI2** scape index 2; SL/HW × 100;
**MI** mesosoma index; ML/PNW × 100;
**SPI** propodeal spines index ; SDL/PSL × 100;
**PI1** petiole index 1; PL/PH × 100;
**PI2** petiole index 2; PW/PNW × 100;
**PI3** petiole index 3; PW/PPW × 100;

**PPI1** postpetiole index 1; PPL/PPH × 100;
**PPI2** postpetiole index 2; PPW/PNW × 100;
**TI** hind tibia index 1; LHT/HW × 100;
**EI** eye index 1; EW/EL × 100;
**EI1** eye index 2; EL/HL × 100;
**EI2** eye index 3; EW/HL × 100.
All lengths are in mm.

## Descriptions

***Crematogaster* (*Crematogaster*) *cypria* Santschi, 1930, new status**
Figs 1, 2, 8, 12, 15

*Crematogaster* (*Acrocoelia*) *jehovae* For. var. *cypria* Santschi, 1930: 266.

**Locus typicus.** Yermasogia river (now Germasogeia [=Yermasoyia] river in Limassol District).

**Material examined.** Type material: syntype worker on photo (AntWeb resources: Available from: Photo by Alexandra Westrich | URL: http://www.antweb.org/specimen/casent0912688; accessed 18 February 2015): Cr. Jehovae | v Fo | cypria Sant || Chypre | Yermasogia | River. 6.II.30 | G. Mavromoustakis || Type || Sammlung | Dr. F. Santschi | Kairouan || ANTWEB | CASENT | 0912688.

Other material examined: 11 workers – Collection L. Borowiec | Formicidae | LBC-CY00067 || CYPRUS, Paphos distr., 17 m | Avakas Peen., Avakas Gorge | mouth 34.91826 N /32.32978 E | 2 V 2012, L. Borowiec || Crematogaster | cypria | det. L. Borowiec (DBET, CASC); 13 workers – Collection L. Borowiec | Formicidae | LBC-CY00067 || CYPRUS, Paphos distr., 755 m | Panagia-Cedar Valley rd. | 34°55.635 N/32°38.838 E | 5 V 2012, L. Borowiec || Crematogaster | cypria | det. L. Borowiec || (DBET, TU); 2 workers – Collection L. Borowiec | Formicidae | LBC-CY00190 || CYPRUS, Limassol Distr. | Agros, 1062 m | 34.9105 N/33.011 E | 19 VIII 2001, leg. Tsausis || Crematogaster | cypria | det. L. Borowiec (DBET).

**Differential diagnosis.** *Crematogaster cypria* at first glance is very similar to *C. jehovae* from the Near East; both species have short propodeal spines and pronotum only dorsolaterally with rugae. However, *C. cypria* differs in the first gastral tergite bearing numerous erect setae, whereas in *C. jehovae* the first gastral tergite is bearing appressed hairs, with a row of erect setae only along the posterior margin of the tergite. From *C. erectepilosa* sp. n. and *C. gullukdagensis* sp. n. it is easily distinguished by shorter propodeal spines and a shorter mesonotal keel (see the key below). *Crematogaster oasium* Santschi, distributed from Algeria to Saudi Arabia, is a similar species, but differs in having very short propodeal spines forming denticles (in *C. cypria* the spine is distinct, approximately twice as long as wide at its base) and the dorsum of the pronotum is distinctly dull (shiny in *C. cypria*).


**Figures 1–2.** *Crematogaster cypria* Santschi, worker **1** dorsal **2** lateral. Scale bar: 1 mm.

**Redescription.** Measurements: Workers (n=24): HL: 0.88 ± 0.048 (0.804-1.017); HW: 0.898 ± 0.062 (0.804-1.061); SL: 0.739 ± 0.025 (0.698-0.816); EL: 0.212 ± 0.014 (0.19-0.251); EW: 0.165 ± 0.01 (0.156-0.19); ML: 1.003 ± 0.066 (0.882-1.212); PSL: 0.146 ± 0.019 (0.112-0.19); SDL: 0.06 ± 0.01 (0.034-0.089); PL: 0.359 ± 0.027 (0.313-0.413); PPL: 0.207 ± 0.017 (0.179-0.24); PH: 0.23 ± 0.018 (0.201-0.268); PPH: 0.259 ± 0.02 (0.215-0.302); PNW: 0.57 ± 0.037 (0.503-0.67); LHT: 0.688 ± 0.029 (0.648-0.771); PW: 0.349 ± 0.04 (0.302-0.436); PPW: 0.302 ± 0.029 (0.263-0.38); CI: 101.8 ± 2.13 (96.6-108.2); SI1: 84.1 ± 2.8 (79.9-89.5); SI2: 82.8 ± 3.5 (74.8-87.6); MI: 175.9 ± 4.8 (160.7-183.4); SPI: 41.0 ± 6.6 (26.6-54.5); PI1: 156.5 ± 8.4 (139.6-172.9); PI2: 61.2 ± 4.6 (55.2-75.6); PPI1: 80.0 ± 4.1 (72.8-86.8); PPI2: 53.0 ± 2.7 (49.6-61.8); HTI: 76.5 ± 2.3 (72.6-80.3); EI: 77.9 ± 3.6 (70.6-85.7); EI1: 24.2 ± 1.0 (23.0-26.0); EI2: 19.1 ± 0.5 (18.3-20.0).

Colour uniformly brown or reddish-brown, mesosoma usually not or only slightly paler coloured than head and abdomen, antennae and legs the same colour as mesosoma (Figs 1, 2).

Head shape quadrate, approximately as wide or slightly wider than long (CI: 101.8 ± 2.13), posterior margin of head in full-face view straight and laterally rounded, occipital carinae distinct (Fig. 8). Antennal scapes reaching or surpassing head margin. Midline of eyes situated slightly above midline of head in full-face view, eyes moderately large (EI1: 24.2 ± 1.0) and slightly protruding. Pronotum laterally rounded, without sharp lateral margins, promesonotal suture indistinct, mesonotum without posterior face, more or less forming one plane with pronotum. Metanotal groove deep, laterally constricted; propodeal spines short, approximately two times as long as wide at base, spiniform, not curved downwards (Fig. 2). Dorsal face of propodeum short but distinct, convex in profile, posterior face of propodeum distinctly sloping, without or with a very shallow transverse groove. Petiole in dorsal view cordiform, dorsum flat, without posterolateral tubercules or denticles, sides carinate, subpetiolar process absent. Postpetiole distinctly bilobed, with a moderately broad median impression, subpostpetiolar process absent.

Head surface finely and sparsely punctate, without microreticulation between punctures, shiny. Masticatory margin of mandibles with four teeth, surface of mandibles distinctly carinate. Clypeus mostly smooth, only on sides with thin, short carinae. Antennal scrobes laterally with 5–7 short carinae not reaching to mid-length of eye. Whole surface of head appears shiny. Vestiture of head mostly with sparse, short, adjacent hairs and 5–8 long erect setae on frons and several long erect setae on underside. Antennal scapes on anterior and dorsal surface covered with suberect setae, on posterior surface basally with adjacent and distally suberect setae (Figs 8, 11). Surface of scape microreticulate. Pronotum only dorsolaterally with short longitudinal rugae, anterior face punctate and microtuberculate at base of setae with very short and sparse carinae, posterior face with slightly carinate setose punctures, sometimes with very thin transverse wrinkles but surface of pronotum appears more or less shiny. Whole dorsal surface of pronotum bearing mixed sparse, short and suberect and long erect setae. Sides of pronotum mostly smooth and shiny with more or less distinct thin, transverse carinae. Mesonotum dorsally in anterior half mostly without sculpture, more or less shiny, without distinct median keel only close to promesonotal suture with small tubercle, in posterior half with thin transverse carinae. Surface of mesonotum with very sparse, short adjacent setae, one to two moderately long, erect setae in anterior part and two pairs of setae posterolaterally. Mesopleuron on whole surface with dense transverse carinae. Dorsal face of propodeum microreticulate, with longitudinal carinae and very sparse and short adjacent pubescence, slope of propodeum smooth and shiny, metapleuron on whole surface with dense, transverse carinae. Petiole on sides with one long and one short erect setae, postpetiolar tubercles with 2-3 erect setae. First gastral tergite with very short and sparse basic pubescence and on whole surface with sparse, moderately long erect setae (Fig. 2), subsequent tergites with row of erect setae along posterior margins. Whole surface of tergites with very fine microreticulation, appears

shiny. First sternite with short and sparse basic pubescence and numerous long, erect setae. Legs bearing sparse, short, adjacent pubescence.

**Distribution.** Known only from Cyprus (Fig. 20).

**Biological data.** Ants were collected on stems of shrubs, on ground around the shrubs, and on rocks. Locality near Avakas Gorge was located near sea shore, only 17 m a.s.l., in a shallow valley of an intermittent stream. The following ant species were recorded in the same area: *Aphaenogaster sporadis* Santschi, *Camponotus cecconii* Emery, *Lepisiota* sp., *Messor* cf. *structor*, *Messor* sp., *Monomorium bicolor* Emery, and *Tapinoma simrothi* Krausse. Locality on roadside between Panagia and Cedar Valley was situated in a montane pine forest at altitude of 755 m. The following ant species were recorded in the same area: *Aphaenogaster sporadis* Santschi, *Camponotus honaziensis* Karaman & Aktaç, *Camponotus jaliensis* Dalla Torre, *Camponotus sanctus* Forel, *Cataglyphis* cf. *nodus*, *Crematogaster* cf. *ionia*, *Messor wasmanni* Krausse, *Pheidole pallidula* (Nylander), *Plagiolepis taurica* Santschi, *Temnothorax* cf. *recedens*, and *Tetramorium* cf. *caespitum*.

***Crematogaster erectepilosa* sp. n.**
http://zoobank.org/7FB3C7FB-3C73-4B2A-89C4-B8EFED0F155C
Figs 3, 4, 7, 10, 14

**Type material.** Holotype worker – Collection L. Borowiec | Formicidae | LBC-GR01365 || GREECE, Dodecanese | Karpathos, Olympos, 429 m | 35,72448 N/27,1697 E | 19 V 2014, S. Salata (MNHW no. 1222 ); 18 paratype workers: the same data as holotype (DBET, CASC, TU no. ANTWEB1008777-ANTWEB1008794); 2 paratype workers – Collection L. Borowiec | Formicidae | LBC-GR01364 || GREECE, Dodecanese, 385 m | Karpathos, Spoa-Mesochori rd. | loc 2., 35,63108 N/27,13624 E | 22 V 2014, S. Salata (DBET no. ANTWEB1008795-ANTWEB1008796); 22 paratype workers – GREECE, Dodecanese, 385 m | Karpathos, Spoa-Mesochori rd. | loc 2., 35,63108 N/27,13624 E | 22 V 2014, S. Salata (DBET, SSC no. ANTWEB100879-ANTWEB1008818); 1 paratype worker – Collection L. Borowiec | Formicidae | LBC-GR01364 || GREECE, Dodecanese, 399 m | Karpathos, Spoa-Mesochori rd. | 35,62748 N/27,12748 E | 21 V 2014, S. Salata (DBET no. ANTWEB1008819); 1 paratype worker – GREECE Dodecanese | Karpathos, Ag. Nikolaos, | 189 m 35°38'N 27°09'E | 20.05.14 S. Salata (SSC no. ANTWEB1008820); 32 paratype workers – GREECE Karpathos | Trachanammos, 0 m. | 35°27'N 27°06'E | 22.05.14 S. Salata ( DBET, SSC no. ANTWEB1008821-ANTWEB1008852); 4 paratype workers – GREECE Dodecanese | Karpathos, Achamandria, | 222 m 35°41'N 27°09'E | 18.05.14 S. Salata (SSC no. ANTWEB1008853-ANTWEB1008856); 1 paratype worker – GREECE Dodecanese | Karpathos, Olympos, 351 m | 35°43'N 27°10'E | 19.05.14 S. Salata (SSC no. ANTWEB1008857); 2 paratype workers – GREECE Dodec. Karpathos, | Vanada, 460 m 35°33' | N/27°09'E, 12.10.2013 | Lymberakis (SSC no. ANTWEB1008858-ANTWEB1008859); 1 paratype worker – GREECE Dodec. Rodos, | Prasonisi, 17 m 36°58' | N/27°44'E, 9.07.2006 | Chatzaki M. (SSC no. ANT-

WEB1008860); 1 paratype worker – GREECE Dodec. | Kandelioussa, 76 m 36°30'N | /26°58'E, 6.06.2006 | Chatzaki M. (SSC no. ANTWEB1008861); 1 paratype worker – Collection L. Borowiec | Formicidae | LBC-GR01551 || GREECE, Dodecanese, Rodos | Prasonisi, 9 VII 2006, 14 m | 35,8842 N 27,768 E | leg. M. Chatzaki (DBET no. ANTWEB1008862); 1 paratype worker – Collection L. Borowiec | Formicidae | LBC-GR01550 || GREECE, Dodecanese, 270 m | Kos, Pelli | 36,8352/N 27,1668 E | 9 IX 2001 leg. M. Chatzaki (DBET no. ANTWEB1008863);

**Differential diagnosis.** *Crematogaster erectepilosa* sp. n. differs from all species from the north-eastern part of the Mediterranean Basin, except *C. cypria* Santschi and *C. gullukdagensis* sp. n., in that the first gastral tergite bearing numerous erect setae. *Crematogaster cypria* is well distinguished by shorter propodeal spines and mesonotal keel (see key below). *C. gullukdagensis* is very similar but differs in having the antennal scape predominantly with subappressed and suberect setae (Fig. 11), while in *C. erectepilosa* sp. n. the setae on scape are mostly erect (Fig. 10). Head in full face view in *C. erectepilosa* sp. n. appears round, while in *C. gullukdagensis* sp. n. it is slightly square. Eyes in *C. erectepilosa* sp. n. are more round (EI 74.3 ± 2.3 [71.5-78.8]) and in *C. gullukdagensis* sp. n. they are more oval (EI 69.5 ± 3.1 [63.4-73.6]). Body ground colour in *C. erectepilosa* sp. n. is darker, yellowish-brown to brown, in *C. gullukdagensis* sp. n. yellowish to pale yellowish-brown. Propodeal spines of *C. erectepilosa* sp. n. in most specimens are slightly curved down, while in *C. gullukdagensis* sp. n. propodeal spines are mostly straight, spine at base slightly thicker in *C. erectepilosa* sp. n. and thinner in *C. gullukdagensis* sp. n. Sides of pronotum in *C. erectepilosa* sp. n. in most specimens have fine longitudinal striation, while in *C. gullukdagensis* sp. n. they are mostly without striation, smooth and shiny.

**Description.** Measurements: Workers (n=23): HL: 0.948 ± 0.039 (0.872-1.017); HW: 0.972 ± 0.056 (0.872-1.072); SL: 0.884 ± 0.027 (0.835-0.921); EL: 0.228 ± 0.007 (0.212-0.235); EW: 0.169 ± 0.005 (0.162-0.179); ML:1.117 ± 0.057 (1.011-1.209); PSL: 0.2 ± 0.023 (0.156-0.251); SDL: 0.065 ± 0.03 (0.044-0.165); PL: 0.415 ± 0.014 (0.391-0.436); PPL: 0.207 ± 0.012 (0.19-0.235); PH: 0.228 ± 0.016 (0.19-0.246); PPH: 0.26 ± 0.017 (0.223-0.291); PNW: 0.6 ± 0.03 (0.547-0.654); LHT: 0.81 ± 0.027 (0.777-0.865); PW: 0.337 ± 0.03 (0.236-0.38); PPW: 0.297 ± 0.018 (0.268-0.335); CI: 102.5 ± 1.9 (99.3-105.4); SI1: 93.3 ± 1.9 (89.3-96.0); SI2: 91.1 ± 3.0 (84.7-96.0); MI: 186.1 ± 3.7 (179.6-194.0); SPI: 28.9 ± 4.3 (23.2-37.8); PI1: 184.3 ± 11.7 (167.9-205.8); PI2: 56.2 ± 4.0 (42.2-59.2); PPI1: 79.1 ± 3.5 (73.4-83.7); PPI2: 49.5 ± 1.0 (47.9-51.2); HTI: 84.8 ± 2.6 (81.1-90.4); EI: 74.3 ± 2.3 (71.5-78.8); EI1: 24.1 ± 0.7 (22.7-25.0); EI2: 17.9 ± 0.7 (16.9-18.7).

Colour uniformly pale to dark brown, mesosoma not paler coloured than head and abdomen, legs the same colour, antennae only slightly paler coloured than mesosoma (Figs 3, 4).

Head shape almost round, approximately as wide as long (CI: 102.5 ± 1.9), posterior margin of head in full-face view straight and laterally rounded, occipital carinae distinct (Fig. 7). Antennal scapes slightly surpassing head margin. Midline of eyes situated slightly above midline of head in full-face view, eyes moderately


**Figures 3–4.** *Crematogaster erectepilosa* sp. n., worker **3** dorsal **4** lateral. Scale bar: 1 mm.

large (EI1: 24.1 ± 0.7) and protruding. Pronotum laterally rounded, with sharp lateral margins, promesonotal suture absent, mesonotum without posterior face more or less forming one plane with pronotum. Metanotal groove deep, laterally constricted; propodeal spines long, 2.7–2.8 times as long as wide at base, spiniform, in most specimens slightly curved downwards (Fig. 4). Dorsal face of propodeum short but distinct, convex in profile, posterior face of propodeum distinctly sloping, without transverse groove. Petiole in dorsal view cordiform, dorsum flat or slightly concave, without posterolateral tubercules or denticles, sides carinate, subpetiolar

process absent. Postpetiole distinctly bilobed, with a narrow median impression, subpostpetiolar process absent.

Head surface finely and sparsely punctate, without microreticulation between punctures, shiny. Masticatory margin of mandibles with four teeth, surface of mandibles distinctly carinate. Clypeus on whole surface with thin carinae or only in the middle carinae indistinct. Antennal scrobes laterally with 7–9 long carinae extending to mid length of eye, also genae with carinae and area behind eyes with thin carinae. Whole surface of head appears shiny. Vestiture of head mostly with sparse, short, suberect hairs and 5–8 long erect setae on frons and several long erect setae on underside. Antennal scapes on anterior and dorsal surface bearing long erect setae, on posterior surface basally with suberect and distally erect setae (Figs 7, 10). Surface of scape with indistinct microreticulation, shiny. Pronotum in anterior half and dorsolaterally with longitudinal rugae, posterior face with punctuation and sparse, very short carinae, surface of pronotum appears more or less shiny. Whole dorsal surface of pronotum bearing mixed sparse, short suberect and long erect setae. Sides of pronotum with more or less distinct thin, transverse carinae disappearing from anterior to posterior margin of pronotum but in most specimens well visible. Mesonotum dorsally on whole length with longitudinal and oblique rugae, more or less shiny, with distinct median keel in most specimens running from anterior margin of mesonotum to its ¾ length, in some specimens reaching to posterior margin of mesonotum. Surface of mesonotum with very sparse, short adjacent setae. Mesopleuron on whole surface with dense, transverse carinae. Dorsal face of propodeum with longitudinal carinae and very sparse and short adjacent pubescence, slope of propodeum smooth and shiny, metapleuron on whole surface with dense, transverse carinae. Petiole on sides and posterior half with long erect setae, also postpetiolar tubercles several erect setae. First gastral tergite with sparse, moderately long, suberect basic pubescence and on whole surface with sparse, moderately long erect setae (Fig. 2), subsequent tergites with row of erect setae along posterior margins. Whole surface of tergites with very fine microreticulation, appears shiny. First sternite with moderately long and sparse basic pubescence and numerous long, erect setae. Legs bearing sparse, moderately long, more or less erect pubescence.

**Etymology.** Named after erect setae on antennal scape.

**Distribution.** Dodecanese Archipelago in Aegean Greece (Fig. 20).

**Biological data.** The ants were collected on ground around shrubs and from shrub leaves and stems. Locality on Karpathos, Olympos was placed 429 m a.s.l. in dry, stony and rocky area with sparse shrubs. The following ant species were recorded in the same area: *Aphaenogaster olympica* Borowiec & Salata, *Camponotus gestroi* Emery, *Camponotus honaziensis* Karaman & Aktaç, *Camponotus ionius* Emery, *Camponotus jaliensis* Dalla Torre, *Camponotus kiesenwetteri* (Roger), *Crematogaster ionia* Forel, *Crematogaster sordidula* (Nylander), *Lepisiota nigra* (Dalla Torre), *Messor orientalis* (Emery), *Messor wasmanni* Krausse, *Pheidole pallidula* (Nylander), *Plagiolepis pallescens* sensu Radchenko, *Tapinoma simrothi* Krausse, *Temnothorax exilis* (Emery), *Temnothorax recedens* (Nylander), and *Temnothorax solerii* (Menozzi). First locality on Spoa-Mesochori rd. was on a rocky slope, above olive orchard, overgrown by shrubs. The following ant

species were recorded in the same area: *Aphaenogaster karpathica* Boer, *Aphaenogaster olympica* Borowiec & Salata, *Camponotus ionius* Emery, *Camponotus jaliensis* Dalla Torre, *Camponotus kiesenwetteri* (Roger), *Camponotus lateralis* (Olivier), *Crematogaster sordidula* (Nylander), *Lepisiota nigra* (Dalla Torre), *Messor wasmanni* Krausse, *Pheidole pallidula* (Nylander), *Plagiolepis pallescens* sensu Radchenko, *Plagiolepis taurica* Santschi, *Tapinoma simrothi* Krausse, *Temnothorax exilis* (Emery), *Temnothorax semiruber* (André), and *Tetramorium* cf. *punctatum*. Second locality on Spoa-Mesochori rd. was near a road, opposite the Spoa-Mesochori rd. locality, area was overgrown by Mediterranean shrubland. The following ant species were recorded in the same area: *Camponotus jaliensis* Dalla Torre, *Camponotus kiesenwetteri* (Roger), *Camponotus lateralis* (Olivier), *Crematogaster ionia* Forel, *Pheidole pallidula* (Nylander), *Plagiolepis pallescens* sensu Radchenko, and *Temnothorax exilis* (Emery).

Locality near Agios Nikolaos was located above the village. The vegetation at this locality is a Mediterranean shrubland and pine forest. The following ant species were recorded in the same area: *Camponotus ionius* Emery, *Camponotus kiesenwetteri* (Roger), *Lepisiota melas* (Emery), *Pheidole pallidula* (Nylander), *Plagiolepis pallescens* sensu Radchenko, *Tetramorium* cf. *caespitum*, and *Tetramorium* cf. *punctatum*.

Locality near Achamandria was on a dry slope overgrown by Mediterranean shrubland and isolated pine trees. The following ant species were recorded in the same area: *Camponotus gestroi* Emery, *Camponotus ionius* Emery, *Camponotus jaliensis* Dalla Torre, *Camponotus kiesenwetteri* (Roger), *Camponotus lateralis* (Olivier), *Crematogaster ionia* Forel, *Crematogaster sordidula* (Nylander), *Lepisiota nigra* (Dalla Torre), *Pheidole pallidula* (Nylander), *Plagiolepis taurica* Santschi, *Temnothorax exilis* (Emery), *Temnothorax recedens* (Nylander), *Temnothorax semiruber* (André), and *Temnothorax solerii* (Menozzi). Locality near Trachanammos was in a sandy valley created by intermittent river, overgrown by Mediterranean shrubland. Nest was located in the soil, under stone beneath shrubs. The following ant species were recorded in the same area: *Camponotus kiesenwetteri* (Roger), *Lepisiota nigra* (Dalla Torre), *Monomorium subopacum* (F. Smith) and *Pheidole pallidula* (Nylander).

***Crematogaster gullukdagensis* sp. n.**
http://zoobank.org/9C76B398-7D55-4039-B93A-7E62C222248B

**Type material.** Holotype worker: Collection L. Borowiec | Formicidae | LBC-TR00073 || TURKEY, Antalaya Prov. | ancient Termessos | 1018 m, 36°58/30°27 | 3 VII 2010, L. Borowiec (MNHW no. 1223); 15 paratype workers: the same data as holotype (DBET, CASC, TU no. ANTWEB1008863-ANTWEB1008878).

**Differential diagnosis.** See diagnosis for *Crematogaster erectepilosa* sp. n.

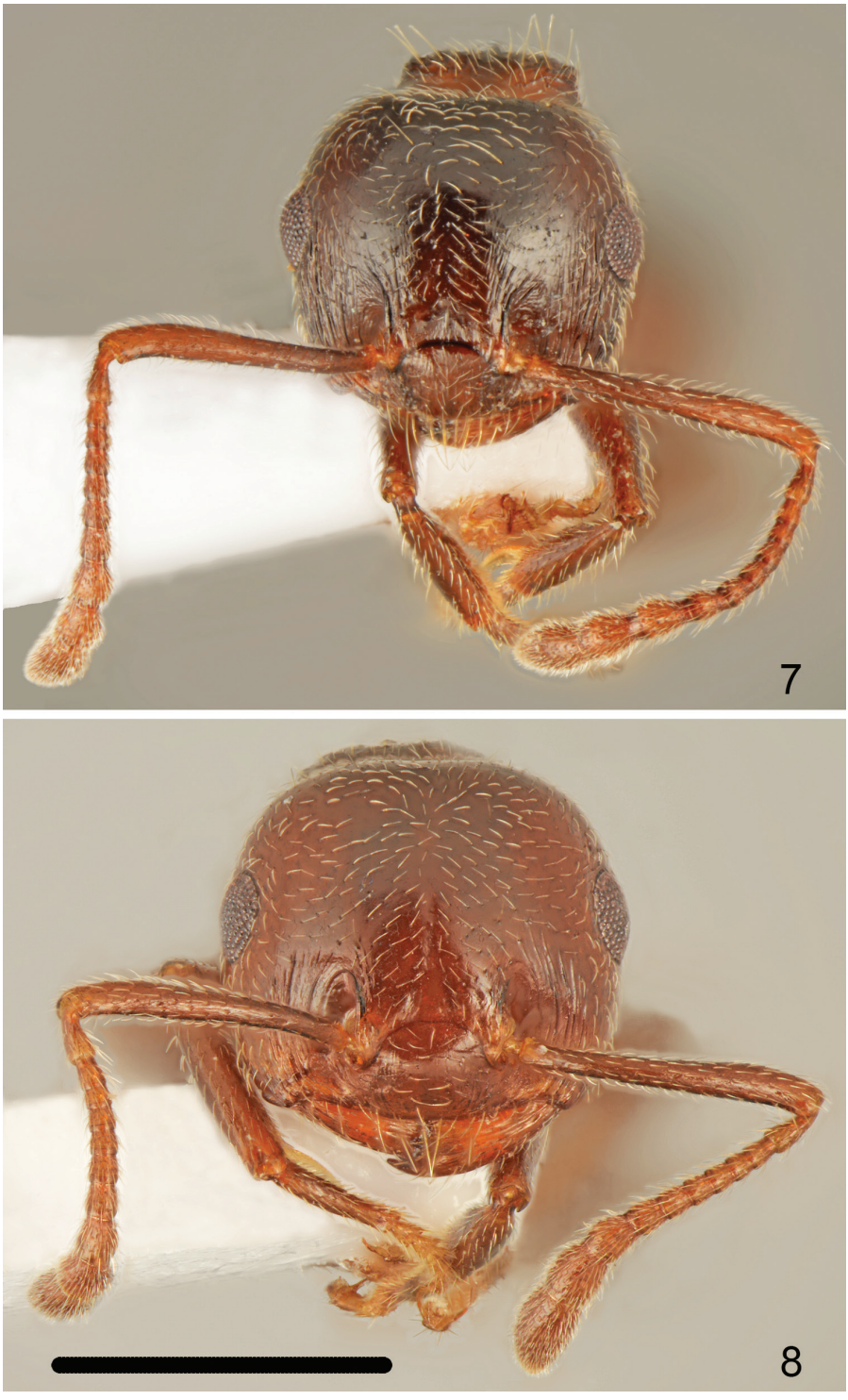
**Description.** Measurements: Workers (n=16): HL: 0.981 ± 0.024 (0.932-1.027); HW: 1.001 ± 0.041 (0.949-1.084); SL: 0.894 ± 0.033 (0.843-0.988); EL: 0.224 ± 0.011 (0.201-0.246); EW: 0.156 ± 0.004 (0.151-0.168); ML:1.165 ± 0.054 (1.084-1.309); PSL: 0.229 ± 0.024 (0.19-0.294); SDL: 0.06 ± 0.01 (0.044-0.086); PL: 0.464


**Figures 5–6.** *Crematogaster gullukdagensis* sp. n., worker **5** dorsal **6** lateral. Scale bar: 1 mm.

± 0.038 (0.424-0.576); PPL: 0.237 ± 0.025 (0.212-0.317); PH: 0.25 ± 0.024 (0.223-0.323); PPH: 0.283 ± 0.019 (0.263-0.338); PNW: 0.618 ± 0.02 (0.575-0.654); LHT: 0.806 ± 0.028 (0.749-0.86); PW: 0.362 ± 0.01 (0.344-0.38); PPW: 0.31 ± 0.015 (0.268-0.335); CI: 101.9 ± 2.0 (99.4-105.6); SI1: 90.7 ± 1.3 (88.7-93.6); SI2: 88.9 ± 1.8 (84.9-91.0); MI: 187.1 ± 4.1 (179.8-191.8); SPI: 26.3 ± 2.8 (20.2-30.4); PI1: 185.4 ± 12.9 (173.7-222.9); PI2: 58.7 ± 1.0 (57.4-60.8); PPI1: 83.9 ± 4.2 (77.8-93.8); PPI2: 50.2 ± 1.9 (43.6-52.5); HTI: 80.8 ± 1.6 (78.9-83.8); EI: 69.5 ± 3.1 (63.4-73.6); EI1: 22.9 ± 1.0 (20.2-24.5); EI2: 16.0 ± 0.3 (15.5-16.7).

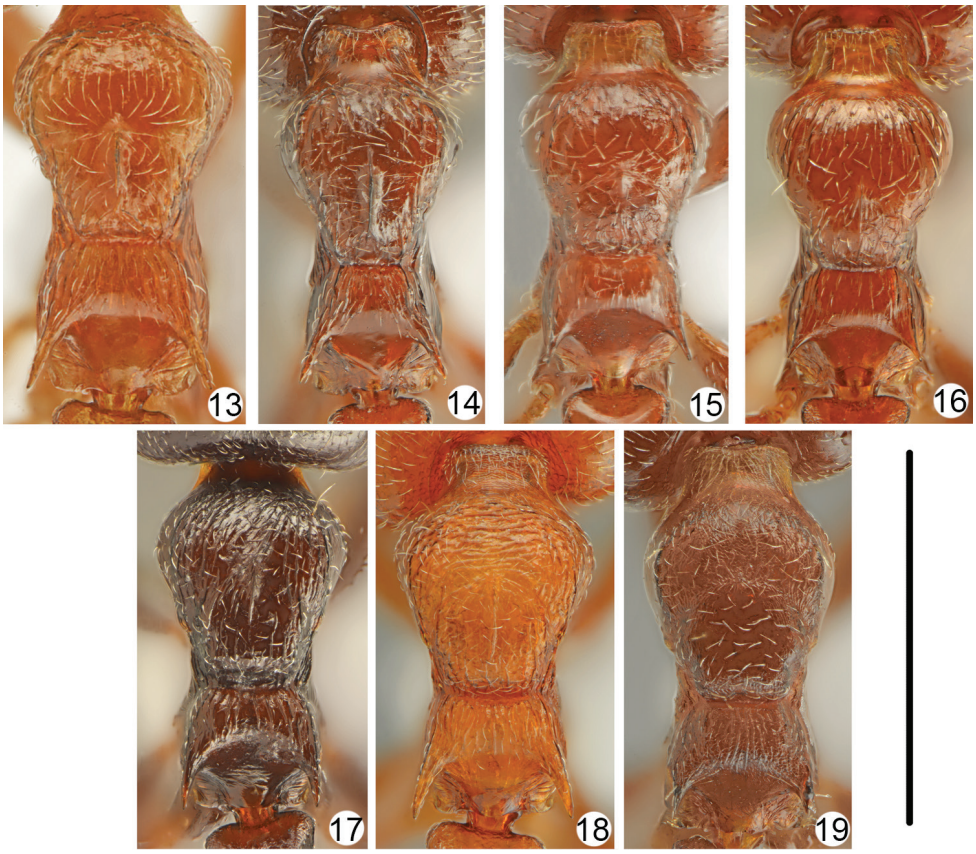
Colour uniformly yellowish brown to pale brown, mesosoma not paler coloured than head and abdomen, legs and antennae the same colour as mesosoma (Figs 5, 6).

Head shape almost square, approximately as wide as long (CI: 101.9 ± 2.0), posterior margin of head in full-face view straight and laterally rounded, occipital carinae distinct (Fig. 9). Antennal scapes slightly surpassing head margin. Midline of eyes situ-




**Figures 7–8.** Worker head **7** *Crematogaster erectepilosa* sp. n. **8** *Crematogaster cypria*. Scale bar: 1 mm.


**Figures 9–12.** Worker head and scapus **9** *Crematogaster gullukdagensis* sp. n. **10** *Crematogaster erectepilosa* sp. n. **11** *Crematogaster gullukdagensis* sp. n. **12** *Crematogaster cypria*. Scale bar: 1 mm (**9**), 0.5 mm (**10–12**).




**Figures 13–19.** Mesosoma **13** *Crematogaster gullukdagensis* sp. n. **14** *Crematogaster erectepilosa* sp. n. **15** *Crematogaster cypria* **16** *Crematogaster jehovae* **17** *Crematogaster ionia* **18** *Crematogaster schmidti* **19** *Crematogaster lorteti*. Scale bar: 1 mm.

ated slightly above midline of head in full-face view, eyes moderately large (EI1: 22.9 ± 1.0) and protruding. Pronotum laterally rounded, with sharp lateral margins, promesonotal suture absent, mesonotum without posterior face more or less forming one plane with pronotum. Metanotal groove deep, laterally constricted; propodeal spines long, 2.7–2.9 times as long as wide at base, spiniform, in most specimens straight (Fig. 6). Dorsal face of propodeum short but distinct, convex in profile, posterior face of propodeum distinctly sloping, without transverse groove. Petiole in dorsal view cordiform, dorsum flat or slightly concave, without posterolateral tubercules or denticles, sides carinate, subpetiolar process absent. Postpetiole distinctly bilobed, with a narrow median impression, subpostpetiolar process absent.

Head surface finely and sparsely punctate, without microreticulation between punctures, shiny. Masticatory margin of mandibles with four teeth, surface of mandibles distinctly carinate. Clypeus laterally with thin carinae, in the middle smooth or with indistinct carinae. Antennal scrobes laterally with 7–9 long carinae extending

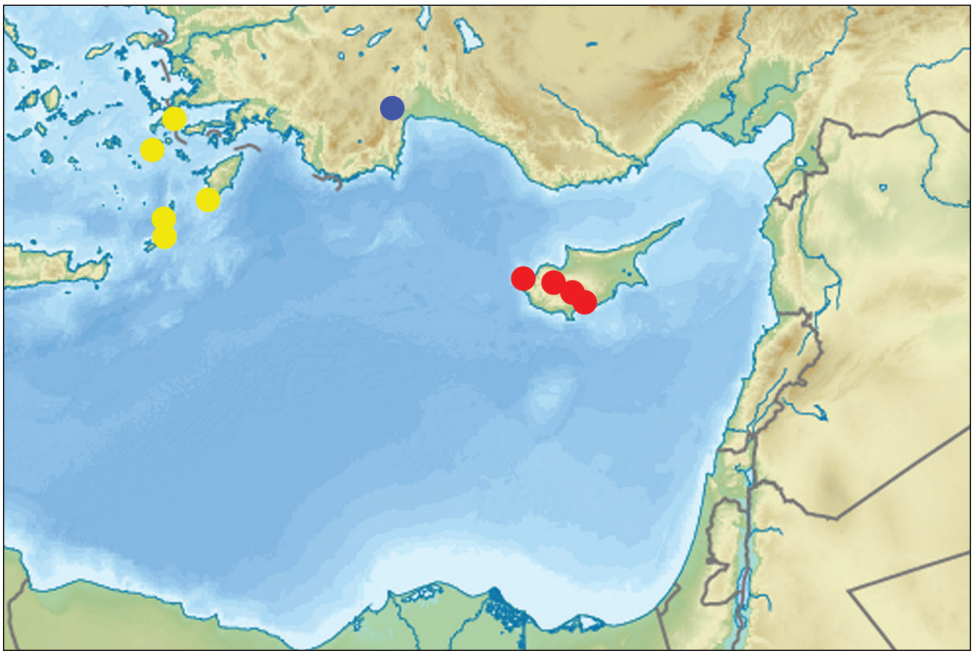


**Figure 20.** Distribution of *Crematogaster cypria* Santschi (red circles), *Crematogaster erectepilosa* sp. n. (yellow circles) and *Crematogaster gullukdagensis* sp. n. (blue circle).

to mid length of eye, also genae with carinae and area behind eyes with thin carinae. Whole surface of head appears shiny. Vestiture of head mostly with sparse, short, adjacent to suberect hairs and 4–6 long erect setae on frons and several long erect setae on underside. Antennal scapes on anterior and dorsal surface bearing suberect setae, sometimes with 2–3 longer and more erect setae, on posterior surface basally with adjacent and distally suberect setae (Figs 9, 12). Surface of scape with indistinct microreticulation, shiny. Pronotum dorsolaterally with longitudinal rugae, anterior face mostly sparsely punctate and at most with few very short rugae, posterior face only with punctuation, surface of pronotum appears more or less shiny. Whole dorsal surface of pronotum bearing mixed sparse, short adjacent to suberect and long erect setae. Sides of pronotum only in anterior half with more or less distinct thin, transverse carinae, posterior half in most specimens completely smooth. Mesonotum dorsally on sides with longitudinal and oblique rugae, centrally partly smooth, more or less shiny, with distinct median keel in most specimens running from anterior margin of mesonotum to its ½-⅔ length, never reaching to posterior margin of mesonotum. Surface of mesonotum with very sparse, short adjacent setae. Mesopleuron on whole surface with dense, transverse carinae. Dorsal face of propodeum laterally with longitudinal carinae, in central part more or less smooth, with very sparse and short adjacent pubescence, slope of propodeum smooth and shiny, metapleuron on whole surface with dense, transverse carinae. Petiole on sides and posterior half with long erect setae, also post-

petiolar tubercles several erect setae. First gastral tergite with sparse, moderately long, adjacent to suberect basic pubescence and on whole surface with sparse, moderately long erect setae (Fig. 6), subsequent tergites with row of erect setae along posterior margins. Whole surface of tergites with very fine microreticulation, appears shiny. First sternite with moderately long and sparse basic pubescence and numerous long, erect setae. Legs bearing sparse, moderately long, adjacent to suberect pubescence.

**Etymology.** Named after terra typica: Güllük Dag mountains in Antalya Province of Turkey.

**Distribution.** SW Turkey (Fig. 20).

**Biological data.** The ants were collected on the trunk of a small oak species and on ground around the tree. The type locality is in a montane area within the ancient Termessos city, at 1018 m a.s.l. The following ant species were recorded from the same area: *Aphaenogaster festae* Emery, *Aphaenogaster maculifrons* Kiran & Aktaç, *Aphaenogaster sporadis* Santschi, *Camponotus aethiops* (Latreille), *Camponotus boghossiani* Forel, *Camponotus lateralis* (Olivier), *Camponotus samius* Forel, *Cataglyphis* sp., *Crematogaster* cf. *ionia*, *Lasius lasoides* (Emery), *Messor* cf. *structor*, *Pheidole pallidula* (Nylander), *Tetramorium anatolicum* Csösz & Schulz, and *Tetramorium* cf. *semilaeve*.

**Key to *Crematogaster* workers from the north-eastern part of the Mediterranean Basin**

1 Petiole subquadrate in dorsal view, sides almost parallel; antennal club three-segmented, sgen. *Crematogaster* s. str. ..... **2**

– Petiole trapezoidal narrowing from front to rear in dorsal view, sides almost parallel; antennal club two-segmented, sgen. *Orthocrema*

2 Propodeum with distinct propodeal spines ..... **3**

– Propodeum without propodeal spines, at most with small tubercles. Cyprus, Caucasian countries, the Near East and North Africa ..... ***Crematogaster inermis* complex***

3 First gastral tergite with numerous erect setae (Figs 2, 4, 6) ..... **4**

– First gastral tergite without or at most with 1–5 erect setae ..... **6**

4 Propodeal spines long, more than 2.5 times longer than width at base. Mesonotal keel long, longer than half length of mesonotum (Figs 4, 6) ..... **5**

– Propodeal spines short, at most 2 times longer than width at base (Fig. 2). Mesonotal keel absent or forming very small tubercle close to promesonotal suture (Fig. 15). Cyprus ..... ***Crematogaster cypria* Santschi**

5 Antennal scape on anterior surface on whole length with erect setae (Fig. 10). Eyes more round. Dodecanese ..... ***Crematogaster erectepilosa* sp. n.**

– Antennal scape on anterior surface with subappressed to suberect setae (Fig. 12). Eyes more oval. SW Turkey ..... ***Crematogaster gullukdagensis* sp. n.**

6 Pronotum at least on sides with more or less distinct rugae, dorsal surface more or less shiny (Figs 16–18). Mesonotal keel present, at least in form of short longitudinal tubercle (Figs 16–18) ..... **7**

– Pronotum without rugae, dorsal surface punctate and microreticulate, dull. Mesonotal keel absent (Fig. 19). Widespread throughout the region ..... ..... ***Crematogaster lorteti*** **Forel**

7 Pronotum on whole surface with rugae (Figs 17, 18). Propodeal spines long, more than 2.5 times longer than width at base..... **8**

– Pronotum only on sides with short rugae, anterior and central part only punctate (Fig. 16). Propodeal spines short, at most 2 times longer than width at base. The Near East (Egypt, Israel, Iraq, Jordan) ..... ..... ***Crematogaster jehovae*** **complex***

8 Body distinctly bicoloured, head and mesosoma yellowish, red to reddish-brown, abdomen dark brown. Rugae on anterior part of pronotum usually transverse (Fig. 18). Widespread throughout the region..... ..... ***Crematogaster schmidti*** **complex***

– Body more or less unicolours , brown to almost black or head and mesosoma only indistinctly paler coloured than abdomen. Rugae on whole pronotum usually longitudinal or on pronotal sides oblique, occasionally in anterior part transverse (Fig. 17). Widespread throughout the region ..... ..... ***Crematogaster ionia*** **complex***

(*These complexes comprise more than one species, some of them probably have been described under valid specific and infraspecific names and some are new to science; all complexes need a revision based on types and material encompassing the entire distribution of these species).

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## Appendix

List of *Crematogaster* s. str. taxa described from the north-eastern Mediterranean region

*Crematogaster auberti laestrigon cretica* Karavaiev, 1927 unavailable name
*Crematogaster* (*Acrocoelia*) *auberti* subsp. *laestrigon* var. *cretica* Karavaiev, 1927: 106, fig. 2 (w.)

*Crematogaster cypria* Santschi, 1930
*Crematogaster jehovae* var. *cypria* Santschi, 1930: 266 (w.)

*Crematogaster gordani* Karaman, 2008
*Crematogaster gordani* Karaman, 2008: 6, figs 1–8, pl. 1.

*Crematogaster inermis aphrodite* Santschi, 1937
*Crematogaster inermis* var. *aphrodite* Santschi, 1937: 298, figs 2, 17 (w.q.m.)

*Crematogaster ionia* Forel, 1911
*Crematogaster scutellaris* var. *ionia* Forel, 1911: 340 (w.q.)

*Crematogaster lorteti* Forel, 1910
*Crematogaster lorteti* Forel, 1910: 435 (w.q.)

*Crematogaster lorteti hellenica* Forel, 1911
*Crematogaster* (*Atopogyne*) *hellenica* Forel, 1911: 342 (q.)

*Crematogaster montenigrina* Karaman, 2008
*Crematogaster montenigrinus* Karaman, 2008: 14, figs 13–16, pl.1.
*Crematogaster scutellaris* subsp. *schmidti* var. *atratula* Zimmermann, 1935: 21 unavailable name

*Crematogaster phoenica* Santschi, 1915
*Crematogaster laestrygon* st. *phoenica* Santschi, 1915: 59 (w.)

*Crematogaster phoenica pygmalion* Santschi, 1934
*Crematogaster phoenica pygmalion* Santschi, 1934: 276 (w.)

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# Redescription of *Chrysoctonus* and description of *Chrysoctonoides* (Hymenoptera, Mymaridae), a new genus from the Australian Region

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## Abstract

*Chrysoctonoides longisetosa* Huber & Triapitsyn (Hymenoptera: Mymaridae), **gen. n.** and **sp. n.**, is described from Australia. It is compared with the related genus *Chrysoctonus*, known from Africa and the New World. *Myrmecomymar* Yoshimoto, **syn. n.**, is synonymized under *Chrysoctonus* Mathot and its type species is transferred to *Chrysoctonus* as *C. masneri* (Yoshimoto), **comb. n.**

## Keywords

Australia, *Chrysoctonus*, *Myrmecomymar*, redescription

## Introduction

Yoshimoto (1990) described a species based on numerous specimens of both sexes collected from a peat bog in Ontario, Canada, and placed it in his new genus *Myrmecomymar*. He was aware that the genus was fairly widespread in the Western Hemisphere, having recorded specimens representing undescribed species from USA, Ecuador, Trinidad, and Venezuela, but he described only the type species. He was unaware that *Myrmecomymar* had previously been described from Africa under a different name, *Chrysoctonus* Mathot (1966). Here, we describe a new genus from Australia related to *Chrysoctonus* and synonymize Yoshimoto's genus.

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## Methods

The type specimens and about 85 specimens of *Myrmecomymar masneri* Yoshimoto, 30 unidentified specimens (several species) of the genus from Canada and USA, and 55 specimens from Central and South America were examined, from Belize and the Dominican Republic in the north to Uruguay in the south. The holotype of *Chrysoctonus apterus* Mathot and several additional specimens from central Africa were also examined. Abbreviations used are: fl =funicle segment (in female) or flagellar segment (in male), gt = gastral tergum, LOL = least ocellar length (i.e., shortest distance between anterior and a posterior ocellus), mps = multiporous plate sensillum, OOL = ocular-ocellar length (i.e., shortest distance between posterior ocellus and eye), POL = posterior ocellar length (i.e., shortest distance between posterior ocelli). The term "fenestra", used below in the descriptions, was defined and illustrated for Mymaridae in Huber 2012: 17 and figs 139 and 140, as well as in Huber 2013, fig. 33. In the former paper, Fig. 140 is mislabelled. The fenestra, or scutellar fenestra, is the same structure so the lower arrow and label on Fig. 140 should be ignored; the upper arrow indicates the correct structure. The following acronyms are used for institutions in which the specimens are deposited.

**ANIC** Australian National Insect Collection, Canberra, ACT, Australia.
**CAS** California Academy of Sciences, San Francisco, California, USA.
**CNC** Canadian National Collection of Insects, Arachnids and Nematodes, Ottawa, Ontario, Canada.
**IRSNB** Institut Royale des Sciences Naturelles de Belgique, Brussels, Belgium.
**UCRC** University of California, Riverside, California, USA.

Photographs were taken with a ProgRes™ C14$^{plus}$ digital camera attached to a microscope, and the resulting layers combined electronically using Syncroscopy Auto-Montage™ and, except for primary types, retouched as needed with Adobe™ Photoshop. Micrographs of gold-coated specimens were taken with a Phillips scanning electron microscope.

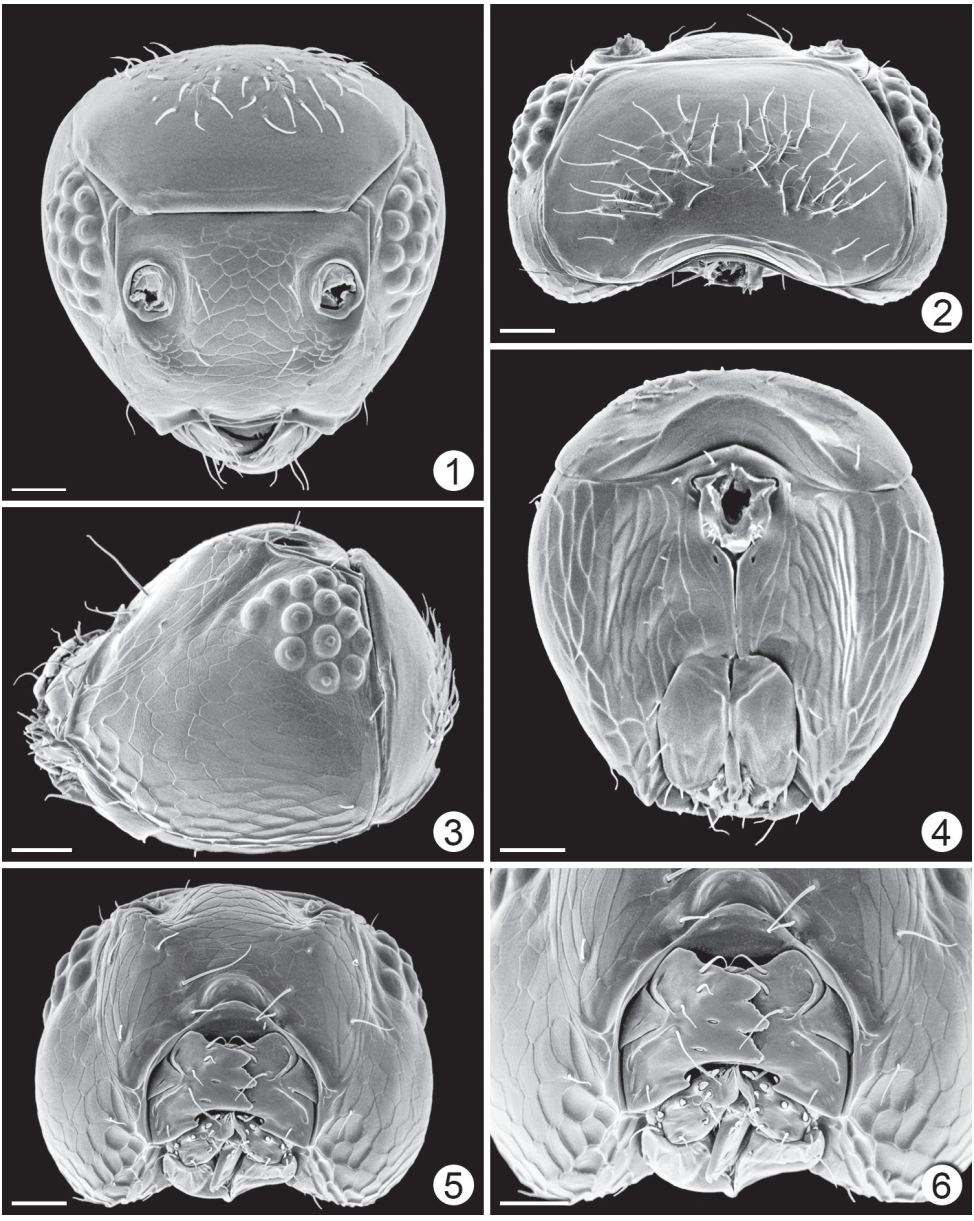
## Taxonomy

### *Chrysoctonus* Mathot

Figs 1–40

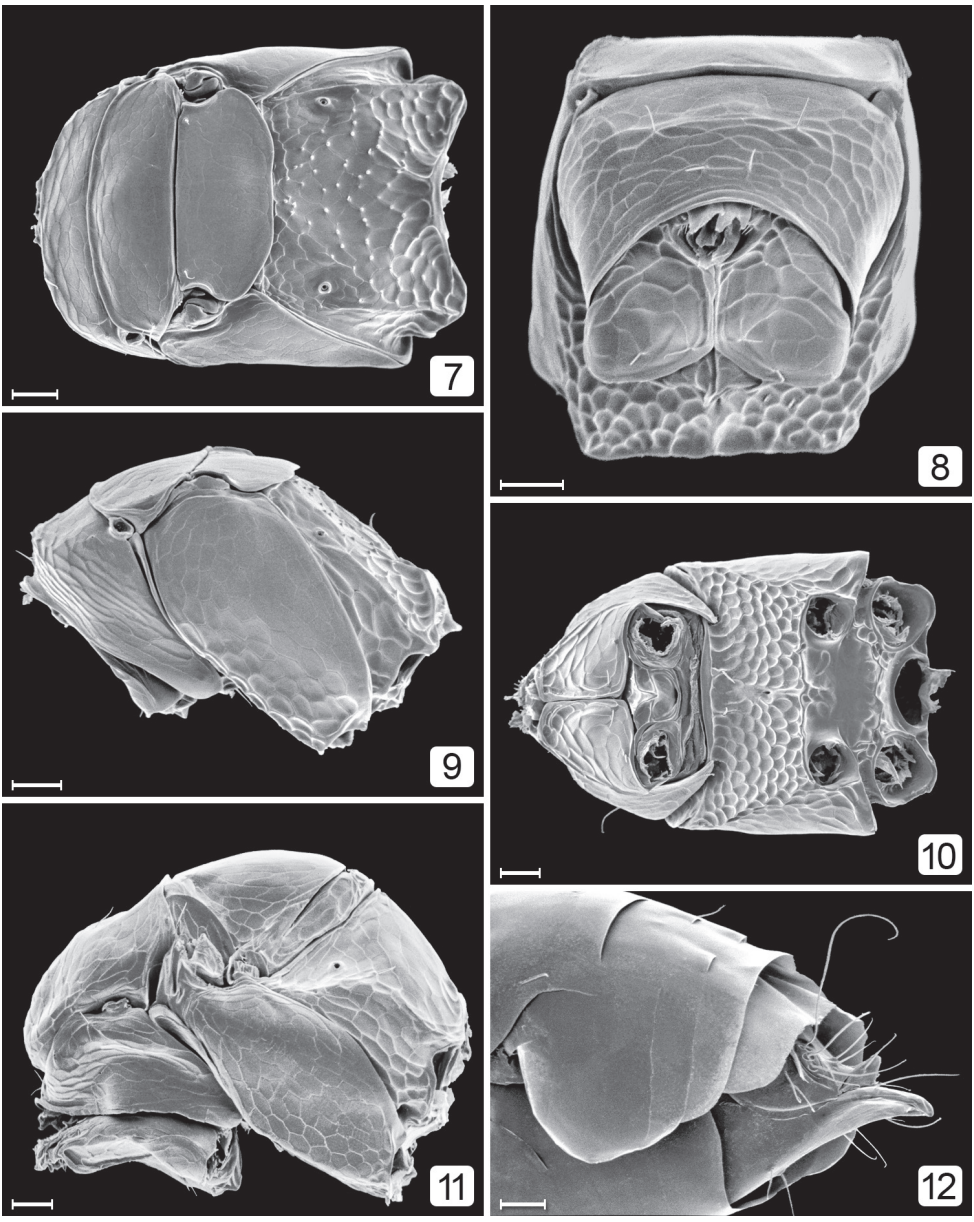
*Chrysoctonus* Mathot, 1966: 224. Type species: *C. apterus* Mathot. Type locality: Democratic Republic of the Congo, Yangambi, 0°46'N, 24°27'E, in forest litter.
*Myrmecomymar* Yoshimoto, 1990: 28. Type species: *M. masneri* Yoshimoto. Type locality: Canada, Ontario, Spencerville. Syn. n.

**Diagnosis. Female.** Body length 425–890. Wingless (Figs 7, 9, 33, 36, 37). Head (Figs 1–6, 33, 35, 37) with eye small and ocelli absent; subantennal sulci absent;



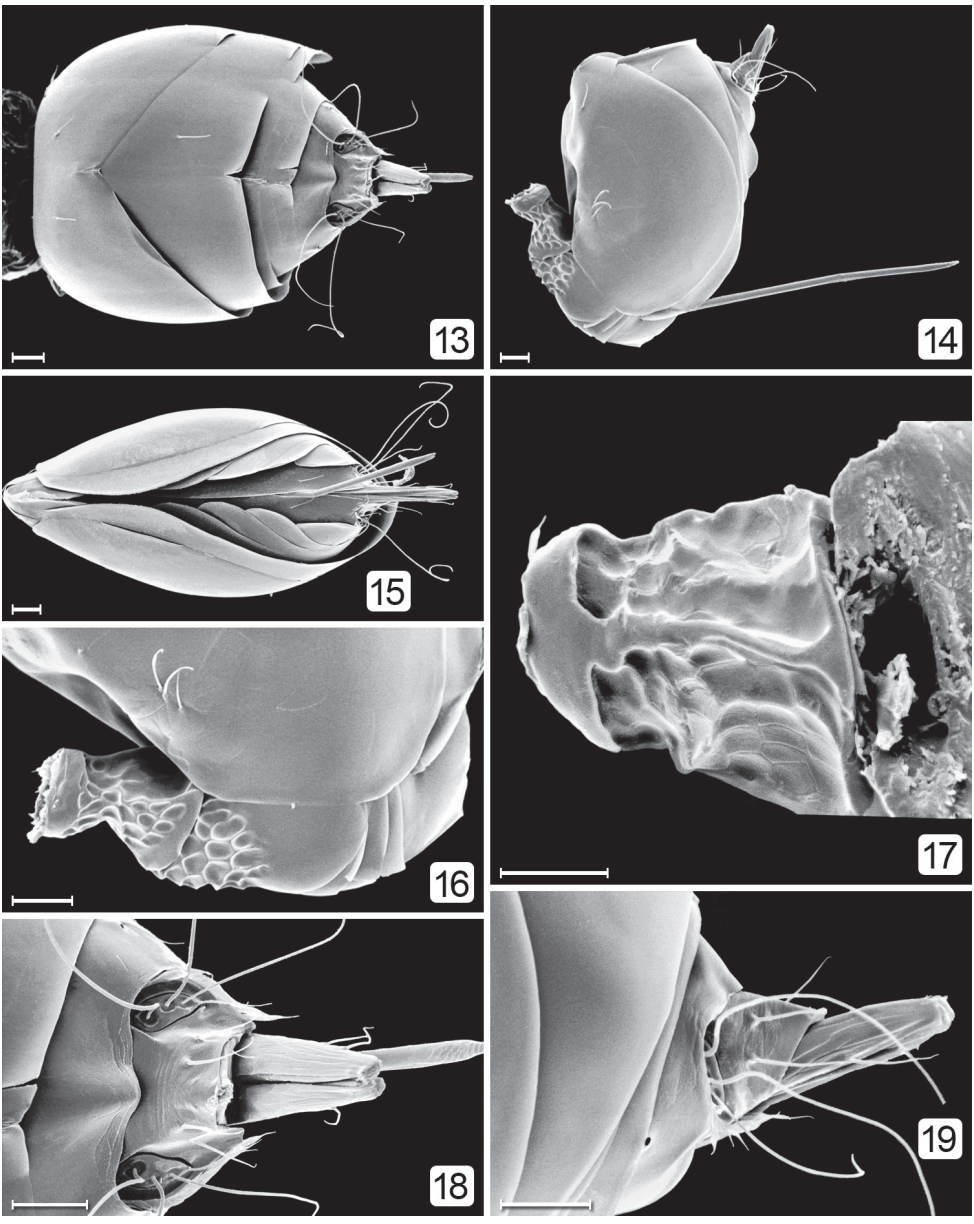

**Figures 1–6.** *Chrysoctonus* sp., female head, specimens from Florida. **1** anterior **2** dorsal **3** lateral **4** posterior **5** ventral **6** mouthparts. Scale bars = 20 μm.

vertex with many appressed, diverging setae medially surrounded by bare area; occiput separated from vertex by curved suture above foramen. Antenna with 4–8 funicle segments, the basal ones short (Figs 33, 34). Mesosoma (Figs 7–10, 36, 37) with pronotum entire, from about half as long as to longer than the short, strongly transverse mesoscutum; notauli apparently absent; scutellum with frenum not de-



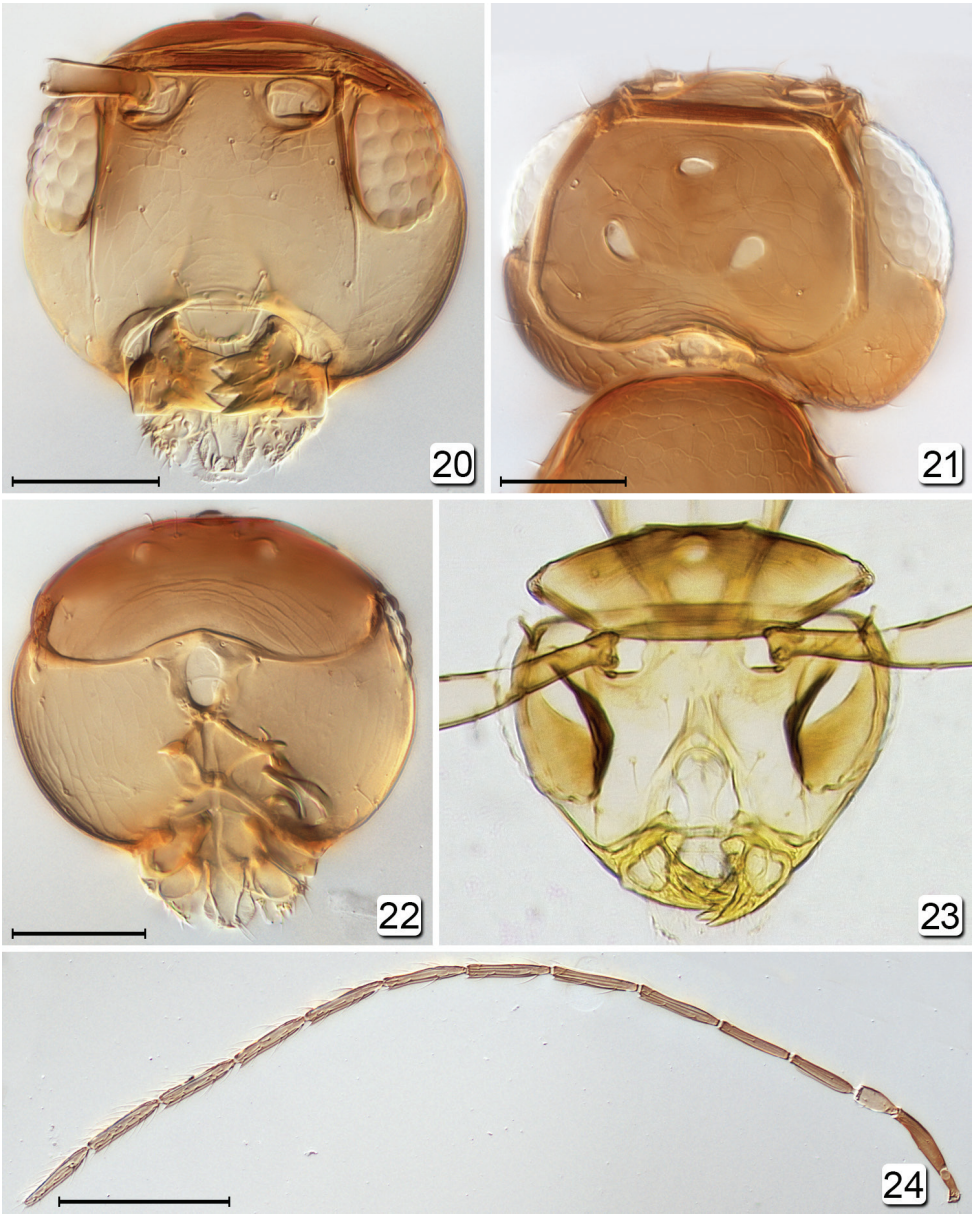

**Figures 7–12.** *Chrysoctonus* sp., mesosoma (except 12); specimens from Florida. **7** female, dorsal **8** female, anterior (slightly ventral) **9** female, lateral **10** female, ventral **11** male, lateral **12** male gaster (apical two-thirds), lateral. Scale bars = 20 μm.

marcated, about as long as or longer than mesoscutum; metanotum narrow, hidden under scutellum; propodeum flat, reticulate, with denticles medially; propodeal spiracle small, several times its diameter from anterior margin of propodeum. Metasoma (Figs 13–19, 33, 38–40) with petiole tubular, about 1.5× as long as wide, strongly




**Figures 13–19.** *Chrysoctonus* sp., female metasoma; specimens from Florida. **13** gaster, dorsal **14** gaster lateral **15** gaster, ventral **16** petiole + base of gaster, lateral **17** petiole, dorsal **18** apex of gaster, dorsal **19** apex of gaster, lateral. Scale bars = 20 μm.

reticulate; gaster with $gt_1$ the largest tergum, with lateral panels covering at least half of gaster, and with a cluster or row of setae anterolaterally; $gt_2$ the next largest tergum; cercal setae long. Gaster without spiracle on $gt_6$. Ovipositor slightly exserted beyond apex of gaster (Figs 18, 19, 38–40).




**Figures 20–24.** *Chrysoctonus* spp., male. **20** head, anterior (USA, Florida) **21** head, dorsal (USA, Georgia) **22** head, posterior (USA, Florida) **23** *C. apterus*, head, anterior (Democratic Republic of the Congo) **24** antenna (USA, Georgia). Scale bars: **20–22** = 50 μm, **24** = 200 μm.

**Male.** Body length 425–760. Fully winged. Head (Figs 20–23) with normal eyes and ocelli. Flagellum 11-segmented (Figs 24, 25), each segment equally wide with parallel sides and several rows of short setae, each much shorter than segment length. Mes-

osoma (Figs 11, 28–30) with pronotum short, in dorsal view barely visible; propleura abutting medially along most of their length (Fig. 29); prosternum small, triangular; mesoscutum as long as scutellum, without notauli (Figs 25, 50); scutellum with (Fig. 28) or without campaniform sensilla, and fenestra wide, occupying most of scutellum. Fore wing with venation more than half wing length (Figs 26, 27); microtrichia unevenly distributed on wing surface; hind wing short and narrow. Metasoma (Fig. 31) with $gt_1$ the largest segment. Genitalia (Figs 30, 32) with aedeagal apodeme at least as long as half length of gaster.

The greatest range in number of funicle segments of any genus of Mymaridae is found in *Chrysoctonus* species: one specimen from Panama had 4 segments and two from Costa Rica had 8 segments; the usual number appears to be 5 segments.

The only described species in *Myrmecomymar* is transferred here to *Chrysoctonus* as *C. masneri* (Yoshimoto), comb. n.

**Hosts and habitat.** Hosts are unknown. Specimens from the type locality were collected in August in pan traps placed near the base of trees in a forest normally flooded in spring and early summer (L. Masner, personal communication). Other specimens of the type species and other, undescribed, species were collected in Canada from a sedge pond, hollows and hummocks in a bog, peat bog, old forest, *Carya* grove, and spring flood debris. In the USA specimens have been collected from a hardwood forest, beaver swamp, oak forest, and forest hammock. In Central and South America and various Caribbean islands specimens were collected from wet cloud forest litter, forest litter, compost pile, forested creek, montane oak forest, cloud forest, rainforest, palm forest, and thicket forest, from about sea level to 2000m. The habitat types strongly suggest that females parasitize hosts found in moist soil or associated with water. The holotype of *C. apterus* and other African specimens were collected from forest litter.

**Distribution.** Western Hemisphere and Afrotropical Region. Specimens have been seen from 22 countries in the New World, from southern Canada to northern Argentina and Uruguay, and 4 countries in central Africa.

### ***Chrysoctonus apterus*** **Mathot**

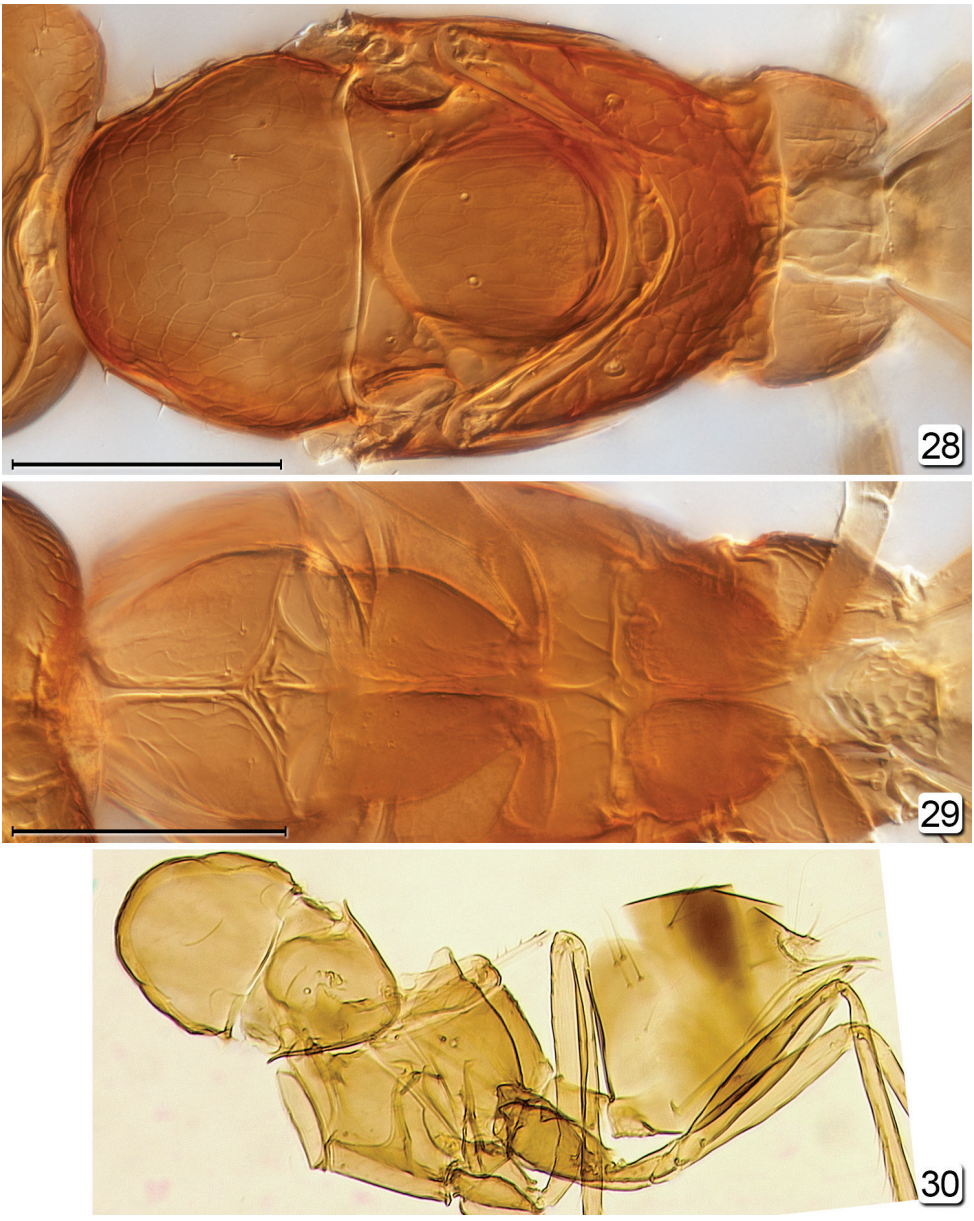
Figs 23, 25, 27, 30, 33–40

*Chrysoctonus apterus* Mathot, 1966: 225 (description). Holotype female (IRSNB), on slide (Fig. 33) labelled as follows: 1. "Yangambi, 17.VIII.51 Lit. Forêt Leg. Obutobe". 2. "Dr. H. Debauche det. Chrysoctonus apterus Deb. Holotype ♀".

**Diagnosis. Female.** Body length 495–561 (n=8). Funicle 7-segmented, with 2 mps on $fl_4$, $fl_6$, and $fl_7$, and 1 mps on $fl_5$. Vertex uniformly covered with short setae arising at interstices of reticulate sculpture, and anteromedially with a distinct cluster of short setae in a circular area (Fig. 35) where the anterior ocellus would be, if present. Meso-


**Figures 25–27.** *Chrysoctonus* spp., male. **25** *C. apterus*, antenna (Democratic Republic of the Congo) **26** *C.* sp. wings (USA, Georgia) **27** *C. apterus*, wings (Democratic Republic of the Congo). Scale bar = 200 μm.

soma entirely reticulate (Figs 36, 37) (cf. Mathot 1966), the reticulations strongest on propodeum. Metasoma (Figs 38–40) apparently without spiracle on $gt_6$, with long, apically curled cercal setae and ovipositor distinctly exserted.




**Figures 28–30.** *Chrysoctonus* spp., male. **28** mesosoma–base of gaster, dorsal (USA, Florida) **29** metasoma–base of gaster, ventral with legs still attached (USA, Florida) **30** *C. apterus*, mesosoma + metasoma (Democratic Republic of the Congo). Scale bars = 100 μm.

**Male.** Body (Fig. 30) length ~640 (crushed, head detached). Head (Fig. 23) width 160. Antenna (Fig. 25) measurements (length and width, except length only for flagellar segments): scape 130/24, pedicel 45/30, fl$_1$ 52, fl$_2$ 73, fl$_3$ 73, fl$_4$ 76, fl$_5$ 73, fl$_6$ 70, fl$_7$


**Figures 31, 32.** *Chrysoctonus* sp., male from USA, Florida. **31** metasoma, dorsal **32** genitalia, dorsal, as seen through metasoma. Scale bars = 500 μm.

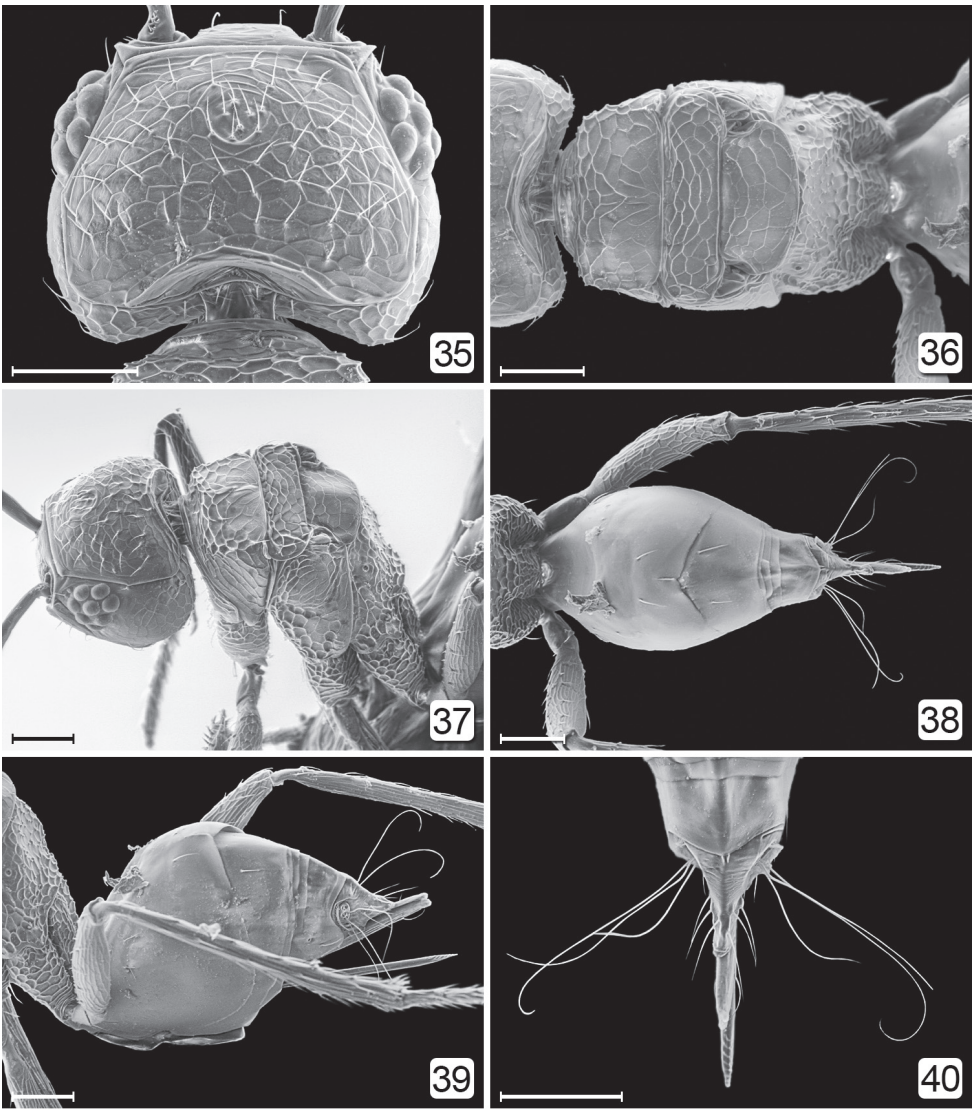
70, $fl_8$ 73, $fl_9$ 76, $fl_{10}$ 80, $fl_{11}$ 77; $fl_6$ length/width 4.38; total flagellum length 824. Wing (Fig. 27) measurements: fore wing length/width 722/140, longest marginal setae 321; hind wing length/width 380/15, longest marginal setae 135.

**Variation.** One female from Gabon, collected 29.ii.2000, has a one antenna with the funicle 6-segmented ($fl_3$ absent) and another female collected on the same day has one funicle with $fl_4$ and $fl_5$ fused.

**Material examined. CENTRAL AFRICAN REPUBLIC. Sangha-Mbaéré:** Parc National Dzanga-Ndoki, 39.6 km 174°S of Lidjombo, 340 m, 2°21'03"N,


**Figures 33–34.** *Chrysoctonus apterus*, holotype. **33** lateral habitus + holotype slide **34** head + antennae, lateral. Scale bars = 100 μm (except for type slide).

16°08'50"E, 20–28.v.2001, B. L. Fisher, sifted litter in rainforest, seasonally flooded riparian, CAS/BLF4146 (3 ♀, CAS, UCRC). **GABON. Ogooue-Maritime:** Mont Doudou, 24.3 km 307°NW Doussala, 375 m, 2°13'21"S, 10°24'21"E, 29.ii.2000, B. L. Fisher, sifted litter in rainforest, CAS/BLF2122 (6 ♀, CAS, CNC, UCRC); Ré-




**Figures 35–40.** *Chrysoctonus apterus*, female, specimen from Central African Republic. **35** head, dorsal **36** mesosoma, dorsal **37** head + mesosoma, dorsolateral **38** metasoma, dorsal **39** metasoma, lateral **40** apex of gaster, dorsal. Scale bars = 50 μm.

serve de Faune de la Moukalaba-Dou 12.2 km 305°NW Doussala, 110 m, 2°17°00"S, 10°29'49"E, 24.ii.2000, B. L. Fisher, sifting, litter in rainforest, CAS/BLF2170 (1 ♀, CAS). **DEMOCRATIC REPUBLIC OF THE CONGO. Pool:** Lesio-Louna Reserve, Iboubikro site, 340 m, 3°16.196'S, 15°28.267'E, 23.vii.2008, M. Sharkey, Y. Braet (1 ♂, UCRC).

***Chrysoctonus masneri* (Yoshimoto)**

*Chrysoctonus masneri* Yoshimoto, 1990: 84 (description). Holotype female (CNC), examined.

**Note.** Yoshimoto (1990) provided relative lengths of the male funicle segments and wings. For comparison with the male of *C. apterus* the corresponding absolute measurements from one male of *C. masneri* from Innisville, Ontario, are given here.

**Antenna measurements** (length and width, except length only for flagellar segments): scape 148/28, pedicel 59/27, $fl_1$ 87, $fl_2$ 98, $fl_3$ 98, $fl_4$ 97, $fl_5$ 98, $fl_6$ 96, $fl_7$ 102, $fl_8$ 98, $fl_9$ $10_2$, $fl_{10}$ 100, $fl_{11}$ 97; $fl_6$ length/width 5.09; total flagellum length 1072. Wing measurements: fore wing length/width 795/152, longest marginal setae 216; hind wing length/width 494/11, longest marginal setae 126.

***Chrysoctonoides* Huber & Triapitsyn, gen. n.**
http://zoobank.org/A5549C89-9EEF-4351-8EFC-AFF43520FC84
Figs 41–66 [Figs 58–66 reproduced from Lin et al. 2007]

*Myrmecomymar*: Lin et al. 2007: 39 (discussion of generic limits, possible new genus), 93 (photographs [figs 170–178]). Generic misidentification.

**Type species.** *Chrysoctonoides longisetosa* Huber & Triapitsyn.

**Derivation of genus name.** After the genus *Chrysoctonus* + *eidos*, Greek for shape, form, resembling, like; referring to the similarity of females and males to those of *Chrysoctonus*. Gender: feminine.

**Diagnosis. Female.** Wingless (Figs 41, 45, 48, 50, 53–55). Head with eye small with about 11 ommatidia (Fig. 53); ocelli absent (Figs 44, 54, 55). Antenna with funicle 7-segmented and clava entire (Figs 43, 49). Mesosoma (Figs 45, 50, 55) with strong, erect setae on mesoscutum and scutellum, and scutellum without campaniform sensilla; tarsi 5-segmented; propodeum medially with numerous small tubercles and laterally with reticulate sculpture. Metasoma with narrow reticulate petiole slightly longer than wide.

**Male.** Fully winged (Fig. 56), with venation much longer than half wing length (Fig. 62). Antenna with flagellum 11-segmented but apical segment small and almost spine-like, each segment with a whorl of setae about twice as long as the segment (Figs 57, 66) Mesosoma (Figs 56, 60) with short, weak setae on mesoscutum and scutellum, and scutellum with campaniform sensilla (Fig. 60).

*Chrysoctonoides* differs from *Chrysoctonus*, the most similar-looking genus, as follows. **Female:** mesoscutum and scutellum each medially much longer than pronotum (each about the same length in *Chrysoctonus*); median and lateral lobes of mesoscutum, and scutellum with strong setae (setae absent in *Chrysoctonus*); fenestra small, some-

what triangular and occupying much less than half width of scutellum (fenestra large, oval, occupying most of scutellum in *Chrysoctonus*). **Male:** Flagellum with each segment somewhat irregular-shaped, often slightly wider medially and with at most only 1 mps and 4 setae, the setae much longer than segment length (each segment with straight edges and parallel-sided, with several mps and setae, the setae much shorter than segment length in *Chrysoctonus*). **Both sexes:** prosternum large, about as long as line of junction of propleura (small, much shorter than line of junction in *Chrysoctonus*).

**Description. Female.** Medium in length and wingless in the only included species. **Head.** Almost cuboidal, about 1.25× as wide as long and about 1.2× as wide as high; in lateral view projecting forward for about length of radicle beyond level of anterior margin of eye then, more ventrally, flat and receding to mouth (Figs 48, 49, 53). Preorbital sulcus clearly separated from eye, from apex of preorbital trabecula extending straight down side of face to just lateral to mouth opening. Face square. Subantennal sulci absent. Torulus almost touching transverse trabecula. Eye small (Figs 44, 49, 53), with about 12 ommatidia, in lateral view somewhat triangular, slightly longer than high. Malar space at least 1.3× eye height. Malar sulcus absent. Gena width in lateral view at level of mid-height of eye about 2.6× eye width, and gena merging smoothly but quite sharply with occiput. Vertex in lateral view slightly convex, horizontal, almost at right angle with face (separated from face by transverse trabecula), posteromedially separated from occiput by slightly curved carina. Ocelli absent (Figs 44, 54, 55). Occiput entire; foramen dorsal, almost at junction with vertex (Fig. 55) so head pendulous (Figs 48, 49, 53). Labrum with 5 setae. Mandibles each with 3 teeth, crossing when closed. **Antenna.** Scape about 5.7× as long as wide, with radicle distinct, narrow, about 0.2× scape length; pedicel about 0.34× scape length, 2.0× as long but wider than $fl_1$; funicle 7-segmented (Figs 43, 49); clava unsegmented, about 0.4× funicle length. **Mesosoma.** About 1.7× as long as wide, 1.3× as long as high, and 0.7× wide as high. Pronotum in dorsal view (Figs 45, 54, 55) short, about 0.3× mesoscutum length, entire, and with a low transverse carina at anterior margin of collar. Pronotal spiracle level with anterior apex of notaulus. Propleura abutting medially, their line of junction much less than length of prosternum. Prosternum somewhat triangular, apparently divided posteriorly by median suture less than half prosternum length. Mesoscutum with straight, strongly diverging notauli. Transscutal articulation straight. Scutellum almost as long as mesoscutum (20: 23), without campaniform sensilla but with two setae in their position (Figs 45, 55) and fenestra a small, somewhat triangular oval behind the setae. Axilla normal, triangular. Prepectus narrow, slightly wider dorsally than ventrally. Mesopleuron almost vertical, about 0.6× as long as high; the mesepimeron almost as wide as mesepisternum. Metanotum extremely narrow, without defined dorsellum. Propodeum in lateral view flat, strongly sloping, about 1.2× as long as scutellum, not clearly separated from metapleuron. Propodeal spiracle small, at extreme anterolateral corner of propodeum and about its diameter from metanotum. **Wings.** Apparently absent (extremely micropterous). **Legs.** Metacoxae (Fig. 61, fore leg) distinctly reticulate.

**Metasoma.** Petiole narrow (Fig. 63), slightly longer than wide (14:10). Gaster about 1.2× as long as high; cerci with long setae. Spiracle on $gt_6$ absent. Ovipositor arising almost at base of gaster, slightly longer than gaster length and slightly exserted beyond gaster apex; ovipositor sheath with 1 subapical seta.

**Male.** Medium in length and fully winged (Fig. 56). **Colour.** Body fairly uniformly light brown, the gaster slightly darker in about apical half; legs beyond coxae and antenna slightly lighter than body. Head about 1.3× as wide as long and about 1.5× as wide as high. Eye large (Figs 56, 57), with about 75 ommatidia, in lateral view almost round, about as long as high. Malar space about 0.3× eye height. Gena in lateral view at level of top and bottom of eye about 0.5× eye width. Ocelli present, with LOL about 0.66× POL, and OOL about 1.0× POL. **Antenna.** Flagellum 11-segmented (Figs 56, 57, 66); scape 6.1× as long as wide, with radicle about 0.18× scape length and distinct; pedicel about 0.36× scape length and 1.25× as long as $fl_1$; flagellomeres each with several extremely long setae and some flagellomeres uneven in width, either slightly wider or slightly narrower medially. **Mesosoma.** About 1.8× as long as wide, 1.7× as long as high, and 1.3× wide as high. Scutellum about as long as mesoscutum (Fig. 60), with the usual campaniform sensilla submedially and also with two short, slender anterolateral setae; fenestra wide and occupying most of scutellum, with its margin anterior to the campaniform sensilla. Metanotum normal, with slightly defined rhomboidal dorsellum. Propodeum in lateral view flat, strongly sloping. **Wings.** Fully winged (Figs 56, 62). Fore wing about 4.6× as long as wide, with microtrichia not evenly covering wing surface. Venation about 0.6× wing length. Parastigma + stigmal vein about 1.8× length of submarginal vein. Hind wing normal; venation about 0.4× wing length. **Legs.** Calcar fringed internally with several setae (Fig. 64). **Metasoma.** Gaster about 1.5× as long as high. Genitalia (Fig. 61) with aedeagus extending well beyond parameres and apparently without aedeagal apodeme (this may have been broken off during dissection).

**Hosts and habitat.** Hosts are unknown. The habitat is rainforest litter.

**Distribution.** Australian Region.

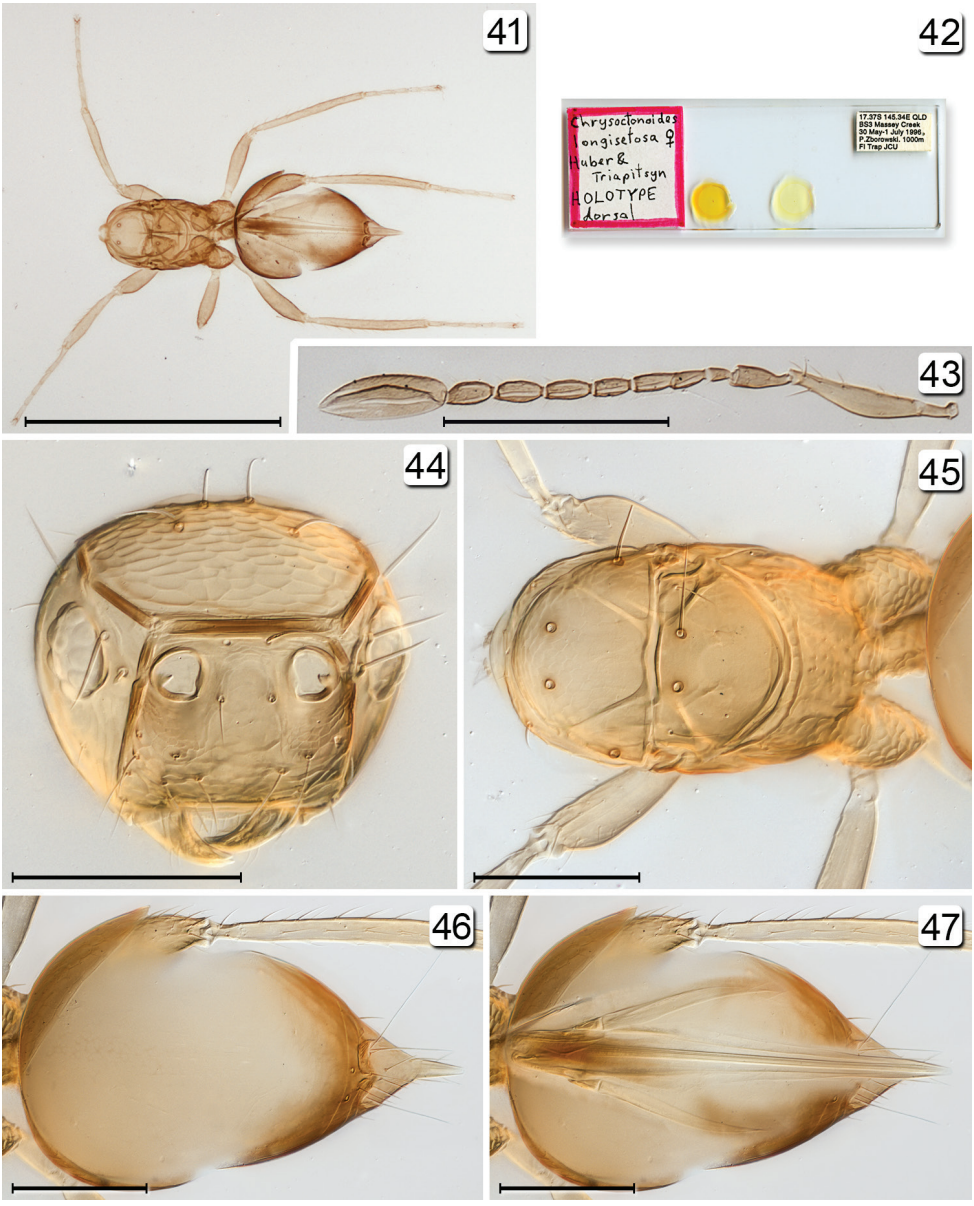
### *Chrysoctonoides longisetosa* Huber & Triapitsyn, sp. n.

http://zoobank.org/6FC4E0C7-F2EA-4014-823F-1187836E3454

Figs 41–55, 58–66

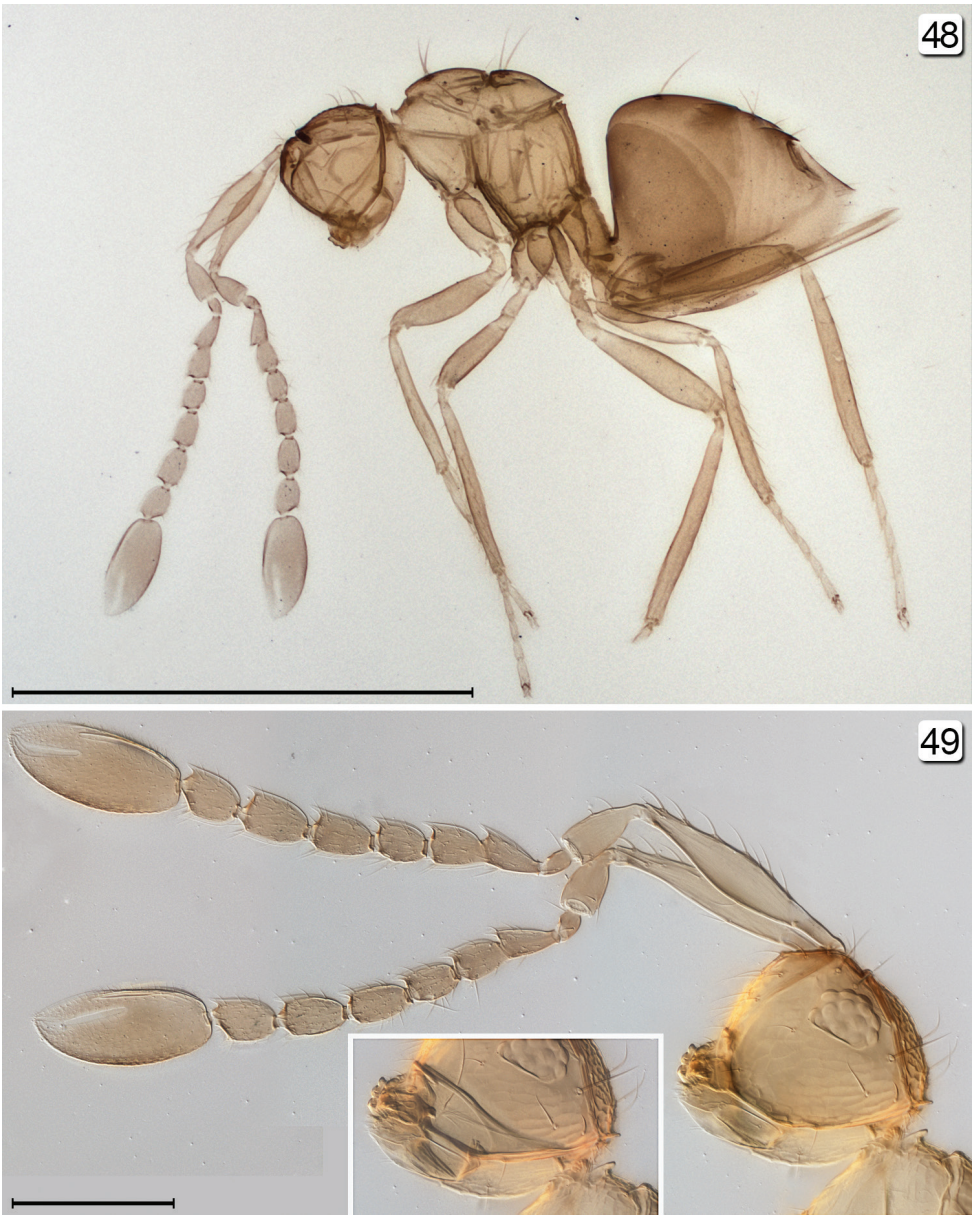
**Holotype female** (ANIC) on slide, labelled: 1. "17.37S 145.34E, QLD BS3 Massey Creek, 1000m, 30 May–1 July 1996, P. Zborowski, 1000m, FI Trap JCU". 2. "Chrysoctonoides longisetae ♀ Huber & Triapitsyn HOLOTYPE".

**Paratypes.** 4 ♀ and 2 ♂. **AUSTRALIA. Queensland:** Atherton, 17.17°S, 145.29°E, 2–16.iii.1988, D.C.F. Rentz, stop A-1, flight intercept trap (1♀, ANIC); Heberton, 30.xii.97–5.i.1998, A. Zwick, rainforest (1♂, CNC); Lake Eacham Na-




**Figures 41–47.** *Chrysoctonoides longisetosa*, holotype female. **41** habitus (excluding head) dorsal **42** type slide **43** antenna **44** head, anterior **45** mesosoma + petiole, dorsal **46** gaster, dorsal **47** ovipositor seen dorsally through gaster. Scale bars: **41** = 500 μm, **42** = 200 μm; **44–47** = 100 μm.

tional Park, 17.17°S, 145.37°E, 760m, 3–7.xi.1976, R.W. Taylor & T.A. Weir (1♀, 1♂, ANIC); Massey Creek, 17.37°S, 145.34°E, 1000m, 3.x–2.xi.1995, L. Umback (1♀, ANIC); 11 km ENE of Mt. Tozer, 12.43°S, 143.18°E, 11-16.vii.1986, T. Weir, rainforest litter, Berlese, 1063 (1♀, ANIC).




**Figures 48, 49.** *Chrysoctonoides longisetosa*, paratype female, Queensland, Atherton. **48** habitus, lateral **49** head + antennae, lateral (inset shows tentorium). Scale bars = 100 μm.

**Other material examined. AMERICAN SAMOA.** Tutuila Island, Mapusaga, 20–27.i.2002, M. Schmaedick, YPT on forest floor (1 ♂, UCRC).

This male is not given paratype status because its specific identity is uncertain. Conspecific females from American Samoa must be collected and compared with the Australian females to determine if they are the same.


**Figures 50–52.** *Chrysoctonoides longisetosa*, paratype female, Queensland, Atherton. **50** mesosoma, lateral **51** metasoma, lateral **52** ovipositor. Scale bars = 100 μm.

**Derivation of species name.** From Latin, *longus*, meaning long, and *setosa*, meaning bristly, referring to the long setae on the flagellum of the male and the mesosoma of the female. The name is treated as a noun in apposition.

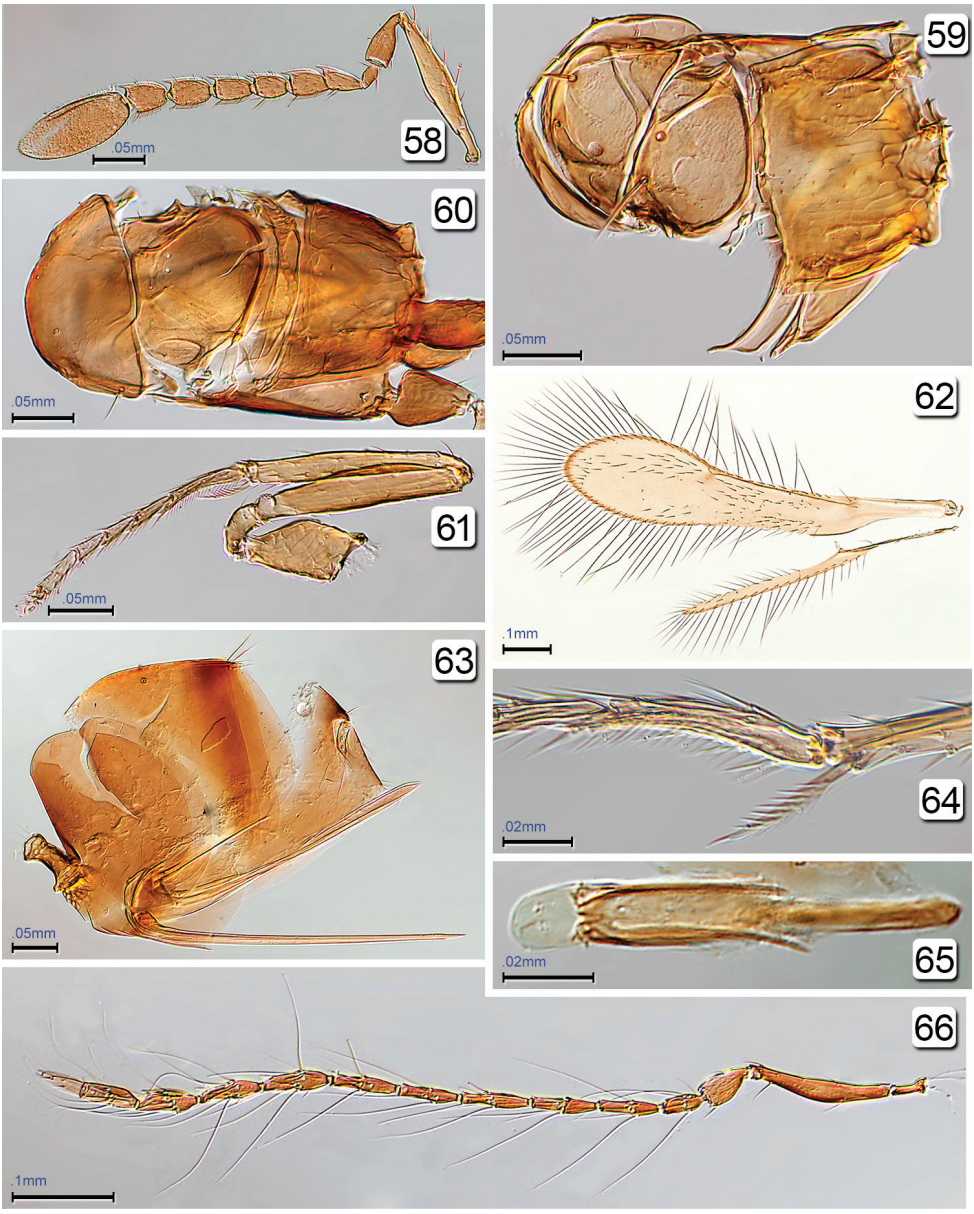
**Description. Female.** Body length 570–675 (n=2). **Colour.** Yellow; brown are trabecula, sockets of setae on mesosoma, and, especially, propodeum, and gaster dor-


**Figures 53–55.** *Chrysoctonoides longisetosa*, paratype female, 11 km ENE of Mt. Tozer. **53** habitus, lateral **54** habitus, dorsal **55** head + mesosoma, dorsal. Scale bars = 200 μm.

sally and laterally in about apical half but anterior to cerci. **Head.** Width 174 (n=1). Vertex with two pairs of fairly short setae, eye orbit dorsally with three long setae, one posteriorly and two anteriorly. **Antenna.** $Fl_1$ the shortest segment (Figs 43, 49, 58) and without mps, the remaining segments each with 1 mps; clava with 4 mps. Measurements (n=2 or 1): scape length/width 167–168/29–32, pedicel 59–64/22–28, $fl_1$


**Figures 56, 57.** *Chrysoctonoides longisetosa*, paratype male from Heberton. **56** habitus, lateral **57** head + antennae, lateral. Scale bars = 200 μm.

24/14, $fl_2$ 36–37/22–23, $fl_3$ 39–42/27–28, $fl_4$ 36–39/24, $fl_5$ 44–46/26, $fl_6$ 46–49/30, $fl_7$ 44–47/32, clava 119–125/54. **Mesosoma.** Mesoscutum with 2 long, stout bristles on anterior part of median lobe and 1on lateral lobe (Figs 45, 50, 55); scutellum with 2 long, diverging setae near transscutal articulation; axilla with 1 shorter seta; propodeum without carinae but with small tubercles medially and with reticulate sculpture laterally, with propodeal seta near posterolateral corner. **Metasoma.** Petiole strongly




**Figures 58–66.** *Chrysoctonoides longisetosa*, paratype female and paratype male from Lake Eacham Nat. Park. **58** female antenna **59** female mesosoma (crushed), dorsal **60** male mesosoma, dorsal **61** fore leg **62** male wings **63** female metasoma, lateral **64** male antennal cleaner **65** male genitalia **66** male antenna. Scale bars: **58–61, 63** = 50 μm; **62, 66** = 100 μm; **64, 65** = 20 μm.

reticulate; gaster in dorsal view with anterior surface of $gt_1$ vertical and less than 0.1× length of gaster, in lateral view lateral panel of $gt_1$ covering more than 0.5 length of gaster; $gt_2$ dorsally covering over half gaster length and with 2 long dorsal setae; re-

maining terga short; cercus with long setae, the longest almost 3× cercal length. Ovipositor slightly projecting beyond gastral apex.

**Male.** Body length 535 μm (n=1). Flagellar segments with uneven edges and varying widths, apparently with 1 mps on each segment; $fl_{11}$ distinctly narrower than $fl_{10}$. Measurements of length/width (n=1): scape length/width 138/23, pedicel 50/25, $fl_1$ 25/13, $fl_2$ 55/13, $fl_3$ 60/13, $fl_4$ 53/18, $fl_5$ 55/13, $fl_6$ 58/15, $fl_7$ 55/18, $fl_8$ 63/25, $fl_9$ 43/25, $fl_{10}$ 43/23, $fl_{11}$ 43/10; total flagellum length about 350; flagellomeres each with a whorl of 4 setae usually at least twice length of segment.

**Relationships.** *Chrysoctonoides* and *Chrysoctonus* may be sister genera though there are still considerable structural differences between them, especially in the mesosoma. Features that suggest a sister group relationship are: females apterous whereas males macropterous, wing shape in males identical, with long venation, antennal (especially funicle) and gastral structure in females very similar. Mathot (1966) had suggested that *Chrysoctonus* had the greatest affinity with *Ooctonus*, but did not say why. We tentatively concur with that proposed relationship on the basis of the similar structure of the metasoma. Both have a tubular petiole and well-sclerotized (non-collapsing) gaster with large $gt_1$ and $gt_2$. The presence of a group of several setae anterolaterally on $gt_1$ (Figs 14, 16) in *Chrysoctonus*, as in *Ooctonus*, is particularly striking. A large fenestra occupies most of the scutellum in males and females of *Ooctonus* but in *Chrysoctonus* and *Chrysoctonoides* only the male has a large fenestra whereas the females of both genera have an oval fenestra, in *Chrysoctonoides* relatively smaller than in *Chrysoctonus*, positioned posterior to the scutellar setae and almost as wide as the distance between them (Figs 45, 59). *Chrysoctonoides* females also lack the lateral cluster of setae on $gt_1$.

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# New species of *Triplocania* Roesler (Psocodea, 'Psocoptera', Ptiloneuridae), from Brazil and Ecuador

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## Abstract

Four species of *Triplocania,* three with M3 simple, based on male specimens and one with forewing M3 forked, based on male and female specimens, are here described and illustrated, namely: *Triplocania bravoi* **sp. n.** (Napo: Ecuador), *Triplocania erwini* **sp. n.** (Napo: Ecuador), *Triplocania trifida* **sp. n.** (Mato Grosso and Rondônia: Brazil) and *Triplocania lamasoides* **sp. n.** (Rondônia: Brazil). They differ from all the other species in the genus, in which the males are known, by the hypandrium and phallosome structures. The female is first described for the M3 forked group. The identification key for males of the M3 forked group is updated.

## Keywords

Epipsocetae, taxonomy, neotropics

## Introduction

*Triplocania* Roesler (1940) is one of 12 genera in the psocopteran family Ptiloneuridae; it is the most species rich genus of this family. It presently includes 32 described species that, according to forewing venation, can be separated in two groups: a large one with 25 species, characterized by having forewing venation caeciliusid, that is, with Rs of

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two branches, and with M of three branches, this group is here referred as MPB group (M with only primary branches); and a smaller group with 7 species, characterized by having M with three primary and secondary branches, this group is here referred as MSB group (M with secondary branches); this group is divided in two subgroups: the first (MSB1) is represented by *Triplocania palaciosi* García Aldrete & Casasola González (2012), it is characterized by having more than one M vein with secondary branches, the branches originating closer to the wing margin than to the main M. The second subgroup (MSB2) is represented by 6 species; it is characterized by having only one secondary branch, in $M_3$, resulting in $M_{3a}$ and $M_{3b,}$ and with branches originating closer to the main M than to the wing margin. The purpose of this work is to describe and illustrate three new species of *Triplocania* belonging in group MPB, based on males, and to describe a new species belonging in subgroup MSB2 mentioned above, based on males and females.

## Material and methods

Ten specimens were available for study; they were dissected in 80% ethanol; their parts (head, right legs and wings, and genitals) were mounted in Canada balsam. Before dissecting, whole specimens were placed in 80% ethanol under a dissecting microscope, illuminated with cold, white light, and observed at 50× to record color. Standard measurements (in μm), were taken with a filar micrometer. Abbreviations of parts measured are as follows: FW and HW: right fore- and hind- wing length, F, T, t1, t2 and t3: lengths of femur, tibia and tarsomeres 1, 2 and 3 of right hind leg, f1… fn: lengths of flagellomeres 1…n of right antenna, Mx4: length of fourth segment of right maxillary palpus, IO: minimum distance between compound eyes in dorsal view of head, D and d: antero-posterior and transverse diameter, respectively, of right compound eye in dorsal view of head, PO: d/D. The types of the Brazilian species will be deposited in the Invertebrate Collection of the Instituto Nacional de Pesquisas da Amazônia (INPA), Manaus, Amazonas, Brazil. The types of the Ecuadorian species will be deposited in the Sección de Entomología, Instituto de Ciencias Biológicas, Escuela Politécnica Nacional, in Quito, Ecuador (EPN).

## Taxonomy

***Triplocania bravoi* sp. n.**
http://zoobank.org/C852F46E-918E-47ED-8C24-F618303BA703
Figures 1–7

**Type-locality.** Ecuador, Napo: Reserva Étnica Waorani, 1 Km S. Onkone Gare Camp, 220m, 0°30'10"S, 76°26'0"W, fogging terre firma forest, 12.II.1995, T. L. Erwin et al. leg.

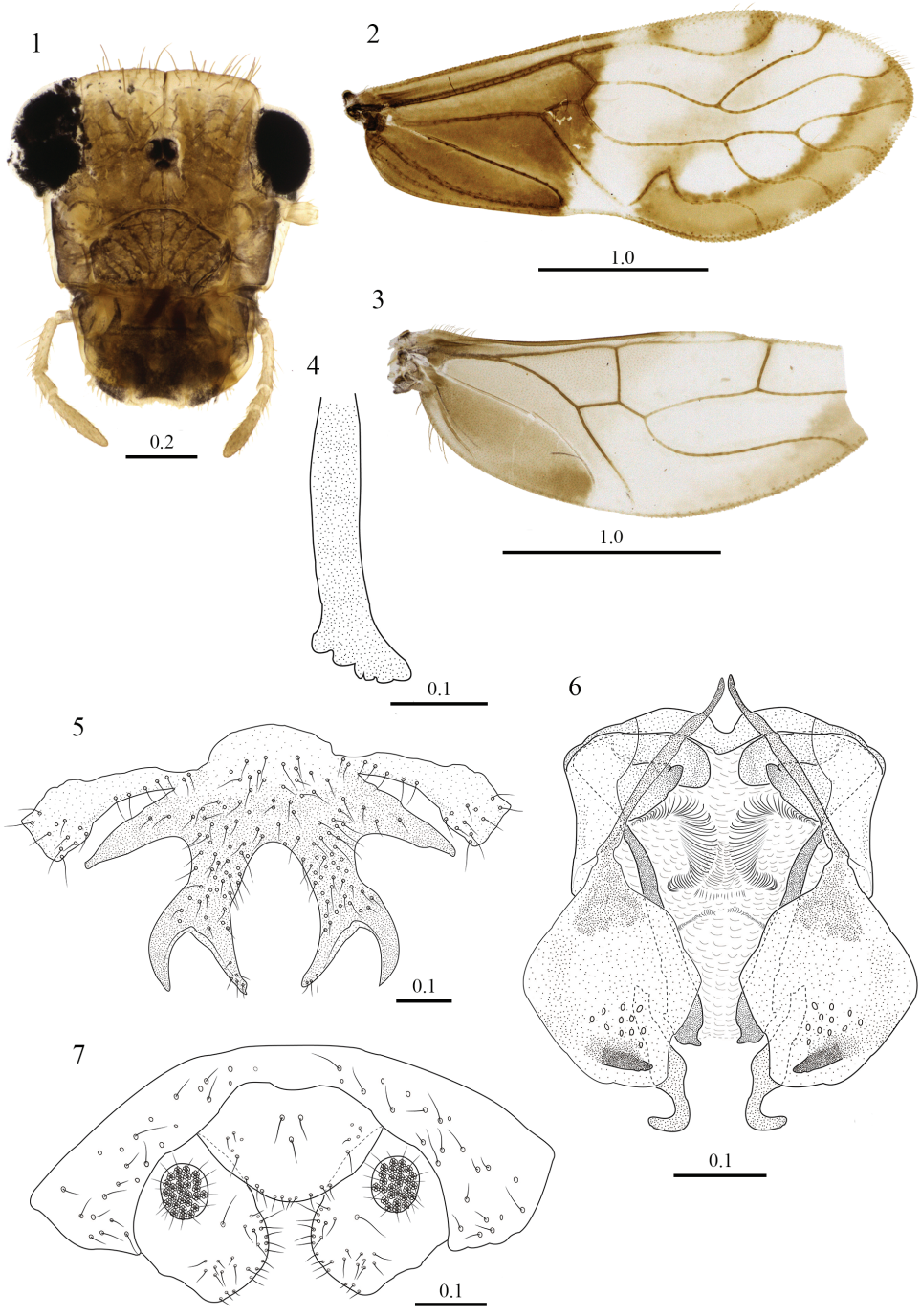
**Type-material.** Holotype male, mounted on one slide; thorax in a separate microvial. Original label: Ecuador. Napo. Reserva Étnica Waorani, 1 Km S. Onkone Gare Camp. 220m. 12.II.1995. 0°30'10"S: 76°26'0"W. Fogging terre firma forest. T. L. Erwin et al. (EPN, slide 160, vial 160).

**Etymology.** This species is dedicated to the Ecuadorian entomologist Freddy Rubén Bravo Quijano, of the Universidade Estadual de Feira de Santana, Bahia, Brazil, in recognition to his important contributions in the taxonomy of Neotropical Psychodidae (Diptera), also for the support to AMSN, to pursue a career studying Psocodea, 'Psocoptera'.

**Diagnosis.** Differing from the known species of *Triplocania*, in having the hypandrium with side sclerites fused proximally to the central piece, and having two forked posterior projections, horn shaped; also by having a U–shaped phallosome, a phallobase with lateral extensions covering partly the anterior pairs of endophallic sclerites, and in having ornamented areas on the endophallus.

**Male. Color.** Compound eyes black, ocelli hyaline, with ochre centripetal crescents; head pattern (Fig. 1). Scape and pedicel pale yellow, $f_1$–$f_3$ pale yellow, with apex white. Mx4 pale brown. Femora pale yellow; tibiae yellow, distally pale brown; tarsomere 1 pale yellow, tarsomeres 2–3 pale brown. Forewing with a brown marginal band from $R_{4+5}$ to almost $CuA_2$; a brown, almost rectangular band, well pigmented proximally and distally, weakly pigmented in the middle, from the apex of the areola postica to posterior end of the pterostigma; pterostigma with proximal and distal brown bands. Proximal third of forewing dark brown, limited posteriorly by level of crossvein Rs–M, as illustrated (Fig. 2). Veins brown. Hindwing with area below CuP dark brown, and a marginal pale brown band from $R_{4+5}$ to almost CuA (Fig. 3).

**Morphology.** As in diagnosis, plus the following: compound eyes without interommatidial setae. Outer cusp of lacinial tip broad, with five denticles (Fig. 4). Forewing pterostigma long, widest in the middle. Areola postica very wide basally, slanted posteriorly, tall proximally with apex round and narrow, distally sinuous and low; $R_{2+3}$ and $R_{4+5}$ sinuous, M stem slightly concave proximally, $M_1$, $M_2$ and $M_3$ sinuous. Hindwing Rs almost straight, $R_{2+3}$ straight, $R_{4+5}$ almost straight, M sinuous. Hypandrium of three sclerites, central piece anteriorly convex, with side projections almost parallel to side sclerites, forked posterior projections densely setose, other setae as illustrated (Fig. 5). Phallosome U-shaped, side struts independent, V shaped, fused posteriorly to external parameres, these stout, bearing a field of pores distally, each with an small projection heavily sclerotized distally; three pairs of endophallic sclerites, a posterior pair, curved outwards distally, close to the ends of the external parameres, a mesal pair, originating from behind the side struts, crossing behind the external parameres, distally dilated, with a small, acuminate projection apically; anterior pair stout, curved inwards, apically pointed and proximally rounded; phallobase with anterior border concave; lateral extensions covering partly the anterior pair of endophallic sclerites; endophallus membranous, with areas thickened and ornamented as illustrated (Fig. 6). Paraprocts broad, a field of setae along inner margin, other setae on apex; sensory fields with 27–28 trichobothria on basal rosettes (Fig. 7). Epiproct wide based, posteriorly




**Figures 1–7.** *Triplocania bravoi* sp. n. (Holotype male). **1** Front view of head **2** Forewing **3** Hindwing **4** Lacinial tip **5** Hypandrium **6** Phallosome in dorsal view **7** Clunium, paraprocts and epiproct. Scales in mm.

rounded, with three large mesal setae, next to anterior margin, other setae as illustrated (Fig. 7).

**Measurements** (in microns). FW: 3289, HW: 2108, F: 774, T: 1377, t1: 285, t2: 59, t3: 117, f1: 466 , f2: 397, f3: 270, Mx4: 201, IO: 440, D: 332, d: 186, PO: 0.56.

***Triplocania erwini* sp. n.**
http://zoobank.org/4269F9B2-0360-4006-BD6D-9CBFA4872294
Figures 8–14

**Type-locality.** Ecuador, Napo: Reserva Étnica Waorani, 1 Km S. Onkone Gare Camp, 220m, 0°30'10"S: 76°26'0"W, fogging terre firma forest, 12.II.1995, T. L. Erwin et al. leg.

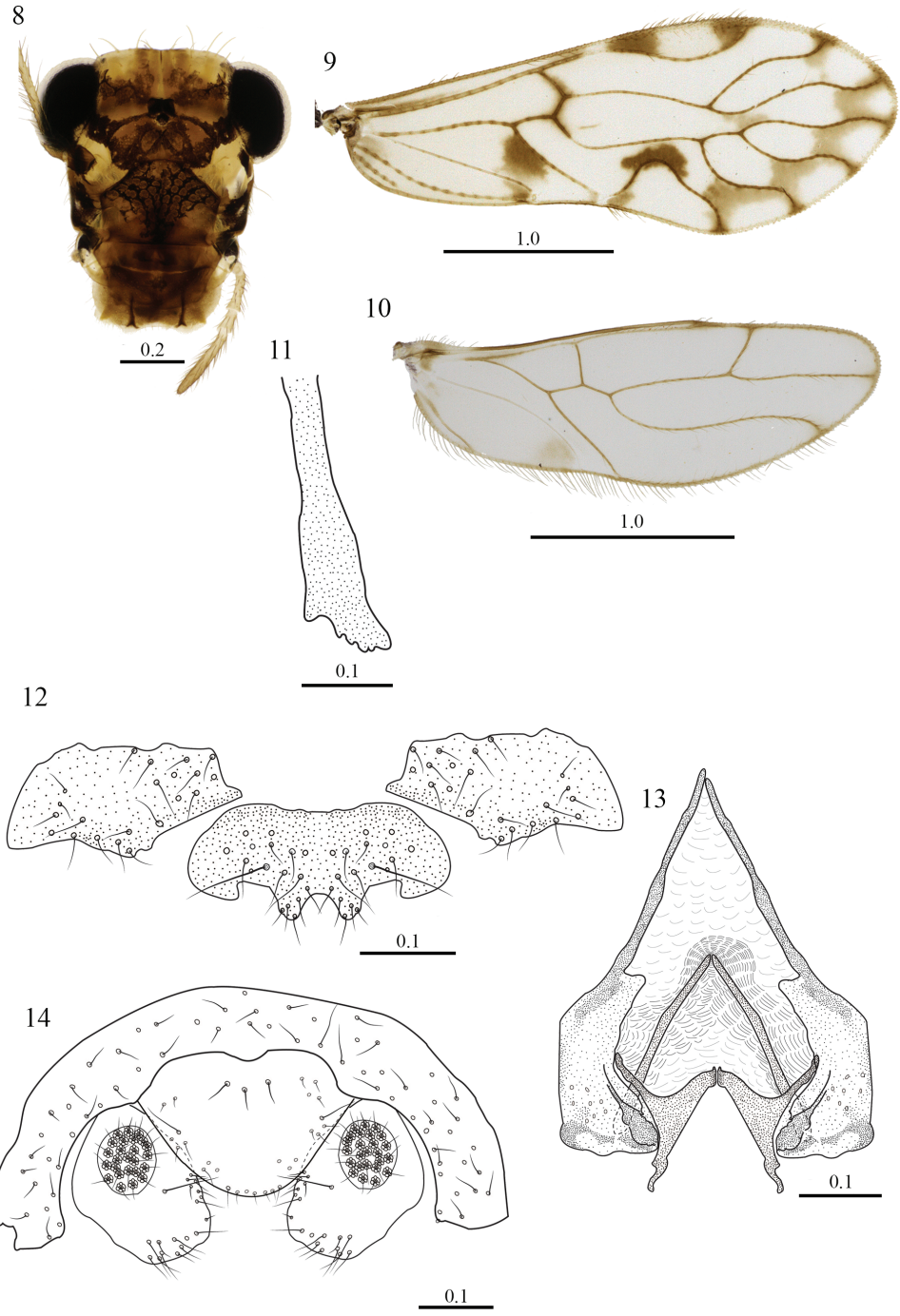
**Type-material.** Holotype male, mounted on slides; thorax in a separate microvial. Original label: Ecuador. Napo. Reserva Étnica Waorani, 1 Km S. Onkone Gare Camp. 220m. 12.II.1995. 0°30'10"S: 76°26'0"W. Fogging terre firma forest. T. L. Erwin et al. Paratype: 1 male, same data as the holotype (EPN, slides 163–164, vials 163–164).

**Etymology.** This species is dedicated to Dr. Terry L. Erwin, of the Smithsonian Institution, Washington, D. C., USA., in recognition to his seminal studies in biodiversity, in estimating the number of arthropods on this planet, in systematics and biology of the Carabidae, and for making available for study to ANGA, the psocid specimens collected by his team in Napo, Ecuador, by canopy fogging.

**Diagnosis.** Differing from the known species of *Triplocania*, in having the hypandrium with side sclerites and central piece similar in size; central piece with two short, lateral posterior projections, and two short, blunt ended, median posterior projections, leaving between them a small concavity, in having the external parameres with a distinct lobe apically on the inner side and, in having two pairs of endophallic sclerites.

**Male. Color**. Body pale brown, with ochre spots as indicated below. Compound eyes black, ocelli hyaline, with ochre centripetal crescents; head pattern (Fig. 8). Scape brown and pedicel yellow, $f_1$–$f_3$ yellow, with apices white. Mx4 brown. Tergal lobes of meso and methathorax brown, pleura with ochre spots above the level of the coxae; dark brown bands on proximal and distal ends of coxae, femora yellow with three brown equidistant bands, a middle one, and one on each end of the femur; tibiae pale brown, tarsomeres 1–3 yellow. Forewing with an irregular, submarginal brown band from $R_{2+3}$ to areola postica, this with a small brown spot proximally, and a dark brown spot between its apex and M, a dark brown spot below the proximal end of CuA, and a brown spot at confluence of CuP–1A; a pale brown spot between proximal ends of $R_{4+5}$–$M_1$; pterostigma with brown bands anteriorly and posteriorly; veins brown, with brown spots at wing margin (Fig. 9). Hindwing almost hyaline, veins brown, with a pale brown spot at confluence of CuP and wing margin (Fig. 10).

**Morphology.** As in diagnosis plus the following: compound eyes without interommatidial setae. Outer cusp of lacinial tip broad, with five denticles (Fig. 11). Fore-




**Figures 8–14.** *Triplocania erwini* sp. n. (Holotype male). **8** Front view of head **9** Forewing **10** Hindwing **11** Lacinial tip. **12** Hypandrium **13** Phallosome in dorsal view **14** Clunium, paraprocts and epiproct. Scales in mm.

wing pterostigma basally narrow, wider in the middle; areola postica wide basally, slightly slanted posteriorly; $R_{2+3}$ and $R_{4+5}$ sinuous, M stem slightly concave proximally, $M_1$, $M_2$ and $M_3$ sinuous. Hindwing Rs almost straight, $R_{2+3}$ and $R_{4+5}$ straight, M sinuous. Hypandrium with two large setae posteriorly between each lateral-median posterior projections (Fig. 12). Phallosome with side struts independent, V shaped, fused posteriorly to external parameres, these stout, with pores posteriorly; the distal lobe of each heavily sclerotized; anterior pair of endophallic sclerites elongate, almost touching anteriorly, inserted on a membranous, V shaped, thickened area, lying distally behind the external parameres, ending in a rounded apex; posterior pair of endophallic sclerites triangular, each anteriorly concave, close to the inner border of the external parameres, with apices sinuous.

**Measurements** (in microns). FW: 3302, HW: 2270, F: 645, T: 882, t1: 330, t2: 63, t3: 115, f1: 519 , f2: 384, f3: 330, Mx4: 239, IO: 398, D: 326, d: 194, PO: 0.59.

***Triplocania lamasoides* sp. n.**
http://zoobank.org/604C9997-0C41-4894-9C41-0B16CCE7CFFF
Figures 15–26

**Type-locality.** Brazil, Rondônia: Ariquemes, Rio ji Paraná, 90°44'S: 61°52'W, Malaise trap. 28.I.1986, J. A. Rafael leg.

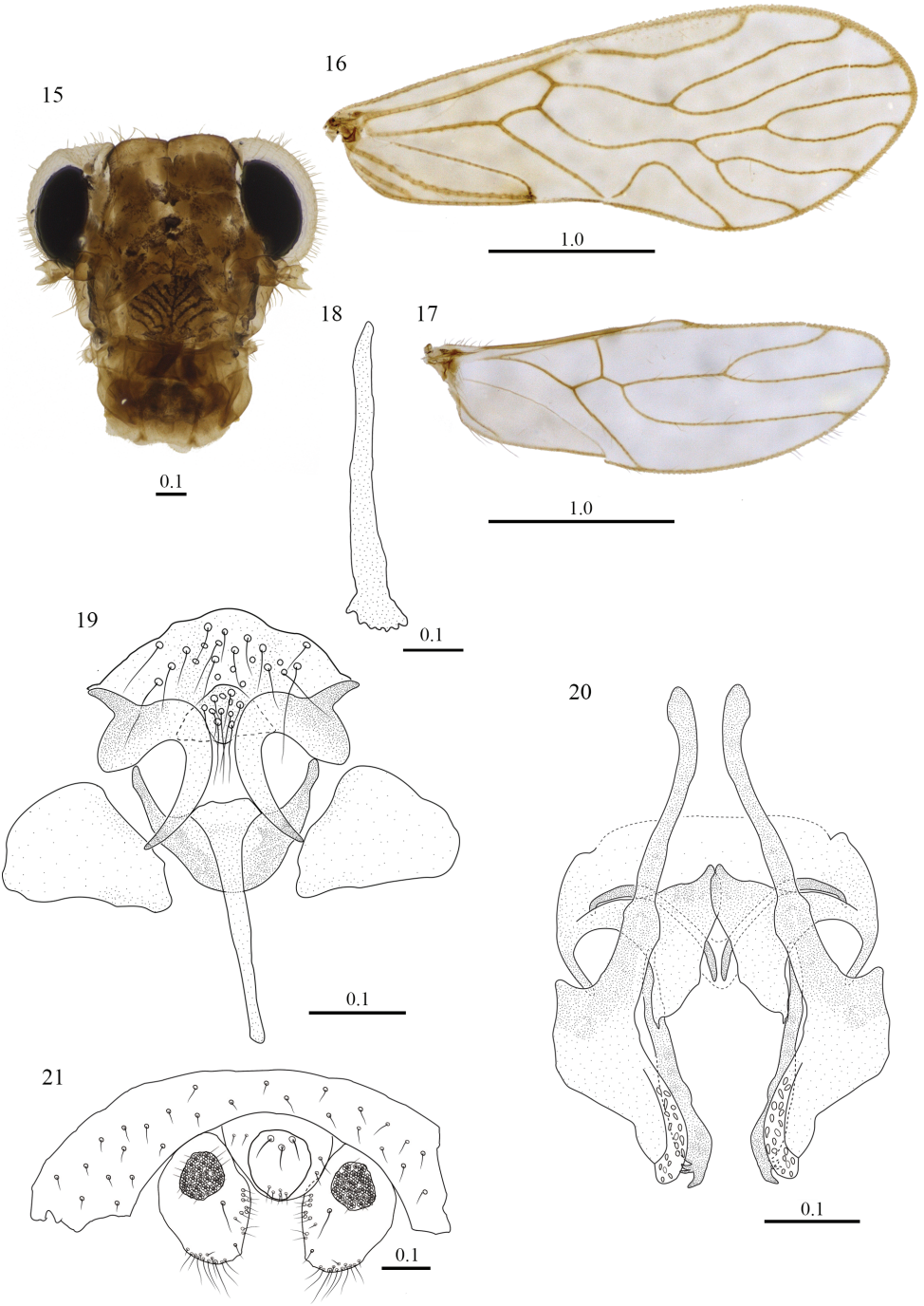
**Type-material.** Holotype male, mounted on slides, with thorax in a separate microvial. Original label: Brasil. Rondonte [Rondônia]. Ariquemes, Rio ji Paraná. 28.I.1986. 90°44'S: 61°52'W. Malaise trap. J. A. Rafael. Paratypes: 1 female and 3 males, same data as the holotype (INPA, slides 57–61, vials 57–61).

**Etymology.** The specific name refers to the proximity of this species to *T. lamasi* Silva–Neto, Rafael & García Aldrete.

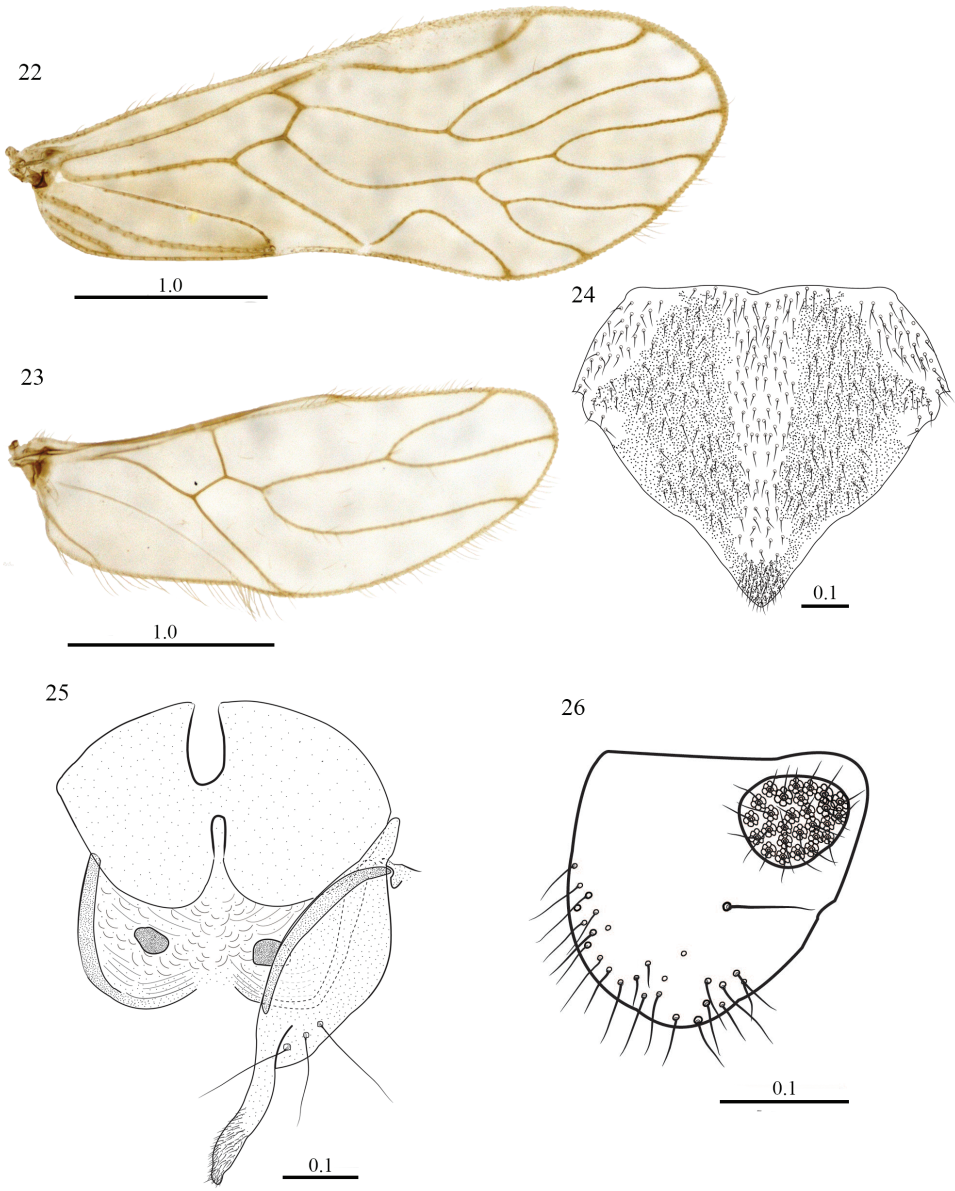
**Diagnosis.** Differing from *T. lamasi* in having the posterior sclerite of the hypandrium thicker in the middle, with the posterior projection more than twice as long; sickle-shaped lateral projections distal to the anterior sclerite barely reaching the inner margins of the lateral sclerites.

**Male. Color.** Body yellowish brown, with dark brown spots as indicated below. Compound eyes black, ocelli hyaline, with ochre centripetal crescents; head pattern (Fig. 15). Scape and pedicel pale brown; flagellomeres pale yellow. Mx4 pale yellow. Tergal lobes of meso- and metathorax reddish brown; episternum of mesothorax ochre. Coxae, trochanters and femora creamy white, tibiae and tarsomeres pale yellow. Forewings hyaline, as illustrated (Fig. 16); veins brown. Hindwing (Fig. 17), hyaline throughout, veins brown.

**Morphology.** As in diagnosis, plus the following: compound eyes with interommatidial setae. Outer cusp of lacinial tip broad, with six denticles (Fig. 18). Forewing pterostigma long, widest in the middle. Areola postica wide basally, slightly slanted posteriorly, apex round, narrow. $R_{2+3}$ and $R_{4+5}$ sinuous, M stem concave, $M_1$ almost straight, $M_2$ sinuous, $M_3$ branched, the branching point closer to M than to the wing




**Figures 15–21.** *Triplocania lamasoides* sp. n. (Holotype male). **15** Front view of head **16** Forewing **17** Hindwing **18** Lacinial tip **19** Clunium, paraprocts and epiproct **20** Hypandrium **21** Phallosome in dorsal view. Scales in mm.




**Figures 22–26.** *Triplocania lamasoides* sp. n. (Paratype female). **22** Forewing **23** Hindwing **24** Subgenital plate **25** Gonapophyses and Ninth sternum **26** Left paraproct Scales in mm.

margin. Hindwing Rs almost straight. Hypandrium (Fig. 19) of four sclerites, anterior piece broad, setose, bearing distally two sickle-shaped lateral projections, heavily sclerotized at both ends, and having also a well defined, setose sclerotized area in the middle; posterior sclerite concave anteriorly, with a long, slender posterior projection in the middle, flanked by two large, broadly triangular lateral sclerites. Phallo-

some (Fig. 20) with side struts independent, V shaped, fused posteriorly to external parameres, these stout, each with an elongate projection on inner margin, with field of pores; three pairs of endophallic sclerites; anterior pair long, slender and curved, mesal pair wide proximally, narrowing distally, pointed, and posterior pair parallel to the inner margin of the external parameres, with three acuminate projections distally. Paraprocts broad, wide proximally, narrowing to round apex; with a field of short setae along inner margin, other setae as illustrated; sensory fields with 30–31 trichobothria on basal rosettes (Fig. 21). Epiproct mesally with an almost elliptic protuberance, with a field of setae posteriorly, and three large mesal setae next to anterior margin (Fig. 21).

**Measurements** (in microns). FW: 3710, HW: 2465, F: 910, T: 1493, t1: 622, t2: 77, t3: 132, f1: 556 , f2: 455, f3: 390, Mx4: 170, IO: 470, D: 395, d: 210, PO: 0.53.

**Female. Color.** Essentially as in the male.

**Morphology.** Fore- and hind- wings (Figs. 22, 23) same as in the male. Subgenital plate broad, V shaped, pigmented area wide, setae as illustrated (Fig. 24); Gonapophyses: $V_1$ long, slender, heavily sclerotized; $V_{2+3}$ stout, heeled, narrow anteriorly and wider in the middle, with three large setae on outer lobe as illustrated, distal process stout, sinuous, distally blunt, with a field of microsetae (Fig. 25). Ninth sternum broad, with two distinct areas, the anterior one unpigmented, with a concavity anteriorly and posteriorly in the middle; posterior area pigmented, thicker than the anterior one, with a strongly sclerotized band latero-posteriorly, and a small, strongly pigmented area mesally on each side. Paraprocts broad, almost triangular, wide proximally, narrowing to round apex, setose posteriorly as illustrated, sensory fields with 26–27 trichobothria on basal rosettes (Fig. 26). Epiproct missing.

**Measurements** (in microns). FW: 3723, HW: 2560, F: 890, T: 1385, t1: 607, t2: 58, t3: 121.

### *Triplocania trifida* sp. n.

http://zoobank.org/B47478F7-C56A-4B90-9179-EBB42A829071

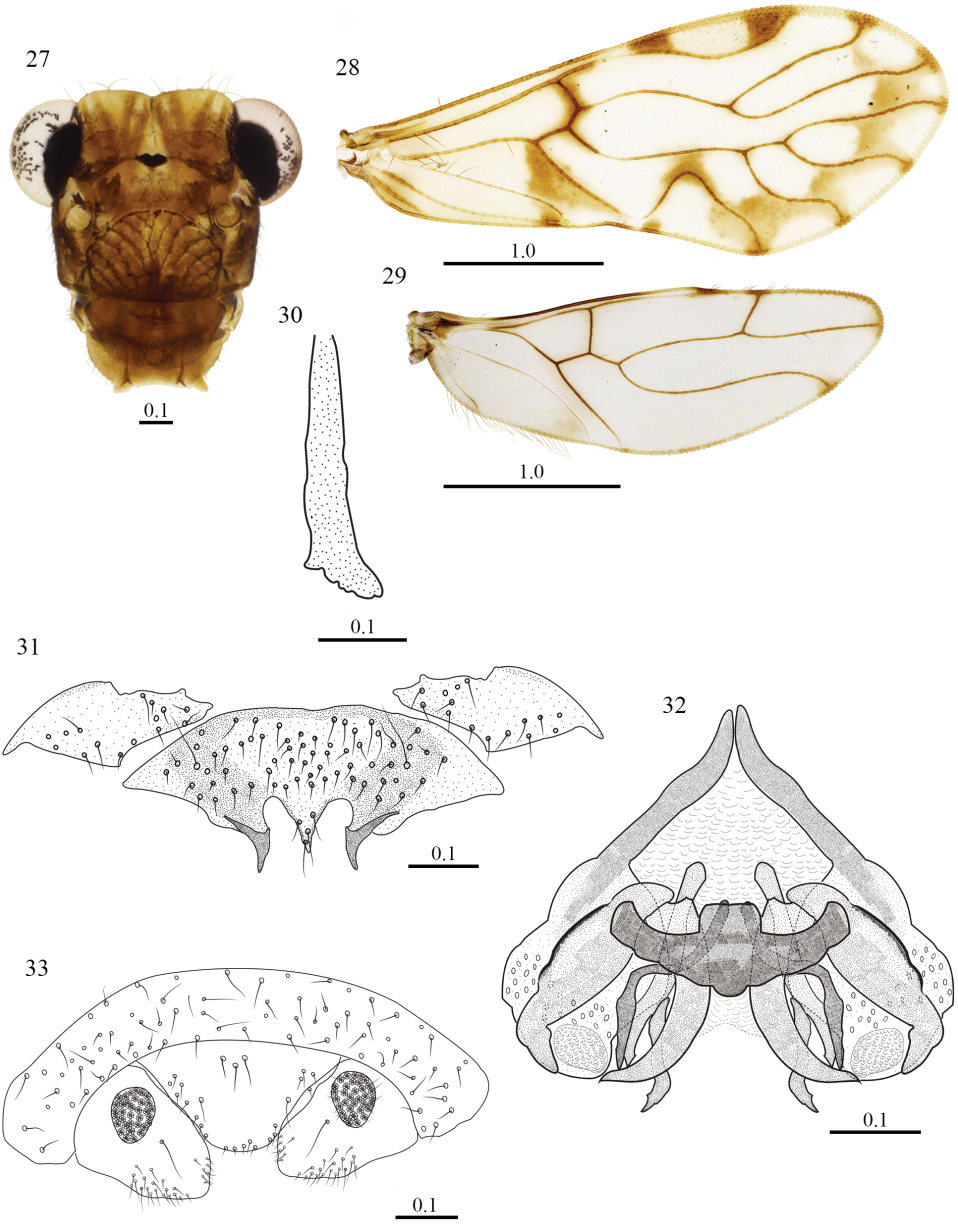
Figures 27–33

**Type-locality.** Brazil, Mato Grosso: Chapada dos Guimarães, 23-30.XI.1983. A. Yamamoto leg.

**Type-material.** Holotype male, mounted on slides; thorax in a separate microvial. Original label: Brasil. Mato Grosso. Chapada dos Guimarães. 23-30.XI.1983. A. Yamamoto. Paratypes: 1 male, Original label: Brasil. Rondonte [Rondônia]. Ariquemes. Rio ji Paraná. 28.I.1986. 09°44'S: 61°52´W. Malaise trap. J. A. Rafael. (INPA, slides 112–113, vials 112–113).

**Etymology.** The specific name refers to the characteristic of the hypandrium, having three posterior projections.

**Diagnosis.** Differing from the known species of *Triplocania*, in having the central piece of the hypandrium with three posterior projections, a middle one, pointed, setose, flanked by lateral, strongly sclerotized, glabrous acuminate projections. Phallo-




**Figures 27–33.** *Triplocania trifida* sp. n. (Holotype male). **27** Front view of head **28** Forewing **29** Hindwing **30** Lacinial tip **31** Hypandrium **32** Phallosome in dorsal view **33** Clunium, paraprocts and epiproct. Scales in mm.

some with a transverse, strongly sclerotized mesal bridge, biconcave anteriorly, convex posteriorly, widest in the middle, narrowing to the sides; four pairs of endophallic sclerites; external parameres distally with an elliptic papillose field.

**Male. Color.** Body yellow, with ochre spots as indicated below. Compound eyes black, ocelli hyaline, with ochre centripetal crescents. Head pattern (Fig. 27). Scape brown, pedicel pale brown, $f_1$ anteriorly pale brown, posteriorly yellow, apex white, $f_2$ yellow. Mx4 brown. Tergal lobes of meso and methathorax pale brown, pleura yellow; femora pale yellow, tibiae pale brown, tarsomeres 1–3 yellow. Forewing with an irregular, submarginal pale brown band from $R_{2+3}$ to posterior end of areola postica, this with a small brown spot proximally, and a dark brown spot between its apex and M; a triangular brown area next to CuA, and a brown spot at confluence of CuP–1A; pterostigma with brown bands anteriorly and posteriorly; veins brown, with brown spots at wing margin (Fig. 28). Hindwing almost hyaline, with small brown spots distally on veins M, $R_{2+3}$ and $R_{4+5;}$ with a pale brown spot at confluence of CuP and wing margin; veins brown (Fig. 29).

**Morphology.** As in diagnosis, plus the following: compound eyes without interommatidial setae. Outer cusp of lacinial tip broad, with five denticles (Fig. 30). Forewing pterostigma wider in the middle, narrow anteriorly; Rs convex, $R_{2+3}$ almost straight proximally and concave distally, $R_{4+5}$ sinuous, M stem slightly concave proximally, then almost straight, $M_2$–$M_3$ sinuos, areola postica wide basally, slightly slanted posteriorly; hindwing Rs almost straight, $R_{2+3}$ and $R_{4+5}$ straight, M sinuous. Hypandrium of three sclerites; side sclerites, large, irregular, with setae as illustrated (Fig. 31). Phallosome with side struts independent, V shaped, fused posteriorly to external parameres, these stout, with pores posteriorly. Anterior pair of endophallic sclerites elongate, sinuous, distally acuminate; a central pair, narrow, elongate, sinuous, heavily sclerotized, with anterior end blunt, posteriorly dilated, lance-shaped; a lateral pair biramous, with inner arms long, curved out, wide based, extended posteriorly and distally acuminate, and outer arms wider in the middle, narrowing at the ends, posteriorly shaped like a bird's head; posterior pair, small, curved outwards, distally acuminate (Fig. 32). Paraprocts broad, almost triangular, sensory fields with 20–31 trichobothria on basal rosettes, setae as illustrated (Fig. 33). Epiproct trapeziform, wide anteriorly, with sides converging towards a straight posterior border, three mesal setae near anterior border, other setae as illustrated (Fig. 33).

**Measurements** (in microns). FW: 3804, HW: 2569, F: 947, T: 1511, t1: 643, t2: 65, t3: 125; f1: 478, f2: 308, IO: 453, D: 328, d: 219, PO: 0.67.

## Key to the males of *Triplocania* of Subgroup MSB2, modified from Silva–Neto et al. (2014)

| | | |
|---|---|---|
| 1 | Hypandrium of four sclerites | **6** |
| – | Hypandrium of no more than three sclerites | **2** |
| 2 | Hypandrium of a single sclerite | **3** |
| – | Hypandrium of three sclerites | **4** |
| 3 | Hypandrium with a long acuminate projection posteriorly, one projection on each antero-lateral extreme, deeply concave in outer margin, forming two acuminate projections, posterior endophallic sclerites with four acuminate projections each, one mesal and three distal | ***T. newi* Silva–Neto, Rafael & García Aldrete** |

– Hypandrium with a short acuminate projection posteriorly, one projection on each antero-lateral extreme, deeply cleft in the middle, posterior endophallic sclerites with three acuminate projections each..... ***T. calcarata*** **New**

4 Central sclerite of hypandrium with five acuminate projections, side struts fused to external parameres ..... ***T. furcata*** **New**

– Central sclerite of hypandrium with two projections, side struts not fused to external parameres ..... **5**

5 Central sclerite of hypandrium flanked by two large, almost triangular sclerites; posterior projections leaving a wide concavity between them; distal ends of posterior endophallic sclerites acuminate, paraprocts triangular ..... ..... ***T. mariateresae*** **Silva–Neto, Rafael & García Aldrete**

– Central sclerite of hypandrium flanked by two small, elongate sclerites; posterior projections leaving a narrow concavity between them; distal ends of posterior endophallic sclerites blunt, paraprocts semi-elliptic ..... ..... ***T. plaumanni*** **Silva–Neto, Rafael & García Aldrete**

6 Posterior sclerite of hypandrium thicker in the middle, with posterior projection longer than the anterior-posterior length of the anterior sclerite; sickle -shaped lateral projections of the anterior sclerite barely reaching the inner margins of the lateral sclerite..... ***T. lamasoides*** **sp. n.**

– Posterior sclerite of hypandrium slender in the middle, with posterior projection not longer than the anterior-posterior length of the anterior sclerite; sickle-shaped lateral projections distal of the anterior sclerite surpass the inner margins of the lateral sclerites ..... ***T. lamasi*** **Silva–Neto, Rafael & García Aldrete**

## Discussion

*T. bravoi* and *T. erwini*, are the first species of *Triplocania* described from Ecuador. The hypandrium with side sclerites fused proximally to the central piece in *T. bravoi* is an exceptional character within *Triplocania*; this character also appears in several species of *Loneura* Navás (*L. amazonica* (New), *L. erwini* (New & Thornton), *L. gorgonaensis* García Aldrete, González & Sarria, *L. insularis* García Aldrete, González & Sarria, and *L. monticola* García Aldrete, González & Sarria). Another exceptional character of *T. bravoi* is the presence of a phallobase. Recently one of us (AMSN) examining specimens of *T. magnifica* Roesler, noted the presence of a phallobase not described in the original paper by Roesler. The pattern of pigmentation and wing venation in *T. bravoi* is similar to *T. magnifica*, with small differences, but the hypandrium and phallosome structures of the two species are quite different.

*T. trifida* and *T. lamasoides* increase the diversity of *Triplocania* in Brazil to 16 species, this country being the most species rich so far for described species of *Triplocania*.

The transverse bridge in the phallosome of *T. trifida* is a character that distinguishes it from other species of *Triplocania*; this character also appears in some species of *Loneura* (*L. jinotegaensis* García Aldrete, *L. mirandaensis* García Aldrete, *L. tuluaen-*

*sis* García Aldrete, Mendivil & González, and *L. andina* García Aldrete, Mendivil & González. The structure the phallosome of *T. trifida* is also very similar, except for the bridge, to the phallosome of *L. gorgonaensis*. The pattern of pigmentation and wing venation in *T. trifida* is similar to *T. erwini* with small differences, but the hypandrium and phallosome structures of the two species are different.

The remarkable similarities of phallosome and hypandrium in species of *Triplocania* and *Loneura* may indicate that the two genera are closer than previously thought.

*T. lamasoides* and *T. lamasi* constitute a pair of sister species within *Triplocania*. The morphological structure that separate them, are the lenght of the posterior projections of the anterior and posterior sclerite of the hypandrium. With more knowledge on the diversity of *Triplocania*, perhaps new cases of species complexes will be found, possibly confirming that the hypandrium is the most variable structure in *Triplocania*. The pair of species *T. lamasoides*–*T. lamasi* alerts also on the difficulty of association between males and females in *Triplocania*. The female of *T. lamasoides* is the first female described for the subgroup MSB2, it was associated with the male because they were collected in the same place and date, but the wings and patterns of body pigmentation are also identical to *T. lamasi*.

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# Review of the West Indian genus *Monotalla* Bechyné (Coleoptera, Chrysomelidae, Galerucinae, Alticini) with description of five new species

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## Abstract

The West Indian genus *Monotalla* Bechyné is reviewed, redescribed and illustrated. Five new species are added: *Monotalla dominica* **sp. n.** (Dominica); *M. lecticofolia* **sp. n.** (St. Lucia); *M. maierae* **sp. n.** (St. Lucia); *M. obrienorum* **sp. n.** (Grenada); and *M. viridis* **sp. n.** (St. Lucia). A key to *Monotalla* species is provided.

## Keywords

New species, flea beetles, West Indies, leaf litter, moss

## Introduction

*Monotalla* was originally proposed for two species, with *Monotalla guadeloupensis* Bechyné, 1956 as the genotype. It was later synonymized with *Pseudodibolia* Jacoby, 1891 by Scherer (1962). However, further studies revealed that it is substantially dif-

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ferent from *Pseudodibolia* based on various features including the presence of only ten antennomeres while *Pseudodibolia* species have 11 (Savini and Furth 2001). The second species included in *Monotalla* by Bechyné (1956), *M. nigrita* (Jacoby) originally proposed in the genus *Glyptina* LeConte, 1859, does not belong to *Monotalla*, although its generic placement is as yet unknown (Savini and Furth 2001).

The Guadeloupe record for *M. guadeloupensis* is surely from the island of Basse-Terre, where the subsequent collections originate. None of the other islands that make up the Guadeloupe archipelago are high enough to harbor *Monotalla*. All specimens with good locality data are from elevations above 525m (on Basse-Terre) to nearly 800m (on St. Lucia).

*Monotalla* specimens have been collected by malaise trapping, berleseing leaf litter and moss, and beating a dead palm frond and unspecified vegetation (in the case of the O'Brien specimens), but in all cases, these activities were in unusual high elevation wet forests. Clearly, finding *Monotalla* requires special methods and efforts in unique and limited habitats. The Smithsonian Archibold-Breden Survey of Dominica, the longest and most richly funded entomological inventory of any West Indian Island (Peck 2006) did not yield a single specimen. The Piton Troumasse location on St. Lucia, which yielded 2 species and the largest series of specimens, is in cloud forest on a knife-edge ridge, a very difficult to reach habitat nearly completely covered in moss. Very few collectors exert the effort to reach these small, steep, wet, slippery and often cold localities. The St. Lucia locality was visited by teams from the West Indian Beetle Fauna Project 7 times over a 5 week period in 2009, during which time traps were deployed continuously and each time sifted litter was returned to the base for Berlese treatment. Another 18 localities in other representative habitat types on St. Lucia were given roughly the same level of effort, but produced zero *Monotalla*. That such effort was required to yield a handful of specimens may explain the absence of known species from other seemingly suitable but less studied islands lying between Basse-Terre and Grenada, namely St. Vincent and Martinique. Other of the Lesser Antillean Volcans north of Basse-Terre, from Saba to Montserrat, reach suitable elevations, but the tiny pockets in the very highest and wettest areas are still virtually unknown. Only Montserrat (Ivie et al. 2008) and Saba (Ivie and D. S. Sikes unpublished) have had any significant effort devoted to these islands, and as yet, no *Monotalla* specimens have been found.

To the west and north, extensive targeted moss sifting in the Greater Antilles by A.S. Konstantinov (Dominican Republic: 2004–2006, 2014 and Puerto Rico: 2008, 2014) did not reveal any *Monotalla* specimens, so the genus may indeed be limited to the Lesser Antilles.

## Material and methods

Dissecting techniques, measurements, and terminology follow Konstantinov (1998). Digital images were taken with an AxioZoom.V16 Zeiss microscope with a digital

camera attached to it. Habitus illustration is produced with a technique described by Litwak and Harel (2013). Observation on the size of punctures on the vertex, pronotum and elytra was done under a Stemi SV11 Zeiss microscope with a Plan-Apochromat 1.6× objective with the light shining straight down on the surface. This makes punctures look generally larger than on the images taken with digital camera.

Specimens are deposited in the National Museum of Natural History, Smithsonian Institution, Washington DC, USA (USNM), Monte L. Bean Life Science Museum, Brigham Young University, Provo, Utah (BYUC), Natural History Museum, Basel, Switzerland (NHMB), and West Indian Beetle Fauna Project Collection, Montana State University, Bozeman, Montana (WIBF).

## Results

### *Monotalla* Bechyné, 1956

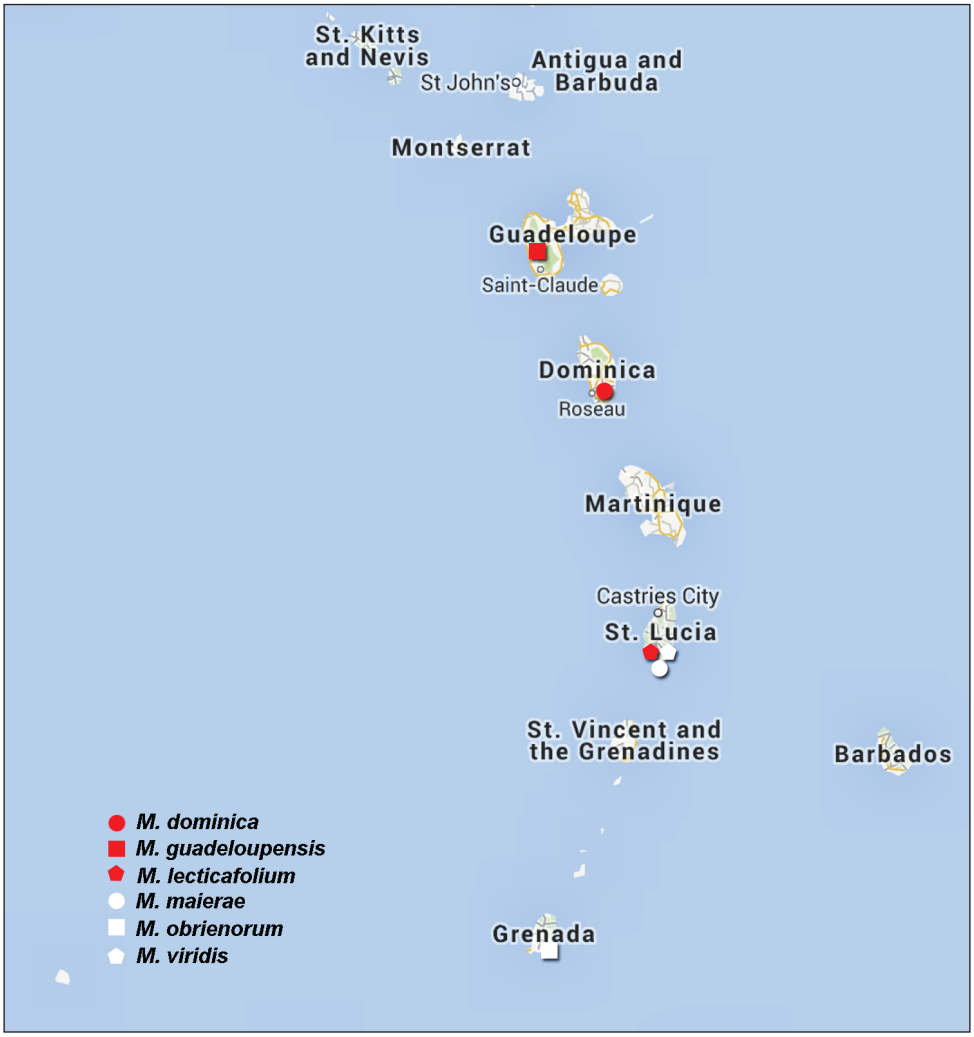
Figs 1–49, Map 1

*Monotalla* Bechyné, 1956: 588 (type species *Monotalla guadeloupensis* Bechyné, 1956: 588, original designation, type locality Guadeloupe).

**Description.** Body length 1.24–1.45 mm, width 0.80–0.91 mm, oval, relatively convex in lateral view (1.70 times as long as thick). Color black, dark brown, greenish, bluish or lightly purple with metallic luster. Legs and antennae brown with femur and basal antennomeres darker than tibia and apical antennomeres. Venter light brown or amber in color.

Head moderately flat in lateral view. Frons and vertex forming slightly convex line in lateral view. Supraorbital pore absent. Antennal calli poorly developed, with all sulci around them absent. Supraorbital sulcus absent. Distance between eyes greater than transverse diameter of eye, much wider than transverse diameter of antennal socket. Frontal ridge wide, interiorly projecting beyond anterofrontal ridge. Anterofrontal ridge not separated from and as tall as frontal ridge. Eyes large, slightly protruding laterally, 0.57 times as wide as long. Vertex covered with evenly and widely spaced large and deep punctures. Labrum with four setiferous pores, apically slightly incised. Antenna with ten antennomeres. First antennomere wide, slightly wider and longer than second antennomere. Third antennomere nearly as long as, but much thinner than second. Antennomeres four and five much smaller than third. Remaining antennomeres much wider and longer than antennomere five.

Pronotum 2.19 times wider than long (measured in middle), without impressions, covered with large, deeply impressed punctures. Sides weakly rounded and narrowly explanate, with maximum width at base. Marginal anterolateral callosity situated obliquely to midline of beetle body. Posterolateral callosity not protruding laterally. Basal margin extending posteriorly, without distinct border in middle. Procoxal cavity widely open behind. Intercoxal prosternal process relatively narrow in middle, expand-




**Map 1.** Distribution of *Monotalla* species in Lesser Antilles.

ing posteriorly, extending beyond procoxae. Mesoscutellum flat, wider than long, apex sharply triangular, sides straight. Mesonotum short and wide with nearly horizontal prealar and postmedial projections. Mesocoxae mostly separated by both meso- and metasternum. Mesosternum not covered by metasternum, horizontal. Metasternum short, shorter than mesosternum.

Elytron widest near mid-length. Humeral callus absent. Elytral punctures arranged in rows. Punctures vary in size, smaller to much smaller than space between rows. Elytral apex narrowly rounded. Epipleura broad, slightly oblique, abruptly narrowing before apex. Mesothoracic wing present with poorly developed veins, except for radial cell and medial bar and spur.


**Figure 1.** *Monotalla guadeloupensis*, dorsal habitus.

Pro- and mesofemora more or less flat, widest near middle, canaliculated on ventral side facing tibiae. Metafemur robust, fairly flat dorsoventrally. Pro- and mesotibiae subcylindrical, slightly wider in distal 1/3, slanting towards tarsi, without spurs apically. Metatibia slightly curved in dorsal and lateral views, dorsal surface flat and deeply canaliculated near apex. Lateral (outer) margin dentate. Apical spur varying in length, but generally long. First metatarsomere attached before tibial apex, nearly as long as remain-

ing metatarsomeres combined. Claw slightly appendiculate near base. Third tarsomere deeply incised.

Abdomen with five distinctly visible sternites. Apical sternite shorter than three preceding sternites combined, without appendages basally. Basal sternite without ridges in middle. Apical abdominal tergite without groove in middle, with a few long setae. Gut with long sclerotized folds.

Median lobe of aedeagus simple, slender, slightly curved in lateral view, more so at base and apex, without or with limited sculpture ventrally. Base with projection in middle.

Vaginal palpi with anterior sclerotizations merged together. Posterior sclerotizations of vaginal palpi oblique or straight at apex. Tignum gradually widening posteriorly before posterior membrane. Spermatheca without distinct border between receptacle and pump. Pump with long appendage at apex. Receptacle bent in basal half. Spermathecal duct long, straight basally, making one loop.

### *Monotalla dominica* Konstantinov, Linzmeier, Clark & Ivie, sp. n.

http://zoobank.org/567042A3-5290-412F-8495-196EFE856DE1
Figs 2–12

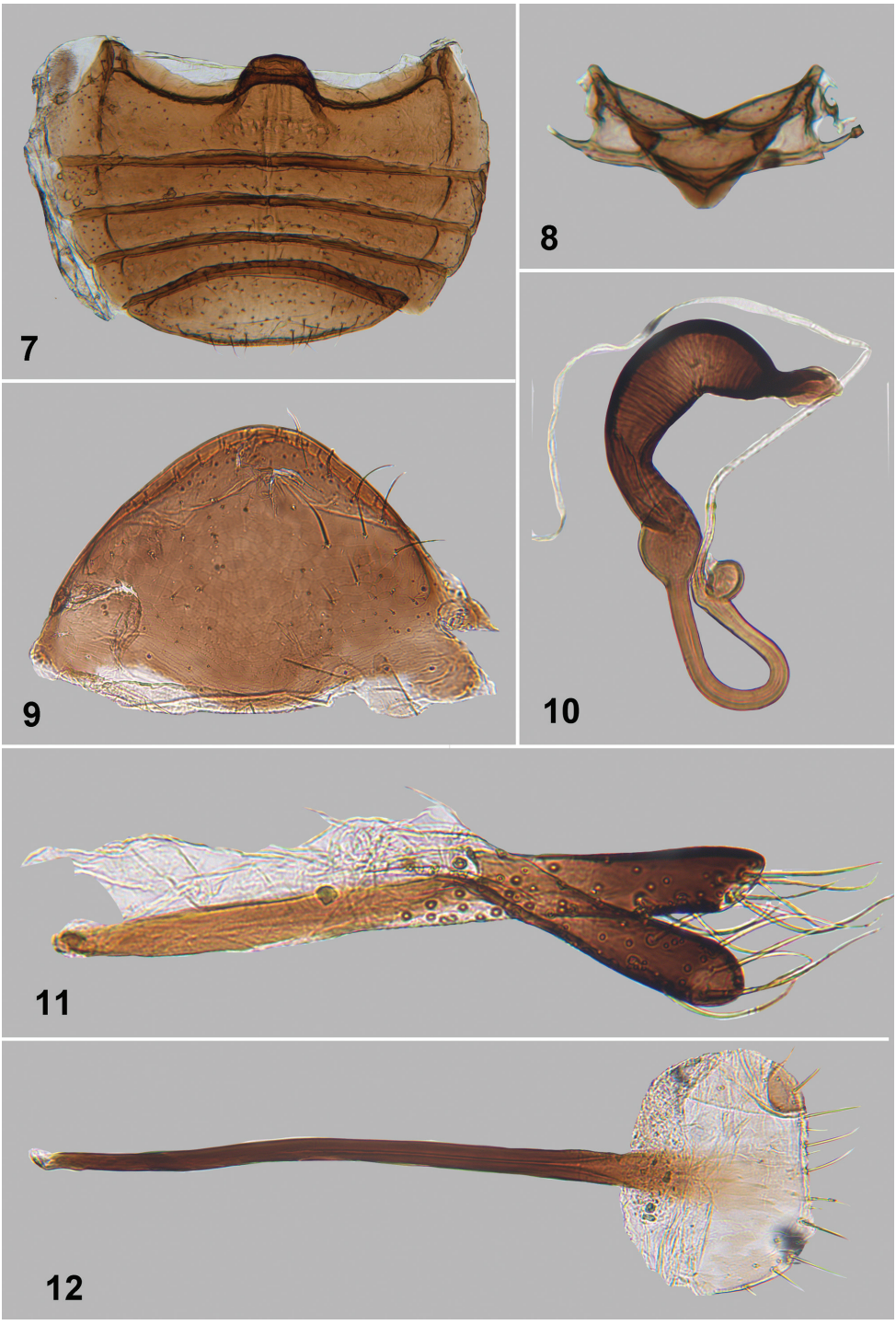
**Description.** Body length: 1.28–1.38 mm, width: 0.84–1.10 mm. Color blackish with light bluish luster. Ventral side and appendages light brown or amber. Distance between eyes about 2 times wider than transverse diameter of eye. Diameter of punctures on vertex smaller than distance between them. Pronotal punctures sparse, slightly elongate in shape, their transverse diameter much smaller than distance between them. Elytral punctures relatively large, forming well developed rows. Distance between punctures in rows about as great as their diameter. Distance between rows much greater than diameter of punctures. Lateral (outer) side of metatibia deeply and coarsely dentate. Metatibial spur curved, nearly as long as denticle situated on apex of inner side of metatibia. Posterior sclerotizations of vaginal palpi nearly parallel-sided, straight at apex. Posterior sclerotization of tignum gradually widening posteriorly, abdominal sternite 8 with two sclerotized spots near apex. Spermatheca with relatively long middle part of receptacle, with internal side forming nearly 90 degree angle.

**Comments.** *Monotalla dominica* can be separated from other *Monotalla* by its short metatibial spur situated on the apex of the inner side of the metatibia that barely projects beyond apicomedial denticle.

**Etymology.** This species is named after the island where it occurs.

**Type material.** Holotype, female: Dominica, ca 2600', Morne Trois Pitons N.P., Freshwater Lake, 17-8-1986, C.W. & L. O'Brien (WIBF, to be deposited in the USNM). Paratype, female, the same label as the holotype (WIBF). Paratype female: Dominica: St. Paul Parish; Morne Trois Piton N.P.; Trail to Middleham Falls; 27May-05JUNE 2011; Santee Malaise (WIBF). Data not on the labels indicate this locality is at 724m (M.Ivie, unpublished) (WIBF). The specimens are provided with one additional label (Holotype or Paratype respectively) *Monotalla dominica* Konstantinov et al. 2015.


**Figures 2–6.** *Monotalla dominica*. **2** Dorsal habitus **3** Lateral habitus **4** Hind tibia and tarsi **5** Head, frontal view **6** Aedeagus, ventral and lateral views.




**Figures 7–12.** *Monotalla dominica*. **7** Abdominal ventrites **8** Mesotergite **9** Apical abdominal tergite **10** Spermatheca **11** Vaginal palpi **12** Tignum.

***Monotalla guadeloupensis* Bechyné, 1956**
Figs 1, 13–21

*Monotalla guadeloupensis* Bechyné, 1956: 588 (type locality Guadeloupe, type NHMB), Savini and Furth 2001: 907 (status restored).

**Description.** Body length: 1.32–1.35 mm, width: 1.05–1.10 mm. Color blackish with light bluish metallic luster. Ventral side and appendages light brown or amber. Distance between eyes about 2 times wider than transverse diameter of eye. Punctures on vertex about as large as distance between them. Pronotal punctures sparce, slightly elongate in shape, their transverse diameter much smaller than distance between them. Elytral punctures relatively large, forming well developed rows. Distance between punctures in rows about as great as their diameter. Distance between rows at base of elytra about as great as diameter of punctures. Distance between rows in middle of elytra greater than diameter of punctures. Lateral (outer) side of metatibia deeply and coarsely dentate. Metatibial spur curved, projects beyond denticle situated on apex of inner side of metatibia. Aedeagus slender, with shallow and wide impression ventrally. Posterior sclerotizations of vaginal palpi slightly widening apically, straight at apex. Posterior sclerotization of tignum gradually narrowing posteriorly, abdominal sternite 8 without sclerotized spots near apex. Spermatheca with relatively long middle part of receptacle, with internal side forming few folds.

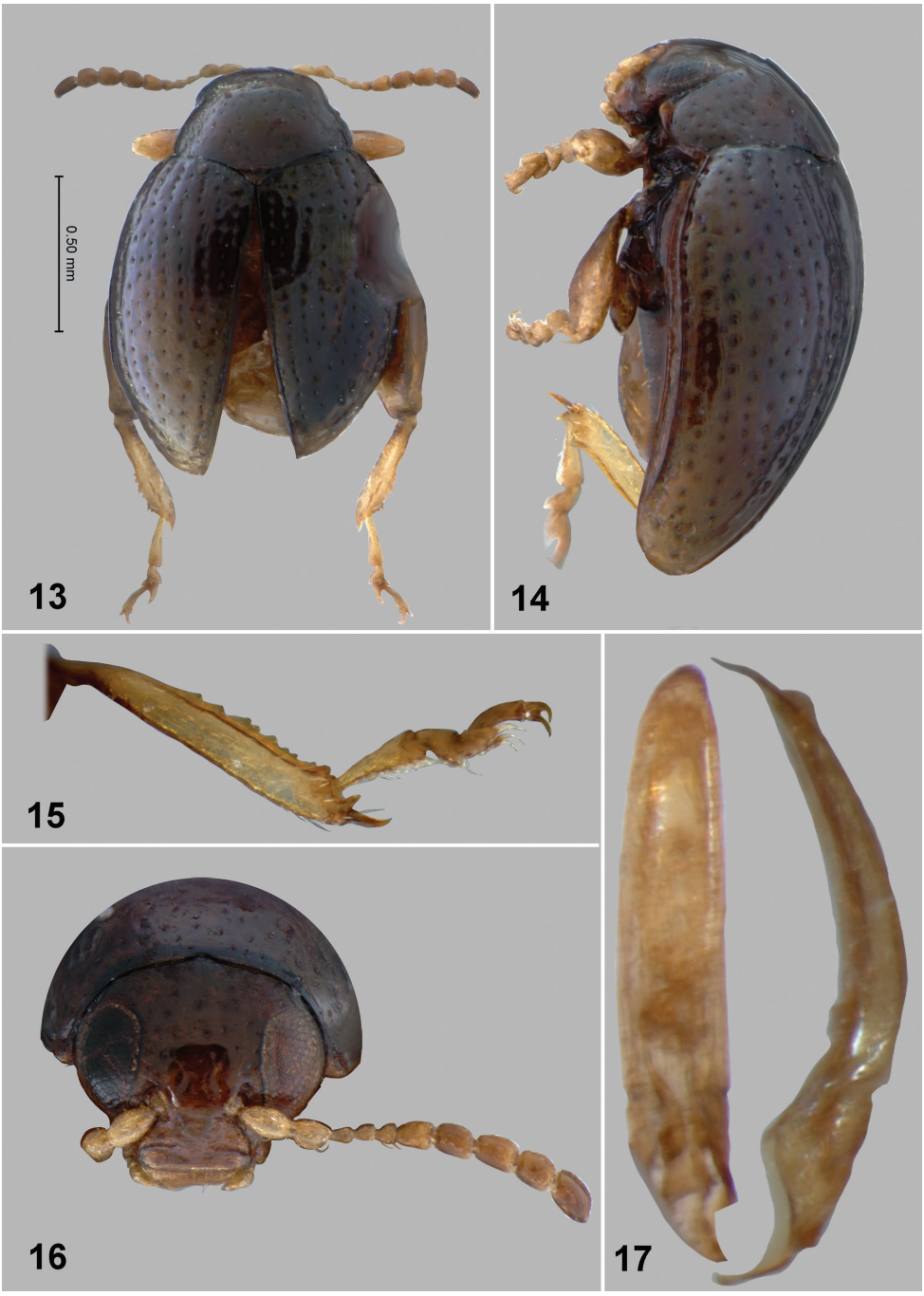
**Comments.** *Monotalla guadeloupensis* is the type species of *Monotalla.* In the key to *Monotalla* species it ends up in the same couplet with *M. lecticafolium*. It can be separated by the following characters: punctures on vertex about as large as distance between them; aedeagus slender, with shallow and wide impression ventrally. In *M. lecticafolium*, punctures on vertex are much smaller than distance between them and aedeagus is robust, without impression ventrally.

**Type material.** Holotype, male: 1) Guadeloupe; 2) 1953 Coll Heikertinger; 3) Holotype *Monotalla guadeloupensis* J. Bechyné det. 1956. (NHMB).

**Material examined.** Guadeloupe: Basse Terre, Mam[elles] de Pigeon, 600-700m, 16°10.668N, 61°44.152W, 21 Aug 2005, M.A. Ivie, beating dead palm frond (male WIBF, female USNM). Guadeloupe: Basse T. Gourbeyre, Palmiste, 05-20 Jan 2003, J. Touroult colr. (male WIBF).

***Monotalla lecticofolia* Konstantinov, Linzmeier, Clark & Ivie, sp. n.**
http://zoobank.org/6F087FA1-1B04-4FC5-8EA8-C5B6E59C550D
Figs 22–26

**Description.** Body length: 1.42–1.43 mm, width: 1.98–1.10 mm. Color blackish with light bluish metallic luster. Ventral side and appendages light brown or amber. Distance between eyes about 2 times wider than transverse diameter of eye. Punctures on vertex much smaller than distance between them. Pronotal punctures sparse,




**Figures 13–17.** *Monotalla guadeloupensis*. **13** Dorsal habitus **14** Lateral habitus **15** Hind tibia and tarsi **16** Head, frontal view **17** Aedeagus, ventral and lateral views.


**Figures 18–21.** *Monotalla guadeloupensis*. **18** Gut, with scerotized folds **19** Tignum **20** Spermatheca **21** Vaginal palpi.


**Figures 22–26.** *Monotalla lecticafolium*. **22** Dorsal habitus **23** Lateral habitus **24** Hind tibia and tarsi **25** Head, frontal view **26** Aedeagus, ventral and lateral views.

slightly elongate in shape, their transverse diameter much smaller than distance between them. Elytral punctures relatively large, forming well developed rows. Distance between punctures in rows about as great as their diameter. Distance between rows greater than diameter of punctures. Lateral side of metatibia deeply and coarsely dentate. Apicomedial metatibial denticle shorter than metatibial spur. Aedeagus robust, without impression ventrally.

**Comments.** In the key to *Monotalla* species *M. lecticofolia* ends up in the same couplet with *M. guadeloupensis*. It can be separated by the following characters: punctures on vertex much smaller than distance between them and aedeagus robust, without impression ventrally. In *M. guadeloupensis*, punctures on vertex about as large as distance between them; aedeagus slender, with shallow and wide impression ventrally.

**Etymology.** This species name comes from Latin words "*lectico*" to collect something from somewhere and "*folia*" leaf.

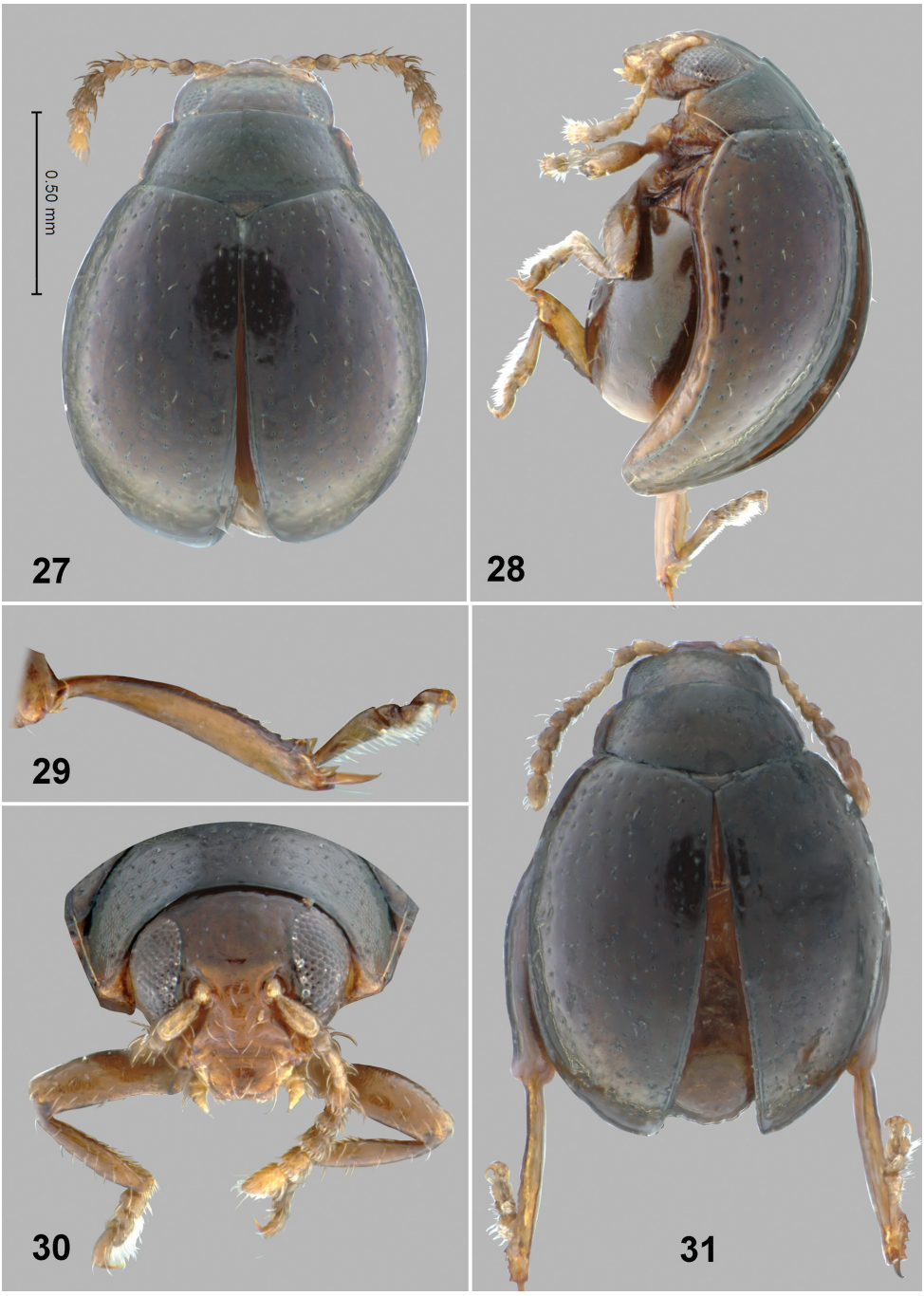
Type material: Holotype, male: 1) St. Lucia: Piton Troumasse trap site. 793m, 13.8535°N, 61.0098°W, 22–30 JUNE 2009 malaise, C. A. Maier & M. L. Gimmel (WIBF, to be deposited in the USNM). Paratypes, male, the same label as the holotype (WIBF). The specimens are provided with one additional label (Holotype or Paratype respectively) *Monotalla lecticofolia* Konstantinov et al. 2015.

***Monotalla maierae*** **Konstantinov, Linzmeier, Clark & Ivie, sp. n.**
http://zoobank.org/641A4308-BB17-4EC7-9537-1EEE8566B7D2
Figs 27–35

**Description.** Body length: 1.32–1.35 mm, width: 1.08–0.90 mm. Elytra with purplish luster. Ventral side and appendages light brown or amber. Distance between eyes about 2 times wider than transverse diameter of eye. Punctures on vertex poorly defined, mostly smaller than distance between them. Pronotal punctures sparse, slightly elongate in shape, their transverse diameter much smaller than distance between them. Elytral punctures relatively small, forming rows. Distance between punctures in rows lesser than or equal to their diameter. Distance between rows greater than diameter of punctures. Lateral side of metatibia with short evenly spaced denticles. Metatibial spur straight, strongly projecting beyond denticle situated on apex of inner side of metatibia. Aedeagus slender, with shallow and wide impression ventrally. Posterior sclerotizations of vaginal palpi slightly widening apically, straight at apex. Posterior sclerotization of tignum gradually narrowing posteriorly, abdominal sternite 8 without sclerotized spots near apex. Spermatheca with relatively long middle part of receptacle, with internal side slightly bend.

**Comments.** *Monotalla maierae* can be separated from all other of *Monotalla* species by the purplish elytra. In addition, *M. maierae* differs from most *Monotalla* based on small and sparse pronotal and elytral punctures.

**Etymology.** We name this species after C. A. Maier who collected three of five new species described in this paper.



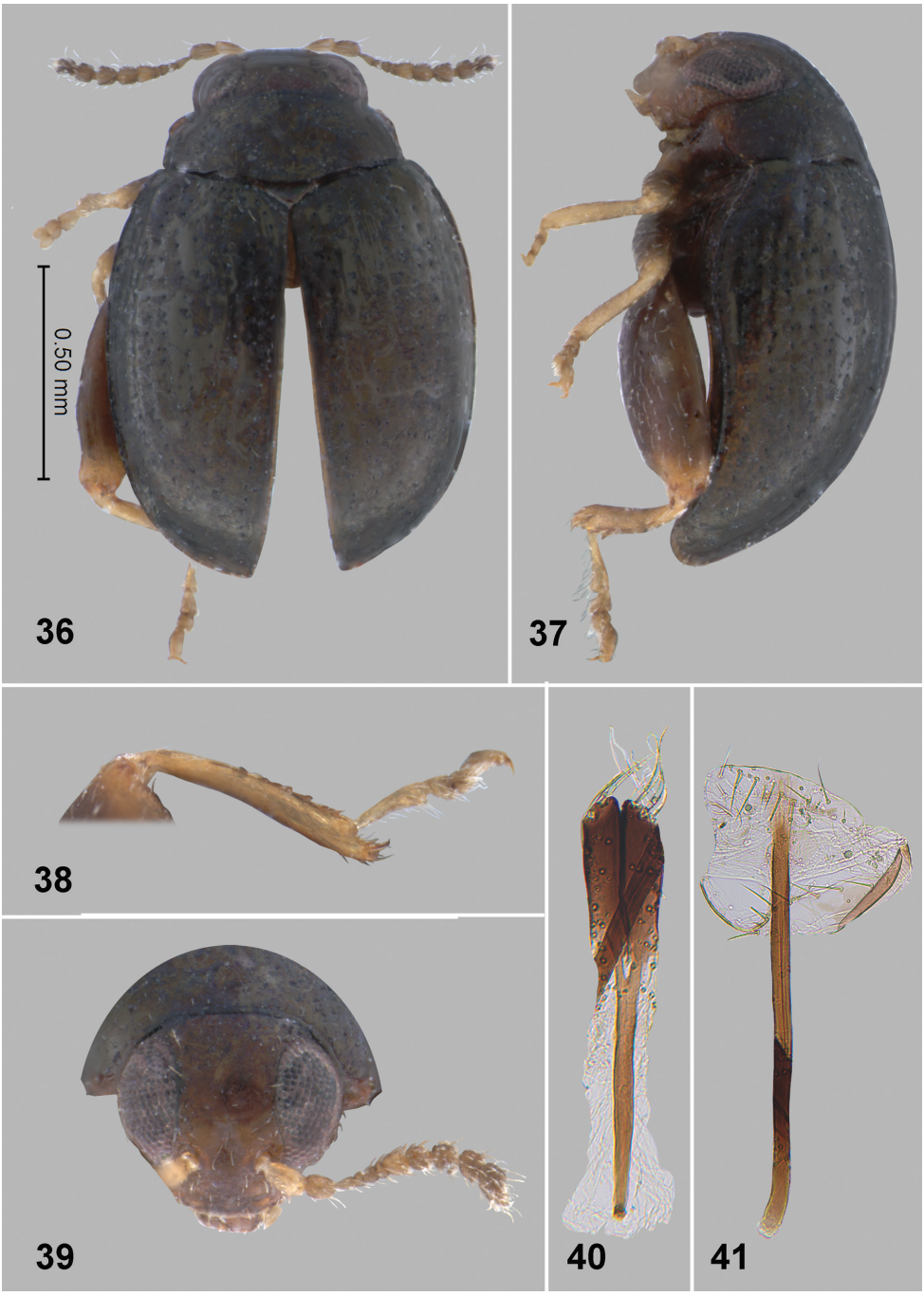

**Figures 27–31.** *Monotalla maierae*. **27** Holotype, dorsal habitus **28** Holotype, lateral habitus **29** Hind tibia and tarsi **30** Head, frontal view **31** Paratype, dorsal habitus.


**Figures 32–35.** *Monotalla maierae*. **32** Spermatheca **33** Vaginal palpi **34** Tignum **35** Aedeagus, ventral and lateral views.

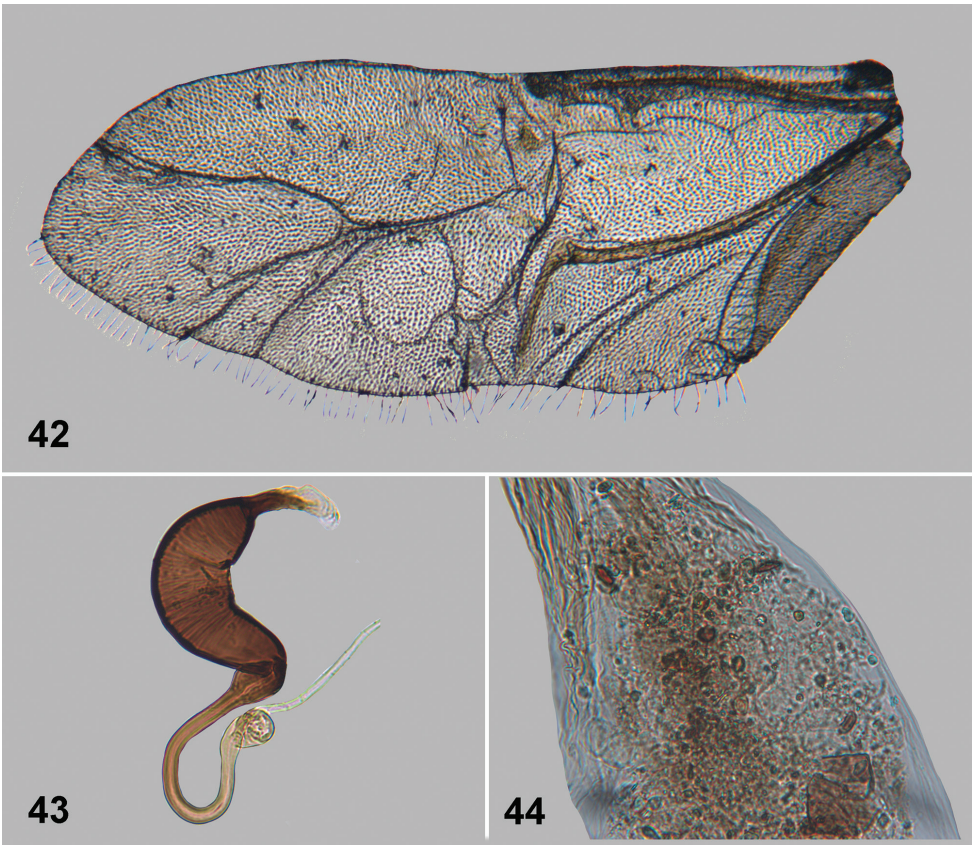
**Type material.** Holotype, male: 1) St. Lucia: Piton Troumasse trap site. 793m, 13.8535°N, 61.0098°W, 17 JUNE 2009. moss berlese C. A. Maier (WIBF, to be deposited in the USNM). Paratypes 2 males, the same label as holotype (1- WIBF, 1- BYUC). Paratypes 2 females: 1) St. Lucia: Piton Troumasse trap site. 793m, 13.8535°N, 61.0098°W, 22 JUNE 2009. litter berlese C. A. Maier (1 - USNM, 1 - WIBF). The specimens are provided with one additional label (Holotype or Paratype respectively) *Monotalla maierae* Konstantinov et al. 2015.

***Monotalla obrienorum* Konstantinov, Linzmeier, Clark & Ivie, sp. n.**
http://zoobank.org/95E5FA0F-2563-4F27-A306-7B8E652E11D2
Figs 36–44

**Description.** Body length: 1.18–1.25 mm, width: 0.91–0.77 mm. Elytra with blackish and bluish luster. Ventral side and appendages light brown or amber. Distance between eyes about 1.4–1.5 times wider than transverse diameter of eye. Punctures on




**Figures 36–41.** *Monotalla obrienorum*. **36** Dorsal habitus **37** Lateral habitus **38** Hind tibia and tarsi **39** Head, frontal view **40** Vaginal palpi **41** Tignum.

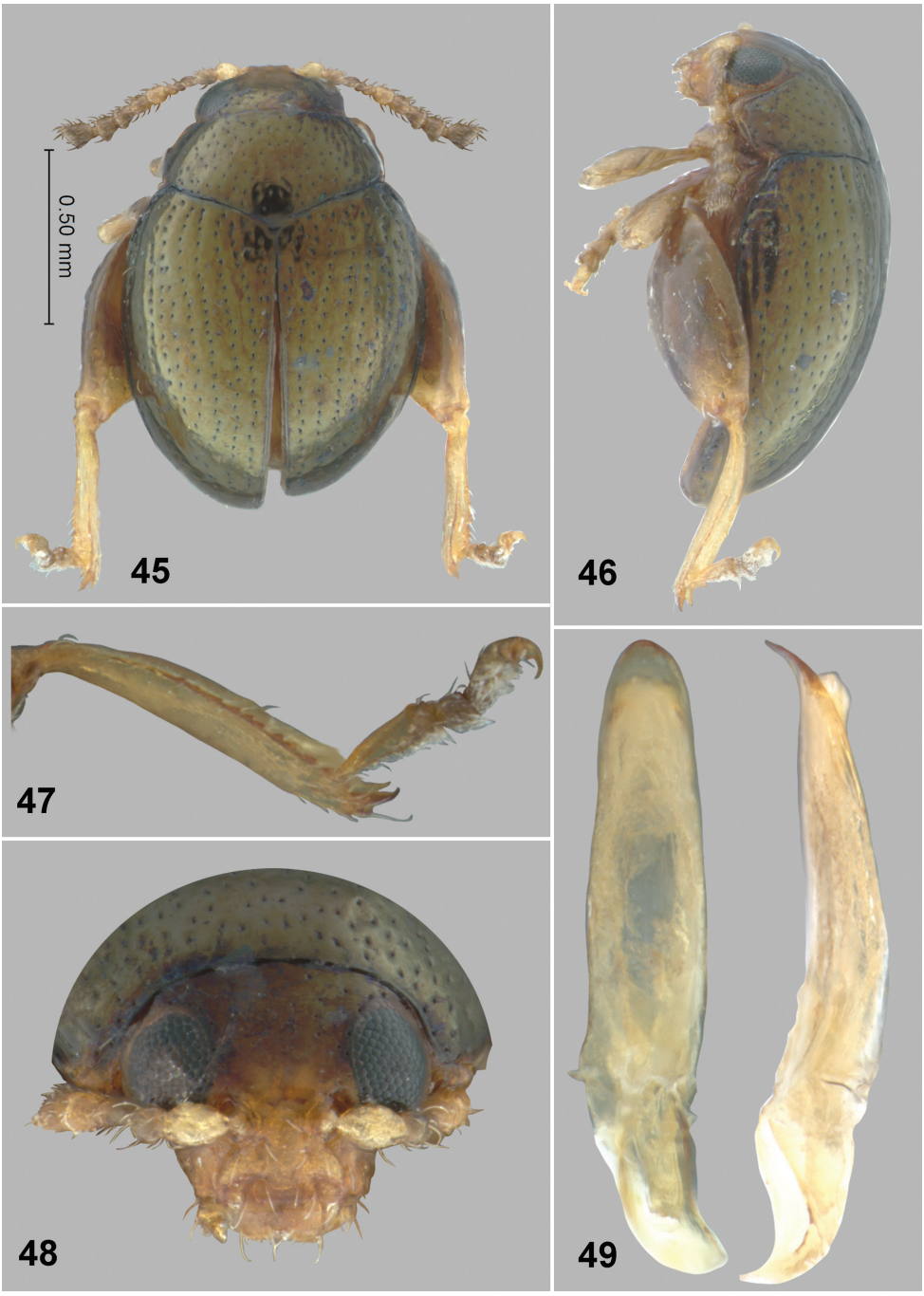



**Figures 42–44.** *Monotalla obrienorum*. **42** Hind wing **43** Spermatheca **44** Gut.

vertex well defined, sparse, smaller than distance between them. Pronotal punctures sparse, slightly elongate in shape, their transverse diameter much smaller than distance between them. Elytral punctures larger than those on pronotum, forming rows. Distance between punctures in rows smaller than or as great as their diameter. Distance between rows greater than diameter of punctures. Lateral side of metatibia with short evenly spaced denticles. Metatibial spur curved, projecting beyond denticle situated on apex of inner side of metatibia. Posterior sclerotizations of vaginal palpi with slightly sinusoidal lateral side, straight at apex. Tignum more or less parallel sided, abdominal sternite 8 without sclerotized spots near apex. Spermatheca with relatively long middle part of receptacle, with internal side slightly bend.

**Comments.** *Monotalla obrienorum* can be separated from all other *Monotalla* species based on the distance between eyes being 1.40–1.50 times greater than the transverse diameter of the eye.

**Etymology.** We name this species after Charles W. & Lois B. O'Brien who collected two of five new species described in this paper.




**Figures 45–49.** *Monotalla viridis*. **45** Dorsal habitus **46** Lateral habitus **47** Hind tibia and tarsi **48** Head, frontal view **49** Aedeagus, ventral and lateral views.

**Type material.** Holotype, female: 1) Grenada, Grand Etang, N.P. Mt. Qua Qua Tr., 10-IX-1991 C.W. & L. B. O'Brien (BYUC). Paratypes, 3 females, the same label as the holotype (1- BYUC, 1- USNM, 1 - WIBF). Paratype, female: 1) Grenada, St. John P, 1 mi E. Gouyave, 5.IX.1991. C.W. & L. B. O'Brien (BYUC). The specimens are provided with one additional label (Holotype or Paratype respectively) *Monotalla obrienorum* Konstantinov et al. 2015.

***Monotalla viridis* Konstantinov, Linzmeier, Clark & Ivie, sp. n.**
http://zoobank.org/1DEB2FE1-9279-4166-A47B-97D450843E31
Figs 45–49

**Description.** Body length: 1.25 mm, width: 0.88 mm. Elytron with light greenish luster. Ventral side and appendages light brown or amber. Distance between eyes slightly less than 2 times wider than transverse diameter of eye. Punctures on vertex well defined, sparse, smaller than distance between them. Pronotal punctures sparse, slightly elongate in shape, their transverse diameter much smaller than distance between them. Elytral punctures slightly larger than those on pronotum, forming rows. Distance between punctures in rows smaller than or as great as their diameter. Distance between rows greater than diameter of punctures. Lateral side of metatibia with relatively large denticles. Metatibial spur curved, projecting beyond denticle situated on apex of inner side of metatibia. Aedeagus more or less robust, without impression ventrally, nearly straight in lateral view.

**Comments.** *Monotalla viridis* can be separated from all other *Monotalla* species based on the light greenish color of the elytra.

**Etymology.** This species is named after its light greenish color.

**Type material.** Holotype, male: 1) St. Lucia: Piton St. Esprit trap site. 571m, 13.8493°N, 60.9795°W, 29 MAY 2009. ex. tree moss C. A. Maier; 2) Holotype *Monotalla viridis* Konstantinov et al. 2015 (WIBF, to be deposited in the USNM).

**Key to *Monotalla* species**

| | |
|---|---|
| 1 | Elytron with light greenish luster. St. Lucia .....***Monotalla viridis* sp. n.** |
| – | Elytron with bluish, blackish or purplish luster.....**2** |
| 2(1) | Metatibial spur barely projecting beyond denticle situated on apex of inner side of metatibia. Dominica.....***Monotalla dominica* sp. n.** |
| – | Metatibial spur strongly projects beyond denticle situated on apex of inner side of metatibia .....**3** |
| 3(2) | Elytron with purplish luster. St. Lucia .....***Monotalla maierae* sp. n.** |
| – | Elytron with bluish or blackish luster.....**4** |
| 4(3) | Distance between eyes 1.40–1.50 times greater than transverse diameter of eye. Grenada.....***Monotalla obrienorum* sp. n.** |

– Distance between eyes 2.01–2.15 times greater than transverse diameter of eye ..... **5**

5(4) Punctures on vertex about as large as distance between them. Aedeagus slender, with shallow and wide impression ventrally. Basse-Terre ..... ..... ***Monotalla guadeloupensis*** **Bechyné, 1956**

– Punctures on vertex much smaller than distance between them. Aedeagus robust, without impression ventrally. St. Lucia..... ***Monotalla lecticofolia*** **sp. n.**

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We thank Matthew Gimmel, Crystal Maier, Charles.W. and Lois B. O'Brien, and the students of Texas A&M University's 2011 field class in Dominica who collected *Monotalla* specimens used in this study, as well at the entire inventory team who contributed to the survey of St. Lucia in 2009. We are grateful to Aiden Jimeno (Twinbrook, MD) for a beautiful habitus drawing of *Monotalla guadeloupensis*. Mention of trade names or commercial products in this publication is solely for the purpose of providing specific information and does not imply recommendation or endorsement by the USDA; USDA is an equal opportunity provider and employer. This is a contribution of the Montana Agricultural Experiment Station.

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# Availability of eleven species names of *Eupelmus* (Hymenoptera, Eupelmidae) proposed in Al khatib et al. (2014)

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*http://zoobank.org/8292E6EE-70FF-42B6-B874-617B7DB0E2AD*

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## Abstract

This paper is an addendum for the availability of the names of 11 new species proposed in Al khatib et al. (2014).

## Keywords

Eupelmus, ICZN, systematics, taxonomy

## Introduction

Al khatib et al. (2014) described 11 new species of West Palaearctic *Eupelmus*, but only the acronyms of the depositories where the holotypes are deposited were given in the publication. The full names and location of the depositories were provided, but only in a Word document (Appendix S2) as part of the Supplementary Information

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(SI) available on the website of *Systematic Entomology* (http://onlinelibrary.wiley.com/doi/10.1111/syen.12089/suppinfo). Article 16.4 of the International Code of Zoological Nomenclature states that "Every new specific and subspecific name published after 1999, ... must be accompanied in the original publication ... where the holotype or syntypes are extant specimens, by a statement of intent that they will be (or are) deposited in a collection and a statement indicating the name and location of that collection" (ICZN 2012). A museum acronym is not a statement of the location or even necessarily a clear indication of the name of a collection. Further, Appendix S2 cannot be considered as part of the publication or itself a publication because it is a Word document and thus contravenes ICZN Article 8.1.3, in addition to Articles 8.5.2 and 8.5.3. As a result, the new names published in Al khatib et al. (2014) are not available because the complete name and locality information of the holotype depositories are not provided in the publication, but only in a document that supplements the publication. For this reason, the authors provide in the present paper the new names published in Al khatib et al. (2014) with a precise statement (Table 1) as to the name and location of the collection in which the holotypes and other material listed in other supplementary files are deposited. Accordingly, the availability of the 11 names proposed in Al khatib et al. (2014) and given below takes the date of the present publication, as per ICZN Article 10.1. Al khatib et al. (2014) also did not include in the publication paratype information for new species with numerous paratypes, citing this information only in Appendix S1 on the *Systematic Entomology* website. We therefore also include here paratype designations to ensure this information is validly published.

**Table 1.** Collection acronyms, names and locations for specimen deposition cited in Al khatib et al. (2014).

| | |
|---|---|
| **AICF** | Lucian Fusu collection, A1. I. Cuza University, Iasi, Romania. |
| **BMNH** | The Natural History Museum, London, United Kingdom. |
| **CBGP** | Center for Biology and Management of Populations, Montpellier, France. |
| **CNC** | Canadian National Collection of Insects, Arachnids and Nematodes, Agriculture & Agri-food Canada, Ottawa, ON, Canada. |
| **FALPC** | Fadel Al khatib personal collection, Faculty of Agricultural Engineering, University of Aleppo, Syria. |
| **GDPC** | Gérard Delvare personal collection, Montpellier, France. |
| **MKUI** | Plant Protection Department, Mustafa Kemal University, Antakya-Hatay, Turkey. |
| **MNHG** | Museum of Natural History of Geneva, Switzerland. |
| **MNHN** | National Museum of Natural History, Paris, France. |
| **NHMW** | Naturhistorisches Museum, Wien, Austria. |
| **NHRS** | Naturhistoriska riksmuseet, Stockholm, Sweden. |
| **NMPC** | Narodni Muzeum v Praze, Prague, Czech Republic. |
| **RMNH** | Rijksmuseum van Naturrlijke Historie collection, Naturalis Biodiversity Centre, Leiden, The Netherlands. |

## Results

***Eupelmus* (*Eupelmus*) *confusus* Al khatib**
http://zoobank.org/E9A1F8A3-00D1-4DB6-9A04-5ACBEBDBFEA3

Al khatib et al. (2014): 822–828.

**Type material. Holotype** ♀. **FRANCE**: Var, Fayence, 43.61774°N, 06.69774°E, 17.iii.2012, emerged 25.iii.2012, ex *Diplolepis rosae* on *Rosa canina* (N. Ris) (1 ♀) [FAL1195/10206] (in MNHG). **Paratypes**. **CYPRUS**: **Lemesos**, 6 km N of Lemesos, 24–25.V.2009, N34.73189°, E33.05175°, pods of carob tree with *Apomyelois ceratoniae* & *Asphondylia gennadii* (Fusu L. & Popovici O.) (5 ♀ 6 ♂ not sequenced) (in AICF) (1 ♀) [LF.ma.CY 01/10427] (in AICF); **6 km N of Lemesos**, 25. V. 2009, sweep net, N34.727028°, E33.052278° (Fusu L. & Popovici O.) (1 ♀ 10 ♂ not sequenced)(in AICF). **FRANCE**: **Alpes-Maritimes**, Biot, N43.63455°, E7.08249°, 11.iii.2012, emerged 27.iii.2012, ex *Andricus kollari* on *Quercus pubescens* (N. Ris) (2 ♀) [FAL1227/10215, FAL1227/10216] (in FALPC); **Alpes-Maritimes**, Opio, N43.64479°, E6.99957°, 04.x.2012, (F. Al khatib & P. Gory) (1 ♀) [FAL1485/10313] (in FALPC); **Alpes-Maritimes**, Pégomas, N43.58844°, E6.93612°, 08.vi.2012, emerged 11.vi.2012, ex *Myopites stylata* on *Dittrichia viscosa* (F. Al khatib & P. Gory) (1 ♀) [FAL1429/10433] (in GDPC); **Alpes-Maritimes**, Sophia -Antipolis, N43.62443°, E7.03667°, 21.ii.2012, emerged 27.ii.2012, ex *Myopites stylata* on *Dittrichia viscosa* (F. Al khatib) (1 ♀ 1 ♂) [FAL1029/10142, FAL1032/10432] (in MNHG); **Alpes-Maritimes**, Sophia-Antipolis, N43.61669°, E7.03722°, 07.vi.2012, emerged 16.vi.2012, ex *Biorhiza pallida* on *Quercus pubescens* (F. Al khatib & P. Gory) (1 ♀) [FAL1338/10227] (in MNHN); **Alpes-Maritimes**, Villars-sur-Var, N43.93730°, E7.08068°, 14.iii.2012, emerged 18.iii.2012, ex *Diplolepis rosae* on *Rosa canina* (F. Al khatib & N. Ris) (2 ♀) [FAL1198/10209 (in MNHG), FAL1198/10210 (in FALPC)]; **Ardèche**, Saint-Georges-les-Bains, N44.85028°, E4.82433°, 13.vi.2012, emerged 14.vi.2012, ex *Biorhiza pallida* on *Quercus pubescens* (F. Al khatib & M. Thaon) (2 ♀) [FAL1325/10224, FAL1325/10225] (in CBGP); **Ardèche**, Saint-Georges-les-Bains, N44.85028°, E4.82433°, 13.vi.2012, emerged 11.vii.2012, ex *Dryocosmus kuriphilus* on *Castanea sativa* (M. Thaon) (1 ♀ 1 ♂) [NB489/10418, NB489c/10419] (in GDPC); **Ardèche**, Saint-Georges-Montpellier, N43.6104°, E3.77227°, ix.2011, emerged ix.2011, ex *Bactrocera oleae* on *Olea europaea* (L. Brancaccio & M. Thaon) (1 ♀ 1 ♂) [FAL1278/10443, FAL1280/10445] (in MNHN); **Aude**, Durban-Corbières, N42.99825°, E2.80690°, 27.iii.2012, emerged 31.iii.2012, ex *Myopites stylata* on *Dittrichia viscosa* (F. Al khatib & N. Ris) (1 ♀) [FAL1122/10175] (GDPC); **Bouches-du-Rhône**, La Ciotat, garden, 09.I.2011 emerged 13-30.IV.2011, *Lasioptera carophila* on *Foeniculum vulgare* (H. Dumas) (5 ♀ 6 ♂ not sequenced, in AICF) (1♀) [LF.ma.FR 01/10422] (in AICF); **Gard**, Garons, N43.76371°, E4.42588°, 11.i.2012, emerged 27.ii.2012, ex *Myopites stylata* on *Dittrichia viscosa* (N. Ris) (1 ♀) [FAL1092/10162] (in MNHG); **Gard**, Roquemaure, N44.03148°, E4.72747°, x.2011, emerged x.2011, ex *Bactrocera oleae* on *Olea europaea* (N. Borowiec) (1 ♀) [FAL1274/10447] (in CBGP); **Haute-Corse**, Aléria, N42.12861°, E9.46555°,

22.ix.2011, ex seeds of *Asphodelus ramosus* infested by *Bruchophagus* sp. (J. Balajas) (2 ♀ 1 ♂) [GDEL4111/10187, GDEL4111/10188, GDEL4111/10189] (in MNHG); **Haute-Corse**, Lumio, N42.55879°, E8.81299°, 23.ix.2012, emerged 28.ix.2012, ex *Bactrocera oleae* on *Olea europaea* (F. Ceccaldi) (2 ♀) [FAL1519/10411, FAL1519/10412] (MNHN); **Haute-Corse**, Piedicorte di Gaggio, N42.22166°, E9.26527°, 22. ix.2011, ex seeds of *Asphodelus ramosus* infested by *Bruchophagus* sp. (J. Balajas) (2 ♀ 3 ♂) [GDEL4114/10190, GDEL4114/10191, GDEL4114a, GDEL4114b & GDEL4114c] (in MNHN); **Hérault**, Causses-et-Veyran, N43.47131°, E3.08508°, x.2011, emerged x.2011, ex *Bactrocera oleae* on *Olea europaea* (A. Auguste-Maros) (1 ♀) [FAL1254/10453] (in FALPC); **Hérault**, Frontignan, N43.43926°, E3.74145°, 17.vi.2012, emerged 19.vi.2012, ex *Myopites stylata* on *Dittrichia viscosa* (F. Al khatib & N. Ris) (1 ♀) [FAL1446/10309] (FALPC); **Hérault**, Laroque, 250-400 m, N45.91722°, E3.74361°, 05.vii.2013, sweeping on *Quercus pubescens* (G. Delvare), (1 ♀) [4173/10596] (in GDPC); **Hérault**, Mèze, N43.41670°, E3.6000°, x.2011, emerged x.2011, ex *Bactrocera oleae* on *Olea europaea* (N. Ris) (2 ♀) [FAL1257/10454 (in CNC), NB229/7052 (in FALPC)]; **Monaco**, Monaco, N43.73263°, E7.41369°, x.2010, ex *Bactrocera oleae* on *Olea europaea* (J.-C. Malausa & C. Roques) (1 ♀) [FAL1247/10436] (in CNC); **Pyrénées-Orientales**, Argelès-sur-Mer, N42.581000°, E3.010910°, x.2011, emerged x.2011, ex *Bactrocera oleae* on *Olea europaea* (N. Ris) (4 ♀ 1 ♂) [FAL1255/10449 & FAL1255/10450 (in GDPC), NB362v/7078, NB362w/7079, FAL1256/10451 (in FALPC)]; **Pyrénées-Orientales**, Banyuls-sur-Mer, 04.ii.2012, emerged 20.ii.2012, ex *Myopites stylata* on *Dittrichia viscosa* (J. Lecomte) (1 ♀) [FAL1100/10164] (in CBGP); **Pyrénées-Orientales**, Banyuls-sur-Mer, N42.47194°, E3.14333°, 250 m, 21.iii.2010 ex galls of *Timaspis phoenixopodos* on *Lactuca viminea* (G. Delvare & J. Lecomte) (2 ♀) [GDEL4001/3303, GDEL4002/3296] (in GDPC); **Pyrénées-Orientales**, Banyuls-sur-Mer, N42.46972°, E3.12388°, 10 m, 21.iii.2010 ex galls of *T. phoenixopodos* on *L. viminea* (G. Delvare & J. Lecomte) (1 ♀) [GDEL4003/3302] (in GDPC); **Pyrénées-Orientales**, Calce, N42.7348°, E2.75471°, x.2011, emerged x.2011, ex *Bactrocera oleae* on *Olea europaea* (N. Borowiec & L. Brancaccio ) (2 ♂) [FAL1251/10448 (in GDPC), FAL1251/10283 (in FALPC)]; **Pyrénées-Orientales**, Perpignan, N42.67720°, E2.86912°, 18.vi.2012, emerged 19.vi.2012, ex *Myopites stylata* on *Dittrichia viscosa* (F. Al khatib & N. Ris) (1 ♀) [FAL1455/10312] (in FALPC); **Var**, Rians, N43.57352°, E5.77148°, 31.ii.2012, emerged 09.iii.2012, ex *Diplolepis rosae* on *Rosa canina*, (N. Ris) (2 ♀ 1 ♂) [FAL1204/10212 (in CNC), FAL1204/10213 & FAL1205/10280 (in MNHG)]; (1 ♀) [FAL1195/10207] (in MNHN), same data as holotype. **GREECE**: **Seres**, Kerkini Lake Nat.Park, Kerkini Mts near Vironeia, 300 m, N41.27833°, E23.21955°, sweep net 22.VI.2008 (Fusu, Popovici & Ramel) (1 ♀) (in AICF) (1 ♀) [LF.ma.GR 01/10425] (in AICF); **Seres**, Kerkini lake, Krousia Mts. Site, N41.20180°, E23.07747°, Malaise trap, 12-18.IX.2007 (G. Ramel) (1 ♀) [LF.ma.GR 02/10426] (in AICF); **Seres**, Kerkini Mts., Plateaux Beech, N41.28580°, E23.03368°, Malaise trap, 08.VIII to 13.VIII.2007, (G. Ramel) (1 ♀ not sequenced, in AICF); **Seres**, Kerkini Lake N. Park, nr Kerkini, Pumping St. Site, N41.19760°, E23.08883°, 13.VI to 19.VI.2007, Malaise trap (G. Ramel) (1♀ not sequenced, in AICF); **Seres**, Kerkini Lake N. Park, Kerkini, Krousia Mts site, 190 m, N41.20180°, E23.07747°, 06.VI-12. VI.2007, Malaise tr. (G. Ramel) (4 ♀ not sequenced, in AICF); same data but 13.VI-19.

VI.2007 (2 ♀ not sequenced, in AICF); same data but 20.VI-26.VI.2007 (4 ♀ not sequenced, in AICF). **IRAN**: **Kerman Prov.**, Bidkhan, 2897 m, N29°34.956' E 56°30.612', 11.v.2012, ex galls on *Salix alba* (M. Mahdavi) (1 ♀) [LF.ma.IR 05/10424] (in AICF). **ITALY**: **Liguria**, Bussana-Vecchia, N43.84026°, E7.82905°, 02.i.2012, emerged 20.ii.2012, ex *Myopites stylata* on *Dittrichia viscosa* (E. Spagnol) (4 ♀) [FAL1051/10145 (in GDPC), FAL1088/10154 & FAL1063/10149 (in CBGP), FAL1074/10153 (in MNHN)] and (3 ♂ not sequenced) [FAL1077a, FAL1077b, FAL1077c] (in MNHN); (3 ♀ not sequenced) [FAL1422d & FAL1422c, FAL1422b] (in FALPC) and (2 ♂ not sequenced) [FAL1418a, FAL1418b] (in CNC) same data but 06.vi.2012, emerged 07.vi.2012 (N. Ris). **SPAIN**: **Logroño**, La Rioja, 15.iii.2012, emerged 16.iii.2012, ex *Myopites stylata* on *Dittrichia viscosa* (R. Cantera Rioja) (2 ♀) [FAL1108/10250 (in GDPC), FAL1110/10168 (in FALPC)]. **SWEDEN**: **Skåne**, Sk, Höganäs kommun, Kullabergs naturreservat, between Hjortstugan and Ransvik, Oak forest in southern slope, N56.29421°, E12.48399°, 27.vi to 30.vii.2005, Trap ID 1004, Coll. event 1797 (SMTP) [LF.u.SW.03/10660] (in NHRS).

***E.* (*Eupelmus*) *gemellus* Al khatib**
http://zoobank.org/4BCB5C66-7AC7-431B-8F51-C76CF7D56AD4

Al khatib et al. (2014): 828–837.

**Type material. Holotype** ♀. **FRANCE**: Haute-Corse, Calenzana, 11.ix.2012, emerged 18.ix.2012, ex *Bactrocera oleae* on *Olea europaea* (F. Ceccaldi) (1 ♀) [FAL1515/10408] (in MNHG). **Paratypes**. **FRANCE**: **Alpes-Maritimes**, Biot, N43.63455°, E7.082490°, 29.x.2012, emerged 01.iii.2013, ex *Megastigmus pistaciae* on *Pistacia lentiscus* (F. Al khatib & N. Ris) (2 ♀ 1 ♂) [FAL1522/10483, FAL1522/10484, FAL1522/10485] (in MNHN); **Alpes-Maritimes**, Biot, N43.63455°, E7.082490°, 11.iii.2012, emerged 27.iii.2012, ex *Mesophleps oxycedrella* on *Juniperus oxycedrus* (N. Ris), (2 ♀) [FAL1359/10230 (in MNHG), FAL1359/10231 (in AICF)]; **Alpes-Maritimes**, Mont-Chauve, 476 m N 43.76578°, E7.27024°, 01.xi.2012, emerged 18.xii.2012, ex *Bactrocera oleae* on *Olea europaea* (M. Thaon) (1 ♀) [NB29/10413] (in FALPC); **Alpes-Maritimes**, Sophia-Antipolis, N43.624423°, E07.03667°, 21.ii.2012, emerged 27.ii.2012, ex *Myopites stylata* on *Dittrichia viscosa* (F. Al khatib) (1 ♀) [FAL1089/10143] (in FALPC); **Ardèche**, Saint-Georges-Montpellier, N43.6104°, E3.77227°, x.2011, ex *Bactrocera olea* on *Olea europaea* (L. Brancaccio & M. Thaon) (1 ♀) [FAL1279/10444] (in MNHG); **Aude**, Bize-Minervois, N43.32692°, E2.870750°, 27.iii.2012, emerged 11.iv.2012, ex *Mesophleps oxycedrella* on *Juniperus oxycedrus* (F. Al khatib & N. Ris), (1 ♀) [FAL1360/10233] (in MNHN); **Aude**, Durban-Corbières, N42.99825°, E2.80690°, 27.iii.2012, emerged 06.iv.2012, ex *Mesophleps oxycedrella* on *Juniperus oxycedrus* (F. Al khatib & N. Ris), (1 ♀) [FAL1362/10234] (in FALPC); **Aude**, Gruissan, N43.12105°, E3.09539°, x.2011, ex *Bactrocera oleae* on *Olea europaea* (N. Ris) (1 ♀) [FAL1266/10446] (in CBGP); **Bouches-du-Rhône**, Lançon-de-Provence, 33 m, N43.54818°, E5.16727°, x.2011, ex *Bactrocera oleae* on *Olea europaea*

(A. Auguste-Maros) (1 ♂) [FAL1269/10439] (in MNHN); **Bouches-du-Rhône**, La Ciotat, 53 m, N43.19011°, E5.65905°, x.2010, ex *Bactrocera oleae* on *Olea europaea* (A. Auguste-Maros) (1 ♂) [FAL1243/10437] (in MNHG); **Haute-Corse**, Bisinchi, 593 m, N42.48983°, E9.32797°, 18.vi.2012, emerged 03.vii.2012, ex *Dryocosmus kuriphilus* on *Castanea sativa* (N. Borowiec & M. Thaon) (4 ♀) [NB441/10414 (in MNHG), NB441/10415 & NB441/10416 (in FLAPC), NB441/10417 (in MNHN)]; **Haute-Corse**, Lumio, N42.55879°, E8.81299°, 13.i.2012, emerged 27.ii.2012, ex *Myopites stylata* on *Dittrichia viscosa* (F. Ceccaldi) (1 ♀) [FAL1013/10137] (in AICF); **Haute-Corse**, Muratu, 750 m, N42.5559°, E9.29929°, emerged 23.i.2013, ex *Dryocosmus kuriphilus* on *Castanea sativa* (N. Borowiec & M. Thaon) (1 ♀) [2013CYN355/10664] (in FALCP); **Var**, la Garde-Freinet, 366 m, N43.31597°, E6.47534°, emerged 28.ii.2013, ex *Dryocosmus kuriphilus* on *Castanea sativa* (N. Borowiec & M. Thaon) (1 ♂) [2013CYN448/10663] (in FALPC); **Var**, Porquerolles, 13 m, N42.99534°, E6.2044°, ex *Bactrocera oleae* on *Olea europaea* (J.-C. Malausa & M. Thaon) (2 ♀) [NB377c/7090 (in GDPC), FAL1260/10438 (in FALPC)]; **Var**, Puget-Ville, 143 m, N43.26728°, E6.10671°, ex *Bactrocera oleae* on *Olea europaea* (J.-C. Malausa & M. Thaon) (1 ♂) [FAL1273a, not sequenced] (in GDPC). **ITALY**: **Liguria**, Bussana-Vecchia, N43.84026°, E7.82905°, 02.i.2012, emerged 24.ii.2012, ex *Myopites stylata* on *Dittrichia viscosa* (E. Spagnol) (2 ♀) [FAL1004/10130, FAL1075/10156] (in MNHN); (1 ♀) [GDEL4122/10194] (in FALPC) same data except collected 25.i.2011 and emerged iv.2011; (1 ♀) [FAL1415/10481] (in CBGP) same data except collected 06.vi.2012 and emerged 07.vi.2012; **Sardinia**, Province Oristano, N39.70041°, E8.739690°, 20.x.2012, sweeping on *Pistacia lentiscus* (L. Brancaccio & M. Thaon) (1 ♀) [FAL1508/10405] (in CNC); **Sardinia,** Province Oristano, N39.70041°, E8.739690°, 20.x.2012, emerged 24.x.2012, ex *Megastigmus pistaciae* on *Pistacia lentiscus* (L. Brancaccio & M. Thaon) (1 ♀) [FAL1513/10407] (in CNC).

***E.* (*Eupelmus*) *janstai* Delvare & Gibson**
http://zoobank.org/27BFFF36-E3EE-4B94-AC0B-D4AB07836E1B

Al khatib et al. (2014): 837–838.

**Type material. Holotype** ♀. **CZECH REPUBLIC**: Břeclav district, Pavlov, 48.86750°N, 16.65416°E, sweeping on *Tilia platyphyllos*, 03.vii.2010 (G. Delvare) [GDEL4046/10032] (in MNHG). **Paratypes**. Moravia, Vranov riv., Dyje, 48.89472°N, 15.81250°E, 13.viii.1991, riparian forest (L. Masner) (2 ♀) (in CNC).

***E.* (*Eupelmus*) *longicalvus* Al khatib & Fusu**
http://zoobank.org/F83B5381-0448-4EE3-B42F-F9AD7749F964

Al khatib et al. (2014): 838–841.

**Type material. Holotype** ♀. **SWEDEN**: Gotlands, Go, Gotlands kommun, Roleks, grazed calcareous pine forest. 57°32.207'N, 18°20.273'E, 16.vii–02.viii.2004, Trap ID 28, Coll. event 1458 (SMTP) [LF.ma.SW 02/10429] (in NHRS). **Paratypes**. **FRANCE**: **Alpes-Maritimes**, La Bollène-Vésubie, 1700 m, N43.96778°, E7.38111°, 19.vii.2009 (G. Delvare) (2 ♀) [GDEL4196/10606, GDEL4197/10607] (in GDPC); **Aveyron**, Peyreleau, 850 m, N44.17528°, E3.23750°, 22.vi.2009 (G. Delvare) (1 ♀) [GDEL4194/10604] (in GDPC); **Hautes-Alpes**, Mont-Dauphin, 1869 m, N44.68972°, E6.6786°, 18.viii.2008 (G. Delvare) (1 ♀) [GDEL4199/10609] (in FALPC). **ITALY**: **Friuli Venezia Giulia**, Giulia, Chiusaforte, 1450 m, N46.40527°, E13.4450°, 12.vii.2008 (G. Delvare) (1 ♀) [GDEL4038/10019] (in GDPC); **Friuli Venezia Giulia**, Giulia, Chiusaforte, 1380 m, N46.39944°, E13.45944°, 12.vii.2008 (G. Delvare) (1 ♀) [GDEL4191/10603] (in FALPC). **SWEDEN**: **Södermanland**, **Sö**, Södertälje kommun, Tullgarns näs, Rävsalaviken, mixed forest next to pasture, N58.955217°, E17.607550°, 03.vii/19.viii.2004, Trap ID 30, Coll. event ID 1055 (SMTP) (4 ♀ not sequenced & 1 ♀ sequenced) [LF.ma.SW 01/10428]; same data but 16.vi/17.vii.2005 and coll. event ID 1717 (5 ♀); same data but 17.vii/08.ix.2005 and coll. event ID 1718 (4 ♀ not sequenced & 1 ♀ sequenced) [LF.ma.SW 03/10430] (in NHRS and AICF); **Södermanland, Sö**, Huddinge kommun, Pine forest with garbage, N59.1765333°, E17.9938500°, 13.vii/10 viii 2004, Trap ID 5, Coll. event ID 766 (SMTP) (1 ♀not sequenced) (AICF).

***E.* (*Eupelmus*) *minozonus* Delvare**
http://zoobank.org/B0EC22D2-129B-4A37-BF5C-FAE526CA3439

Al khatib et al. (2014): 843–846.

**Type material. Holotype** ♀. **HUNGARY**: Veszprém, Hegyesd, 175 m a.s.l, 46.93333°N, 17.52278°E, 27.vi.2010, sweeping *Quercus cerris* (G. Delvare) [GDEL4030/10010] (in MNHG). **Paratypes**. Same data as holotype (4 ♀) [GDEL4030/10009, GDEL4030/10120 & GDEL4031/1001 (in GDPC and MNHN), GDEL4030/10668 (in FALPC)].

***E.* (*Eupelmus*) *opacus* Delvare**
http://zoobank.org/23647401-C103-4AD7-ABA5-C41EC6126087

Al khatib et al. (2014): 846–847.

**Type material. Holotype** ♀. **SWEDEN**: Östergötland, Ög, Ödeshögs kommun, Omberg, Stocklycke äng, lime meadow, 58°18.452'N, 14°37.859'E, 23.viii/16.ix.2005, Trap ID 13, Coll. event 1648 (SMTP) [LF.ur.SW 02/10460] (in NHRS). **Paratype**. **GREECE**: Kerkini Lake N. Park, Kerkini, Krousia Mts site, Malaise tr., 06.vi–12.vii.2007, 41°11'32.4"N, 23°03'59.5"E, 190 m a.s.l., Leg. Gordon Ramel (1 ♀) [LF.ur.GR 01/10459] (in AICF).

***E.* (*Eupelmus*) *pistaciae* Al khatib**
http://zoobank.org/111A405E-470F-481A-A43D-663460CEC078

Al khatib et al. (2014): 847–850.

**Type material. Holotype** ♀. **FRANCE**: Hérault, Cazevieille, 230 m a.s.l, 43.75222°N, 3.77000°E, 28.x.2011, emerged v.2012, ex *Megastigmus pistaciae* on *Pistacia terebinthus* (G. Delvare) [GDEL4027/10507] (in MNHG). **Paratypes**. **FRANCE**: **Hérault**, same data as holotype (6 ♀) [GDEL4027/6390 (in GDPC), GDEL4027/6391 (in FALPC), GDEL4027/6392 (in AICF), GDEL4027/6393 (in MNHN), GDEL4027/10004 (in FALPC), GDEL4027/10506 (in BMNH)] (3 ♂) [GDEL4027/6394 & GDEL4027/6395 (in GDPC), GDEL4027/10005 (in FALPC)]; **Hérault**, Viols-le-Fort, 200 m, N43.74583°, E3.70389°, 28.x.2009, emerged v. 2010, ex *Megastigmus pistaciae* on *Pistacia terebinthus* (G. Delvare) (1 ♀) [GDEL4022/3704bis] (in GDPC).

***E.* (*Eupelmus*) *priotoni* Delvare**
http://zoobank.org/3565E30B-92D9-4DC4-BB94-7224D6BA3D22

Al khatib et al. (2014): 850–852.

**Type material. Holotype** ♀. **FRANCE**: Aveyron, Sauclières, 700 m a.s.l, Lit de la Virenque, 43.96389°N, 3.35583°E, 15.vi.2011 (G. Delvare) [GDEL4051/10038] (in MNHG).

Unfortunately, a mistake was included in the original description of *E. priotoni* in *Al khatib* et al. (2014). Like other *Eupelmus* species described in this paper, the upper surface of the costal cell on the fore wing has only one row of setae on the apical half and not 3-4 rows as previously written.

***E.* (*Eupelmus*) *purpuricollis* Fusu & Al khatib**
http://zoobank.org/1F354047-F041-4CD6-B1DA-1D53815B9B7C

Al khatib et al. (2014): 854–855.

**Type material. Holotype** ♀. **GREECE**: Kerkini lake nr Neo Petritsi; Malaise trap, Midway Site, 30.vi–06.vii.2008, 41°18'49.8"N, 23°16'35.6"E, 750 m a.s.l., Leg. Gordon Ramel, [LF.ur.GR 02/10650] (in AICF). **Paratypes**. **GREECE**: same data as for holotype but 09–13.vii.2008 (1 ♀ not sequenced). Kerkini Lake N. Park, Kerkini, Krousia Mts site, Malaise tr., 11–17.vii.2007, 41°11'32.4"N, 23°03'59.5"E, 190 m a.s.l., Leg. Gordon Ramel, (1♀) [LF.ur.GR 05/10653] (in AICF); same data but 18–24.vii.2007 (1♀) [LF.ur.GR 03/10651] (in GDPC).

***E.* (*Eupelmus*) *simizonus* Al khatib**
http://zoobank.org/CCD5B87E-9C81-456A-9DD8-F737AE6AC2F3

Al khatib et al. (2014): 855–856.

**Type material. Holotype** ♀. **FRANCE**: Ardèche, Les Vans, 175 m a.s.l., Lit du Granzon, 44.38722°N, 4.15444°E, 15.vii.2012, sweeping on *Quercus pubescens*, (G. Delvare) [GDEL4142/10297] (in MNHG).

***E.* (*Eupelmus*) *tremulae* Delvare**
http://zoobank.org/3001FBF7-A5AF-4D65-A274-6673F34264F1

Al khatib et al. (2014): 856–857.

**Type material. Holotype** ♀. **CZECH REPUBLIC**, Jindóichùv Hradec, Veselí nad Lužnicí, 1 km E of Charles University field station (Ruda), 422 m a.s.l, 49.15296°N, 14.70646°E, ex *Harmandia* sp. (Cecidomyiidae) on *Populus tremula*, 05.vi.2007, adult emergence 13.vi.2007 (P. Jansta) [PJ07003_1_1/10570] (in MNHG). **Paratypes**. Same data (1 ♀) [PJ07003_1_1/10569] (in MNHN) (1 ♂) [PJ07003_1_1/10571] (in MNHN).

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# A new species and additional records of *Rugilus* Leach from Qinling, China (Coleoptera, Staphylinidae, Paederinae)

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## Abstract

A new species of *Rugilus* Leach, *R.* (*Rugilus*) *huanghaoi* **sp. n.** from Qinling, Shaanxi Province, China, is described and illustrated. Additional records of seven species from Qinling are reported.

## Keywords

Coleoptera, Staphylinidae, Paederinae, Rugilus, Qinling, China, new species

## Introduction

According to a series of revisions of the genus *Rugilus* Leach from Palaearctic and Oriental regions (Assing 2012a, 2012b, 2013, 2014, 2015), 32 species of the genus have been recorded from China, 25 of them are placed in the nominotypical subgenus, and seven in the subgenus *Eurystilicus* Fagel. Seven species have been report fromed the Qinling Shan, one of the most diverse areas in China: *R.* (*Eurystilicus*) *rufescens* (Fauvel, 1874), *R.* (*E.*) *simlaensis* (Cameron, 1931), *R.* (*E.*) *velutinus* (Fauvel, 1895), *R.* (*Rugilus*) *dabaicus* Assing, 2012, *R.* (*R.*) *fodens* Assing, 2012, *R.* (*R.*) *gansuensis* Rougemont, 1998, and *R.* (*R.*) *reticulatus* Assing, 2012. During several recent field trips to this region conducted by the authors and their colleagues, all known and an additional new species were collected.

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## Material and methods

The type material listed in the present study is deposited in the Insect Collection of Shanghai Normal University, Shanghai, P. R. China (SNUC).

The dissected body parts were mounted in Euparal on plastic slides. The habitus photos were taken using a Canon 7D camera. The photos of the sternites and aedeagi were taken using a Canon G9 camera mounted on an Olympus CX31 microscope.

**Measurements:**

Body length: measured from the anterior margin of the labrum to the apex of the abdomen.
Length of forebody: measured from anterior margin of the labrum to the posterior margin of the elytra.
Eye length: longitudinal length of eye in dorsal view.
Postocular length: measured from posterior margin of eye to posterior constriction of head.
Head width: width of head across (and including) eyes.
Head length: measured from the clypeal anterior margin to head base.
Pronotum width: maximal width of pronotum.
Pronotum length: measured in midline from front margin to posterior margin.
Width of elytra: combined width of elytra at posterior margin.
Length of elytra: measured from apex of scutellum to posterior margin.

## Description of new species

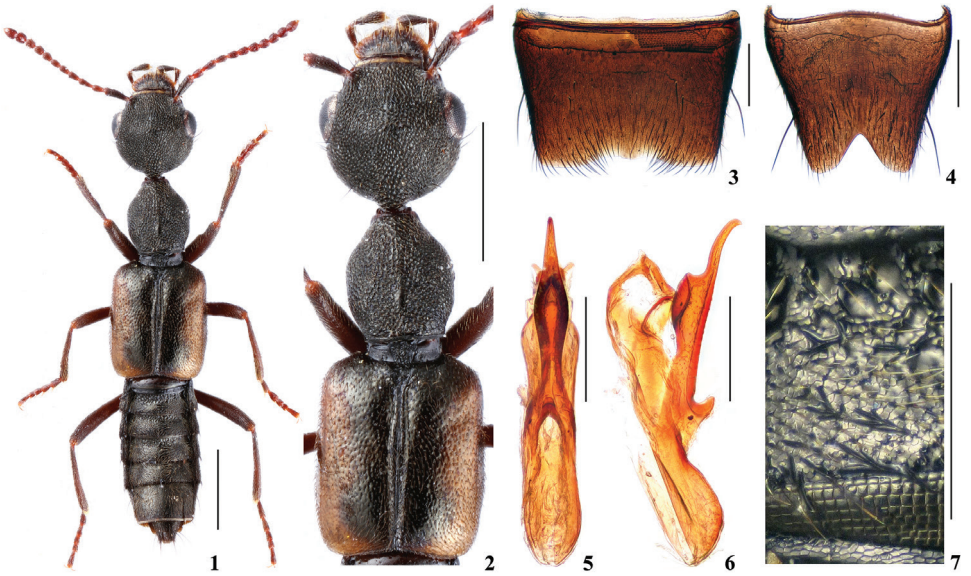
***Rugilus* (*Rugilus*) *huanghaoi* sp. n.**
http://zoobank.org/8E11E667-B5DC-4D85-A334-153047FE5BDC
Figs 1–7

**Type material.** Holotype: male: "China: Shaanxi Prov., Zhouzhi County, Houzhenzi, Qinling, Qinlingliang, N33.48.963, E107.44.483, alt. 2018 m, 7.V.2008, HUANG Hao & XU Wang leg." (SNUC). Paratypes: 1 male, 1 female: "China: Shaanxi Prov., Mei County, Taibai Shan, Kaitianguan, N34.00.692, E107.51.415, alt. 1853 m, 22–23.V.2008, HUANG Hao & XU Wang leg.".

**Description.** Body length 5.4–6.4 mm; forebody length: 4.1–4.3 mm.

Body (Fig. 1) dark brown; lateral margins of elytra widely yellowish brown; legs and antennae reddish brown.

Head (Fig. 2) 0.96–0.97 times as long as wide; punctation umbilicate, very dense, rather coarse and partly confluent, interstices reduced to very narrow ridges; without microsculpture. Eyes large and convex; approximately 0.8–0.9 times as long as pos-




**Figures 1–7.** *Rugilus* (*Rugilus*) *huanghaoi* sp. n. **1** habitus **2** forebody **3** male sternite VII **4** male sternite VIII **5** aedeagus in ventral view **6** aedeagus in lateral view **7** median portion of tergite III. Scale bars: 1 mm (**1, 2**), 0.25 mm (**3–7**).

tocular portion. Anterior margin of labrum with two pronounced teeth on either side of the median incision.

Pronotum (Fig. 2) 1.16–1.17 times as long as wide, 0.75–0.77 times as broad and 0.92–0.94 times as long as head; punctation similar to that of head; midline with narrow and short impunctate elevation in posterior half; interstices without microsculpture. Elytra (Fig. 2) 0.90–0.98 times as long as wide, 1.13–1.26 times as long and 1.47–1.52 times as broad as pronotum; punctation dense, distinctly finer than that of head and pronotum; interstices without microsculpture.

Abdomen narrower than elytra; tergites III-VI with transverse impressions anteriorly. Punctation of these impressions coarse and dense; punctation of remaining surfaces fine and dense; interstices with distinct microsculpture (Fig. 7); posterior margin of tergite VII with distinct palisade fringe.

*Male*. Sternite VII (Fig. 3) with broad and trapezoidal excision in the middle of posterior margin; on either side of this excision with a tuft of long black setae. Sternite VIII (Fig. 4) with triangular excision posteriorly. Aedeagus (Figs 5, 6) long and narrow; ventral process widest near middle and gradually narrowed apically in ventral view; abruptly narrowed and slightly curved ventrally in apical third in lateral view.

**Comparative notes.** Based on the similar external characters, especially the bicoloured elytra and the male sexual characters, the new species is most similar to *R. morvani* (Rougemont, 1987) from Nepal, from which it is distinguished by the deeper excision of the male sternite VII, with a more prominently produced centre, longer

and denser setae on either side of the excision, and by the longer and narrower apical portion of the aedeagal ventral process.

**Distribution and habitat data.** The species was found in two localities in the Qinling Shan. The specimens were collected by sifting decaying leaf litter in mixed forests at altitudes from ca. 1850 to 2020 m. The paratypes were collected together with *R. reticulatus*.

**Etymology.** The species is named in honor of Hao Huang, one of the collectors of the type material.

## New records

### *Rugilus* (*Eurystilicus*) *rufescens* (Fauvel, 1874)

**Material examined. CHINA: Shaanxi:** 2 males, Foping, 850–950 m, 20.VII.2004, Hu, Tang & Zhu leg.

**Comment.** The species is widespread in the East Palaearctic and Oriental regions (Assing 2012a).

### *Rugilus* (*Eurystilicus*) *simlaensis* (Cameron, 1931)

**Material examined. CHINA: Shaanxi:** 1 female, Ankang City, Ningshaan County, Huoditang Foresty Centre, 33°26'N, 108°27'E, 1500–1700 m, 12.VII.2012, Li-Zhen Li leg.

**Comment.** The distribution of this species ranges from the Himalaya to Mainland China and Taiwan (Assing 2012a). The above material was collected together with *R. velutinus*.

### *Rugilus* (*Eurystilicus*) *velutinus* (Fauvel, 1895)

**Material examined. CHINA: Shaanxi:** 3 males, Ankang City, Ningshaan County, Huoditang Foresty Centre, 33°26'N, 108°27'E, 1500–1700 m, 12.VII.2012, Li-Zhen Li leg.; 1 female, Hanzhong City, Nanzheng County, Yuanba Town, Liping National Forest Park, 32°50'N, 106°36'E, 1400–1600 m, 16.VII.2012, Yu-Hong Pan leg.

**Comment.** The species is widespread in the East Palaearctic and Oriental regions (Assing 2012a). Some of the above material was collected together with *R. simlaensis*.

### *Rugilus* (*Rugilus*) *dabaicus* Assing, 2012

**Material examined. CHINA: Shaanxi:** 5 males, 16 females, Ningshaan County, Qinling, Huoditang Linchang, N33.26.060, E108.26.291, 1724 m, 24–25.V.2008, Hao

Huang & Wang Xu leg.; 19 females, same locality, 1500–1700 m, 12.VII.2012, Yan Chen, Li-Zhen Li, Wen-Rong Li, Wen-Li Ma, Yu-Hong Pan & Jie-Qiong Zhao leg.; 15 females, Foping, 1250–1400 m, 18.VII.2004, Hu, Tang & Zhu leg.

**Comment.** The species was originally described from Daba Shan in Hubei (Assing 2012a) and recently recorded from Qinling Shan in Shaanxi (Assing 2015).

### *Rugilus* (*Rugilus*) *fodens* Assing, 2012

**Material examined. CHINA: Shaanxi:** 2 males, 5 females, Hanzhong City, Nanzheng County, Yuanba Town, Liping National Forest Park, 32°50'N, 106°36'E, 1400–1600 m, 15.VII.2012, Chen, Li, Ma & Zhao leg.; 2 males, 2 females, same locality, 16.VII.2012.

**Comment.** This species was previously known from Daba Shan in Hubei and Micang Shan in Sichuan and Shaanxi (Assing 2012a). The above material was collected together with *R. gansuensis*.

### *Rugilus* (*Rugilus*) *gansuensis* Rougemont, 1998

**Material examined. CHINA: Shaanxi:** 1 male, 2 females, Zhouzhi County, Houzhenzi, Qinling, West Sangongli Gou, N33.50.613, E107.48.524, 1336 m, 17–19.V.2008, Hao Huang & Wang Xu leg.; 1 male, Zhouzhi County, Houzhenzi, Qinling, N33.51.203, E107.50.183, 1260 m, 5–10.V.2008, Hao Huang & Wang Xu leg.; 1 male, 2 females, Hanzhong City, Nanzheng County, Yuanba Town, Liping National Forest Park, 32°50'N, 106°36'E, 1400–1600 m, 15.VII.2012, Chen, Li, Ma, Pan & Zhao leg.

**Comment.** This species is widespread in Qinling from Gansu to Shaanxi (Assing 2012a, 2013). Some of the above material was collected together with *R. fodens*.

### *Rugilus* (*Rugilus*) *reticulatus* Assing, 2012

**Material examined. CHINA: Shaanxi:** 2 males, 10 females, Zhouzhi County, Qinling, Daoban, N38.43.645, E107.58.147, 1900 m, 4.V.2008, Hao Huang & Wang Xu leg.; 1 male, Mei County Taibai Shan, Kaitianguan, N34.00.692, E107.51.415, 1853 m, 22–23.V.2008, Hao Huang & Wang Xu leg.; 11 females, Mt. Taibai, 1450–1750 m, 15.VII.2004, Hu & Tang leg.; 3 females, Foping, 2065 m, 21.VII.2004, Hu, Tang & Zhu leg.

**Comment.** The species was known from Qinling in Shaanxi and Funiu Shan in Henan (Assing 2012a). Some of the above material was collected together with *R. huanghaoi*.

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