

A new subterranean species of *Pseudocrangonyx* from China with an identification key to all species of the genus (Crustacea, Amphipoda, Pseudocrangonyctidae)

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Abstract

A subterranean species of *Pseudocrangonyx elegantulus* Hou, **sp. n.** is described from caves of Wulongdong National Forest Park in Henan Province, China. *Pseudocrangonyx elegantulus* is characterized by both male and female with calceoli on antenna II; urosomite III dorsal margin without armature; uropod III with peduncle 0.30 times as long as outer ramus and terminal article of the outer ramus a little shorter than adjacent spines; telson cleft 0.27 of its length. Phylogenetic analysis based on 28S and COI sequences supported the species distinctness. A key to the genus *Pseudocrangonyx* with 22 species and a map of their distributions are provided.

Keywords

cave, COI distance, molecular phylogeny, *Pseudocrangonyx*, taxonomy

Introduction

The genus *Pseudocrangonyx* was established by Akatsuka and Komai in 1922, including 21 described species that are widely distributed in subterranean freshwaters or springs of Japan, the Korean peninsula, eastern China, and the Far East of Russia

(Labay 2001, Sidorov and Gontcharov 2013, Tomikawa et al. 2016). The genus exhibits typical subterranean adaptive morphology in the loss of eyes and pigmentation, elongated appendages, and vestigialization of dorsal armature on urosomites (Sidorov and Gontcharov 2013).

To date, 13 species are known from the Far East of Russia, including *P. bohaensis* (Derzhavin, 1927), *P. levanidovi* Birstein, 1955, *P. camtschaticus* Birstein, 1955, *P. birsteini* Labay, 1999, *P. relictata* Labay, 1999, *P. susanaensis* Labay, 1999, *P. korkishkorum* Sidorov, 2006, *P. febras* Sidorov, 2009, *P. elenae* Sidorov, 2011, *P. kseniae* Sidorov, 2012, *P. holsingeri* Sidorov & Gontcharov, 2013, *P. sympatricus* Sidorov & Gontcharov, 2013, and *P. tiunovi* Sidorov & Gontcharov, 2013. Four species have been described from Japan, *P. kyotonis* Akatsuka & Komai, 1922, *P. shikokunis* Akatsuka & Komai, 1922, *P. yezonis* Akatsuka & Komai, 1922, and *P. gudariensis* Tomikawa & Sato, 2016. One species was recorded in South Korea, *P. coreanus* Uéno, 1966. Three species are known from China, *P. manchuricus* Oguro, 1938, *P. asiaticus* Uéno, 1934, and *P. cavernarius* Hou & Li, 2003. The genus shows a broad distribution along the northern Asia-Pacific margins. This is expected to be related to the land-bridges formed with the fluctuations of sea level. However, the evolutionary history of the genus *Pseudocrangonyx* was poorly discussed, and most studies focused on species revision and discovery.

During a field survey of freshwater amphipods in Henan Province, China, three species were found, including two epigeal freshwater gammarids, *Gammarus preciosus* Wang et al., 2009 and *G. monticellus* Hou et al., 2014, and one cave *Pseudocrangonyx* species new to science. In this paper, the fourth species, *Pseudocrangonyx elegantulus* sp. n., is described and illustrated. In addition, the phylogenetic position of the new species within *Pseudocrangonyx* was estimated using nuclear 28S rRNA and mitochondrial cytochrome *c* oxidase subunit I (COI) sequence data. The distributions of all 22 species of the genus *Pseudocrangonyx* are presented in Figure 1, where only type localities are used for *P. elegantulus*, *P. korkishkorum*, *P. febras*, *P. cavernarius*, *P. tiunovi*, *P. holsingeri*, *P. sympatricus*, *P. gudariensis*, *P. elenae*, *P. kseniae*, *P. manchuricus*, and *P. asiaticus*, and others are based on the published paper (Sidorov 2006). A key to world species of the genus *Pseudocrangonyx* is provided.

Materials and methods

Morphological observations

The specimens were collected by sweeping various groundwater environments with a fine-meshed hand net. Samples preserved in 95% ethanol in the field, then deposited in a -20°C refrigerator for long-term preservation. The body length was recorded by holding the specimen straight and measuring the distance along the dorsal side of the body from the base of the first antenna to the base of the telson. All dissected appendages were mounted on slides according to the methods described by Holsinger (1967).

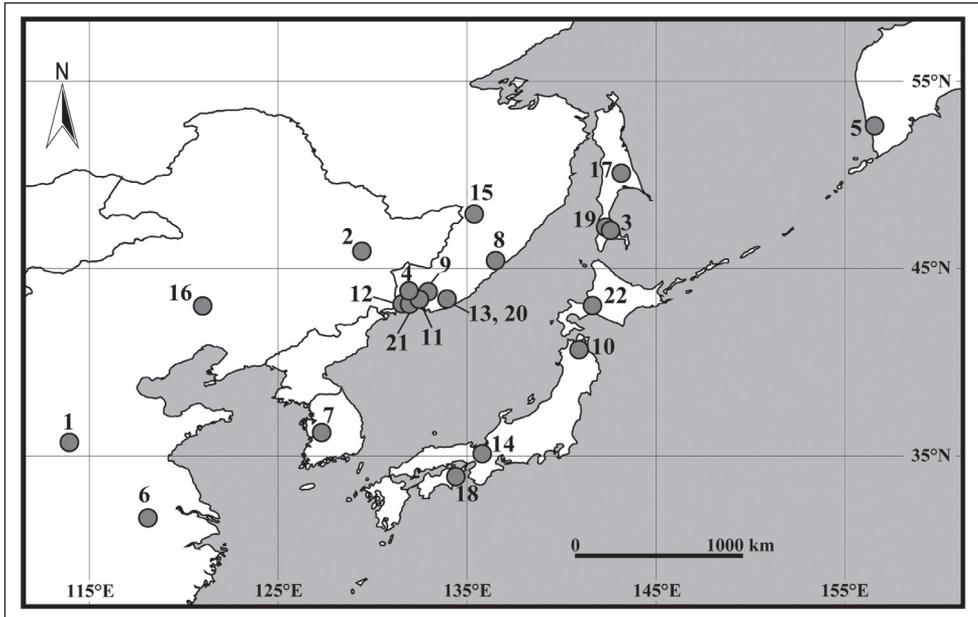


Figure 1. Distribution map of *Pseudocrangonyx* species. **1** *Pseudocrangonyx elegantulus* sp. n. **2** *P. asiaticus* Uéno, 1934 **3** *P. birsteini* Labay, 1999 **4** *P. bohaensis* (Derzhavin, 1927) **5** *P. camtschaticus* Birstein, 1955 **6** *P. cavernarius* Hou & Li, 2003 **7** *P. coreanus* Uéno, 1966 **8** *P. elenae* Sidorov, 2011 **9** *P. febras* Sidorov, 2009 **10** *P. gudariensis* Tomikawa & Sato, 2016 **11** *P. holsingeri* Sidorov & Gontcharov, 2013 **12** *P. korkishkoorum* Sidorov, 2006 **13** *P. kseniae* Sidorov, 2012 **14** *P. kyotonis* Akatsuka & Komai, 1922 **15** *P. levani-dovi* Birstein, 1955 **16** *P. manchuricus* Oguro, 1938 **17** *P. relictæ* Labay, 1999 **18** *P. shikokunis* Akatsuka & Komai, 1922 **19** *P. susanaensis* Labay, 1999 **20** *P. sympatricus* Sidorov & Gontcharov, 2013 **21** *P. tiunovi* Sidorov & Gontcharov, 2013 **22** *P. yezonis* Akatsuka & Komai, 1922.

Appendages were drawn using a Leica DM2500 compound microscope equipped with a drawing tube. All types and other material are lodged in the Institute of Zoology, Chinese Academy of Sciences (IZCAS), Beijing.

DNA sequencing and phylogenetic analyses

Genomic DNA was extracted from appendages of the *Pseudocrangonyx* specimen using a TIANamp Genomic DNA Kit (TIANGEN). The fragments of 28S and COI were amplified and sequenced following published protocols (Hou et al. 2007). The new sequences and reference sequences downloaded from GenBank were aligned using MAFFT v.7.304 (Katoh and Standley 2016). In total, 29 samples of 14 *Pseudocrangonyx* species were used in molecular phylogenetic analyses (Table 1). There are seven species from Russian Far East including *P. febras*, *P. holsingeri*, *P. korkishkoorum*, *P. kseniae*, *P. susanaensis*, *P. sympatricus*, and *P. tiunovi*, six species from Japan including *P. yezonis* and *P. gudariensis*, and four newly described species (Tomikawa et al. 2016) and

Table 1. Samples used for the phylogenetic analyses. The locality information is accompanied by sequence accession numbers. Species names marked with an asterisk were obtained from Tomikawa et al. (2016).

Species	Voucher	Locality	28S	COI
<i>Pseudocrangonyx elegantulus</i> sp. n.	1602	Wulongdong National Forest Park, Linzhou, Henan, China	KY436646	KY436647
<i>P. sp6*</i>	G1298	Gujo, Gifu, Japan	LC171545	LC171546
<i>P. sp6*</i>	G1297	Gujo, Gifu, Japan	LC171541	LC171542
<i>P. sp5*</i>	G1296	Kami, Kochi, Japan	LC171537	LC171538
<i>P. sp5*</i>	G1295	Kami, Kochi, Japan	LC171533	LC171534
<i>P. sp5*</i>	G1294	Seiyo, Ehime, Japan	LC171529	LC171530
<i>P. sp5*</i>	G1271	Takamatsu, Kagawa, Japan	LC171502	LC171503
<i>P. gudariensis</i>	NSMT-Cr24605	Aomori, Aomori, Japan	LC171498	LC171499
<i>P. sp3*</i>	G406	Taga, Shiga, Japan	LC171495	–
<i>P. sp3*</i>	G405	Taga, Shiga, Japan	LC171491	LC171492
<i>P. sp3*</i>	G404	Taga, Shiga, Japan	LC171488	–
<i>P. sp5*</i>	G402	Matsue, Shimane, Japan	LC171485	LC171486
<i>P. sp5*</i>	G401	Ota, Shimane, Japan	LC171481	LC171482
<i>P. holsingeri</i>	S49	Steklajnuha, Primory, Russia	KJ871679	KF153111
<i>P. sp2*</i>	G1283	Niimi, Okayama, Japan	LC171525	LC171526
<i>P. sp2*</i>	G1278	Mine, Yamaguchi, Japan	LC171510	LC171511
<i>P. sp2*</i>	G1277	Mine, Yamaguchi, Japan	LC171506	LC171507
<i>P. yezonis</i>	G1280	Mukawa, Hokkaido, Japan	LC171518	LC171519
<i>P. yezonis</i>	G1279	Daisen, Akita, Japan	LC171514	LC171515
<i>P. korkishkorum</i>	B1	Barabashevka, Primory, Russia	KJ871678	KF153107
<i>P. korkishkorum</i>	N2	Narva, Primory, Russia	KJ871677	KF153106
<i>P. korkishkorum</i>	N1	Narva, Primory, Russia	KJ871676	KF153105
<i>P. korkishkorum</i>	B3	Barabashevka, Primory, Russia	–	KF153109
<i>P. korkishkorum</i>	B2	Barabashevka, Primory, Russia	–	KF153108
<i>P. kseniae</i>	S66	Kievka, Primory, Russia	KJ871675	KF153115
<i>P. tiunovi</i>	S13	Vladivostok, Primory, Russia	KJ871674	KF153110
<i>P. febras</i>	S23	Arsenyevka, Primory, Russia	–	KF153114
<i>P. susunaensis</i>	S32	Yuzhno-Sakhalinsk, Sakhalin, Russia	–	KF153113
<i>P. sympatricus</i>	S67	Kievka, Primory, Russia	–	KF153112
<i>Crangonyx floridanus</i>	G1322	Chiba, Chiba, Japan	LC171549	LC171550
<i>Crangonyx pseudogracilis</i>	–	–	EF522940	EF570296
<i>Crymostygius thingvallensis</i>	–	–	HQ286019	HQ286032

P. elegantulus sp. n. from China. Three crangonyctoid species were selected as outgroup taxa: *Crymostygius thingvallensis* Kristjánsson & Svavarsson, 2004, *Crangonyx floridanus* Bousfield, 1963, and *Crangonyx pseudogracilis* Bousfield, 1958.

The best-fit partitioning schemes and nucleotide substitution models were selected using PartitionFinder v.1.1.0 on the Bayesian criterion (Lanfear et al. 2012). The COI data were partitioned into first, second, and third codon positions with TrN+I+G, TrNef+I+G, and TrN+G models, respectively. The best model for 28S was GTR+G. Therefore, a four-partition scheme was used in the following analyses.

Phylogenetic relationships were inferred using maximum parsimony (MP), maximum likelihood (ML) and Bayesian inference (BI) on single gene and concatenated sequences. MP analysis and bootstrap evaluation were performed using PAUP* 4.0b10 (Swofford 2002) with tree bisection reconnection swapping algorithm. ML phylogenies were conducted using RAxML v.8.2.7 (Stamatakis 2014) with 1000 rapid bootstrap replicates followed by a thorough tree search. Bayesian analyses were carried out using MrBayes v.3.2.1 (Ronquist et al. 2012), implementing two independent runs of five million generations. The convergence was checked using Tracer v.1.5 (Rambaut and Drummond 2009) and the first 25% trees were discarded as burn-in.

Taxonomy

Family Pseudocrangonyctidae Holsinger, 1989

Genus *Pseudocrangonyx* Akatsuka & Komai, 1922

Type species. *Pseudocrangonyx shikokunis* Akatsuka & Komai, 1922.

Pseudocrangonyx elegantulus Hou, sp. n.

<http://zoobank.org/702B105F-271E-47F0-BCC9-7B12114A6102>

Figs 2–7

Material examined. Holotype: female (IZCAS-I-A1602-1), 7.5 mm, Wulongdong National Forest Park (113.943°E, 35.716°N), altitude 770 m, Wulong Town, Linzhou City, Henan Province, China, June 19, 2014, collected by Y. Li and J. Liu. Paratype: male (IZCAS-I-A1602-2), 6.3 mm, same data as holotype.

Etymology. The specific name is from Latin *elegantulus* (elegant), in reference to the peculiar shape; adjectival, masculine.

Diagnosis. Female larger than male; eyes absent; lateral cephalic lobe rounded; inferior antennal sinus indistinct; both male and female with calceoli on antenna II; coxal gills present on gnathopod II and pereopods III–VI; sternal gills absent; epimeral plate I without armature on distal margin; urosomite III dorsal margin without armature; uropod I peduncle with one basofacial spine; inner ramus of male uropod II with two serrate and four simple robust terminal spines accompanied by one seta; uropod III peduncle 0.30 times as long as outer ramus and terminal article of the outer ramus a little shorter than adjacent spines.

Description of holotype female (IZCAS-I-A1602-1), 7.5 mm.

Head. (Fig. 2A): eyes absent; lateral cephalic lobe rounded; inferior antennal sinus indistinct.

Antenna I (Fig. 2B, C): peduncle articles 1–3 in length ratio 1.0 : 0.7 : 0.4, with distal setae; flagellum with 16 articles, articles 3–15 with aesthetascs; accessory flagellum

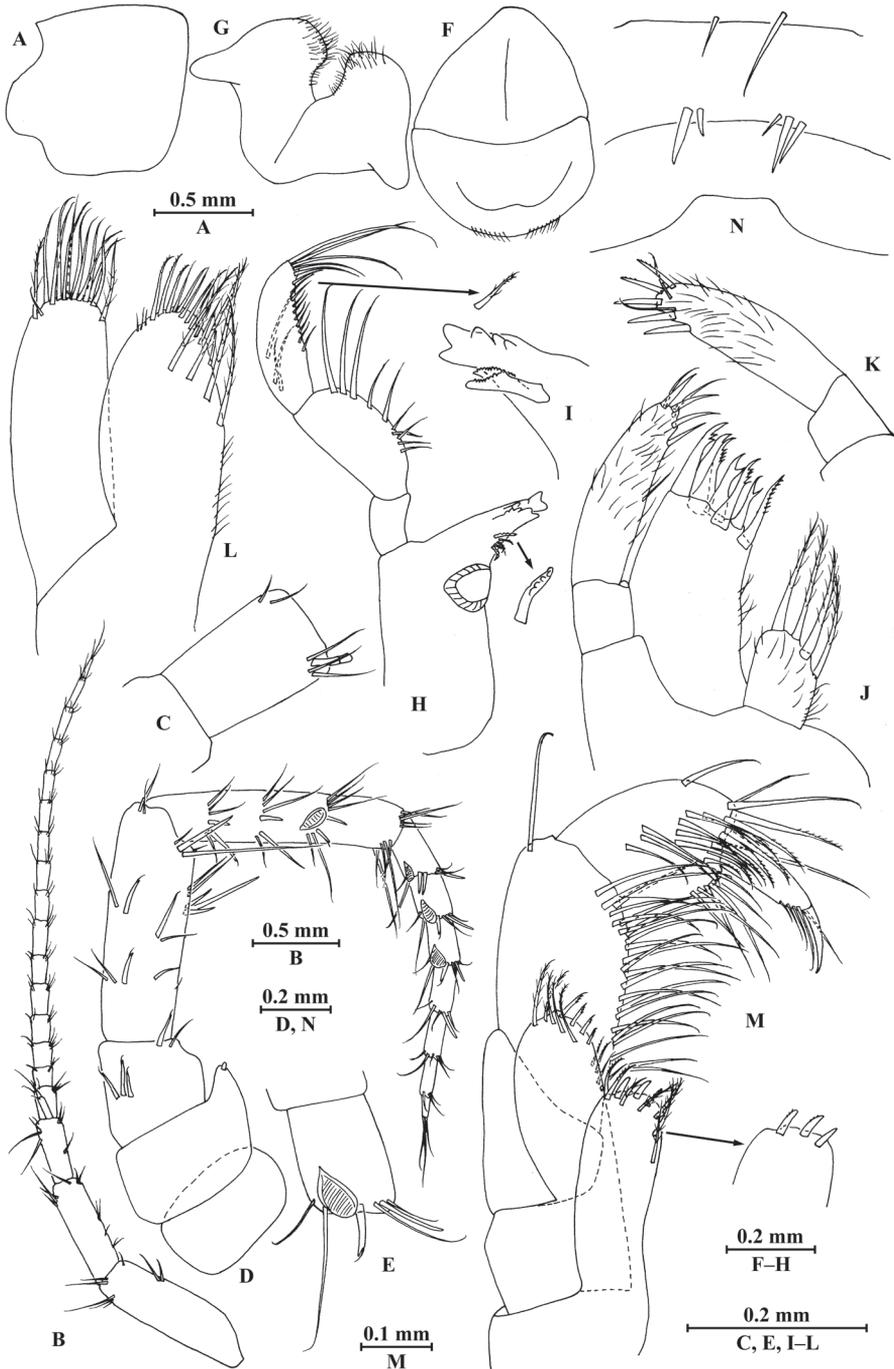


Figure 2. *Pseudocrangonyx elegantulus* sp. n., female holotype, from Henan, China. **A** head **B** antenna I **C** aesthetascs of antenna I **D** antenna II **E** calceoli of antenna II **F** upper lip **G** lower lip **H** left mandible **I** incisor of right mandible **J** left maxilla **K** palp of right maxilla **L** maxilla II **M** maxilliped **N** urosomites (dorsal view).

with two articles, subequal to the first article of primary flagellum; both primary and accessory flagella with short distal setae.

Antenna II (Fig. 2D, E): peduncle articles 3–5 in length ratio 1.0 : 2.2 : 2.9, with spines accompanied by setae; flagellum with seven articles, with one or two spines and setae on first three articles and with setae on the rest articles; calceoli of crangonyctid type, present on peduncular article 5 and first three flagellum articles; rod-like structures accompanied with setae on first four flagellum articles.

Upper lip (Fig. 2F): ventral margin rounded, bearing fine setae.

Mandible (Fig. 2H, I): incisor of left mandible with five teeth; lacinia mobilis with five teeth; spine row with five serrated spines; articles 1–3 of palp in length ratio 1.0 : 2.2 : 2.4, second article with ten marginal setae, article 3 with three B-setae, ten D-setae and five E-setae apically; incisor of right mandible with five teeth, lacinia mobilis bifurcate, with small teeth.

Lower lip (Fig. 2G): inner lobes absent, outer lobes covered with thin setae.

Maxilla I (Fig. 2J, K): asymmetrical, left inner plate with four plumose setae; outer plate with seven serrated apical spines; second article of left palp densely setose, with two simple setae and four slender spines apically; second article of right palp with five spines and two slender setae.

Maxilla II (Fig. 2L): inner plate with four plumose facial setae in an oblique row; inner and outer plates with long setae apically.

Maxilliped (Fig. 2M): inner plate with three stout apical spines, two serrated setae, and five plumose setae; outer plate bearing four setae, four serrated spines and five plumose setae apically; palp 4-articulate, articles 1–2 in length ratio 0.7 : 1, article 2 with a row of simple setae on interior side and one simple seta on exterior side; article 4 hooked, with five setae at hinge of unguis.

Pereon. *Gnathopod I* (Fig. 3A, B): coxal plate bearing one fine seta on proximal margin and three setae on anterodistal corner, 1.7 times as wide as deep; basis with long setae on posterior margin, anterior margin bare; merus bearing setae on posterodistal corner; carpus as long as wide, approximately 0.5 times as long as propodus, bearing three clusters of setae along posterior margin, two clusters of setae on anterior margin, and three pectinate setae on posterodistal corner; propodus pear-shaped, palm margin with 16 robust spines, some distally notched; dactylus with one seta on anterior margin and two setae at hinge of unguis, posterior margin dentate.

Gnathopod II (Fig. 3C, D): coxal plate bearing one fine seta on proximal margin, three setae on anterodistal corner and one seta on distal margin; basis with setae on posterior margin, anterior margin bare; merus bearing setae on posterodistal corner; carpus 1.5 times as long as wide, approximately 0.7 times as long as propodus, bearing seven clusters of setae along posterior margin and three pectinate setae on posterodistal corner; propodus stout, palm margin with 14 distally notched spines; dactylus with one seta on anterior margin and two setae at hinge of unguis, posterior margin dentate.

Pereopod III (Fig. 4A, B): coxal plate bearing four setae on anterior margin and two setae on distal margin, 1.4 times as wide as deep; basis with seven setae along anterior margin and long setae on posterior margin; merus, carpus, and propodus in length



Figure 3. *Pseudocrangonyx elegantulus* sp. n., female holotype. **A** gnathopod I **B** propodus of gnathopod I **C** gnathopod II **D** propodus of gnathopod II.

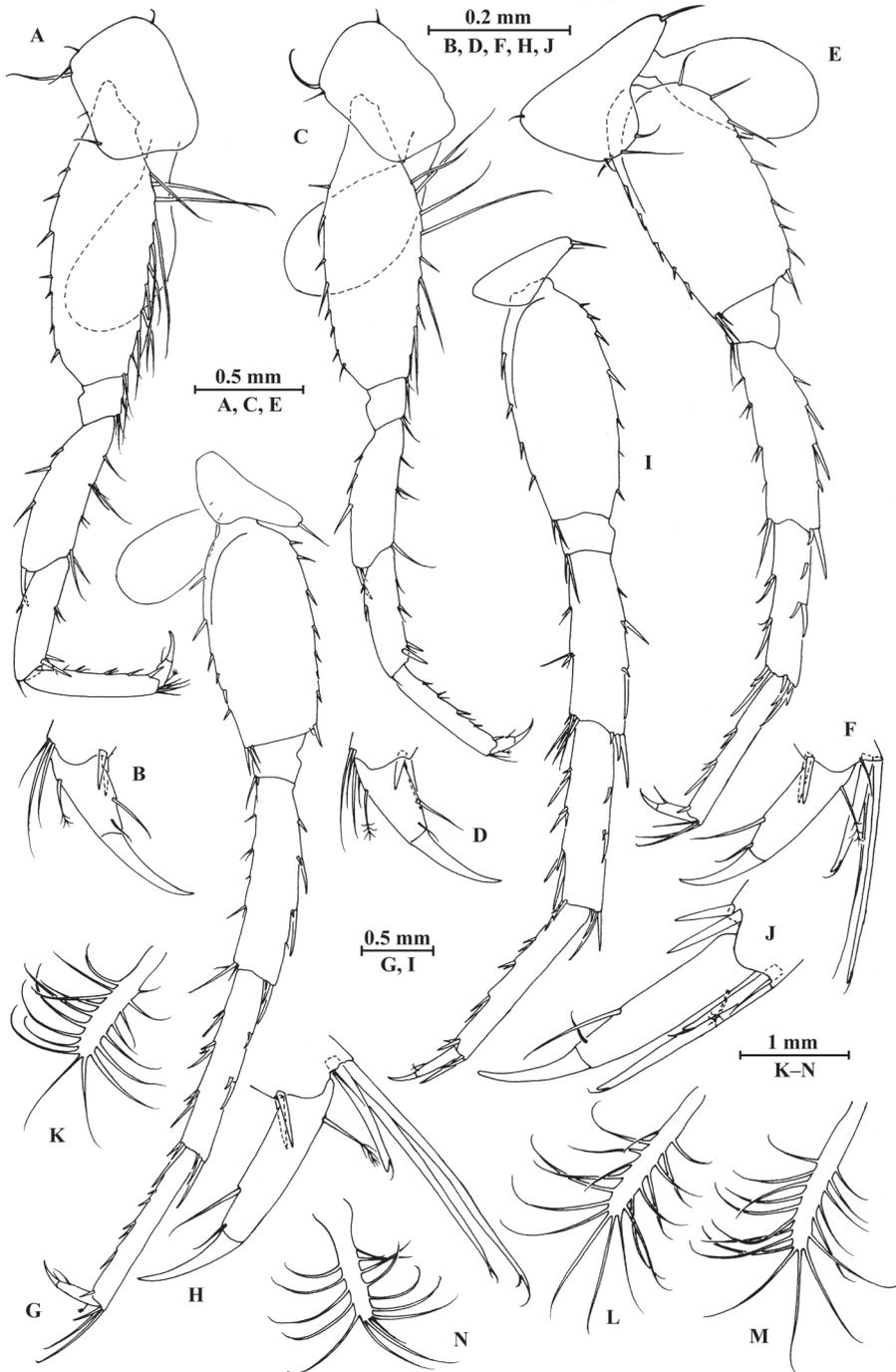


Figure 4. *Pseudocrangonyx elegantulus* sp. n., female holotype. **A** pereopod III **B** dactylus of pereopod III **C** pereopod IV **D** dactylus of pereopod IV **E** pereopod V **F** dactylus of pereopod V **G** pereopod VI **H** dactylus of pereopod VI **I** pereopod VII **J** dactylus of pereopod VII **K** oostegite of gnathopod II **L** oostegite of pereopod III **M** oostegite of pereopod IV **N** oostegite of pereopod V.

ratio 1.0 : 0.7 : 0.8; merus with three spines on anterior margin and four clusters of setae on posterior margin, anterodistal corner with one spine; carpus with one fine seta on anterior margin and two setae on posterior margin, anterodistal corner with one seta and posterodistal corner with two spines accompanied with one seta; dactylus with one plumose seta on anterior margin, one seta on posterior margin, and one seta at hinge of unguis.

Pereopod IV (Fig. 4C, D): similar to pereopod III; coxal plate bearing three setae on anterior margin, 1.6 times as wide as deep; merus, carpus, and propodus in length ratio 1.0 : 0.9 : 1.0.

Pereopod V (Fig. 4E, F): coxal plate irregular, anterior lobe larger than posterior lobe, bearing four setae and one seta on anterior and posterior lobes, respectively; basis with setae on anterior and posterior margins, respectively; merus, carpus, and propodus in length ratio 1.0 : 0.9 : 0.9; merus and carpus with spines accompanied by setae on both margins; dactylus with one plumose seta on posterior margin, one seta on anterior margin, and one seta at hinge of unguis.

Pereopod VI (Fig. 4G, H): coxal plate similar to that of pereopod V, with smaller anterior lobe, bearing one seta on posterior lobe; basis with setae on anterior and posterior margins; merus, carpus, and propodus in length ratio 1.0 : 1.0 : 0.9; merus and carpus with spines accompanied by setae on both margins; dactylus with one plumose seta on posterior margin, one seta on anterior margin, and one seta at hinge of unguis.

Pereopod VII (Fig. 4I, J): coxal plate subtriangular, with two setae on posteroproximal corner; basis with setae on anterior and posterior margins; merus, carpus, and propodus in length ratio 1.0 : 1.1 : 1.1; merus and carpus with spines accompanied by setae on both margins; dactylus with one plumose seta on posterior margin, one seta on anterior margin, and one seta at hinge of unguis.

Coxal gills: present on gnathopod II and pereopods III–VI; sternal gills absent.

Oostegite (Fig. 4K–N): narrow, present on gnathopod II and pereopods III–V, with marginal setae.

Pleon. *Epimeral plates* (Fig. 5A–C): plate I distally rounded, bearing three fine setae on posterior margin and one seta on posterodistal corner, distal margin without armature; plate II with two spines on distal margin and three fine setae on posterior margin, posterodistal corner rounded with one seta; plate III with two spines on distal margin and two fine setae on posterior margin, posterodistal corner rounded with one seta.

Pleopods I–III (Fig. 5D–F): similar, peduncle with two retinacula on interior side and one fine seta on exterior distal corner; outer ramus shorter than inner ramus, both inner and outer rami fringed with plumose setae.

Urosome. *Urosomites* (Fig. 2N): urosomite I with two setae on dorsal margin; urosomite II with two spines on left side and two spines accompanied by one seta on right side; urosomite III dorsal margin without armature.

Uropods I–III (Fig. 5G–I): uropod I peduncle with one basofacial spine, with three spines on exterior side, interior and exterior distal corners with one spine respectively; inner ramus approximately 0.77 times as long as peduncle, with three spines on interior side, one seta and one spine on exterior side, and six terminal spines accompanied by one

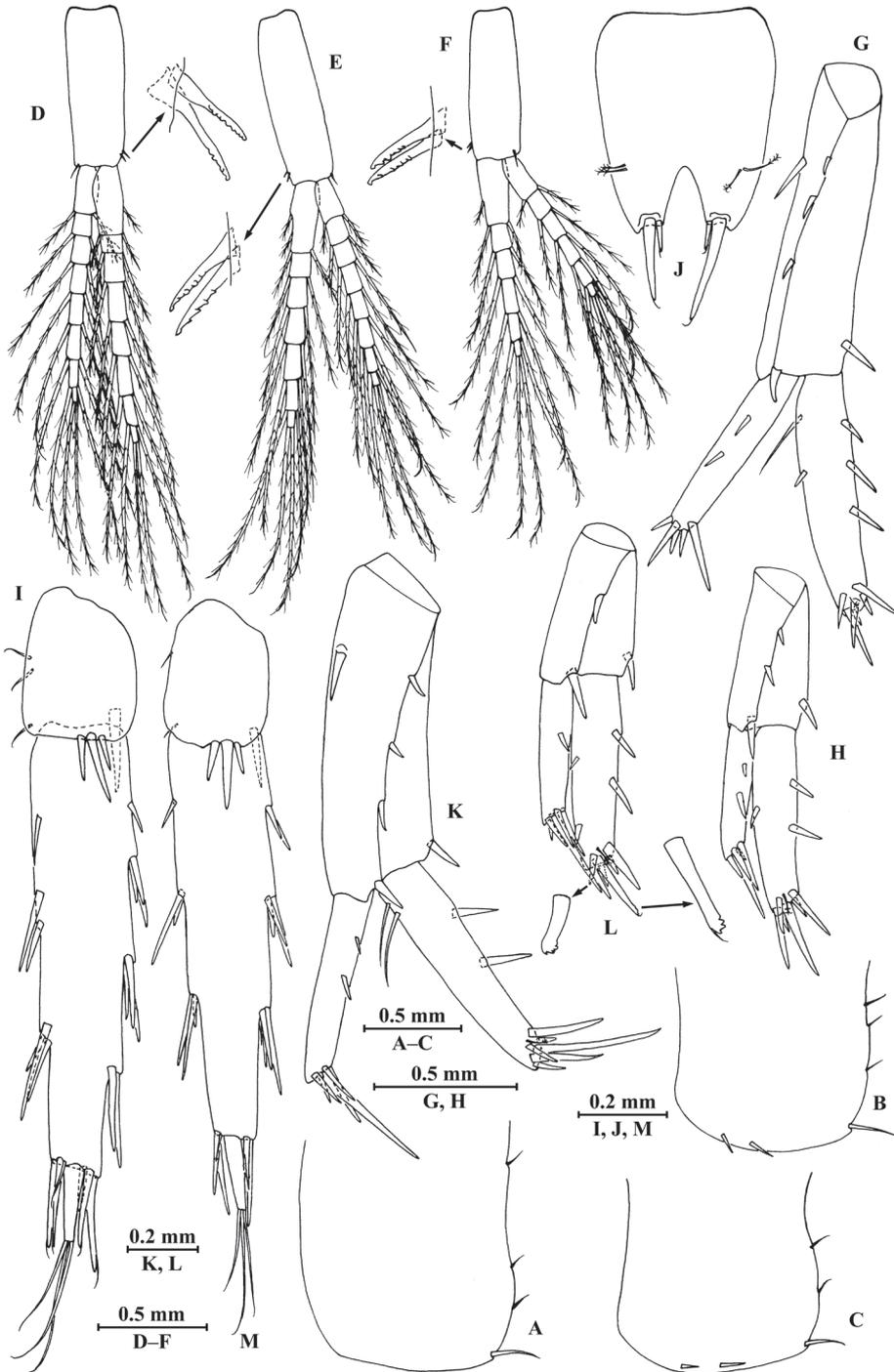


Figure 5. *Pseudocrangonyx elegantulus* sp. n., **A–J** female **K–M** male **A** epimeral plate I **B** epimeral plate II **C** epimeral plate III **D** pleopod I **E** pleopod II **F** pleopod III **G** uropod I **H** uropod II **I** uropod III **J** telson **K** uropod I **L** uropod II **M** uropod III.

seta; outer ramus approximately 0.76 times of inner ramus, with two spines on exterior side and five terminal spines. Uropod II half shorter, peduncle bearing two spines on exterior side and one spine on each distal corner; inner ramus with two spines on interior side, one spine on exterior side, and six terminal spines accompanied by one seta; outer ramus approximately 0.71 times of inner ramus, with two spines on exterior side and five terminal spines. Uropod III with peduncle 0.30 times as long as outer ramus, with one dorsal and three ventral robust spines; inner ramus absent; outer ramus 2-articulate, first article of outer ramus with stiff spines on interior and exterior sides, terminal article 0.19 times of the first article, with three distal setae, a little shorter than adjacent spines.

Telson (Fig. 5J): 1.2 times as long as wide, cleft 0.27 of its length, each lobe with two setae on surface and two distal spines.

Description of paratype male (IZCAS-I-A1602-2), 6.3 mm.

Head. *Antenna II* (Fig. 7A): peduncle articles 3–5 in length ratio 1.0 : 2.6 : 3.0, with setae along anterior and posterior margins; flagellum with six articles, with spines and setae on first article and with setae on the rest articles; calceoli of crangonyctid type present on peduncular article 5 and first two flagellum articles; rod-like structures accompanied with setae on flagellum articles.

Pereon. *Gnathopod I* (Fig. 6A, B): coxal plate bearing three setae on anterodistal corner, 1.6 times as wide as deep; basis with long setae on posterior margin, anterior margin bare; merus bearing setae on posterodistal corner; carpus 0.8 times as long as wide, approximately 0.5 times as long as propodus, bearing five clusters of setae along posterior margin and two pectinate setae on posterodistal corner; propodus pear-shaped, palm margin with 14 distally notched spines; dactylus with one seta on anterior margin.

Gnathopod II (Fig. 6C, D): coxal plate bearing five setae on distal margin; basis with long setae on posterior margin, anterior margin bare; merus bearing setae on posterodistal corner; carpus 1.5 times as long as wide, approximately 0.7 times as long as propodus, bearing seven clusters of setae along posterior margin; propodus stout, palm margin with 12 distally notched spines; dactylus with one seta on anterior margin.

Pereopods III–VII (Fig. 7B–F): similar to those of male.

Pereonites I–VI without armature on dorsal margin. *Pereonite VII* (Fig. 7H): with seven setae on dorsal margin.

Pleon. *Pleonites I–III* (Fig. 7I–K): dorsal margins with five, two, and nine setae, respectively.

Urosome. *Urosomites* (Fig. 7L, M): urosomite I with four setae on dorsal margin; urosomite II with two spines on each side.

Uropods I–III (Fig. 5K–M): uropod I peduncle with one basofacial spine, with three spines on exterior side, interior and exterior distal corners with one spine respectively; inner ramus approximately 0.73 times as long as peduncle, with two spines on interior side, two simple setae on exterior side, and six terminal spines accompanied by one seta; outer ramus approximately 0.8 times of inner ramus, with two spines on exterior side and five terminal spines. Uropod II shorter, peduncle bearing one spine on exterior side and one spine on each distal corner; inner ramus with two spines on each side, distal part with two serrated and four simple robust spines accompanied by one



Figure 6. *Pseudocrangonyx elegantulus* sp. n., male paratype. **A** gnathopod I **B** propodus of gnathopod I **C** gnathopod II **D** propodus of gnathopod II.

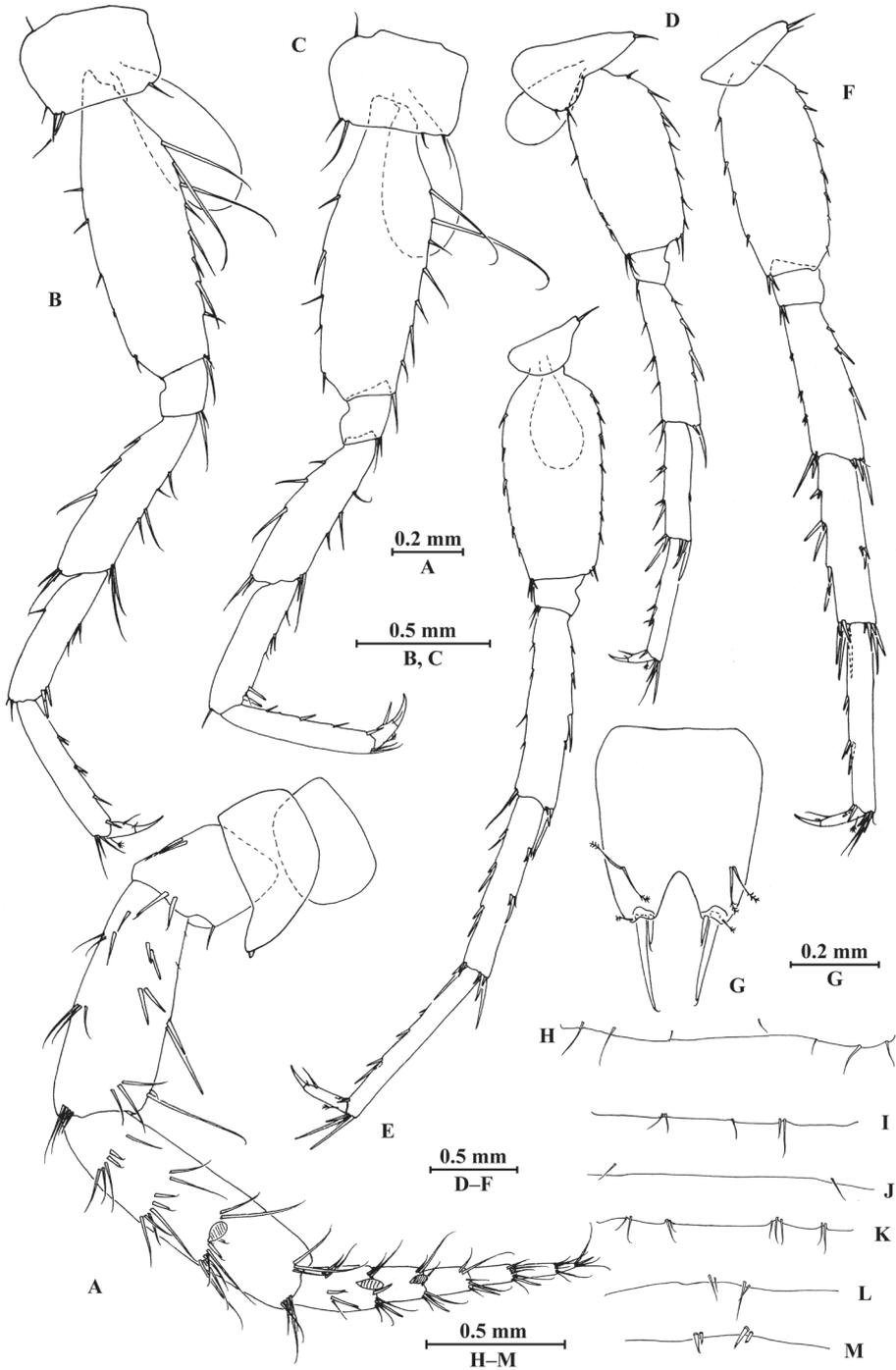


Figure 7. *Pseudocrangonyx elegantulus* sp. n., male paratype. **A** antenna II **B** pereopod III **C** pereopod IV **D** pereopod V **E** pereopod VI **F** pereopod VII **G** telson **H** pereonite VII (dorsal view) **I–K** pleonites (dorsal view) **L, M** urosomites I, II (dorsal view).

seta; outer ramus approximately 0.72 times of inner ramus, with one spine on exterior side and five terminal spines. Uropod III peduncle 0.31 times as long as outer ramus, with one dorsal and three ventral robust spines; inner ramus absent; outer ramus bi-articulate, first article of outer ramus with three groups of stiff spines on interior and exterior sides, terminal article 0.18 times of the first article, with three distal setae, a little shorter than adjacent spines.

Telson (Fig. 7G): 1.2 times as long as wide, cleft 0.24 of its length, each lobe with two setae on surface and two distal spines accompanied by one short seta.

Habitat. This species was collected from groundwater flowing through a cave of the Wulongdong National Forest Park.

Remarks. *Pseudocrangonyx elegantulus* sp. n. is clustered with *P. yezonis* Akatsuka & Komai, 1922 supported by high statistical supports in the molecular phylogenetic tree. Unfortunately, the original description of the latter species is poor and no redescription has been published. The following comparisons are based on recent observations (Ko Tomikawa pers. comm.). The new species is morphologically similar to *P. yezonis* in antenna II with calceoli; the armature of gnathopods I and II and pereopods III–VII; both rami of pleopods with more than five articles; urosomite III dorsal margin without armature. It can be distinguished from *P. yezonis* Akatsuka & Komai, 1922 by the following characters (*P. yezonis* in parentheses): pereonites I–VI without armature on dorsal margin, only pereonite VII with dorsal setae (with long setae on dorsal margins of pereonites I–VII); uropod III terminal article of outer ramus a little shorter than adjacent spines (subequal).

The new species is most similar to *P. cavernarius* Hou & Li, 2003 in the armature of gnathopods I and II and pereopods III–VII; epimeral plate I without armature on distal margin; both rami of pleopods with more than five articles. The new species can be distinguished from *P. cavernarius* Hou & Li, 2003 by the following characters (*P. cavernarius* in parentheses): antenna II with calceoli (absent); inner plate of maxilla II with four plumose facial setae in an oblique row (with five plumose setae); urosomite I with two setae on dorsal margin (with four clusters of setae); urosomite III dorsal margin without armature (with one pair of fine spines); outer ramus of uropod I with five terminal spines (with four terminal spines); uropod II inner ramus with six terminal spines accompanied by one seta (with five terminal spines) and outer ramus with five terminal spines (with three terminal spines); uropod III peduncle with one dorsal and three ventral robust spines (with three distal spines), terminal article of outer ramus a little shorter than adjacent spines (longer); each lobe of both male and female telson with two setae on surface (with no armature).

The new species is similar to *P. asiaticus* Uéno, 1934, which was redescribed by Uéno (1966), in the accessory flagellum being subequal to the first article of primary flagellum; the armature of gnathopods I and II and pereopods III–VII. It can be distinguished from *P. asiaticus* Uéno, 1934 by the following characters (*P. asiaticus* in parentheses): antenna II with calceoli (absent); incisor of mandible with five teeth (with 5–6 teeth); mandible spine row with five serrated spines (with 8–10 serrated setae); maxilliped inner plate with three stout apical spines, two serrated setae, and five

plumose setae (with five serrated spines and seven plumose setae); sternal gills absent (present on gnathopod II and pereopods III–IV); each lobe of both male and female telson with two setae on surface (with no armature).

The new species is similar to *P. elenae* Sidorov, 2011 in body length (longer than 6.0 mm); the armature of gnathopod I and II and pereopods III–VII; epimeral plate I without armature on distal margin; both rami of pleopods with more than five articles; urosomite III dorsal margin without armature; terminal article of outer ramus of uropod III shorter than adjacent spines. It can be distinguished from *P. elenae* Sidorov, 2011 by the following characters (*P. elenae* in parentheses): accessory flagellum of antenna I subequal to the first article of primary flagellum (shorter than accompanying flagellar article); antenna II of female with calceoli (absent); mandible spine row with five serrated spines (with six serrated setae); maxilla I with four plumose setae on inner plate (with five plumose setae); inner plate of maxilla II with four plumose facial setae in an oblique row (with five plumose setae); inner plate of maxilliped with three stout apical spines, two serrated setae, and five plumose setae (with five simple strong apical setae and nine plumose setae); epimeral plate II with two spines on distal margin (with one seta).

The new species resembles *P. gudariensis* Tomikawa & Sato, 2016 in epimeral plate I without armature on distal margin; urosomite III dorsal margin without armature. It can be distinguished from *P. gudariensis* Tomikawa & Sato, 2016 by the following characters (*P. gudariensis* in parentheses): accessory flagellum of antenna I subequal to the first article of primary flagellum (longer); antenna II of female with calceoli (absent); mandible spine row with five serrated spines (with 2–3 weakly pectinate setae); maxilla I with four plumose setae on inner plate (with three plumose setae); inner plate of maxilla II with four plumose facial setae in an oblique row (with three plumose setae); inner plate of maxilliped with three stout apical spines, two serrated setae, and five plumose setae (with three apical and two subapical robust setae); terminal article of uropod III outer ramus a little shorter than adjacent spines (longer); epimeral plates II and III with two spines on distal margins (with one seta); telson of male cleft 0.24 of its length (0.08).

The new species is also similar to *P. holsingeri* Sidorov & Gontcharov, 2013 in the armature of gnathopod I and II and pereopods III–VII; epimeral plate I without armature on distal margin; both rami of pleopods with more than five articles. It differs from *P. holsingeri* Sidorov & Gontcharov, 2013 by the following characters (*P. holsingeri* in parentheses): accessory flagellum of antenna I subequal to the first article of primary flagellum (longer); inner plate of maxilliped with three stout apical spines, two serrated setae, and five plumose setae (with two apical and three sub-apical setae); epimeral plate III with two spines on distal margin (with three setae); uropod I peduncle with one basofacial spine (with two basofacial spines in female); uropod III peduncle with one dorsal and three ventral robust spines (with two sets of stiff setae on distal margins).

Distinguishing features of all the 22 species of genus *Pseudocrangonyx* can be found in the key below.

Molecular phylogeny

The final alignment contained 32 taxa with 2123 bp, including 1465 bp for 28S and 658 bp for COI. MP, ML and BI yielded a congruent topology (Fig. 8). The monophyly of the genus *Pseudocrangonyx* was well supported, but the relationships within the genus *Pseudocrangonyx* remained unresolved, as found in the previous molecular study (Tomikawa et al. 2016). The new species *P. elegantulus* was clustered with *P. yezonis* with high support value. The uncorrected *p*-distance between *P. elegantulus* and *P. yezonis* was 12–15% for COI, which was comparable to distances found between Russian *Pseudocrangonyx* species (Sidorov and Gontcharov 2013).

As mentioned in the Remarks, the new species *P. elegantulus* is morphologically similar to *P. cavernarius*. Unfortunately, we were unable to obtain fresh material for *P. cavernarius*, because of tourist development in the type locality. Our phylogenetic results revealed that *P. elegantulus* was grouped with *P. yezonis* from the northern part of Japan. However, the divergences of 12–15% for COI confirmed the distinctness of new species, in comparison with the various COI distances used for amphipod delimitation (Rock et al. 2007). In addition, *P. elegantulus* and *P. yezonis* are mutually allopatric, as *P. elegantulus* is located at the inner land of China and separated from *P. yezonis* by sea. Therefore, morphological examination, molecular phylogenetic analyses, and distribution data support *P. elegantulus* being a new species.

Key to the species of *Pseudocrangonyx*

- 1 Epimeral plates II–III with sub-angled posterodistal corners 2
- Epimeral plates II–III with obtuse or rounded posterodistal corners 3
- 2 Inner plate of maxilla I with five or more setae 4
- Inner plate of maxilla I with less than five setae 5
- 3 Uropod I, ratio of outer ramus to inner ramus less than 0.5
..... *P. kyotonis* Akatsuka & Komai, 1922
- Uropod I, ratio of outer ramus to inner ramus higher than 0.5 6
- 4 Telson cleft 0.17 of its length *P. bobaensis* (Derzhavin, 1927)
- Telson cleft less than 0.17 of its length
..... *P. yezonis* Akatsuka & Komai, 1922
- 5 Mandible palp, article 3 equally long as article 2 *P. relicta* Labay, 1999
- Mandible palp, article 3 longer than article 2 *P. camtschaticus* Birstein, 1955
- 6 Mandible palp, article 2 twice as wide as article 3
..... *P. birsteini* Labay, 1999
- Mandible palp, article 2 a little wider than article 3 7
- 7 Telson cleft more than or equal to 0.2 of its length 8
- Telson cleft less than 0.2 of its length or not cleft 9
- 8 Maxilliped palp, article 3 less than 0.5 times as wide as deep 10
- Maxilliped palp, article 3 higher than 0.5 times as wide as deep 11

9	Epimeral plates I–III with 7–9 setae on posterior margins	<i>P. manchuricus</i> Oguro, 1938
–	Epimeral plates I–III with less than 9 setae on posterior margins	12
10	Maxilla I, inner plate with three plumose setae.....	<i>P. susanaensis</i> Labay, 1999
–	Maxilla I, inner plate with more than three plumose setae	<i>P. asiaticus</i> Uéno, 1934
11	Female antenna II with calceoli.....	<i>P. elegantulus</i> sp. n.
–	Female antenna II without calceoli	13
12	Male gnathopod II armed with serrate robust setae at palmar angle	<i>P. febras</i> Sidorov, 2009
–	Male gnathopod II armed with notched robust setae at palmar angle.....	14
13	Antenna I, accessory flagellum subequal to first article of primary flagellum .	<i>P. cavernarius</i> Hou & Li, 2003
–	Antenna I, accessory flagellum longer than first two articles of primary flagel- lum.....	<i>P. sympatricus</i> Sidorov & Gontcharov, 2013
14	Antenna I, accessory flagellum shorter than first article of primary flagellum....	<i>P. levanidovi</i> Birstein, 1955
–	Antenna I, accessory flagellum longer than first article of primary flagellum..	15
15	Female antenna II, flagellum with eight articles	16
–	Female antenna II, flagellum with less than eight articles	17
16	Uropod III, terminal article of outer ramus shorter than adjacent spines.....	<i>P. shikokunis</i> Akatsuka & Komai, 1922
–	Uropod III, terminal article of outer ramus longer than adjacent spines.....	<i>P. korkishkoorum</i> Sidorov, 2006
17	Maxilla I, inner plate with three plumose setae or less.....	18
–	Maxilla I, inner plate with more than three plumose setae	19
18	Telson not cleft.....	<i>P. kseniae</i> Sidorov, 2012
–	Telson cleft.....	20
19	Female uropod I peduncle with two basofacial spines	<i>P. holsingeri</i> Sidorov & Gontcharov, 2013
–	Female uropod I peduncle with one basofacial spine.....	21
20	Sternal gills absent	<i>P. gudariensis</i> Tomikawa & Sato, 2016
–	Sternal gills present	<i>P. coreanus</i> Uéno, 1966
21	Male antenna II with swollen peduncular article 5.....	<i>P. tiunovi</i> Sidorov & Gontcharov, 2013
–	Male antenna II with a common peduncular article 5 ...	<i>P. elenae</i> Sidorov, 2011

Discussion

Four *Pseudocrangonyx* species are recorded from subterranean freshwaters of China. *Pseudocrangonyx asiaticus* and *P. manchuricus* are known from interstitial water strata

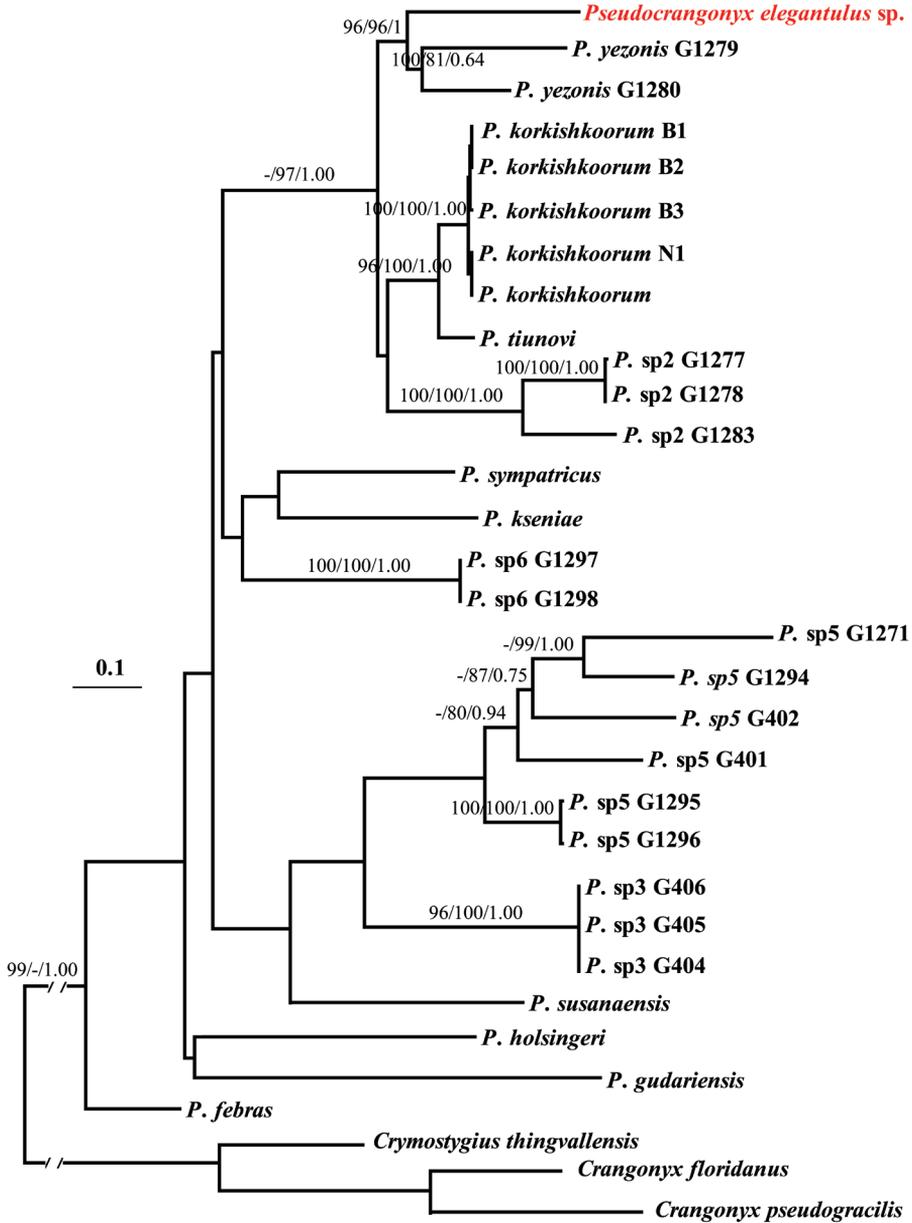


Figure 8. The ML tree derived from concatenated data set of 28S and COI. Support values greater than 70% are shown above branches in order for MP, ML, and BI analyses. Names of terminal taxa include voucher numbers for ingroups according to literature (Tomikawa et al. 2016).

approximately 10 meters under the surface of the earth, while *P. cavernarius* and *P. elegantulus* inhabit caves. Because the subterranean habitats are imperiled by drought and tourism, conservation plans should be strengthened.

Our molecular analyses revealed significant COI differentiation (12–20%) for species of the genus *Pseudocrangonyx*. Molecular evidences help us to discover new species, especially for subterranean or cave species which are morphologically indistinguishable (Hou and Li 2010). Phylogenetic results supported a single origin of the genus *Pseudocrangonyx*, however the diversification pattern across the Asia-Pacific margins was uncertain. Extensive sampling and detailed genetic data are needed to clarify the evolutionary history of *Pseudocrangonyx* amphipods.

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Harryplax severus, a new genus and species of an unusual coral rubble-inhabiting crab from Guam (Crustacea, Brachyura, Christmaplacidae)

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Abstract

Harryplax severus, a new genus and species of coral rubble-dwelling pseudozioid crab is described from the island of Guam in the western Pacific Ocean. The unusual morphological features of its carapace, thoracic sternum, eyes, antennules, pereopods and gonopods place it in the family Christmaplacidae Naruse & Ng, 2014. A suite of characters on the cephalothorax, pleon and appendages distinguishes *H. severus* **gen. & sp. n.** from the previously sole representative of the family, *Christmaplax mirabilis* Naruse & Ng, 2014, described from Christmas Island in the eastern Indian Ocean. This represents the first record of Christmaplacidae in the Pacific Ocean. With the discovery of a second genus, a revised diagnosis for Christmaplacidae is provided.

Keywords

Pacific, Mariana Islands, taxonomy, Decapoda, Pseudozioidea, coral reef, coelobite, cryptofauna

Introduction

Naruse and Ng (2014) described a new genus and new species of pseudozioid crab, *Christmaplax mirabilis*, from an anchialine cave in Christmas Island, an Australian territory in the eastern Indian Ocean. They argued that there were sufficient unique suprageneric characters to distinguish this species from the remainder of the Pseudoziioidea, necessitating the establishment of a new family, Christmaplacidae. In addition to the establishment of this family and the clarification of familial morphological characters within Pseudoziioidea, Naruse and Ng (2014) also transferred *Flindersoplax* Davie, 1989, previously in Pseudoziidae sensu Ng et al. (2008) to the Planopilumnidae Ng, 2010, on the basis of the characters of the male anterior thoracic sternum and pleon and the G1.

In the early 2000's, a collection of specimens made by the late Harry Conley from the reefs and rubble beds around the island of Guam, in the western Pacific, were presented by Gustav Paulay (then of the University of Guam) to the second author for study. This resulted in some important publications contributing to the knowledge on the brachyuran fauna of Guam and the Mariana Islands (Ng 2002a, b, c; Tan and Ng 2003; Ng and Takeda 2003; Ng and Ng 2003; Paulay et al. 2003; Lasley et al. 2010). However, some of this material has remained unstudied. Among them were two small and unusual specimens which are here described as a new genus and a new species assigned to the Christmaplacidae.

Material and methods

The present material was collected by excavating the rubble at low tide, to a depth of approximately 1–2 m. As noted in Ng (2002b) and Ng and Ng (2003), the fauna in deep rubble (described as chalicophilous by Ng and Takeda 2003) is poorly known, and the collector, the late Harry Conley, had the habit of digging deep into the shallow water rubble fields in Guam, sometimes to depths of 30 m, in his search for shells. In the process, he uncovered many rare and novel species of brachyurans (see also McLay 2001).

Measurements are written as carapace maximum width × carapace median length, in millimeters. Material examined are deposited in the Queensland Museum, Brisbane, Australia (QM) and Zoological Reference Collection of the Lee Kong Chian Natural History Museum, National University of Singapore (ZRC). The following abbreviations are used: **coll.** = collected by; **G1**, **G2** = male first and second gonopods, respectively; **P1-P5** = first to fifth pereopods, respectively (P1 being the chelipeds and P2-P5 are the first to fourth ambulatory legs); **stn.** = station. The sutures on the thoracic sternum are referred to by the numbers of the adjacent thoracic sternites separated by a slash (e.g. suture 5/6 is the suture between sternites 5 and 6). Terminology essentially follows that of Mendoza and Manuel-Santos (2012), Mendoza et al. (2012), and Naruse and Ng (2014).

Taxonomy

Superfamily Pseudozioidea Alcock, 1898

Family Christmaplacidae Naruse & Ng, 2014

Diagnosis. Carapace subovate; anterior half of anterolateral margin arcuate, cristate, granulate, posterior half armed with two widely spaced sharp teeth. Eyes reduced, immobile; orbits with sunken exorbital angle, with strong, ridged, anteriorly projecting infraorbital tooth (inner orbital angle), the mesial surface of which receives the antennule. Antennules elongated, cannot be fully retracted into their fossae. Cheliped with large, sharp, triangular, lobiform inner carpal spine; merus with highly convex flexor margin lined with conical spines; major chela with modified opposing molariform teeth on proximal cutting margins of fingers. Ambulatory legs elongate, very slender, meri at least five times as long as wide. G1 sinuous, without spiniform granules; G2 short, about one-third length of G1, distal segment short, about one-fifth total length of G2, petaloid in shape (emended from Naruse and Ng 2014).

Harryplax gen. n.

<http://zoobank.org/C1615819-9D6D-402A-B6AC-4084BFC28EC0>

Type species. *Harryplax severus* sp. n., by present designation.

Diagnosis. Carapace transversely subovate; dorsal surface granular, regions poorly defined; front bilobed, produced beyond orbits; anterolateral margin arcuate, cristate, lined with granules, with two teeth after exorbital angle; posterolateral margins straight, converging posteriorly; endostomial ridge strongly developed. Antennules well developed; second and third articles relatively long, stout, partially retractable into antennular fossa, distal tip of second article reaching infraorbital tooth; basal article of antenna rectangular, slender (much longer than wide), subsequent two articles elongate, flagellum long. Thoracic sternum narrow, granulate; thoracic sternites 1 and 2 fused, triangular; thoracic sternite 3 demarcated from sternite 2 by distinct transverse suture; thoracic sternites 3 and 4 nearly fused except for notches restricted laterally, which continue medially as oblique grooves, forming wide V, and forming the boundary between the two sternites; sternite 4 long, tip of male telson not reaching level of P1 condyles when pleon folded against thoracic sternum; male press-button present as rounded tubercle on sternite 5, midway between sutures 4/5 and 5/6. Median line present on exposed portion of sternite 4, absent in sterno-pleonal cavity except at level of sternites 7 and 8. Penis protruding from gonopore anterior to coxo-sternal condyle of P5. Vulva large, on sternite 6 abutting against posterior border of sternite 5, sub-circular operculum present. Chelipeds robust, distinctly asymmetric, not exhibiting any sexual dimorphism; major chela with eroded molariform tooth on proximal cutting margin of dactylus, large molariform tooth on proximal cutting margin of fixed

finger; carpus with broadly triangular, sharp tooth on inner margin; merus anterior margin lined with conical spines. Ambulatory legs long, slender; anterior margins lined with small spines. Male pleon relatively broad; all somites and telson freely articulated. G1 slender, slightly sigmoid, surfaces without spines or sharp granules, distal half lined with stiff, short simple setae; G2 stout, about one-third of G1 length, distal segment short, petaloid.

Etymology. The new genus is named primarily in honor of the intrepid field collector, the late Harry T. Conley, who collected many interesting crustaceans in the rubble beds of Guam, including the species presently being described. The name is also an allusion to a famous namesake, Harry Potter, the magical hero of the popular book series by J.K. Rowling, and Mr. Conley's uncanny ability to collect rare and interesting creatures as if by magic. The name is an arbitrary combination of "Harry" and the suffix "-plax". Gender feminine.

Remarks. *Harryplax*, new genus, is classified in Pseudozioidea following Naruse and Ng's (2014) definition based on the following morphological features: 1) having all the somites of the male pleon and the telson freely articulated; 2) the G2 being about a third the length of the G1; 3) the penis emerging from a coxal (P5) gonopore that is anterior to the coxo-sternal condyle; and 4) the large vulvae which are positioned close to each other in the thoracic sternum. Naruse and Ng (2014) exhaustively discussed the comparative morphology of the pseudozioid families, viz. Pseudoziidae, Planopilumnidae, Pilumnoididae, and Christmaplacidae (see also Guinot and Macpherson 1987; Davie 1989; Ng and Wang 1994; Ng and Liao 2002; Ng 2010; Ng and Ah Yong 2013). They highlighted the diagnostic characters of Christmaplacidae which effectively distinguish it from the rest of Pseudozioidea as follows: "The immobile eyes without pigmentation, elongated antennules that cannot retract into their fossae, large lobiform inner carpal spine of the cheliped, large lobiform and spiniform flexor margin of the merus of the cheliped, and the elongated ambulatory legs are unique characters in the Pseudozioidea." (Naruse and Ng 2015: 270, Table 1).

Harryplax is assigned to Christmaplacidae as it shares the following features with the type genus, *Christmaplax*: 1) a sub-ovate carapace with a strongly arcuate anterolateral margin armed with two well-spaced teeth after the effaced exorbital angle; 2) reduced and immobile eyes; 3) robust and similarly proportioned chelipeds, where the major chela has the two opposing modified teeth on the proximal cutting margins of the fingers; 4) long, slender ambulatory legs (unique in Christmaplacidae); 5) a sternal press-button equidistantly positioned on sternite 5 between suture 4/6 and 5/6; 6) a penis emerging from a gonopore on the P5 coxa, anterior to its coxo-sternal condyle; and 7) a simple unarmed G1 with a relatively short and stout G2, the terminal segment of which is short and petaloid in shape.

There are several morphological features, however, that distinguish *Harryplax* from *Christmaplax*:

The carapace has the front more distinctly projecting beyond the supraorbital margin in dorsal view (Fig. 1A) (front only slightly projecting; cf. Naruse and Ng 2014: figs 1a, 2b, 3a);

There are no distinct notches separating the supraorbital margin from the front nor from the anterolateral margin (Fig. 1A) (slight notch between front and supraorbital margin, and deep, pronounced notch marking boundary with anterolateral margin; cf. Naruse and Ng 2014: figs 1a, 2b, 3a);

The anterior portion of the anterolateral margin is more gently arcuate (less convex) but is more strongly cristate (Figs 1A, B, 2A) (more strongly convex and with the crest less pronounced; cf. Naruse and Ng 2014: figs 1a-c, 2a, 3a);

The teeth on the carapace anterolateral margin, especially the first, are more prominent, with the tips distinctly curved (Fig. 1A) (teeth relatively smaller with weakly curved tips; cf. Ng and Naruse 2014: figs 1a, 3a);

The eyes, while immobile and reduced, are relatively better developed with longer peduncles and bigger corneas, and are visible even from dorsal view (Fig. 1A, B, 2A) (hidden from dorsal view, sunken into orbit, with shorter peduncles and much reduced corneas; cf. Naruse and Ng 2014: figs 1a, c, 2a, b);

The basal article of the antenna is much longer and narrower (Fig. 2A) (shorter and wider; cf. Naruse and Ng 2014: figs 1c, 6a);

The second and third antennular segments are stout (especially the third), and, although the joint between two articles also reaches the mesial surface of infraorbital tooth when folded, the third article can be partially folded into antennular fossa (Figs 1B, 2A) (second and third antennular articles slender, too long to fold into antennular fossa; cf. Naruse and Ng 2014: fig. 2a, b);

The thoracic sternum is relatively narrower and the posterior end of sternite 3 is slightly wider than the anterior end of sternite 4 (Figs 1C, D, 3A, B) (thoracic sternum distinctly wider, posterior end of sternite 3 distinctly narrower than anterior end of sternite 4; cf. Fig. 1E; Naruse and Ng 2014: figs 1b, 3b, 6c);

Thoracic sternite 4 has a distinct median line in both the male and the female (Figs 1C, D, 3A, B) (median line absent on sternite 4; cf. Fig. 1E; Naruse and Ng 2014: figs 1b, 3b, 6c);

The vulvae are round, and their anterior edge is in contact with thoracic suture 5/6 (Figs 1D, 2H) (vulvae lunate, 'half-moon', in shape, anterior edge not touching suture 5/6; cf. Fig. 1E; Naruse and Ng 2014: fig. 5d);

The endopod of the third maxilliped is relatively narrower (esp. merus) and the lateral margin of the exopod is convex (Fig. 2B) (endopod broader, lateral margin of exopod straight; cf. Naruse and Ng 2014: fig. 6b).

The ambulatory legs are relatively shorter and stouter, and the dactyli are distinctly shorter than the propodi (Figs 1A, 2F, G) (ambulatory legs longer and more slender, dactyli subequal in length to propodi; cf. Naruse and Ng 2014: figs 1a, 3a);

The G1 is only slightly sinuous throughout its length, and the G2 is relatively stouter (Fig. 3E, F) (G1 distinctly sinuous, more pronouncedly curved, G2 more slender; cf. Naruse and Ng 2014: fig. 5b, c).

Naruse and Ng (2014: 265, 270) observed that there was a transverse ridge separating thoracic sternites 2 and 3 in *Christmaplax mirabilis*, but this is not an accurate description of the structures. What separates sternites 2 and 3 is a prominent transverse

suture (as in *Harryplax severus*) but the margin of sternite 2 adjacent to the suture is just slightly raised. The different morphological features of *Harryplax* require the emendation of the current diagnosis of the family Christmaplacidae (see above).

***Harryplax severus* sp. n.**

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Figs 1A–D, 2, 3

Type material. Holotype ♀ (7.9 × 5.6 mm) (ZRC 2016.0253), Guam, Piti Reef margin, 1–1.5 m depth, in rubble; coll. H.T. Conley, September 1998; paratype ♂ (5.4 × 3.9 mm) (ZRC 2016.0254), Guam, Glass Breakwater near mouth of Apra Harbour, 4.6–7.6 m depth, among rocks; coll. H.T. Conley, 18 July 2001.

Comparative material. *Christmaplax mirabilis* Naruse & Ng, 2014, holotype ♂ (11.0 × 7.9 mm) (QM W29223), stn. CI-D04, Christmas Island, Thundercliff Cave, coll. T. Naruse & Y. Fujita, 15 February 2012; paratype ♀ (11.3 × 8.3 mm) (ZRC 2014.0814), stn. CI-D07, same locality as holotype, coll. Y. Fujita & T. Naruse, 16 February 2012.

Description. Carapace (Figs 1A, B, 2A) transversely subovate, 1.38–1.41 times as wide as long, dorsal surface slightly convex, mostly smooth but becoming more granulate at periphery, regions poorly defined; H-shaped gastric grooves barely discernible. Front well produced anteriorly, ventrally deflexed; frontal margin bilobed, lobes separated by wide V-shaped concavity, anterior margins slightly concave, mesial angles more produced than lateral. Supraorbital margin granulate, forming slightly obtuse angle with base of front, continuing uninterrupted into anterolateral margin (without notches); infraorbital margin much shorter, junction with supraorbital margin sunken; orbit small, laterally unarmed, infraorbital angle produced as large ridge-like tooth, mesial surface slightly concave for accommodating distal end of second antennular article when folded, tooth produced anteriorly beyond orbit when viewed dorsally. Exorbital angle not clearly marked in dorsal view. Anterior half of anterolateral margin, arcuate, cristate, lined with round granules; posterior half with two strong teeth with sharp, incurved apices, first tooth distinctly larger, more curved than second tooth which marks junction between antero- and posterolateral margins. Posterolateral margins almost straight, convergent posteriorly; surfaces covered with tiny granules. Suborbital, subhepatic, and pterygostomial regions covered with many fine and some larger granules; pterygostomial region with a granulate ridge anterior to Milne Edwards' aperture. Epistome short, with medial transverse depression, posterior margin with a small median projection. Endostomial ridge strongly developed. Lateral margins of buccal cavern subparallel, slightly convergent anteriorly, concave.

Antennules (Figs 1B, 2A) well developed; basal antennular segment large, high, upper half forming cavity for second article; second and third articles long, can be partially retracted into antennular fossae, second article longer than third, which has distal end wider than proximal end; mesial surface of internal orbital tooth accommodating joint of second and third antennular articles when folded. Antennal basal article

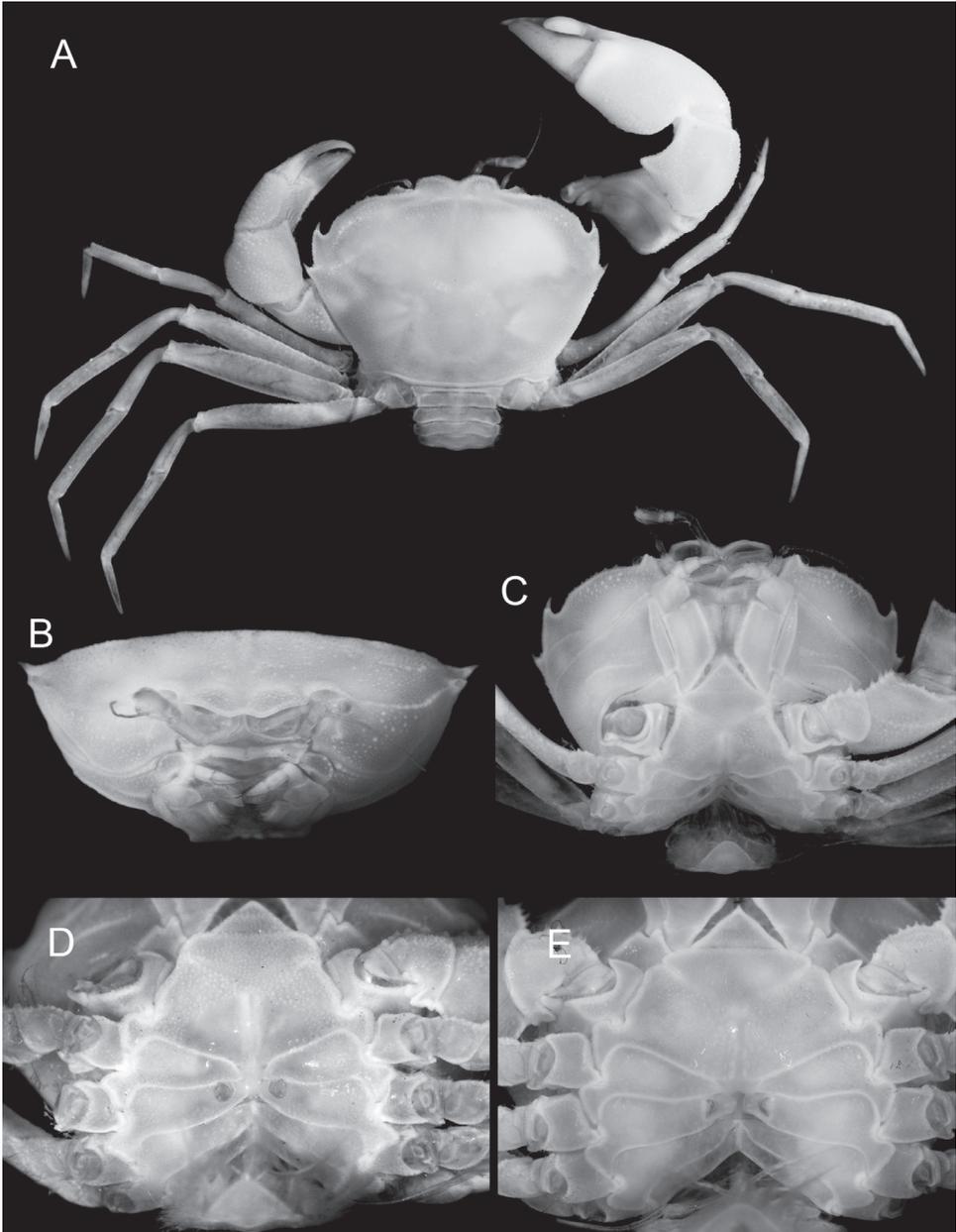


Figure 1. **A–D** *Harryplax severus* gen. & sp. n., holotype, female (ZRC 2016.0253) **E** *Christmaplax mirabilis* Naruse & Ng, 2014, paratype, female (ZRC 2014.0814) **A** habitus, dorsal view **B** cephalothorax, frontal view **C** cephalothorax, ventral view **D, E** thoracic sternum and vulvae, ventral view.

subrectangular, longer than wide, not completely filling orbital hiatus, barely mobile, subsequent two articles elongate, cylindrical; flagellum long, reaching first anterolateral tooth when folded laterally along anterolateral margin.

Eye (Figs 1A, B, 2A) reduced, immovable; visible from dorsal view of carapace, with small granules on dorsal surface; cornea discernible on rounded, bulbous distal end of eyestalk, visible from dorsal and anterior views.

Third maxillipeds (Figs 1B, C, 2B) forming narrow triangular median hiatus when closed; ischium long, median length about twice of that of merus, with shallow longitudinal sulcus; merus quadrate, anterior margin slightly concave, distolateral angle rounded, distal and mesial margins granulate; exopod slender, lateral margin convex, mesial margin with subdistal triangular tooth, flagellum long.

Male thoracic sternum (Fig. 3A, B) transversely narrow. Sternites 1 and 2 fused, triangular in outline, apex acute, lateral margins straight; sternite 2 separated from sternite 3 by distinct transverse suture; sternites 3 and 4 almost completely fused except for incomplete sutures laterally which continue mesially as shallow but distinct V-shaped groove; sternite 4 long, narrow, ratio of width (measured at lateral extremes of episternites) over length (measured as distance between tip of closed telson to center of suture 3/4) = 3.5; male pleonal locking mechanism (press-button) present as round tubercle on sternite 5 midway between sutures 4/5 and 5/6; sutures 4/5 and 5/6 interrupted medially; suture 6/7 fused medially, median marked by trapezoidal area that is less calcified than surrounding area of sterno-pleonal cavity, appearing like a 'hole'; suture 7/8 fused medially and connecting with median line; sternite 7 widely exposed when pleon closed, wider than long; small portion of sternite 8 exposed between lateral edges of pleomeres 2 and 3 when pleon is pressed closed against thoracic sternum. Median line present on exposed region of sternite 4, absent within sterno-pleonal cavity except at level of sternites 7 and 8. Penis (Fig. 3C) protruding from gonopore on P5 coxa, anterior to coxo-sternal condyle. Female thoracic structure (Figs 1C, D) similar to that of male; vulva (Fig. 3H) on sternite 6, round, relatively large, anterior border contacting sture 5/6, operculum similarly round, no sternal projections.

Chelipeds (Figs 1A, 2C–E) distinctly asymmetrical, right chelipeds more robust and specialized in examined material; no obvious sexual dimorphisms. Anterior margins of basis-ischium and merus of both chelipeds lined with sharp conical spines of varying length, upper margin of merus distinctly convex, cristate, lined with pointed granules, lower outer margin gently convex, cristate, granulate, terminating distally with granulate tuberosity. Carpus finely granulate, with strong, sharp, broadly triangular, lamellar tooth on inner margin (larger in major cheliped). Major chela wide, inflated; external and internal surfaces mostly smooth; upper surface weakly granulate, inner margin of upper surface carinate, with transverse concavity immediately beneath it on inner surface; lower margin lined with sharp granules. Fingers stout, fixed finger shorter than movable finger, almost straight except for upcurved tip, cutting margin with large, proximal molariform tooth with flattened occlusal surface, followed distally by 2 smaller cutting teeth, lower margin armed with large conical granules; movable finger gently curved downwards, with large, but eroded, flat tooth proximally, followed distally by 1 cutting tooth. Minor chela relatively narrower, more granulate, fingers less robust, without molariform teeth, lower margin with conical spines.

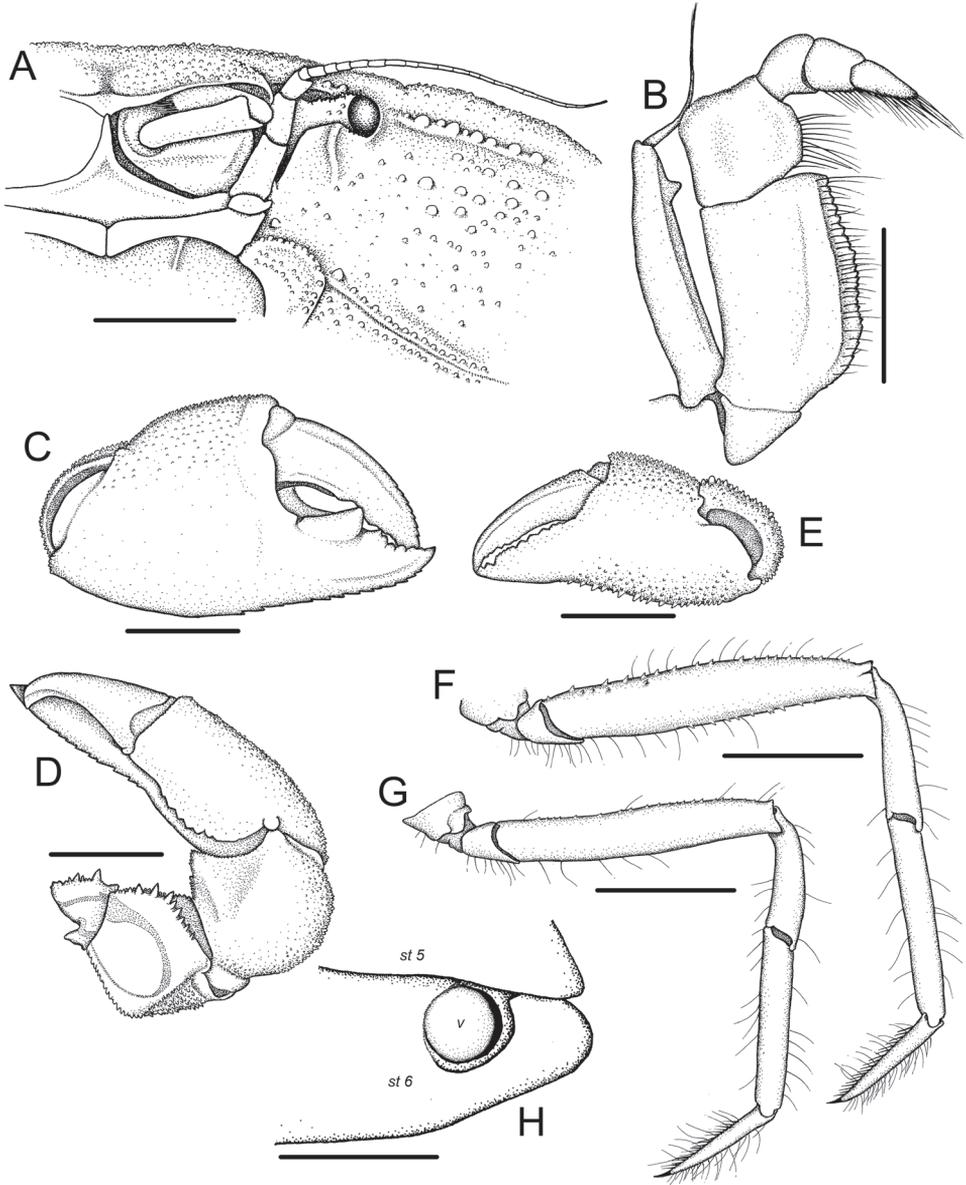


Figure 2. *Harryplax severus* gen. & sp. n., holotype, female (ZRC 2016.0253). **A** cephalothorax, left side, antero-ventral view **B** right third maxilliped, ventral view **C** right (major) chela, external view **D** right (major) cheliped, dorsal view **E** left (minor) chela, external view **F** right P4, dorsal view **G** right P5, dorsal view **H** right vulva, ventral view. Legend: st 5, 6 – sternites 5 and 6, respectively; v – vulva. Scale bars: 1.0 mm (**A**, **B**), 2.0 mm (**C–G**), 0.5 mm (**H**).

Ambulatory legs (Figs 1A, 2F, G) long, slender, sparsely setose; P4 longest, combined merus-to-dactylus length 1.57–1.60 times carapace width, merus approximately five times as long as wide; P2 and P5 shortest. Meri flattened, margins lined with sharp

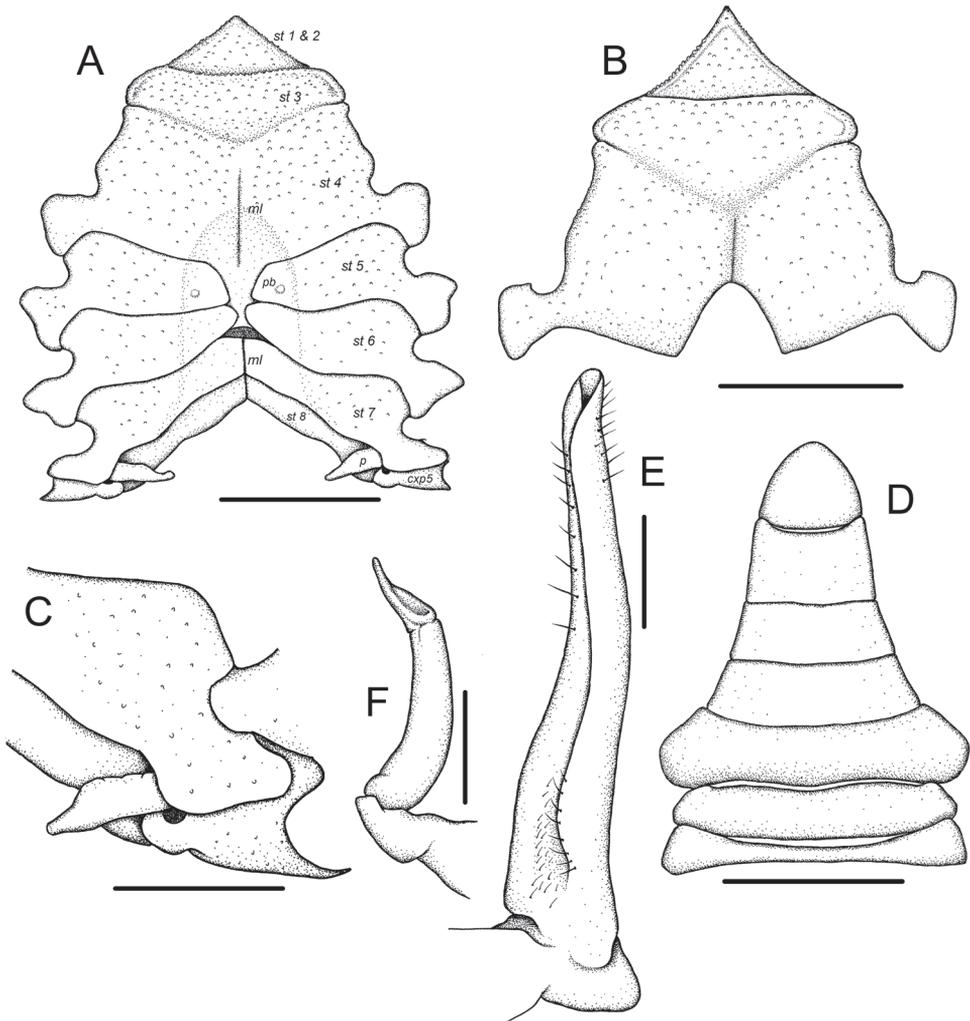


Figure 3. *Harryplax severus* gen. & sp. n., paratype, male (ZRC 2016.0154). **A** thoracic sternum (sternites 1–8), ventral view **B** anterior thoracic sternum (sternites 1–4), ventral view **C** posterior sternites & penis, posteroventral view **D** pleon, ventral view **E** left G1, external view **F** left G2, external view. Legend: cpx5 – coxa of P5; ml – median line; p – penis; pb – tubercle of the sterno-pleonal press-button; st 1–8 – sternite 1–8, respectively. Scale bars: 1.0 mm (**A**, **B**, **D**), 0.5 mm (**C**), 0.25 mm (**E**, **F**).

granules, which are much smaller on P5; other articles unarmed, except for propodus of P2 which is lined with small sharp granules; carpus subcylindrical, curved proximally; propodus straight, flattened; dactylus subcylindrical, tapering distally, terminating in sharp curved claw, flexor margins with row of closely packed short stiff setae.

Male pleon (Fig. 3D) with all somites and telson free; somites 1 and 2 short; somite 1 partially concealed under posterior margin of carapace, with transverse ridge; somite 3 widest, subsequent somites trapezoidal, progressively narrowing, producing a

combined lateral margin that is concave; telson subtriangular, lateral margins convex, apex rounded. Female pleon longitudinally oval with all somites and telson free; relatively narrow, somite 3 widest, telson wider than long; in female holotype, pleopods developed, setose throughout entire length.

G1 (Fig. 3E) slender, slightly sinuous, unarmed, mesial and lateral margins each with row of stiff simple setae towards distal end; aperture terminally placed. G2 (Fig. 3F) about one-third length of G1, distal segment petaloid in shape.

Etymology. The specific epithet, *severus* (L., harsh, rough, rigorous), alludes to the rigorous and laborious process by which this crab was collected. It is also an allusion to a notorious and misunderstood character in the Harry Potter novels, Professor Severus Snape, for his ability to keep one of the most important secrets in the story, just like the present new species which has eluded discovery until now, nearly 20 years after it was first collected. The name is used here as a noun in apposition.

Remarks. *Harryplax severus* sp. n., shares some key morphological features with *C. mirabilis* which are presumably adaptations to a stygobitic lifestyle (i.e. reduced eyes, well-developed antennules and antennae, and long, slender ambulatory legs), which in turn suggests that the environmental conditions under which the former thrives are probably similar to the conditions in underwater caves. *Harryplax severus* is clearly a chalicophilous species, as it was collected deep in coral rubble or under subtidal rocks. It is also possible that it is a cavity dweller, or coelobite (viz. Choi and Ginsburg 1983; Choi 1984; Takada et al. 2007, 2008), living within the interstices of coral rubble and rocks. It is clearly a part of the poorly known coral reef cryptofauna and its reclusive nature accounts for its rarity and absence in conventional reef surveys. The new species is only known from the type locality, Guam, thus far.

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We are grateful to the late Harry Conley for collecting this important material. A soft-spoken ex-Marine with a steely determination and a heart of gold, his endeavours have substantially advanced the cause of marine science. Thanks are also due to our old friend, “master hunter” Gustav Paulay, who passed the second author the bulk of Conley’s material and got us started on our studies of the Pacific cryptofauna. We also thank Shane Ah Yong, Paul Clark, and Tohru Naruse for their helpful comments and suggestions for the improvement of this paper.

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Review of the genus *Craspedolcus* Enderlein sensu lato in China, with the description of a new genus and four new species (Hymenoptera, Braconidae, Braconinae)

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Abstract

A new genus is split off the genus *Craspedolcus* Enderlein, 1920 (Hymenoptera, Braconidae, Braconinae): *Maculibracon* **gen. n.** with type species *Maculibracon abruptus* **sp. n.** The genus *Craspedolcus* Enderlein sensu stricto is redefined, a key to both genera and to their species in China, Thailand and Vietnam is included. *Craspedolcus obscuriventris* Enderlein, 1920, (**syn. n.**) is a new synonym of *C. vagatus* (Smith, 1858), as *Ipoobracon maculicosta* Enderlein, 1920 and *Iphiaulax bhotanensis* Cameron, 1907 of *Maculibracon simlaensis* (Cameron, 1899), **comb. n.** The genus *Craspedolcus* is recorded from China for the first time with two species: *Craspedolcus fraternus* Enderlein, 1920, and *C. politus* **sp. n.** The genus *Maculibracon* is represented by three species in China: *M. simlaensis* (Cameron, 1899), **comb. n.** (also present in Vietnam), *M. hei* **sp. n.** and *M. luteonervis* **sp. n.** and a fourth species is described from Thailand: *M. abruptus* **sp. n.** *Hybogaster zebripteræ* Wang & Chen, 2008, from China (Fujian) is transferred to *Iphiaulax* Foerster, 1863, (**comb. n.**) and the following names are new combinations in *Maculibracon* **gen. n.**: *Bracon lepcha* Cameron, 1899; *B. phaedo* Cameron, 1899; *B. simlaensis* Cameron, 1899; *Iphiaulax bhotanensis* Cameron, 1907; *I. laertius* Cameron, 1903; *I. leptopterus* Cameron, 1903; *I. lineaticarinatus* Cameron, 1907; *Ipoobracon lissotomus* Roman, 1914; *I. maculicosta* Enderlein, 1920 and *I. pallidicornis* Roman, 1914. *Craspedolcus montezuma* (Cameron, 1887) is provisionally transferred to the genus *Digonogastra* Viereck, 1912.

Keywords

Hymenoptera, Braconidae, Braconinae, *Craspedolcus*, *Maculibracon*, new genus, new species, Oriental, China, Thailand, Vietnam

Introduction

Craspedolcus Enderlein, 1920 (Hymenoptera, Braconidae, Braconinae) is an Oriental and Wallacean genus that neither has been revised nor has its type species fully illustrated. Quicke (1985) redescribed the genus and gives a list of species belonging to it, later augmented by Quicke and van Achterberg (1990). In the Taxapad database 18 species are listed as valid (Yu et al. 2016). The only included New World species, *C. montezuma* (Cameron, 1887) from Mexico, was transferred by Enderlein (1920) from *Iphiaulax* Foerster, 1863, to *Craspedolcus* but is here excluded. The short description does not give a clue why it should be included in *Craspedolcus* except for “the centre [of first tergite] with a keel down the middle”. A median keel at the middle of the first tergite occurs also in other genera, and a similar species described in the same paper (*Iphiaulax chontalensis*) has been transferred to *Digonogastra* Viereck, 1912. Most likely *C. montezuma* belongs to the latter genus and is here excluded from *Craspedolcus*. Based on the original descriptions of the remaining species three are synonyms: *C. obscuriventris* Enderlein, 1920 (syn. n.) of *C. vagatus* (Smith, 1858), and *Ipobracon maculicosta* Enderlein, 1920 (syn. n.) and *Iphiaulax bhutanensis* Cameron, 1907 (syn. n.) of *Bracon simlaensis* Cameron, 1899. *Iphiaulax bhutanensis* was already informally synonymised with *B. simlaensis* by Yu et al. (2016). It results in 15 valid species of *Craspedolcus* s. lat. with a general distribution from Myanmar, Bhutan and India, Sundanese islands, Sulawesi up to the Philippines. So far *Craspedolcus* s. lat. is unknown from China, but among the Braconinae in the collection of the Institute of Zoology of the Chinese Academy of Sciences (Beijing) five species were found originating from southern China. The variation in the genus as defined by Quicke (1987) is extreme and the genus is likely polyphyletic after the recognition of *Serraulax* Quicke, 1987, as a separate genus. The latter genus is more similar to one part of the genus than to the other. Two very similar, but well separable genera are present in China: *Craspedolcus* s. str. and a new genus, *Maculibracon* gen. n. The latter genus was also found by the second author among material from Vietnam and Thailand deposited in the collection of Naturalis Biodiversity Center (Leiden). The biology of the new species is unknown, but members of the related genus *Campyloneurus* Szépligeti, 1900, are koinobiont endoparasitoids of larvae of Cerambycidae and Pyralidae. For the recognition of the subfamily Braconinae, see van Achterberg (1990, 1993) and for the terminology used in this paper, see van Achterberg (1988). For additional references see Yu et al. (2016).

Materials and methods

The terminology and measurements used follow van Achterberg (1988, 1993). The following abbreviations are used: **POL** = postocellar line; **OOL** = ocular-ocellar line; **OD** = maximum diameter of lateral ocellus. The stigmal spot of the fore wing is the dark spot below the parastigma (Figs 1, 15). The medial length of the third metasomal

tergite is measured from the posterior border of the second suture to the posterior margin of the tergite.

Photographs were made with a Keyence VHX-2000 digital microscope and the photos were slightly processed (mainly cropped and the background modified) in Photoshop CC. For the descriptions and measurements a Leica M125 stereomicroscope was used. The specimens are deposited in the Institute of Zoology, Chinese Academy of Sciences, Beijing (IZCAS) and in Naturalis Biodiversity Center, Leiden (RMNH). An asterisk indicates a new record for the country.

Results

Key to *Craspedolcus* auctt. in China, Vietnam and Thailand

- 1 Scapus elongate, 2.6–2.9 times longer ventrally than its maximum width (Figs 12, 26, 41); third and fourth tergites with transverse subposterior groove (Figs 5, 9); median carina of first tergite low (Figs 5, 9); antero-lateral areas of second tergite large and touching large medio-basal area (Figs 5, 19, 33); surroundings of vein cu-a of hind wing setose; vein cu-a of fore wing subinterstitial (Fig. 1) or shortly postfurcal and perpendicular (Fig. 15); median carina of second tergite shorter and weak (Fig. 5); propodeum flat posteriorly in lateral view (Figs 9, 25, 40); vein 1r-m of hind wing shorter than vein SC+R1 (Fig. 1); antero-lateral grooves of third tergite medium-sized and remaining far removed from each other (Figs 5, 19, 33); hypopygium long and acute apically, reaching level of apex of metasoma (Figs 9, 14); second metasomal tergite below basal smooth areas densely striate (Figs 19, 33); medial area of first tergite gradually lowered anteriorly (Figs 9, 25, 40); *Craspedolcus* Enderlein, 1920 s. str. **2**
- Scapus stout, 1.5–2.2 times longer than its maximum width (Figs 49, 66, 74, 91); third and fourth tergites without transverse subposterior groove (Figs 47, 60, 72, 85); median carina of first metasomal tergite high anteriorly (Figs 55, 60); antero-lateral areas of second tergite minute and remaining from small medio-basal area (Figs 47, 60, 72, 85); surroundings of vein cu-a of hind wing glabrous; vein cu-a of fore wing distinctly postfurcal and inclivous (Figs 43, 56, 68, 81); median carina of second tergite long and high (Figs 47, 60, 72, 85); propodeum medio-posteriorly more or less protruding in lateral view (Figs 53, 65, 78, 90); oblique antero-lateral grooves of third tergite long and almost meeting submedially (Figs 47, 60, 72, 85); hypopygium medium-sized and subtruncate apically, not reaching level of apex of metasoma (Figs 55, 67); second metasomal tergite below basal smooth areas smooth (Figs 47, 60, 72, 85); medial area of first tergite steep anteriorly (Figs 53, 65, 78, 90)...*Maculibracon* gen. n. **3**

- 2 Anterior half of second metasomal tergite more or less longitudinally striate behind smooth basal areas (Fig. 19); stigmal spot medium-sized, not or hardly intruding into first discal cell of fore wing (Fig. 15); Sumatra, *China (Yunnan) ***Craspedolcus fraternus*** Enderlein, 1920
- Anterior half of second metasomal tergite smooth, at most with some short striae near basal areas (Fig. 33); stigmal spot large, intruding into cells of fore wing below parastigma (Fig. 29); *China (Hainan)..... ***Craspedolcus politus* sp. n.**
- 3 Propodeum medio-posteriorly with smooth protuberance in lateral view (Figs 78, 90); scapus mainly yellowish brown (except for dark brown stripe on outer side) and similar to colour of head in dorsal view, rather slender and less protruding ventrally (Figs 74, 91); head less narrowed posteriorly (Figs 76, 88); medial area of first tergite low anteriorly (Figs 78, 90); slightly infusate apical area of fore wing wide, and rather close to vein 1r-m (Figs 68, 81); stigmal spot often larger, at least up to middle of first discal cell (Figs 68, 81) **4**
- Propodeum medio-posteriorly with ribbed protuberance in lateral view (Figs 53, 65); scapus dark brown or blackish, darker than head in dorsal view, rather stout and more protruding ventrally (Figs 49, 66); head more narrowed posteriorly (Figs 51, 63); medial area of first tergite high anteriorly (Figs 53, 65); slightly infusate apical area of fore wing narrow to medium-sized, remaining far from vein 1r-m (Figs 43, 56); stigmal spot smaller, up to dorsal third or half of first discal cell (Figs 43, 56) **5**
- 4 Stigmal spot of fore wing larger and up to vein m-cu, enclosing nearly entire vein 1-SR+M (Fig. 81); pterostigma narrowly blackish apically (Fig. 81); medio-basal area of second tergite distinctly triangular (Fig. 85); vein 1-SR+M of fore wing dark brown (Fig. 81); Indonesia (Java), India, Bhutan, Myanmar, *Vietnam, *China (Hainan) ***Maculibracon simlaensis*** (Cameron, 1899), **comb. n.**
- Stigmal spot of fore wing up to anterior half of first discal cell, enclosing 0.6 of vein 1-SR+M (Fig. 68); pterostigma yellow apically (Fig. 68); medio-basal area of second tergite nearly rhombic (Fig. 72); vein 1-SR+M of fore wing yellow (Fig. 68); *China (Yunnan).....***Maculibracon luteonervis* sp. n.**
- 5 Stigmal spot of fore wing smaller, up to anterior third of first discal cell (Fig. 56); pterostigma anteriorly dark brown (Fig. 56); medial area of first tergite gradually lowered anteriorly (Fig. 65); distal rim of fore wing distinctly infusate and area wider (Fig. 56); medio-posterior protuberance of propodeum with two medium-sized round tubercles (Fig. 65); *China (Yunnan) ***Maculibracon hei* sp. n.**
- Stigmal spot of fore wing larger, up to middle of first discal cell (Fig. 43); pterostigma anteriorly yellow (Fig. 43); medial area of first tergite steep anteriorly (Fig. 53); distal rim of fore wing only posteriorly narrowly infusate (Fig. 43); medio-posterior protuberance of propodeum with small round tubercle anteriorly followed by two short transverse crests (Fig. 53); *Thailand ***Maculibracon abruptus* sp. n.**

Descriptions

Craspedolcus Enderlein, 1920, s. str.

Figs 1–41

Craspedolcus Enderlein, 1920: 92; Shenefelt 1978: 1673; Quicke 1985: 354–357 (group A), 1987: 108; Quicke and van Achterberg 1990: 252. Type species (by original designation): *Craspedolcus trisulcatus* Enderlein, 1920.

Diagnosis. Scapus elongate, 2.6–2.9 times longer ventrally than its maximum width and protruding ventrally, rounded subbasally (Figs 12, 26, 41) and inner side without distinct ledge apically; face evenly convex; propodeum flat medio-posteriorly in lateral view (Figs 9, 25, 40); vein 3-SR of fore wing 2.5–3.4 times vein 2-SR (Figs 1, 15, 29); vein 1r-m of hind wing shorter than vein SC+R1 (Figs 1, 16, 30); vein cu-a of fore wing subinterstitial (Figs 1, 29) or shortly postfurcal and perpendicular (Fig. 15); fore wing elongate (Figs 1, 15, 29); hind wing with 3–5 subbasal bristles; surroundings of vein cu-a of hind wing setose; median carina of first tergite low and medial area gradually lowered anteriorly in lateral view (Figs 5, 9, 25, 40); second metasomal tergite below basal smooth areas striate; antero-lateral areas of second tergite large and touching large medio-basal area (Figs 5, 19, 33); median carina of second tergite medium-sized and weak (Figs 5, 19, 33); antero-lateral grooves of third tergite medium-sized and remaining far removed from each other (Figs 5, 19, 33); maximum width of third tergite 2.4–4.1 times its medial length (Figs 5, 19, 33); third and fourth tergites with transverse subposterior groove (Figs 5, 9, often crenulate but smooth in Chinese spp.); fifth and sixth tergites largely exposed and flat; subapically upper valve of ovipositor with small nodus, its lower valve fully exposed and with small teeth ventrally (Figs 10, 21, 35); hypopygium long and acute apically, reaching level of apex of metasoma (Figs 9, 14, 28); ovipositor sheath with short setae and 0.7–1.0 times as long as body.

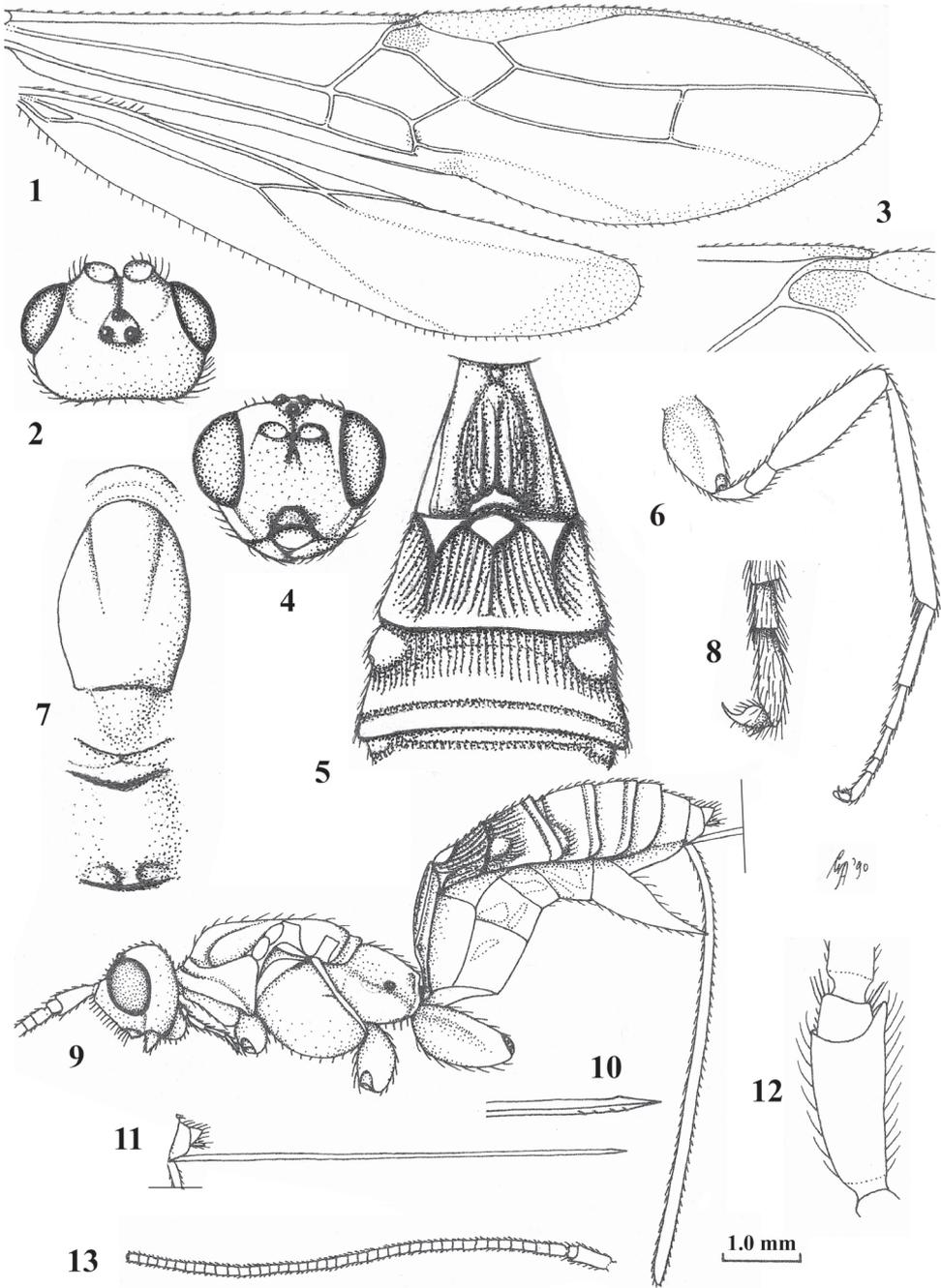
Distribution. Oriental (India, *China, Philippines, Sundanese region) and Wallacea (Sulawesi).

Craspedolcus fraternus Enderlein, 1920

Figs 14–27

Craspedolcus fraternus Enderlein, 1920: 92; Shenefelt 1978: 1673; Quicke and van Achterberg 1990: 252, 256 (lectotype designation).

Material. (6 ♀; IZCAS): 1 ♀, “[China:] Yunnan, Xishuangbanna, Meng’a, 1050–1080 m, 11.V.1958, Shuyong Wang, No. IOZ(E)1964633”; 1 ♀, “Yunnan, Xiaomengyang, 810 m, 31.III.1957, Shuyong Wang, No. IOZ(E)1964540”; 1 ♀, “Yunnan, Xishuangbanna, Mengla, 620–650 m, 15.XI.1958, Fuji Pu, No. IOZ(E)1964636”; 1 ♀, “Yunnan, Xishuangbanna, Menghai, 1200–1600 m, 16.VIII.1957, Lingchao Zang, No.



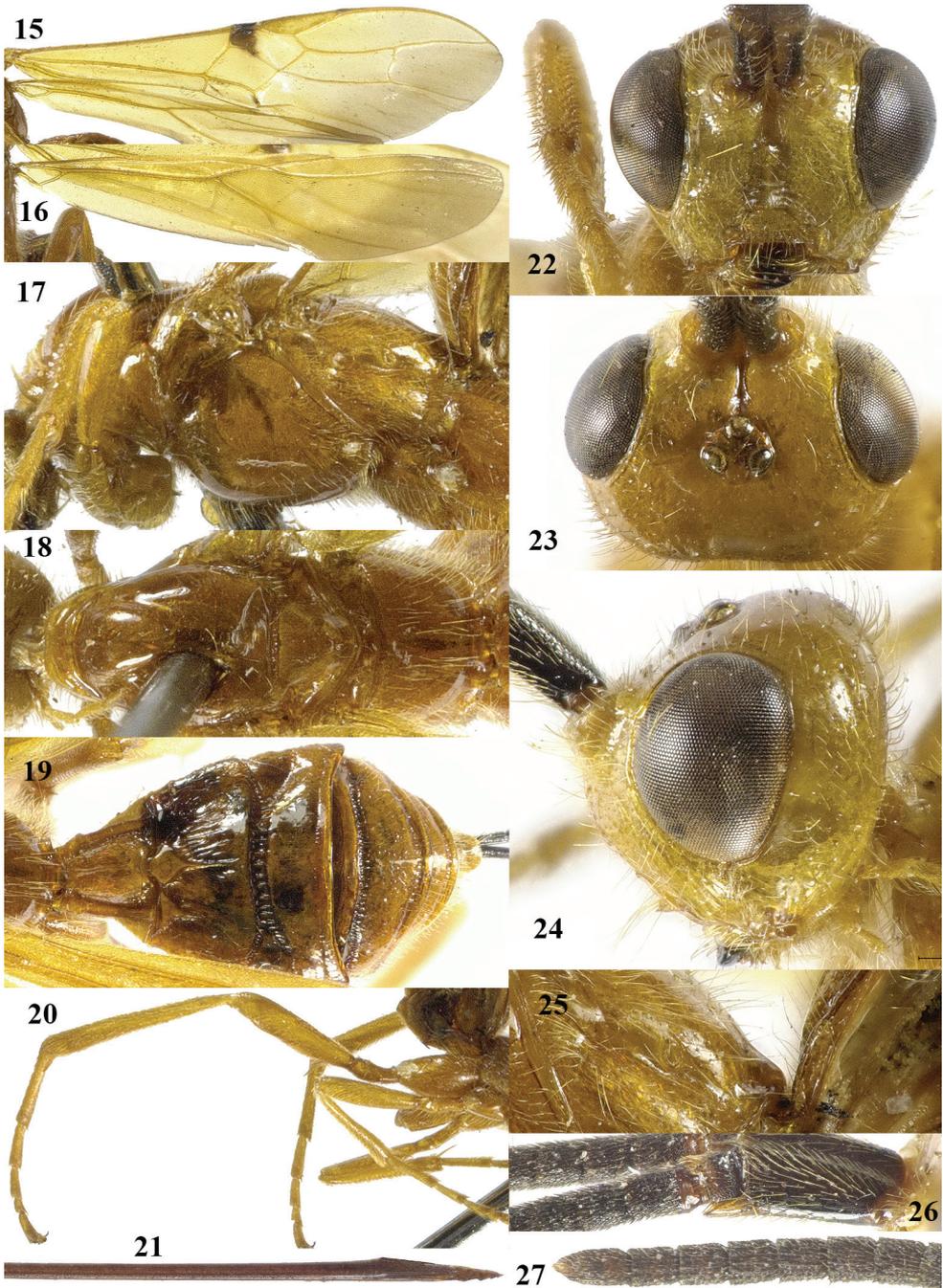
Figures 1–13. *Craspedolcus trisulcatus* Enderlein, ♀, lectotype. **1** wings **2** head dorsal **3** detail of vein 1-SR of fore wing **4** head anterior **5** first–third metasomal tergites dorsal **6** hind leg lateral **7** mesosoma dorsal **8**, outer hind claw lateral **9** habitus lateral **10** apex of ovipositor lateral **11** ovipositor **12** scapus outer side lateral **13** antenna lateral. **1, 6, 9, 11, 13:** scale-line (= 1 ×); **2–5, 7:** 2 ×; **8, 10, 12:** 5 ×.



Figure 14. *Craspedolcus fraternus* Enderlein, ♀, China (Yunnan), habitus lateral.

IOZ(E)1964634”; 1 ♀, “Yunnan, Simao, Mt. Puwenlong, 950–1300 m, 11.V.1957, Dahua Liu, No. IOZ(E)1964544”; 1 ♀, “Yunnan, Xishuangbanna, Gannanba, 650 m, 20.III.1957, Shuyong Wang, No. IOZ(E)1964545”.

Diagnosis. Body and hind leg brownish yellow; pterostigma yellow, at most apically infuscate (Fig. 15); fore wing with a distinct but small stigmal spot near parastigma, not intruding into first discal cell of fore wing (Fig. 15) or slightly so; first tergite smooth except for its median carina (Fig. 19); anterior half of second metasomal tergite longitudinally striate (except for smooth basal areas; Fig. 19) and remainder of tergite smooth; third tergite smooth basally and its transverse subposterior groove smooth (Fig. 19); length of ovipositor sheath 0.8–1.0 times both length of body and of fore wing.



Figures 15–27. *Craspedolcus fraternus* Enderlein, ♀, China (Yunnan). **15** fore wing **16** hind wing **17** mesosoma lateral **18** mesosoma dorsal **19** metasoma dorsal **20** hind leg lateral **21** apex of ovipositor lateral **22** head, anterior **23** head, dorsal **24** head lateral **25** propodeum lateral **26** scapus outer side lateral **27** apex of antenna.

Craspedolcus fraternus and *C. politus* are the only species of *Craspedolcus* s. str. having the transverse subposterior groove and basal half of the third tergite smooth, the first tergite smooth, shiny and its median carina low, second tergite smooth posteriorly, and ovipositor sheath with yellowish setae. *Craspedolcus fraternus* has a smaller stigmal spot than *C. politus* (Fig. 15 versus Fig. 29) and the anterior half of the second tergite more extensively striate (Fig. 19 versus Fig. 33).

Variation. Length of body of female 9.5–14.4 mm, of fore wing of female 11.0–15.2 mm, and of ovipositor sheath 9.6–15.0 mm; antenna of female with 68 (1), 69 (2), 71 (1) segments; vein 3-SR of fore wing 2.4–2.9 times vein 2-SR; length of first tergite 1.2–1.3 times its apical width; length of ovipositor sheath 0.82–0.99 times fore wing; mesosoma and metasoma ventrally yellowish brown or infuscated; fore wing with irregular stigmal spot up to vein 1-SR+M or apical 0.2 of first submarginal cell; ventrally apex of scapus more or less yellowish; vein cu-a of fore wing interstitial or narrowly postfurcal; extent of apical infuscation of hind wing as figured (Fig. 16) or somewhat less; face colour similar to that of mesoscutum or distinctly paler; vein 1-SR+M of fore wing yellow or partly brown; fore tarsus 1.3–1.4 times as long as fore tibia; long ventral setae of scapus appressed or erect.

Distribution. Indonesia (Sumatra), *China (Yunnan).

***Craspedolcus politus* sp. n.**

<http://zoobank.org/1D7F176D-641D-4CEB-9306-EE7CDBD67DB0>

Figs 28–41

Type material. Holotype, ♀ (IZCAS), “[China:] Hainan, Jianfengling, 4.V.1985, Maobin Gu, No. IOZ(E)1964586”. Paratypes (3 ♀; IZCAS): 1 ♀, same data as holotype, but No. IOZ(E)1964591; 1 ♀ id., 4.IV.1984, Youdong Lin, No. IOZ(E)1964590; 1 ♀, Hainan, [locality unknown], 8.VII.1982, Youdong Lin, No. IOZ(E)1964610.

Diagnosis. Body and hind leg yellowish brown; pterostigma yellow, but apically dark brown (Fig. 29); fore wing with stigmal spot up to vein CU1b, intruding in cells of fore wing below parastigma and included veins dark brown (Fig. 29); first tergite smooth except for its median carina and few striae (Fig. 33); second metasomal tergite smooth except for crenulae or short striae near outer side of antero-lateral areas and below nearly rhombical medio-basal area (Fig. 33); third tergite (including its transverse subposterior groove and both antero-lateral grooves) smooth (Fig. 33); length of ovipositor sheath 0.9 times body. For the separation from other species of *Craspedolcus*, see the diagnosis of *C. fraternus* Enderlein.

Description. Holotype, ♀, length of body 12.0 mm, of fore wing 12.8 mm, of ovipositor sheath 10.3 mm.

Head. Antenna 0.85 times as long as fore wing, with 71 segments; apical antennal segment with short spine, scapus slender, parallel-sided and distinctly protruding ventro-apically, with narrow indistinct apical ledge at inner side and basally gradually

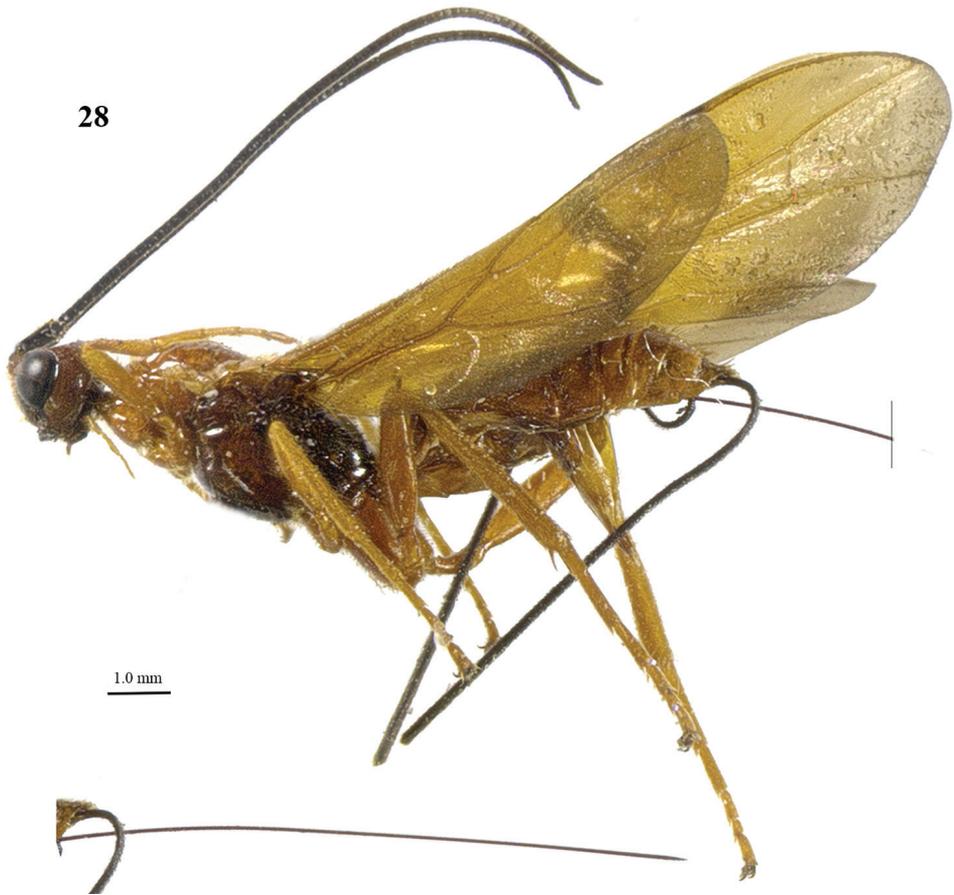
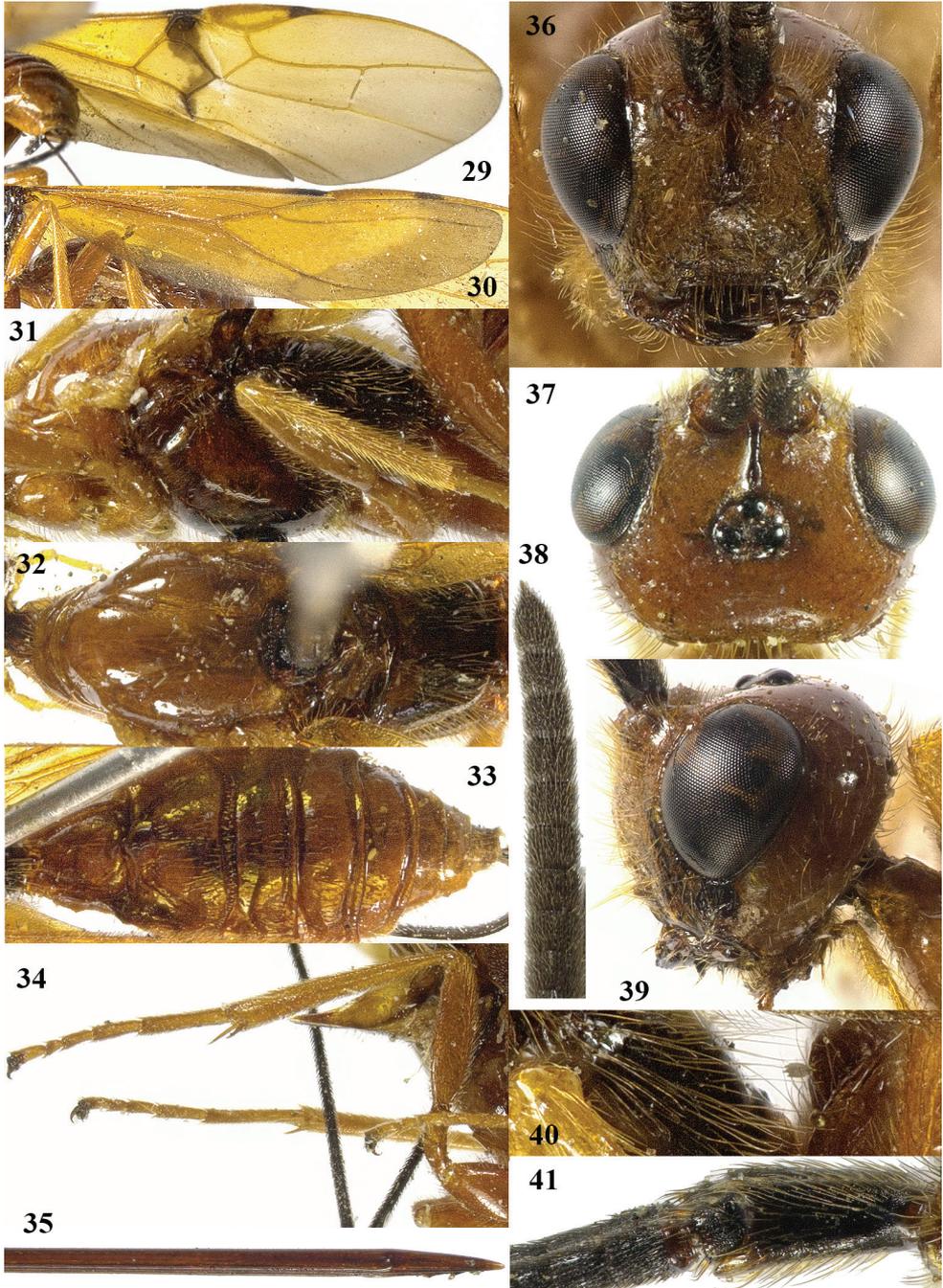


Figure 28. *Craspedolcus politus* sp. n., ♀, holotype, habitus lateral.

narrowed, its ventral setae erect (Figs 38, 41); third, fourth and penultimate segments 1.8, 1.2 and 1.1 times their maximum width, respectively; length of maxillary palp 0.8 times height of head; eye not emarginated (Fig. 36); face weakly and evenly convex, remotely finely punctate and with long erect yellowish setae; clypeus flat, superficially rugose, dorsally with weak carina and ventral margin thin and lamelliform protruding, with a row of long yellowish setae ventrally; hypoclypeal depression 0.5 times as wide as minimum width of face (Fig. 36); frons shallowly concave behind antennal sockets, with deep median groove, smooth except for a few punctures laterally (Fig. 36); vertex smooth except for few punctures and weakly convex, glabrous; OOL:diameter of posterior ocellus:POL = 30:7:5; in dorsal view length of eye 1.4 times temple; temples subparallel-sided behind eyes, with spaced setiferous punctures and long setae (Figs 37, 39); malar suture absent present and curved; length of malar space 0.8 times basal width of mandible; mandible twisted and with two wide teeth.



Figures 29–41. *Craspedolcus politus* sp. n., ♀, holotype. **29** fore wing **30** hind wing **31** mesosoma lateral **32** mesosoma dorsal **33** metasoma dorsal **34** hind leg lateral **35** apex of ovipositor lateral **36** head anterior **37** head dorsal **38** apex of antenna **39** head dorsal **40** propodeum lateral **41** scapus outer side lateral.

Mesosoma. Length of mesosoma 1.9 times its height (Fig. 31); side of pronotum shiny and smooth; propleuron with spaced punctures; pronotum vertical anteriorly and with a shallow groove and no antescutal depression; mesopleuron smooth and glabrous, anteriorly punctulate and sparsely setose; mesosternal sulcus smooth and narrow; metapleuron smooth and with long setae, convex; mesoscutum glabrous except some setae near notaulic courses, shiny and smooth; notauli shallowly impressed, smooth; scutellar sulcus present and with distinct fine crenulae; scutellum nearly flat anteriorly and smooth; side of scutellum smooth; metanotum medio-anteriorly with short carina, posteriorly evenly convex and smooth; propodeum smooth, with many long setae and evenly convex, medio-apically smooth in lateral view (Fig. 40).

Wings. Fore wing (Fig. 29): m-cu 0.8 times as long as 1-M; 1-SR+M sharply angled after arising from 1-M, 1.5 times as long as 1-M; 3-SR weakly curved, and SR1 straight; r:3-SR:SR1 = 6:36:41; 2-SR:3-SR:r-m = 13:35:13; r-m largely sclerotised; 1-CU1 widened and 0.06 times 2-CU1; cu-a vertical; CU1b narrower than 3-CU1. Hind wing (Fig. 30): with 4 coarse subbasal bristles on C+SC+R and with 3 hamuli on R1; SR weakly curved basally and marginal cell parallel-sided apically; subbasal cell near cu-a setose; 1r-m straight and 0.9 times as long as SC+R1; 2-SC+R 1.3 times longer than wide.

Legs. Tarsal claws simple and with long bristly setae ventrally; fore tarsus 1.5 times as long as fore tibia and tibia bristly setose and pimply anteriorly; length of femur, tibia and basitarsus of hind leg 4.2, 10.1 and 6.2 times their maximum width, respectively; hind tibia with dense appressed setae (Fig. 34); hind tibial spurs 0.3 and 0.4 times as long as hind basitarsus; inner side of hind tibia and tarsus densely bristly setose.

Metasoma. Length of first tergite 1.2 times its apical width, medial area low anteriorly, dorso-lateral carinae strongly developed, medial area smooth except for low median carina and few striae; second tergite largely smooth (including deep oblique anterior grooves) except for median carina connected to nearly rhombical medio-basal area and weak crenulae near medio-basal area and outer side of antero-lateral triangular areas (Fig. 33); second metasomal suture strongly crenulate, laterally narrowed and oblique; medially second tergite about as long as third tergite; maximum width of third tergite 3.5 times its medial length; third–fifth tergites smooth and with smooth transverse subposterior groove and antero-lateral grooves; ovipositor sheath 0.80 times as long as fore wing and 0.9 times body; hypopygium just surpassing apex of metasoma.

Colour. Yellowish brown; antenna (including entire scapus), mandible apically, stemmaticum, and ovipositor sheath dark brown or black; posterior half of mesosoma largely infuscate; apical 0.2 of pterostigma dark brown; remainder of pterostigma and wing membrane yellow, but fore wing with irregular stigmal spot up to vein CU1b, including dark brown veins 1-SR, 1-SR+M, m-cu and 3-CU1 and apically wings with wide infuscate area; remainder of veins brownish yellow (Figs 29, 30).

Variation. Length of body of female 10.4–12.0 mm, of fore wing of female 12.0–13.4 mm, and of ovipositor sheath 9.3–12.0 mm; antenna of female with 71 (2), 68 (1) segments; vein 3-SR of fore wing 2.6–3.0 times vein 2-SR; length of first tergite 1.2–1.3 times its apical width; length of ovipositor sheath 0.78–0.90 times fore wing;

mesosoma and metasoma ventrally yellowish brown or infuscated; infusate apical part of fore wing up to vein r-m or somewhat narrower; ventrally apex of scapus more or less yellowish vein cu-a of fore wing interstitial or narrowly postfurcal; fore tarsus 1.4–1.5 times as long as fore tibia; apical infuscation of hind wing as figured (Fig. 30) or somewhat wider; face colour similar to that of mesoscutum or paler.

Distribution. China (Hainan).

Etymology. Named “politus” (Latin for “made smooth”) because of the smooth transverse subposterior grooves of the metasoma and the smooth third tergite.

***Maculibracon* gen. n.**

<http://zoobank.org/7FFC7170-6E03-45F7-9177-71052DFD6FEA>

Figs 42–91

Craspedolcus Enderlein, 1920: 92 (p.p.); Shenefelt 1978: 1673 (p.p.); Quicke 1985: 354–357 (group B), 1987: 108 (p.p.); Quicke and van Achterberg 1990: 252 (p.p.).

Type species. *Maculibracon abruptus* sp. n.

Diagnosis. Scapus stout, 1.5–2.2 times longer than its maximum width and protruding ventrally (Figs 49, 66, 74, 91), rounded subbasally and inner side at most with narrow ledge apically; face flattened medially; propodeum medio-posteriorly more or less protruding in lateral view (Figs 53, 65, 78, 90); vein 3-SR of fore wing 2.4–2.8 times vein 2-SR (Figs 43, 56, 68, 81); vein 1r-m of hind wing 1.0–1.6 times as long as vein SC+R1 (Figs 44, 57, 69, 82); vein 3-SR of fore wing 0.9 times as long as vein SR1 or longer (Figs 43, 56, 68, 81); hind wing with 4–5 subbasal bristles; vein cu-a of fore wing strongly postfurcal and inclivous (Figs 43, 56, 68, 81); fore wing elongate (Figs 43, 56, 68, 81); median carina of first tergite high and medial area steep anteriorly in lateral view (Figs 53, 65, 78, 90); second metasomal tergite below basal areas smooth; antero-lateral areas of second tergite minute and remaining from small medio-basal area (Figs 47, 60, 72, 85); median carina of second tergite long and high (Figs 47, 60, 72, 85); strongly oblique antero-lateral grooves of third tergite long and almost meeting submedially (Figs 47, 60, 72, 85); maximum width of third tergite 2.7–3.2 times its medial length (Figs 47, 60, 72, 85); third and fourth tergites without transverse subposterior groove (Figs 47, 60, 72, 85); fifth and sixth tergites largely exposed and flat; subapically upper valve of ovipositor with small nodus, its lower valve fully exposed and with small teeth ventrally (Figs 54, 79); hypopygium medium-sized and subtruncate apically, not reaching level of apex of metasoma (Figs 42, 55, 67, 80); ovipositor sheath narrow, with short yellowish setae and 0.4–0.8 times as long as body.

Distribution. Oriental (India, Bhutan, Myanmar, *Thailand, *Vietnam, *China, Philippines, Sundanese region).

Etymology. Name derived from “macula” (Latin for “spot, mark”) and the generic name *Bracon*, because of the conspicuous dark spot of the fore wing. Gender: masculine.

Notes. Quicke (1985) already indicated that *Craspedolcus* was heterogeneous; he divided the genus in two groups. Group A includes the type species (= *Craspedolcus* s. str.) and group B is described in this paper as new genus. The new genus is similar to the Afrotropical genus *Serraulax* Quicke, 1987, but differs by having the inner apex of scapus simple or with a minor ledge (*versus* with moderately wide ledge formed by a false margin in *Serraulax*), vein 1r-m of hind wing about as long as vein SC+R1 (*versus* distinctly longer), vein 2-SC+R of hind wing hardly longer than wide (*versus* distinctly longer than wide), vein cu-a of fore wing distinctly inclivous (*versus* more or less perpendicular), median carina of first tergite present anteriorly (*versus* absent anteriorly), second tergite smooth (*versus* distinctly longitudinally striate) and third tergite without subposterior transverse groove (*versus* with subposterior groove present).

Some species of the genus *Hybogaster* Szépligeti, 1906, are very similar to the new genus (e.g. first tergite with strong median carina and medial area protuberant anteriorly, wings elongate and mainly yellow, and fore wing with a dark stigmal spot). They differ by having the second tergite spaced longitudinally striate, the scapus short ovoid and not protruding ventrally, antero-lateral grooves of third tergite subvertical and indistinct because of the depression near it, vein 1-SR+M of fore wing straight or nearly so and upper valve of ovipositor without subapical nodus, depressed and covering the narrow and ventrally smooth lower valve. The genus *Hybogaster* remains unknown from China; the holotype of the only reported species, *Hybogaster zebripteræ* Wang & Chen, 2008, from China (Fujian) has been examined and proved to belong to *Iphiaulax* Foerster, 1863, comb. n.

The following names form new combinations in *Maculibracon* gen. n.: *Bracon lepcha* Cameron, 1899; *B. phaedo* Cameron, 1899; *B. simlaensis* Cameron, 1899; *Iphiaulax bhotanensis* Cameron, 1907; *I. laertius* Cameron, 1903; *I. leptopterus* Cameron, 1903; *I. lineaticarinatus* Cameron, 1907; *Ipobracon lissotomus* Roman, 1914; *I. maculicosta* Enderlein, 1920, and *I. pallidicornis* Roman, 1914.

***Maculibracon abruptus* sp. n.**

<http://zoobank.org/90A521BE-A3BD-4B2C-9576-C7C8CF0C9AF6>

Figs 42–54

Type material. Holotype, ♀ (RMNH), “Peninsular **Thailand**, NW [of] Phuket, Nai Yang, 26.II-4.III.[20]07, [S.] Risch”.

Diagnosis. Entire scapus dark brown, rather stout and rather protruding ventrally; head distinctly narrowed posteriorly (Fig. 51); pterostigma entirely yellow; stigmal spot of fore wing rather large, up to middle of first discal cell (Fig. 43); wing membrane of fore wing yellow distally only posteriorly narrowly infusate remaining far from vein 1r-m (Fig. 43); medio-posterior protuberance of propodeum with small round tubercle anteriorly followed by two short transverse crests, ribbed in lateral view (Fig. 53); medial area of first tergite high and steep anteriorly (Fig. 53); body and hind leg brownish yellow; length of ovipositor sheath 0.5 times fore wing and 0.6 times body. Similar to *M. leptopterus*



42

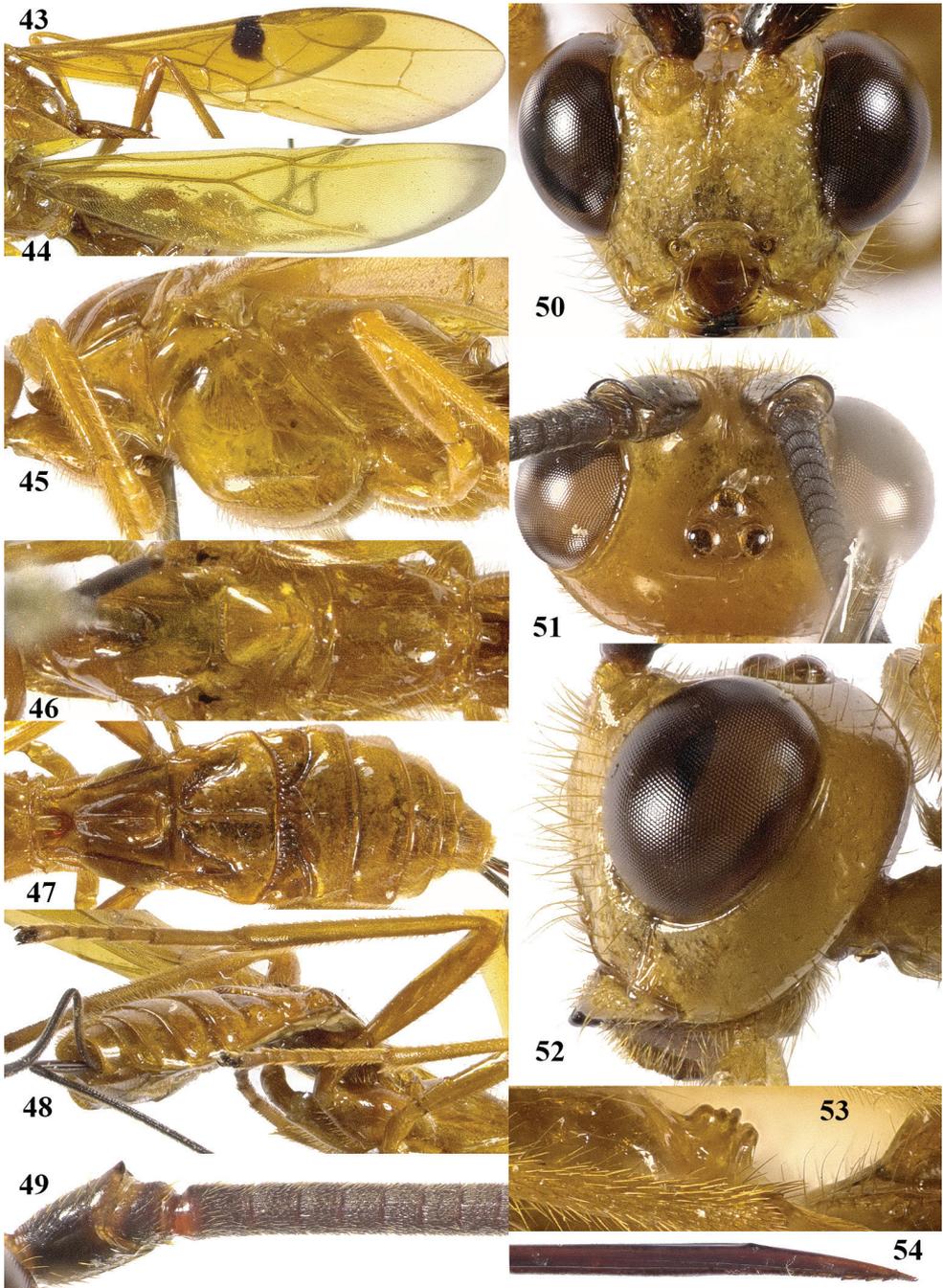
1.0 mm

Figure 42. *Maculibracon abruptus* sp. n., ♀, holotype, habitus lateral.

(Cameron, 1903) because of dark scapus, stigmal spot up to middle of first discal cell and anteriorly steep medial area of first tergite. The new species differs by the longer ovipositor sheath (0.7 times *versus* 0.4 times in *M. leptopterus* according to the original description), the sculpture of the second metasomal tergite (absent *versus* crenulate or striate near smooth antero-lateral areas), colour of the setae of the face (yellow *versus* fuscous), the shape of the medio-posterior protuberance of the propodeum (posteriorly with two short transverse crests *versus* no crests) and the colour of the pterostigma (yellow apically *versus* dark brown).

Description. Holotype, ♀, length of body 14.5 mm, of fore wing 16.2 mm, of ovipositor sheath 8.7 mm.

Head. Antenna incomplete, with 60 segments remaining; scapus rather stout, 1.6 times longer than wide and distinctly emarginated apically, slightly longer ventrally than dorsally in lateral view, with a narrow apical ledge at inner side and gradually narrowed basally (Fig. 49); third and fourth segments 1.5 and 0.9 times their maximum width, respectively; length of maxillary palp as long as the height of head; inner side of eye not emarginated but slightly sinuate (Fig. 50); face moderately convex but flattened medially and medio-dorsally with weak median crest, sparsely punctate, and with long erect setae; clypeus flat, nearly smooth, dorsally with coarse curved carina and ventral margin thin and lamelliform, with few long setae ventrally; hypoclypeal de-



Figures 43–54. *Maculibracon abruptus* sp. n., ♀, holotype. **43** fore wing **44** hind wing **45** mesosoma lateral **46** mesosoma dorsal **47** metasoma dorsal **48** hind leg lateral **49** scapus outer side lateral **50** head anterior **51** head dorsal **52** head lateral **53** propodeum lateral **54** apex of ovipositor lateral.

pression 0.4 times as wide as minimum width of face (Fig. 50); frons shallowly concave behind antennal sockets, smooth, except for a rather shallow median groove (Fig. 50); vertex smooth, except for with some shallow setiferous punctures with long setae and shiny; stemmaticum distinctly protruding; OOL:diameter of posterior ocellus:POL = 31:15:9; in dorsal view length of eye 2.1 times temple; temples linearly narrowed behind eyes, with some long setae, punctate dorsally and sparsely punctate ventrally (Fig. 51, 52); malar suture shallow, curved; length of malar space 0.8 times basal width of mandible; mandible twisted, both teeth robust and subequal.

Mesosoma. Length of mesosoma 1.7 times its height; side of pronotum shiny and smooth (Fig. 45); propleuron with spaced punctures; pronotum vertical anteriorly, with a shallow pronope and groove and narrow antescutal depression; mesopleuron smooth and glabrous, except for an oblique band with punctures and short setae; mesosternal sulcus smooth and narrow; metapleuron smooth and with long setae, convex; mesoscutum glabrous except some setae near notaulic courses, shiny and smooth; notauli smooth, only distinct anteriorly and medially shallowly impressed; scutellar sulcus present and with distinct fine crenulae; scutellum distinctly convex and smooth except for some punctures; side of scutellum smooth; metanotum medio-anteriorly with short carina, posteriorly evenly convex and smooth; propodeum distinctly remotely punctate, with long setae, evenly convex but medio-posteriorly with protuberance consisting of small round tubercle anteriorly followed by two short transverse crests (Fig. 46), ribbed in lateral view (Fig. 53).

Wings. Fore wing (Fig. 43): m-cu 0.8 times as long as 1-M; 1-SR+M weakly bent subbasally 1.3 times as long as 1-M; 3-SR weakly curved, and SR1 straight; r:3-SR:SR1 = 10:56:46; 2-SR:3-SR:r-m = 20:54:20; r-m largely sclerotised; 1-CU1 slightly widened and 0.14 times 2-CU1; cu-a weakly inclivous; CU1b nearly as wide as 3-CU1. Hind wing (Fig. 44): with 4 coarse subbasal bristles on C+SC+R and with 3 hamuli on R1; SR weakly curved basally and marginal cell parallel-sided apically; area near cu-a glabrous; 1r-m straight and 1.6 times as long as SC+R1; 2-SC+R as wide as long.

Legs. Tarsal claws simple and with long bristly setae ventrally; length of femur, tibia and basitarsus of hind leg 5.0, 12.0 and 7.3 times their maximum width, respectively; hind tibia with dense and rather appressed setae; hind tibial spurs 0.3 and 0.4 times as long as hind basitarsus; inner side of hind tibia and tarsus densely bristly setose (Fig. 48).

Metasoma. Length of first tergite 1.3 times its apical width, dorso-lateral carinae strongly developed, medial area smooth except for high median carina and medial area steep anteriorly (Figs 47, 53); second tergite smooth (including deep oblique anterior grooves) except strong median carina connected to minute triangular medio-basal area, antero-lateral triangular areas large (Fig. 47); second metasomal suture strongly crenulated, laterally narrowed and weakly up curved; medially second tergite 1.6 times longer than third tergite; maximum width of third tergite 3.0 times its medial length; third–fifth tergites smooth and without transverse subposterior groove and with long antero-lateral grooves; ovipositor sheath 0.54 times as long as fore wing and 0.6 times body; hypopygium ending just anterior of apex of metasoma.

Colour. Yellowish brown; antenna (but small part of scapus brown) and mandible apically dark brown; ovipositor sheath blackish with yellow setae; stigmal spot medium-sized, up to dorsal third of first discal cell (Fig. 43); veins yellow except dark brown basal half of 1-SR+M and most of 1-SR; wing membrane yellow, except for stigmal spot and infusate narrow apical margin (Figs 43, 44).

Distribution. *Thailand.

Etymology. Named after the medio-anterior steep part of the first tergite: “abruptus” is Latin for “steep”.

***Maculibracon hei* sp. n.**

<http://zoobank.org/859877FC-DF4C-4BF8-BFE5-08CE11C94144>

Figs 55–66

Type material. Holotype, ♀ (IZCAS), “[China:] Yunnan, Lancang, 1000 m, 30.VII.1957, Lingchao Zang, No. IOZ(E)1964638”.

Diagnosis. Entire scapus dark brown or black, rather stout and more protruding ventrally; head rather directly narrowed posteriorly (Fig. 63); stigmal spot rather small, up to anterior third of first discal cell (Fig. 56); wing membrane yellow with slightly infusate apical area of fore wing medium-sized, but remaining far from vein 1r-m (Figs 56, 57); pterostigma anteriorly dark brown and remainder yellow; medio-posterior protuberance of propodeum with two medium-sized round tubercles, ribbed in lateral view (Fig. 65); medial area of first tergite high anteriorly and gradually lowered basally (Figs 60, 65); body and hind leg brownish yellow; length of ovipositor sheath 0.6 times fore wing and 0.7 times body. Similar to *M. leptopterus* (Cameron, 1903) because of dark scapus and medium-sized stigmal spot. The new species differs by the longer ovipositor sheath (0.7 times *versus* 0.4 times in *M. leptopterus* according to the original description), the sculpture of the second metasomal tergite (absent *versus* crenulate or striate near smooth antero-lateral areas), colour of the setae of the face (yellow *versus* fuscous), the size of the stigmal spot (up to anterior third of first discal cell *versus* up to middle of cell) and the colour of the pterostigma (anteriorly dark brown *versus* yellow except dark brown apex).

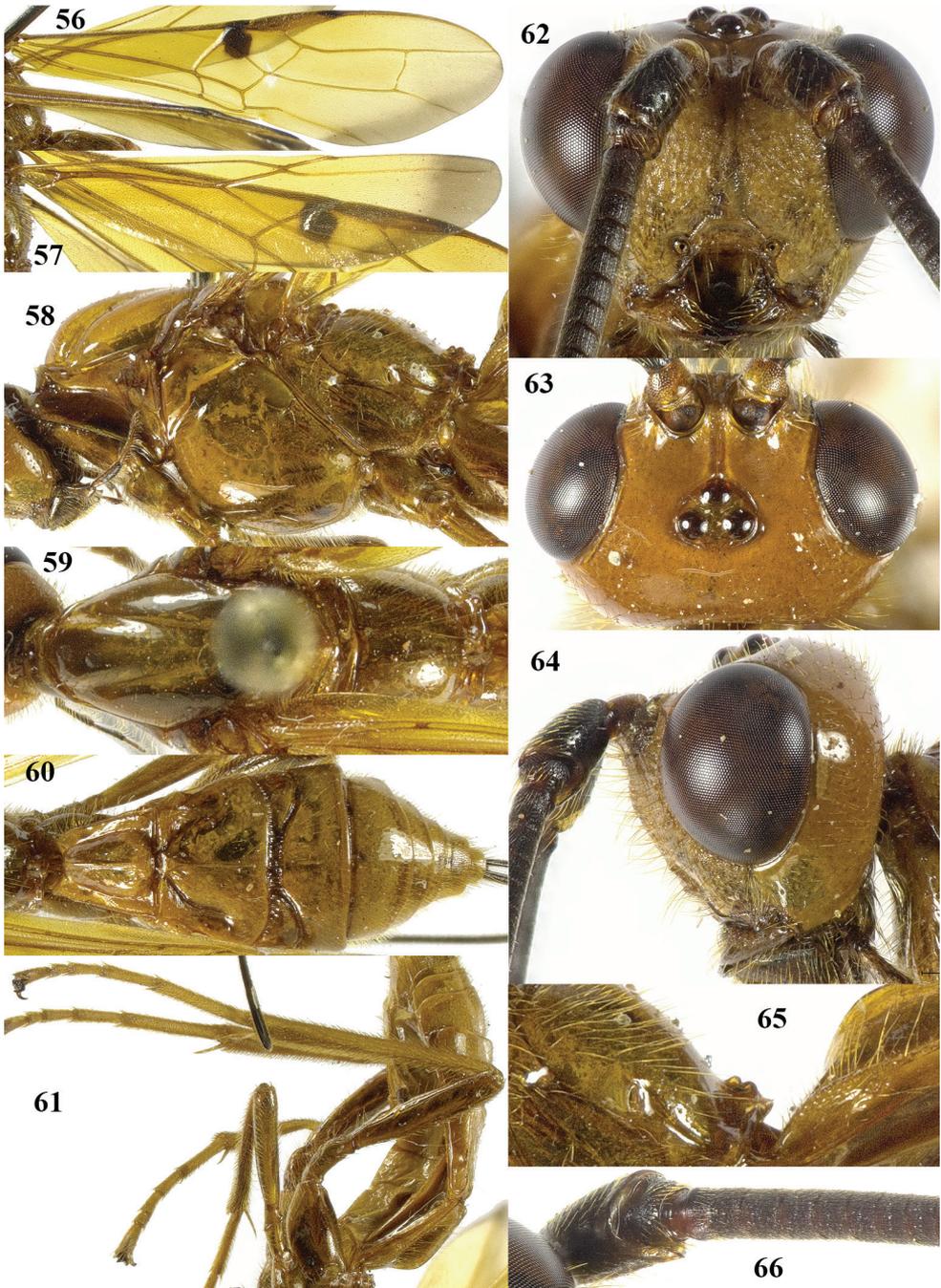
Description. Holotype, ♀, length of body 17.2 mm, of fore wing 17.8 mm, of ovipositor sheath 11.2 mm.

Head. Antenna incomplete, left antenna with 83 segments remaining, right antenna with 67 segments remaining; scapus rather stout, 1.5 times longer than wide and distinctly emarginate apically, longer ventrally than dorsally in lateral view, with a narrow apical ledge at inner side and gradually narrowed basally (Fig. 66); third and fourth segments 1.7 and 1.1 times their maximum width, respectively; length of maxillary palp as long as height of head; inner side of eye not emarginated but slightly sinuate (Fig. 63); face moderately convex but flattened medially and medio-dorsally with weak median crest, coarsely and densely punctate, and with long erect setae; clypeus flat, rugose, dorsally with coarse curved carina and ventral margin thin and



Figure 55. *Maculibracon hei* sp. n., ♀, holotype, habitus lateral.

lamelliform, with few long setae ventrally; hypoclypeal depression 0.3 times as wide as minimum width of face (Fig. 62); frons shallowly concave behind antennal sockets, rugose, with a rather shallow median groove (Fig. 62); vertex smooth, with few long setae and shiny; stemmaticum distinctly protruding; OOL:diameter of posterior ocellus:POL = 25:10:8; in dorsal view length of eye 2.3 times temple; temples directly



Figures 56–66. *Maculibracon hei* sp. n., ♀, holotype. **56** fore wing **57** hind wing **58** mesosoma lateral **59** mesosoma dorsal **60** metasoma dorsal **61** hind leg lateral **62** head anterior **63** head dorsal **64** head lateral **65** propodeum lateral **66** scapus outer side lateral.

narrowed behind eyes, with some long setae, punctate dorsally and sparsely punctate ventrally (Fig. 63, 64); malar suture shallow, curved; length of malar space 0.8 times basal width of mandible; mandible twisted, both teeth robust and subequal.

Mesosoma. Length of mesosoma 1.8 times its height (Fig. 58); side of pronotum shiny and smooth; propleuron with spaced punctures; pronotum vertical anteriorly, with a shallow pronope and groove and narrow antescutal depression; mesopleuron smooth and glabrous, except for an oblique band with punctures and short setae; mesosternal sulcus smooth and narrow; metapleuron smooth and with long setae, convex; mesoscutum glabrous except some setae near notaulic courses, shiny and smooth; notauli smooth, only distinct anteriorly and medially shallowly impressed; scutellar sulcus present and with distinct fine crenulae; scutellum distinctly convex and smooth except for some very sparse punctulation; side of scutellum smooth; metanotum medio-anteriorly with short carina, posteriorly evenly convex and smooth; propodeum distinctly remotely punctate, with long setae, evenly convex but medio-posteriorly with protuberance consisting of small medium-sized round tubercles anteriorly followed by two short transverse crests (Fig. 59), ribbed in lateral view (Fig. 65).

Wings. Fore wing (Fig. 56): m-cu 0.6 times as long as 1-M; 1-SR+M angularly bent subbasally 1.2 times as long as 1-M; 3-SR weakly curved, and SR1 straight; r:3-SR:SR1 = 5:29:24; 2-SR:3-SR:r-m = 11:29:11; r-m largely sclerotised; 1-CU1 slightly widened and 0.17 times 2-CU1; cu-a weakly inclivous; CU1b nearly as wide as 3-CU1. Hind wing (Fig. 57): with 4 or 5 coarse subbasal bristles on C+SC+R and with 3 hamuli on R1; SR weakly curved basally and marginal cell subparallel-sided apically; area near cu-a glabrous; 1r-m straight and 1.3 times as long as SC+R1; 2-SC+R as wide as long.

Legs. Tarsal claws simple and with long bristly setae ventrally; length of femur, tibia and basitarsus of hind leg 5.2, 12.5 and 7.9 times their maximum width, respectively; hind tibia with dense and rather appressed setae; hind tibial spurs 0.3 and 0.4 times as long as hind basitarsus; inner side of hind tibia and tarsus densely bristly setose (Fig. 61).

Metasoma. Length of first tergite 1.3 times its apical width, dorso-lateral carinae strongly developed, medial area smooth except for high median carina and medial area steep anteriorly (Fig. 60, 65); second tergite smooth (including deep oblique anterior grooves) except strong median carina connected to minute triangular medio-basal area, antero-lateral triangular areas large (Fig. 60); second metasomal suture strongly crenulated, laterally narrowed and weakly up curved; medially second tergite 1.5 times longer than third tergite; maximum width of third tergite 2.7 times its medial length; third and fourth tergites with rather weakly median carina; third–fifth tergites smooth and without transverse subposterior groove and with long antero-lateral grooves; ovipositor sheath 0.63 times as long as fore wing and 0.65 times body; hypopygium ending just anterior of apex of metasoma (Fig. 55).

Colour. Yellowish brown; antenna (included scapus) and mandible apically dark brown; ovipositor sheath blackish with yellow setae; stigmal spot rather small, up to 0.4 anterior of first discal cell (Fig. 56); apical 0.2 of pterostigma dark brown and remainder

yellow; veins yellow except dark brown basal half of 1-SR+M and most of 1-SR; wing membrane yellow, except for stigmal spot and slightly infusate apical area of fore wing medium-sized, but remaining far from vein 1r-m (Figs 56, 57).

Distribution. *China (Yunnan).

Etymology. Named in honour of Prof. Dr Jun-hua He (Hangzhou) for his significant contribution to our knowledge of the Chinese Hymenoptera.

***Maculibracon luteonervis* sp. n.**

<http://zoobank.org/1C7553C2-DF16-437F-AC89-95E3BBF141EC>

Figs 67–79

Type material. Holotype, ♀ (IZAS), “[China:] Yunnan, Xishuangbanna, Menghun, 750 m, 1.VI.1958, Yiran Zhang, No. IOZ(E)1964632”.

Diagnosis. Scapus mainly yellowish brown, except for dark brown stripe on outer side, rather slender and less protruding ventrally (Fig. 74); head roundly narrowed posteriorly (Fig. 76); propodeum medio-posteriorly with smooth protuberance in lateral view (Fig. 78); medial area of first tergite low anteriorly (Fig. 78); wing membrane yellow with slightly infusate apical area of fore wing wide and rather close to vein 1r-m; stigmal spot of fore wing up to anterior half of first discal cell, enclosing 0.6 of vein 1-SR+M (Figs 68, 69); pterostigma entirely yellow (Fig. 68); medio-basal area of second tergite nearly rhombic (Fig. 72); vein 1-SR+M of fore wing yellow; body and hind leg brownish yellow; length of ovipositor sheath 0.8 times fore wing and 0.8 times body. Similar to *M. laertius* (Cameron, 1903) because of the yellowish scapus in dorsal view, medium-sized stigmal spot of the fore wing, anteriorly low medial area of the first tergite and the wide apical infusate area of the fore wing. The new species differs by having the apex of the pterostigma yellow (*versus* dark brown in *M. laertius*), ovipositor sheath 0.8 times fore wing (*versus* about 0.4 times), stigmal spot nearly square (*versus* obliquely narrowed) and head gradually roundly narrowed posteriorly in dorsal view (*versus* obliquely narrowed).

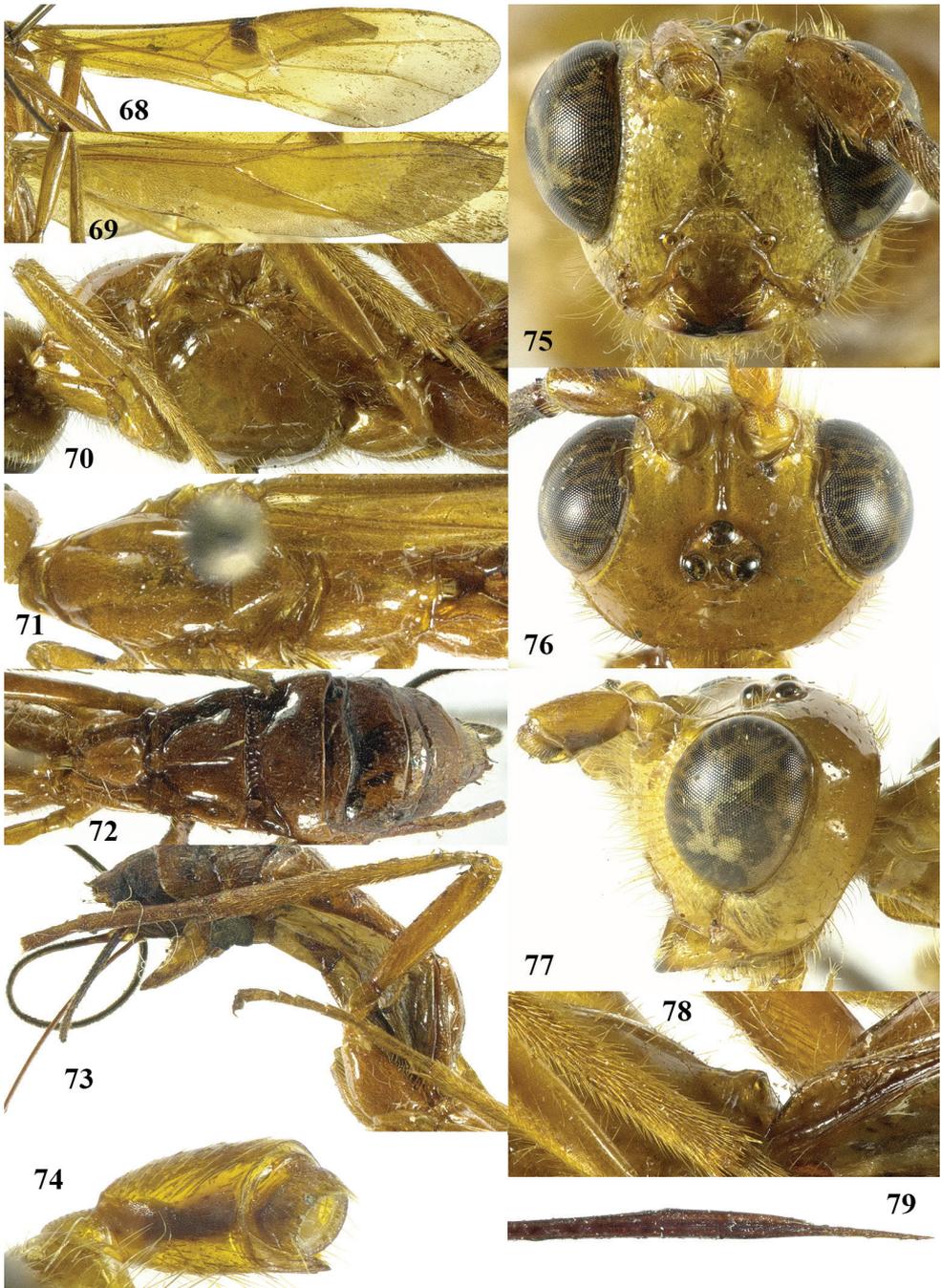
Description. Holotype, ♀, length of body 17.1 mm, of fore wing 16.7 mm, of ovipositor sheath 13.0 mm.

Head. Antenna incomplete, left antenna with 75 segments remaining; scapus rather stout, 1.5 times longer than wide and distinctly emarginated apically, slightly longer ventrally than dorsally in lateral view, with a narrow apical ledge at inner side and gradually narrowed basally (Fig. 74); third and fourth segments 1.4 and 1.0 times their maximum width, respectively; length of maxillary palp as long as the height of head; inner side of eye not emarginated but slightly sinuate (Fig. 75); face moderately convex but flattened medially and medio-dorsally with weak median crest, densely punctate, and with long erect setae; clypeus flat, punctate, dorsally with coarse curved carina and ventral margin thin and lamelliform, with few long setae ventrally; hypoclypeal depression 0.4 times as wide as minimum width of face (Fig. 75); frons shallowly concave behind antennal sockets, smooth, except for a rather shallow median groove (Fig. 75);



Figure 67. *Maculibracon luteonervis* sp. n., ♀, holotype, habitus lateral.

vertex smooth, with few long setae and shiny; stemmaticum distinctly protruding; OOL:diameter of posterior ocellus:POL = 24:9:8; in dorsal view length of eye 1.9 times temple; temples gradually roundly narrowed behind eyes, with some long setae, almost smooth dorsally and sparsely punctate ventrally (Figs 76, 77); malar suture shallow, curved; length of malar space 0.8 times basal width of mandible; mandible twisted, both teeth robust and subequal.



Figures 68–79. *Maculibracon luteonervis* sp. n., ♀, holotype. **68** fore wing **69** hind wing **70** mesosoma lateral **71** mesosoma dorsal **72** metasoma dorsal **73** hind leg lateral **74** scapus outer side lateral **75** head anterior **76** head dorsal **77** head lateral **78** propodeum lateral **79** apex of ovipositor lateral.

Mesosoma. Length of mesosoma 2.1 times its height (Fig. 70); side of pronotum shiny and smooth; propleuron with spaced punctures; pronotum vertical anteriorly, with a shallow pronope and groove and narrow antescutal depression; mesopleuron smooth and glabrous, except for an oblique band with punctures and short setae; mesosternal sulcus smooth and narrow; metapleuron smooth and with long setae, convex; mesoscutum glabrous except some setae near notaulic courses, shiny and smooth; notauli smooth, only distinct anteriorly and medially shallowly impressed; scutellar sulcus present and with distinct fine crenulae; scutellum distinctly convex and smooth except for some punctures; side of scutellum smooth; metanotum medio-anteriorly with short carina, posteriorly evenly convex and smooth; propodeum distinctly remotely punctate, with long setae, evenly convex but medio-posteriorly with one smooth protuberance (Fig. 71), ribbed in lateral view (Fig. 78).

Wings. Fore wing (Fig. 68): m-cu 0.8 times as long as 1-M; 1-SR+M angularly bent subbasally 1.4 times as long as 1-M; 3-SR weakly curved, and SR1 straight; r:3-SR:SR1 = 10:55:59; 2-SR:3-SR:r-m = 20:55:19; r-m largely sclerotised; 1-CU1 slightly widened and 0.18 times 2-CU1; cu-a weakly inclivous; CU1b nearly as wide as 3-CU1. Hind wing (Fig. 69): with 6 coarse subbasal bristles on C+SC+R and with 3 hamuli on R1; SR weakly curved basally and marginal cell parallel-sided apically; area near cu-a glabrous; 1r-m straight and 0.95 times as long as SC+R1; 2-SC+R twice longer than wide.

Legs. Tarsal claws simple and with long bristly setae ventrally; length of femur, tibia and basitarsus of hind leg 5.3, 10.0 and 7.9 times their maximum width, respectively; hind tibia with dense and rather appressed setae; one hind tibial spur 0.2 times as long as hind basitarsus, the other is broken; inner side of hind tibia and tarsus densely bristly setose (Fig. 73).

Metasoma. Length of first tergite 1.5 times its apical width, dorso-lateral carinae strongly developed, medial area smooth except for high median carina and medial area steep anteriorly (Figs 72, 78); second tergite smooth (including deep oblique anterior grooves) except strong median carina connected to minute nearly rhombic medio-basal area, antero-lateral triangular areas large (Fig. 72); second metasomal suture strongly crenulate, laterally narrowed and weakly up curved; medially second tergite 1.4 times longer than third tergite; maximum width of third tergite 2.7 times its medial length; third–fifth tergites smooth and without transverse subposterior groove and with long antero-lateral grooves; ovipositor sheath 0.78 times as long as fore wing and 0.76 times body; hypopygium ending just anterior of apex of metasoma (Fig. 67).

Colour. Brownish yellow; antenna (scapus mainly yellowish brown, except for dark brown stripe on outer side) and mandible apically dark brown; ovipositor sheath blackish with yellow setae; stigmal spot medium-sized, up to anterior half of first discal cell, enclosing 0.6 of vein 1-SR+M (Fig. 68); veins yellow (included 1-SR+M) except dark brown basal half of 1-SR; pterostigma entirely yellow (Fig. 68); wing membrane yellow, with slightly infuscate apical area of fore wing wide and rather close to vein 1r-m (Figs 68, 69).



Figure 80. *Maculibracon simlaensis* (Cameron), ♀, Vietnam, habitus lateral.

Distribution. *China (Yunnan).

Etymology. Named after the yellow vein 1-SR+M of the fore wing, contrasting with the dark brown surrounding stigmal spot. “Luteus” is Latin for “yellow” and “nervus” for “sinew, vein”.

***Maculibracon simlaensis* (Cameron, 1899), comb. n.**

Figs 80–91

Bracon simlaensis Cameron, 1899: 65–66.

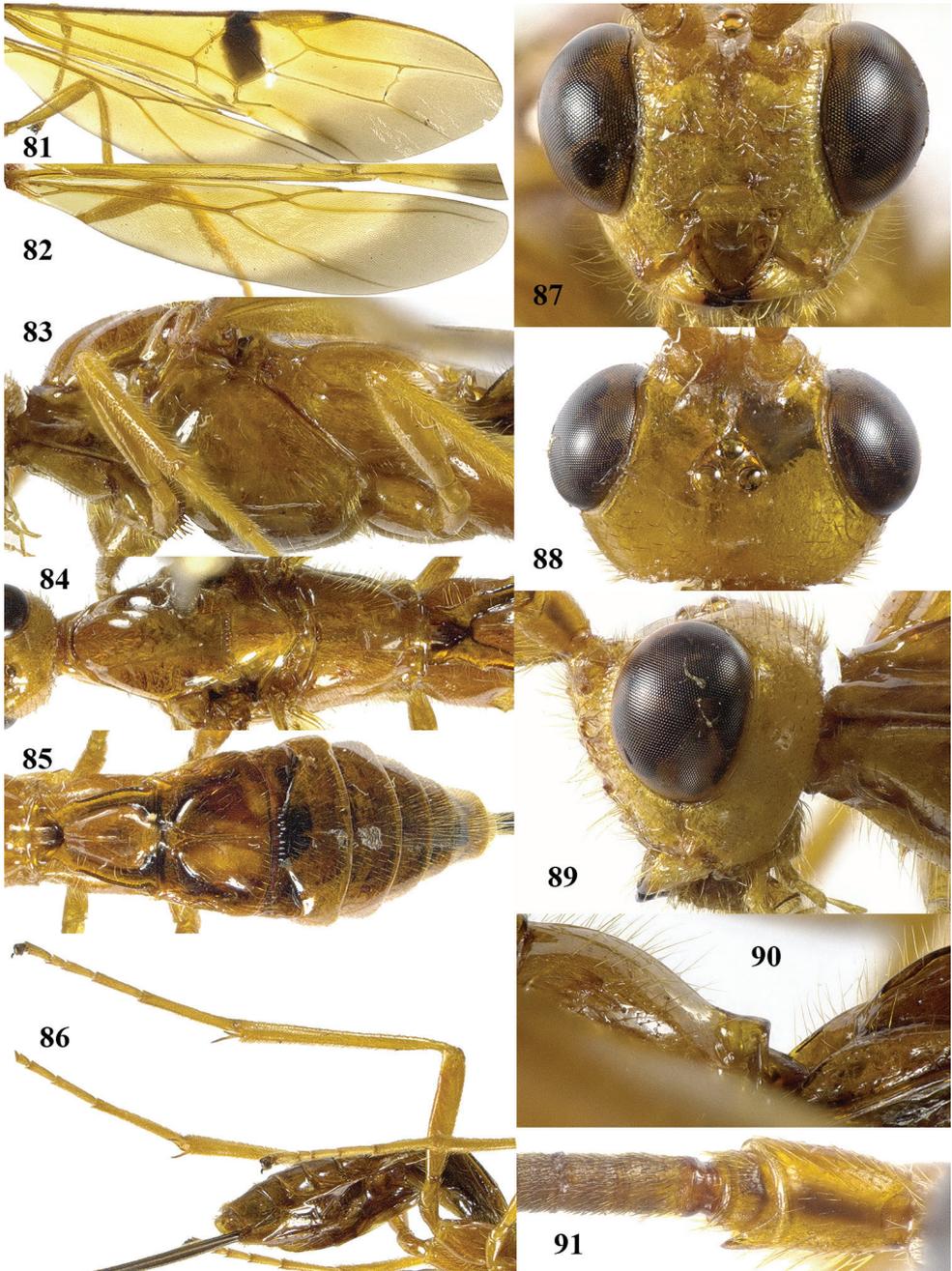
Iphiaulax simlaensis; Baltazar 1972: 273 (lectotype designation); Shenefelt 1978: 1795.

Craspedolcus simlaensis; Quicke 1985: 357; van Achterberg and O’Toole 1993: 37.

Bracon lepcha Cameron, 1899: 69–68.

Iphiaulax lepcha; Baltazar 1972: 272; Shenefelt 1978: 1776.

Craspedolcus lepcha; Quicke 1985: 356; van Achterberg and O’Toole 1993: 24 (as synonym of *Craspedolcus simlaensis* (Cameron, 1899)).



Figures 81–91. *Maculibracon simlaensis* (Cameron), ♀, Vietnam. **81** fore wing **82** hind wing **83** mesosoma lateral **84** mesosoma dorsal **85** metasoma dorsal **86** hind leg lateral **87** head anterior **88** head dorsal **89** head lateral **90** propodeum lateral **91** scapus outer side lateral.

Iphiaulax bhotanensis Cameron, 1907: 4; Dover 1925: 40 (as synonym of *Iphiaulax lepcha* (Cameron, 1899); Shenefelt 1978: 1776. **Syn. n.**

Craspedolcus bhotanensis; Quicke 1985: 357.

Ipobracon maculicosta Enderlein, 1920: 71–72; Shenefelt 1978: 1824. **Syn. n.**

Craspedolcus maculicosta; Quicke and van Achterberg 1990: 252, 259 (lectotype designation).

Material. (2 ♀; IZCAS): 1 ♀, “[China:] Hainan, Ledong, 26.VIII.1984, Zhiqing Chen, No. IOZ(E)1964588”; 1 ♀, “Hainan, Jianfengling, 13.V.1984, Maobin Gu, No. IOZ(E)1964589”; 1 ♀ (RMNH), “C. **Vietnam:** Thua Thien Hué, Phong Dién N. R., n[ea]r base-camp, 50-100 m, 25.iii.2001, C. v. Achterberg, RMNH’01”.

Diagnosis. Scapus mainly yellowish brown, except for dark brown stripe on outer side, rather slender, twice as long as wide and less protruding ventrally (Fig. 91); head less narrowed posteriorly (Fig. 88); propodeum medio-posteriorly with smooth protuberance in lateral view (Fig. 90); wing membrane yellow except wide and slightly infuscate apical area of fore wing, rather close to vein 1r-m; stigmal spot of fore wing up to vein m-cu, enclosing nearly entire vein 1-SR+M (Figs 81, 82); vein 1-SR+M of fore wing dark brown; pterostigma narrowly blackish apically and remainder yellow (Fig. 81); medial area of first tergite low anteriorly (Figs 85, 90); medio-basal area of second tergite distinctly triangular (Fig. 85); body and hind leg brownish yellow; length of ovipositor sheath 0.7 times fore wing and 0.7 times body.

Variation. Length of body of female 16.7–19.2 mm, of fore wing of female 16.3–18.5 mm, and of ovipositor sheath 11.2–12.5 mm; antenna of female with 83 (1), 95 (1) segments; apical antennal segment with short spine; penultimate segment 1.1–1.2 times their maximum width; vein 3-SR of fore wing 2.4–2.5 times vein 2-SR; length of first tergite 1.4–1.7 times its apical width; length of ovipositor sheath 0.68–0.69 times fore wing; mesosoma and metasoma ventrally yellowish brown or infuscated.

Distribution. India, Bhutan, Myanmar, Indonesia (Java), *Vietnam, *China (Hainan).

Acknowledgements

The second author thanks the staff of the Instytut Zoologii of the Polish Academy of Sciences (Warsaw) for the loan of the lectotype of *Craspedolcus trisulcatus* and help during his visit to Łom, and Mrs Hong Liu (IZCAS) for the loan of specimens. This research was supported by the State Key Program of National Natural Science Foundation of China (31230068), 973 Program (2013CB127600), the National Special Basic Research Funds (2011FY120200-2-8), and the Fund for Innovative Research Groups of the National Natural Science Foundation of China (31321063).

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A review of insect parasitoids associated with *Lobesia botrana* (Denis & Schiffermüller, 1775) in Italy. I. Diptera Tachinidae and Hymenoptera Braconidae (Lepidoptera, Tortricidae)

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Abstract

This paper is aimed to summarize the information available on the parasitoid complex of the European Grapevine Moth (EGVM), *Lobesia botrana* (Denis & Schiffermüller, 1775) (Lepidoptera Tortricidae) in Italy. The list is the result of the consultation of a vast bibliography published in Italy for almost two hundred years, from 1828 to date. This allowed the clarification and correction of misunderstandings and mistakes on the taxonomic position of each species listed.

In Italy the complex of parasitoids detected on EGVM includes approximately 90 species belonging to ten families of Hymenoptera (Braconidae, Ichneumonidae, Chalcididae, Eulophidae, Eupelmidae, Eurytomidae, Pteromalidae, Torymidae, Trichogrammatidae, and Bethyridae) and one family of Diptera (Tachinidae). This paper deals with EGVM parasitoids of the families Tachinidae (Diptera) and Braconidae (Hymenoptera). Only two species of Tachinidae are associated to EGVM larvae in Italy, *Actia pilipennis* (Fallen) and *Phytomyza nigrina* (Meigen), whereas the record of *Eurysthaea scutellaris* (Robineau-Desvoidy) is doubtful. Moreover, 21 species of Braconidae are reported to live on EGVM, but, unfortunately, eight of them were identified only at generic level. *Bracon mellitor* Say has been incorrectly listed among the parasitoids of *L. botrana*. Records concerning *Ascogaster rufidens* Wesmael, *Meteorus* sp., *Microgaster rufipes* Nees, and *Microplitis tuberculifer* (Wesmael) are uncertain.

Keywords

Biological control, braconid wasps, European grapevine moth, natural enemies, tachinid flies

Introduction

The European Grapevine Moth (EGVM), *Lobesia botrana* (Denis & Schiffermüller, 1775) (Lepidoptera, Tortricidae) is an important pest in the grape-growing regions of Europe, the Middle East, northern and western Africa and southern Russia (CABI 2016a), whereas its occurrence in Japan has been invalidated (Bae and Komai 1991). This species was accidentally introduced in North and South America. It was found for the first time in California in 2009 (Varela et al. 2010, Gilligan et al. 2011, Ioriatti et al. 2012), in Chile in 2008 (Gonzalez 2010, Ioriatti et al. 2012) and in Argentina in 2010 (SENASA 2010, Ioriatti et al. 2012, SENASA 2016).

EGVM massively appeared in the wine-growing areas of southern Europe (France, Italy, the Iberian Peninsula) at the end of 1800. A century before, the species had been named but not described by Denis and Schiffermüller (1775 and 1776) as *Tortrix botrana*.

Later on, the moth was described by Jacquin (1788), OG Costa (1840), Milliere (1865) and Dufrane (1960) under different names.

The taxonomic history of EGVM is rather complicated; over time the species has been attributed to various genera or it has been misinterpreted as different species, generating confusion in biological data and at the synonymic level. In the “Datasheet Report” for European Grapevine Moth of CABI (2016a) this confusion is still present and the list of “Other Scientific Names” shows synonymies, mainly due to misinterpretation, which are no longer valid: *Tortrix reliquana* Hübner, 1825 (= *Lobesia reliquana*) is a valid species; *Penthina vitivorana* Packard, 1869 is synonym of *Paralobesia viteana* (Clemens, 1860); *Tinea “premixtana”* is a wrong spelling for *Tortrix “permixtana”* Hübner, 1796, probably the *Tortrix permixtana auct. nec* Denis & Schiffermüller, 1775, which is synonymous with the aforementioned *L. reliquana* (Hübner) (cf. Brown 2005, Fauna Europaea). Finding papers with the original reports, in the continuous transfer from a publication to another, has required a lot of work and the appreciated help of various colleagues. The continuous progress of the taxonomic knowledge and the numerous changes that have been and are still proposed, required supervision and updating of the names of the species attributed by the former authors, especially those who published their data before the second half of 1900.

Since its first record, EGVM had been associated with the grapevine (Denis and Schiffermüller 1775). Subsequently, its biology and its damage to the grapevine was defined (Jacquin 1788, Kollar 1837 [1840]). It is only in the second half of the 19th century that the species fully showed its aggressiveness, alarming wine-makers and attracting the interest of applied entomologists. In Italy the first report of *L. botrana* is attributed to Oronzo Gabriele Costa (1828), who found the moth in the Otranto surroundings (Apulia) on *Olea europaea* L. inflorescences, and classified the species as *Noctua romana*, later replaced by *Noctua romaniana* (OG Costa 1840, A. Costa 1857, 1877, Del Guercio 1899, Silvestri 1912, Tremewan 1977). In 1849 Semmola described the damage on the grapevine in the Vesuvian region of Naples (A. Costa 1857). In 1869 Levi, in a paper on the grape moth “*Tortrix Uvae*” or “*uvana*”, *E. ambiguella*, which heavily infested vineyards near Gorizia, mentioned the presence of

three larvae of a second “grape worm”, which he found before the harvest, and whose larva was characterized by a “... more lively and spirited temperament that made him squirming and slipping from the hands like an eel”, and which he attributed to *Tortrix vitisana* that is today a synonym for *L. botrana*. He recalls the subject a few years later (Levi 1873), with news on parasitoids of *E. ambiguella*. At the same time, Dei (1873) assigned to *L. botrana* the liability of the heavy damage caused to the grapevine in Trieste district and in other parts of Italy (Ioriatti and Anfora 2007). Also Ghiliani (1871) and De Stefani (1889) mentioned the species (as *Lobesia permixtana*) for its damage to grape.

With regard to the grape moth parasitoids, Camillo Rondani (1871-1878) reported only one Ichneumonid, *Pimpla instigator* Fabricius, 1793, living on *Cochylis roserana* Frölich, 1828 (= *E. ambiguella*), but did not mention *L. botrana*.

In 1899, Del Guercio described in detail the morphology and the behavior of EGVM, providing the first list of seven parasitoids obtained from larvae and pupae collected in the vineyards of Tuscany. In a paper dealing with Italian Chalcidoidea, Masi (1907) reported three species emerged from EGVM, one of which he described as *Dibrachys affinis*. Later on, he named another Chalcidoid as *Elachistus affinis*, also obtained from EGVM (Masi 1911).

At the time when Paul Marchal in France was publishing an important work on EGVM (1912), in Italy Giulio Catoni (1910-1914) and Filippo Silvestri (1912) carried out their investigations, in Trentino-South Tyrol and Campania (Portici-Naples) respectively, publishing interesting information on EGVM.

With the impressive collections of pupae of the first spring-summer generation and of the overwintering second generation, Catoni collected EGVM and EGBM individuals in varying proportions, although frequently EGVM was more abundant. The purpose of his investigations was to provide a valid argument to declare as mandatory the “autumnal application of bands and rags to the vine stems” with the aim to collect the migrating larvae, prevent moth emerging and allow parasitoid spreading. From these pupae Catoni obtained 15 species of parasitoids (Catoni 1914). Silvestri (1912) described rather accurately the morphology and habits of EGVM, providing comprehensive information of 26 species of parasitoids. These important contributions are followed by the list of EGVM parasitoids reported in Italy until the year 1911 by Gustavo Leonardi (1925), who mentioned 21 species, and by Francesco Boselli (1928), who listed 42 species from 1911 to 1925. The results of Catoni and Silvestri describing EGVM parasitoids were then mentioned by Stellwag (1928) and reviewed by Thompson (1946).

After a long period of time of nearly 70 years, in which the essays on EGVM parasitoids were very rare, in the 1990s Marchesini and Dalla Montà (1994) published a long list of parasitoids associated to EGVM in the Veneto vineyards. With the introduction of the IPM (Integrated Pest Management) principles, the role of natural enemies was more and more emphasized and the interest for the EGVM parasitoids in Italy came back, and the investigations - though occasional - were never interrupted to date.

The other vine moth, *Eupoecilia ambiguella* (Hübner, 1796) (European Grape Berry Moth, EGBM) was recognized as the major grape berry pest in Europe until the 1920s (Berlese 1900, Solinas 1962, Bovey 1966). More recently and in many areas, it has been gradually replaced by *L. botrana*. The shift started in the Mediterranean Basin and is now extending - for climatic reasons - to Central Europe, where populations of EGVM and EGBM overlap.

EGVM larvae feed on grapevine flowers and berries and on a number of other plants growing in warm-dry environments. Its host range includes approximately 40 species belonging to 27 families (Coscollá 1997). The spurge flax *Daphne gnidium* L. (Malvales Thymelaeaceae) is considered as its original host plant (Marchal 1912, Balachowky and Mesnil 1935, Bovey 1966, Lucchi and Santini 2011, Tasin et al. 2011, CABI 2016a, Lucchi et al. in press). However, EGVM is frequently associated with other hosts in habitats where suitable host plants occur. These include olive tree inflorescence (O. Costa 1828 and 1840, Tzanakakis and Savopoulou-Soultani 1973, Stoeva 1982, Savopoulou-Soultani et al. 1990, Coscollá 1997, Stavridis and Savopoulou-Soultani 1998, Thiéry 2005, Roditakis in Ioriatti et al. 2011), Virginia creeper (Stoeva 1982, Coscollá 1997, Thiéry 2005, CABI 2016a), jujube (Bovey 1966, Coscollá 1997, Thiéry 2005, CABI 2016a), rosemary (Bovey 1966, Coscollá 1997, Thiéry 2005, Roditakis in Ioriatti et al. 2011, CABI 2016a), arbutus (Coscollá 1997, Thiéry 2005, CABI 2016b) evergreen clematis (Stoeva 1982, Coscollá 1997, Thiéry 2005, CABI 2016a), dogwood (Stoeva 1982, Coscollá 1997, Thiéry 2005, CABI 2016a), ivy (Bovey 1966, Coscollá 1997), currant (Bovey 1966, Stoeva 1982, Coscollá 1997, Thiéry 2005, CABI 2016a).

Larval feeding on green and ripe berries of grapevine allows the infection by various microorganisms that frequently results in bunch rots (Fermaud and Le Menn 1989), making this leafroller the most economically important pest of grapevine in the wine-growing areas, worldwide (Ioriatti et al. 2011). The natural enemy assemblage of *L. botrana* varies considerably both in time and space. It includes entomopathogenic fungi, bacteria and baculovirus, together with a long list of arthropod predators as spiders and insects belonging to Dermaptera, Hemiptera, Neuroptera, Diptera and Coleoptera, as well as parasitoids (Marchesini and Dalla Montà 1994, Coscollá 1997, Ioriatti et al. 2011, Sentenac 2012, CABI 2016a). The complex of insect parasitoids feeding on *L. botrana* in Europe includes mainly Hymenoptera Ichneumonoidea, Chalcidoidea, Bethyloidea and few species belonging to Diptera (Tachinidae) (Martinez et al. 2006).

Extensive scientific efforts are still needed to develop biological control as an effective solution for practical use in the field. Egg parasitoids of the genus *Trichogramma* have been mass-released in a inundative strategy with variable results (Castaneda-Samayoa et al. 1993, Hommay et al. 2002, Ibrahim 2004), though they can be frequently found in cultivated and natural environments (Barnay et al. 2001, Ibrahim 2004, Lucchi et al. 2016). The pteromalids *Dibrachys affinis* Masi and *D. cavus* (Walker) are gregarious generalist larval-pupal parasitoids of Lepidoptera, Diptera and Hyme-

noptera that can be readily reared in the laboratory. However, due to the lack of host specificity and because they can also behave as hyperparasites, they have not considered as good candidates for biological pest control. An ichneumonid species, *Campoplex capitator* Aubert, is known as the most frequent and efficient parasitoid of EGVM in European vineyards. It is a larval parasitoid that has been regarded as the best candidate for future EGVM biological control programs. Substantial releases have not taken place because of the difficulties associated with artificially mass-rearing of the species (Thiéry and Xuéreb 2004).

The limited knowledge of the field efficacy of EGVM natural enemies has recently come to light for the questions raised in this regard by some American entomologists, who persistently questioned the potential of the biological control for EGVM management (Varela et al. 2010). In this respect, there is an urgent need to check the existing literature with the aim to critically revise the taxonomic nomenclature, assigning to each species its valid name and assessing their potential as biocontrol agents.

We fully agree with what was written by William Robin Thompson in the “Catalogue of Parasites and Predators of Insects Pests” (published under his direction in several volumes from 1943 to 1972) concerning the introduction of natural enemies of insect pests accidentally introduced in a new country: “... it is necessary to know the identity and habits for the parasites and predators attacking the pest in its native home. The name and habits of the natural enemies of many pests are recorded in the literature, but it is usually a very difficult and tedious task to assemble the information. A comprehensive list or catalogue of the predators of injurious insects, with the reference to the original papers in which they were recorded is, therefore, one of the fundamental necessities in biological control work.” (Thompson 1943).

Among the difficulties that can arise when compiling these lists, Thompson suggests mainly the “inaccuracy in observation, rearing work and identification contained in the works of former authors, which greatly limits their practical value.” Many past mistakes of unusual parasitoid species associated to EGVM in Italy might be due to a poor lab management of the field collection. We should take into consideration that Catoni (1910-14), Ruschka and Fulmek (1915) and, more recently, Colombero et al. (2001), have proposed lists of parasitoids obtained by clusters where the two vine moths were possibly present, without indicating from which individual each parasitoid was obtained. Nevertheless, it is also true that often the two tortricids may share the same parasitoids (see e.g.: Villemant et al. 2012, tableau 2.9). Those parasitoids have often a fairly broad host range and can attack suitable hosts living in the same environment, on the same plant, and even on the same cluster (Loni et al. 2012, Scaramozzino et al. in press).

Over time, the observations and the rearing techniques have been refined and rarely constitute a serious obstacle to this type of investigation. On the other hand, there is still a great difficulty in parasitoid and predator identification, which is intrinsic to the vastness and complexity of the taxonomic groups to which they belong.

This paper deals with Diptera Tachinidae and Hymenoptera Braconidae and aims to be the first contribution of a revised and updated list of the Italian parasitoids of *L. botrana*.

Materials and methods

Lobesia botrana and its parasitoids in Italy

The Italian records on EGVM parasitoids are a fragmented patchwork. This paper includes data from fewer than half of the Italian regions (nine of 20), and most of these data come from the northern part of Italy (Trentino-South Tyrol 37 species, Veneto 31 species, Piedmont 25 species) followed by Sardinia (22 species) Tuscany (20 species), Campania (19 species), Apulia (7 species), and Sicily and Umbria (1 species). An important part of the information (e.g.: Trentino-South Tyrol, Campania, Tuscany, Umbria and Sicily) comes from works published between the end of 19th and early 20th centuries, and some specific identifications are not responding to current taxonomic criteria, so requiring an accurate revision.

Most of the data result from studies conducted in the vineyards (approx. 85 species recorded in 29 papers) and some from the spurge flax (*Daphne gnidium* L.) in natural or semi-natural environments (approx. 15 species and 6 papers). In some contributions, mostly focused on general aspects, such as for example the grapevine protection from EGVM attacks, the reports on parasitoids are marginal and not very consistent.

The origin, quality and consistency of the data are not uniform and reflect the absence, in certain regions, of people with the necessary scientific knowledge and skill to carry out this type of investigation.

The list of parasitoid species feeding on *L. botrana* in Italy was drawn up using all the papers published on the subject, both in Italy (Table 1) and worldwide. We also revised the lists of parasitoids compiled by Thompson (1943), Coscollá (1997), Hoffman and Michl (2003) and by CABI (2016b). The names of the species have been verified and updated by following the on-line “Home of Ichneumonidea” and flash-drive Taxapad databases of Yu et al. (1997–2012, 2012), Noyes (2014) and the Fauna Europaea (de Jong et al. 2014).

Various names are not related to any species currently known and are considered “nomina dubia”, while some misspellings have been amended. The list contains the names used by the different authors in their publications and those updated according to the sources mentioned above. Names no longer valid are preceded by a dot and are followed by the name of the authors who used them. Within the list, the species are divided by Order and Family and sorted alphabetically. Valid names are in bold. Synonyms, misspellings, combinations other than those valid today, are in a smaller font and show in square brackets the valid name. The papers examined and included in the list are sorted alphabetically and consecutively numbered. These numbers are shown in the table, in the columns of the main geographical areas in which Italy can be divided: northern Italy (indicated by NORTH and including the Regions of Valle d’Aosta, Piedmont, Liguria, Lombardy, Trentino-South Tyrol, Veneto, Friuli-Venezia Giulia and Emilia-Romagna); Central Italy (shown with CENTER and including Tuscany, Marche, Umbria, Lazio and Abruzzo), southern

Table 1. References consulted for the compilation of the parasitoid list of the European grapevine moth in Italy. See references for the full bibliographic citation. The numbers on the left are the same as in Table 2.

Number	Authors
1	Bagnoli B, Lucchi A (2006)
2	Barbieri R, Cavallini G, Pari P, Guardigni P (1992)
3	Baur H (2005)
4	Boselli F (1928)
5	Caotni G (1910)
6	Catoni G (1914)
7	Cerretti P, Tschornig H-P (2010)
8	Colombera S, Alma A, Arzone A (2001)
9	Dalla Montà L, Marchesini E (1995)
10	Del Guercio G (1899)
11	Delrio G, Luciano P, Prota R (1987)
12	Forti D (1991)
13	Laccone G (1978)
14	Leonardi G (1925)
15	Loni A, Samartsev KG, Scaramozzino PL, Belokobylkij SA, Lucchi A, (2016)
16	Lozzia GC, Rigamonti EI (1991)
17	Lucchi A, Santini L (2011)
18	Lucchi A, Scaramozzino PL, Michl G, Loni A, Hoffmann C (2016)
19	Luciano P, Delrio G, Prota R (1988)
20	Marchesini E, Dalla Montà L (1994)
21	Marchesini E, Dalla Montà L (1998)
22	Marchesini E, Dalla Montà L, Sancassani GP (2006)
23	Masi L (1907)
24	Masi L (1911)
25	Moleas T (1979)
26	Moleas T (1995)
27	Nobili P, Correnti A, Vita G, Voegelé J (1988)
28	Nuzzaci G, Triggiani O (1982)
29	Pinna M, Gremo F, Scaramozzino PL (1989)
30	Roat C, Forti D (1994)
31	Ruschka F, Fulmek L (1915)
32	Scaramozzino PL, Loni A, Lucchi A, Gandini L (In press)
33	Silvestri F (1912)
34	Stellwaag F (1928)
35	Zangheri S, Dalla Montà L, Duso C (1987)

Italy (indicated with SOUTH, including Campania, Molise, Apulia, Basilicata and Calabria), Sicily and Sardinia. In two separate columns we indicated if the record is earlier or later than 1970. If the species has been recorded before and after that date, it is shown on both columns.

Results

The complex of parasitoids detected on EGVM in Italy includes some 90 species belonging to ten families of Hymenoptera (Braconidae, Ichneumonidae, Chalcididae, Eulophidae, Eupelmidae, Eurytomidae, Pteromalidae, Torymidae, Trichogrammatidae and Bethyilidae) and one family of Diptera (Tachinidae). More than fifty species belong to Ichneumonidae, followed by Braconidae with 21 species, Eulophidae eight species, Trichogrammatidae six species, and Pteromalidae five species. All the other families are represented by one or two species. The parasitoids of EGVM, belonging to the families Tachinidae (Diptera) and Braconidae (Hymenoptera), reported in Italy by various authors (see Table 1) are listed in Table 2.

Order: DIPTERA

Family: TACHINIDAE

Subfamily: Tachininae

Actia pilipennis (Fallen, 1810)

Fig. 1

Scaramozzino et al. (in press).

Italian distribution of reared parasitoids. Tuscany: Scaramozzino et al. (in press).

Distribution. Palearctic species widely distributed, present, with few exceptions, all over Europe; to the east it reaches the Kuril Islands and Japan through southern Siberia and Mongolia (Andersen 1996).

Host range. It is a rather polyphagous species: little more than fifteen hosts are known, mostly belonging to the family Tortricidae (Mesnil 1963, CABI 2016b). Martinez (2012) points out that this species has been obtained by *Sparganothis pilleriana* (Denis & Schiffermüller, 1775), another important tortricid pest of the grapevine, but, curiously, it has not been found on the European grapevine moth yet. Recently, Delbac et al. (2015) obtained a single specimen of this tachinid fly from *L. botrana* in a Bordeaux vineyard. Unlike *Phytomyptera nigrina* (see below), in this case the maggot of *A. pilipennis* abandons the dead caterpillar and pupate nearby.

Ecological role. During a research carried out in the natural reserve of Migliarino-San Rossore-Massaciuccoli, (Pisa), we have obtained quite often specimens of this Tachinid from larvae of the three generations of EGVM and from larvae of *Cacoecimorpha pronubana* (Hübner, 1799), both living on the shoot tips of *Daphne gnidium* (Scaramozzino et al. in press). In the natural reserve, the species has been raised in small number by EGVM from 2012 to 2015. In 2014 the overall rate of parasitism was quite low, not even reaching 1%.

Table 2. List of Tachinidae (Diptera) and Braconidae (Hymenoptera) parasitoids of *Lobesia botrana* reported in Italy.

Order-family / subfamily / species	subfamily	<1970	>1970	NORTH	CENTER	SOUTH	SICILY	SARDINIA
DIPTERA								
TACHINIDAE								
<i>Actia pilipennis</i> (Fallen, 1810)	Tachininae		•		32			
• <i>Discochaeta hypomentatae</i> Rond. [= <i>Eurysthaea scutellaris</i>]								
<i>Eurysthaea scutellaris</i> (Robineau-Desvoidy, 1848)			•	Forti in Coscollá 1997 (as <i>Dischocata hypomentatae</i>)				
<i>Phytomyptera</i> sp.	Tachininae		•			27		
<i>Phytomyptera nigrina</i> (Neigen, 1824)	Tachininae	• [4, 14: as <i>Phytomyptera nitidiventris</i>] 14 (as <i>P. n.</i> var. <i>unicolor</i> Rond.)	•	3, 8, 20, 21, 23	1, 10, 33 (as <i>Phytomyptera nitidiventris</i> and <i>P. nitidiventris</i> var. <i>unicolor</i>), 36	13, 28, 33 (as <i>Phytomyptera nitidiventris</i> and <i>P. nitidiventris</i> var. <i>unicolor</i>)	25 (as <i>Phytomyptera nitidiventris</i> and <i>P. nitidiventris</i> var. <i>unicolor</i>)	19
• <i>Phytomyptera nitidiventris</i> Rond. [= <i>Phytomyptera nigrina</i>]								
• <i>Phytomyptera nitidiventris</i> var. <i>unicolor</i> Rond. [= <i>Phytomyptera nigrina</i>]								
• <i>Phytomyptera unicolor</i> Rond. [= <i>Phytomyptera nigrina</i>]								
HYMENOPTERA								
BRACONIDAE								
<i>Agathis</i> sp. Latreille, 1804	Agathidinae		•					11
<i>Agathis malvacearum</i> Latreille, 1805	Agathidinae		•			25, 26		
<i>Apanteles</i> sp. Forster, 1862	Microgastrinae		•			28		19
<i>Apanteles albipennis</i> (Nees, 1834)	Microgastrinae		•			13		
<i>Aleiodes</i> sp. Wesmael, 1838	Rogadinae		•			28		
<i>Ascogaster quadridentata</i> Wesmael, 1835	Cheloninae		•	20, 21, 22	1			19
<i>Ascogaster rufidens</i> Wesmael, 1835	Cheloninae	• 4				33		

Order-family / subfamily / species	subfamily	<1970	>1970	NORTH	CENTER	SOUTH	SICILY	SARDINIA
<i>Bassus linguarius</i> (Nees, 1812)	Agathidinae		•			28		
<i>Bracon (Glabrobracon) adnotus</i> Papp, 2000	Braconinae		•		15, 32 (as <i>Bracon</i> spp.)			
<i>Bracon mellitor</i> Say, 1836	Braconinae	• 14 (as <i>Bracon vernoniae</i>)						
• <i>Bracon vernoniae</i> Ashm. [= <i>Bracon mellitor</i>]								
<i>Chelonus</i> sp. Panzer, 1806	Cheloninae		•					11
<i>Colastes</i> sp. Haliday, 1833	Exothecinae		•	8				
<i>Habrobracon</i> sp. Ashmead, 1895	Braconinae		•			26		11
• <i>Habrobracon brevicornis</i> Wesmæl [= <i>Habrobracon hebetor</i>]								
<i>Habrobracon concolorans</i> (Marshall, 1900)	Braconinae		•		15, 32 (as <i>Bracon</i> spp.)			
<i>Habrobracon hebetor</i> (Say, 1836)	Braconinae	• 4 (as <i>Habrobracon</i> sp.)	•		15, 32 (as <i>Bracon</i> spp.)	25, 33 (as <i>Habrobracon</i> sp.), Goidanich, 1934	33 (as <i>Habrobracon</i> sp. from <i>Ephesia elutella</i>)	
<i>Habrobracon pilleriana</i> Fischer, 1980	Braconinae		•		15, 32 (as <i>Bracon</i> spp.)			
<i>Meteorus</i> sp. Haliday, 1835	Euphorinae	• 4				33		
• <i>Microbracon brevicornis</i> Wesmæl [= <i>Habrobracon hebetor</i>]		• Thompson, 1946						
• <i>Microgaster globata</i> (Linnaeus, 1758) [= <i>Microgaster rufipes</i>]								
<i>Microgaster rufipes</i> Nees, 1834	Microgastrinae	•		6 (as <i>Microgaster globata</i>)				
<i>Microplitis</i> sp. Foerster, 1862	Microgastrinae		•	8, 20, 21, 22				
<i>Microplitis tuberculifer</i> (Wesmæl, 1837)	Microgastrinae	• 4 (as <i>Microplitis tuberculifera</i>)		6, 31				

Order-family / subfamily / species	subfamily	<1970	>1970	NORTH	CENTER	SOUTH	SICILY	SARDINIA
<i>Therophilus tumidulus</i> (Nees, 1812)	Agathidinae		•					19 (as <i>Microdus tumidulus</i>)

Table explanation. First column shows: 1- Order and Family to which the parasitoid belongs (e.g.: DIPTERA Tachinidae), 2 - Valid specific names of parasitoids in bold italics followed by the author who described the species and the year of description. The author's name and the year are in parenthesis if the species is assigned to a genus different from the original description (e.g.: *Itopectis alternans* (Gravenhorst, 1829) was described and included in 1829 by Gravenhorst in the genus *Pimpla* while it is now assigned to the genus *Itopectis*), 3 - Names that are in synonymy, or which relate to combinations genus-species no longer valid and to incorrect spellings, as found in the works cited in the references. These names are preceded by a black dot and are followed by the valid name in bold and in square brackets to which it refers in the list (e.g.: *Phytomyptera nitidiventris* Rond. [= *Phytomyptera nigrina*]).

Second column includes, only for the valid species, the relating subfamily.

Third column titled "<1970", are indicated with a dot the valid species recorded before that date.

Fourth column titled "> 1970", are indicated with a dot the valid species recorded after that date.

Columns "North", "Center", "South", "Sicily" and "Sardinia" the records that refer to a specific area are shown by a number (which refers to the work mentioned in the "references"), with in parenthesis the name used in the message if it differs from that of the valid species [e.g.: 4 (as *Phytomyptera nitidiventris*)]. If there are several papers that use the same name for a species that is no longer valid, the reference numbers and the invalid names are included in square brackets (e.g.: [4, 14: as *Phytomyptera nitidiventris*]).

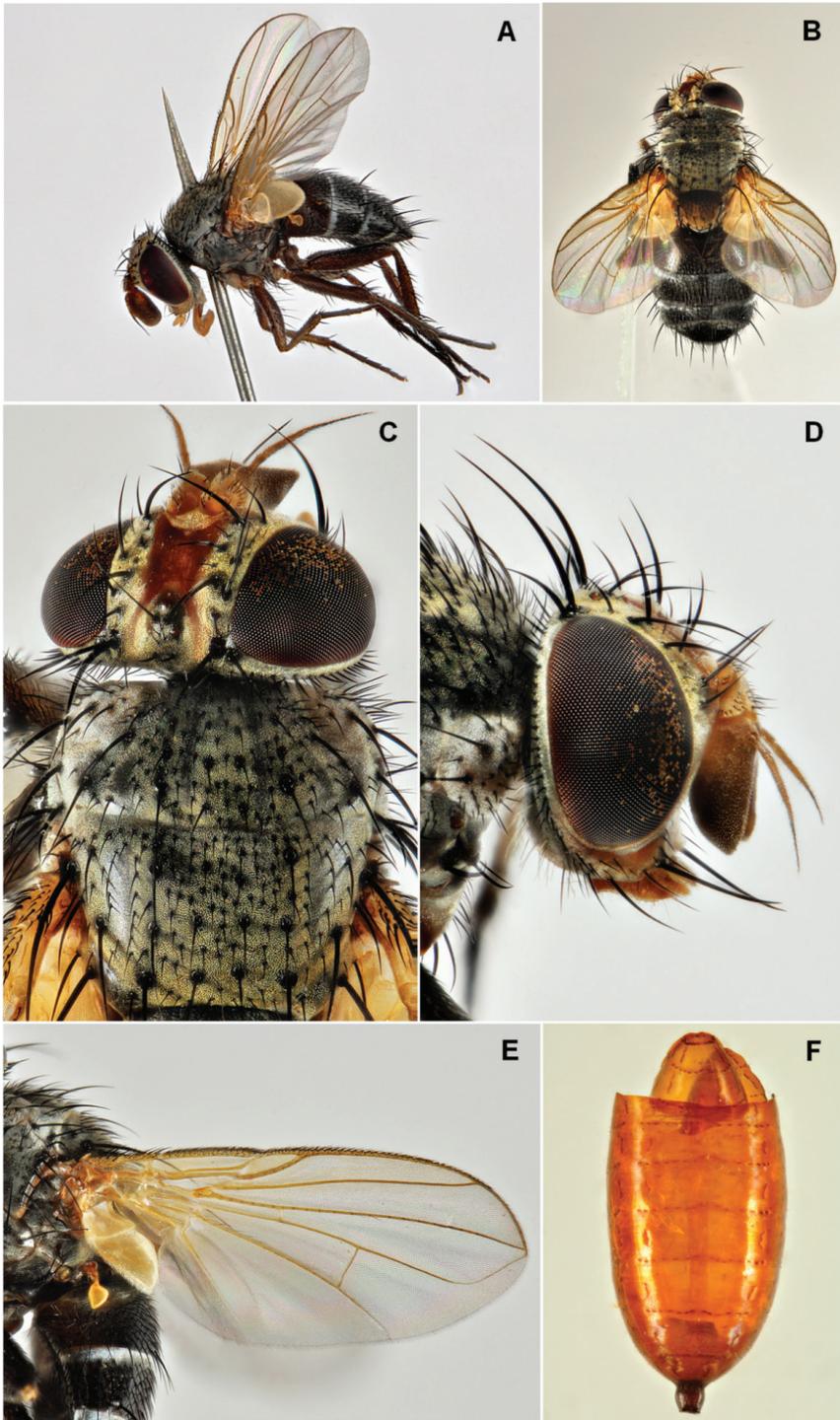


Figure 1. *Actia pilipennis* (Fallen, 1810), female. **A** habitus, lateral view **B** habitus, dorsal view **C** head and anterior part of thorax, dorsal view **D** head, lateral view **E** wing **F** opened puparium.

***Phytomyptera* sp.**

Moleas, 1995; Coscollá, 1997

Note. Very probably the species reported by Moleas (1995) belongs to *P. nigrina* (see below): Cerretti (2010) cited six *Phytomyptera* species from Italy, but only *P. nigrina* was associated to *L. botrana*.

***Phytomyptera nigrina* (Meigen, 1824) (Pn)**

Fig. 2

Laccone 1978, Nuzzaci and Triggiani 1982, Luciano et al. 1988, Marchesini and Dalla Montà 1992, 1994, 1998, Coscollá 1997, Colombera et al. 2001, Baur 2005, Marchesini et al. 2006, Bagnoli and Lucchi 2006, Martinez et al. 2006, Cerretti and Tschorsnig 2010, Scaramozzino et al. (in press).

Phytomyptera unicolor Rond.: Del Guercio 1899

Phytomyptera nitidiventris Rond.: Silvestri 1912, Catoni 1914, Leonardi 1925, Boselli 1928, Stellwaag 1928, Thompson 1946

Phytomyptera nitidiventris var. *unicolor* Rond.: Leonardi 1925

Phytomyptera spp. Moleas 1995, Coscollá 1997

Italian distribution of reared parasitoids. Apulia: Nuzzaci and Triggiani 1982, Laccone 1978

Campania: Silvestri 1912 (Portici, Nola)

Piedmont: Colombera et al. 2001, Baur 2005

Sardinia: Luciano et al. 1988

Tuscany: Del Guercio 1899, Bagnoli and Lucchi 2006, Scaramozzino et al. (in press)

Umbria: Silvestri 1912 (Bevagna)

Veneto: Marchesini and Dalla Montà 1992, 1994, 1998, Marchesini et al. 2006

Emilia-Romagna: Baur 2005 (Bologna, leg. Campadelli)

Distribution. North Central and South Europe, Russia North West, Ukraine (Fauna Europaea)

Host range. Larval endophagous koinobiont parasitoid, *Phytomyptera nigrina* (see Tab. 3) recurs very often in all researches conducted in Italy on parasitoids of *L. botrana*.

This insect is associated to 29 species of Lepidoptera: Pterophoridae, Pyralidae, Sesiidae, Yponomeutidae and various genera and species of Tortricidae, included *E. ambiguella*.

Among the Tachinidae living on the vine moths, Pn shows the lowest number of hosts. For more details, see Martinez et al. (2006) and with regard to the hosts reported in Italy see Cerretti and Tschorsnig (2010). As known, Pn larva hatches from an egg placed on the integument of the victim and, once actively penetrated, consumes its internal or-

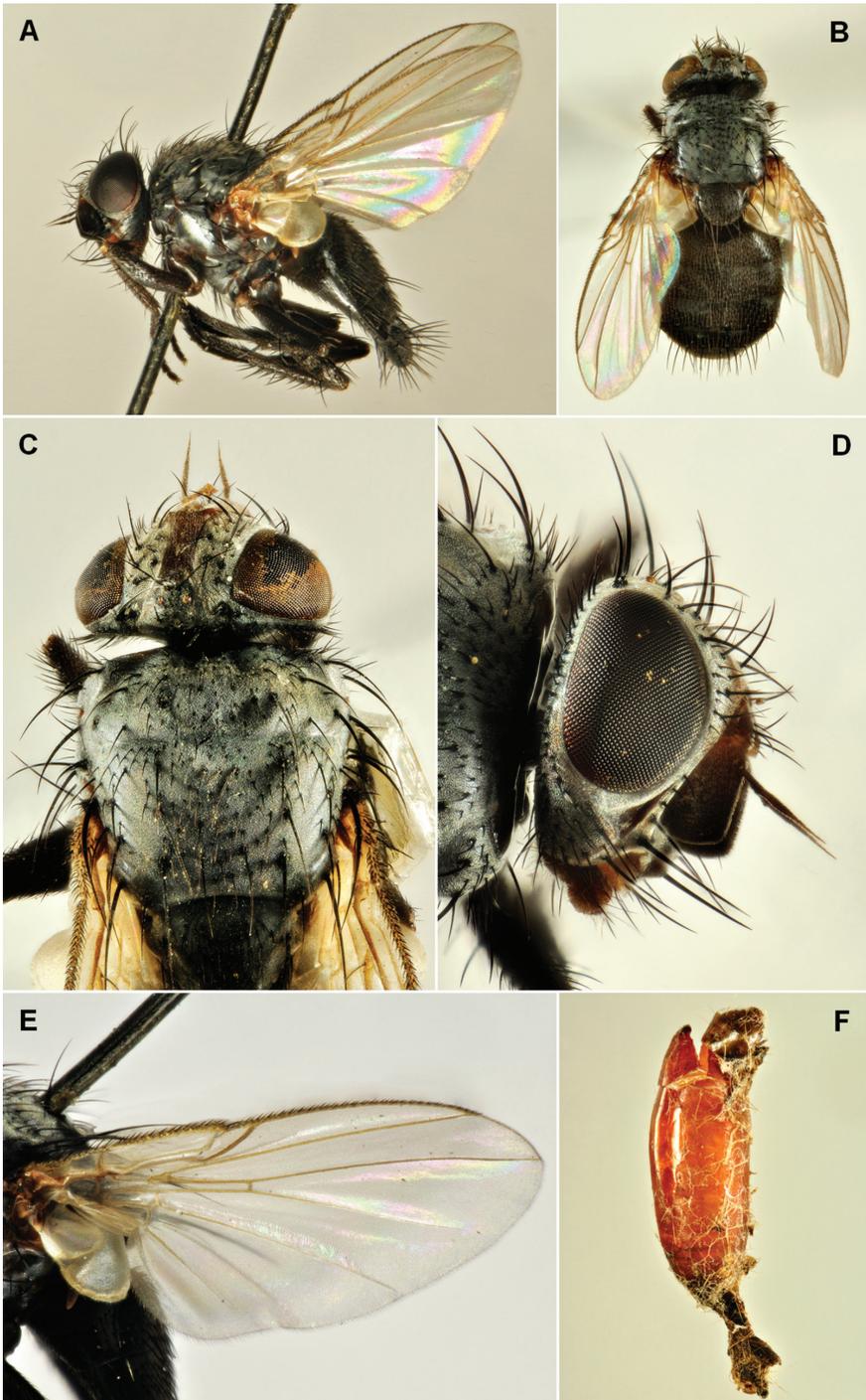


Figure 2. *Phytomyptera nigrina* (Meigen, 1824), female. **A** habitus, lateral view **B** habitus, dorsal view **C** head and anterior part of thorax, dorsal view **D** head, lateral view **E** wing **F** opened puparium tight to the skin of the EGVM dead larva.

Table 3. *Phytomypta nigrina*: percentages of parasitism on the European Grapevine Moth reported in Italy by different authors.

Author/s, publication year	Italian Region	Host plant	Year	1 st generation (antophagous)	2 nd generation (carpophagous)	3 rd generation (carpophagous)
Colombera et al. 2001	Piedmont	grapevine	1998	17.3	0	does not occur
Colombera et al. 2001	Piedmont	grapevine	1999	6.5	(2 specimens)	does not occur
Laccone 1978	Apulia / Cerignola	grapevine	1978	26.08	11,4 / 12,4 / 14,7	0
Marchesini et al. 1994	Veneto/ Pernumia (PD)	grapevine	1989	0	1,76	0
Marchesini et al. 1994	Veneto/ Pernumia (PD)	grapevine	1990	0	0,23	0
Marchesini et al. 1994	Veneto/ Pernumia (PD)	grapevine	1991	0	0,97	0
Marchesini et al. 1994	Veneto/ Colognola (VR)	grapevine	1990	0.36	6,72	0
Marchesini et al. 1994	Veneto/ Colognola (VR)	grapevine	1991	1	0	0
Marchesini et al. 1994	Veneto/ Colognola (VR)	grapevine	1992	0	0,48	0
Marchesini et al. 1994; Marchesini et al. 2006	Veneto/ Valpolicella (VR)	grapevine	1992 (1)	0 / 0.64	0,48 / 2,14	0 / 0
Marchesini et al. 2006	Veneto	grapevine	2000 (2)		14,6 / 4,4	0 / 0
Marchesini et al. 2006	Veneto	grapevine	2001 (2)	0 / 0	1,0 / 0,8	0 / 0
Nuzzacci and Triggiani 1982	Apulia	Daphne gnidium	1979-1982	?	?	30
Luciano et al. 1988	Sardinia	Daphne gnidium	1986-87	25-24,1	?	7,1-0

(1) Data obtained in vineyards treated with both BT (*Bacillus thuringiensis*) and MP (methyl-parathion)

(2) Data obtained in vineyards with chemical defense or biological defense.

gans and kills it (Bagnoli and Lucchi 2006). The existence of the puparium inside the host cocoon tight to the skin of the larva is a distinctive character for the species (Fig. 2F). Though Pn plays an important role in the natural control of *L. botrana*, especially reducing the summer population (Bagnoli and Lucchi 2006, Thiery et al. 2006), it was not considered suitable for the control of *Paralobesia viteana* in the US, because of its relatively low host specificity, the low rate of parasitism reported in nature, and, referring in general to Tachinidae, due to previous experiences of unsuccessful releases (Martinez et al. 2006).

Ecological role. Its importance as parasitoid depends on the host generation; indeed, various authors found that the parasitism rates are more generally related to the EGVM antophagous generation on grapevine: in this case they can overcome 25% of parasitism rate, both on grapevine in Apulia (Laccone 1978) and on *Daphne gnidium* in Sardinia (Luciano et al. 1988) (see table 2). In Tuscany, *P. nigrina* (Pn) was mostly found in the vineyards of the medium and lower Arno valley, especially on larvae of the anthophagous generation (Bagnoli and Lucchi 2006). In the natural reserve of San Rossore (Pisa), during several years of investigation carried out on *D. gnidium*, a single specimen of Pn was obtained from EGVM larvae of the second generation, collected in late July 2014 (Scaramozzino et al. in press), in contrast to observations carried out on the same host plant by other authors (see Table 3), whereas *Actia pilipennis* was more frequent in our case.

In Piedmont, Pn reached on the first generation of EGVM and EGBM, in two successive years, significant parasitization rates (17.3 and 6.5%), but it was virtually absent (only two individuals obtained) in the second overwintering generation (Colombera et al. 2001).

Silvestri (1912) collected Pn from June to mid-October, Nuzzaci and Triggiani (1982) cited it as the more frequent parasitoid on *D. gnidium* in summer, with parasitism rates close to 30%. Laccone (1978) obtained Pn also in the second generation, with significant parasitization rates (from 11.4 to 14.7%). In Veneto, parasitization levels detected for this species were very low in the first generation (0.36 and 0.64%; Marchesini and Dalla Montà 1994), slightly higher, but with a significant 14.6%, in the second generation (Marchesini et al. 2006).

In France, Thiery et al. (2006) found Pn on the first generation of EGVM; they reported parasitization rates ranging from 5.2 to 41.2%. Pn has not been detected for the moment on EGVM overwintering generation, apart from what has been reported in the work of Colombera et al. (2001).

Subfamily: Exoristinae

***Eurysthaea scutellaris* (Robineau-Desvoidy, 1848)**

Discochaeta hyponomeutae Rond.: Forti 1991 (in Coscollá 1997: 218), Coscollá 1997.

Notes. Coscollá (1997) refers that this tachinid fly is the only parasitoid obtained by Forti (1991) from larvae of EGVM second generation, with a rate of parasitism of

3.7%, though later on Roat and Forti did not mention this species in their list published in 1994. Cerreti and Tschorsnig (2010) reported eight species of Lepidopteran host for *E. scutellaris* (mostly Yponomeutidae, but also Tortricidae and Geometridae) for Italy, but he did not mention *L. botrana* among them.

According to Cerreti (2010), Cerreti and Tschornig (2010) and Fauna Europaea, in Italy there are other four species of Tachinidae that could parasitize EGVM, though they have not been found on this host in our country yet (Martinez et al. 2006). These are *Elodia morio* (Fallen, 1820), *Nemorilla floralis* (Fallen, 1810), *N. maculosa* (Meigen, 1824) and *Pseudoperichaeta nigrolineata* (Walker, 1853) (Martinez et al. 2006).

Order: HYMENOPTERA

Superfamily: ICHNEUMONOIDEA

Family: BRACONIDAE

Subfamily: Agathidinae

Agathis sp.

Delrio et al. 1987, Coscollá 1997

Italian distribution of reared parasitoids. Sardinia: Delrio et al. 1987

Host range. The cosmopolitan genus *Agathis* Latreille, 1804, according to Yu (1997–2012) includes 162 species, 35 of which recorded in Europe (Fauna Europaea). They live on larvae of various microlepidoptera, especially Gelechioidea, Pyraloidea and Tortricoidea, as solitary koinobiont endoparasitoid. Detailed information on Agathidinae behavior can be found in Shaw and Huddleston (1991).

Ecological role. In Sardinia Delrio et al. (1987) obtained, by *L. botrana* feeding on grape, an unidentified species of *Agathis* which, in association with other species (*Elachertus affinis* Masi, *Chelonus* sp. and *Habrobracon* sp.), parasitized 10-12% of the first generation larvae and 5% of the second and third generation larvae.

Agathis malvacearum Latreille, 1805

Moleas 1979, 1995, Coscollá 1997, Hoffman and Michl 2003

Italian distribution of reared parasitoids. Apulia: Moleas 1979, 1995

Distribution. Spread in Central and Southern Europe, UK, Finland, Russia, Caucasus, Turkey, Iran, Central Asia, Canada (Quebec), USA (some States bordering Canada) (Yu et al. 2012).

Host range. *Agathis malvacearum* lives on 7 species of moths: 2 Coleophoridae, 3 Gelechiidae, 1 Pterophoridae and 1 Tortricidae (Yu et al. 2012).

Ecological role. This species was obtained in low numbers during a three-year investigation in vineyards of table grapes in five locations of Apulia and has been associated to EGVM only by Moleas (1979).

***Bassus linguarius* (Nees, 1812)**

Nuzzaci and Triggiani 1982

Italian distribution of reared parasitoids. Apulia: Nuzzaci and Triggiani 1982

Distribution. It occurs in Central and Southern Europe, Great Britain, Finland, Turkey, Iran, Armenia, Kazakhstan and Mongolia (Yu et al. 2012)

Host range. Yu (1997-2012) and Yu et al. (2012) mentions *Coleophora* sp. (Lepidoptera Coleophoridae) as the only known host of this braconid.

Ecological role. In Apulia this species reached 9% of parasitization rate on EGVM larvae developing on *Daphne gnidium* in September.

***Therophilus tumidulus* (Nees, 1812)**

Microdus tumidulus Nees: Luciano et al. 1988

Italian distribution of reared parasitoids. Sardinia: Luciano et al. 1988

Distribution. *Therophilus tumidulus* is widespread in the Palearctic area: throughout Europe, Morocco, Russia, Caucasus, Turkey, Iran, Central Asia as far as Japan and China (Yu 1997-2012; Yu et al. 2012).

Host range. The species is known as larval parasitoid of Lepidoptera Momphidae, Gelechiidae, Depressariidae and especially Tortricidae, including the vine tortrix moth *S. pilleriana* (Voukassovitch 1924, Villemant et al. 2012).

Ecological role. *Therophilus tumidulus* was the second most frequent larval parasitoid of EGVM on *Daphne gnidium* in Sardinia, after *P. nigrina*, with parasitism rates ranging from 12.5 to 24.1% in the first generation and 8.6% in the third generation. Telenga (1934) mentioned this species as one of the main parasitoids of EGVM in Crimea vineyards.

Subfamily: Braconinae

***Bracon mellitor* Say, 1836**

Goidanich 1931

Bracon vernoniae Ashm.: Leonardi 1925

Distribution. This species, distributed in North America from Canada to Mexico, is also present in Cuba, Brazil, Hawaii, while it is not present in Europe. In 1935 it was introduced from Hawaii into Egypt to control the Pink Bollworm, *Pectinophora gossypiella* (Saunders, 1844) (Lepidoptera Gelechiidae), but it seems not established (Bey 1951, Yu et al. 2012).

Host range. *Bracon mellitor* lives on many hosts, mainly belonging to the Coleoptera Curculionidae and several families of Lepidoptera, especially Tortricidae, Pyralidae, Gelechiidae and Noctuidae (Yu 1997-2012; Yu et al. 2012). Among these species are included the already mentioned *P. viteana* and *L. botrana*. The former was initially confused with *L. botrana* (see e.g. Johnson and Hammar 1912), and it is likely that the record of *B. vernoniae* on *L. botrana* reported by Leonardi (1925) originates from this mistake, since Marsh (1979) and Tillman and Cate (1989) did not include this moth among the hosts of this *Bracon*.

***Bracon (Glabrobracon) admotus* Papp, 2000**

Loni et al. 2016

Bracon sl.: Scaramozzino et al. (in press)

Italian distribution of reared parasitoids. Tuscany: Loni et al. 2016, Scaramozzino et al. (in press)

Distribution. This species was originally described by Papp (2000) on specimens from Bulgaria and Hungary. Beyarslan and Erdoğan (2012) recorded this species from Turkey, and Loni et al. (2016) from Italy.

Host range. The species was raised from larvae of *Byctiscus betulae* (Linnaeus, 1758) (Coleoptera: Attelabidae) in the leaves of *Populus tremula* L. rolled up like a cigar (Papp 2000)

Loni et al. (2016) obtained three males (two in October 2014 and one in October 2015) by EGVM larvae feeding on *D. gnidium* in the Nature Reserve of San Rossore (Pisa).

***Habrobracon* sp.**

Delrio et al. 1987, Moleas 1995, Coscollá 1997

Italian distribution of reared parasitoids. Sardinia: Delrio et al. 1987

Host range. Idiobiont larval ectophagous and gregarious parasitoid predominantly of Coleoptera and Lepidoptera.

Ecological role. In Sardinia vineyards Delrio et al. (1987) obtained by *L. botrana* an unidentified species of *Habrobracon* which, along with other species (*Elachertus affinis* Masi, *Agathis* sp. and *Chelonus* sp.), emerged from 10-12% of the first generation larvae and from 5% of second and third generation larvae. The genus *Habrobracon* Ashmead, 1895 is also used in synonymy with *Bracon* Fabricius, 1804, in the Fauna Europaea, where nearly 250 species of this genus in Europe are listed.

***Habrobracon concolorans* (Marshall, 1900)**

Loni et al. 2016

Bracon sl.: Scaramozzino et al. (in press)**Italian distribution of reared parasitoids.** Tuscany: Loni et al. 2016, Scaramozzino et al. (in press)**Distribution.** *Habrobracon concolorans* is a Trans-Eurasian species (Samartsev and Belokobylskij 2013), widely distributed in the Palaearctic region.**Host range.** Loni et al. (2016) found this species associated with EGVM for the first time. In the Nature Reserve of San Rossore, on *Daphne gnidium*, *H. concolorans* feeds on larvae of the three EGVM generations. It develops as ectoparasitoid on mature larvae, killing them before they make the cocoon, and showing both solitary and gregarious habits, with up to four individuals feeding on the same host larva. To date it is only known from 13 host species, mostly Lepidoptera (Gelechiidae, Noctuidae, Nymphalidae, Pyralidae, Tortricidae) and one Coleoptera Anobiidae (Loni et al. 2016). Moreover, *H. concolorans* is a major parasitoid of the highly invasive South American tomato leafminer, *Tuta absoluta* (Meyrick, 1917) (Lepidoptera, Gelechiidae) (Biondi et al. 2013).**Ecological role.** *Habrobracon concolorans* has been found associated to three other species of Braconinae (*H. hebetor*, *H. pillerianae* and *Bracon admotus*) that emerged from more than 1,200 EGVM samples collected in 2014 (Loni et al. 2016) with a parasitization rate of 2.4%.***Habrobracon hebetor* (Say, 1836)**

Moleas 1979, Loni et al. 2016

Habrobracon sp.: Silvestri 1912, Boselli 1928, Stellwaag 1928*Habrobracon brevicornis* Wesmael: Goidanich 1934*Microbracon brevicornis* Wesm.: Thompson 1946*Bracon* sl.: Scaramozzino et al. (in press)**Italian distribution of reared parasitoids.** Campania: Silvestri 1912

Tuscany: Loni et al. 2016, Scaramozzino et al. (in press)

Sicily: Silvestri 1912 (from larvae of *Ephestia elutella*)

South Italy: Moleas 1979

Distribution. Cosmopolitan.**Taxonomic notes.** In the past, the taxonomic position of *H. hebetor* was not well defined; it has a large number of synonyms because of the wide distribution, the broad host range and the morphological variability, so that it was attributed to the genera *Bracon*, *Habrobracon* and *Microbracon* (Loni et al. 2016). It was considered for long time separated from his junior synonym *Bracon brevicornis* (Wesmael, 1838) (see e.g.: Marsh 1979, Fauna Europaea) on the basis of various morphological characteristics.

Host range. Highly polyphagous, it is known to attack various species of pyralid moths feeding on stored products, as well as other Lepidopterous pests on several cultivated plants (Yu et al. 2012). It is an idiobiont ectophagous and gregarious parasitoid of Lepidopteran larvae. In Loni et al. (2016) a list of records of *H. hebetor* found on EGVM is provided. Goidanich (1934), reviewing the specimens obtained from larvae of *L. botrana* and *Ephestia elutella* by Silvestri, assigns them to *Habrobracon brevicornis*. In 2014 Loni et al. (2016) obtained two females of this species from a larva of *L. botrana* feeding on *D. gnidium*. Under the name *H. brevicornis* it was known as a major parasitoid of the European Corn Borer *Ostrinia nubilalis* (Hübner, 1796) (Lepidoptera, Pyralidae), and, with the aim of controlling this pest, it was introduced and released in different locations in North America (Goidanich 1931, Marsh 1979, Yu et al. 2012).

***Habrobracon pillerianae* Fischer, 1980**

Loni et al. 2016

Bracon s. l.: Scaramozzino et al. (in press)

Italian distribution of reared parasitoids. Tuscany: Loni et al. 2016, Scaramozzino et al. (in press)

Distribution. Currently this species is only found in Asian Turkey (Fischer 1980) and in Tuscany (Italy) (Loni et al. 2016)

Host range and ecological role. Very little information is available on this species (Fischer 1980). This author described *H. pillerianae* on the basis of six specimens emerged from *Sparganothis pilleriana* in Central Anatolia (Turkey). We personally obtained this Braconid by EGVM larvae feeding on grapevine in Cerreto Guidi (FI) in June 2005 and August 2008 and on *D. gnidium* in San Rossore (Pisa), from late June to early September 2014 (Loni et al. 2016). Although it proved to be the most common species among the Braconinae found in S. Rossore (it accounted for about 6% of all collected parasitoids), the parasitism rate on *L. botrana* larvae was only around 1.3%.

Also in this species the larvae developed both solitary and gregariously, with up to three individuals feeding on the same host (Loni et al. 2016).

Subfamily: Cheloninae

***Ascogaster quadridentata* Wesmael, 1835**

Fig. 3

Luciano et al. 1988, Marchesini and Dalla Montà 1992, 1994, 1998, Coscollá 1997, Marchesini et al. 2006, Bagnoli and Lucchi 2006.

Italian distribution of reared parasitoids. Sardinia: Luciano et al. 1988

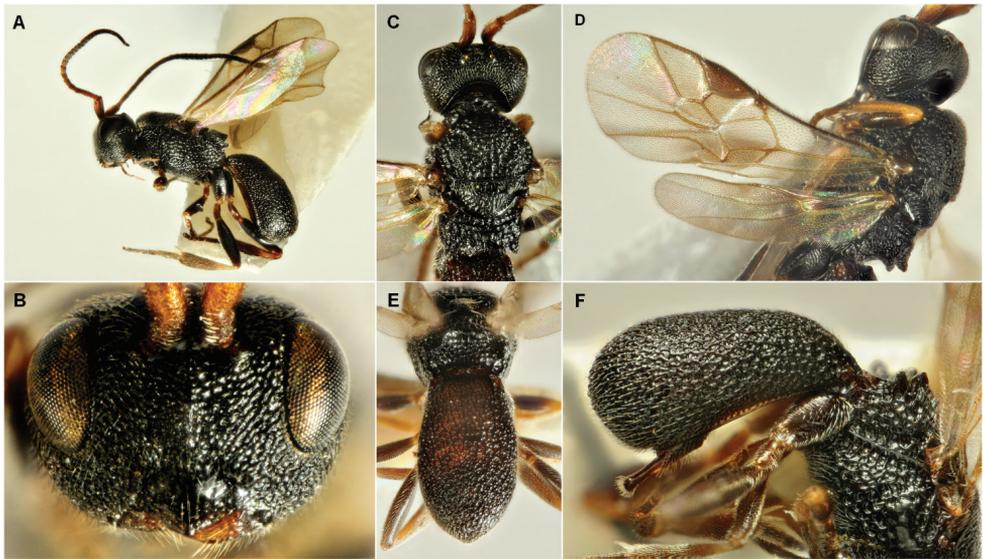


Figure 3. *Ascogaster quadridentata* Wesmael 1835. **A** habitus male, lateral view **B** head male, anterior view **C** head and mesosoma, dorsal view **D** wings, male **E** metasoma male, dorsal view **F** metasoma female lateral view.

Tuscany: Bagnoli and Lucchi 2006

Veneto: Marchesini and Dalla Montà 1992, 1994, 1998, Marchesini et al. 2006

Distribution. The species is present in Europe and North Africa; in Asia it is recorded up to Japan (for more details see: Yu 1997-2012 and Cabi 2016a). *A. quadridentata* was introduced in North America and New Zealand for the biological control of *Cydia pomonella* L. (Lepidoptera, Tortricidae).

Host range. This koinobiont egg-larval endophagous parasitoid feeds on various species of economically important moths, especially belonging to the family Tortricidae. Yu et al. (2012) provide a list of sixty-seven host species. In the vineyards it has been also associated to *P. viteana* and *E. ambiguella*.

Ecological role. As already highlighted by Bagnoli and Lucchi (2006), in Tuscany this parasitoid is usually present at low density in all the three generations of *L. botrana*. In Veneto it has never been obtained by larvae of the first generation, but reached a maximum rate of parasitism of 4.4% in the second generation and 2.7% in the third generation. In Sardinia it was obtained only from first generation larvae of EGVM living on *D. gnidium*, with a parasitism rate of 3.7%.

Ascogaster rufidens Wesmael, 1835

Silvestri 1912, Boselli 1928, Stellwaag 1928

Italian distribution of reared parasitoids. Campania: Silvestri 1912 (Portici)

Distribution. This species shows a Palearctic distribution, being present in Europe (excluding Iberian Peninsula, ex Yugoslavia and Greece), Russia, Far East Russia, and China.

Host range. Koinobiont endophagous egg-larval parasitoid. The only record is due to Silvestri (1912) that frequently reared it in August from EGVM larvae. Like the previous species, it lives on microlepidoptera, especially Tortricidae.

***Chelonus* sp.**

Delrio et al. 1987, Coscollá 1997

Italian distribution of reared parasitoids. Sardinia: Delrio et al. 1987

Distribution. *Chelonus* Panzer, 1806 is a cosmopolitan genus with 190 species in Europe (Fauna Europaea).

Host range. Like the species of the genus *Ascogaster*, the *Chelonus* spp. are koinobiont egg-larval endophagous parasitoids of various groups of microlepidoptera and Noctuidae.

Ecological role. In Sardinia Delrio et al. (1987) obtained an unidentified species of *Chelonus* that, along with other species (*Elachertus affinis* Masi, *Agathis* sp. and *Habrobracon* sp.) parasitized 10-12% of the EGVM larvae of the first generation and 5% of the larvae of the second and third generations.

Subfamily: Exothecinae

***Colastes* sp.**

Colombera et al. 2001

Italian distribution of reared parasitoids. Piedmont: Colombera et al. 2001

Distribution and host range. *Colastes* Haliday, 1833 is a cosmopolitan genus represented in Europe by 15 species, which are, as all the members of the subfamily, idiobiont ectophagous solitary parasitoids on larvae of several leafminers (Shaw and Huddleston 1991). Only one specimen was obtained from the first generation larvae of EGVM in Piedmont.

Subfamily: Euphorinae

***Meteorus* sp.**

Silvestri 1912, Boselli 1928, Stellwaag 1928

Italian distribution of reared parasitoids. Campania: Silvestri 1912 (Nola, Portici)

Apulia: Silvestri 1912 (S. Vito dei Normanni - Lecce)

Distribution. *Meteorus* Haliday, 1835 is a cosmopolitan genus with a large number of species, Yu (1997-2012) lists 316 species, 46 of which are present in Europe (Fauna Europaea).

Host range. The species of the genus *Meteorus* are koinobiont endophagous larval parasitoids of Coleoptera and Lepidoptera. *M. pendulus* (Müller, 1776) and *M. rubens* (Nees, 1811) have been found on *E. ambiguella*, while *M. colon* (Haliday, 1835) was obtained from *S. pilleriana*. Silvestri (1912) in July and August repeatedly observed some specimens of an unidentified *Meteorus* from larvae of EGVM collected in Campania and Apulia vineyards.

Subfamily: Microgastrinae

Apanteles sp.

Nuzzaci and Triggiani 1982, Luciano et al. 1988, Moleas 1995, Coscollá 1997

Italian distribution of reared parasitoids. Apulia: Nuzzaci and Triggiani 1982

Sardinia: Luciano et al. 1988

Distribution. *Apanteles* Förster, 1863 is a big cosmopolitan genus which - according to Mason (1981) - would include between 5,000 and 10,000 species. Yu (1997-2012) lists a little less than a thousand species. In Europe are reported 195 species (Fauna Europaea).

Taxonomic notes. *Apanteles* is a polyphyletic complicated group, both for the high number of species and for the evident morphological convergence accompanied by the characters reduction. Mason (1981) divided this group in 26 distinct genera (see Whitfield et al. 2002).

The situation is still controversial and Mason's opinion is not accepted by all taxonomists of the group (see note 180 in Broad et al. 2012).

Host range. Like all Microgastrinae, *Apanteles* spp. are koinobiont endophagous larval parasitoids of Lepidoptera Ditrysia and are undoubtedly among the most important parasitoids of this order. For more details, see Shaw and Huddleston (1991).

Ecological role. In Apulia, an unidentified species of *Apanteles* was repeatedly found in September-October; this emerged from EGVM larvae living on *D. gnidium*, with a parasitization rate of approx. 20% (Nuzzaci and Triggiani 1982). Again, on *D. gnidium* in Sardinia, another unidentified *Apanteles* was obtained both from EGVM larvae of first and third generation, with parasitization rates of 6.2% and 24.1% respectively (Luciano et al. 1988).

***Apanteles albipennis* (Nees, 1834)**

Laccone 1978

Italian distribution of reared parasitoids. Apulia: Laccone 1978**Distribution.** Palaearctic species, widespread in Europe and in the former Soviet Union up to the east coast.**Host range.** Yu (1997-2012) provides a list of 33 species of Lepidopteran hosts including Tortricidae, Gelechiidae, Pterophoridae, Coleophoridae, Pyralidae and other families, plus two erroneous records: one species of Buprestidae and one of Curculionidae (Coleoptera). Among the hosts of *A. albipennis* is also recorded *S. pilleriana* (Ruschka and Fulmek 1915).**Ecological role.** Specimens of this species were rarely obtained from EGVM larvae of first and second generation collected on vine in Apulia (Laccone 1978).***Microgaster rufipes* Nees, 1834 [= *M. globata* auctt., not (Linnaeus, 1758)]***Microgaster globata*: Catoni 1914, Stellwaag 1928**Italian distribution of reared parasitoids.** Trentino-South Tyrol: Catoni 1914, Stellwaag 1928**Distribution.** *Microgaster* is a cosmopolitan genus, fairly rich in species. Yu (1997-2012) reports 178 species, 45 of which in Europe (Fauna Europaea).**Taxonomic notes.** In the past, the name “*globata*” was often referred to the European species of *Microgaster* Latreille, 1804, characterized by red hind femora. Nowadays we do not know exactly to what species the old quotes of many authors refer (Nixon 1968). This is probably the case of the records of Catoni (1914) and Schwangart (Stellwaag 1928). Recently Van Achterberg (2014) addressed the issue and eventually renamed *M. globatus* auctt. with the oldest available name *Microgaster rufipes* Nees, 1834.The species is now reported in the Fauna Europaea as *Microgaster rufipes* Nees, 1834, but is still listed by Broad et al. (2012, 2016) and Yu et al. (2012) under the incorrect name of *M. globata*.**Host range.** Yu et al. (2012) list fifty hosts, many of which are tortricids. Those of Catoni (1914) and Schwangart (Stellwaag 1928) are the only references of *M. globata* on *L. botrana*.***Microplitis* sp.**

Marchesini and Dalla Montà 1992, 1994, 1998, Coscollá 1997, Colombara et al. 2001, Marchesini et al. 2006

Italian distribution of reared parasitoids. Piedmont: Colombera et al. 2001

Veneto: Marchesini and Dalla Montà 1992, 1994, 1998, Marchesini et al. 2006

Distribution. *Microplitis* Förster, 1863 is a cosmopolitan genus that counts about 180 species.

Host range. All the species of this genus are solitary or gregarious endoparasitoids of Lepidopteran larvae (especially Noctuidae).

Ecological role. Both Marchesini et al. (1994, 2006) and Colombera et al. (2001) have obtained a few specimens of an unidentified species of *Microplitis* by EGVM larvae of the second generation.

Microplitis tuberculifer (Wesmael, 1837)

Microplitis tuberculifera: Catoni 1914, Ruschka and Fulmek 1915, Boselli 1928

Microplites tuberculifera (Wesm.) Reinh.: Stellwaag 1928

Italian distribution of reared parasitoids. Trentino-South Tyrol: Catoni 1914, Ruschka and Fulmek 1915

Distribution. *Microplitis tuberculifer* is widespread and common throughout the Palearctic region, with the exception of North Africa.

Host range. It is a solitary koinobiont endoparasitoid of Lepidopteran larvae (Noctuidae and Geometridae), and it is also reported on *E. ambiguella* in Austria, together with EGVM (Ruschka and Fulmek 1915), and Bulgaria (Balevski 1989, Yu et al. 2012).

The only Italian records of this species on the two vine moths are due to Catoni (1914) and Ruschka and Fulmek (1915).

Subfamily: Rogadinae

Aleiodes sp.

Nuzzaci and Triggiani 1982

Italian distribution of reared parasitoids. Apulia: Nuzzaci and Triggiani 1982

Distribution. *Aleiodes* Wesmael, 1838, is a cosmopolitan genus of 240 species (Yu, 1997–2012), with 42 of them listed in Europe (Fauna Europaea).

Host range. In most cases, the species of this genus live on larvae of macrolepidoptera, both diurnal and nocturnal and, to a lesser extent, on larvae of microlepidoptera, including tortricids. They are koinobiont larval endoparasitoids, and lay their eggs in the host young larva and pupate inside the mummified remains of the dead caterpillar. Three species of *Aleiodes* are associated with *L. botrana*. Nuzzaci and Triggiani (1982) obtained a single specimen of an unidentified species of *Aleiodes* by EGVM larvae living on *D. gnidium*.

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Redescription of the red-striped soft scale, *Pulvinaria tenuivalvata* (Newstead), with a new synonymy (Hemiptera, Coccoomorpha, Coccidae)

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Abstract

The soft scale, *Pulvinaria tenuivalvata* (Newstead, 1911), is a major pest of sugarcane in Egypt. This paper provides a redescription and illustration of the adult female based on a microscopic study of the morphology of several adult female specimens and of the type series illustrated by De Lotto (1965) on citronella grass from Uganda. Two paratypes of *Pulvinaria saccharia* De Lotto, 1964 are also studied and the name is placed here as a junior synonym of *P. tenuivalvata*.

Keywords

Coccidae, Egypt, pest, sugarcane, synonymy

Introduction

Sugarcane, *Saccharum officinarum* L. (Poaceae) is one of the main crops in Egypt, and the control of pests on this crop is very important. The red-striped soft scale *Pulvinaria tenuivalvata* is a major pest since 1992, when it was observed for the first time and named as *Pulvinaria elongata* Newstead (Karam and Abou-Alkhair 1992). It attacks leaves, causing a major reduction in crop yield due to depletion of sap, production of honeydew and growth of sooty mould. Early and heavy infestations have resulted in complete yield lost (El-Serwy et al. 2008).

The species was described by Newstead (1911) as *Lecanium tenuivalvatum*, based on adult females, all of which were heavily parasitised, infesting citronella grass (*Cymbopogon citratus*) in Uganda. De Lotto (1964) described and illustrated for the first time *Pulvinaria saccharia* collected on leaves of sugar cane in Durban, Natal, and stated that the species is structurally very closely related to *Pulvinaria tenuivalvata* (Newstead, 1911). The same author (De Lotto 1965) redescribed and illustrated the adult female of *Pulvinaria tenuivalvata* from a single specimen from the type locality and the type host plant. Williams (1982), in his study of *Pulvinaria iceryi* (Signoret) and its allies on sugarcane and other grasses, separated *P. tenuivalvata* from five *Pulvinaria* species, giving a key and commenting on the great similarity of these five species, *P. elongata* Newstead, *P. iceryi* (Signoret), *P. saccharia* De Lotto, *P. sorghicola* De Lotto and *P. tenuivalvata* (Newstead). He stated that *P. tenuivalvata* is very close to *P. saccharia*. Watson and Foldi (2002) discussed the identity of the pest on sugarcane in Egypt and identified the species as *Pulvinaria tenuivalvata* (Newstead), although it had previously been identified as *Pulvinaria elongata* Newstead (Karam and Abu-Elkhair 1992) and *Saccharolecanium krugeri* (Zehntner) (Ali et al. 1997). In 2001, Ghabbour and Hodgson described and illustrated the 1st instar nymph and 2nd and 3rd instar female nymphs of *P. tenuivalvata* and provided a key.

The present paper redescribes and illustrates the adult female of *Pulvinaria tenuivalvata* (Newstead) in detail. In addition, we were able to study two paratypes of *Pulvinaria saccharia* De Lotto, 1964 and conclude that the name *Pulvinaria saccharia* is a junior synonym of the name *Pulvinaria tenuivalvata*.

Materials and methods

Slide-mounted adult females were studied from the entomology collections at The Natural History Museum, London, U.K. (BMNH) and Muséum national d'Histoire naturelle, Paris, France (MNHN). The photos were produced using with a Leica DFC 420 camera and the software Leica Application Suite, version 2.8.1. The drawings were made using the software Illustrator CS6 version 16.0.0. Morphological terms follow those by Hodgson (1994) and Qin and Gullan (1992).

Taxonomy

Pulvinaria tenuivalvata Newstead, 1911

Lecanium tenuivalvatum Newstead, 1911: 92.

Pulvinaria tenuivalvata (Newstead), De Lotto 1965: 217.

Pulvinaria elongata Newstead; Karam and Abu-Elkhair 1992: 587, misidentification.

Saccharolecanium krugeri (Zehntner); Ali et al. 1997: 149, misidentification.

Pulvinaria saccharia De Lotto, 1964: 863, 2 paratype adult females, South Africa, Natal, Durban, on *Saccharum officinarum*, J. Munting, 25/03/1964 (BMNH); De Lotto 1966: 468; Hodgson 1968: 207; 1969: 29, 30; Qin and Gullan 1992: 121. **syn. n.**

Description of the adult female. Figs 1–6. The adult female of *P. tenuivalvata* is very elongate, convex with the cephalic region flattened. The body colour varies from pale crimson to flesh-coloured with two irregular longitudinal bands of bright crimson on the dorsum. No true ovisac is formed, except under the body where it extends forward to the eyes and may project slightly from beneath the female body.

Body (Fig. 1A): very elongate, oval, narrow at both ends, 3.4–6.5 mm long, 1.5–2.5 mm wide. Derm membranous. Anal cleft rather shallow ranged from 0.70 to 0.74 mm in length. Stigmatic clefts poorly developed.

Margin: marginal setae (Fig. 1B) numerous, slender and pointed, with well-developed basal-sockets, distributed in one row with 12–18 setae on each side between the anterior and posterior stigmatic clefts, mostly about 35–40 µm long, a few only approximately 20 µm long, the longest setae similar in length to the median stigmatic setae (Fig. 2A). Three stigmatic setae present (Fig. 1F) in each stigmatic cleft; these setae short, stout, pointed, the median seta longest (Fig. 2B), straight or more-or-less curved, variable in size and thickness, 25–40 µm long, lateral spiracular setae also variable in size and shape, each 15–20 µm long, pointed (Figs 2B, 5A).

Dorsum: dorsal setae (Fig. 1G) stout, conical, 10–15 µm long, not lanceolate (Fig. 6), scattered all over body surface. Submarginal tubercles absent. Preopercular pores minute (Fig. 1D) about 3 µm in diameter, grouped in small number (6–18) anteriorly to the anal plates. Filamentous pores minute (Fig. 1E), evenly distributed. Anal plates (Fig. 1C₁) together quadrate, each plate 125–140 µm long and 70–75 µm wide. Each plate with four short setae; one apical, one subapical, one inner margin seta and one outer margin seta. Ano-genital fold (Fig. 1C₂) with two pairs of long anterior marginal setae (a median pair each nearly 45 µm long and a submedian pair each around 65 µm long) and three pairs of long lateral margin setae, 55–65 µm. Anal ring with four pairs of long setae and two rows of pores.

Venter: submarginal setae (Fig. 1J) setose, approx. 7 µm long, placed in a submarginal row. Interantennal setae long, present in three pairs. Preulvar setae long, one pair on each of the three prevulvar segments. Minute ventral setae evenly distributed. Antennae well developed, eight segmented (Figs 1H, 4), 300–370 µm long, 3rd segment longest.

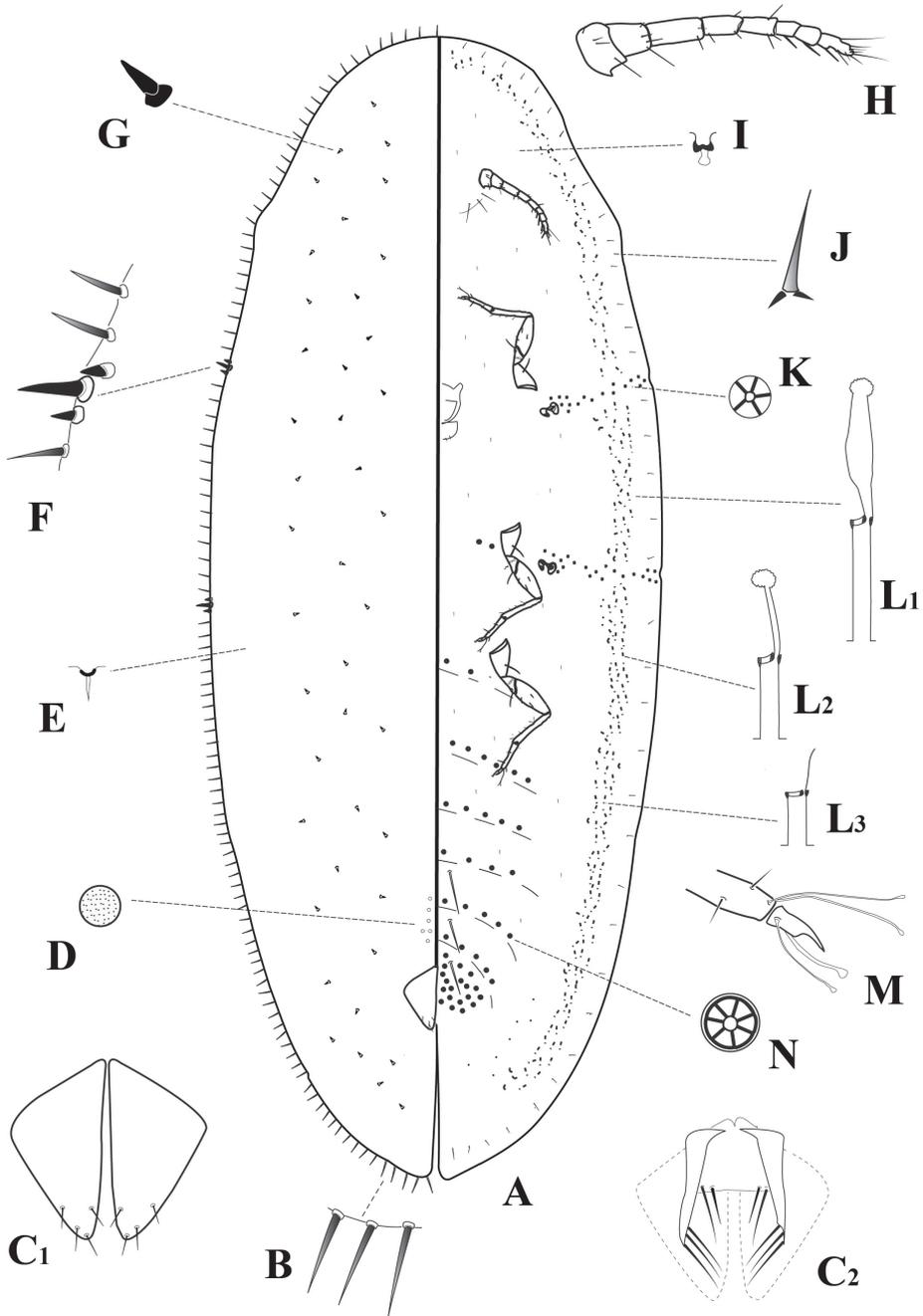
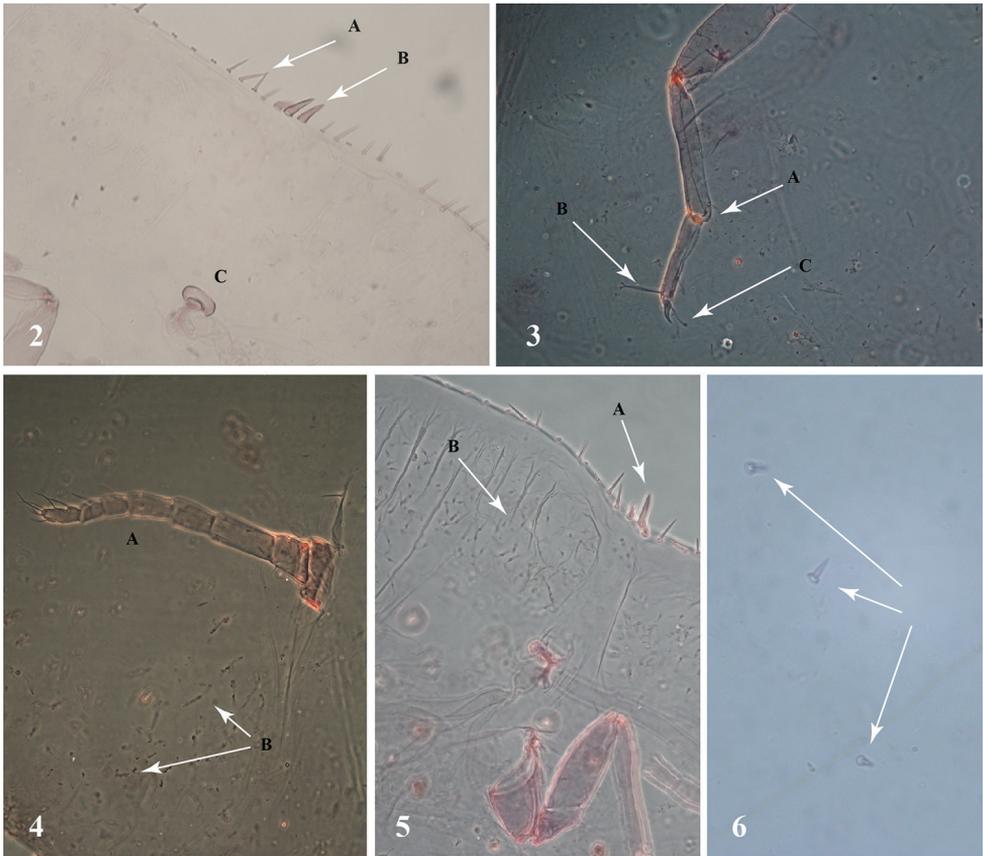


Figure 1. *Pulvinaria tenuivalvata* (Newstead). **A** Body, venter and dorsum **B** marginal setae **C1** anal plates, dorsal view **C2** ano-genital fold **D** dorsal discoidal pore **E** dorsal filamentous pore **F** spiracular setae **G** dorsal seta **H** antenna **I** ventral microduct **J** ventral submarginal seta **K** spiracular disc-pore **L** ventral tubular ducts of three types: L1, type I, L2, type II, L3, type III **M** claw digitules unequal **N** multilocular disc-pore.



Figures 2–6. *Pulvinaria tenuivalvata* (Newstead). **2A** marginal setae **2B** anterior spiracular setae **2C** anterior spiracle **3A** tibio-tarsal articular sclerite **3B** tarsal digitules **3C** claw digitules unequal **4A** antenna **4B** ventral tubular ducts of the type I **5A** posterior spiracular setae **5B** ventral tubular ducts of the type I **6** dorsal conical setae.

Legs well developed, each with a distinct tibio-tarsal articular sclerite (Fig. 3A), claw without distinct denticle (Fig. 3C). Tarsal digitules, slender, knobbed at apex (Figs 1M, 3B), 45–50 μm long. Hind trochanter + femur 200–260 μm long. Claw digitules unequal, one twice diameter of other, both slender, of the same length, each slightly knobbed at the apex (Figs 1M, 3C), 35–40 μm long. Anterior and posterior spiracles well-developed. Spiracular disc-pores (Fig. 1K) with five loculi, some with four or three loculi, 3–4 μm in diameter, present in a narrow band extending from each spiracle to margin. Multilocular disc-pores (Fig. 1N) with 7–8 loculi, some pores occasionally with fewer loculi, approx. 5 μm in diameter, numerous around vulva, in single rows on all preceding abdominal segments and a few present, submedially, on metathorax and mesothorax. Ventral microducts present, minute (Fig. 1I), sparse. Ventral tubular ducts (Fig. 1L) in a submarginal band, 4–6 ducts wide, numerous around entire body, except caudal area and head region where they are sparse. Three types of ventral tubular ducts are present,

all of similar diameter. Type I (Fig. 1L1) long and narrow, numerous, with outer ductule about 20 μm long, approx. 3 μm in diameter, inner ductule approx. 24 μm long, longer and wider than outer ductule and with a large terminal gland. Type II (Fig. 1L2) shorter than type I, less numerous, 10 μm long and 3 μm in diameter, inner ductule 7 μm long, narrower than outer one and with a terminal gland. Type III (Fig. 1L3), the shortest, with outer ductule 5 μm long and inner ductule slender and short, without a terminal gland, very few in number.

Material examined. Egypt: 100 km south of Cairo, Benisueif, on sugarcane and rarely on maize, M.A. Shalaby, ? 1997 (BMNH); upper Egypt, Giza, on sugarcane leaves, 1997 (BMNH); Qena Governorate, Luxor and Qus (700 km south of Cairo), on undersides of sugarcane leaves, S.A. El-Serwy, 01/1999 (BMNH); Giza region, 40–80 km south of Cairo, on *Saccharum officinarum* (commercial), S.A. El-Serwy, 10/08/1999 (BMNH); upper Egypt, Qena Governorate, on sugarcane leaves, 12/2000 (BMNH); on sugarcane, S. Ramadan, 2011 (MNHN). **Uganda:** Entebbe, on citronella grass, C.C. Gowdey, 18/02/1910, G. De Lotto, 1960, B.M. 1963–473 (BMNH). **South Africa,** Natal, Durban, on *Saccharum officinarum*, J. Munting, 25/03/1964, *Pulvinaria saccharia*, 2 paratypes, B.M. 1964–662 (BMNH).

Host plants. The main host plant in Egypt is sugarcane, *Saccharum officinarum*, but it has also been recorded from several other Poaceae in Egypt: *Imperata cylindrica*, *Sorghum vulgare saccharatum*, and *Zea mays*. The species is known on *Cymbopogon citratus* (citronella grass) and *Pennisetum purpureum* in Uganda (García Morales et al. 2016), and from Zimbabwe and South Africa (Natal), on *Saccharum officinarum* (as *P. saccharia*).

Comments. Two paratypes of *Pulvinaria saccharia* De Lotto, 1964, have been examined, both adult females. The dorsal setae are short, strong and spiniform, but certainly not lanceolate as stated by the previous authors (De Lotto 1964; Williams 1982). The claw digitules are unequal, one much thicker than the other one, but of the same length. This character was first observed by De Lotto (1964; 1965) and confirmed by Williams (1982) and Watson and Foldi (2002). These two paratypes show the presence of three types of ventral submarginal tubular ducts, as always. *Pulvinaria saccharia* has ventral multilocular disc-pores on the metathorax and the mesothorax. The range of setae between the anterior and the posterior spiracles is about 29–31. The combined length of hind trochanter plus femur is about 200–220 μm . On the appearance in life of *P. saccharia*, De Lotto (1964) mentioned that “*P. saccharia* does not form any ovisac but a thin layer of white cottony wax laid beneath the body along the margin”. A similar type of ovisac on adult females of *P. tenuivalvata* was observed in Egypt. All these characters fall within the range of the morphological characters of *P. tenuivalvata*, so *P. saccharia* is here treated as a synonym of *P. tenuivalvata*.

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Sulawesifulvius thailandicus – a new species of the genus *Sulawesifulvius* Gorczyca, Chérot & Štys from Thailand (Hemiptera, Heteroptera, Miridae, Cylapinae)

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Abstract

A new species of the genus *Sulawesifulvius*, *S. thailandicus* Wolski, Yasunaga & Gorczyca, **sp. n.**, is described from Thailand. The present finding also represents the first distribution record in Indochina for the genus. Color adult habitus images for *S. thailandicus* and *S. schuhi* (type species of the genus), male genital drawings of *S. thailandicus*, and scanning electron micrographs of selected structures of *S. schuhi* and *S. thailandicus* are provided.

Keywords

Miridae, Cylapinae, *Sulawesifulvius*, description, diagnosis, Oriental Region

Introduction

Sulawesifulvius Gorczyca, Chérot & Štys, 2004 is a unique cylapine genus established by Gorczyca et al. (2004) to accommodate a single species, *S. schuhi* Gorczyca, Chérot & Štys, 2004, described from Sulawesi, Indonesia. Recently, Mu and Liu (2014) added the new species *S. yinggelingensis* Mu & Liu from Hainan (China) and Yeshwanth and Chérot (2015) described a new species, *S. indicus* Yeshwanth & Chérot, from India,

which significantly expanded the distribution range of *Sulawesifulvius* from the Wallacea to the Oriental Region (Fig. 22).

In this paper, a new species, *S. thailandicus*, is diagnosed and described based on material recently collected in central Thailand. Habitus photographic images of *Sulawesifulvius schuhi* (type species of the genus) and *S. thailandicus* sp. n., male genitalic drawings of *S. thailandicus* sp. n., and scanning electron micrographs of the selected structures of *S. schuhi* and *S. thailandicus* are provided. The present discovery of a new species in Thailand also represents the first distributional record from Indochina for the genus.

Materials and methods

Observations were made using an Olympus SZX12 stereomicroscope and an Olympus BX50 optical microscope. Digital images of live individuals were taken by TY with Canon EOS Kiss digital camera body + Olympus OM-System. Scanning electron micrographs were taken using Hitachi S-3400N and Phenom XL Scanning Electron Microscopes. Measurements were taken using an eyepiece (ocular) micrometer; all measurements are given in millimeters.

Dissections of male genitalia were performed using the technique mentioned by Kerzhner and Konstantinov (1999). The terminology of the male genitalic structures follows Konstantinov (2003) for the elements of the genital capsule and parameres and Cassis (2008) in using the term “endosoma” for the male intromittent organ. The study was based on the material deposited in the Insect Collection, Entomology & Zoology Group, Plant Protection Research and Development Office, Department of Agriculture, Bangkok (DOA), T. Yasunaga Collection, Nagasaki, Japan (TYCN); and Department of Zoology, University of Silesia, Poland (US).

Taxonomy

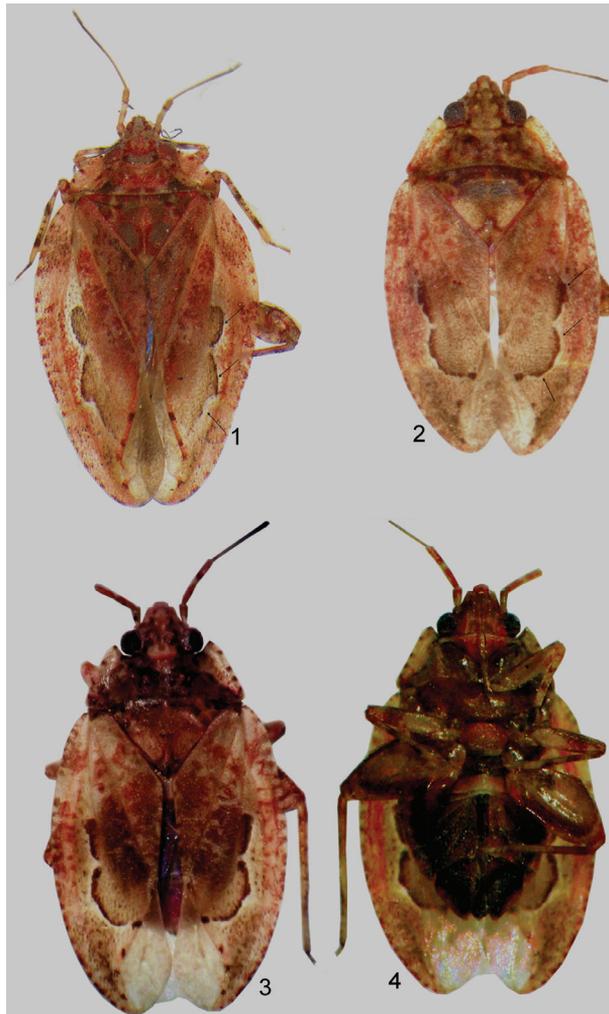
Sulawesifulvius thailandicus Wolski, Yasunaga & Gorczyca, sp. n.

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Figures 2–4, 12–25

Diagnosis. Recognized by the following set of characters: dorsum yellow with large dark brown and red areas (Figs 2–3); parameres as described below and depicted in Figs 14–17; endosoma with three well-developed sclerites (Fig. 13).

Sulawesifulvius thailandicus is most similar to *S. schuhi* and *S. yinggelingensis* in having large red markings on the dorsal surface (Figs 2–3, 20, 23; Mu and Liu 2014) (only slightly tinged with red in *S. indicus*) (Yeshwanth and Chérot 2015). *S. thailandicus* can, however, be easily distinguished by the characteristic shape of the parameres (as depicted in Figs 14–17) and the endosoma with three endosomal sclerites (Fig. 13).



Figures 1–4. Dorsal habitus photograph of *Sulawesifulvius schubi* (1 ♂ paratype) and *S. thailandicus* (2 holotype 3 ♀ paratype). Ventral view of *S. thailandicus* (4 ♀ paratype).

Description. **COLORATION** (Figs 2–4, 22–25). Dorsum yellow extensively mottled with dark brown and red. **Head.** Ground coloration yellow; vertex and frons moderately tinged with brown; vertex with two blackish patch posteriorly, each bordering inner margin of eye; tubercles on vertex and frons each with small dark brown patch; mandibular and maxillary plates and clypeus tinged with red; mandibular plates with two small, dark brown patches basally; antennal segments I and II yellow broadly tinged with red; segment dark brownish; labium dirty yellow tinged with red. **Thorax.** *Pronotum.* Yellow broadly tinged with brown and red; calli tinged with black. *Mesoscutum and scutellum.* Mesoscutum dark brown with small yellow tinges; scutellum mostly yellow, dark brown basally, with brown triangular pattern apically and with

small, brown, longitudinal patch at extreme apex. *Thoracic pleura*. Proepimeron yellowish, weakly tinged with red; mesepimeron and metepisternum dark castaneous; scent gland evaporative area dirty yellow. *Hemelytron*. Yellow, extensively tinged with dark brown, brown, and red; apical half of exocorium and basal portion of cuneus with marking composed of black, longitudinal, curved patches bordering R+M vein and inner half of basal margin of cuneus (Fig. 2, arrow); membrane fuscous mottled with yellow. *Legs*. Dirty yellow with dark brown, brown and red tinges. **Abdomen**. Dark brown. **STRUCTURE, TEXTURE, AND VESTITURE** (Figs 2–4, 18–25). **Head**. Vertex and frons each with pair of relatively large tubercles; labial segments I and II subdivided. *Pronotum*. Calli small. *Mesoscutum and scutellum*. Scutellum flat.

Male genitalia (Figs 12–17). *Genital capsule* (Fig. 12). Weakly flattened dorsoventrally; dorsal wall long, only weakly shorter than ventral wall; proctiger narrow; genital opening terminal in orientation; lateral margin immarginate. *Aedeagus* (Fig. 13). *Ductus seminis* relatively broad and rather short; sclerotized part of ductus seminis inside endosoma (dss) ovoid; secondary gonopore clearly present; endosoma with three sclerites (es1, es2 and es3); each sclerite sharply pointed; es1 nearly cylindrical at basal three fourths, apical one fourth tapering toward apex; sclerites es2 and es3 strongly curved; es2 tapering toward apex; es3 weakly broadened apically. *Right paramere* (Figs 14–15). Apical process relatively short, tapering toward apex, with protruding, hook-shaped process subapically; paramere body broad, covered with relatively long, semierect setae dorsally; basal process triangular. *Left paramere* (Figs 16–17). Apical process strongly broadened toward apex, with protruding hook-shaped process apically; paramere body long and thin, its lateral margins sinuate; sensory lobe and basal process strongly developed, elongated, tapering toward apex and sharply pointed

Measurements. ♂ (*: holotype measurements): Body length 2.95–3.05*, width 1.6–1.75*; Head length 0.48–0.53*, width across eyes 0.65–0.68*, interocular distance 0.3–0.33*; antennal segments I 0.14*–0.16, II 0.37–0.40*, III 0.46*–0.53, IV 0.17; labium obscured by glue and immeasurable in the examined specimens); pronotal length 0.53–0.55*; anterior margin 0.73–0.75*, lateral margin 0.3, posterior margin 1.26–1.33*. ♀: Body length 3.45, width 1.95; Head length 0.57, width across eyes 0.72, interocular distance 0.33; antennal segments I 0.15, II 0.45, III 0.57, IV missing; labial length 1.05; pronotal length 0.55, anterior margin 0.82, lateral margins 0.60, posterior margin 1.35.

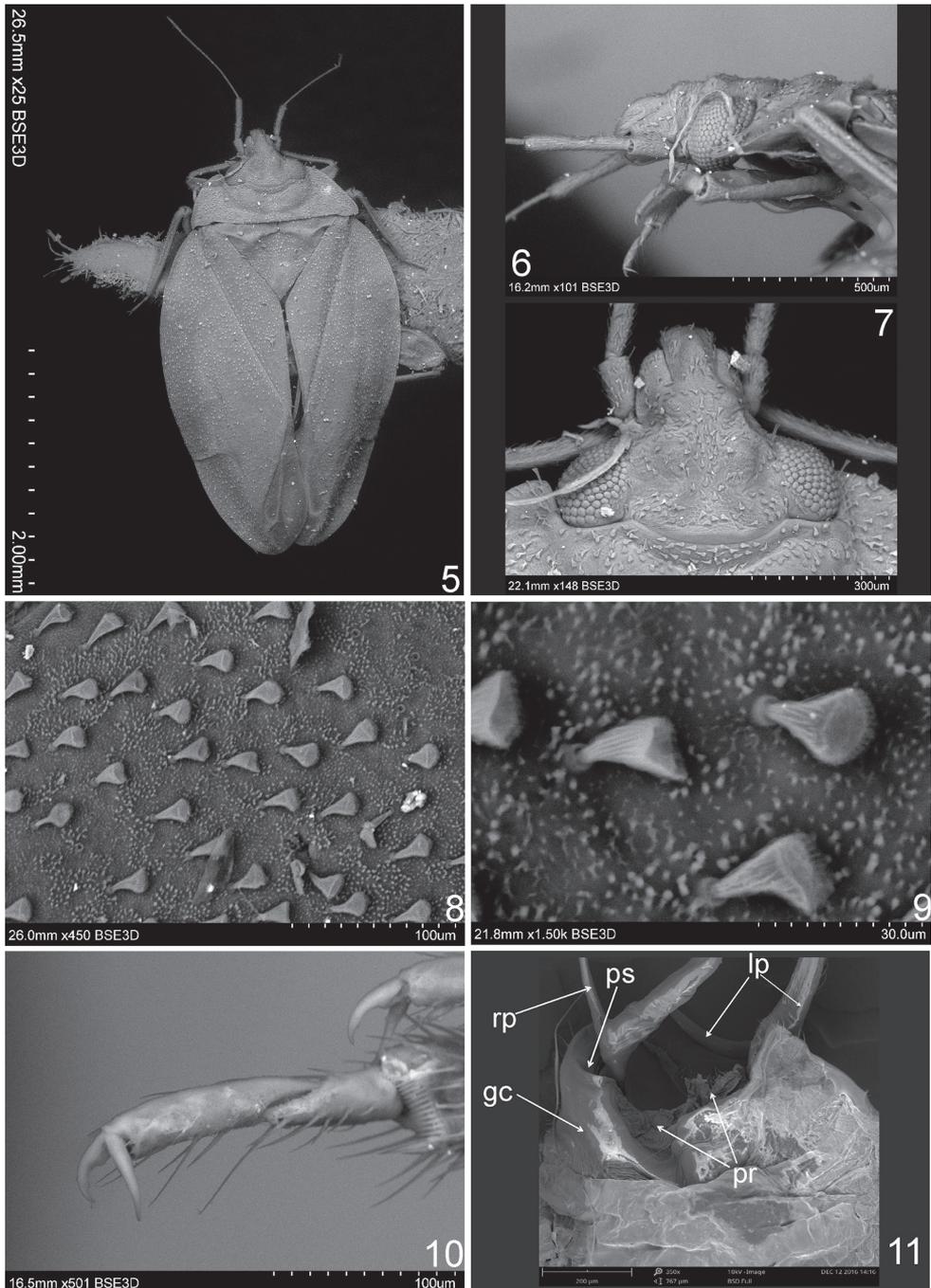
Female. Similar to male in coloration, structure, texture, and vestiture.

Biology. Unknown.

Distribution. Thailand (Nakhon Ratchasima, Nakhon Nayok).

Etymology. The specific name refers to the country where the holotype was collected.

Type material. Holotype male. Nakhon Ratchasima Prov., Wang Nam Khieo, Sakaerat Environmental Research Station, Sakaerat Biosphere Reserve, 14°30'27"N, 101°55'39"E, 410 m alt., light trap, 25 Sep 2013, T. Yasunaga (DOA); **paratypes** ♂: Nakhon Ratchasima Prov., Wang Nam Khieo, Sakaerat Environmental Research



Figures 5–11. Scanning electron micrographs of *Sulawesifulvius schuhi* (♂, paratype). **5** Dorsal habitus **6** Head and pronotum (lateral view) **7** Head (dorsal view) **8, 9** Structure and vestiture of hemelytron **10** Protarsus **11** Posterior half of male abdomen (dorsal view). Abbreviations: gc = genital capsule; lp = left paramere; pr = proctiger; ps = paramere socket; rp = right paramere.

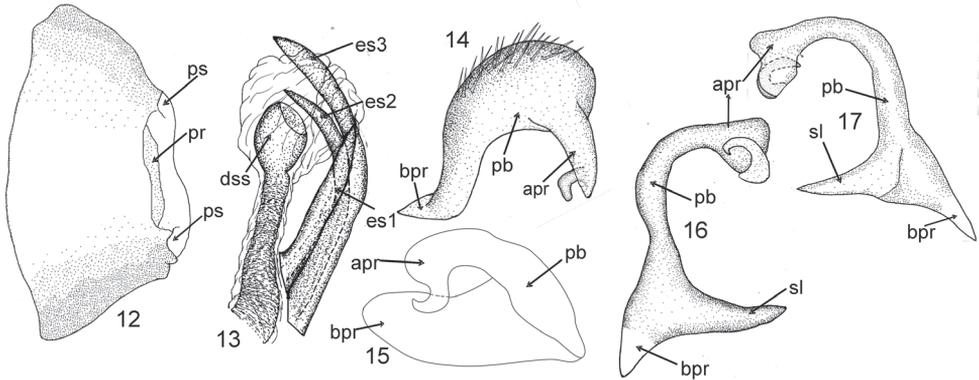
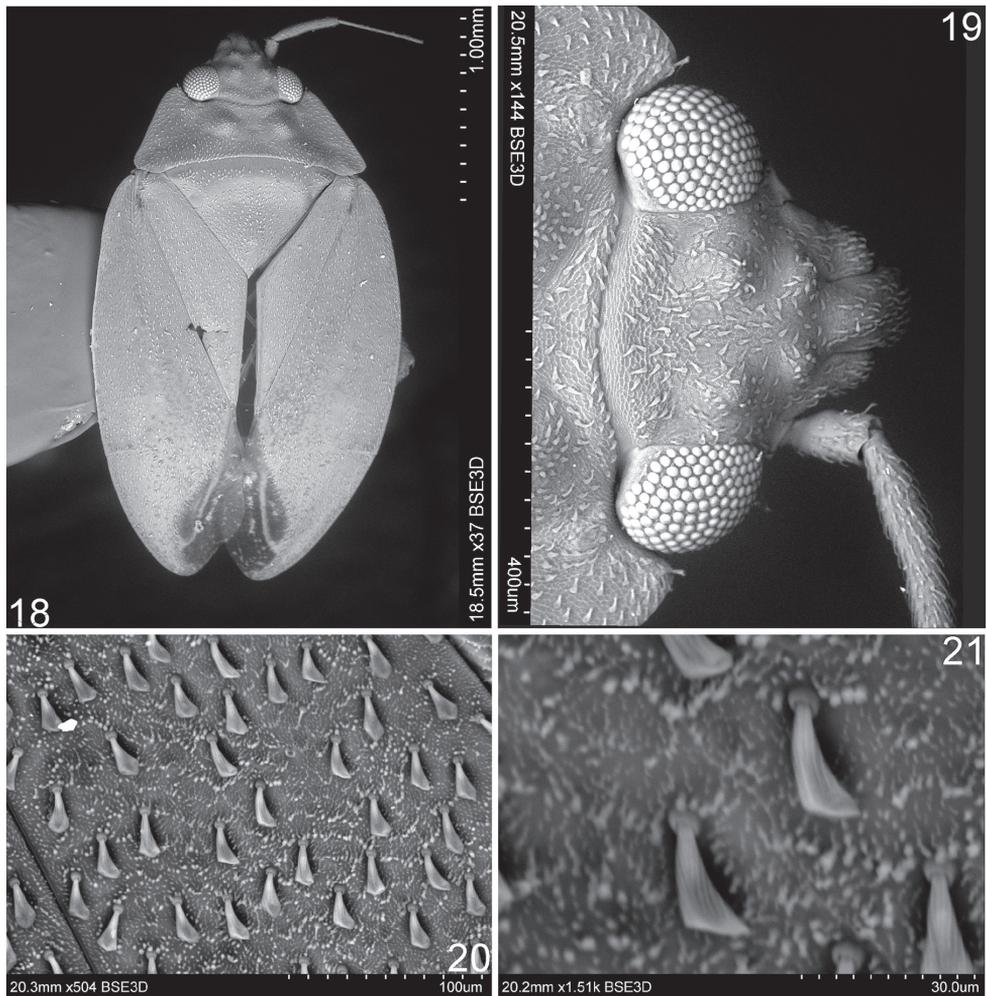


Figure 12–17. Male genitalia of *Sulawesifulvius thailandicus*. **12** Genital capsule (dorsal view, aedeagus and parameres removed) **13** Endosoma (right lateral view) **14** Right paramere (right lateral view) **15** Right paramere (dorsal view) **16** Left paramere (right lateral view) **17** Left paramere (left lateral view). Abbreviations: apr = apical process; bpr = basal process; dss = sclerotized portion of ductus seminis inside endosoma; es 1, 2, 3 – endosomal sclerites; pb = paramere body; pr = proctiger; ps = paramere socket; sl = sensory lobe.

Station, Sakaerat Biosphere Reserve, 14°30'27"N, 101°55'39"E, *Dipterocarpus* forest, light trap, 22 July 2015, leg. J. Gorczyca & A. Herczek (US); ♀: THAILAND: Nakhon Nayok: Sarika, N14°18'39" E101°18'00", at light, 22 Mar 2010, T. Yasunaga & K. Yamada (AMNH_PBI 00380553) (TYCN).

Discussion

Gorczyca et al. (2004) included *Sulawesifulvius* in the subfamily Cylapinae, based on the presence of the two-segmented tarsus and the claw with a subapical tooth (Fig. 10). The placement of *Sulawesifulvius* in the tribe Fulviini *sensu* Gorczyca (2000, 2006) was based on its horizontally elongated head and short antenna (Figs 1–7, 18–19, 22–24). Our examination revealed that *Sulawesifulvius* possesses the subdivided labial segment I which is shared by most genera currently placed in Fulviini (Wolski and Henry 2012, 2015; Wolski 2013; Wolski and Gorczyca 2014) but is not present in other tribes of Cylapinae, except for such rhinomirines as *Rhinomiris* Kirkaldy (Wolski and Henry 2015), *Lundbladiola* Carvalho, *Pararhinomiris* Gorczyca, *Rhinomiridius* Poppius, and *Rhinomiriella* Gorczyca (Wolski, pers. obs.). Other characters that warrants a placement of *Sulawesifulvius* within the tribe Fulviini include among others: 1) the dorsal surface with ornamentation composed of dense, tiny tubercles (Figs 7–8; 19–21); 2) the labial segment II subdivided subapically; 3) eyes with dense interocular setae (Figs 7, 19); 4) the metathoracic gland evaporative area narrowly developed, restricted to ventral margin of metepisternum; 5) the two segmented tarsus (Fig. 10); 6) the genital capsule with the dorsal wall long, only weakly shorter than ventral wall, genital opening terminal in orientation (Fig. 12; Gorczyca et al. 2004: fig. 6; Mu and Liu 2014: fig. 5; Yeshwanth and Chérot 2015: fig. 1).



Figures 18–21. Scanning electron micrographs of *Sulawesifulvius thailandicus* (holotype) **18** Dorsal habitus **19** Head (dorsal view) **20–21** Structure and vestiture of hemelytron.

Similar, shagreened surface of the dorsum to that found in *Sulawesifulvius* is present in many genera of Fulviini (Gorczyca and Wolski 2007: fig. 9; Wolski and Henry 2012: Figs 27–32, 54, 58, 60–61, 73–74; Pluot-Sigwalt and Chérot 2013: Figs 2A–B; Wolski and Gorczyca 2014: fig. 29–31) and is not found in other tribes of Cylapinae except for some rhinomirines (Wolski, pers. obs.).

The subdivision of the labial segment II in the Fulviini was noted among others by van Doesburg (1985: fig. 5) and Namyatova et al. (2016: fig. 10A). This character was also noted for *Psallops* Usinger and was not found in the representatives of the remaining cylapine tribes (Namyatova et al. 2016).

In *Sulawesifulvius* the dorsal wall of the genital capsule is long, weakly shorter than ventral wall and the genital opening is terminal in orientation (Fig. 12). Similar shape



Figures 22–25. *Sulawesifulvius thailandicus*, a male adult live individual (SERS).

of the genital capsule was noted for the fulviine genera *Peritropis* (Moulds and Cassis 2006: fig. 1H; Yeshwanth et al. 2016: Figs 34, 39, 45, 52, 57, 62), *Mimofulviella* Wolski (Wolski 2008), *Euchilofulvius* Poppius (Yeshwanth et al. 2016: fig. 10) and *Fulvius* Stål (Yeshwanth et al. 2016: Figs 16, 21, 34, 39) and is very common among other fulviine genera (Wolski, pers. obs.). In other cypeline tribes the dorsal wall of the genital capsule is shorter than the ventral wall and the genital opening is directed more upwards (Yasunaga 2000: fig. 5; Cassis et al. 2003: Figs 1H, 2E; Cassis and Monteith 2006: fig. 3A; Wolski 2010: Figs 6A, 15A; Wolski and Gorczyca 2012: Figs 79, 83; Yeshwanth et al. 2016: Figs 2, 76).

Sulawesifulvius was diagnosed by Gorczyca et al. (2004), Mu and Liu (2014), and Yeshwanth et al. (2016). The most distinctive characters of *Sulawesifulvius*, not shared by any other known fulviines, include the antennal segment III longest (Figs 1–3), the cuneus long, curved, nearly enveloping membrane (Figs 1–3, 5, 18, 22, 25), and the enlarged metafemur with subapical depressions laterally (Gorczyca et al. 2004: fig. 2). An additional character that could clearly distinguish *Sulawesifulvius* from other Fulviini is the characteristic marking on the hemelytron composed of blackish, longitudinal, curved patches occupying apical half of the exocorium, bordering R+M vein and inner half of the basal margin of the cuneus (Figs 1, 2 (arrows); Mu and Liu 2014: 1–2; Yeshwanth and Chérot 2015: Figs 8–9). The shape of the parameres

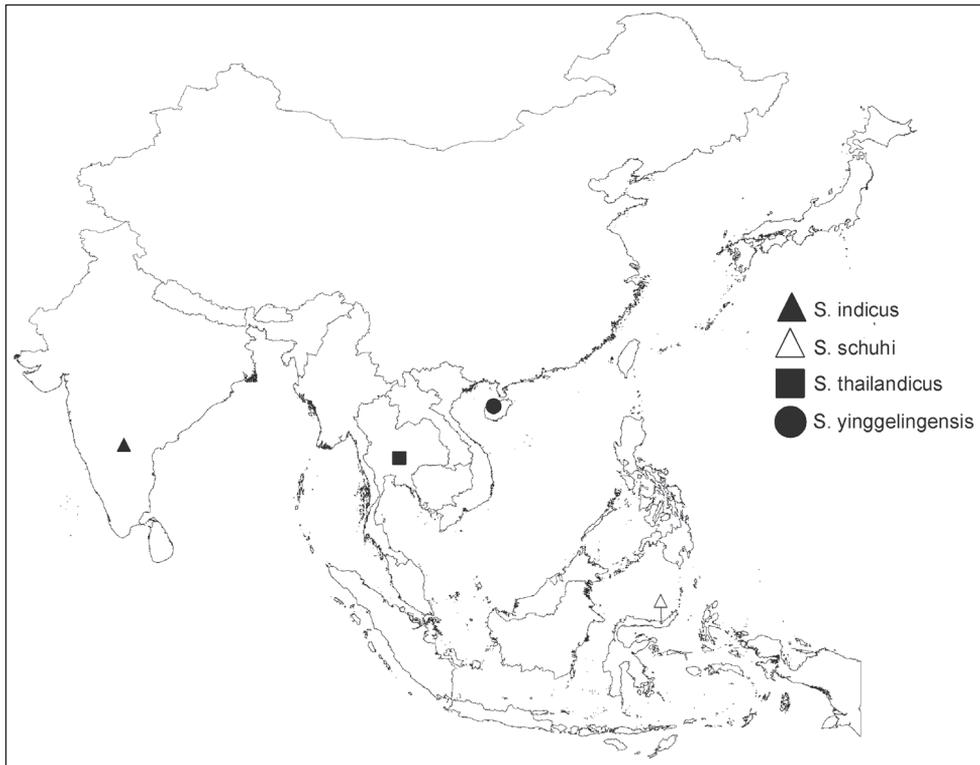


Figure 26. Distribution map of *Sulawesifulvius*.

in *Sulawesifulvius* species (except for *S. indicus*) is bizarre, not exhibited by any other fulviine (Figs 14–17; Gorczyca et al. 2004: 6–9, Mu and Liu 2014: 7–10). By the oval body (Figs 1–3, 5, 18, 22) and the short pronotum with elevated lateral margins and anterior angle protruding onto eyes (Figs 1–5, 7, 18–19, 22) *Sulawesifulvius* is most similar to the genus *Peritropis* Uhler, from which it can be easily distinguished by the characters mentioned above.

Acknowledgments

We thank Taksin Archawakom (director of SERS: Sakaerat Environmental Research Station, Nakhon Ratchasima, Thailand) and Kazutaka Yamada (Tokushima Prefectural Museum, Tokushima, Japan) who kindly supported our field investigations. We also are grateful to Magdalena Kowalewska-Groszkowska (Museum and Institute of Zoology, Polish Academy of Science, Warsaw, Poland) and Jolanta Brożek (US) for their kind assistance in taking SEM microphotographs. Frédéric Chérot (Service Public de Wallonie, Gembloux, Belgium) and Anna A. Namyatova (University of New South Wales, Sydney, Australia) kindly reviewed the manuscript.

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Some taxonomic notes on the genus *Oberea* Dejean, 1835 from Asia (Coleoptera, Cerambycidae, Lamiinae)

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Abstract

In the current work, the following taxonomic changes of genus *Oberea* Dejean, 1835 are proposed: *O. flavescens* Breuning, 1947, **rest. stat.**; *O. toi* Gressitt, 1939, **rest. stat.**; *O. sylvia* Pascoe, 1858, **rest. stat.**; *O. taiwana* Matsushita, 1933 = *O. taihokuensis* Breuning, 1962, **syn. n.**; *O. sumbana* Breuning, 1961 = *O. antennata* Franz, 1972, **syn. n.**; *O. brevithorax* Gressitt, 1939 is newly recorded from Vietnam.

Keywords

New country record, new synonym, *Oberea*, restoration name, taxonomy

Introduction

The genus *Oberea* Dejean, 1835, belonging to the subfamily Lamiinae, family Cerambycidae, consists of more than 300 species worldwide. The two monographic books on the taxonomy of Cerambycidae from China (Gressitt 1951) and Laos (Rondon and Breuning 1970), the most important works on *Oberea* in Asia, treated 77 and 20 *Oberea* species, respectively. *Oberea* worldwide was revised by Breuning (1960–1962). Some species were downgraded to infrasubspecific rank in Breuning's work basing on the similarity of body coloration (Breuning 1960–1962), and some of them were restored or described as new species (Kurihara and Ohbayashi 2007; Kurihara 2009; Li et al. 2014, 2016). During the recent study, some further taxonomic clarification of the genus *Oberea* is presented in the current work, based on examination of types.

Material and methods

Pictures of adult morphology are composites taken using a digital camera mounted onto a Leica MZ Apo dissecting microscope and subsequently processed using Auto-montage® software. For detailed examination, genitalia were extracted from specimens softened in water, cleared in 10% KOH, observed in water on glass microscope slides, then transferred into ethanol 70% and stored in capsules mounted on the same pin as the specimens. Drawings were made using a drawing tube mounted onto a compound microscope.

The following collection abbreviations are used in the text.

BMNH	The Natural History Museum, London, UK
MNHN	Muséum national d'Histoire Naturelle, Paris, France
MHNG	Muséum d'histoire naturelle, Geneva, Switzerland
MHNL	Musée des Confluences, Lyon, France
NMB	Musée d'Histoire Naturelle de Bâle, Basel, Switzerland
SWU	Insect Collection of Southwest University, Chongqing, China
SYSU	Sun Yat-sen University (ex Lingnan National History Museum or Zhongshan University), Guangzhou, China

Taxonomy

Oberea flavescens Breuning, 1947, rest. stat.

Figs 1–2

Oberea flavescens Breuning, 1947: 146. Type locality: China, Sichuan.

Oberea atropunctata v. *flavescens*: Breuning 1962: 169.

Redescription. *Body* (Fig. 1) 17.5–17.9 mm long and 3.0 mm wide. Head ochreous, apical mandible dark brown; antennae reddish brown, scape dark brown; ventral surface (except the abdominal sternite II and III black) and legs pale yellowish brown, tarsi darker. Body clothed with short golden pubescence and some erect hairs on pronotum, base of elytra and ventral surface of the basal antennal segments. *Head* slightly narrower than prothorax, vertex distinctly depressed at middle with a groove; eyes very large, inferior lobes twice as long as the gena in male and 1.5 times in female. Antennae distinctively shorter than body, reaching the apical fourth of elytra, antennomere ratio: 12.3: 2.5: 16.0: 15.8: 15.8: 15.9: 15.7: 15.4: 13.5: 12.6: 12.5 in males and 14.1: 3.0: 14.8: 14.2: 14.1: 14.9: 15.3: 15.1: 14.8: 14.4: 13.6: 13.5 in females. *Prothorax* wider than long; apical and basal margins slightly emarginated; sides rounded at middle, slightly constricted basally and apically; pronotum raised in middle, finely and densely punctured. *Scutellum* squared, slightly emarginated. *Elytra* very long, nearly 5.5 times as long a humeral width, and 4.5 times as long as head and prothorax combined,

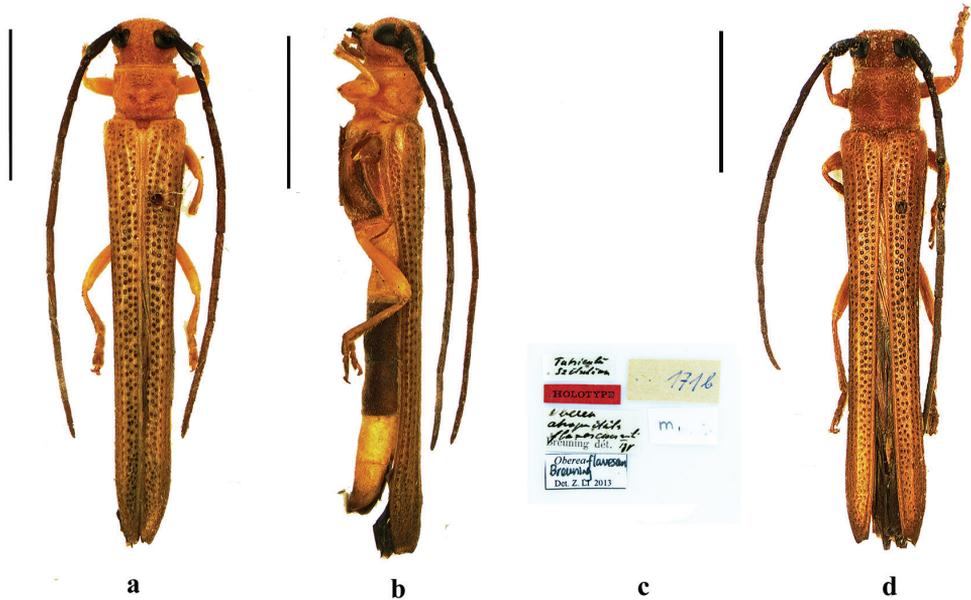


Figure 1. Habitus of *O. flavescens* Breuning, 1947, **a–c** holotype, female, from Sichuan **a** dorsal view **b** lateral view **c** label (not to scale) **d** male, from Sichuan, dorsal view. Scale bar 5.0 mm.

slightly narrowed from behind base to apical quarter, basal punctured arranged in 6 longitudinal series, and the punctures large and deep at basal area, gradually finer and irregular towards apex. *Metepisternum* and sides of abdominal segments finely punctured. Hind femora reaching posterior edge of abdominal segment I; hind tibiae almost twice as long as tarsi. Abdominal sternite V with a shallow triangular concave in males and with a median longitudinal groove in females.

Male terminalia: (Fig. 2) Tergite VIII broader than long, apex truncated and slightly emarginated, densely clothed with short setae (Fig. 2a); tegmen curved in profile, parameres elongate, mostly covered with long setae at the apical half; base of each parameres transversely and obliquely ridged on ventral side; the ridge covered with dense fine hairs (Fig. 2b–e); Median lobe 1.1 times as long as tegmen and slightly curved in profile; the median struts $3/5$ times as long as the whole median lobe in length; dorsal plate slightly longer than ventral plate; apex of ventral plate rounded; median foramen rounded (Fig. 2f); endophallus with 2 pairs of rods at apical portion; longer pair very slender baculiform, about 3.5 times as long as shorter pair (Fig. 2g).

Type material examined. *Oberea flavescens* Breuning: Holotype, ♀, Chine, Szetschuan, Tatsienlu (MNHG).

Additional material examined. China, Sichuan: 1♂, Chine, Szetschuan, Tatsienlu (MNHG) [a mislabeled paratype]

Distribution. China (Sichuan).

Remarks. This species was first described by Breuning in 1947 based on a specimen from Sichuan Province, China but it was downgraded to a variety of *O. atro-*

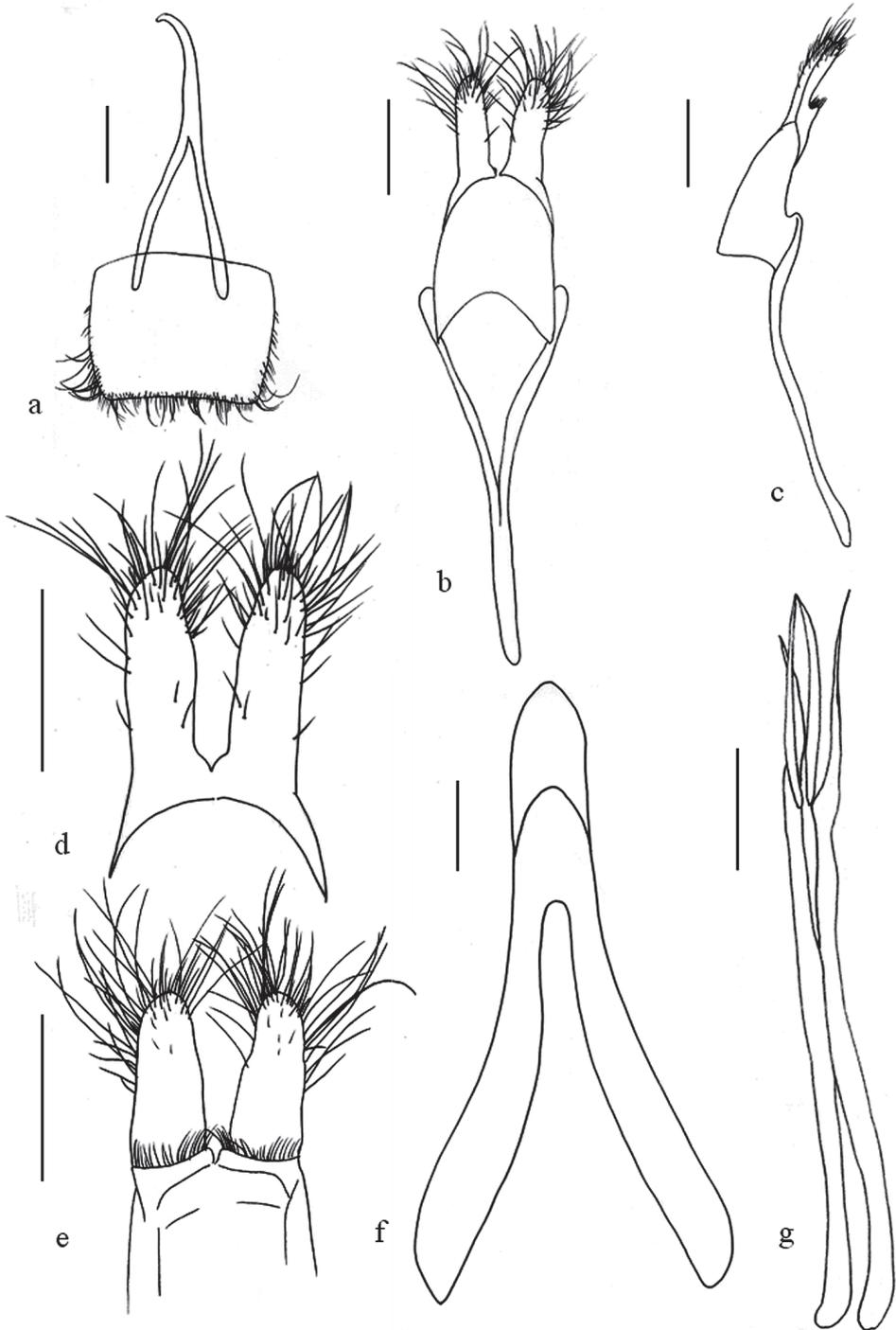


Figure 2. *Oberea flavescens*, male genitalia, **a** tergite viii **b** tegmen, dorsal view **c** tegmen, lateral view **d** parameres, dorsal view **e** parameres, ventral view **f** median lobe, ventral view **g** sclerites in endophallus. Scale bar 0.5 mm.

punctata Pic, 1916 in his revisionary work (1960–1962). A careful examination and comparison of the types of *O. flavescens* and *O. atropunctata* (Figs 4–5) show that they are different species. *Oberea flavescens* differs from *O. atropunctata* in having longer elytra and shorter antennae. They can be distinguished by having differently shaped male genitalia, the long pair of rods being 3.5 times as long as the short pair (1.5 times as long as in *O. atropunctata*) and the short pair consisting of two simple short rods.

***Oberea toi* Gressitt, 1939, rest. stat.**

Fig. 3

Oberea toi Gressitt, 1939a: 106. Type locality: China, Guangdong.

Oberea atropunctata v. *toi*: Breuning 1962: 170.

Type material examined. *Oberea toi* Gressitt: Holotype, ♀, Lung-ping-hui, Lien District, N. Kwangtung Prov., 16. V. 1934, F. K. To Coll. (SYSU).

Additional material examined. China, Jiangxi: 1 ♀, Kiukiang (MNHG).

Distribution. China (Guangdong, Jiangxi).

Remarks. *Oberea toi* Gressitt, 1939 was originally described by Gressitt from Guangdong, China, and then was downgraded to a variety of *O. atropunctata* by Breuning (1960–1962). It was regarded as the synonym of *O. atropunctata* (Löbl & Smetana, 2010);



Figure 3. Habitus of *O. toi* Gressitt, 1939, holotype, female, from Guangdong, **a** dorsal view **b** lateral view. (not to scale).

however, the examination of the types shows that they are different species. Despite the similar color pattern of their bodies, *O. toi* differs from *O. atropunctata* in the following characters: antennae as long as the body in female, and hind femora exceeding the posterior edge of abdominal segment I. Therefore, we suggest restoring *O. toi* Gressitt, 1939 from synonymy of *O. atropunctata* Pic, 1916.

***Oberea atropunctata* Pic, 1916**

Figs 4–5

Oberea atropunctata Pic, 1916: 17. Type locality: China, Yunnan.

Description. *Male terminalia:* (Fig. 5) Tergite VIII broader than long, apex truncated and slightly emarginated, rounded at side, densely clothed with short setae (Fig. 5a); tegmen curved in profile, parameres stouter, mostly covered with long hairs; transverse and oblique ridge at basal lobe on ventral side with dense fine hairs (Fig. 5b–e); penis 1.25 times as long as tegmen and curved in profile; the median struts $4/5$ times as long as the whole median lobe in length; dorsal plate slightly longer than ventral plate; apex of ventral plate rounded; median foramen rounded (Fig. 5f); endophallus with two pairs of sclerites apically, the long pair very slender baculiform, the short pair fused at base forming a “Y” (Fig. 5g).

Diagnosis. Body 17.9 mm long and 3.0 mm wide. The species is very similar to *O. flavescens* Breuning and *O. toi* Gressitt, especially in color patterns. The following combination of characters separates it from *O. flavescens*: shape of rods in the endophallus; elytra nearly 4.2 times as long as humeral width, and 3.7 times as long as head and prothorax combined.

Type material examined. *Oberea atropunctata* Pic: Holotype, ♀, Yunnan (MNHN).

Additional material examined. **China**, Sichuan: 1♂, Sichuan Province, 8.V.1985 (SWU); Yunnan: 1♂, China, Yun-nan-sen (MNHG).

Distribution. China (Sichuan, Yunnan).

***Oberea taiwana* Matsushita, 1933**

Fig. 6

Oberea taiwana Matsushita, 1933: 423. Type locality: China, Taiwan.

Oberea taihokuensis Breuning, 1962: 168. Type locality: China, Taiwan. **syn. n.**

Oberea taihokuensis v. *flavosternalis* Breuning, 1962: 169. [Unavailable name according to ICZN, art. 10.2.]

Type material examined. *O. taihokuensis* Breuning: Holotype, ♀, Formosa, Taihoku, 20.IV.1932, coll. M. Chujo (MHNG).

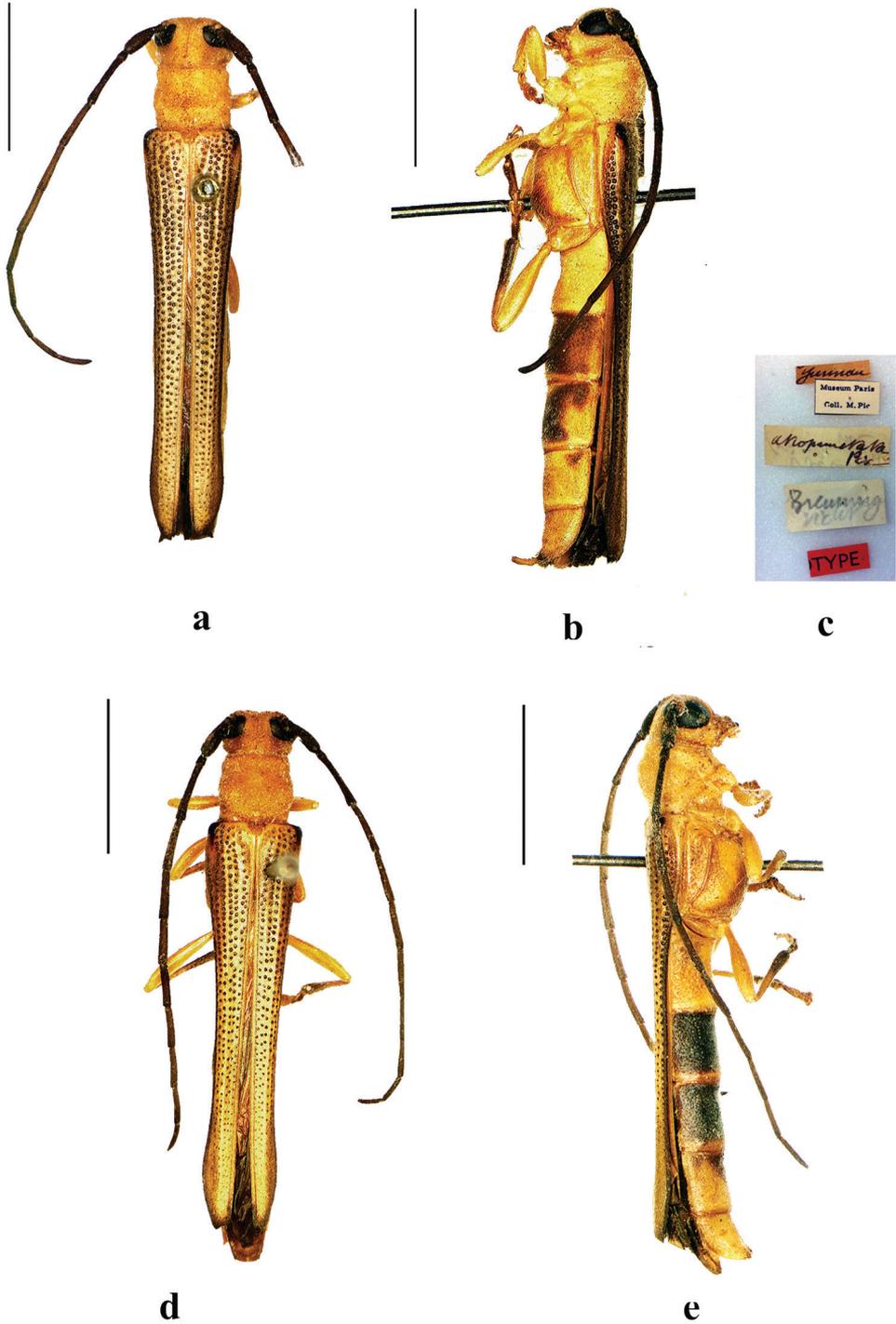


Figure 4. Habitus of *O. atropunctata* Pic, 1916, **a–c** holotype, female, from Yunnan **a** dorsal view **b** lateral view **c** label (not to scale) **d–e** male, from Yunnan **d** dorsal view, **e** lateral view. Scale bar 5.0 mm.

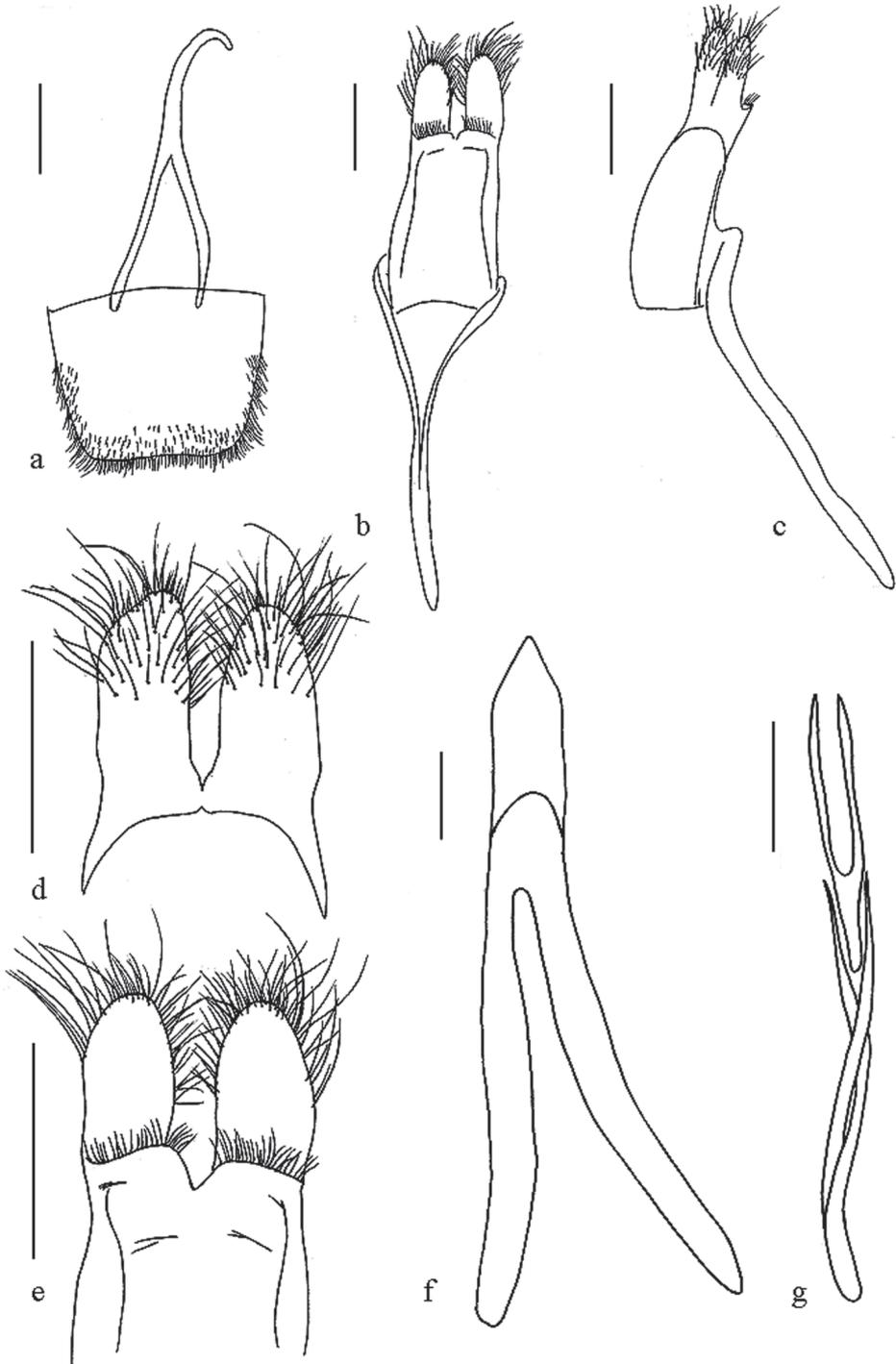


Figure 5. *Oberea atropunctata*, male genitalia, **a** tergite viii **b** tegmen, dorsal view **c** tegmen, lateral view **d** parameres, dorsal view, **e** parameres, ventral view **f** median lobe, ventral view **g** sclerites in endophallus. Scale bar 0.5 mm.

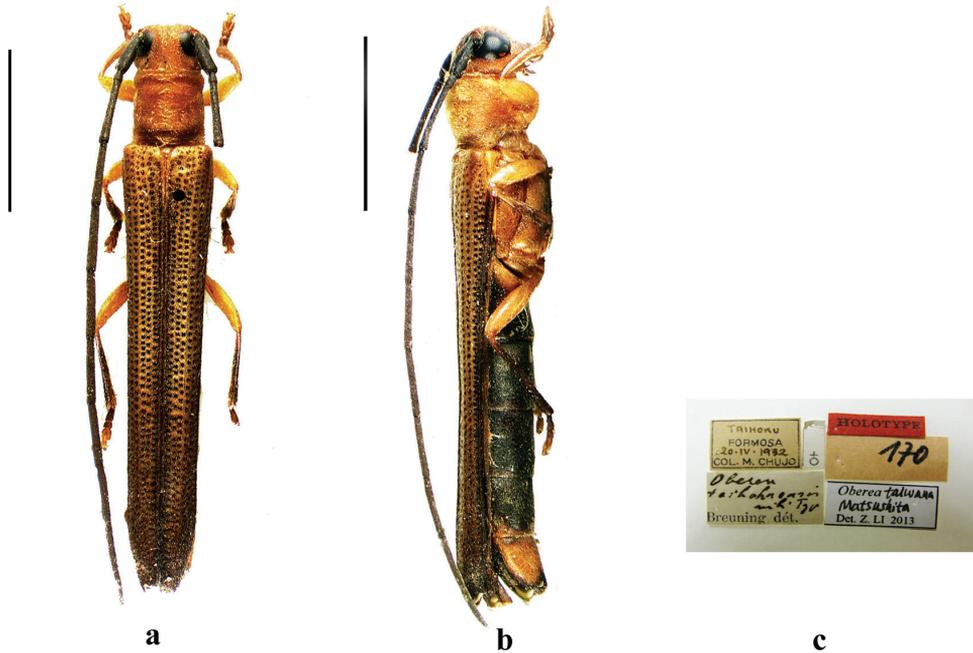


Figure 6. Habitus of *O. taihokuensis* Breuning, 1962, holotype, female, from Taiwan, **a** dorsal view **b** lateral view, **c** label (not to scale). Scale bar 5.0 mm.

Additional material examined. **China, Taiwan:** 1♂, Formosa, Kosempo (MHNG) [holotype of *Oberea taihokuensis* v. *flavosternalis*]; 1♀, Formosa, Kurau [a mislabeled Paratype].

Distribution. China (Taiwan).

Remarks. Matsushita described *O. taiwana* from Taiwan, China in 1933. In Breuning's revision (1960–1962) on worldwide *Oberea*, *O. taiwana* Matsushita was recorded without examining types and *O. taihokuensis* was described as a new species in 1962. Kurihara and Ohbayashi (2007) revised the *Oberea* species from Taiwan and re-described *O. taihokuensis* based on the original description. According to the original description of *O. taiwana*, the type was deposited in Hokkaido University, but Dr. Kurihara could not find any type there (Kurihara *in litt.*). After having compared photo and description of *O. taiwana* in Kurihara and Ohbayashi's publication (2007) and the holotype of *O. taihokuensis*, it is suggested that *O. taihokuensis* Breuning, 1962 is junior synonym of *O. taiwana* Matsushita, 1933.

***Oberea sylvia* Pascoe, 1858, rest. stat.**

Figs 7–8

Oberea sylvia Pascoe, 1858: 261. Type locality: "China, Borealis".

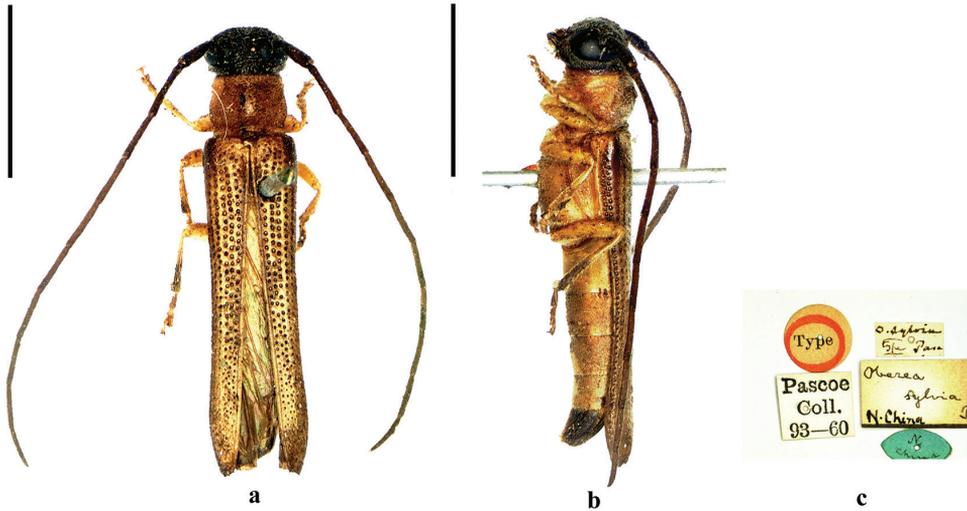


Figure 7. Habitus of *O. sylvia* Pascoe, 1958, holotype, male, from North China, **a** dorsal view **b** lateral view **c** label (not to scale). Scale bar 5.0 mm.

Redescription (Fig. 7). *Body* 12.5–13.5 mm long and 2.3mm wide. *Head* black except for labrum yellowish brown to reddish brown, maxillary palpus and labial palpus pale yellowish brown; antennae reddish brown, scape dark brown. *Prothorax*, elytra and ventral surface (except for the abdominal segment V black) ochraceous; legs yellowish brown, apical half of hind tibia and tarsi darker brown. Body clothed with short golden pubescence and some erect hairs on pronotum, base of elytra and ventral surface of the basal antennal segments. *Head* short, with distinctly depressed vertex; eyes very large, inferior lobes 2 times as long as the gena in male. Antennae of males longer than body, antennomere III longer than pedicel and antennomere IV. *Prothorax* 1.2 times wider than long, slightly constricted basally and apically; pronotum with a tubercle in middle, finely and densely punctured. Scutellum squared, slightly emarginated. Elytra nearly three times as long as humeral width, and 3.6 times as long as head and prothorax combined, slightly narrowed from behind base to apical quarter, apex truncate; basal disc with large and deep punctures arranged in line, punctures becoming gradually finer and irregular towards apical quarter. *Metepisternum* and sides of abdominal surface finely punctate. Metafemora reaching posterior edge of abdominal segment I; metatibiae almost twice as long as tarsi. Abdominal sternite V with a shallow triangular concave in males.

Male terminalia. (Fig. 8) Tergite VIII broader than long, apex truncated and slightly emarginated, rounded at sides, densely clothed with long hairs and short setae (Fig. 8a); Tegmen curved and penis curved in profile, parameres mostly covered with long setae on the apical half; base of each lobe in ventral side transversely and obliquely ridged; the ridge with dense fine hairs (Fig. 8b–e); penis 1.2 times as long as tegmen, dorsal plate slightly longer than ventral plate; the median struts 3/5 times as long as the whole median lobe in length; apex of the ventral plate rounded; median foramen rounded (Fig. 8f); apical endophallus with 2 pairs of baculiform rods, the long pair 2.8 times as long as short pair (Fig. 8g).

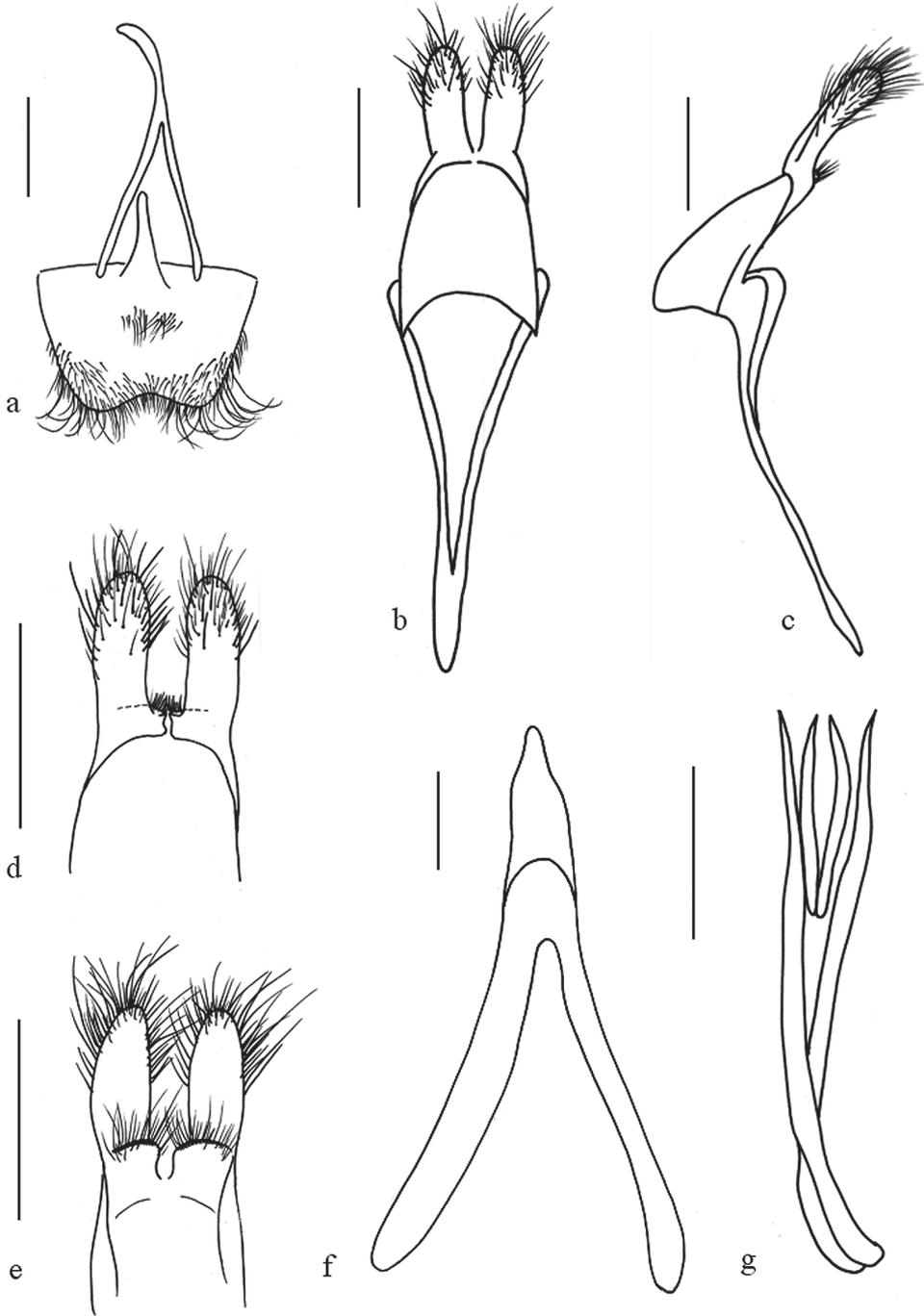


Figure 8. *Oberea sylvia*, male genitalia, **a** tergite viii **b** tegmen, dorsal view **c** tegmen, lateral view **d** parameres, dorsal view **e** parameres, ventral view **f** median lobe, ventral view, **g** sclerites in endophallus. Scale bar 0.5 mm.

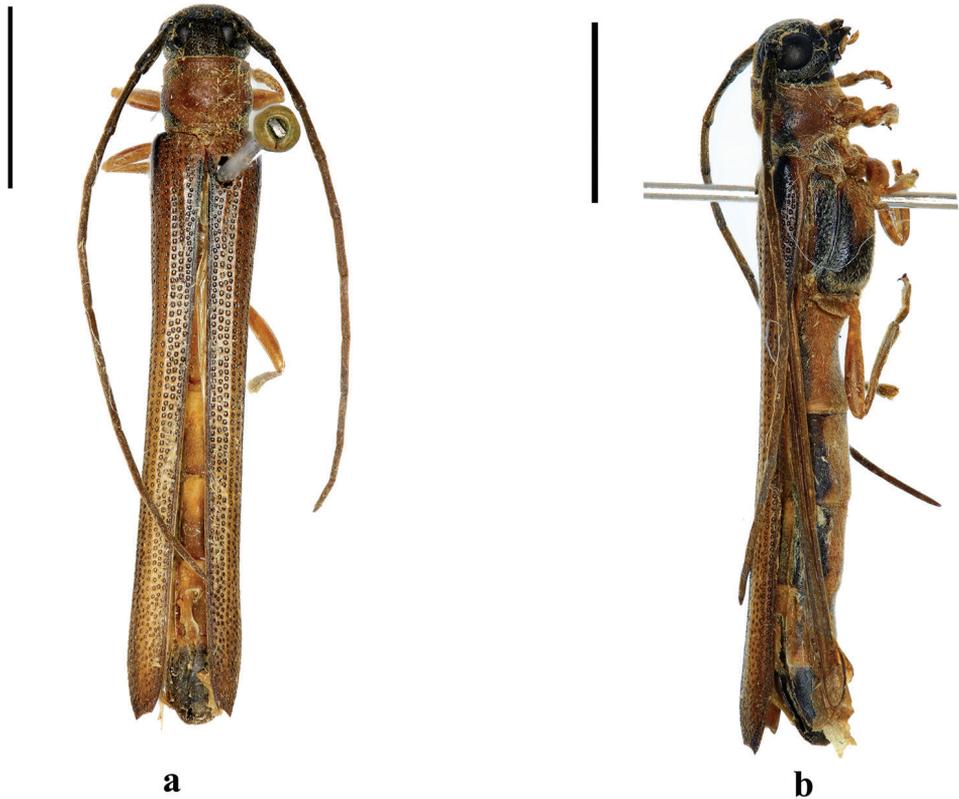


Figure 9. Habitus of *O. brevithorax* Gressitt, 1936, male, from Tonkin, **a** dorsal view **b** lateral view. Scale bar 5.0 mm.

Type material examined. *Oberea sylvia* Pascoe: Holotype, ♂, N. China (BMNH).

Additional material examined. China: 1♂, Chine (MHNL); 4♂♂, Chine (BMNH).

Distribution. East China.

Remarks. *Oberea sylvia* was originally described by Pascoe 1858 and regarded as synonym of *O. nigriceps* (White, 1844) (Breuning, 1962). After comparing the types, *O. sylvia*, which distinctly differs from *O. nigriceps* in male genitalia (Fig. 8), is restored to specific rank.

The holotype probably was collected by Robert Fortune. According to his book “Three years wandering in the north provinces of China”, the northern province of China included Shanghai, Zhejiang Province and Jiangsu Province; therefore “N. China” or “China borealis” might mean east China. Unfortunately, there is no detailed information about the location of the specimen that the first author examined.

Oberea brevithorax Gressitt, 1936

Fig. 9

Oberea brevithorax Gressitt, 1936: 108. Type locality: China, Taiwan.

Oberea brevithorax inepta Gressitt, 1939b: 122. Type locality: China, Fujian.

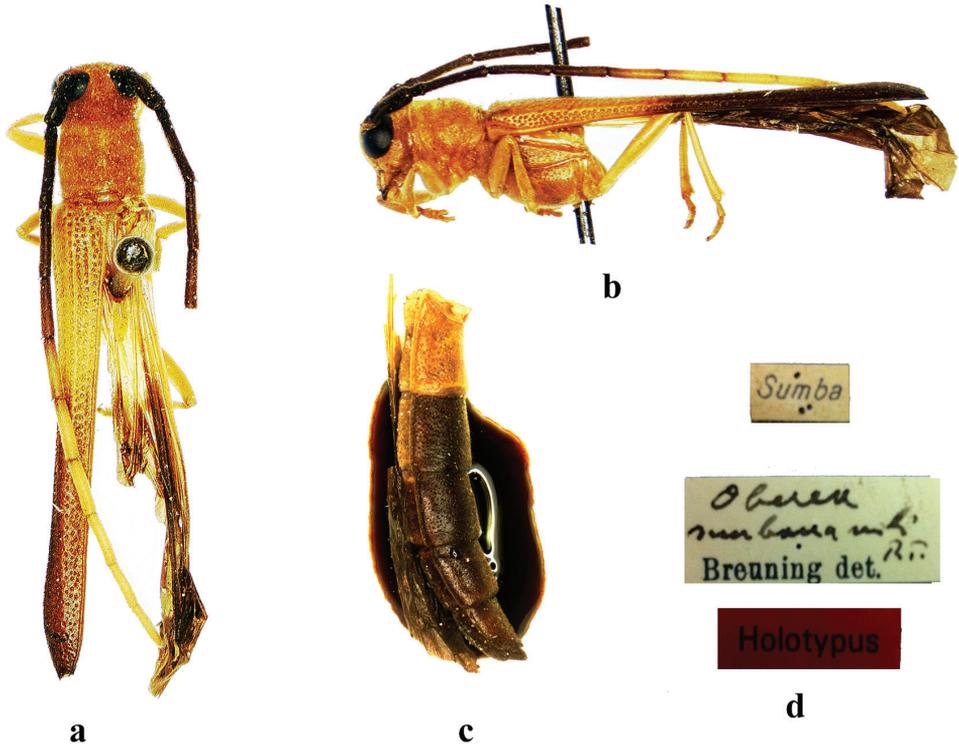


Figure 10. Habitus of *O. sumbana* Breuning, 1961, holotype, male, from Sumba, **a** dorsal view **b** lateral view (without abdomen) **c** abdomen, lateral view **d** label. (not to scale).

Oberea binotaticollis v. *brevithorax*: Breuning 1962: 193.

Oberea binotaticollis v. *inepta*: Breuning 1962: 193.

Oberea brevithorax: Kurihara and Ohbayashi 2007: 211.

Type material examined. *Oberea brevithorax inepta* Gressitt: Holotype, ♂, Cha Shan, Kien-ning District, Fukien Province, SE. China, VI. 22-28. 1933. D. C. Ngu coll. (SYSU).

Additional material examined. **China**, Zhejiang: 1♂, Zhejiang province, Lin'an city, West Tianmushan, Dajingwu, 30°22'18.86"N, 119°26'03.81"E, 828m, 9–11. VII.2012, leg. Jianyue Qiu and Hao Xu (SWU); **Vietnam**, 1♂, Chapa, Tonkin, J. Clemont coll. (MHNG); 1♂, Chapa, Tonkin (MHNG).

Distribution. China (Fujian, Hainan, Zhejiang, Taiwan) ; Vietnam (new record).

Remarks. *Oberea brevithorax* was first described as a valid species by Gressitt in 1936 but was downgraded as a variety of *Oberea binotaticollis* Pic, 1915 by Breuning in his revision. Kurihara and Ohbayashi (2007) compared them and confirmed that they were two different species, easily distinguished from each other by different body proportions, antennal lengths, and male genitalia. The species was only recorded in China but recently, some specimens collected in Tonkin, Vietnam, were found in MHNG, and they are a new record to Vietnam.

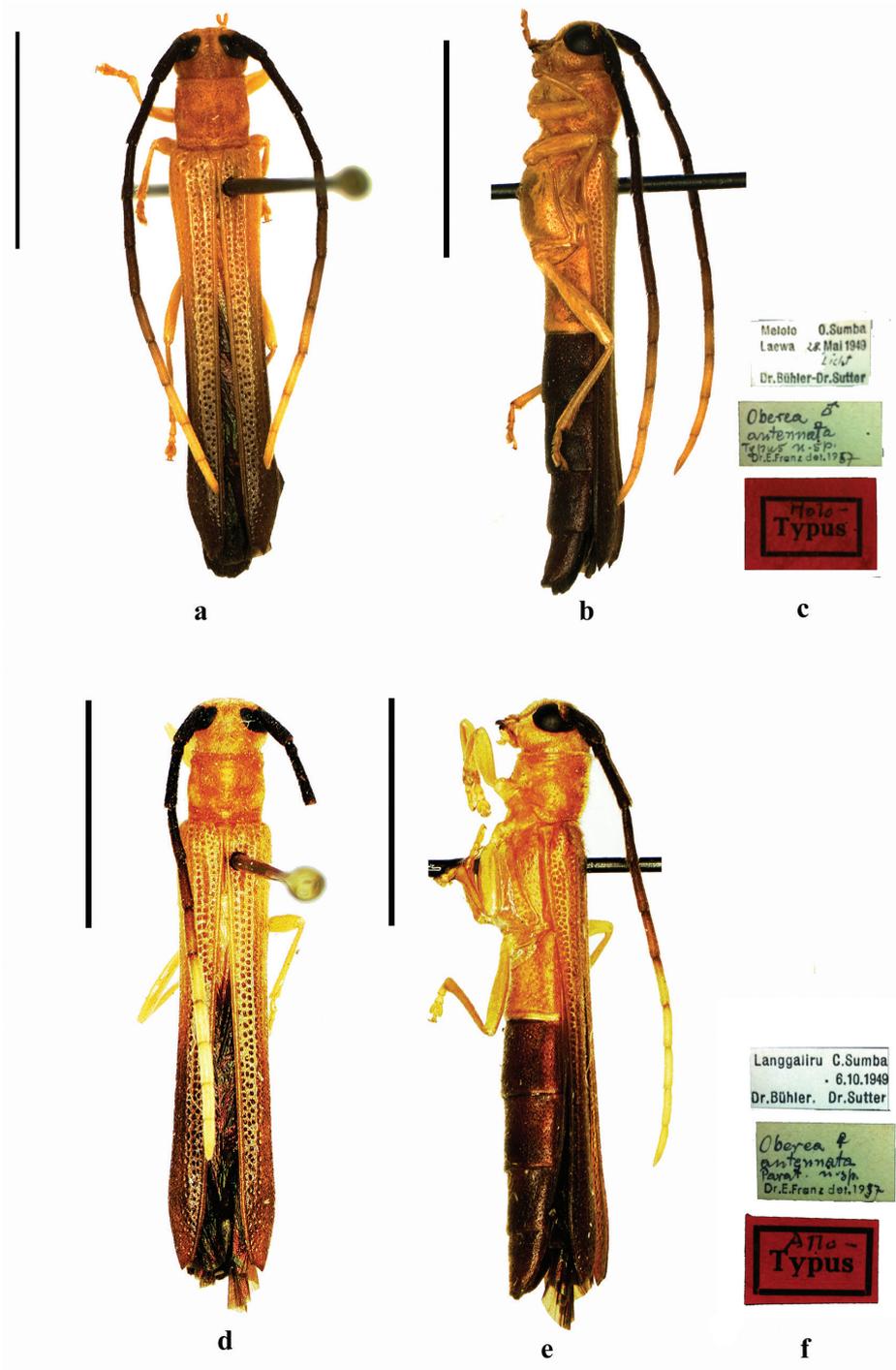


Figure 11. Habitus of *O. antennata* Franz, 1972, **a–c** holotype, male, from Sumba **a** dorsal view **b** lateral view, **c** label (not to scale) **d–f** allotype, female, from Sumba **d** dorsal view **e** lateral view **f** label (not to scale). Scale bar 5.0 mm.

***Oberea sumbana* Breuning, 1961**

Figs 10–11

Oberea sumbana Breuning, 1961: 131. Type locality: Indonesia, Sumba.*Oberea antennata* Franz, 1972: 143. Type locality: Indonesia, Sumba. **syn. n.**

Type material examined. *Oberea sumbana* Breuning: Holotype, ♂, Sumba (MHNG); Allotype: ♀, Waingapoe, 96, [P.] Everett [printed label faded] (MHNG). *Oberea antennata* Franz: Holotype, ♂, O. Sumba: Melolo Iaewa, 28.V.1949, Dr. Bühler & Dr. Sutter leg. (NMB); Allotype: ♀, C. Sumba: Langgaliru, 6.10.1949. Dr. Bühler & Dr. Sutter leg. (NMB).

Distribution. Indonesia.

Remarks. After examining the holotypes of *O. sumbana* and *O. antennata*, it is concluded that *O. antennata* Franz, 1972 is junior synonym of *O. sumbana* Breuning, 1961.

Acknowledgments

We are grateful to the following colleagues for the loan or gift of specimens upon which the present work is based: Mr. Gérard L. Tavakilian (MHNH), Ms. Azadeh Taghavian (MHNH), Mr. Maxwell V. L. Barclay (BMNH), Mr. Harold Labrique (MHNL), Prof. Hong Pang (SYSU), Mr. Hao Xu (Hunan Agricultural University, Hunan, China) and Ms. Jianyue Qiu (SWU). We want to express our special thanks to Dr. Takashi Kurihara (Ehime University, Japan) for providing his publications and other important information. We thank Dr. Francesco Vitali (Musée national d'Histoire naturelle de Luxembourg) and to both anonymous referees for improving the manuscript. The research is supported by the National Natural Science Foundation of China (No.31501882), the Fundamental Research Funds for the Central Universities (XDJK2015C056) and the China Scholarship Council (CSC).

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A new genus and two new species of Southeast Asian *Bidessini* as well as new synonyms for Oceanian species (Coleoptera, Dytiscidae)

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Abstract

Rompindessus jenisi Balke, Bergsten & Hendrich, **gen. n.** et **sp. n.** is described from near Rompin village in West Malaysia. The new genus is characterized by the presence of an occipital line and basal pronotal striae, the presence of a thick anterior bead on clypeus and two-segmented parameres as well as by the absence of basal elytral striae, the absence of sutural line on elytron, the absence of basal epipleural transverse carina, and the absence of longitudinal elytral carina. Moreover, male pro- and mesotarsus appear stout, and distinctly dilated laterally; the pronotum is comparably long and parallel-sided and the colour of beetle conspicuous dark orange. *Leiodytes kualalipis* Balke, Wang, Bergsten & Hendrich, **sp. n.** is described from West Malaysia (Pahang) and South Vietnam (Cat Tien). It is well characterized by its large size, elongate body and the form of the median lobe. *Limbodessus fijiensis* (J. Balfour-Browne, 1944), **comb. n.** described from Fiji is a new synonym of *Limbodessus curvuplicatus* (Zimmermann, 1927) described from Samoa.

Keywords

Bidessini, Dytiscidae, new combination, new genus, new species, new synonymy, Oceania, Southeast Asia

Introduction

There are currently 48 genera in the Bidessini (Nilsson 2016; Miller 2016; Miller and Bergsten 2016). With a body length of typically around 1–3 mm, they constitute most of the smaller species of Dytiscidae. Bidessini genera have to date been justified mainly on a diagnostic combination of structural features (Biström 1988; Balke et al. 2002; Miller and Short 2015; Miller and Bergsten 2016) rather than apomorphies and this had to lead to recognition of genera that render other paraphyletic (Balke and Ribera 2004). Some of these features such as presence / absence of elytral striae (plicae) or occipital line have been shown to vary within clades of closely related species (Balke et al. 2015) or even within one species (Balke unpublished). In this context, the use of phylogenetic reconstructions based on DNA sequence data offers a source of information that helps to delineate monophyletic entities (Hendrich and Balke 2009; Balke et al. 2013). Here, we report the discovery of two new species of Bidessini from Peninsula Malaysia. Both species are known from older collections only and therefore we use morphological characters and a pragmatic approach to make tentative generic assignments that lead us to suggest one new genus here.

Material and methods

Drawings of the male genitalia were made based on digital images. The beetles were studied with a Leica MZ 12.5 stereomicroscope at 10–100x and a Scanning Electron Microscope (JSM-5600, JOEL, Tokyo, Japan) at 90–1000X. The terminology to denote the orientation of the genitalia follows Miller and Nilsson (2003). Label data of the type material are cited in quotation marks. The following abbreviations were used in the text: **TL** (total length), **TL-H** (total length without head), and **MW** (maximum width). Google Earth (<http://earth.google.com>) was used to locate localities and the coordinates are given in decimal degree format. Specimens mentioned in this work are deposited in several collections, which are abbreviated in the text as follows:

BMNH	Natural History Museum [former British Museum (Natural History)], London, England
CSR	Collection Saverio Rocchi, Firenze, Italy
CWT	Collection L. J. Wang, Taipei, Taiwan
MNHN	Muséum National d'Histoire Naturelle, Paris, France
NHMW	Naturhistorisches Museum Wien, Austria
TFRI	Taiwan Forestry Research Institute, Taipei, Taiwan
ZSM	Zoologische Staatssammlung München, Germany

Taxonomy

***Rompindessus* Balke, Bergsten & Hendrich, gen. n.**

<http://zoobank.org/2562EA40-B2CA-4909-89B4-8332C6367AE0>

Type species. *Rompindessus jeni* sp. n. by present designation.

Diagnosis. Of the set of structural features generally used to classify Bidessini, the following combination is present in this taxon: 1) occipital line present; 2) basal pronotal striae present; 3) basal elytral striae absent; 4) sutural line on elytron absent; 5) basal epipleural transverse carina absent; 6) clypeus with thick anterior bead (or margin); 7) longitudinal elytral carina on disc absent; and 8) parameres two-segmented. Moreover, the male pro- and mesotarsus appear stout, and distinctly dilated laterally; the pronotum is comparably long and parallel-sided and the colour of beetle is conspicuously dark orange. This differentiates *Rompindessus* gen. n. from all other Bidessini. In the key to Bidessini genera by Miller and Bergsten (2016) *Rompindessus* keys out to *Platydytes* Biström, 1988, which only occurs in sub-Saharan Africa. Apart from geography, *Rompindessus* can be distinguished from *Platydytes* by the thickly bordered clypeal margin (finely bordered to indistinct in *Platydytes*), the enlarged, laterally expanded male pro- and mesotarsomeres I-III, the dark orange colouration with dark speckles on elytra, and the more discontinuous body outline between pronotum and elytra.

Etymology. Named after the collecting locality, Rompin village, and the ending –dessus as used for many genera in Bidessini.

***Rompindessus jeni* Balke, Bergsten & Hendrich, sp. n.**

<http://zoobank.org/73B2A0D7-62AC-4891-9510-3504A50D96EC>

Holotype. Male (NHMW). “Malaysia, Pahang, 40km W Rompin, Selendang, 29.4.–6.6., leg. I. Jeni, 1993”.

Type locality. Situated around Malaysia, Pahang, Selendang, between these points 2.622516°N 103.334934°E / 2.609909°N 103.382443°E / 2.643574°N 103.409337°E, it is not known where exactly this particular beetle was discovered. The altitude is around 50 to 250m (Jeniš pers. comm.). According to satellite images in Google Earth, the lower elevations are now heavily transformed into oil palm plantations.

Description. Habitus elongate oval. Measurements: TL = 2.45 mm, TL-H = 2.15 mm; MW = 1.1 mm; elytra 3.5× longer than pronotum.

Colouration. Head, pronotum and elytron dark orange, the latter with few darker speckles (Fig. 1). Ventral side and appendages testaceous.

Surface sculpture. Head with distinct microreticulation posterior of occipital line; finer microreticulation along eyes and clypeus, frons without microreticulation and thus shiny / polished but with few setiferous punctures. Pronotum and elytron with distinct microreticulation and sparse setiferous punctation. Ventral surfaces polished, with faint and sparse setiferous punctation.

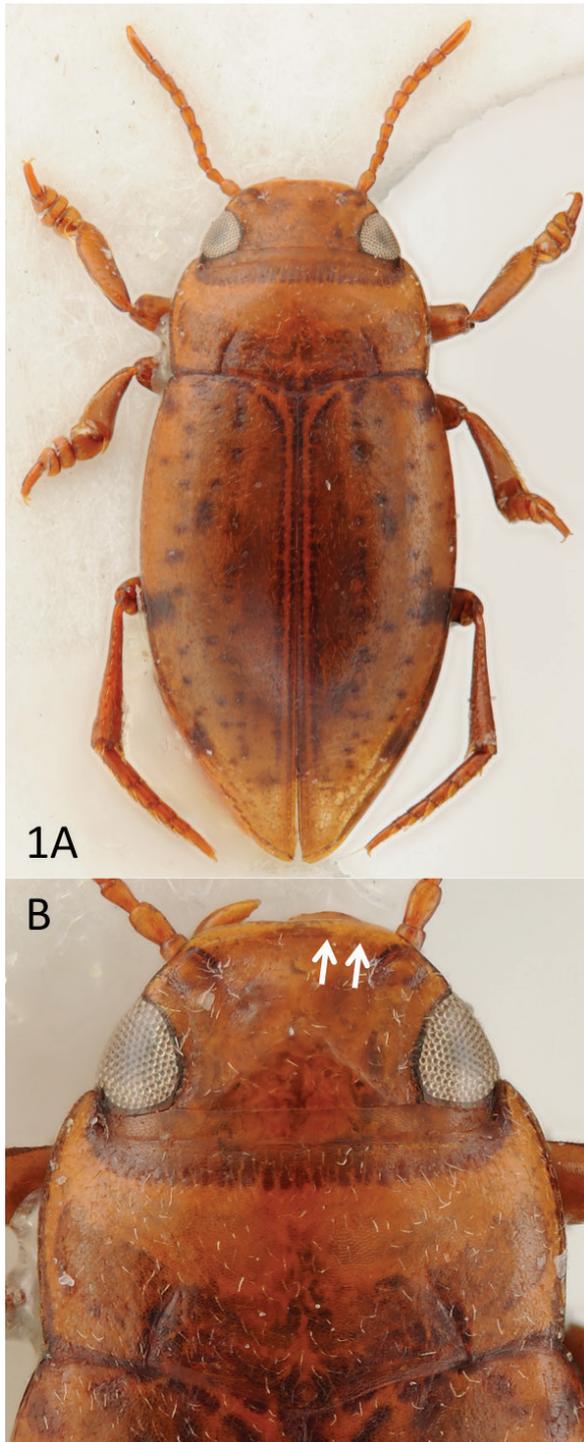


Figure 1. *Rompindessus jenisi* gen. et sp. n., holotype, habitus (A), head, pronotum and base of elytra (B). White arrows point to the thick anterior bead of clypeus.

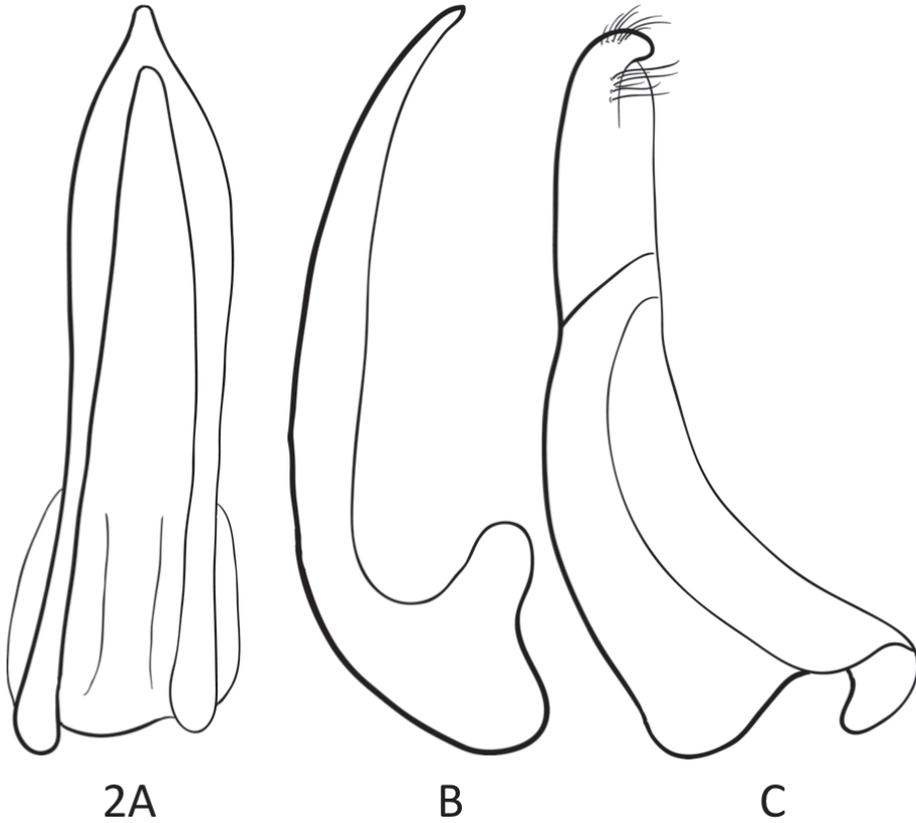


Figure 2. *Rompindessus jeniš* gen. et sp. n., holotype, median lobe of aedeagus, ventral view (A), lateral view (B), paramere, lateral view (C).

Structures. Head with distinct occipital line and broadly beaded clypeus (Fig. 1A). Pronotum with faint lateral bead and distinct basal striae, the latter are curved inwards (Fig. 1). Elytron without basal striae and without sutural line. Basal epipleural transverse carina absent. Metathoracic wings apparently fully developed (not dissected but seen from opening caused by previous removal of the last three ventrites). Pro- and mesotarsus appearing stout as they are distinctly dilated laterally.

Male. Median lobe of aedeagus simply curved (Fig. 2A, B), lateral lobes (parameres) of two parts and of general Bidessini type (e.g. as figured for *Uvarus lacustris* (Say, 1823), *Leiodytes evanescens* (Boheman, 1848), *Platydytes incognitus* Biström, 1988 and *Bidessus unistriatus* (Goeze, 1777) in Biström (1988)) (Fig. 2C).

Female. Unknown.

Etymology. Named after Ivo Jeniš, discoverer of this species. The specific epithet is a substantive in the genitive case.

Distribution. Only known from the type locality.

Habitat. Unknown.

Leiodytes Guignot, 1936

Type species. *Hydroporus evanescens* Boheman, 1848

Diagnosis. Very small, yellowish diving beetles (1.4–2.2 mm for the known species, 2.7 mm with the new one described below) with black markings on elytra. Shape of body globular to elongate, widest in middle, not flattened. 1) Occipital line present; 2) basal pronotal striae present; 3) basal elytral striae present; 4) sutural line on elytron absent; 5) basal epipleural transverse carina absent; 6) clypeus with fore margin narrowly and finely bordered, sometimes unmodified; 7) longitudinal elytral carina on disc absent; and 8) parameres two-segmented.

Includes 27 species (Nilsson 2016), widely distributed in the Afrotropical, Oriental and Palearctic regions.

Leiodytes kualalipis Balke, Wang, Bergsten & Hendrich, sp. n.

<http://zoobank.org/3F824AE1-26C9-4E15-AB50-5974F10ED08A>

Holotype. Male (ZSM). “Malaysia, Pahang, Kuala Lipis, old rubber plantation, iv.1997, Balke & Hendrich”. **Paratypes**, 2 males (CSR, ZSM), 1 female (CSR) “S Vietnam (Cat Tien), 120 km NNE Ho Chi Minh, Cat Tien NP, 3.–15.07.1995, A. Napolov leg.”; 2 males (CWT) “Vietnam, Nam Cat Tien, 200 m, 17-25-VI-1995, leg. Malicky”; 3 males, 2 females (CWT, NHMW, TFRI). “Vietnam, Dong NAI, Nam Cat Tien NP, 120 m, 18-IX-1998, leg. L. J. Wang”.

Type locality. The type locality was around 4.200104°N 102.061570°E, altitude 100m. The entire region is now heavily transformed into oil palm plantations. The paratype locality was in Nam Cat Tien National Park, as a rough reference we obtained a position at the forest border 11.422096°N 107.427578°E.

Description. Habitus elongate oval. Measurements: TL = 2.7 mm; TL-H = 2.4 mm; MW = 1.3 mm; elytra 4.2× longer than pronotum.

Colouration. Beetle dark yellow with few darker basal pronotal markings and darker pattern on elytra (Fig. 3).

Surface sculpture. Head with distinct microreticulation posterior of occipital line; faint to extremely faint microreticulation along eyes and clypeus, frons without microreticulation and thus shiny / polished but with few setiferous punctures. Pronotum and elytron without microreticulation but with dense, coarse setiferous punctation. Ventral surfaces mostly polished, metaventrite, metacoxa and ventrites 1–3 with large punctures bearing short setae, distance between punctures approximately the diameter of a single puncture (similar to *Leiodytes vietnamensis* Wang, Satô & Yang, 1998, p. 165, Fig. 6A in their work).

Structures. Head with faint occipital line and depressed before clypeus leading to the impression that the clypeus is broadly beaded (Figs 3B, 4). Pronotum with faint lateral bead and distinct basal striae, the latter are strongly directed inwards (Figs 3B, 4). Elytron with basal striae but without sutural lines. Basal epipleural transverse carina

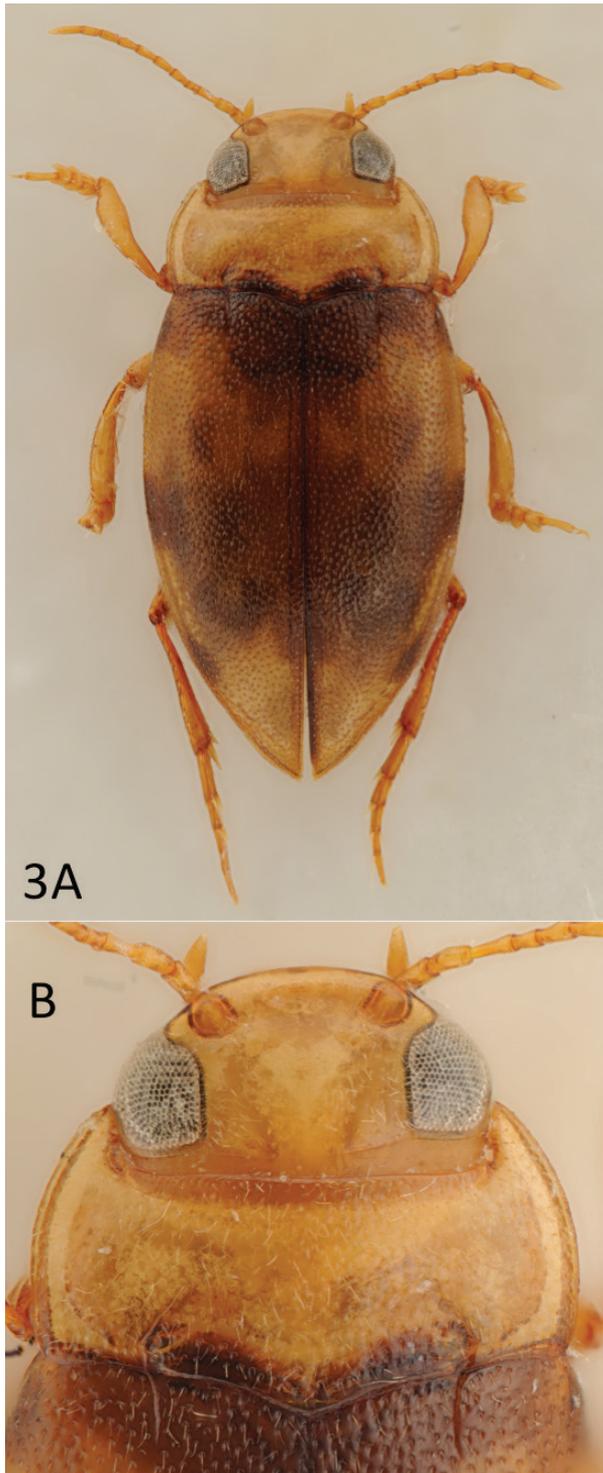


Figure 3. *Leiodytes kualalipis* sp. n., holotype, habitus (A), head, pronotum and base of elytra (B).

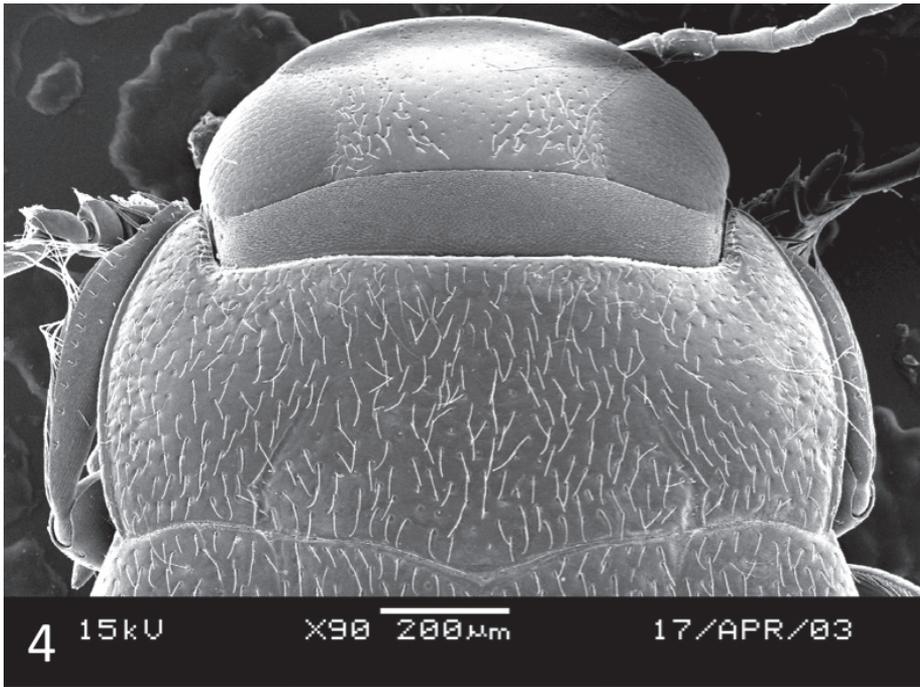


Figure 4. *Leiodytes kualalipis* sp. n.: male paratype, SEM of head, pronotum and base of elytra.

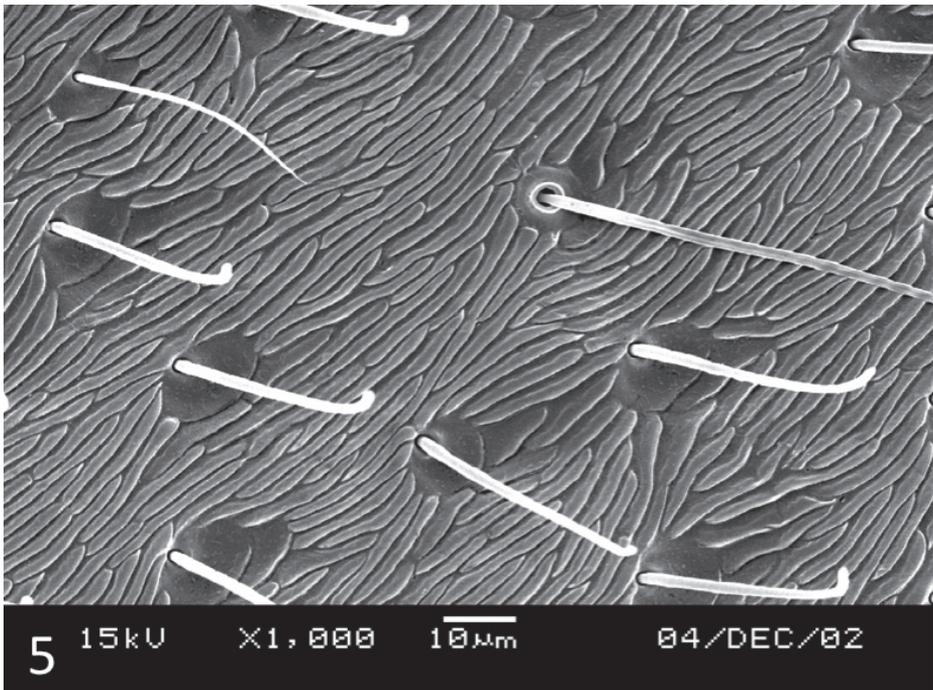


Figure 5. *Leiodytes kualalipis* sp. n.: female paratype, SEM of microreticulation on metasternum.

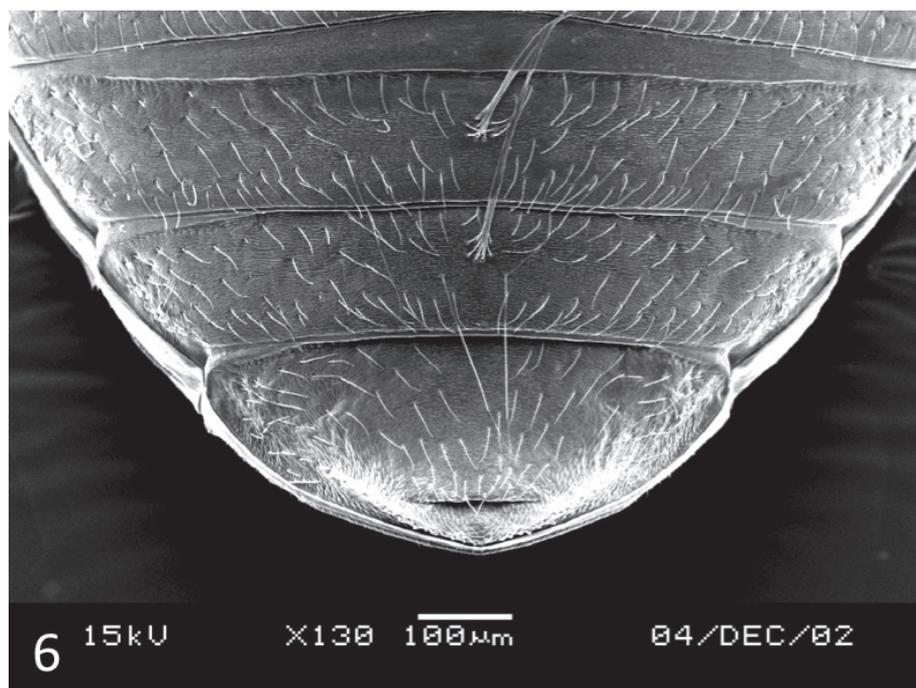


Figure 6. *Leiodytes kualalipis* sp. n.: female paratype, SEM of last ventrite with deep suture apically.

absent. Flight wings apparently fully developed (not dissected but seen from opening caused by previous removal of the last three ventrites). Pro- and mesotarsus not conspicuously dilated laterally.

Male. Median lobe of aedeagus in lateral view thin and pointed apically, apical portion spatulate in ventral view (Figs 7A, B); lateral lobes (parameres) of two parts and distally broad, with broad “nose” or broadly twisted (Fig. 7C).

Female. Similar to male, but surface dull due to presence of strong microreticulation dorsally and ventrally (Figs 5, 6).

Diagnosis. This is the largest species of *Leiodytes* and well characterised by its size as the other species in the region are distinctly smaller (below 2.2 mm or even below 2 mm long, see e.g. Régimbart 1899; Wang et al. 1998). Besides the larger size, this new species has a unique feature: the last ventrite has a deep suture apically (Fig. 6). This might be an autapomorphy for the new species.

This is, to our knowledge, the second species reported from the Malayan Peninsula, *L. nicobaricus* (Redtenbacher, 1867) being the other one (Balke et al. 2004; Hendrich et al. 2004).

Etymology. Named after the type locality, Kuala Lipis Town. The species name is a noun in apposition.

Distribution. A species with a wide geographic range, known from the type locality in West Malaysia as well as from Southern Vietnam. The distance between these two localities is roughly 1,000 km measured as a straight line across the Gulf of Thailand.

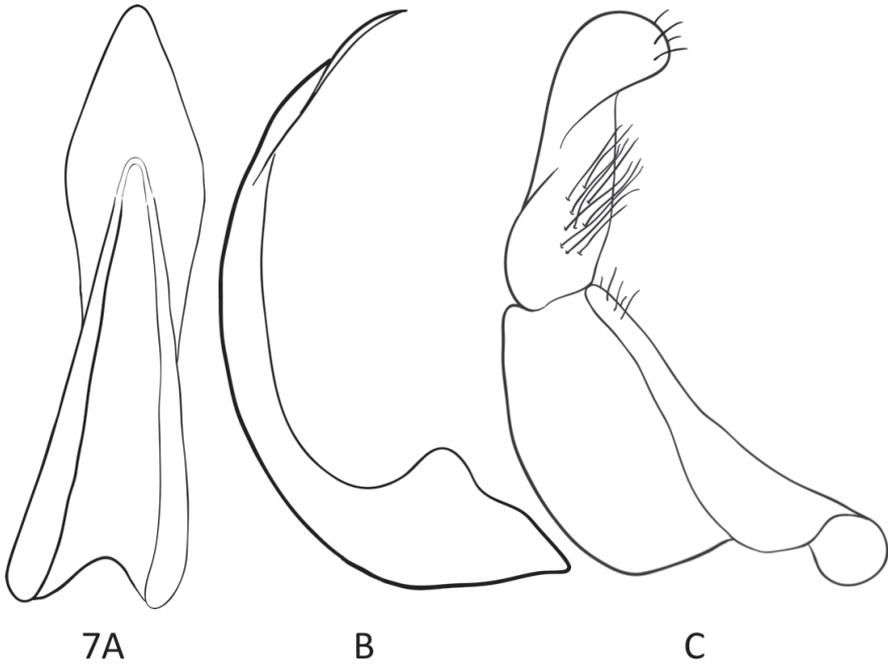


Figure 7. *Leiodytes kualalipis* sp. n., median lobe of aedeagus, ventral view (A), lateral view (B), paramere, lateral view (C).

Habitat. The holotype was collected in shallow water, among dense layers of rotten leaves, in a shaded forest pool situated in an old rubber plantation overgrown by secondary forest (Fig. 8). The species was associated with the Dytiscidae: *Copelatus* sp., *Hydaticus pacificus pacificus* Aubé, 1838 and *Hyphydrus birmanicus* Régimbart, 1888.

In Vietnam, the species was collected in shallow water made by jeep on a path. Synotypically occurring dytiscid species included *Leiodytes nicobaricus* (Redtenbacher, 1867), *Hydroglyphus orientalis* (Clark, 1863) and *Sandracottus maculatus* (Wehncke, 1876).

Note

Nilsson (2016) in the updated World Catalogue of Dytiscidae lists two Bidessini species of unclear generic placement. One of them is *Hydroporus aberrans* Clark, 1863: 426, described from Indonesia (“Java”). The holotype cannot be located in the Natural History Museum London, which houses Clark’s collections. Clark (1863) wrote that he only received one imperfect specimen from Mr. Bowring from Java. It was about 1.6 mm long, with parallel-sided “abdomen” but laterally rounded thorax (narrow anteriorly and posteriorly) and each elytron had eight rows of coarse punctures (Clark referred to them as “striae”). The dorsal colouration was testaceous, with the area between the 1st–6th rows being irregularly rufo-testaceous. This might refer to a species of *Leiodytes*, although we have not seen any species of that genus with rows of coarse serial punctures on the elytron.



Figure 8. Habitat of *Leiodytes kualalipis* sp. n. near Kuala Lipis, West Malaysia. Drawing of beetle by D. Paramonov (Riga).

We can however rule out that any of the new species proposed herein is conspecific with *Hydroporus aberrans*.

The other species of unclear generic placement was *Hydroporus fairmairei* Branden, 1885, which we transfer to *Limbodessus* below.

New combinations and synonymies

Limbodessus curvuplicatus (Zimmermann, 1927)

Fig. 9A, B

Bidessus curvuplicatus Zimmermann, 1927:16 (Samoa).

Limbodessus curvuplicatus (Zimmermann, 1927): Balke and Ribera 2004: 125.

= *Hydroporus dorsoplagiatus* Fairmaire, 1881: 249 (Fiji); preoccupied by Fairmaire (1880: 247), **syn. n.**

= *Hydroporus fairmairei* Branden, 1885: 53 (a replacement name for *H. dorsoplagiatus* Fairmaire, 1881); this replacement name is in turn preoccupied by *Hydroporus fairmairei* Leprieur (1876: 142, currently in *Deronectes*), objective synonym of *Hydroporus dorsoplagiatus* Fairmaire, 1881.

= *Bidessus fijiensis* J. Balfour-Browne, 1944: 99 (Fiji), **syn. n.**

Liodessus fijiensis (J. Balfour-Browne, 1944): Biström 1988: 19.

Limbodessus fijiensis (J. Balfour-Browne, 1944), **comb. n.**

Type material. *Hydroporus dorsoplagiatus*: not located. A loan request was sent to MNHN with request number 66649 on 11.08.2016, and Antoine Mantilleri as well as later Dr. Arnaud Faille searched the collection and did not find potential type material. This might still be stored in the Oberthür collection, however, and might be found at some stage.

Bidessus curvuplicatus: Holotype, male (BMNH) and paratype, male (ZSM), Samoan Is. Mulifanua Upolu, F. Burton and G.H. Hopkins, Type.

Bidessus fijiensis: Holotype, female (BMNH) Namaka, C Fiji 1545, 8.12.43, R.A. Lever, Pres. By Imp. Inst. Ent. B.M. 1945.9, *Bidessus fijiensis* Type! J. Balfour-Browne det.

Additional material. 8 exx (ZSM) Fiji: Viti Levu, Rakiraki, Navara, 50m, 10.xi.2003, 17.416024°S 178.147712°E, Wewalka & Balke (FI 11).

Diagnosis. A stout, yellow to yellow orange *Limbodessus* with slightly enlarged male antenna and distinct angle between base of elytron and base of pronotum (Fig. 9). Female with strongly expanded antennomeres 3–6. Fijian specimens are slightly smaller than the Samoan types: 3.5 mm (Samoa) *versus* 2.8–3.2 mm (Fiji).

Notes on classification. We have not seen type material of *Hydroporus dorsoplagiatus* but have collected specimens in Fiji that match the description by Fairmaire (1881). At the same time, we found that our Fiji specimens agree with the types of *Limbodessus curvuplicatus* (Zimmermann, 1927) from Samoa. Moreover, *Bidessus fijiensis* J. Balfour-Browne, 1944, later moved to *Liodessus* by Biström (1988), and which we here move to *Limbodessus*, agrees well with our newly collected Fijian specimens and thus establishes another junior synonym to *Hydroporus fairmairei*, the replacement name of *Hydroporus dorsoplagiatus*. However, since the replacement name *Hydroporus fairmairei* suggested by Branden (1885) is also a junior homonym (see above), the oldest valid synonym, *Limbodessus curvuplicatus* (Zimmermann, 1927), becomes the valid name.

Distribution. Samoa, Fiji.

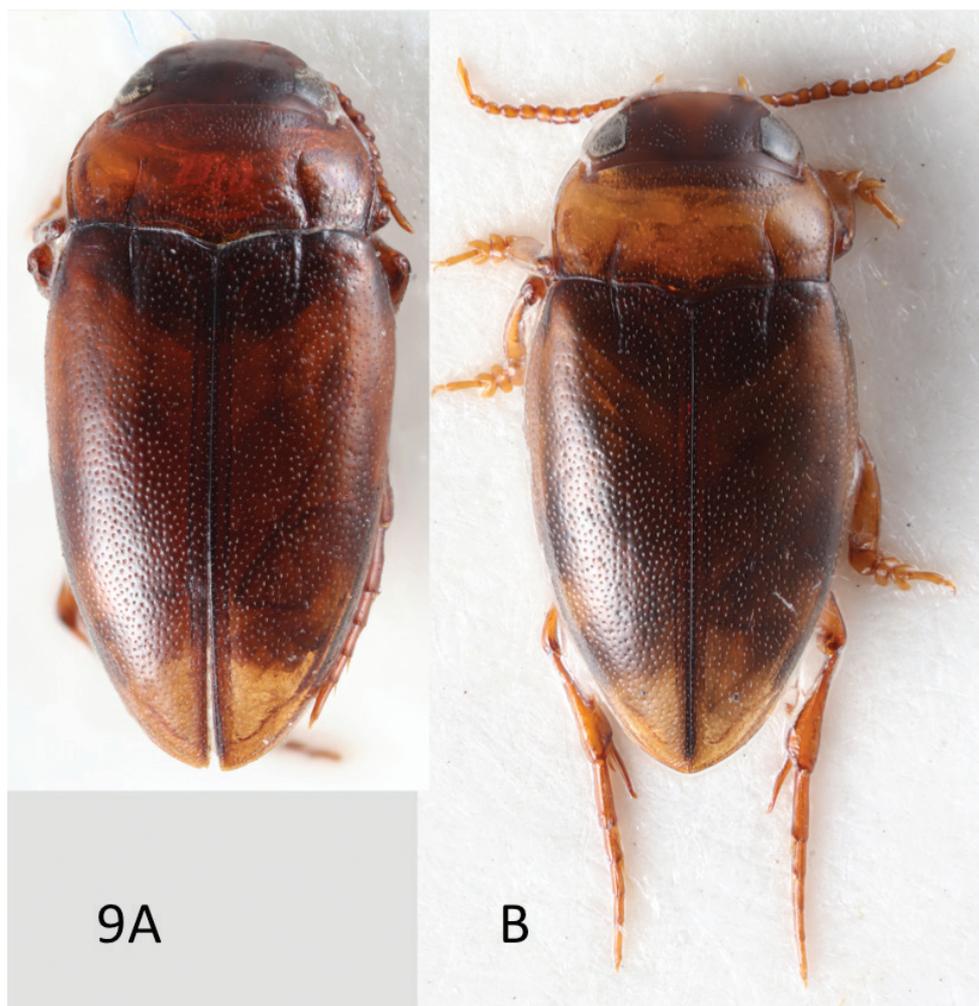


Figure 9. *Limbodesus curviplicatus*: male paratype of *Bidessus curviplicatus* Zimmermann, 1927 from Samoa (**A**) and male specimen from Fiji (**B**).

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