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Eleven nominal species of *Burmoniscus* are junior synonyms of *B. kathmandius* (Schmalfuss, 1983) (Crustacea, Isopoda, Oniscidea)

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Abstract

Holotypes, paratypes, and specimens newly collected from the type localities (i.e., topotypes) of *Burmoniscus aokii* (Nunomura, 1986), *B. boninensis* (Nunomura, 1986), *B. daitoensis* (Nunomura, 1986), *B. hachijoensis* Nunomura, 2007, *B. japonicus* (Nunomura, 1986), *B. kagoshimaensis* Nunomura, 2003, *B. murotoensis* (Nunomura, 1986), *B. okinawaensis* (Nunomura, 1986), *B. shibatai* (Nunomura, 1986), *B. tanabensis* Nunomura, 2003, and *B. watanabei* (Nunomura, 1986) were examined in order to clarify their taxonomic status. Observation of 13 morphological characters that were purposed to show species-level diagnostic variations in the original descriptions suggests that all eleven nominal species are identical, and molecular analysis based on three gene fragments supports this suggestion. Additionally, the morphology of the carpus of pereopod 1 and of the endo- and exopodites of pleopod 1 of these species are consistent with those of *B. kathmandius* (Schmalfuss, 1983). The eleven above-mentioned species of *Burmoniscus* described from Japan are therefore relegated to junior synonyms of *B. kathmandius*, originally reported from Nepal.

Keywords

COI, 12S rRNA, 16S rRNA, Japan, Philosciidae, taxonomy

Introduction

The genus *Burmoniscus* Collinge, 1914 includes more than 100 nominal species, 14 of which have been recorded in Japan (Nunomura 2003a,b, 2007, Schmalfuss 2004, Karasawa and Honda 2012, Karasawa and Goto 2014), but the taxonomy of this genus remains poorly understood (Karasawa and Honda 2012, Karasawa and Goto 2014). In Japan, these species were originally described as belonging to the genus *Setaphora* Budde-Lund, 1909 (Nunomura 1986), which has been shown to be a synonym of *Anchiphiloscia* Stebbing, 1908 (Ferrara and Taiti 1986). Subsequently, Taiti and Ferrara (1991) assigned *S. okinawaensis* Nunomura, 1986, to *Burmoniscus* based on examination of specimens from Hawaii. Additionally, these authors suspected that several of the nominal species from Japan that had been described by Nunomura (1986) were identical to *B. okinawaensis*. In 1993, Kwon and Jeon (1993) re-examined type specimens of *S. aokii* Nunomura, 1986, *S. boninensis* Nunomura, 1986, *S. daitoensis* Nunomura, 1986, *S. japonica* Nunomura, 1986, *S. murotoensis* Nunomura, 1986, *S. shibatai* Nunomura, 1986, *S. watanabei* Nunomura, 1986, and *B. okinawaensis*, and concluded that all these species belonged to *Burmoniscus* and were identical. The authors also proposed *B. okinawaensis* as the valid name. More recent studies, however, have suggested that these species are eight valid species of this genus in Japan (e.g., Schmalfuss 2004, Nunomura 2011, 2015). The three most recently described congeners from Japan, viz., *B. kagoshimaensis* Nunomura, 2003, *B. tanabensis* Nunomura, 2003, and *B. hachijoensis* Nunomura, 2007, might be ascribed to the *B. okinawaensis* complex. Schmalfuss (1983) initially described a species collected from Nepal as *Rennelloscia kathmandia* Schmalfuss, 1983 but subsequently moved it to *Burmonicus* (Schmalfuss 2004). Not appreciating that *Burmoniscus* is masculine in gender, Karasawa et al. (2012) mistakenly referred to this species as *B. kathmandia* whereas the correct spelling is *B. kathmandius*. The morphological characteristics of this species, including the two convex regions of the tip of the pleopod 1 endopodite in males, the branched setae of the carpus, and the shape of the male's pleopod 1 exopodite, are consistent with those of *B. okinawaensis* described by Nunomura (1986) and Taiti and Ferrara (1991). Thus, I suspected that eleven of the 14 nominal species of *Burmoniscus* in Japan are not only identical to each other, but are in fact junior synonyms of *B. kathmandius*.

The objective of the present study was to redescribe the purportedly diagnostic morphological features of the type specimens, or of new material collected from the type localities (topotypes), of these eleven *Burmoniscus* species from Japan, and thus determine whether or not they are distinct from *B. kathmandius*.

Material and methods

Sample collection

Holotypes or paratypes were examined when possible; however, when such specimens were in poor condition or required dissection, new specimens collected from the type

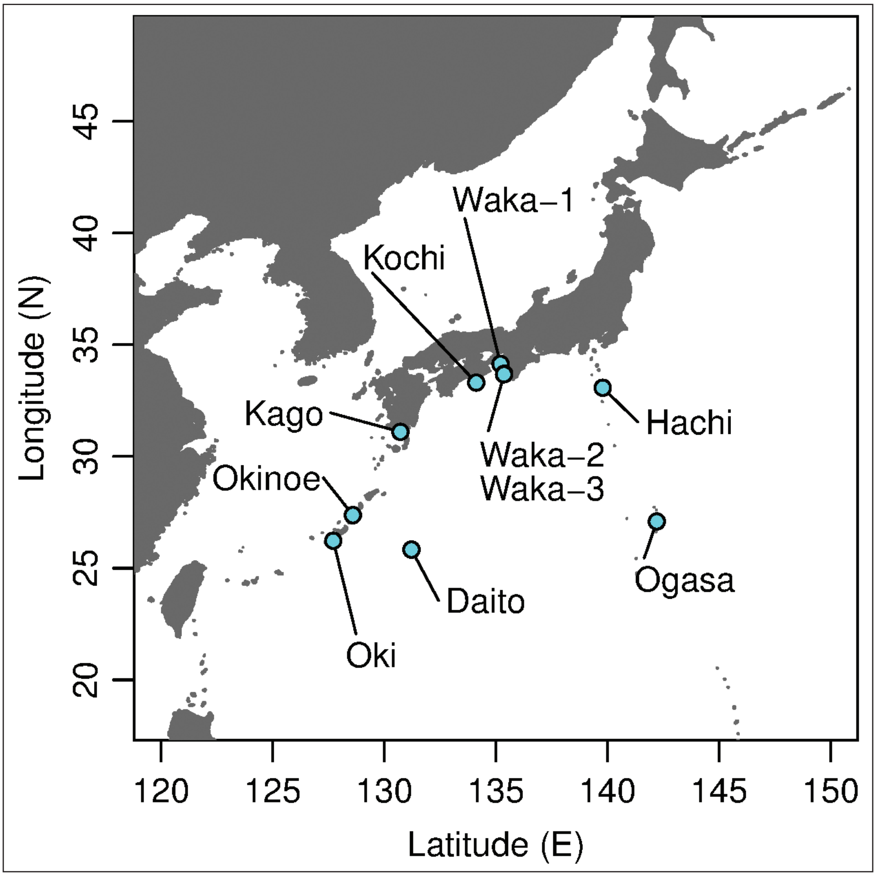

Figure 1. Map of type localities of the 11 *Burmoniscus* species. Daito: Minami-daitojima Island, Okinawa; Hachi: Hachijojima Island, Tokyo; Kago: Sata Town, Kagoshima; Kochi: Muroto City, Kochi; Ogasa: Chichijima Island, Ogasawara Islands, Tokyo; Oki: Naha City, Okinawa; Okinoe: Okinoerabujima Island, Kagoshima; Waka-1: Kainan City, Wakayama; Waka-2: Tanabe City, Wakayama; Waka-3: Shirahama Town, Wakayama.

localities (topotypes) were examined instead. I was unable to collect specimens of *B. aokii* and *B. boninensis* from their type localities on Chichijima Island, so new specimens from another site on Chichijima Island were examined instead. In addition, because efforts to collect new specimens of *B. hachijoensis* from the type locality on Hachijojima Island failed, some specimens were collected from another site on this island. The type localities of the eleven species of *Burmoniscus* are illustrated in Figure 1 and detailed collection data are provided in Suppl. material 1. For the sake of clarity, the current report tentatively treats all the topotypic (or near-topotypic) material as the respective nominal species described by Nunomura (1986, 2003a,b, 2007). Voucher specimens are deposited in the collection of the Kitakyushu Museum of Natural History and Human History (KMNH-IvR), Kitakyushu, Fukuoka Prefecture, Japan.

Morphology

Male specimens were used for morphological examination, except for pereopod 1 of *B. aokii* and *B. boninensis* and maxilla 1 of *B. tanabensis*, of which only female had these appendages unbroken. The antenna 1, maxilliped, genital papilla, endopodites and exopodites of pleopods 1 and 2, and pereonites 1–7 were unilaterally removed from the body of each specimen under a stereo microscope (SZH, Olympus Corp., Japan). These body parts were then placed in Hoyer's mounting medium (Krantz and Walter 2009) on slides, gently covered with a coverslip, and drawn under a microscope (Eclipse E400, NIKON Corp., Japan). The b/c and d/c co-ordinates of the *noduli laterales* were calculated following the method of Vandel (1962). The epimeron 7 and pleotelson were drawn using a stereo microscope (SZH) or a digital microscope (VHX-2000, KEYENCE Corp., Japan). Scanning electron microscopy (SEM) was used to visualize the morphology of the ommatidia, the outer endite of maxilla 1, and pereopod 1. These three parts were removed from the body, dried at room temperature, then placed on aluminum stubs and coated with gold. SEM photos were taken using a JCM-5100 (JEOL Ltd., Japan). Exopodite length of the uropod and head width were measured using a digital microscope, and the length of the uropod was standardized by calculating the ratio of exopodite length to head width to avoid confounding effects of body size. The voucher specimens used for morphological analysis are listed in Suppl. material 2.

Molecular analysis

A single topotypic (or near-topotypic) material of the eleven species was used for molecular analysis, but a single specimen for *B. aokii* and *B. boninensis* was used. Total DNA was extracted from leg muscle using the Qiagen DNeasy Blood and Tissue Kit, according to the manufacturer's protocol (Qiagen, Germany). Parts of the mitochondrial cytochrome c oxidase subunit I (COI) and mitochondrial 12S and 16S ribosomal RNA (rRNA) genes were amplified by polymerase chain reaction (PCR) using the following primers: LCO1490 and HCO2198 (Folmer et al. 1994) for the COI region, 12Sai and 12Sbi (Palumbi 1996) for the 12S rRNA region, and 16Sar and 16Sbr (Klossa-Kilia et al. 2006) for the 16S rRNA region. If the 16S rRNA region could not be amplified using these primers, a different primer, 16Sar-int-sf (Parmakelis et al. 2008), was used instead. PCR was carried out in 20-µl reaction volumes with Ex Taq (Takara Bio, Japan). The cycle program comprised an initial denaturation step at 94°C for 3 min followed by 30 cycles of 1 min at 94°C, 1 min at 44–48°C, and 1 min at 72°C, and finally a 7-min extension at 72°C. PCR products were purified using a illustra ExoProStar (GE Healthcare Japan Corp., Japan) and directly sequenced by Macrogen Japan (Japan) using the same primer sets used for PCR. *Burmoniscus* sp., *B. meeusei* (Holthuis, 1947), *B. dasystylus* Nunomura, 2003, *B. ocellatus* (Verhoeff, 1928), and *Ligidium ryukyuensis* Nunomura, 1983 from Japan were also added to the molecular analysis, the last as an outgroup. No material *B. kathmandius* from Nepal was available. Sample details and accession numbers are given in Suppl. material 1.

The sequences were aligned using the default settings in MUSCLE 3.5 (Edgar 2004) at SeaView 4 (Gouy et al. 2010). Gaps were excluded from subsequent analyses. Maximum Likelihood (ML) analysis was performed using RAxML Version 8 (Stamatakis 2014). The best-fit models of sequence evolution for both gene and codon, as determined by the Akaike Information Criterion correction (AICc) in the program KAKUSAN 4 (Tanabe 2011), were partitioned equal-mean-rate models. Bootstrap support was assessed using 1000 replicates. Genetic distances were calculated as p-distances using MEGA 6 (Tamura et al. 2013).

Results and discussion

Eye. The number of ommatidia varied considerably among the nominal species. *Burmoniscus hachijoensis* had the fewest ommatidia (12), but most species had more than 20 ommatidia (Suppl. material 3). Nunomura (2003a) argued that *B. tanabensis* could be distinguished from *B. watanabei* and *B. okinawaensis* because it has fewer ommatidia. In the present study, however, the number of ommatidia varied from 13 to 21 within a population from the type locality of *B. okinawanesis* (Fig. 2), and these numbers might be somewhat correlated with body size. Thus, the number of ommatidia is not a reliable feature for separating these species of *Burmoniscus*.

Antenna 1. As re-described from newly collected topotypes (Fig. 3), the antennae 1 of all specimens consisted of three articles and the apical article bore numerous aesthetascs. Two of these were long and located at the tip, while the others were short and located on the lateral margin. There was variation in the number of short aesthetascs among specimens (4–8). As in the original descriptions of *Burmoniscus* species, the total number of aesthetascs ranged from 2 to 11 (Suppl. material 3). The number of aesthetascs was used to distinguish *B. tanabensis* and *B. hachijoensis* by Nunomura (2003a, 2007), as both species had more aesthetascs than *B. okinawaensis* and *B. watanabei*. However, there has been no comparison of *B. tanabensis* and *B. hachijoensis* to other species with more than five aesthetascs. For example, Nunomura (1986) described the antenna 1 of *B. shibatai* as having a total of eleven aesthetascs, but this species was not discussed by him later (Nunomura 2003a, 2007). Moreover, the original descriptions of some species mentioned only two aesthetascs on antenna 1, but small aesthetascs were always present in addition to these, even if they were minute and difficult to observe. It is possible that their presence was overlooked in the original descriptions. Taken together, these observations suggest that the number of aesthetascs on antenna 1 is not suitable for distinguishing among species of *Burmoniscus*.

Outer endite of maxilla 1. The outer endites of maxillae 1 of the eleven nominal species of *Burmoniscus* with which we are concerned all bore 10 setae, both simple and bifid. However, there was variation in the number of simple and bifid types among species. For example, *B. shibatai* and *B. tanabensis* had only simple setae, while other species

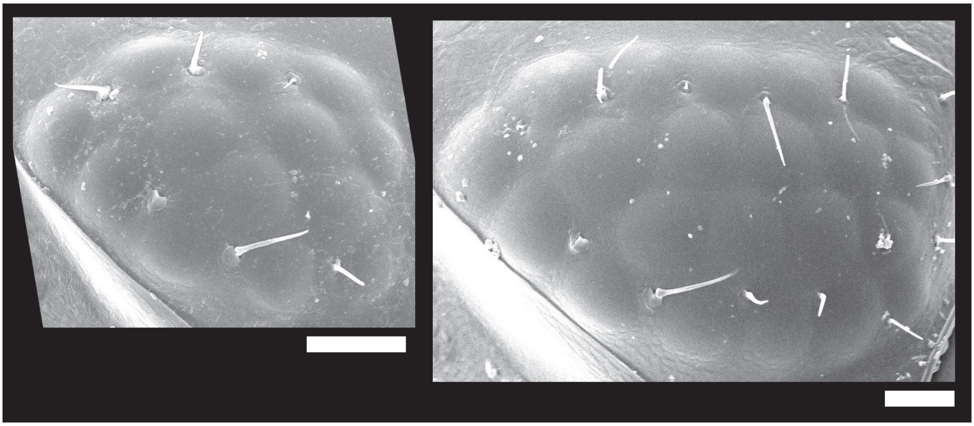

Figure 2. SEM photos of ommatidia of male specimens collected from type locality of *Burmoniscus okinawaensis*, KMNH-IvR-500828 and -500829. Scale bars: 50 µm.

had 2–6 bifid setae (Suppl. material 3). Nunomura (2003a) used the lack of bifid setae on maxilla 1 as a taxonomic characteristic distinguishing *B. tanabensis* from *B. okinawaensis* and *B. watanabei*. However, a single bifid seta is present in the figure accompanying the original description of *B. tanabensis* (fig. 3G in Nunomura 2003a). Examination of new topotypic specimens of *B. tanabensis* and *B. okinawaensis* showed that *B. tanabensis* bears several bifid setae on maxilla 1 (Fig. 4). This suggests that the numbers of the two types of setae cannot be used to distinguish *B. tanabensis*. Whether such variation is useful to distinguish among other *Burmoniscus* species remains unknown.

Maxilliped. This could be described on the basis of holotypes or paratypes (Fig. 5), although the apical part of the palp of the holotype of *B. okinawaensis* was broken. The rectangular endite is covered by numerous minute setae at the distal margin, which also bears a small penicil and a stout spine. The palp consists of triangular apical and rectangular basal articles. The apical article bears a bundle of fine setae at the tip and two clumps of several long setae in the mid regions, and the basal article has one long and one short spine. There were some errors in the original descriptions of these features. For example, the original description of *B. kagoshimaensis* does not show two groups of setae in the mid region of the apical article of the palp, whereas the holotype in fact bears them (Fig. 5). In the Remarks of the original description of *B. hachijoensis*, the less numerous bifid setae on the maxilliped were used for species delimitation, but the presence of any bifid setae on the maxilliped could not be confirmed in the holotype nor in the figure by Nunomura (2007). Moreover, Nunomura (1986) argued that a bare endite is an important taxonomic character (e.g., in *B. boninensis* and *B. shibatai*), but present observations suggest that the apical margin of the endite of all species is covered by minute setae. Another erroneous omission can be mentioned. Taiti and Ferrara (1986) regarded that the penicil on the endite of the maxilliped as a defining taxonomic character of the genus *Burmoniscus*, but the original descriptions of the Japanese species did not mention such a penicil, which the present study has

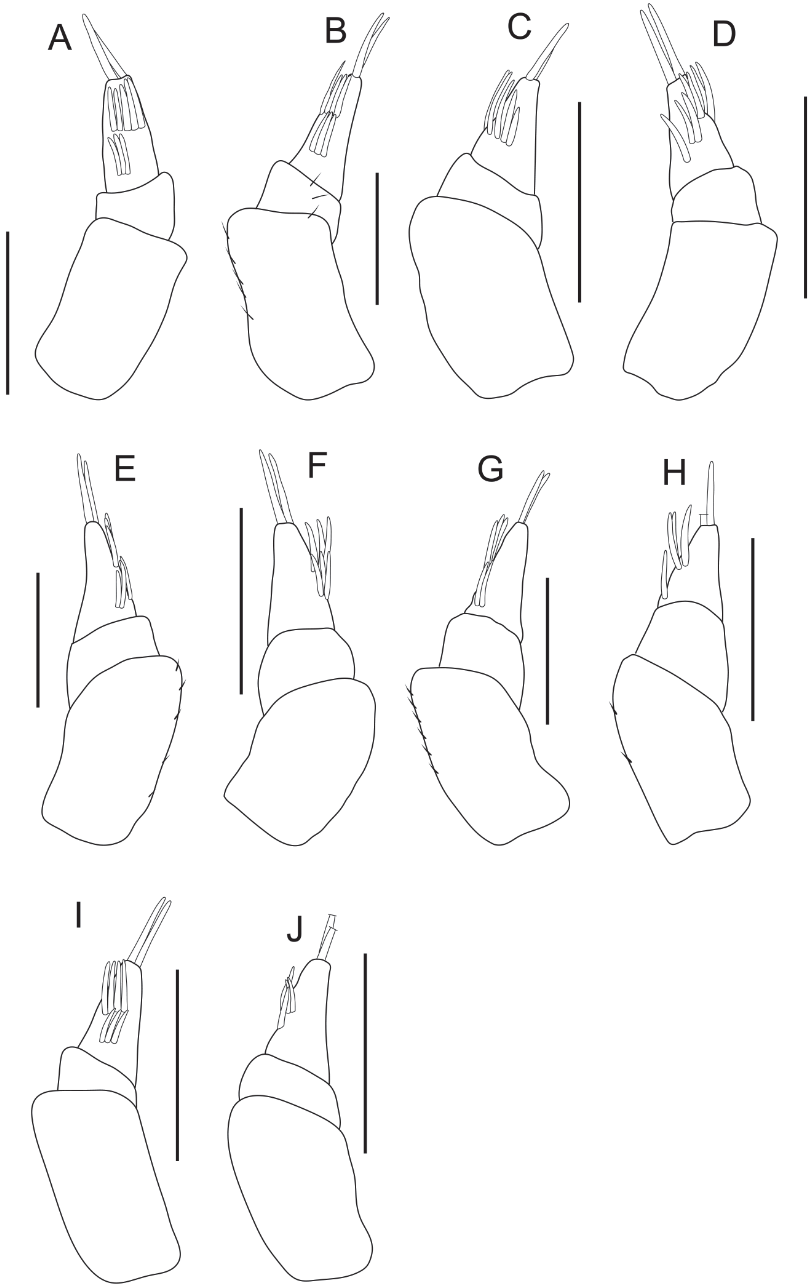

Figure 3. Antenna 1. **A** specimen collected from Chichijima Island (including type localities of *Burmoniscus aokii* and *B. boninensis*), KMNH-IvR-500809 **B** *B. daitoensis*, KMNH-IvR-500811 **C** *B. hachijoensis*, KMNH-IvR-500814 **D** *B. japonicus*, KMNH-IvR-500817 **E** *B. kagoshimaensis*, KMNH-IvR-500821 **F** *B. murotoensis*, KMNH-IvR-500824 **G** *B. okinawaensis*, KMNH-IvR-500830 **H** *B. shibatai*, KMNH-IvR-500834 **I** *B. tanabensis*, KMNH-IvR-500837 **J** *B. watanabei*, KMNH-IvR-500842. All specimens male. Scale bars: 100 μm.

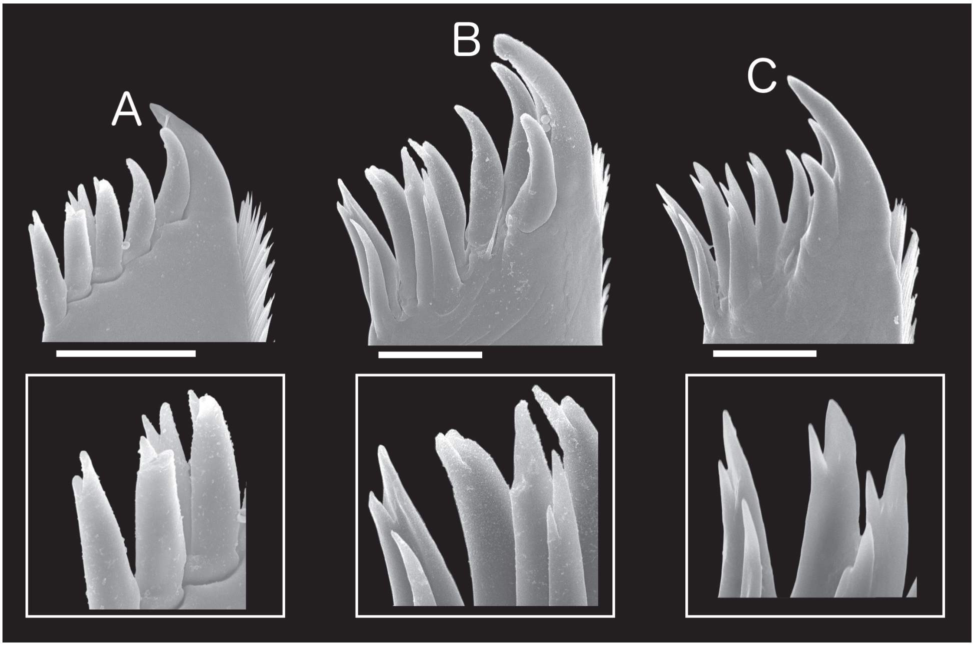

Figure 4. SEM photos of outer endite of maxilla 1 of specimens collected from the type localities of *Burmoniscus tanabensis* (**A** male and **B** female) and *B. okinawaensis* (**C** male), with details of setal tips. **A** KMNH-IvR-500838 **B** KMNH-IvR-500839 **C** KMNH-IvR-500830. Scale bars: 50 µm.

confirmed to be universally present (Fig. 5). Thus, the morphological characteristics of the maxilliped as originally described appear unsuitable for use as defining taxonomic characteristics for these species.

Carpus of pereopod 1. Nunomura (1986) did not describe the fine characteristics of the longest seta on the inner margin of the carpus of pereopod 1. Subsequently, however, this trait was used to distinguish *B. kagoshimaensis* and *B. tanabensis* (Nunomura 2003a,b), although there were inconsistencies in the descriptions. Nunomura (2003b) described the long seta of the carpus of *B. kagoshimaensis* as being bifurcate in the Description, but in the Remarks he considered the absence of a bifid seta on pereopod 1 to be one of the defining taxonomic characters for *B. kagoshimaensis*, based on comparison with *B. okinawaensis*. Nunomura (2003a) also noted that *B. tanabensis* had a simple long seta on the carpus and argued that the simple seta was an important taxonomic characteristic of this species. SEM photos of the carpus of pereopod 1 were obtained in the present study from topotypic specimens (Fig. 6). The longest seta was located on the middle of the inner margin of the carpus and the second longest seta was located in the basal region. The SEM photos revealed that the tip of the longest setae of all species is trifurcate, although the branches are very small and often difficult to observe. These observations suggest that the descriptions of this seta by Nunomura (2003a,b) were erroneous. Moreover, SEM photos revealed that the morphological features of the carpus of all species are consistent with those of *B. kathmandius* as described by Schmalfuss (1983, fig. 22).

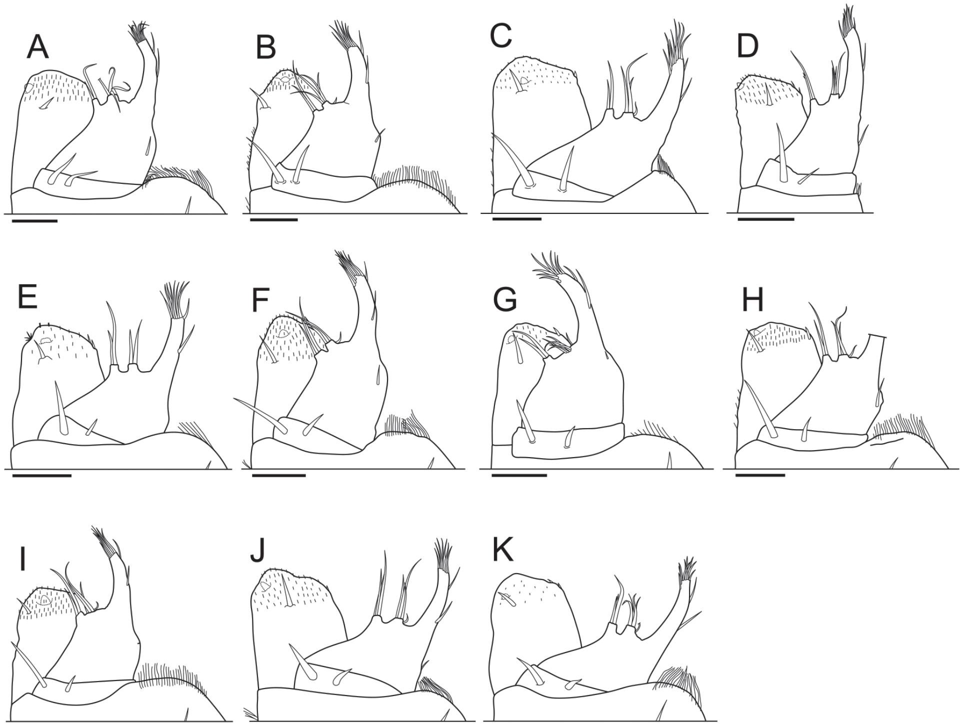

Figure 5. Maxillipeds. **A** *Burmoniscus aokii*, holotype **B** *B. boninensis*, holotype **C** *B. daitoensis*, holotype **D** *B. hachijoensis*, holotype **E** *B. japonicus*, holotype **F** *B. kagoshimaensis*, holotype **G** *B. murotoensis*, holotype **H** *B. okinawaensis*, holotype **I** *B. shibatai*, holotype **J** *B. tanabensis*, holotype **K** *B. watanabei*, Paratype (Cr-5350). All specimens male. Scale bars: 50 µm.

Genital papilla. The morphological characteristics of the genital papilla of terrestrial isopods typically exhibit little variation among related species. In contrast, the original descriptions of the Japanese species of *Burmoniscus* (Nunomura 1986, 2003a, b, 2007) suggested that the genital papillae could be separated into two types: 1) pointed at the tip, and 2) round or truncate. The former type was reportedly found in *B. aokii*, *B. daitoensis*, *B. japonicus*, *B. kagoshimaensis*, *B. okinawaensis*, *B. tanabensis*, and *B. watanabei*, and the latter in *B. boninensis*, *B. hachijoensis*, *B. murotoensis*, and *B. shibatai* (Suppl. material 3). However, the present data suggest that these descriptions were incorrect. In all the examined species (Fig. 7), the genital papillae consist of a rectangular lobe at the tip and a ventral shield with a thickened cuticle. The shields of all species are morphologically similar and fusiform. The pointed type of papillae may represent the ventral shield only, whereas the round or truncate type may represent a ventral shield with a lobe. Thus, this morphological character is not reliable for use as a defining taxonomic character.

Male pleopod 1 endopodite. The morphological characteristics of the tip of the endopodite of pleopod 1 have often been used as defining taxonomic characteristics for

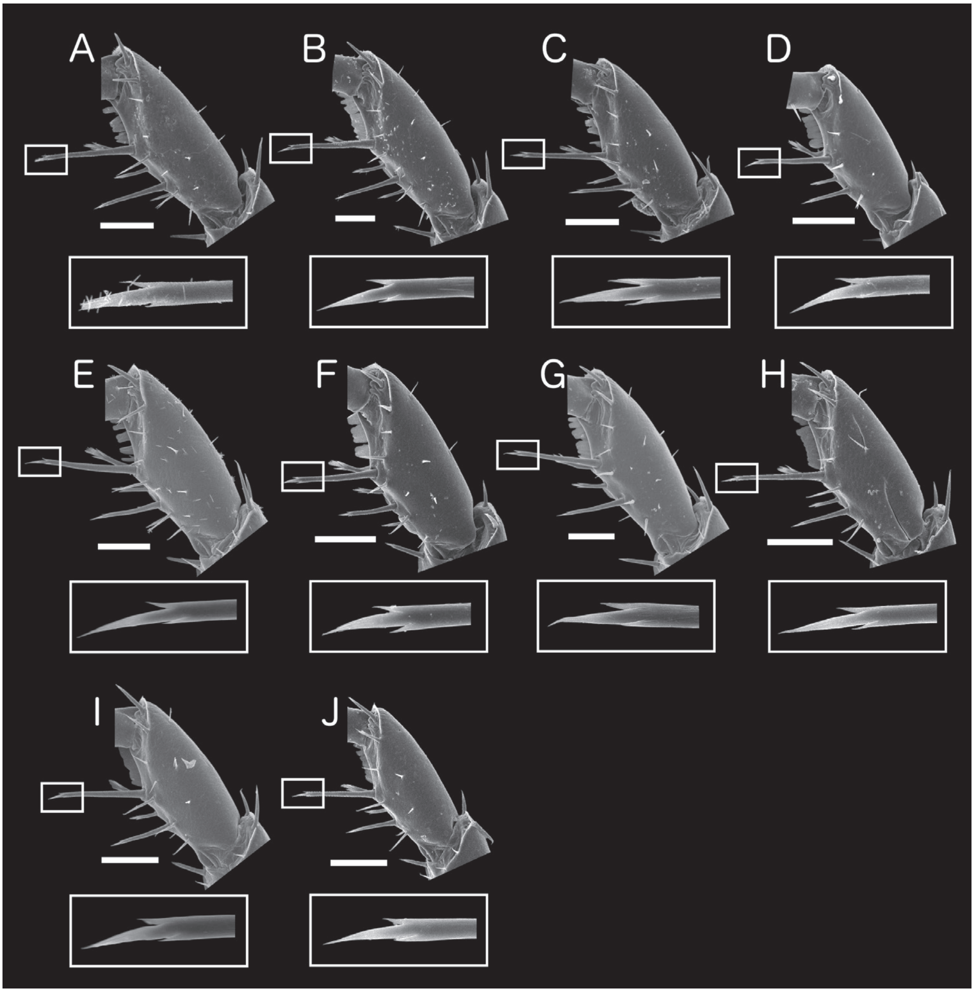

Figure 6. SEM photos of carpus of pereopod 1, with details of tip of longest seta. **A** specimen collected from Chichijima Island (including type localities of *Burmoniscus aokii* and *B. boninensis*), KMNH-IvR-500810 **B** *B. daitoensis*, KMNH-IvR-500811 **C** *B. hachijoensis*, KMNH-IvR-500815 **D** *B. japonicus*, KMNH-IvR-500818 **E** *B. kagoshimaensis*, KMNH-IvR-500822 **F** *B. murotoensis*, KMNH-IvR-500825 **G** *B. okinawaensis*, KMNH-IvR-500831 **H** *B. shibatai*, KMNH-IvR-500834 **I** *B. tanabensis*, KMNH-IvR-500837 **J** *B. watanabei*, KMNH-IvR-500842. All specimens male except A (female). Scale bars: 100 µm.

males of the genus *Burmoniscus* (e.g., Taiti and Ferrara 1986; Kwon and Jeon 1993). *Burmoniscus kagoshimaensis* has two flap-like type structures at the tip, and Nunomura (2003b) pointed out that this structure differs from those of *B. okinawaensis*. The present reexamination of the holotype of *B. kagoshimaensis* has shown, however, that they are indeed similar to those of *B. okinawaensis* (Fig. 8). Moreover, the original descriptions suggested that several species have no or just one lobe-like structure at the tip, a characteristic that has been considered important for distinguishing species

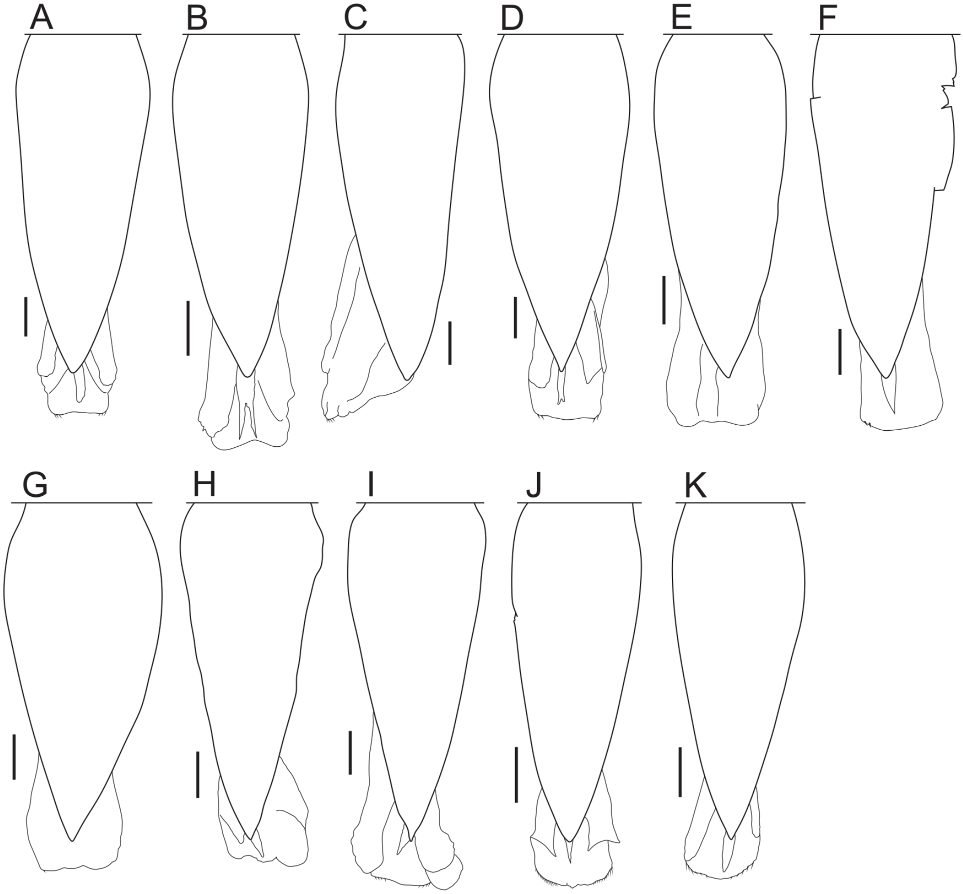

Figure 7. Genital papilla. **A** *Burmoniscus aokii*, holotype **B** *B. boninensis*, paratype (Cr-5506) **C** *B. daitoensis*, holotype **D** *B. hachijoensis*, KMNH-IvR-500816 **E** *B. japonicus*, KMNH-IvR-500819 **F** *B. kagoshimaensis*, holotype **G** *B. murotoensis*, holotype **H** *B. okinawaensis*, KMNH-IvR-500832 **I** *B. shibatai*, holotype **J** *B. tanabensis*, holotype **K** *B. watanabei*, paratype (Cr-5350). All specimens male. Scale bars: 50 µm.

(Suppl. material 3). However, the present observations suggest that most species have a lobe-like structure on each side of the tip (Fig. 8). Exceptions are the paratypes of *B. boninensis* and *B. watanabei*, which have a lobe only on the outer margin, thus more or less consistent with Nunomura (1986). In sum, I conclude that any variation in the tip of this endopodite is no more than intraspecific variation, similar to that observed among specimens from the type locality of *B. okinawaensis* (Fig. 9). Possession of a lobe on each margin at the tip is also characteristic of *B. kathmandius* (fig. 23 in Schmalfuss 1983).

Male pleopod 1 exopodite. As with the endopodite, the morphological features of the exopodite of pleopod 1 in males are also important for the taxonomic differentiation of species of *Burmoniscus* (e.g., Schmalfuss 1983). In the original descriptions

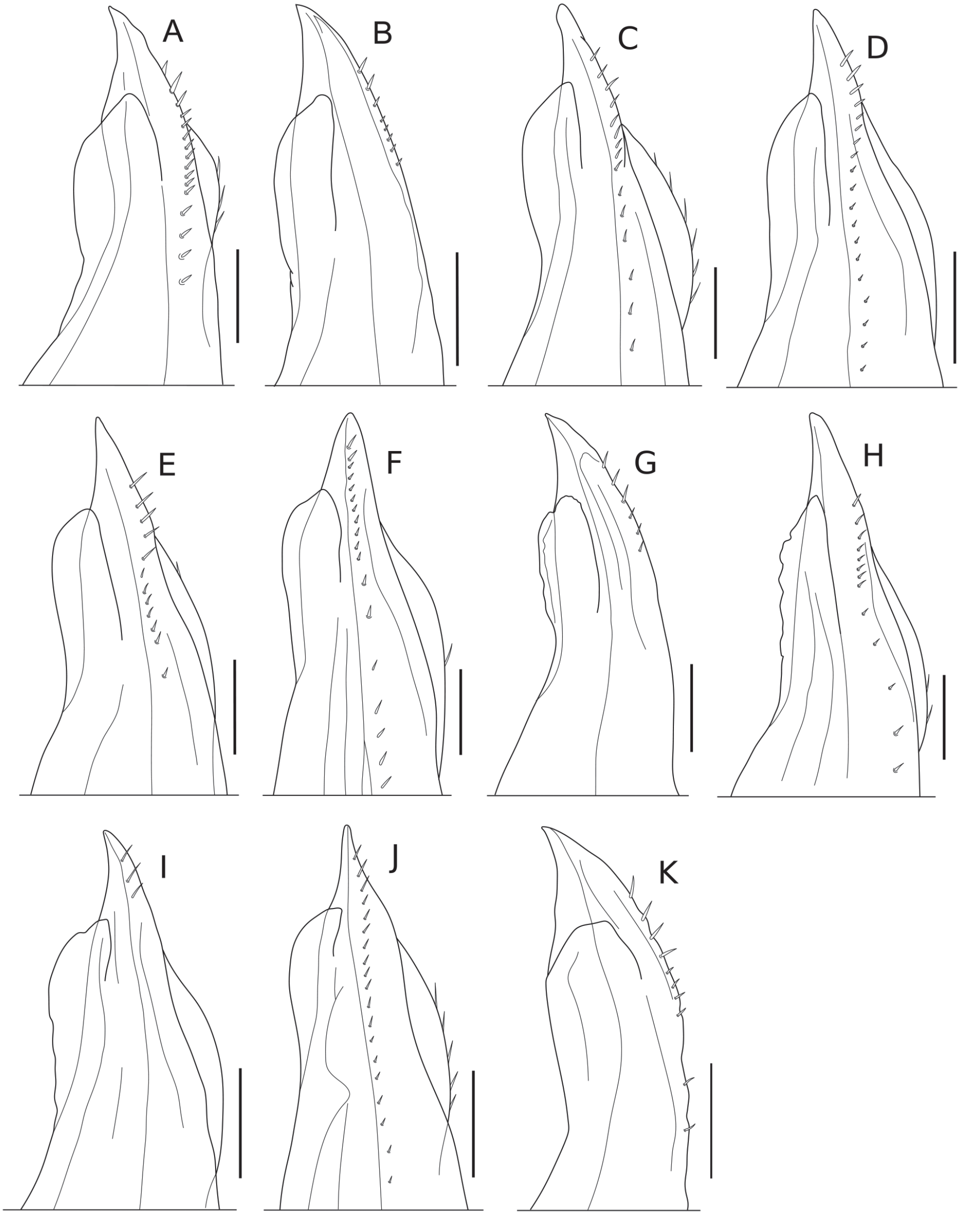

Figure 8. Pleopod 1 endopodite. **A** *Burmoniscus aokii*, holotype **B** *B. boninensis*, paratype (Cr-5506) **C** *B. daitoensis*, holotype **D** *B. hachijoensis*, holotype **E** *B. japonicus*, holotype **F** *B. kagoshimaensis*, holotype **G** *B. murotoensis*, holotype **H** *B. okinawaensis*, KMNH-IvR-500832 **I** *B. shibatai*, holotype **J** *B. tanabensis*, holotype **K** *B. watanabei*, paratype (Cr-5350). All specimens male. Scale bars: 50 μm.

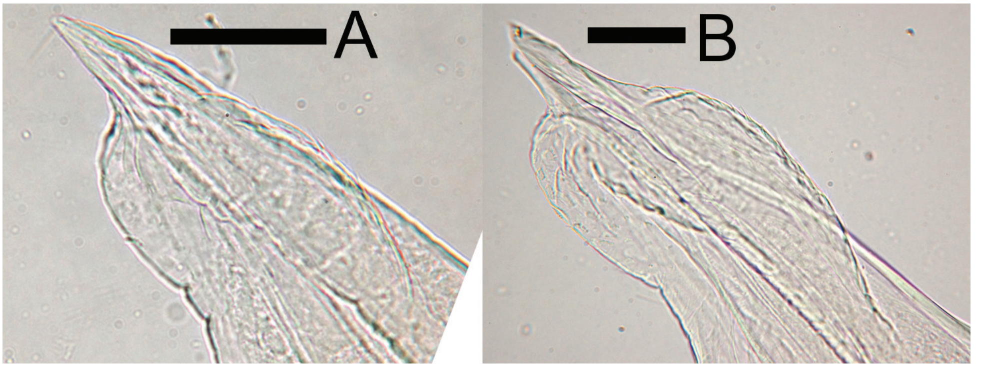

Figure 9. Photos of pleopod 1 endopodite of two specimens (**A** and **B**) collected from type locality of *Burmoniscus okinawaensis* (personal collection). Both specimens male. Scale bars: 50 µm.

of the Japanese species, roughly three types of exopodite were recognized: semicircular, triangular, and rounded (Suppl. material 3). The present reexamination has revealed that all species have an exopodite with a shallow concavity on the outer margin and a rounded inner margin, although there are small morphological variations among the nominal species (Fig. 10). For example, *B. hachijoensis* has a narrower exopodite, while that of *B. daitoensis* and *B. murotoensis* is wider than those of other species. However, this variation may be a function of specimen condition and/or growth. Moreover, the shape of the exopodite of the Japanese species is consistent with that of *B. kathmandius* (fig. 5 in Schmalfuss 1983).

Male pleopod 2 endopodite. The present reexamination of Japanese *Burmoniscus* has shown that the endopodite of male pleopod 2 of all the nominal species tapers towards the tip, although the extent of the curve at the tip varies among species (Fig. 11). The endopodites of *B. japonicus*, *B. kagoshimaensis*, and *B. watanabei* have a greater outward curvature than those of the other species, but it is unclear whether such variation is useful for taxonomic differentiation of species. Nunomura (1986) used the form of the endopodite as a defining taxonomic trait for *B. japonicus*, *B. daitoensis*, *B. boninensis*, and *B. aokii*. However, the lengths of the endopodite of *B. japonicus* and *B. boninensis* were almost equal to those of other species. Moreover, Nunomura (1986) concluded that the shape of both lobes of pleopod 2 was an important character for identifying *B. daitoensis* and *B. aokii*, but his figures and my observations suggested that neither the endopodite nor the exopodite (see below) of pleopod 2 has two lobes. Taken together, these observations suggest that the endopodite of male pleopod 2 is unsuitable for differentiating among species of *Burmoniscus*.

Male pleopod 2 exopodite. Depending on species, the exopodite of pleopod 2 has been described as semicircular, triangular, or round in the original descriptions (Suppl. material 3), but these differences have not been used to distinguish among the species of *Burmoniscus* (Nunomura 1986, 2003a,b, 2007). The present reexamination has shown that all the exopodites are actually very similar, i.e. triangular with a rounded inner margin (Fig. 12).

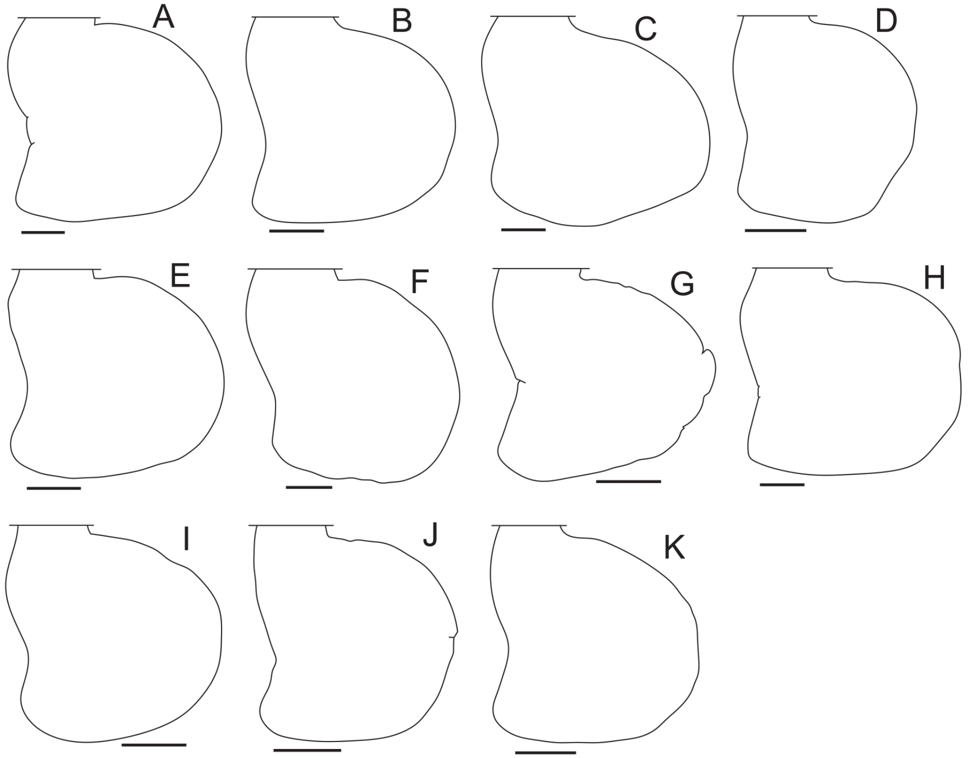

Figure 10. Pleopod 1 exopodite. **A** *Burmoniscus aokii*, holotype **B** *B. boninensis*, paratype (Cr-5506) **C** *B. daitoensis*, holotype **D** *B. hachijoensis*, holotype **E** *B. japonicus*, KMNH-IvR-500819 **F** *B. kagoshimaensis*, KMNH-IvR-500821 **G** *B. murotoensis*, holotype **H** *B. okinawaensis*, KMNH-IvR-500832 **I** *B. shibatai*, KMNH-IvR-500835 **J** *B. tanabensis*, holotype **K** *B. watanabei*, paratype (Cr-5350). All specimens male. Scale bars: 100 µm.

Pleon and pleotelson. The length of the pleon and the shape of the posterior part of the pleotelson were previously used as distinguishing taxonomic characteristics for *B. japonicus* and *B. murotoensis*, respectively (Nunomura 1986). The present reexamination revealed no difference in the lengths and widths of any pleonite among all species (Fig. 13). The shape of the posterior section of the pleotelson exhibits some variation, however, e.g., tapering versus rounded (Fig. 13). Nunomura (1986) described the pleotelson of *B. murotoensis* as being truncate posteriorly, but the holotype actually has a posteriorly tapered pleotelson. This discrepancy suggests that the taxonomic characters defined by Nunomura (1986) are not suitable for distinguishing among the two species. Instead, morphological variation in the posterior part of the pleotelson likely represents intraspecific variation, so cannot be used to distinguish among the Japanese species of *Burmoniscus*.

Epimera 7. The original descriptions did not describe epimera 7 explicitly (Suppl. material 3). However, in the Remarks for *B. kagoshimaensis* it was cited in vague terms,

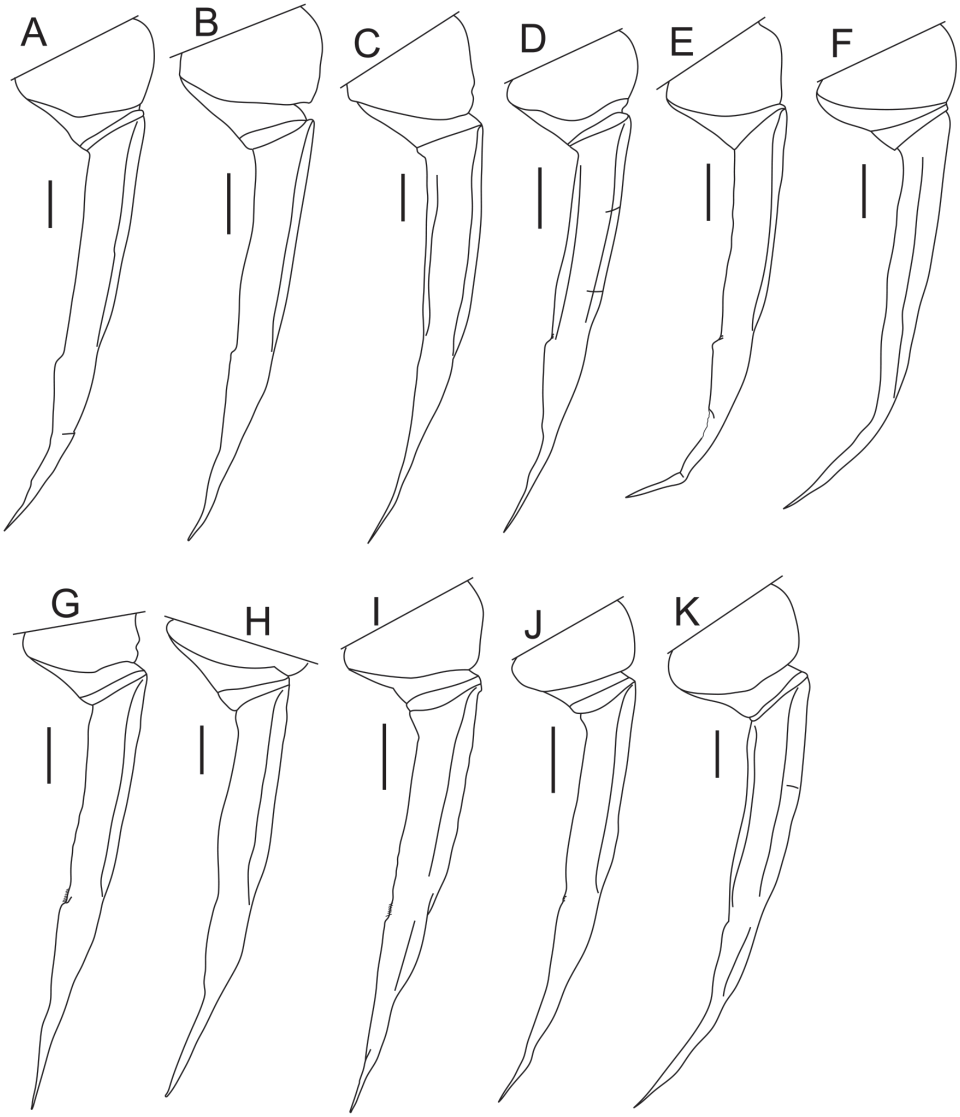

Figure 11. Pleopod 2 endopodite. **A** *Burmoniscus aokii*, holotype **B** *B. boninensis*, paratype (Cr-5506) **C** *B. daitoensis*, KMNH-IvR-500812 **D** *B. hachijoensis*, holotype **E** *B. japonicus*, holotype **F** *B. kagoshimaensis*, holotype **G** *B. murotoensis*, KMNH-IvR-500826 **H** *B. okinawaensis*, KMNH-IvR-500832 **I** *B. shibatai*, KMNH-IvR-500835 **J** *B. tanabensis*, holotype **K** *B. watanabei*, holotype. All specimens male. Scale bars: 100 µm.

"shape of postero-lateral margin of pereonal somite 7", as a feature distinguishing this from *B. okinawaensis* (Nunomura 2003b). The present reexamination of the postero-lateral margin of epimeron 7 showed no difference in shape between *B. kagoshimaensis* and *B. okinawaensis* (Fig. 14).

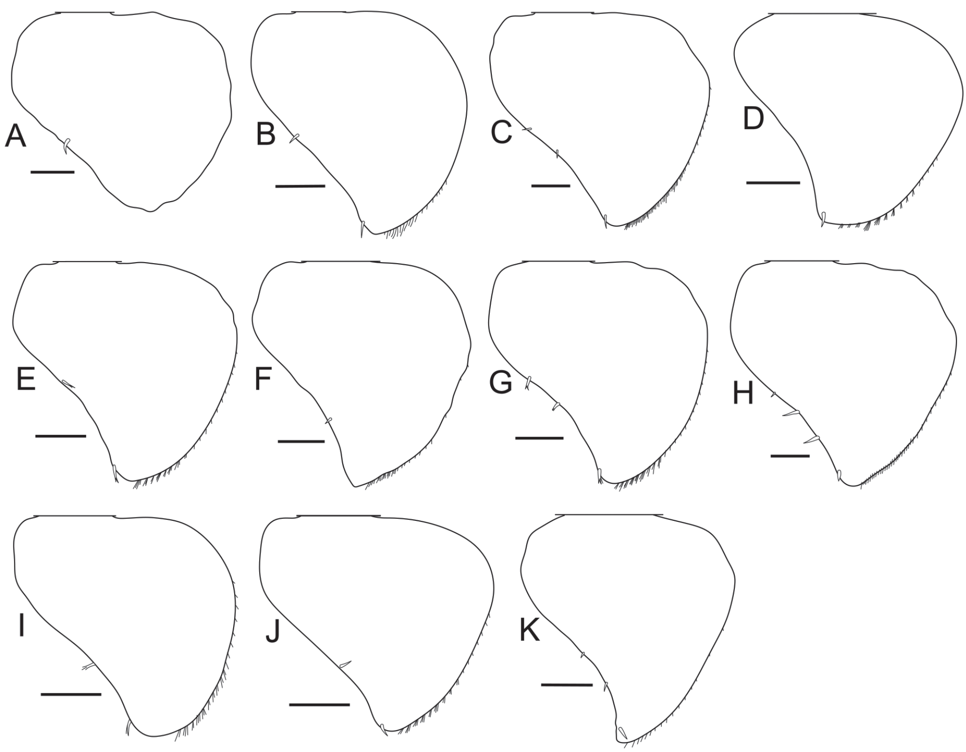

Figure 12. Pleopod 2 exopodite. **A** *Burmoniscus aokii*, holotype **B** *B. boninensis*, paratype (Cr-5506) **C** *B. daitoensis*, KMNH-IvR-500812 **D** *B. hachijoensis*, holotype **E** *B. japonicus*, KMNH-IvR-500819 **F** *B. kagoshimaensis*, holotype **G** *B. murotoensis*, KMNH-IvR-500826 **H** *B. okinawaensis*, KMNH-IvR-500832 **I** *B. shibatai*, KMNH-IvR-500835 **J** *B. tanabensis*, holotype **K** *B. watanabei*, paratype (Cr-5350). All specimens male. Scale bars: 100 μm.

Uropods. Uropods vary in length and have been used as a taxonomic characteristic to distinguish among some species. Original descriptions have often compared the length of the endopodite and exopodite (Suppl. material 3). The uropodal exopodites of 99 new specimens collected from the respective type localities were measured and compared using the ratio of exopodite length to head width among sites to avoid the confounding effect of body size (Fig. 15). The median value at each site ranged from 0.54 to 0.63; there was considerable variation within a site, and the ranges overlapped among the sites. Thus, the variation is too considerable for this feature to be useful in taxonomy.

Noduli laterales. In the original descriptions, the position of the *noduli laterales* was used as a taxonomic characteristic to distinguish among *B. boninensis*, *B. kagoshimaensis*, *B. murotoensis*, *B. okinawaensis*, *B. shibatai*, and *B. watanabei* (Nunomura 1986). Nunomura (1986) described variation in how far the *noduli laterales* on pereonite 2 extended from the lateral margin and concluded that the variation was sufficient to constitute a taxonomic difference. Moreover, Nunomura (2003b) argued that the remote position of the *noduli latarales* on pereonite 4 was an important characteristic

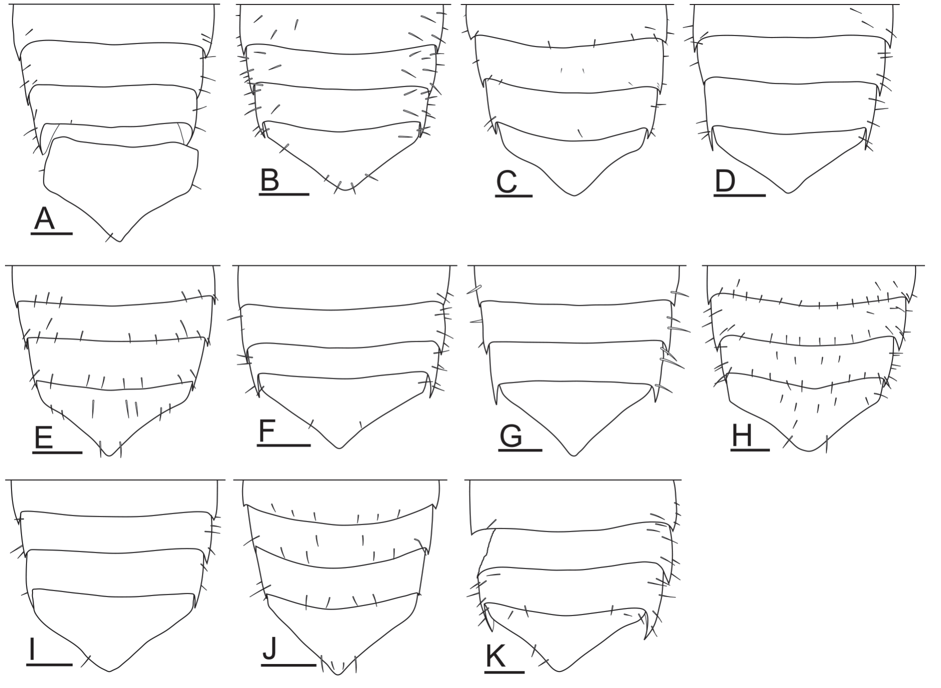

Figure 13. Pleonites 3–5 and pleotelson. **A** *Burmoniscus aokii*, holotype **B** *B. boninensis*, paratype (Cr-5506) **C** *B. daitoensis*, KMNH-IvR-500812 **D** *B. hachijoensis*, holotype **E** *B. japonicus*, KMNH-IvR-500819 **F** *B. kagoshimaensis*, holotype **G** *B. murotoensis*, holotype **H** *B. okinawaensis*, KMNH-IvR-500832 **I** *B. shibatai*, holotype **J** *B. tanabensis*, KMNH-IvR-500840 **K** *B. watanabei*, holotype. All specimens male. Scale bars: 100 µm.

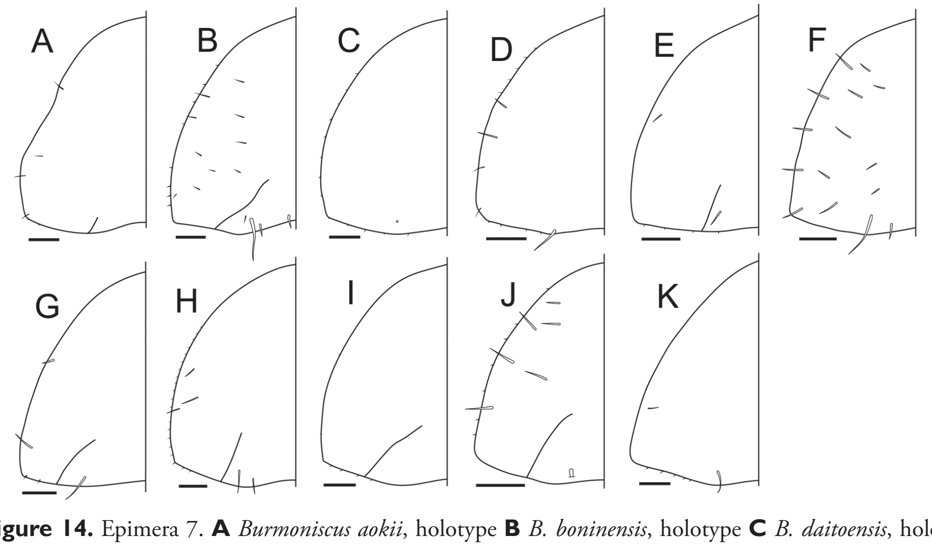

Figure 14. Epimera 7. **A** *Burmoniscus aokii*, holotype **B** *B. boninensis*, holotype **C** *B. daitoensis*, holotype **D** *B. hachijoensis*, holotype **E** *B. japonicus*, holotype **F** *B. kagoshimaensis*, holotype **G** *B. murotoensis*, holotype **H** *B. okinawaensis*, KMNH-IvR-500832 **I** *B. shibatai*, holotype **J** *B. tanabensis*, holotype **K** *B. watanabei*, holotype. All specimens male. Scale bars: 100 µm.

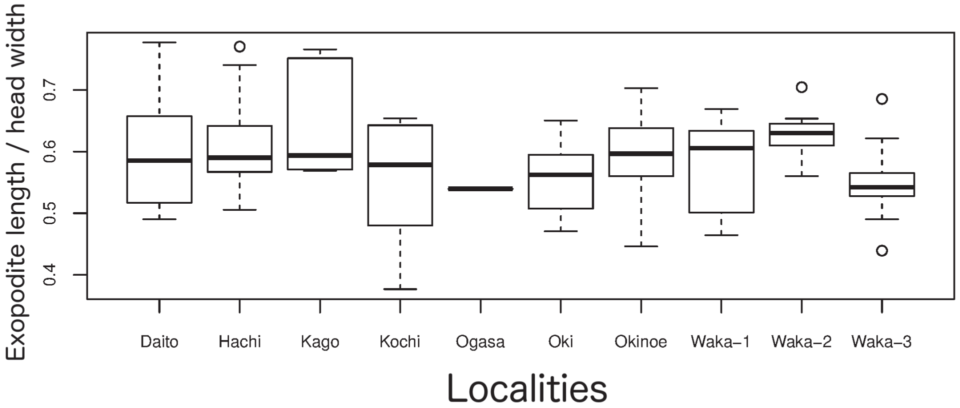

Figure 15. Median values and ranges of proportional length of uropodal exopodite, with respect to width of head, of *Burmoniscus* samples collected from type localities. The names of sampling sites are given in Figure 1. The lower and upper edges of each box mark the 25% and 75% percentiles. The whiskers represent the largest and smallest observed values, except for existing outliers. All specimens male.

for separating *B. tanabensis* from *B. okinawaensis* (Suppl. material 3). Taiti and Ferrara (1986) argued that the position of the *noduli laterales* is an important diagnostic characteristic for the genus *Burmoniscus*, but not of the species within it. They concluded that all species of this genus have one *nodulus lateralis* per side on each pereonite and the d/c co-ordinates exhibit clear peaks on pereonites 2 and 4. This contradicts most of the original descriptions. The present reexamination has shown that all species described by Nunomura (1986) have *noduli laterales* on pereonite 4 near the lateral margin (Suppl. material 3) and the newly calculated d/c and b/c co-ordinates reported herein for new specimens collected from type localities show that the setae on pereonites 2 and 4 are remote from the lateral margin in all species (Figs 16, 17). This pattern is identical to that of *B. okinawaensis* collected from Hawaii (Taiti and Ferrara 1991) and also consistent with the genetic diagnosis of Taiti and Ferrara (1986).

Molecular analysis. The total alignments of the three sequenced regions contained 1210–1243 bases. The 50% majority-rule consensus tree produced by the ML analysis is shown in Fig. 18. This analysis could not fully clarify the phylogenetic relationships among the 14 species of *Burmoniscus* in Japan, but four species, *Burmoniscus* sp., *B. ocellatus*, *B. dasystylus*, and *B. meeusei*, exhibited distinct genetic independence from the others. The mean genetic difference (p-distance) among specimens collected from the type localities of eleven *Burmoniscus* species was 0.003, which is distinctively lower than what is usually regarded as interspecific-level differences in isopods (13–28% in Klossa-Kilia et al., 2006). The pairwise genetic distances among *Burmoniscus* sp., *B. ocellatus*, *B. dasystylus*, *B. meeusei*, and grouped data of the other eleven *Burmoniscus* species ranged from 0.249 to 0.290, suggesting that these five, at least, are independent species. The present study also found two haplotypes in the eleven *Burmonicus* species. One of them was found in *B. daitoensis*, *B. kagoshimaensis*, *B. okinawaensis*, *B. shibatai*, and *B. watanabei*, among which four species are distributed in southwestern

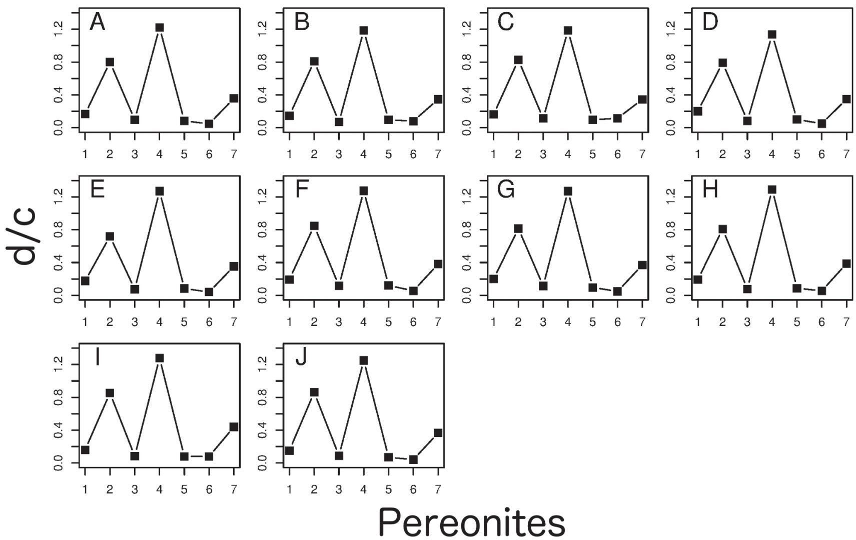

Figure 16. The d/c co-ordinate values of the *noduli laterales*. **A** specimens collected from Chichijima Island (including type localities of *Burmoniscus aokii* and *B. boninensis*), KMNH-IvR-500809 **B** *B. daitoensis*, KMNH-IvR-500813 **C** *B. hachijoensis*, KMNH-IvR-500816 **D** *B. japonicus*, KMNH-IvR-500820 **E** *B. kagoshimaensis*, KMNH-IvR-500823 **F** *B. murotoensis*, KMNH-IvR-500827 **G** *B. okinawaensis*, KMNH-IvR-500833 **H** *B. shibatai*, KMNH-IvR-500836 **I** *B. tanabensis*, KMNH-IvR-500841 **J** *B. watanabei*, KMNH-IvR-500843. All specimens male.

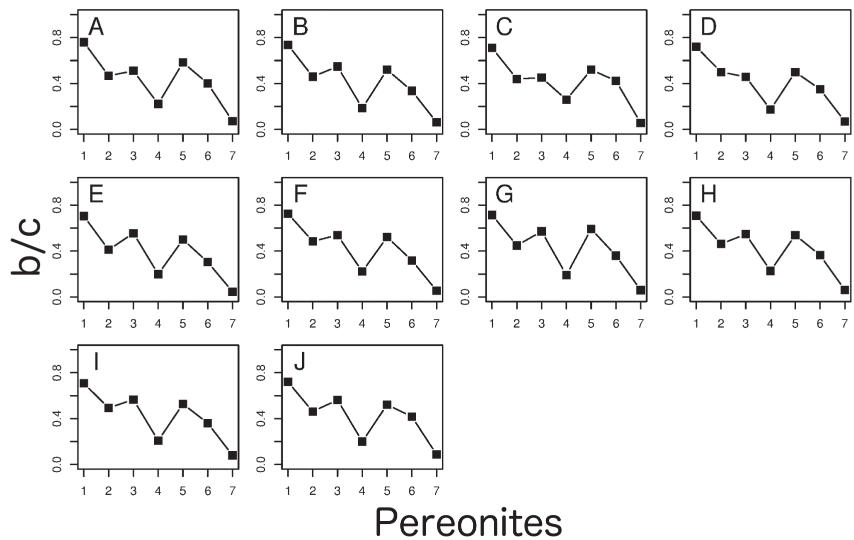

Figure 17. The b/c co-ordinate values of the *noduli laterales*. **A** specimens collected from Chichijima Island (including type localities of *Burmoniscus aokii* and *B. boninensis*), KMNH-IvR-500809 **B** *B. daitoensis*, KMNH-IvR-500813 **C** *B. hachijoensis*, KMNH-IvR-500816 **D** *B. japonicus*, KMNH-IvR-500820 **E** *B. kagoshimaensis*, KMNH-IvR-500823 **F** *B. murotoensis*, KMNH-IvR-500827 **G** *B. okinawaensis*, KMNH-IvR-500833 **H** *B. shibatai*, KMNH-IvR-500836 **I** *B. tanabensis*, KMNH-IvR-500841 **J** *B. watanabei*, KMNH-IvR-500843. All specimens male.

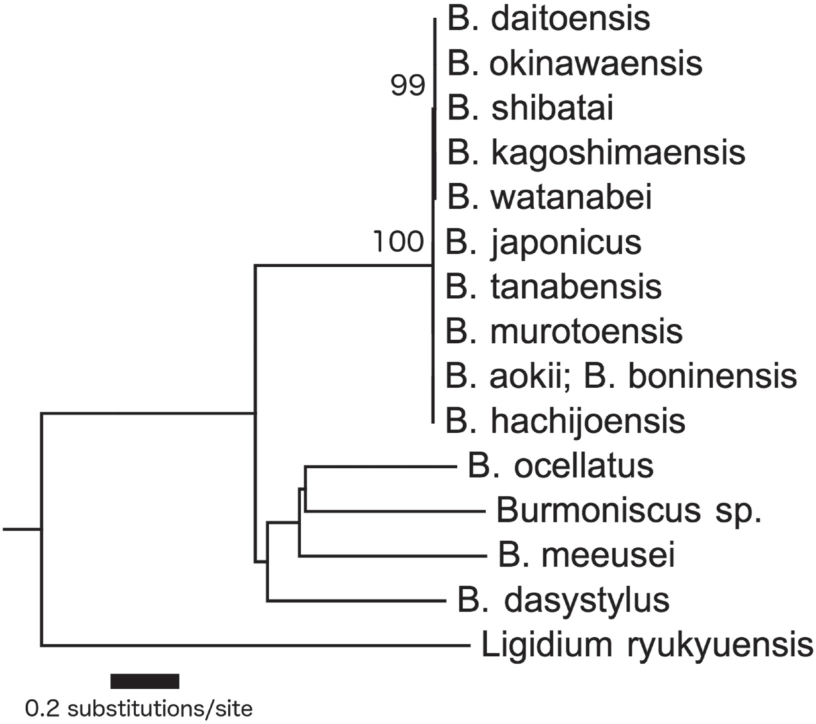

Figure 18. ML phylogenetic tree based on combined COI, 12S rRNA, and 16S rRNA sequence data. A specimen collected from a site on Chichijima Island was used in this analysis in lieu of specimens collected from the type localities of *Burmoniscus aokii* and *B. boninensis*. Bootstrap values exceeding 90% are shown at each relevant node.

Japan. The other haplotype was found in species distributed in eastern Japan. It may be interesting to investigate the history of gene flow and migration of these species, but clarifying this subject would require further analysis beyond the objectives of the present study.

Conclusions

Based mostly on examination of type specimens and topotypic (or near-topotypic) material, I have re-described the morphological features and re-calculated various indices that were originally used for diagnosing and differentiating the eleven Japanese nominal species of *Burmoniscus*. They all exhibited little variation among species, and errors in some of the original description could be demonstrated. Based on these findings, it can be concluded that the species-level classification of Japanese *Burmoniscus* by Nunomura (1986, 2003a,b, 2007) is unsatisfactory, and instead it is proposed that there is a single species of *Burmoniscus* in Japan, as first proposed by Taiti and Ferrara

(1991) and Kwon and Jeon (1993). Moreover, its morphological features are consistent with those of *B. kathmandius*, so these eleven nominal species in Japan should be treated as junior synonyms of *B. kathmandius*.

The present study has largely settled the taxonomic problems concerning *Brumoniscus* species in Japan, but one problem still remains unsolved. Nunomura (1986) compared some morphological characteristics of *B. japaonicus* to those of *S. truncata*, but the taxonomic status of this latter species is still doubtful. It was described by Dollfus (1898) on specimens from Indonesia (Celebes and Flores), but his description neglected some of the potentially diagnostic characteristics. Arcangeli (1927) recorded this species from Kyoto but it is not clear if these specimens are definitely conspecific with those from Indonesia. Clarifying the taxonomic status of *S. truncata* and the relationship with *B. kathmandius* requires observation of the holotype of the former, which I have not yet managed to locate. At the present stage of knowledge, it may be appropriate to treat *S. truncata* and *B. kathmandius* as different species. However, it is possible that the specimens of *S. truncata* from Kyoto recorded by Arcangeli (1927) refer to *B. kathmandius* but their reexamination is necessary to confirm this synonymy.

Acknowledgements

Permission for collecting terrestrial isopods from Kashima Island, Tanabe City, was obtained from the Board of Education in Tanabe, Wakayama Prefecture. I thank Dr. Toshio Kishimoto (Museum of Natural and Environmental History, Shizuoka) for collecting specimens, Dr. Hisashi Negoro (Toyama Science Museum) and Mr. Noboru Nunomura (Kanazawa University, Institute of Nature and Environmental Technology) for loaning the holotypes and paratypes, and Dr. Mark J. Grygier (Lake Biwa Museum) for reading a previous draft and improving the English. This work was supported by the Grant-in-Aid for Scientific Research (B), Grant Number 25281053 and Grant-in-Aid for Young Scientists (B) Grant Number 26830145.

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Suppl. material 1

Type localities, collection data of new specimens, and accession numbers

Authors: Shigenori Karasawa

Data type: specimens data

Suppl. material 2

Details of specimens used for morphological observation

Authors: Shigenori Karasawa

Data type: specimens data

Suppl. material 3

Summary of diagnostic features of each nominal species of *Burmoniscus* in Japan according to the respective original descriptions

Authors: Shigenori Karasawa

Data type: measurement

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RESEARCH ARTICLE

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A new species of the rare genus *Priscomilitaris* from the Seto Inland Sea, Japan (Crustacea, Amphipoda, Priscomilitaridae)

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Abstract

A new species of the priscomilitarid amphipod, *Priscomilitaris heike*, from the Seto Inland Sea, Japan, is named and described. This new species is the third species of Priscomilitaridae and the second species of *Priscomilitaris*. Additionally, nucleotide sequences of nuclear 28S rRNA and histone H3 as well as mitochondrial cytochrome *c* oxidase subunit I from its holotype were determined. *Priscomilitaris heike* **sp. n.** is distinguished from its congener, *P. tenuis* Hirayama, 1988, by having deep antennal sinus, long flagellar article 1 of antennae 1 and 2, long mandibular palp article 2, 10 robust setae on outer ramus of maxilla 1, and rounded epimeral plates. A key to the species of Proscomilitaridae is provided.

Keywords

Amphipoda, Priscomilitaridae, Priscomilitaris, new species, Seto Inland Sea, Japan, correct original spelling

Introduction

Priscomilitaridae Hirayama, 1988 is a small family of amphipods comprising two monotypic genera *Priscomilitaris* Hirayama, 1988 and *Paraphotis* Ren, 1997 from coastal waters in Japan and China (Hirayama 1988; Ren 1997; Myers and Lowry 2003). *Priscomilitaris* was erected by Hirayama (1988) along with a new species *P. tenuis*

Hirayama, 1988 from Ariake Sea, Japan. There has been no record of this genus since its original description, and thus several areas await intensive taxonomic surveys.

The Seto Inland Sea is a vast inland sea separating Honshu, Shikoku, and Kyushu. More than 90 species of amphipods were recorded from the sea (Nagata 1965; Ariyama 1996, 2015, 2016). During field surveys of marine crustaceans in the Seto Inland Sea made by HT, an undescribed species of *Priscomilitaris* was collected. In this paper, we describe and illustrate this undescribed species, and provide a key to species of Priscomilitaridae. Additionally, we provide nucleotide sequences obtained from the undescribed *Priscomilitaris* species for future molecular systematic studies.

Material and methods

Sample

The present specimen was collected with a dredge (mouth 40 cm wide, 15 cm high, mesh size 5 mm) at 14 m depth off Abashima Island, Takehara City, Hiroshima Prefecture, Seto Inland Sea, Japan (34°19'30.6"N, 132°56'31.9"E: Fig. 1). The specimen was preserved in 80% ethanol. For DNA extraction, dorsal side muscle was removed from inside pleon of the specimen, and was transferred into absolute ethanol.

Morphological observation

All appendages of the examined specimen were dissected in 80% ethanol and mounted in gum-chloral medium on glass slides under a stereomicroscope (Olympus SZX7). The specimen was examined using a light microscope (Nikon Eclipse Ni) and illustrated with the aid of a camera lucida. The body length from the tip of the rostrum to the base of the telson was measured along the dorsal curvature to the nearest 0.1 mm. The nomenclature of the setal patterns on the mandibular palp follows Stock (1974). The unique holotype has been deposited in the Tsukuba Collection Center of the National Museum of Nature and Science, Tokyo (NSMT).

PCR and DNA sequencing

The extraction of genomic DNA from pleon muscle followed Tomikawa et al. (2014). Primer sets for the PCR and cycle sequencing (CS) reactions used in this study were as follows: for 28S rRNA (28S), 28F and 28R (PCR and CS) (Hou et al. 2007) with 28SF and 28SR (CS) (Tomikawa et al. 2012) as internal primers; for histone H3 (H3), H3aF and H3bR (PCR and CS) (Colgan et al. 1998); for cytochrome *c* oxidase subunit I (COI), jgLCO1490 and jgHCO2198 (Geller et al. 2013), respectively, with M13F and M13R tails (Messing 1983), used for PCR, and then M13F and M13R used as primers

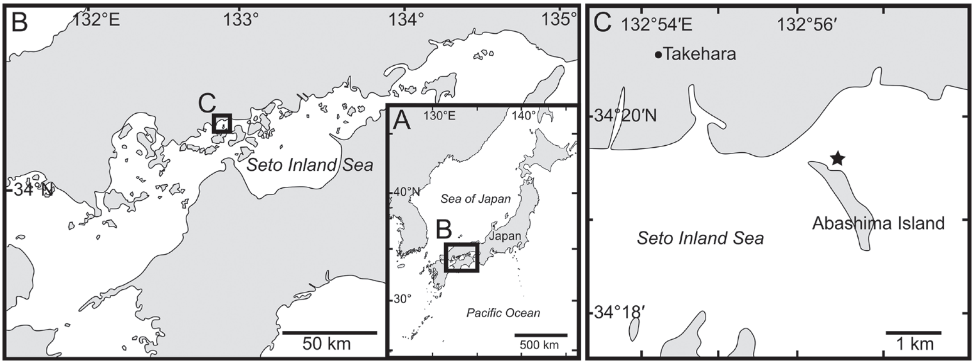

Figure 1. Map showing sampling locality of *Priscomilitaris heike* sp. n. **A** Japan **B** Seto Inland Sea **C** Abashima Island. Star indicates type locality.

for CS, followed the method outlined in Raupach et al. (2015). The PCR reactions and DNA sequencing were performed using the modified method mentioned in Nakano (2012). The PCR reactions were performed using a T100 Thermal Cycler (Bio-Rad) using an Ex *Taq* Polymerase Kit (Takara Bio Inc.) for 28S plus H3, and *Taq* Polymerase Kit (Takara Bio Inc.) for COI. The PCR mixtures were heated to 94°C for 5 min, followed by 35 cycles at 94°C (10 s each), 50°C for 28S and H3 or 49°C for COI (20 s each), and 72°C (1 min 24 s for 28S, 24 s for H3, 42 s for COI), and a final extension at 72°C for 6 min. The sequencing mixtures were heated to 96°C for 2 min, followed by 40 cycles at 96°C (10 s each), 50°C (5 s each) and 60°C (1 min for 28S, and 42 s for H3 and COI). The obtained sequences were edited using DNA BASER (Heracle Biosoft S.R.L.). These DNA sequences were deposited with the International Nucleotide Sequence Database Collaboration (INSDC) through the DNA Data Bank of Japan (DDBJ).

Taxonomy

Family Priscomilitaridae Hirayama, 1988

Remarks. This family name was subsequently used as Priscomilitariidae by Myers and Lowry (2003). The generic name of its type species, *Priscomilitaris*, ends in a Latin word, militaris (genitive militaris, stem militar-). Therefore, the stem of this family name should be Priscomilitar- according to the Art 29.3. of the Code (ICZN 1999). The original spelling by Hirayama (1988) is thus obviously correct. Because Myers and Lowry (2003) did not provide a statement for any demonstrably intentional change of the spelling Priscomilitaridae, the spelling Priscomilitariidae is an incorrect subsequent spelling according to the Art 33.3. of the Code. This incorrect spelling is used in the influential web sources, e.g. WoRMS (Horton and Lowry 2015). The incorrect spelling of Priscomilitaridae on those web registries should be emended to avoid additional erroneous citations of the spelling of this family name.

Genus *Priscomilitaris* Hirayama, 1988

Priscomilitaris heike **sp. n.**
http://zoobank.org/4F6D58AC-1993-40C0-B0C2-B2CBADE15140
Figures 2–5
New Japanese name: Heike-yokoebi

Holotype. Male (2.3 mm), NSMT-Cr 24368, east of Abashima Island (34°19'30.6"N, 132°56'31.9"E; 14 m deep), Takehara, Hiroshima, Japan, 15 February 2016, collected by H. Tanaka.

Description. Head (Fig. 2): slightly shorter than pereonites 1 and 2 combined; rostrum short, acute; eyes absent; lateral cephalic lobe acute, ventral margin with 2 minute setae; antennal sinus rounded. Pereon (Fig. 2): pereonite 1 short, 0.6 times as long as pereonite 2; pereonite 5 with strong sternal tooth extending anteroventrally (Fig. 3J). Pleon (Fig. 2): dorsal surfaces of pleonites 1–3 smooth, with pair of minute setae; epimeral plates 1–3 rounded, each with minute seta on ventral submargin. Urosomites 1–3 (Figs 2, 3K–M): dorsal surfaces with pair of minute setae.

Antenna 1 (Fig. 3A): length 0.4 times as long as body; length ratio of peduncle articles 1–3 1.0 : 1.1 : 0.8; peduncle article 1 with 1 penicillate and 3 minute setae on anterior margin, and 2 pairs of setae and 2 single setae on posterior margin; peduncle article 2 with 2 setae on medial surface, and 3 pairs and 3 clusters of setae on posterior margin; peduncle article 3 medial and lateral surfaces each with a seta, and 3 pairs and 2 clusters of setae on posterior margin; primary flagellum 6-articulate with long aesthetascs, article 1 long, length 2.1 times as long as article 2, article 6 minute; accessory flagellum absent.

Antenna 2 (Fig. 3B): length 0.9 times as long as antenna 1; length ratio of peduncular articles 3–5 1.0 : 1.7 : 1.7; article 3 quadrate with 2 single setae and a pair of setae on posterior margin; article 4, anterior margin with 2 short setae and one long seta, posterior margin with 4 single setae and pair of setae; article 5 with 2 short setae on anterior margin, and 4 pairs and 2 clusters of setae on posterior margin; flagellum 5-articulate, article 1 long, length 2.5 times as long as article 2, article 5 minute; calceoli absent.

Upper lip (Fig. 3C): ventral margin concave, with minute setae. Lower lip (Fig. 3D): outer lobes broad, setulose, mandibular lobes narrow; inner lobes distinct. Mandible (Fig. 3E, F): left and right mandibles similar to each other; incisors 5-dentate, lacinia mobilis 4-dentate, accessory setal rows each with 4 blade setae, molar process triturative with a plumose seta; palp 3-articulate, length ratio of article 1–3 1.0 : 2.1 : 1.3, article 1 bare, article 2 with 4 ventral, 2 dorsal and 2 lateral setae, article 3 with 4 A-, 4 C-, 9 D-, and 2 Esetae. Maxilla 1 (Fig. 3G): inner plate small, subtriangular without setae; outer plate rectangular with 10 weakly serrate or unarmed robust setae; palp 2-articulate, exceeding outer plate, article 1 lacking setae, article 2 with 3 robust and 1 slender setae on apical margin, and 2 slender setae on apical submargin. Maxilla 2 (Fig. 3H): inner and outer plates with apical setae. Maxilliped (Fig. 3I): inner plate rectangular, not reaching half of palp article 1, with 2 robust setae on apical margin; outer plate weakly curved inward, exceeding half of palp article 2, with robust and

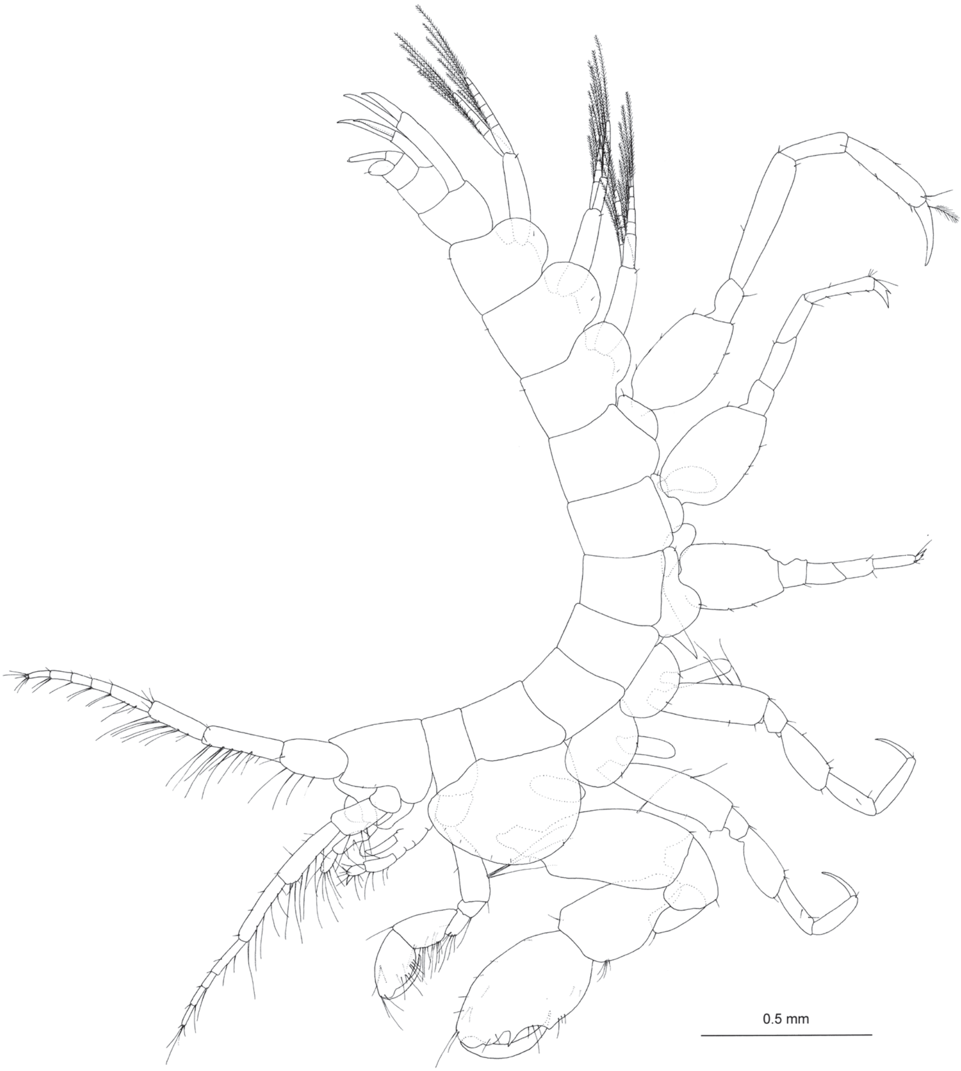

Figure 2. *Priscomilitaris heike* sp. n., holotype, male, 2.3 mm, NSMT-Cr 24368, Abashima Island, Takehara, Hiroshima Prefecture, Japan. Habitus, lateral view.

slender setae; palp 4-articulate, ventral margin of article 2 with setae, medial and lateral surfaces of article 3 with setae, article 4 with long, slender robust setae.

Gnathopod 1 (Fig. 4A, B): smaller than gnathopod 2, coxa ovate, with or without ventral setae; posterior margin of basis with long setae; carpus not lobate, slightly longer than propodus, with weakly pectinate setae on posterior margin; propodus ovate, posterior margin serrate; dactylus long, smooth. Gnathopod 2 (Fig. 4C): coxa semicircular, covering coxa of gnathopod 1, with minute setae on ventral submargin; basis anteroproximally concave, posterior margin with a long seta; carpus not lobate,

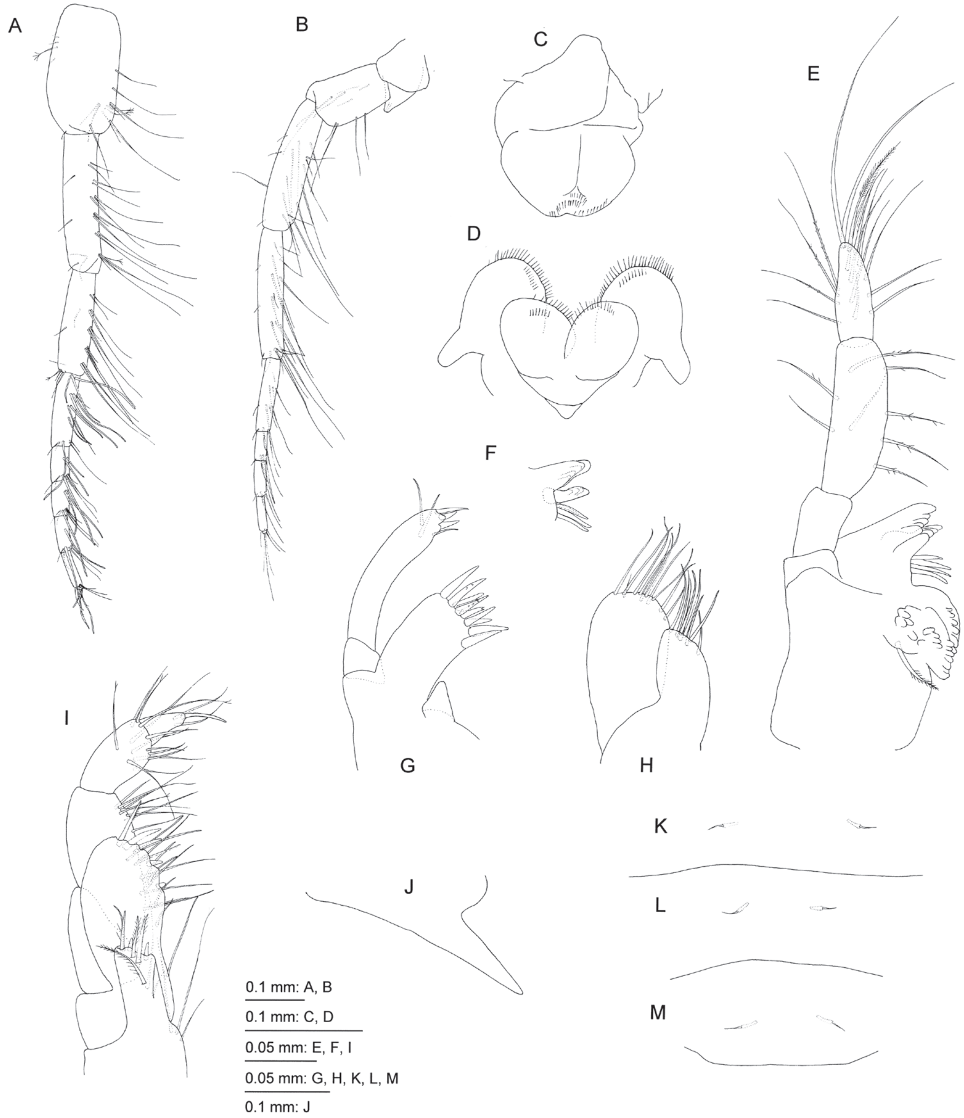

Figure 3. *Priscomilitaris heike* sp. n., holotype, male, 2.3 mm, NSMT-Cr 24368, Abashima Island, Takehara, Hiroshima Prefecture, Japan. **A** antenna 1, medial view **B** antenna 2, medial view **C** upper lip, anterior view **D** lower lip, ventral view **E** left mandible, medial view **F** incisor, lacinia mobilis, and accessory setal row of right mandible, lateral view **G** maxilla 1, anterior view **H** maxilla 2, anterior view **I** maxilliped, anterior view **J** sternal tooth on pereonite 5, right lateral view **K–M** urosomites 1–3, dorsal views.

length 0.9 times as long as propodus; palmar margin of propodus shallowly concave, with acute protuberance; dactylus long, smooth, exceeding palmar margin.

Pereopod 3 (Fig. 4D): coxa semioval with 2 minute setae on ventral margin; anterodistal margin of basis shallowly concave, posterior margin with long seta; length

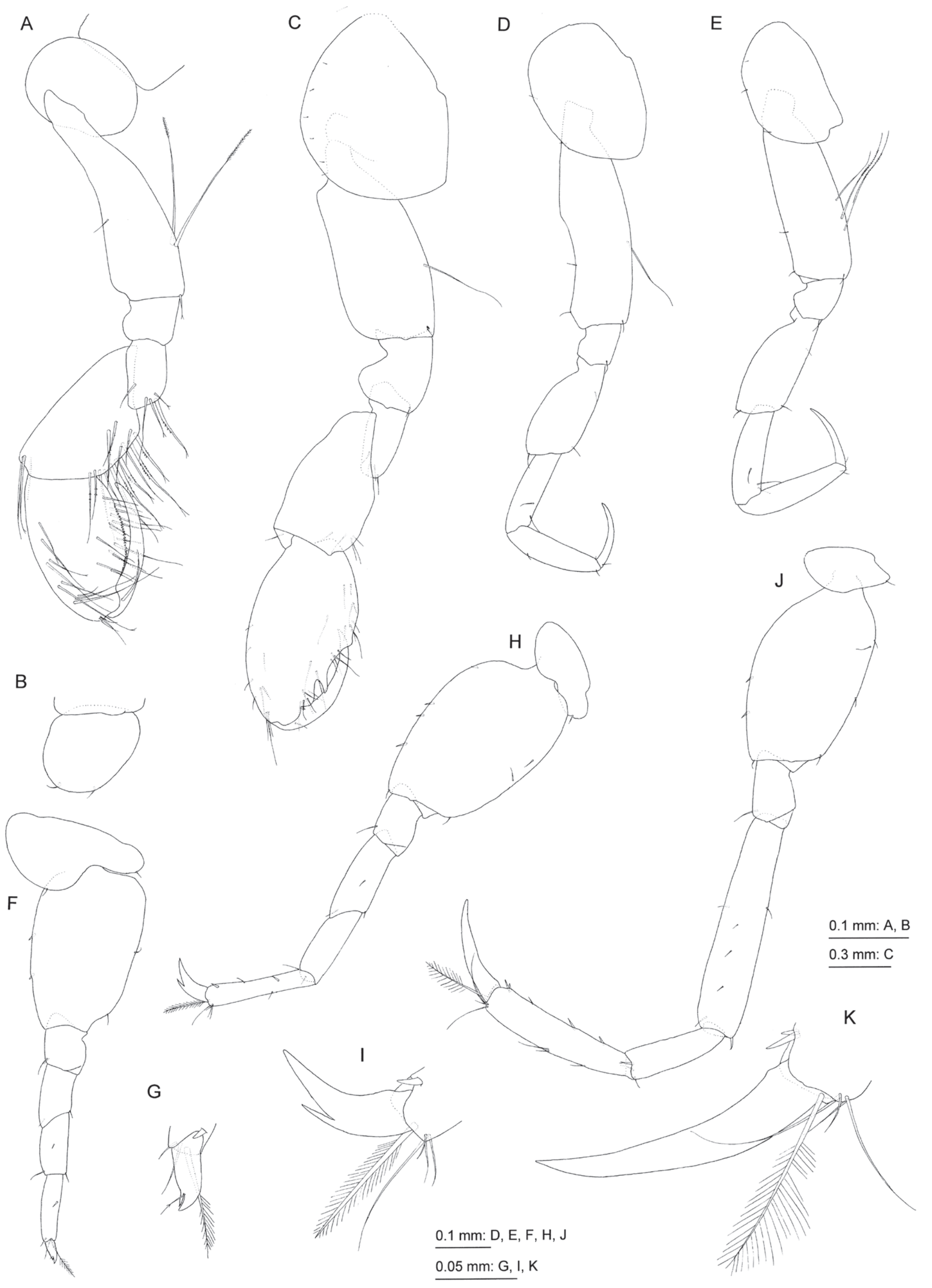

Figure 4. *Priscomilitaris heike* sp. n., holotype, male, 2.3 mm, NSMT-Cr 24368, Abashima Island, Takehara, Hiroshima Prefecture, Japan. **A** right gnathopod 1, medial view **B** coxa of left gnathopod 1, lateral view **C** gnathopod 2, lateral view **D** pereopod 3, lateral view **E** pereopod 4, lateral view **F** pereopod 5, lateral view **G** distal part of propodus and dactylus of pereopod 5, lateral view **H** pereopod 6, lateral view **I** distal part of propodus and dactylus of pereopod 6, lateral view **J** pereopod 7, lateral view **K** distal part of propodus and dactylus of pereopod 7, lateral view.

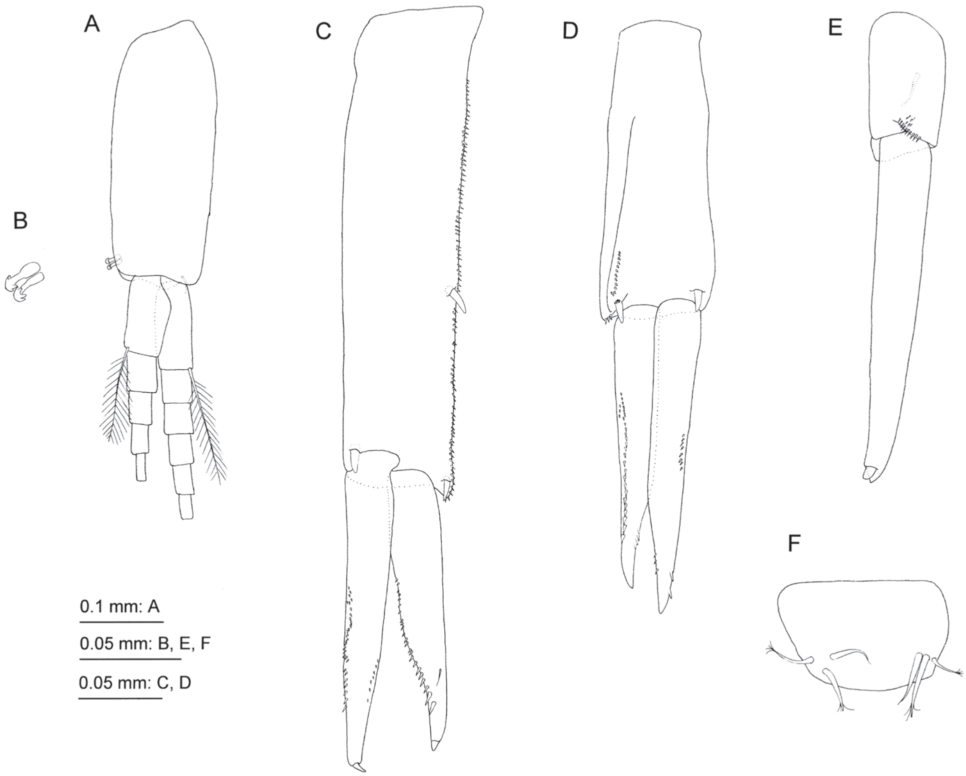

Figure 5. *Priscomilitaris heike* sp. n., holotype, male, 2.3 mm, NSMT-Cr 24368, Abashima Island, Takehara, Hiroshima Prefecture, Japan. **A** pleopod 2, posterior view, some setae on rami omitted **B** retinacula on peduncle of pleopod 2, posterior view **C–E** uropods 1–3, dorsal views **F** telson, dorsal view.

ratio of merus, carpus, propodus and dactylus 1.0 : 0.8 : 0.9 : 0.6; dactylus smooth. Pereopod 4 (Fig. 4E): coxa semioval with 3 minute setae on ventral margin; basis lacking anterodistal concavity, posterior margin with 3 long setae; length ratio of merus, carpus, propodus and dactylus 1.0 : 0.8 : 0.9 : 0.6; dactylus smooth. Pereopod 5 (Fig. 4F, G): coxa bilobate, anterior lobe large with small seta on distal margin, posterior lobe with small seta on posterodistal corner; basis subrectangular, lacking posterodistal lobe; length ratio of merus, carpus, propodus and dactylus 1.0 : 1.0 : 1.0 : 0.4; propodus with long plumose seta on distal margin; dactylus with small accessory tooth. Pereopod 6 (Fig. 4H, I): coxa shallow, bilobate, posterior lobe with small seta on posterodistal corner; basis oval, lacking posterodistal lobe; length ratio of merus, carpus, propodus and dactylus 1.0 : 0.8 : 1.0 : 0.3; distal margin of merus oblique; propodus with long plumose seta on distal margin; dactylus with accessory tooth. Pereopod 7 (Fig. 4J, K): coxa oblong with seta on posterodistal corner; basis ovate, lacking posterodistal lobe; ischium rectangular, length 1.6 times as long as width; length ratio of merus, carpus, propodus and dactylus 1.0 : 0.5 : 0.7 : 0.5; propodus with long plumose seta on distal margin; dactylus smooth.

Coxal gills (Fig. 2): present on gnathopod 2, pereopods 3–6.

Pleopods 1–3 (Fig. 5A, B) each with paired retinacula (Fig. 5B) on inner distal margin of peduncle, bifid plumose setae (clothes-pin setae) on inner basal margin of inner ramus absent; inner and outer rami of pleopods 1–3 consisting of 5 and 6 articles, respectively.

Uropod 1 (Fig. 5C): extending beyond uropod 2; peduncle long, length 1.6 times as long as inner ramus, dorsolateral margin with robust seta and numerus minute setae; inner ramus length 1.1 times as long as outer ramus, inner and outer margins with minute robust setae, apical part with robust seta; inner margin of outer ramus with minute robust setae, outer submargin with seta, apical part with robust seta. Uropod 2 (Fig. 5D): extending beyond uropod 3; peduncle almost as long as inner ramus, distal part of dorsolateral margin with minute robust setae; inner ramus slightly longer than outer ramus, inner distal and outer margins with minute robust setae; outer ramus with minute robust setae on outer and inner distal margins. Uropod 3 (Fig. 5E): extending beyond telson, uniramous; peduncle short, with facial seta and minute robust setae along with distal margin; ramus long, length 2.4 times as long as peduncle, 1-articulate with terminal robust seta. Telson (Fig. 5F): entire, fleshy, length 0.6 times width, with 2 clusters of 6 setae on distal submargin. Female unknown.

Sequences. Three nucleotide sequences of the holotype, NSMT-Cr 24368, were determined: 28S, LC155260 (1274 bp); H3, LC155261 (328 bp); and COI, LC155259 (658 bp).

Distribution. This species is known only from the type locality.

Etymology. After ‘Heike’ (literally ‘House of Taira’) that controlled the Seto Inland Sea, the Chugoku region, the Shikoku region as well as the Kyushu region during the Heian Period. The specific name is a Japanese word, not a Latin or Latinized one.

Remarks. *Priscomilitaris heike* sp. n. is distinguished from *P. tenuis* by the following features (features of *P. tenuis* in parentheses): antennal sinus deep (shallow), flagellar article 1 of antenna 1 length 2.1 (1.3) times as long as article 2, flagellar article 1 of antenna 2 length 2.5 (1.0) times as long as article 2, mandibular palp article 2 longer than article 3 (subequal), outer plate of maxilla 1 with 10 (12) robust setae, epimeral plates rounded (quadrate). This new species differs from *Paraphotis sinensis* in the following features (features of *P. sinensis* in parentheses): antennal sinus deep (shallow), sternal tooth present on pereonite 5 (pereonite 4), flagellar article 1 of antenna 1 length 2.1 (1.4) times as long as article 2, flagellar article 1 of antenna 2 length 2.5 (1.4) times as long as article 2, outer plate of maxilla 1 with 10 (9) robust setae, palmar margin of propodus of gnathopod 2 with protuberance (absent).

Key to species of Priscomilitaridae

1	Gnathopod 2, palmar margin of propodus without protuberance .... ***Paraphotis sinensis*** **Ren, 1997**
–	Gnathopod 2, palmar margin of propodus with protuberance **2**

2 Antennal sinus shallow, flagellar article 1 of antennae 1 and 2 length subequal to or weakly longer than article 2, mandibular palp article 2 subequal to article 3, outer plate of maxilla 1 with 12 robust setae, epimeral plates quadrate .... ***P. tenuis*** **Hirayama, 1988**
– Antennal sinus deep, flagellar article 1 of antennae 1 and 2 length more than twice as long as article 2, mandibular palp article 2 longer than article 3, outer plate of maxilla 1 with 10 robust setae, epimeral plates rounded....***P. heike*** **sp. n.**

Acknowledgements

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RESEARCH ARTICLE

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The nymph and imago of Chinese mayfly *Siphlonurus davidi* (Navás, 1932)

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Abstract

The imagos and nymphs of *Siphlonurus davidi* (Navás, 1932) are described for the first time. The adult has colourful wings and cross veins, the MP is forked asymmetrically at its base, a long cubital area is present with more intercalaries, and it has a relatively simpler penis and larger hindwings compared to its congeners. The venation and genitalia show that it is a plesiomorphic species in the genus. A key to the Asian species of *Siphlonurus* with coloured wings is provided in conclusion.

Keywords

China, evolution, mayfly, *Siphlonurus*, wing

Introduction

The species *Siphlonurus davidi* (Navás, 1932), which was based on a single male subimago, was re-described by Sartori and Peters in 2004. The damaged type consists of a twisted sub-imaginal specimen, which shows unclear characteristics and makes its systematic position questionable. On the other hand, because of the long cubital area of its forewing, the relatively broader hindwing, and the simple genitalia, it shows some valuable phylogenetic characters. Using these, Navás (1932) originally placed it in the genus *Siphluriscus* Ulmer, 1920, which is currently considered to possess the highest number of plesiomorphies in the order Ephemeroptera (Zhou and Peters 2003; Ogden et al. 2009). However, the poor state of the sub-imaginal type precludes deeper investigations and discussion.

In 2013, a Chinese professor working on aquatic insects collected within a national park in Sichuan province (southwestern China), the same province where the type of *Siphlonurus davidi* was originally found. Among his mayfly collection, some *Siphlonurus* nymphs and imagos were present: the imago wings had distinct pigmented spots and markings. After careful examination and comparison with the good quality photographs in Sartori and Peters (2004), they were recognized as *Siphlonurus davidi*. These specimens will greatly increase our knowledge and understanding of this species, so they are described and illustrated here. Furthermore, venation and male genitalia of imagos show it is a valid species which has some plesiomorphies.

Materials and methods

1♂2♂♂subimagos, 4♀♀subimagos and 25 nymphs, Jing Hai (Mirror pool or lake, alt. 2398m), 2013-VII-6; 2♀♀5 nymphs, Xi-Niu Hai (rhinoceros pool, alt. 2348 m), 2013-VII-7, leg. Beixing Wang; 1♀ and 36 nymphs, Lao-Hu Hai (tiger pool, alt. 2439 m), 2013-VII-7, leg. Hun He and Guangba Li; 50 nymphs, Jia-zu Hai (bamboo pool, alt. 2744 m), 2013-VII-6, leg. Yong Cao.

All specimens were collected at Jiu-Zhai-Guo (Jiuzhai Valley), Sichuan Province, China, and now are deposited in Mayfly Collection, College of Life Sciences, Nanjing Normal University, China. The nymphs were sampled from pools or lakes and imaginal materials were attracted to and collected by lights.

Results

Siphlonurus davidi (Navás, 1932)

Siphluriscus? *davidi* Navás, 1932: 929, fig. 46, male subimago. Type: male subimago, from China (Sichuan=Se-Tchouen).
Siphluriscus? *davidi* [sic.]: Ulmer, 1936: 215.
Siphluriscus davidi: Wu, 1935: 251; Gui, 1985: 80.
Siphlonurus davidi: Zhou & Peters, 2003: 346 (tentatively); Sartori & Peters, 2004: 2, figs 1–7 (redescription on type and transfer).

Distribution. China (Sichuan).

Description. NYMPH (in alcohol, Figs 1–2).

Body length 15.0–20.0 mm, caudal filament 6.0–7.0 mm, yellowish brown; head mostly obscured by compound eyes, hypognathous, length of antenna subequal to width of head, surface of antennae with very sparse tiny setae (Fig. 1A); *Mouthparts*:

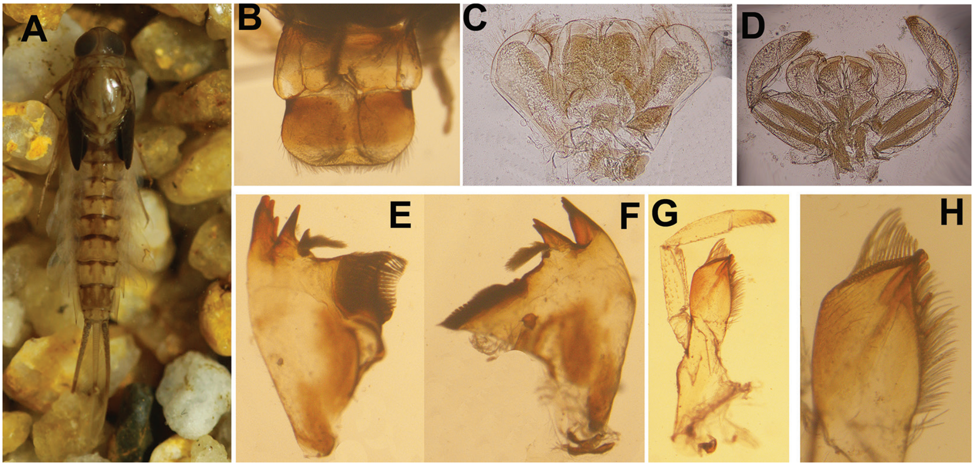

Figure 1. Nymphal characters of *Siphlonurus davidi*. **A** habitus **B** labrum and clypeus **C** hypopharynx **D** labium **E** right mandible **F** left mandible **G** maxilla **H** apex of maxillary lacia-genicia

clypeus extended; labrum with obvious median groove, free margin with setae, an additional row of setae on dorsal surface near anterior margin; ventral surface with shorter setae; posterolateral corner slightly sclerotized (Figs 1B, 2A). Outer incisor of left *mandible* apically divided into three teeth, inner incisor with two teeth, prostheca constituted by two tufts of spines with common stem (Figs 1F, 2C); apex of right outer mandibular incisor serrated into four teeth, inner one with three teeth, prostheca also divided into two groups of numerous spines (Figs 1E, 2B); galea-lacinea of *maxilla* with a row of spines on crown, apex of maxilla divided into three broad denticles (maxillary canines *sensu* Kluge, 2004), upper half of inner margin with two rows of spines, three of them broader than others (dentisetae *sensu* Kluge, 2004), lower half with a row of setae (Figs 1G,H, 2D); *maxillary palpi* 3-segmented, basal one and second one subequal in length, apical one about 0.6× length of second one, surface of all segments with sparse setae, those on apical one slightly longer (Figs 1G, 2D). *Hypopharynx* (Figs 1C, 2E): lingua sub-quadrate, apical margin with short setae; superlinguae with longer setae on apical margin and lateral area. *Labium* with heart-shaped, unfused glossae and paraglossae, the latter slightly narrower but longer than the former; aboral surface with long hair; labial palpi 3-segmented, progressively shorter from base to apex, surface with setae and spines, those on apical segment longer (Figs 1D, 2F).

Thorax: all legs similar, femora with broad median marking bands, tibiae pale, tarsus with basal and apical colour rings, the latter one darker; length of femora: tibiae: tarsus ca. 1.8: 1.0: 1.5, surface with very short sparse spines and setae; mid- and hind-legs with clear patellar-tibial suture. *Claws* relatively slim and simple, without teeth (Fig. 2N).

Abdomen: Each tergite with three pairs of stripes dorsally; one pair parallel near median line, one at lateral margin, one oblique pair between them. Colour of tergites 3, 6, 9 slight darker than others; each tergite with a pair of short median stripes.

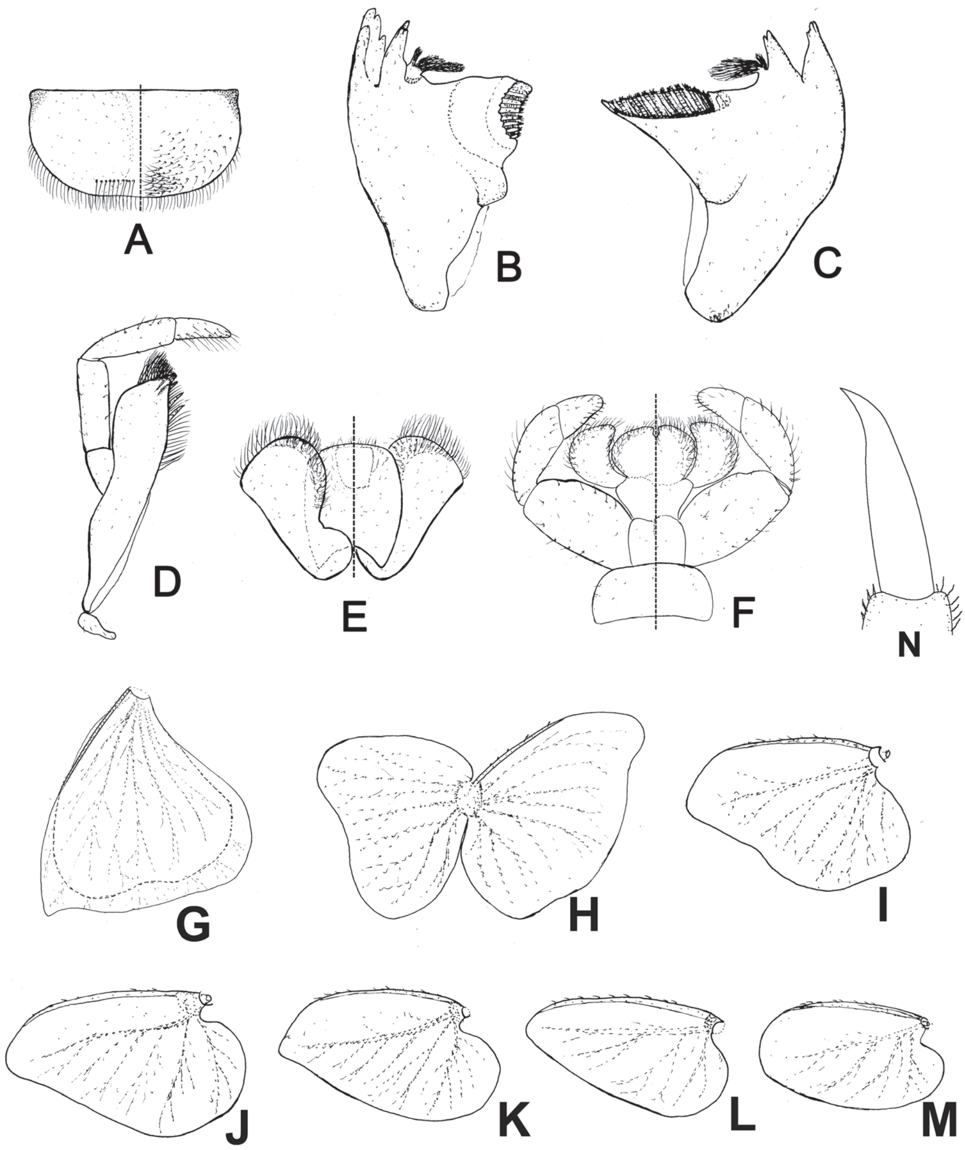

Figure 2. Mouthparts and gills of *Siphlonurus davidi* nymph. **A** labrum **B** right mandible **C** left mandible **D** maxilla **E** hypopharynx (dorsal view on left; ventral view on right) **F** labium (dorsal view on left; ventral view on right) **G**–**M** gills 1-7 (double lamellae of gills separated) **N** claw

Posterolateral corner of each tergite extended into sharp spines, progressively larger and wider from anterior to posterior (Fig. 1A). *Gills* on abdominal segments 1–7; gills 1–2 similar in shape and structure, with two lamellae, dorsal one slightly broader than ventral one, the former with sclerotized leading marginal line while the latter with a emarginated outer margin (Fig. 2G, H); gills 3–7 single, progressively shorter

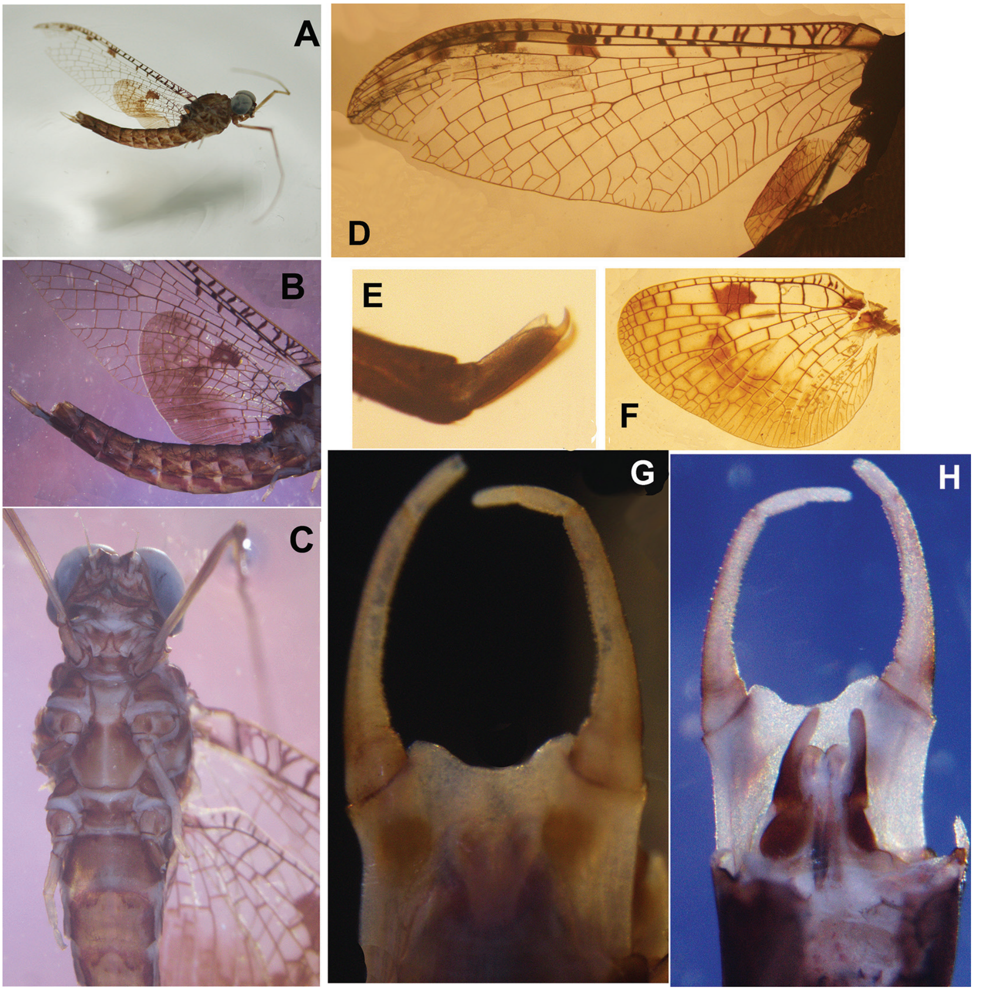

Figure 3. Male structures of *Siphlonurus davidi*. **A** habitus **B** abdomen (lateral view) **C** front body (ventral view) **D** forewing **E** claws **F** hindwing **G** genitalia (ventral view) **H** genitalia in dorsal view

from anterior to posterior, tracheae gray and well visible; leading margin of gills 3–7 sclerotized, with small spines (Fig. 2I–M); cerci with long setae on mesal margin and tiny spines on articulations, terminal filament with long hair on both sides and spines between segments (Fig. 1A).

MALE (in alcohol, Figs 3–4).

General colouration reddish brown, with pale sutures and grooves on body (Fig. 3A–C); body length 13.0 mm, forewing 13.0 mm, hindwing 6.0 mm, antennae 2.0 mm. *Head*: compound eyes widely contiguous, each of them spherical, upper portion grey, lower portion black, a clear line between them (Fig. 3A, C). *Thorax*: coxa and trochanter of foreleg deeply pigmented with reddish brown in colour, and apical half of femora, tibia and tarsus also brown but basal half of each is pale (Fig. 3A); length

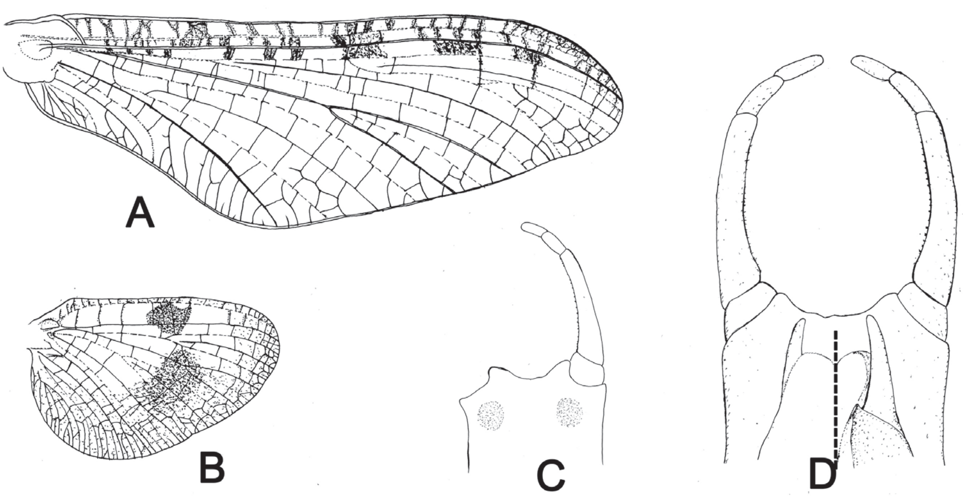

Figure 4. Male structures of *Siphlonurus davidi*. **A** forewing **B** hindwing **C** genitalia (ventral view) **D** genitalia in dorsal view (dorsal view of penes on right; ventral view on left).

ratio of femora, tibia and tarsus of foreleg = 2: 1: 3.7, five segments of fore-tarsus progressively shorter from distally; two claws similar, acute, hooked (Fig. 3E); mid- and hind-legs apparently vestigial in the single male imago (this may be due to damaged or broken legs in the previous life stage of this specimen) but normal in females and male sub-imagos (Fig. 3A, C). *Wings*: base of forewing slightly pigmented, cross veins between C, Sc, R_1 and R_2 surrounded with distinct pigments (Figs 3A–D, 4A); MA and Rs with long common stem, further jointing with MP, then stem of them fused with R_1 or run along it. MA fork distal to middle of wing, MP fork at very base, just slightly more distal than fork of Rs and MA, MP_2 strongly bent backwards at base, very close to CuA, thus making the MP area relatively broad; CuA slightly curved backwards, joining margin of forewing just before tornus; 6-9 relatively longer attaching veins between CuA and posterior margin, 1-3 may be fork further; CuP stemmed with CuA clearly at base, curved strongly backwards, slightly longer than half of CuA; A_1 attached posterior margin with two veinlets (Figs 3D, 4A). Base and cross veins of hindwing clearly pigmented, especially those between C and Sc veins; an additional large dark patch at middle of Sc and R_1 cells; outer half of hindwing washed with reddish colour, it makes this area semi-transparent, area near centre of hindwing darker than others; MA fork at distal 1/3 point, Rs fork more basal than MA, MP fork basal to middle of hindwing (Figs 3F, 4B); ratio of width: length about 0.65. *Abdomen*: each tergite with a pair of brown stripes in middle, another pair of longer oblique stripes near anterolateral corner, lateral margin of terga strongly and broadly pigmented (Fig. 3A–B); each sternite with a pair of indistinct short median marks, anterolateral corner and lateral margins clearly pigmented (Fig. 3C). *Genitalia*: subgenital plate deeply emarginated, ventral surface with two large round brown marks (Figs 3G, 4C); forceps 4-segmented, basal one shortest but broadest, second

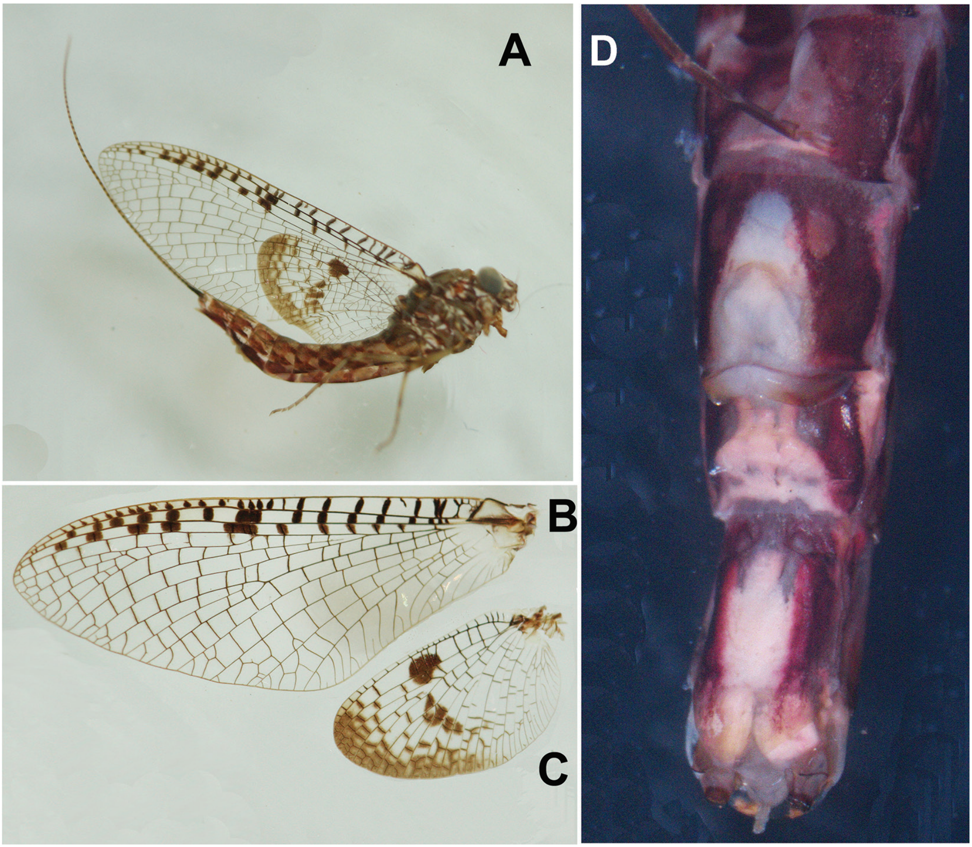

Figure 5. Female structures of *Siphlonurus davidi*. **A** habitus **B** forewing **C** hindwing **D** posterior part of abdomen (ventral view).

segment about twice length of third and apical segments together, the latter two subequal in length, each slightly longer than basal one, inner margin of forceps with tiny projections; penes short, invisible in ventral view, basal half of penis broad, with a large broad membranous lobe in ventral; apical half slim (Figs 3H, 4D). Cerci lost, terminal filament vestigial.

FEMALE (in alcohol, Fig. 5).

Body length 12.0–13.0 mm, forewing 12.0–13.0 mm, hindwing 6.0–7.0 mm, cerci 15 mm; body colour pattern similar to male imago (Fig. 5A). Two compound eyes separated widely, distance between them near to width of eye. Ratios of foreleg femora: tibiae: tarsus lengths = 2.5: 1.8: 3.0, that of midleg and hindleg = 2.5: 1.5: 2.2; tarsus 5-segmented but basal one fused with tibiae partially, fourth segment shortest, others progressively shorter from basal to apical; two claws of all legs with hooked apex. *Forewing*: all cross veins surrounded with darker pigments than male, especially those at outer half portion (Fig. 5A–B). *Hindwing*: base pigmented, all cross veins covered with distinct colour, distal half darker, two additional dark patches near middle

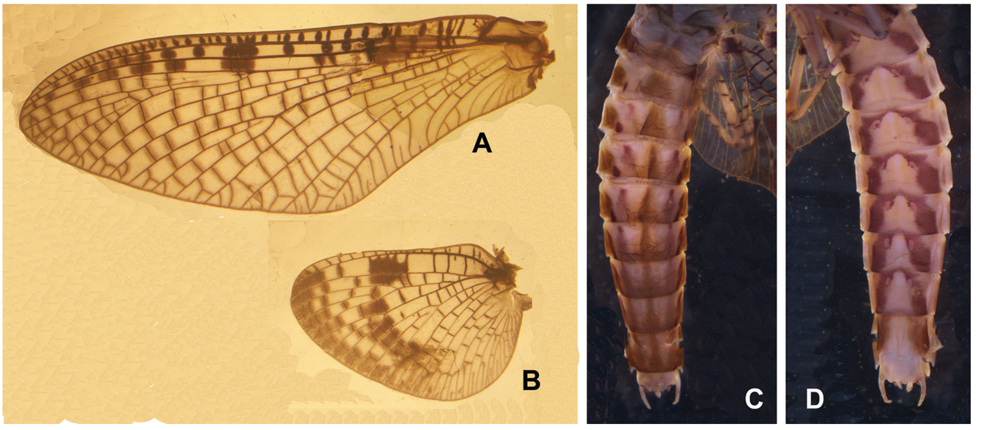

Figure 6. Male subimaginal structures of *Siphlonurus davidi*. **A** forewing **B** hindwing **C** abdomen (dorsal view) **D** abdomen (ventral view).

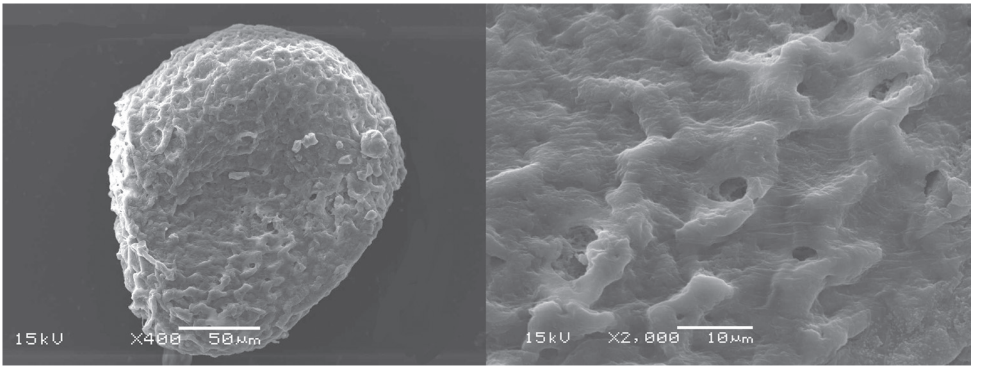

Figure 7. Egg of *Siphlonurus davidi* (SEM image). **A** shape and surface of Egg **B** surface enlarged.

(Fig. 5A, C); posterior margin of sternite 7 thickened and extended slightly (Fig. 5D). Ceri reddish brown, base and articulations darker; terminal filament tiny, pale.

MALE SUBIMAGO (in alcohol, Fig. 6).

Similar to male but duller. *Femora*: ratio of tibiae: tarsus of foreleg = 1.0: 0.6: 1.2, that of mid- and hind-legs 1.0: 0.6: 0.9. Colour pattern of abdominal terga and sterna similar to male but clearer (Fig. 6C–D). Subgenital plate only shallowly curved, posterior margin waved.

FEMALE SUBIMAGO (in alcohol).

Similar to female imago in colour pattern but opaque. Ratio of femora: tibiae: tarsus of legs = 1.0: 0.6: 1.0.

EGGS (Fig. 7).

Generally oval but one pole larger than the other, approximately 150 µm in length and 100 µm in width, without polar cap. Exochorionic surface uniform, consisting of irregular ridges or rims.

Key to three Asian *Siphlonurus* species with coloured wings (male)

1 Ventral lobe of penes with teeth..**2**
– Ventral lobe of penes without teeth ....***Siphlonurus davidi***
2 All cross veins of forewing pigmented, fore- and hindwings with colourful stripes and spots..***Siphlonurus palaearcticus***
– Cross veins of wings without pigment, hindwing may with central spot but without stripe ....***Siphlonurus binotatus***

Key to three Asian *Siphlonurus* species with coloured wings (female)

1 All cross veins of forewing pigmented, fore- and hindwings with colourful stripes and spots..**2**
– Cross veins of wings without pigment, hindwing may with central spot but without stripe ....***Siphlonurus binotatus***
2 Cross veins between C to Rs of forewing clearly surrounded with colourful pigments; distal half of hindwing with colour, semi-transparent ....
....***Siphlonurus davidi***
– Cross veins of whole forewing surrounded with pigments; hindwings wing pigments surrounding cross veins, other parts transparent ....
....***Siphlonurus palaearcticus***

Key to three Asian *Siphlonurus* species with coloured wings (mature nymph)

1 Abdomen with clear, obvious, relatively wide trachea or thread-like markings..***Siphlonurus binotatus***
– Abdomen maybe with various markings but without distinct above colour pattern..**2**
2 Obvious posterolateral spines present on terga 1–9 ....***Siphlonurus davidi***
– Obvious posterolateral spines present on terga 3–9 ....
....***Siphlonurus palaearcticus***

Remarks

Approximately 40 *Siphlonurus* species have been reported from the Nearctic and Palaearctic realms, Eurasia hosting half of them (Kluge 2004). Just as Sartori and Peters (2004) pointed out, *S. davidi* is close to the *S. palaearcticus* (Tshernova, 1930) and *S. binotatus* (Eaton, 1892) because all of these three species have colourful wings in imagos. However, the imagos of *S. davidi* can be differentiated from the latter two by the following characters:

1) The forewing of *S. davidi* has more pigmented patches than that of *S. binotatus* but fewer than *S. palaearcticus*. According to Uéno (1928) and Gose (1979), *S. binotatus* has only one conspicuous marking on forewings. On the contrary, *S. palaearcticus* has numerous markings and spots on forewing, and a distinct dark stripe at middle. The forewings of *S. davidi* have no stripe but spots and markings between C and R_2 veins.
2) Compared to *S. binotatus* and *S. palaearcticus*, the MP on forewing of *S. davidi* forks more basally, CuP more curved and cubital area is longer.
3) Unlike *S. binotatus* and *S. palaearcticus*, the hindwings of *S. davidi* are more colourful. They have two obvious dark patches and half of the hindwing is pigmented and semi-transparent. On the contrary, *S. binotatus* has only one clear stripe or patch near the centre, the other part of hindwing has no colour and is totally hyaline. The cross veins in the hindwing of *S. palaearcticus* are pigmented but the patches are separated.
4) The penis of *S. davidi* has only ventral membranous lobe, but the lobe of *S. binotatus* and *S. palaearcticus* have teeth on its apex.

In nymphs, the terga of *S. davidi* and *S. binotatus* have three pairs of stripes while that of *S. palaearcticus* has only one pair. Similarly, all abdominal terga of *S. davidi* and *S. binotatus* nymph have distinct posterolateral spines, while the spines of *S. palaearcticus* are only on segments 3–9 and much smaller. *Siphlonurus binotatus*, on the other hand, has obvious tracheae-like markings on the abdomen and obvious dark spots near the lateral margins of terga, which are not found in *S. davidi* or *S. palaearcticus*. The latter two species have different colour patterns on nymphal legs. The median half of femora of *S. davidi* is washed with brown pigments, but that of *S. palaearcticus* is paler. Both species have two brown rings on the tarsal base and apex respectively, while the apical one of *S. davidi* is much darker than that of *S. palaearcticus.* The gill figures provided by Kluge (1982) and Uéno (1928, 1931) show the nymphal gills 2–7 of *S. binotatus* and *S. palaearcticus* have sclerotized leading margins, but all gills of *S. davidi* nymph have these lines.

Plesiomorphic and autapomorphic characters

Based on the double gills 1–2, coxae and mouthparts without gills, simple claws of nymphs and colourful wings, the distal fork MA of hindwing, the fused subgenital plate, and complex penes of imagos, *S. davidi* is definitely a species which belongs in the Siphlonuridae. However, at least three characteristics show it is older than other species in the genus *Siphlonurus*. The first one is the forking point of MP which is sub-equal to that of fusion point of MA and Rs. In other *Siphlonurus* species, as far as we know, like in *S. palaearcticus*, this point is more distal. The second character is the cubital area which is longer and with more intercalaries between CuA and the posterior margin of wing. The third structure mentioned here is the hindwings of *S. davidi*, which are approximately half the length of forewings, longer than in other *Siphlonurus* species (less than half). It should be pointed out that these three characters of *S. davidi* are also found in *Siphluruscus chinensis* (Siphluriscidae), which is clearly a basal clade of Ephemeroptera; therefore, these characters are considered as plesiomorphic.

The MP vein in forewing of *S. davidi* is somewhat unique. It forks asymmetrically at the base, then MP_2 bends backwards strongly near to CuA. This condition is common in Ephemeridae and Potamanthidae, and is similar to *Siphluruscus chinensis*, but it seems that it is not found in other siphlonurids.

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An updated list of type material of Ephemeroptera Hyatt & Arms, 1890, deposited at the Zoological Museum of Hamburg (ZMH)

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Abstract

The type specimens of Ephemeroptera (Insecta) housed at the Zoological Museum of Hamburg (ZMH) are compiled in this document. The current nomenclature of all species is given. In total, Ephemeroptera type material of ZMH encompasses 161 species. Fifty-one holotypes and five lectotypes are present. Forty-one species are represented by syntypes, 85 by paratypes and five by paralectotypes. Material of two species (*Cinygma asiaticum* Ulmer, 1924 and *Pseudocloeon klapaleki* Müller-Liebenau, 1982) is missing. The present catalogue is an updated version of Weidner (1964a).

Keywords

Ephemeroptera, Hamburg, type specimens, Ulmer, ZMH

Introduction

The Ephemeroptera collection of the Zoological Museum of Hamburg (ZMH) contains 433 species and approximately 4,500 specimens. In total, 161 species are represented by type material. In this sense, this is one of the largest collections with the highest number of type specimens of this insect order in Germany. Furthermore, the mayfly collection together with the caddisfly collection comprise some of the oldest voucher material of the entomological collection at the ZMH which was mainly collected at the end of the 19^{th} century and in the first decades of the 20^{th} century by the Hamburgian entomologist Dr. h.c. Georg Ulmer (1877–1963) (e.g., Weidner 1964b).

Georg Ulmer was born in Hamburg on 5 March 1877. He was the oldest son of seven siblings. After his father died in 1889, he decided to become a school teacher. During his qualification time in the early 1890s, he began collecting insects in the vicinity of Hamburg (Ulmer 1964). Initially, he started to compile a beetle collection but since he observed a mass emergence of mayflies at the river Fulda near Kassel in 1898, he started to focus his collecting efforts and taxonomic studies on primarily aquatic insect groups like mayflies or caddisflies (Ulmer 1964). In 1899, he finished his teacher training and started his career as a board school teacher in Hamburg for 32 years until 1934. Beside his profession, he studied voluntarily the faunistics, biology, systematics and taxonomy of Ephemeroptera (e.g., Ulmer 1904a, 1926, 1939) and Trichoptera (e.g., Ulmer 1905, 1951), and other freshwater invertebrates (e.g., Ulmer 1901, 1902a).

His first publication (Ulmer 1900) was followed by 175 scientific publications until his death on 15 January 1963 (Illies 1964). In the first years of his scientific career, he mainly studied the faunistics and taxonomy of caddisflies in the vicinity of Hamburg (e.g., Ulmer 1902b), or other localities in Germany (e.g. Ulmer 1904b, 1915). From the year 1905 on, he intensively started to study the material from foreign countries (including tropical regions), which has been lent to him by colleagues or other institutions (e.g., Ulmer 1905).

Besides the Trichoptera, Ulmer worked on mayflies (e.g., Ulmer 1908, 1909, 1912). Between 1904 and 1943, he published thirty research papers on the systematics and taxonomy of Ephemeroptera (Kimmins 1963; Illies 1964) with the description of 111 species (Weidner 1964a). His studies on mayflies resulted in the fundamental revision of the Southeast Asian mayfly fauna with the description of numerous species (Ulmer 1939).

During World War II (in 1943), the Zoological Museum Hamburg (that time located near the central railway station) was bombed and nearly all dry preserved material housed in the collections was destroyed and burned in the fire. Only material deposited in ethanol was transferred into the underground networks and survived the war (Weidner 1967). The valuable Ephemeroptera and Trichoptera collection of Georg Ulmer was kept in his private house outside of Hamburg. In 1964, the insect collection of Georg Ulmer was donated to the ZMH (Weidner 1964b) providing the majority of the recent voucher material of the ZMH in these two insect orders.

Table 1. List of type material of Ephemeroptera Hyatt & Arms, 1890, deposited at the Zoological Museum of Hamburg, with the state and metamorphic stage of materials, current nomenclature, family assignment, related literature and complementary information. Abbreviations in this list are as follows: Type: HT= Holotype; LT= Lectotype; PT= Paratype(s); PLT= Paralectotype(s); ST = Syntypes. (state): (1) Specimen conserved in alcohol; (2) Pinned dry specimen; (3) Specimen or part of it mounted on microscopic slide. Stage: F= Female imago; M= Male imago; N= Nymph; SF= Female subimago; SM= Male subimago. Complementary information: a. Holotype wrongly designated by Weidner (1962, 1964a); b. Holotype designated by Ulmer on the label, not in the publication; c. Holotype apparently not in Stockholm (see http://www.nrm.se/download/18.1cb760b014a762ca801342e9/1421068753427/EPHEMEROPTERA_list.pdf); d. Specimen not labelled, but comes from the type series; e. Not type material! The types are the nymphs and the adults were only described in 1925; f. Only fore- and hindlegs in ZMH; g. Only fore wing in ZMH and remains in Naturkunde Museum, Berlin; h. Only foreleg; i. Only hind wing in ZMH and remains in Naturkunde Museum, Berlin; j. Only one forewing in ZMH and remains apparently not in Stockholm (http://www.nrm.se/download/18.1cb760b014a762ca801342e9/1421068753427/EPHEMEROPTERA_list.pdf); k. Wrongly considered by Ulmer, as a syn. of *E. bellieri* (Hagen).

Taxon	Original name	Author(s), year	Type (state)	Stage	Current nomenclature	Family	Literature & Complementary information
alegrettae	*Massartella alegrettae*	Ulmer, 1943	HT (2)	M	*Massartella alegrettae* Ulmer, 1943	Leptophlebiidae	(i.)
ambiguum	*Pseudocloeon ambiguum*	Müller-Liebenau, 1982	PT (1)	N	*Liebebiella ambigua* (Müller-Liebenau, 1982)	Baetidae	Waltz and McCafferty 1987
ammophila	*Oligoneuria ammophila*	Spieth, 1938	PT (1)	N	*Homoeoneuria ammophila* (Spieth, 1938)	Oligoneuriidae	Edmunds and Allen 1957
anatolica	*Rhithrogena anatolica*	Kazanci, 1985	PT (1)	M	*Rhithrogena anatolica* Kazanci, 1985	Heptageniidae	(d.)
annandalei	*Polymitarcys annandalei*	Chopra, 1927	ST (1)	F	*Ephoron annandalei* (Chopra, 1927)	Polymitarcyidae	Hubbard and Srivastava 1985
apicatum	*Cloeon apicatum*	Navás, 1933	ST (2)	M	*Cloeon navasi* van Bruggen, 1957	Baetidae	van Bruggen 1957; (d.)
balcanicus	*Metretopus balcanicus*	Ulmer, 1920	HT (3)	M	*Metreletus balcanicus* (Ulmer, 1920)	Ameletidae	Puthz 1977a; (f.)
belgica	*Torleya belgica*	Lestage, 1917	(PT) (2)	M, F	*Torleya major* (Klapalek, 1905a)	Ephemerellidae	(e.)
bengalensis	*Ecdyonurus bengalensis*	Ulmer, 1920	HT, PT (2, 3)	M, F, SM, SF	*Ecdyonurus bengalensis* Ulmer, 1920	Heptageniidae	(b.)
berneri	*Rheobaetis berneri*	Müller-Liebenau, 1974	HT (1)	N	*Heterocloeon berneri* (Müller-Liebenau, 1974)	Baetidae	McCafferty and Provonsha 1975
bicorne	*Centroptilum bicorne*	Ulmer, 1909	PT (1)	F	*Afroptilum bicorne* (Ulmer, 1909)	Baetidae	Gillies, 1990
biobionicum	*Deleatidium biobionicum*	Ulmer, 1938	PT (2)	F	*Meridialaris biobionica* (Ulmer, 1938)	Leptophlebiidae	Peters and Edmunds 1972; (g.)

Taxon	Original name	Author(s), year	Type (state)	Stage	Current nomenclature	Family	Literature & Complementary information
bishopi	*Platybaetis bishopi*	Müller-Liebenau, 1980a	HT (1)	N	*Platybaetis bishopi* Müller-Liebenau, 1980	Baetidae	
boettgeri	*Pseudocloeon boettgeri*	Ulmer, 1924	ST (1, 2, 3)	M, F	*Pseudocloeon boettgeri* Ulmer, 1924	Baetidae	
borneonia	*Epeorella borneonia*	Ulmer, 1939	LT, PLT (1, 2)	M, F, SF	*Epeorella borneonia* Ulmer, 1939	Heptageniidae	Sartori 2014c; (a.)
braueri	*Hagenulodes braueri*	Ulmer, 1920	PT (1)	M	*Hagenulodes braueri* Ulmer, 1920	Leptophlebiidae	
brenneriana	*Rhithrogena brenneriana*	Klapalek, 1905a	PT (1)	M	*Rhithrogena alpestris* Eaton, 1885 (syn.)	Heptageniidae	Puthz 1975
brunneum	*Cloeon brunneum*	Esben-Petersen, 1909	ST (1, 2)	M, F	*Americabaetis peterseni* (Hubbard, 1974) (syn. obj.)	Baetidae	Lugo-Ortiz and McCafferty 1999
caenoides	*Neoephemeropsis caenoides*	Ulmer, 1939	LT, PLT (1, 3)	M, F, N	*Potamanthellus caenoides* (Ulmer, 1939)	Neoephemeridae	Bae and McCafferty 1998
camerunense	*Pseudocloeon camerunense*	Ulmer, 1920	ST (1, 3)	M, F	*Ophelmatostoma camerunense* (Ulmer, 1920)	Baetidae	Gillies et al. 1990
canariensis	*Baetis canariensis*	Müller-Liebenau, 1971	HT, PT (1)	M, N	*Baetis canariensis* Müller-Liebenau, 1971	Baetidae	
cavum	*Cinygma cavum*	Ulmer, 1927	PT (1)	M	*Cinygmula cava* (Ulmer, 1927)	Heptageniidae	Levanidova 1972
chinensis	*Baetis chinensis*	Ulmer, 1936	ST (1)	M, F	*Baetis chinensis* Ulmer, 1936	Baetidae	
chinensis	*Heptagenia chinensis*	Ulmer, 1920	ST (2)	M	*Heptagenia chinensis* Ulmer, 1920	Heptageniidae	(d.)
chinensis	*Siphluriscus chinensis*	Ulmer, 1920	PT (3)	M	*Siphluriscus chinensis* Ulmer, 1920	Siphluriscidae	(f.)
corsicus	*Ecdyonurus corsicus*	Esben-Petersen, 1912a	PT (2)	M	*Ecdyonurus corsicus* Esben-Petersen, 1912	Heptageniidae	Belfiore 1987; (k.)
costaricanus	*Leptohyphes costaricanus*	Ulmer, 1920	HT (2, 3)	F	*Tricorythodes costaricanus* (Ulmer, 1920)	Leptohyphidae	Bamgardner 2008
crassinervis	*Polyplocia crassinervis*	Ulmer, 1939	PT (2)	SM	*Polyplocia campylociella* Ulmer, 1939 (syn.)	Euthyplociidae	Demoulin 1953
croaticus	*Siphlonurus croaticus*	Ulmer, 1920	PT (1, 3)	M	*Siphlonurus croaticus* Ulmer, 1920	Siphlonuridae	
curvata	*Paraleptophlebia curvata*	Ulmer, 1927	PT (1, 3)	M	*Paraleptophlebia strandii* (Eaton, 1901) (syn.)	Leptophlebiidae	Kluge 2009
deigma	*Liebebiella deigma*	Waltz & McCafferty, 1987	HT, PT (1, 3)	N	*Liebebiella vera* (Müller-Liebenau, 1981) (syn.)	Baetidae	Kluge and Novikova 2011
difficilum	*Pseudocloeon difficilum*	Müller-Liebenau, 1982	PT (1, 3)	N	*Liebebiella difficila* (Müller-Liebenau, 1982)	Baetidae	Waltz and McCafferty 1987
diptera	*Hagenulopsis diptera*	Ulmer, 1920	ST (1)	M, SM, SF	*Hagenulopsis diptera* Ulmer, 1920	Leptophlebiidae	

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duporti	*Ephemera duporti*	Lestage, 1921	PT (2)	M	*Ephemera duporti* Lestage, 1921	Ephemeridae	
eatoni	*Rhithrogena eatoni*	Esben-Petersen, 1912a	PT (2)	F	*Rhithrogena eatoni* Esben-Petersen, 1912	Heptageniidae	(d.)
edmundsi	*Platybaetis edmundsi*	Müller-Liebenau, 1980b	HT (1)	N	*Platybaetis edmundsi* Müller-Liebenau, 1980	Baetidae	
ehrhardti	*Thraulus ehrhardti*	Ulmer, 1920	ST (1, 2, 3)	M, F	*Needhamella ehrhardti* (Ulmer, 1920)	Leptophlebiidae	Dominguez and Flowers 1989
eloisae	*Derlethina eloisae*	Sartori, 2008	PT (1)	N	*Derlethina eloisae* Sartori, 2008	Teloganodidae	Sartori et al. 2008
feuernborni	*Pseudoligoneuria feuernborni*	Ulmer, 1939	ST (1, 3)	N	*Chromarcys magnifica* Navás, 1932 (syn.)	Oligoneuriidae	Kluge 2004
flexus	*Siphlurus flexus*	Clemens, 1913	PT (1)	M	*Siphloplecton basale* (Walker, 1853) (syn.)	Metretopodidae	McDunnough 1924
fluviatile	*Cloeon fluviatile*	Ulmer, 1920	PT (1, 3)	M, F	*Cloeon fluviatile* Ulmer, 1920	Baetidae	
formosana	*Ephemera formosana*	Ulmer, 1920	PT (2, 3)	M, F, SM, SF	*Ephemera formosana* Ulmer, 1920	Ephemeridae	
formosanus	*Chirotonetes formosanus*	Ulmer, 1912	ST (1, 2, 3)	M, SF	*Isonychia formosana* (Ulmer, 1912)	Isonychiidae	Ueno 1931
fruhstorfferi	*Massartella fruhstorfferi*	Ulmer, 1943	PT	SF	*Massartella brieni* (Lestage, 1924) (syn.)	Leptophlebiidae	Pescador and Peters 1990
fuegiensis	*Ameletus fuegiensis*	Lestage, 1935	HT (1, 3)	N	*Metamonius anceps* (Eaton, 1885) (syn.)	Nesameletidae	Mercado and Elliott 2004
fulmeki	*Acentrella fulmeki*	Ulmer, 1939	HT, PT (1, 3)	M, F	*Labiobaetis fulmeki* (Ulmer, 1939)	Baetidae	McCafferty and Waltz 1995
fusca	*Atalophlebia fusca*	Ulmer, 1920	HT (1)	M	*Koorrnonga fusca* (Ulmer, 1920)	Leptophlebiidae	Campbell and Suter 1988; (c.)
gornostajevi	*Epeorus gornostajevi*	Tshernova, 1981	PT (1)	M	*Epeorus gornostajevi* Tshernova, 1981	Heptageniidae	
grandis	*Chirotonetes grandis*	Ulmer, 1913	ST (1, 3)	M	*Isonychia grandis* (Ulmer, 1913)	Isonychiidae	Ulmer 1924
guranica	*Heptagenia guranica*	Belov, 1981	PT (1)	M	*Heptagenia guranica* Belov, 1981	Heptageniidae	
haenschi	*Euthyplocia haenschi*	Ulmer, 1942	PT (2)	M	*Euthyplocia haenschi* Ulmer, 1942	Euthyplociidae	
horai	*Potamanthellus horai*	Lestage, 1930	HT (2)	SM	*Potamanthellus amabilis* (Eaton, 1892) (syn.)	Neoephemeridae	Bae and McCafferty 1998
hutanis	*Dudgeodes hutanis*	Sartori, 2008	PT (1)	N	*Dudgeodes hutanis* Sartori, 2008	Teloganodidae	Sartori et al. 2008

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hyalinus	*Ecdyonurus hyalinus*	Ulmer, 1912	ST (1, 2, 3)	M, F, SM, SF	*Afronurus hyalinus* (Ulmer, 1912)	Heptageniidae	Kang and Yang 1994
insularis	*Rhithrogena insularis*	Esben-Petersen, 1913	PT (2)	M, F	*Rhithrogena insularis* Esben-Petersen, 1913	Heptageniidae	(d.)
irina	*Cinygmula irina*	Tshernova & Belov, 1982	PT (1)	M	*Cinygmula irina* Tshernova & Belov, 1982	Heptageniidae	
jacobsoni	*Tricorythus jacobsoni*	Ulmer, 1913	ST (1, 3)	M, F	*Sparsorythus jacobsoni* (Ulmer, 1913)	Tricorythidae	Sroka and Soldán 2008; (a.)
japonicus	*Chirotonetes japonicus*	Ulmer, 1920	ST (1, 2, 3)	M, F	*Isonychia japonica* (Ulmer, 1920)	Isonychiidae	Ueno 1931; (a.)
javanicus	*Afronurus javanicus*	Ulmer, 1939	HT (1)	M	*Afronurus javanicus* Ulmer, 1939	Heptageniidae	
javanicus	*Baetis javanicus*	Ulmer, 1913	ST (1, 2, 3)	F	*Baetis javanicus* Ulmer, 1913	Baetidae	
jorgenseni	*Campsurus jorgenseni*	Esben-Petersen, 1912b	ST (1)	M, F	*Campsurus jorgenseni* Esben-Petersen, 1912	Polymitarcyidae	
jorgenseni	*Cloeon jorgenseni*	Esben-Petersen, 1909	ST (1, 3)	M, F	*Americabaetis jorgenseni* (Esben-Petersen, 1909)	Baetidae	Lugo-Ortiz and McCafferty 1999
karnyi	*Hagenulus karnyi*	Ulmer, 1939	ST (1, 3)	SM, SF	*Choroterpes* (*Euthraulus*) *karnyi* (Ulmer, 1939)	Leptophlebiidae	Peters and Edmunds 1970
kraepelini	*Pseudocloeon kraepelini*	Klapalek, 1905b	LT, PLT (1, 3)	M, SM	*Pseudocloeon kraepelini* Klapaleck, 1905	Baetidae	Waltz and McCafferty 1985
krieghoffi	*Chitonophora krieghoffi*	Ulmer, 1920	ST (2)	M, S	*Ephemerella mucronata* (Bengtsson, 1909) (syn.)	Ephemerellidae	Jacob 1974
lacuscoerulei	*Tasmanophlebia lacuscoerulei*	Tillyard, 1933	PT (1)	SF	*Tasmanophlebia lacuscoerulei* Tillyard, 1933	Oniscigastridae	(d.)
laminatum	*Deleatidum laminatum*	Ulmer, 1920	PT (3)	M	*Meridialaris laminata* (Ulmer, 1920)	Leptophlebiidae	Peters and Edmunds 1972; (h.)
lamuriensis	*Thalerosphyrus lamuriensis*	Sartori, 2014e	HT, PT (1, 3)	N	*Thalerosphyrus lamuriensis* Sartori, 2014	Heptageniidae	
latifrons	*Cinygmula latifrons*	Tshernova & Belov, 1982	PT (1)	M	*Cinygmula hirasana* (Imanishi, 1935) (syn.)	Heptageniidae	Kluge 1995
latus	*Tricorythus latus*	Ulmer, 1916	PT (1, 2, 3)	M	*Tricorythus latus* Ulmer, 1916	Tricorythidae	
lestagei	*Atalophlebiodes lestagei*	Ulmer, 1938	ST (1, 3)	N	*Meridialaris lestagei* (Ulmer, 1938)	Leptophlebiidae	Dominguez et al. 2006

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lieftincki	*Heptagenia lieftincki*	Ulmer, 1939	HT, PT (1, 3)	M, F	*Compsoneuria lieftincki* (Ulmer, 1939)	Heptageniidae	Sartori 2014a
lobatus	*Ecdyonurus lobatus*	Ulmer, 1924	ST (1, 2, 3)	M, F, SF	*Afronurus lobatus* (Ulmer, 1924)	Heptageniidae	Mol 1987
longilobata	*Leptophlebia longilobata*	Tshernova, 1928a	PT (1, 3)	M	*Paraleptophlebia longilobata* (Tshernova, 1928)	Leptophlebiidae	Tiunova and Kluge 2016
longus	*Tricorythus longus*	Ulmer, 1916	PT (1, 2, 3)	M, F	*Tricorythus longus* Ulmer, 1916	Tricorythidae	
lucida	*Atalophlebia lucida*	Ulmer, 1920	HT (1)	M	*Thraulophlebia lucida* (Ulmer, 1920)	Leptophlebiidae	Demoulin 1955; (c.)
macedonicus	*Rhoenanthus macedonicus*	Ulmer, 1920	HT (2)	M	*Neoephemera maxima* (Joly, 1871)	Neoephemeridae	Bae and McCafferty 1998
maculipennis	*Thraulus maculipennis*	Ulmer, 1920	HT (1)	M	*Hermanella maculipennis* (Ulmer, 1920)	Leptophlebiidae	Dominguez and Flowers 1989
magnificus	*Rhoenanthus magnificus*	Ulmer, 1920	PT (1, 2, 3)	M	*Rhoenanthus magnificus* Ulmer, 1920	Potamanthidae	
major	*Choroterpides major*	Ulmer, 1939	HT, PT (1, 3)	M, N	*Dilatognathus major* (Ulmer, 1939)	Leptophlebiidae	Kluge 2012
malaisei	*Cinygma malaisei*	Ulmer, 1927	PT (1, 3)	M	*Cinygmula malesei* (Ulmer, 1927)	Heptageniidae	Levanidova 1972
marginatus	*Thraulus marginatus*	Ulmer, 1913	ST (1, 3)	M, F	*Choroterpes* (*Euthraulus*) *marginatus* (Ulmer, 1913)	Leptophlebiidae	Peters and Edmunds 1970
media	*Ephemera media*	Ulmer, 1936	ST (2)	M, F, SM, SF	*Ephemera media* Ulmer, 1936	Ephemeridae	(a.)
media	*Teloganopsis media*	Ulmer, 1939	HT, PT (1, 3)	M, N	*Teloganopsis media* Ulmer, 1939	Ephemerellidae	Ubero-Pascal and Sartori 2009; Sartori 2014f; (d.)
melli	*Thalerosphyrus melli*	Ulmer, 1926	PT (2, 3)	M, F	*Epeorus melli* (Ulmer, 1926)	Heptageniidae	Zhou et al. 2007
mexicana	*Heptagenia mexicana*	Ulmer, 1920	PT (3)	M	*Maccaffertium mexicanum* (Ulmer, 1920)	Heptageniidae	Wang and McCafferty 2004; (f.)
mjoebergi	*Euphyurus mjoebergi*	Ulmer, 1917	PT (1, 3)	M	*Ulmerophlebia mjoebergi* (Ulmer, 1917)	Leptophlebiidae	Demoulin 1955
montium	*Thraulus montium*	Ulmer, 1943	HT (2)	M	*Traverella montium* (Ulmer, 1943)	Leptophlebiidae	Allen 1973
multus	*Baetis multus*	Müller-Liebenau, 1984	PT (3)	N	*Labiobaetis multus* (Müller-Liebenau, 1984)	Baetidae	McCafferty and Waltz 1995
nasuta	*Heptagenia nasuta*	Ulmer, 1939	ST (1, 2)	M, F	*Trichogenia nasuta* (Ulmer, 1939)	Heptageniidae	Webb et al. 2006; (a)
natans	*Chankagenesia natans*	Buldowsky, 1935	PT (1)	M, F	*Chankagenesia natans* Buldowsky, 1935	Palingeniidae	
necatii	*Ecdyonurus necatii*	Kazanci, 1987	PT (1)	SM	*Electrogena necatii* (Kazanci, 1987)	Heptageniidae	Kazanci 2001

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necopinatus	*Baetis necopinatus*	Müller-Liebenau, 1981	HT (1, 3)	M	*Labiobaetis necopinatus* (Müller-Liebenau, 1981)	Baetidae	McCafferty and Waltz 1995
nigrescens	*Baetis nigrescens*	Navás, 1932	ST (2)	M	*Baetis nigrescens* Navás, 1932	Baetidae	Müller-Liebenau 1971
nigrescens	*Tasmanophlebia nigrescens*	Tillyard, 1933	PT (1)	F, N	*Tasmanophlebia nigrescens* Tillyard, 1933	Oniscigastridae	(d.)
nigropunctata	*Caenis nigropunctata*	Klapalek, 1905b	ST (2, 3)	F	*Caenis nigropunctata* Klapalek, 1905	Caenidae	Malzacher 2015
nigropunctatula	*Caenis nigropunctatula*	Malzacher, 2015	HT, PT (1, 3)	M, F	*Caenis nigropunctatula* Malzacher, 2015	Caenidae	
nitidum	*Centroptilum nitidum*	Ulmer, 1916	ST (2)	F	*Bugilliesia nitida* (Ulmer, 1916)	Baetidae	Lugo-Ortiz and McCafferty 1996
novatus	*Baetis novatus*	Müller-Liebenau, 1981	HT (3)	N	*Baetis novatus* Müller-Liebenau, 1981	Baetidae	
obscurum	*Pseudocloeon obscurum*	Ulmer, 1913	ST (3)	M	*Pseudocloeon obscurum* Ulmer, 1913	Baetidae	Müller-Liebenau 1981
olivascens	*Baetis olivascens*	Ulmer, 1939	HT, PT (1, 3)	M, SM, SF	*Baetis olivascens* Ulmer, 1939	Baetidae	
operosus	*Baetis operosus*	Müller-Liebenau, 1984	PT (3)	N	*Labiobaetis operus* (Müller-Liebenau, 1984)	Baetidae	McCafferty and Waltz 1995
orientale	*Pseudocloeon orientale*	Müller-Liebenau, 1982	PT (1)	N	*Liebebiella orientale* (Müller-Liebenau, 1982)	Baetidae	Waltz and McCafferty 1987
orientalis	*Palingenia orientalis*	Chopra, 1927	PT (2)	M	*Palingenia orientalis* Chopra, 1927	Palingeniidae	
orientalis	*Raptobaetopus orientalis*	Müller-Liebenau, 1978	HT (3)	N	*Baetopus orientalis* (Müller-Liebenau, 1978)	Baetidae	Jacob 1991
ornata	*Rhithrogeniella ornata*	Ulmer, 1939	HT, PT (1, 3)	M, F	*Rhithrogeniella ornata* Ulmer, 1939	Heptageniidae	Sartori 2014d
ornatum	*Procloeon ornatum*	Tshernova, 1928b	LT (1, 3)	M	*Procloeon ornatum* Tshernova, 1928	Baetidae	Sowa 1975
paradoxa	*Anagenesia paradoxa*	Buldowsky, 1935	PT (1)	M, F	*Anagenesia paradoxa* Buldowsky, 1935	Palingeniidae	
parvus	*Ecdyonurus parvus*	Ulmer, 1912	ST (1, 2, 3)	M, F	*Rhithrogena parva* (Ulmer, 1912)	Heptageniidae	Sartori 2014b
patagonica	*Atalophlebia patagonica*	Lestage, 1931	HT (1, 3)	F	*Meridialaris patagonica* (Lestage, 1931)	Leptophlebiidae	Peters and Edmunds 1972
pekinensis	*Caenis pekinensis*	Malzacher, 2016	HT, PT (1,3)	N	*Caenis pekinensis* Malzacher, 2016	Caenidae	

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pekingensis	*Baetis pekingensis*	Ulmer, 1936	HT, PT (1)	M, F, SM, SF	*Alainites pekingensis* (Ulmer, 1936)	Baetidae	Waltz et al. 1994
peruvianus	*Baetis peruvianus*	Ulmer, 1920	ST (2)	M, SM	*Andesiops peruvianus* (Ulmer, 1920)	Baetidae	Lugo-Ortiz and McCafferty 1999
pescadori	*Jubabaetis pescadori*	Müller-Liebenau, 1980b	HT (3)	N	*Jubabaetis pescadori* Müller-Liebenau, 1980	Baetidae	
peterseni	*Leptohyphes peterseni*	Ulmer, 1920	ST (1, 3)	M, F, SM, SF	*Leptohyphes peterseni* Ulmer, 1920	Leptohyphidae	
petersi	*Rheobaetis petersi*	Müller-Liebenau, 1974	HT (1)	M, N	*Heterocloeon petersi* (Müller-Liebenau, 1974)	Baetidae	McCafferty and Provonsha 1975
philippinensis	*Caenodes philippinensis*	Ulmer, 1924	ST (1, 2, 3)	M	*Caenis philippinensis* (Ulmer, 1924)	Caenidae	Kluge 1985
pictipennis	*Ephemera pictipennis*	Ulmer, 1924	ST (2)	M, F	*Ephemera pictipennis* Ulmer, 1924	Ephemeridae	
powelli	*Lachlania powelli*	Edmunds, 1951	PT (1)	M, F, N	*Lachlania saskatschevanensis* Ide, 1941 (syn.)	Oligoneuriidae	McCafferty 1996
proba	*Choroterpes proba*	Ulmer, 1939	ST (1, 3)	N	*Choroterpes proba* Ulmer, 1939	Leptophlebiidae	
prominens	*Habrophlebiodes prominens*	Ulmer, 1939	HT (1, 3)	M	*Habrophlebiodes prominens* Ulmer, 1939	Leptophlebiidae	
pseudorhodani	*Baetis pseudorhodani*	Müller-Liebenau, 1971	HT, PT (1)	M, N	*Baetis pseudorhodani* Müller-Liebenau, 1971	Baetidae	
puigae	*Teloganopsis puigae*	Ubero-Pascal & Sartori, 2009	PT (1)	N	*Teloganopsis puigae* Ubero-Pascal & Sartori, 2009	Ephemerellidae	
pulcher	*Afronurus pulcher*	Ulmer, 1930	PT (1)	SM, SF	*Afronurus collarti* (Navás, 1930) (syn.)	Heptageniidae	Demoulin 1956
purpurata	*Ephemera purpurata*	Ulmer, 1920	PT (2)	M	*Ephemera purpurata* Ulmer, 1920	Ephemeridae	
ranauensis	*Caenis ranauensis*	Malzacher, 2015	HT, PT (1, 3)	M, F	*Caenis ranauensis* Malzacher, 2015	Caenidae	
rhenicola	*Caenis rhenicola*	Malzacher, 1976	HT, PT (1)	M	*Caenis pusilla* Navás, 1913 (syn.)	Caenidae	Alba-Tercedor and Malzacher 1986
rossicus	*Ecdyonurus rossicus*	Tshernova, 1928b	PT (1)	M	*Kageronia fuscogrisea* (Retzius, 1783) (syn.)	Heptageniidae	Puthz 1977b
sauteri	*Ephemera sauteri*	Ulmer, 1912	PT (2)	M, F	*Ephemera sauteri* Ulmer, 1912	Ephemeridae	
scotti	*Caenis scotti*	Ulmer, 1930	PLT (1)	M, F	*Caenis scotti* Ulmer, 1930	Caenidae	
seminiger	*Simothraulus seminiger*	Ulmer, 1939	HT (1)	M	*Simothraulus seminiger* Ulmer, 1939	Leptophlebiidae	Grant and Peters 1993
sexfasciata	*Atalophlebia sexfasciata*	Ulmer, 1916	HT (1, 3)	M	*Atalomicria sexfasciata* (Ulmer, 1916)	Leptophlebiidae	Harker 1954; (j.)

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sikorai	*Euthyplocia sikorai*	Vayssière, 1895	PT (1, 3)	N	*Proboscidoplocia sikorai* (Vayssière, 1895)	Euthyplociidae	Demoulin 1966
sinensis	*Iron sinensis*	Ulmer, 1926	PT (2, 3)	M	*Epeorus sinensis* (Ulmer, 1926)	Heptageniidae	Edmunds and Traver 1954
soror	*Baetis soror*	Ulmer, 1908	ST (1)	M, F	*Offadens soror* (Ulmer, 1908)	Baetidae	Lugo-Ortiz and McCafferty 1998
sowai	*Rhithrogena sowai*	Puthz, 1972	HT (2)	M	*Rhithrogena sowai* Puthz, 1972	Heptageniidae	
sudanense	*Centroptilum sudanense*	Ulmer, 1916	PT (1)	M, SM	*Bugilliesia sudanense* (Ulmer, 1916)	Baetidae	Lugo-Ortiz and McCafferty 1996
sumatrana	*Baetis sumatrana*	Ulmer, 1939	ST (1, 3)	M, F	*Baetis sumatrana* Ulmer, 1939	Baetidae	Müller-Liebenau 1981
sumatranus	*Ecdyonurus sumatranus*	Ulmer, 1939	HT (1, 3)	F	*Rhithrogena sumatrana* (Ulmer, 1939)	Heptageniidae	Sartori 2014b
thienemanni	*Compsoneuriella thienemanni*	Ulmer, 1939	LT, PLT (1, 2, 3)	M, F, N	*Compsoneuriella thienemanni* Ulmer, 1939	Heptageniidae	Sartori 2014a
tibiale	*Cinygma tibiale*	Ulmer, 1920	PT (1, 3)	M	*Rhithrogena tibiale* (Ulmer, 1920)	Heptageniidae	Tshernova and Belov 1982
tibialis	*Atopopus tibialis*	Ulmer, 1920	PT (2, 3)	M, F	*Atopopus tibialis* Ulmer, 1920	Heptageniidae	
traverae	*Rheobaetis traverae*	Müller-Liebenau, 1974	HT (1)	N	*Heterocloeon curiosum* (McDunnough, 1923) (syn.)	Baetidae	McCafferty and Provonsha 1975
triangularis	*Siphlonurus triangularis*	Clemens, 1915	PT (1)	M, F, N	*Siphlonurus quebecensis* (Provancher, 1878) (syn.)	Siphlonuridae	McDunnough 1925
truncatus	*Campsurus truncatus*	Ulmer, 1920	PT (2)	M, F	*Campsurus truncatus* Ulmer, 1920	Polymitarcyidae	
ulmeri	*Asionurus ulmeri*	Braasch & Soldán, 1986	HT, PT (1, 3)	N	*Asionurus ulmeri* Braasch & Soldán, 1986	Heptageniidae	
ulmeri	*Baetis ulmeri*	Müller-Liebenau, 1981	HT (1, 3)	M	*Labiobaetis ulmeri* (Müller-Liebenau, 1981)	Baetidae	McCafferty and Waltz 1995
ulmeri	*Behningia ulmeri*	Lestage, 1930	HT (1)	N	*Behningia ulmeri* Lestage, 1930	Behningiidae	
ulmeri	*Dudgeodes ulmeri*	Sartori, 2008	HT, PT (1, 3)	M, SM, F, N	*Dudgeodes ulmeri* Sartori, 2008	Teloganodidae	Sartori et al. 2008 Sartori 2014f
ulmeri	*Trichogenia ulmeri*	Braasch & Webb, 2006	HT, PT (1, 3)	N	*Trichogenia ulmeri* Braasch & Webb, 2006	Heptageniidae	

Taxon	Original name	Author(s), year	Type (state)	Stage	Current nomenclature	Family	Literature & Complementary information
ulmeriana	*Caenis ulmeriana*	Malzacher, 2015	HT, PT (1, 3)	M, F	*Caenis ulmeriana* Malzacher, 2015	Caenidae	
umbrata	*Teloganella umbrata*	Ulmer, 1939	HT (1)	SF	*Teloganella umbrata* Ulmer, 1939	Teloganellidae	
unguicularis	*Euphyurus unguicularis*	Ulmer, 1917	PT (1)	M	*Austrophlebiodes unguicularis* (Ulmer, 1917)	Leptophlebiidae	Campbell and Suter 1988
unguiculatus	*Campsurus unguiculatus*	Ulmer, 1920	ST (2)	M	*Tortopsis unguiculatus* (Ulmer, 1920)	Polymitarcyidae	Molineri 2010
ussingi	*Rhithrogena ussingi*	Esben-Petersen, 1910	PT (2)	M	*Rhithrogena germanica* Eaton, 1885 (syn.)	Heptageniidae	Sowa 1971
verum	*Pseudocloeon verum*	Müller-Liebenau, 1982	PT (1, 3)	N	*Liebebiella vera* (Müller-Liebenau, 1981)	Baetidae	Waltz and McCafferty 1987
virens	*Cloeon virens*	Klapalek, 1905b	ST (2, 3)	M, F	*Cloeon virens* Klapalek, 1905	Baetidae	
vitellinum	*Centroptilum vitellinum*	Ulmer, 1939	HT (2)	M	*Centroptilum vitellinum* Ulmer, 1939	Baetidae	
winckleri	*Isonychia winckleri*	Ulmer, 1939	ST (2)	M, F, SF	*Isonychia winckleri* Ulmer, 1939	Isonychiidae	(a.)
wui	*Leptophlebia wui*	Ulmer, 1936	ST (1)	M, F	*Leptophlebia wui* Ulmer, 1936	Leptophlebiidae	
wui	*Caenis wui*	Malzacher, 2016	HT, PT (1,3)	N	*Caenis wui* Malzacher, 2016	Caenidae	
Missing material							
asiaticum	*Cinygma asiaticum*	Ulmer, 1924	ST (2)	M	*Incertae sedis*	Heptageniidae	Tshernova and Belov 1982
klapaleki	*Pseudocloeon klapaleki*	Müller-Liebenau, 1982	PT (1)	N	*Liebebiella klapaleki* (Müller-Liebenau, 1982)	Baetidae	Waltz and McCafferty 1987

Georg Ulmer was an outstanding specialist and his comprehensive studies on the faunistics and taxonomy of various groups of freshwater invertebrates formed the foundation of the recent taxonomy and systematics of those groups, especially Ephemeroptera and Trichoptera.

In addition to Ulmer's collection, the ZMH also stores primary type material described by other authors, such as Klapalek (1905a,b), Lestage (1930, 1935), Malzacher (1976, 2015, 2016), Müller-Liebenau (1971, 1974, 1980a, b, 1981), and Sartori (2008, 2014e). An interesting finding was the discovery of several paratypes of species described by Esben-Petersen (e.g. 1909, 1912a, b, 1913), which were not labelled as such but come from the type series, judging from the dates and places on labels. More information on these mayfly specialists can be found at http://www.ephemeroptera.de/inhaltsverz_deutsch/Galerie____/galerie____.html, a webpage maintained by Udo Jacob and Arne Haybach.

The only attempt, prior to this type catalogue, has been made by Weidner (1962, 1964a, 1977), who published a list of Ephemeroptera type material deposited in ZMH, without any taxonomic remarks. At that time, 121 species were mentioned. This catalogue is accessible online (https://www.cenak.uni-hamburg.de/sammlungen/zoologie/entomologie/typenkatalog.html).

Multiple subsequent taxonomic surveys utilizing a variety of different, high-resolution methods (morphological and molecular) led not only to the description of many new taxa, but also several supraspecific changes (e.g. Peters and Edmunds 1972; Puthz 1977; Braasch and Soldán 1986; Campbell and Suter 1988; Gillies 1990; Grant and Peters 1993; McCafferty and Waltz 1995; Lugo-Ortiz and McCafferty 1996, 1999; Sartori et al. 2008; Sartori 2014a, b, c.).

The catalogue that follows is arranged alphabetically by species name, followed by the original combination, author(s) name and year of publication. For each entry, an actual nomenclature (valid names or synonymy) is given. The kind of type and the metamorphic stage of specimens are abbreviated as indicated in the table header. The present study is a completely independent and new work; data reported by Weidner were not copied as a base for this catalogue. This study is entirely original work, based on the first author's specimen-by-specimen examination of the ZMH collections from December 2013 to June 2014. Recent publications by Malzacher (2015, 2016) on Ulmer's collection were also added.

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RESEARCH ARTICLE

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A new species and a revised key of the genus *Thoradonta* (Orthoptera, Tetrigidae)

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Abstract

A new species of the genus *Thoradonta* (Orthoptera, Tetrigidae), *Thoradonta varispina* Zha & Sheng, **sp. n.**, was found in Lengshuihe Nature Preserve, Jinsha, Guizhou, China. It is introduced with a description and photographs and compared with similar taxa. Ecology, habits, and morphological variation of the new species are discussed and illustrated. Generic characteristics of *Thoradonta* are updated and an updated key to all known species of *Thoradonta* is given.

Keywords

Ecology, habits, morphological variation, Scelimeninae, taxonomy

Introduction

The genus *Thoradonta* Hancock belongs to Scelimeninae, Tetrigidae, type species *Thoradonta dentata* Hancock. To date it includes 21 known species worldwide, distributed in subtropical and tropical Asia (China, Bengal, Hong Kong, India, Indonesia, Malaysia, Myanmar, Nepal, Singapore, Sri Lanka, the Philippines, and Vietnam) and equinoctial Africa (Zha et al. 2016b).

During investigation of species diversity in Lengshuihe Nature Preserve, Jinsha County, Guizhou Province, China during 3–10 Aug 2015, a new species of the genus *Thoradonta* was found, *Thoradonta varispina* Zha & Sheng, sp. n. A description and illustrations introduce the species, and it is compared with similar taxa. Ecology, habits, and morphological variation of body structure of the genus *Thoradonta* are discussed. Generic characteristics of *Thoradonta* are updated and an updated key to all known species of the genus is given.

Material and methods

Specimens were photographed using a stereomicroscope (Keyence VHX-1000). Morphological terminology and measurement landmarks follow Shishodia (1991) and Zheng (2005). Measurements are given in millimeters (mm). Type specimens are deposited in the Specimen Room of the School of Life Sciences, Huaibei Normal University, Huaibei, Anhui, China.

Taxonomy

***Thoradonta varispina* Zha & Sheng, sp. n.**
http://zoobank.org/57E266B7-4DF3-4656-AC37-7EAD7FDC0E38
Figs 1–3

Diagnosis. *Thoradonta varispina* sp. n. is distinguished from *T. obtusilobata* Zheng, 1996 by the following characters: 1) vertex 1.8–2.0 times as wide as one eye (width of the widest part of an eye in dorsal view); 2) midkeel of pronotum not reaching anterior margin of pronotum; 3) upper margin of hind femur before antegenicular denticle with a small protrusion only, but not forms into 2–3 lamellae; 4) lower margin of hind femur entire, without protrusion; 5) third pulvillus of first segment of hind tarsus distinctly longer than first and second.

Description. Female. Body size small, covered with numerous small granules and many nodules.

Head. Head not protruding over level of pronotal surface; vertex 1.8-2.0 times as wide as one eye, anterior margin straight, protruding but not surpassing anterior margins of eyes, lateral margins folded upwards but not surpassing top of eyes; median carina conspicuous and protruding in anterior half which is visible before eyes in profile, while obscure or absent in posterior half; vertex together with frontal ridge arcuate and protruding, distinctly concave between lateral ocelli, then strongly arched and protruding between antennae, longitudinal furrow between antennae slightly wider than diameter of first segment of antenna, margins of longitudinal furrow finely serrate. Antenna filiform, 17-segmented, inserted slightly below lower margins of eyes, length of longest segment (segment IV, male in VIII) 4.5 times its width. Eyes globose,

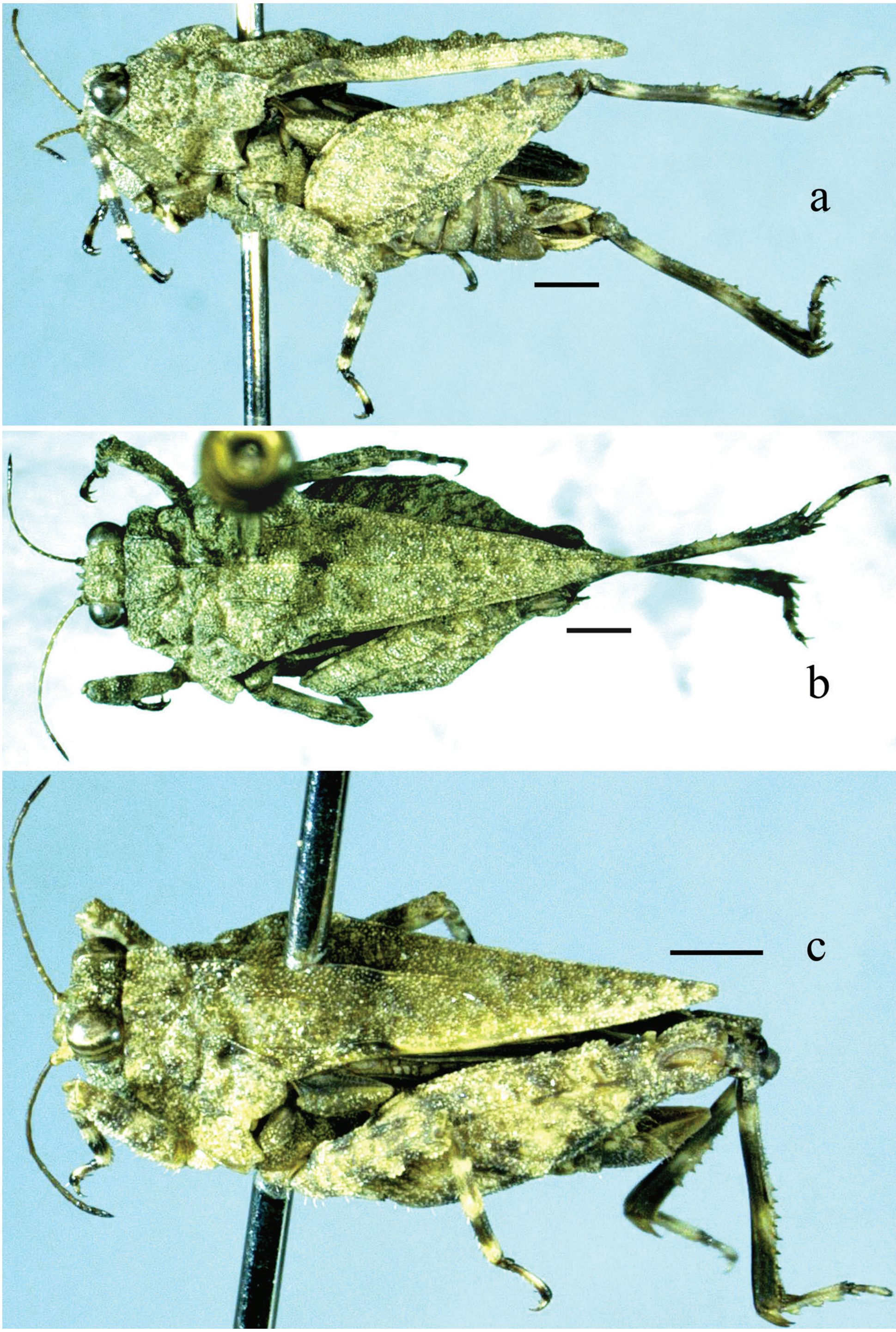

Figure 1. *Thoradonta varispina* sp. n.: **a–b** lateral and dorsal views of female **c** oblique view of male. Scale bars: 1.0 mm.

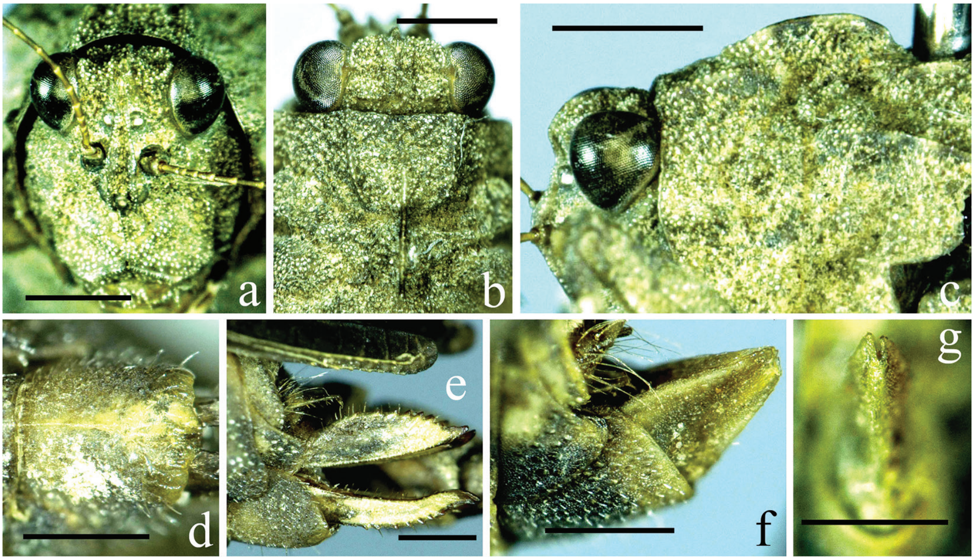

Figure 2. *Thoradonta varispina* sp. n.: **a** frontal view of female head **b** dorsal view of female head and anterior part of pronotum **c** lateral view of female head and anterior area of pronotum **d** ventral view of female subgenital plate **e** lateral view of female ovipositor **f** laterial view of male subgenital plate **g** posterior view of male subgenital plate. Scale bars **a–c**: 1.0 mm, **d–g**: 0.5 mm.

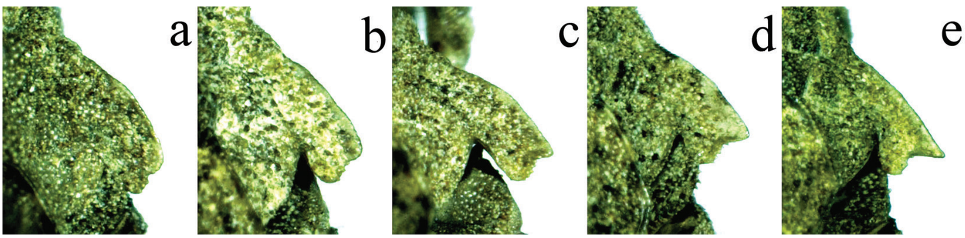

Figure 3. Outline of lateral lobes of pronotum with apex of posterior angle of different individuals of *Thoradonta varispina* sp. n..

protruding but not above level of pronotum; lateral ocellus situated slightly below middle of anterior margin of eye.

Thorax. Pronotum very coarse, covered with numerous small granules and many nodules; middle of anterior margin little concave; lateral keels of prozona erected, distal part higher than basal part, slightly contracted backward, sometimes distal part excessively contracted inward. Midkeel not reaching anterior margin of pronotum, otherwise nearly entire, in profile upper margin of pronotum distinctly undulate with wave peaks becoming lower backward. These sinusoidal waves lamellate and erected, first highest, with intumesced base, both sides of intumescence with a pair of big nodules at margins of pronotum; second lamella longest and undulate, on both sides pronotal disc distinctly concave followed by a pair of long oblique nodules, and lateral margins of pronotum distinctly folded upwards; the latter midkeel with 4–5 lamellae of intumesced base. Humeral angle obtusely angled; a pair of abbreviated carinae present between shoulders, slightly contracted forwards; pronotum slightly uplifted between shoulders; hind process of pronotum long cone-shaped, reaching (few specimens) or slightly surpassing (most specimens) apex hind femora, distal part slightly down-curved and apex sharp. Posterior angles of lateral lobes of pronotum laminate and expanded and extending outwards, apex varies distinctly in different individuals: upper lobe not produced, slightly produced or triangularly laterally produced; subtruncate behind which is margined with fine teeth (Fig. 3). Posterior margin of each lateral lobe has two concavities. Visible part of tegmina ovate, 2.7 times as long as wide, apex rounded. Hind wing not reaching top of hind process of pronotum, not reaching or reaching apex of hind femur. Margins of all femora with fine teeth; upper margin of fore femur slightly undulate, lower margin distinctly undulate; upper and lower margins of mid femur distinctly undulate; mid femur slightly wider than fore femur and visible part of tegmen, not narrowed or thicker from basal to distal area. Hind femur about 2.5 times as long as wide, rear of upper margin before antegenicular denticle slightly protruding; antegenicular denticle isolated and long triangular, its apex relatively sharp, genicular denticle fingered extending backward and apex obtuse. Hind tibia distally slightly wider than basally, outer side with 5–7 spines, inner side with 4–6 spines; first segment of hind tarsus 1.3–1.4 times longer than third, third pulvillus longer than first and second, apex of third pulvillus relatively obtuse, apices of first and second sharp.

Abdomen. Ovipositor: upper valvulae 3.3 times as long as wide, outer margins of upper and lower valvulae with saw-like teeth. Posterior margin of subgenital plate: narrowing backward; middle triangularly protruding, sometimes this protrusion folded inward, forming a basal concavity and a protrusion on both sides (Fig. 2d, e).

Coloration. Body dark brown. Antenna brown, distal segments darker than basal segments; hind wings black; for and mid femora and tibiae with 3 yellowish brown bands each, bands of all femora obscure; lower outside of hind femur black, center of inner side of hind femur dark brown; hind tibia with 2 long yellowish brown bands.

Male. Body size slightly smaller than female. Antenna 16-segmented. Fore femur nearly the same as that of female; mid femur distinctly wider than fore femur and visible part of tegmen, narrowing from basal to distal side, and basal part thicker than distal part. Subgenital plate short cone-shaped, apex bifurcate but not bidentate.

Measurements. Length of body ♂6.2–7.8 mm, ♀7.5–9.0 mm; length of pronotum ♂6.1–7.0 mm, ♀7.5–8.7 mm; length of hind femur ♂3.5–4.2 mm, ♀4.7–5.4 mm.

Type material. Holotype female, China, Guizhou, Jinsha County, Lengshuihe Natural Reserve, N27°54', E106°00', 650 m alt, 7 Aug. 2015, collected by Ling-Sheng ZHA. Paratypes: 27 males and 19 females, 500–800 m alt, 5–9 Aug. 2015, other data same as holotype.

Ecology and habits. All specimens of the new species were collected in humid, sandy, and stony environments alongside streams (Fig. 4). Body surfaces of most individuals are covered tightly by numerous sand grains. They move frequently in sunshine, and they feed on mosses, algae, lichens and all sorts of humus.

Figure 4. Habitats of *Thoradonta varispina* sp. n. (photographed in Lengshuihe Natural Reserve, Jinsha County, Guizhou, China).

Etymology. This new species epithet means spine of upper lobe of posterior angle of lateral lobe of pronotum varies in different individuals.

Distribution. China (Guizhou).

Key to species of the genus *Thoradonta* Hancock, with distributions

1 Tegmen and wing invisible. Indonesia........ ***T. butlini*** **Blackith & Blackith**

– Tegmina and wings visible...**2**

2 Upper lobe of posterior angle of lateral lobe of pronotum not produced or slightly produced, not spinose (Fig. 3) **3**

– Upper lobe of posterior angle of lateral lobe of pronotum produced conspicuously and spinose (Fig. 5) **5**

3 Body length 10.79–12.81 mm; hind process of pronotum distinctly surpassing apex of hind femur (Fig. 6e). Nepal .... ***T. aspinosa*** **Ingrisch**

– Body length 6.0–9.0 mm; hind process of pronotum shorter, only reaching or slightly surpassing apex of hind femur (Fig. 6b, c) **4**

4 Vertex 1.5 times as wide as one eye; midkeel of pronotum reaching anterior margin of pronotum; upper margin of hind femur before antegenicular denticle with 2–3 lamellate protrusions, lower margin with a distinct protrusion. China ....***T. obtusilobata*** **Zheng**

– Vertex 1.8–2.0 times as wide as one eye; midkeel of pronotum not reaching anterior margin of pronotum; upper margin of hind femur before antegenicular denticle with a small protrusion only, lower margin without protrusion. China .... ***T. varispina*** **sp. n.**

5 Hind process of pronotum shorter, not reaching or reaching apex of hind femur (Fig. 6a, b)...**6**

– Hind process of pronotum longer, surpassing apex of hind femur (Fig. 6c–e) ...**9**

6 Hind process reaching apex of hind femur (Fig. 6b); lower lobe of posterior angle of lateral lobe of pronotum acutely produced (Fig. 5c). India, Bengal.. .... ***T. bengalensis*** **Shishodia**

– Hind process not reaching apex of hind femur (Fig. 6a); lower lobe of posterior angle of lateral lobe of pronotum truncate or subtruncate 7

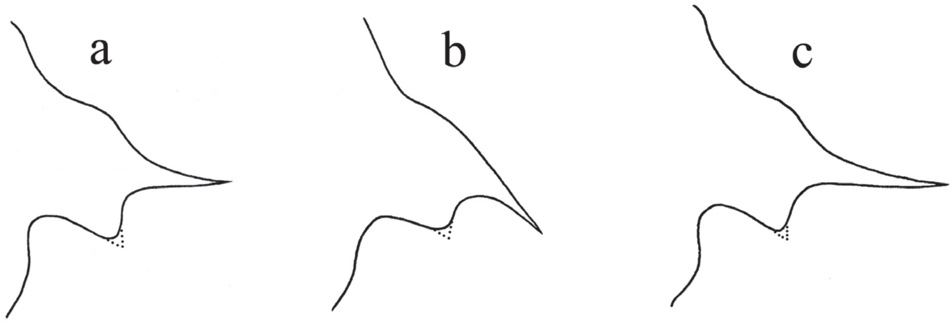

Figure 5. Variations of spine of posterior angle of lateral lobe of pronotum in the genus *Thoradonta*: **a** normal and pointing laterally **b** normal and oblique backward **c** long and pointing laterally.

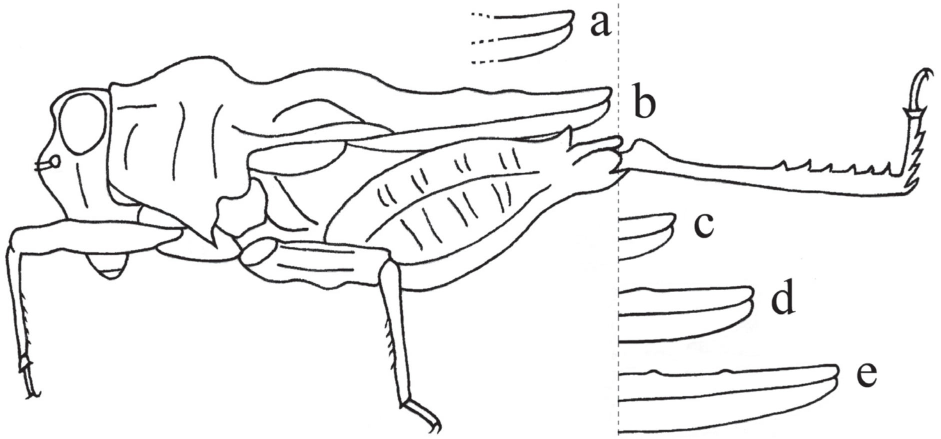

Figure 6. Variations of the length of pronotum in the genus *Thoradonta*: **a** hind process of pronotum doesn't reach apex of hind femur **b** reaches apex of hind femur **c** slightly surpasses apex of hind femur **d** nearly reaches middle of hind tibia **e** nearly reaches apex of hind tibia.

7 Wings shorter, not reaching apex of hind process; third pulvillus of first segment of hind tarsus longer than second (Fig. 5b). China, Hong Kong, India, Indonesia, Malaysia, Singapore, Sri Lanka .... ***T. nodulosa* (Stål)**

– Wings longer, reaching apex of hind process; third pulvillus of first segment of hind tarsus equal to second in length **8**

8 Upper lobe of posterior angle of lateral lobe of pronotum obliquely dentate (Fig. 5b). Malaysia .... ***T. dentata* Hancock**

– Upper lobe of posterior angle of lateral lobe of pronotum acutely spinose, pointing laterally (Fig. 5a). Equinoctial Africa .... ***T. spinata* Hancock**

9 Body size stout; hind process of pronotum surpassing slightly beyond apex of hind femur (Fig. 6c) **10**

– Body size slender; hind process of pronotum surpassing far beyond apex of hind femur (Fig. 6d, e) **13**

10 Anterior margin of vertex nearly as wide as posterior margin; spine of upper lobe of posterior angle of lateral lobe of pronotum pointing distinctly obliquely backward (Fig. 5b). China..............................***T. yunnana*** **Zheng**

– Anterior margin of vertex distinctly narrower than posterior margin; spine of upper lobe of posterior angle of lateral lobe of pronotum pointing laterally or slightly obliquely backward...**11**

11 Spine very long (Fig. 5c); wings reaching apex of hind process of pronotum. China .... ***T. longispina*** **Zheng & Xie**

– Spine shorter (Fig. 5a); wings not reaching apex of hind process of pronotum...**12**

12 Antenna inserted at the level of lower margins of eyes, the longest segment 4.0 times as long as wide; first segment of hind tarsus 1.75 times as long as third. China, India.. ***T. spiculoba*** **Hancock**

– Antenna inserted decidedly below lower margins of eyes, the longest segment 6 times as long as wide; first segment of hind tarsus 1.3–1.4 times as long as third. Thailand...***T. spiculobaoides*** **Zha & Kang**

13 Spine of upper lobe of posterior angle of lateral lobe of pronotum pointing laterally (Fig. 5a, c) **14**

– Spine of upper lobe of posterior angle of lateral lobe of pronotum pointing obliquely backward (Fig. 5b) **16**

14 Vertex 2.0 times as wide as one eye; wings not reaching apex of hind process (Figs. 5c, 6c, d). India, Vietnam .... ***T. centropleura*** **Podgornaya**

– Vertex not more than 1.5 times as wide as one eye; wings reaching or surpassing apex of hind process...**15**

15 Spine slender and longer (Fig. 5c); pronotum 2.4–3.0 times as long as posterior part of hind process which is beyond hind femur (Fig. 6e); wings surpassing apex of hind process. China .... ***T. longipenna*** **Zheng & Liang**

– Spine shorter (Fig. 5a); pronotum 3.3–4.0 times as long as posterior part of hind process which is beyond hind femur (Fig. 6d); wings reaching apex of hind process. China .... ***T. transspicula*** **Zheng**

16 Vertex wider, 1.5–2.0 times as wide as one eye (Fig. 6d)..........................**17**

– Vertex narrower, 1.18–1.35 times as wide as one eye...............................**21**

17 Wings longer, surpassing far beyond apex of hind process; disc of pronotum black. China .... ***T. nigrodorsalis*** **Zheng & Liang**

– Wings shorter, not reaching or surpassing slightly beyond apex of hind process; pronotum and body in the same color **18**

18 Pronotum not less than 5.0 times as long as posterior part of hind process which is beyond apex of hind femur **19**

– Pronotum not more than 4.0 times as long as posterior part of hind process which is beyond apex of hind femur **20**

19 Lateral keels of prozona parallel; wings not reaching apex of hind process. China ....***T. lancangensis*** **Zheng**

– Lateral keels of pronoza distinctly contracted backward; wings surpassing apex of hind process. China .... ***T. dianguiensis*** **Deng, Zheng & Wei**

20 Antenna inserted between lower margins of eyes; lateral keels of pronoza parallel; humeral angle widely rounded. China, India ..... ***T. lativertex*** **Günther**

– Antenna inserted decidedly below lower margins of eyes; lateral keels of pronoza distinctly contracted backward; humeral angle obtusely angled. Thailand .... ***T. lativertexoides*** **Zha & Kang**

21 Vertex 1.25–1.35 times as wide as one eye; body surface smooth; length of posterior part of hind process which is beyond apex of hind femur 3.0–3.4 mm (Fig. 6e). The Philippines .... ***T. palawanica*** **Günther**

– Vertex nearly as wide as one eye; body surface coarse; length of posterior part of hind process which is beyond apex of hind femur 1.5-2.0 mm (Fig. 6d). China, India, Myanmar, Thailand .... ***T. apiculata*** **Hancock**

Discussion

Species of the genus *Thoradonta* generally live in humid and sandy places near streams, rivers, or ponds. They move frequently in sunshine, and they generally feed on mosses, algae, lichens and all sorts of humus. Though provided with developed hind wings they seldom really fly, instead their hind femora are well-developed, suitable for jumping when disturbed. Colors of their bodies are generally adapted to the soil of their habitats. Apart from generally coarse an uneven, body surfaces of most individuals were often tightly covered by numerous sand grains. We infer that they lay eggs in sandy soil, and most of their life time they may conceal their body in sandy soil (Zha et al. 2016a) to avoid bad environments such as low temperature, being preyed, rain, drought etc.; when temperature is high and light is good, they may crawl out from sandy soil for feeding and mating. Their small size and long-term living in sandy soil made them easily be preserved during evolution. Additionally, based on collecting times of all known adults (from beginning of April to end of November), we infer part or all species of the genus living outside the tropics may overwinter as adults (the genus from tropical countries do not hibernate at all).

According to *T. varispina* sp. n., and comparing with descriptions of 21 known species of the genus *Thoradonta* (Hancock 1909, 1915, Günther 1938, Zheng 1983, 1996, 2005, Blackith and Blackith 1987, Shishodia 1991, Zheng and Liang 1991, Podgornaya 1994, Ingrisch 2001, Deng et al. 2006, Zha et al. 2016b), generic characteristics of *Thoradonta* should be updated as follows.

Body size small. Vertex equal to or wider than one eye, frontal ridge distinctly protruding forward between antennae. Antenna filiform, inserted between or below lower anterior margins of eyes. Eyes globular and prominent, lateral ocellus situated in or slightly below middle of anterior margin of eye. Distal segments of maxillary palpus slightly compressed. Pronotal disc generally covered with many nodules; midkeel undulate, partially lamellate and erected before shoulders; pronotum slightly uplifted between shoulders; a pair of abbreviated carinae present between shoulders; lateral margins of pronotum behind humeral angles folded upwards; hind process of pronotum wedge-shaped, not reaching, reaching or surpassing apex of hind femur; posterior angle of lateral lobe of pronotum laminate and expanded and extending outwards, apex varies conspicuously: 1) upper lobe generally produced, spinose or acutely angled, extending laterally or obliquely backward; 2) lower lobe generally truncate, sometimes also produced and obtusely angled or acutely angled; 3) both upper and lower lobes not produced or produced inconspicuously, and apex truncate or subtruncate. Visible part of tegmina ovate, hind wing normal but invisible in *T. butlini*. First segment of hind tarsus generally longer than third.

Podgornaya (1994) indicated two forms of wings and pronotum (brachypterous and macropterous) as occurring in *T. spiculoba* specimens collected from Vietnam, as well as *T. apiculata* from Thailand reported by Storozhenko and Dawwrueng (2015) recently, while in *T. varispina* sp. n., though varying more or less it is indistinct. So we think the view that similar specimens with different lengths of both wings and pronotum in Tetrigidae are two different species is debatable, at least not so in *T. varispina* sp. n.. Notably for *T. varispina* sp. n., the apex of the posterior angle of the lateral lobe of pronotum varies conspicuously between individuals, but never forms into a spine, which is easily distinguished from other spinose species of the genus. The morphological variation of apex of lateral lobe of pronotum from spinose to truncate indicates that Scelimeninae is very close to Metrodorinae in phylogeny, and this finding would help studying taxonomy and evolution of these Tetrigidae insects.

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A review of *Elocomosta* Hansen with a description of a new species with reduced eyes from China (Coleoptera, Hydrophilidae, Sphaeridiinae)

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Abstract

A new species of the genus *Elocomosta* Hansen, 1989 (Coleoptera: Hydrophilidae: Sphaeridiinae: Coelostomatini), *E. lilizheni* **sp. n.**, is described from Guangxi Province, China. It is compared in detail with the only other known species of the genus, *E. nigra* Hansen, 1989 from Borneo, and the genus is diagnosed from the remaining coelostomatine genera. The new species is unusual among Hydrophilidae by having extremely reduced eyes.

Keywords

China, Coelostomatini, *Elocomosta*, eye reduction, new species

Introduction

The tribe Coelostomatini is one of the largest groups of hydrophilid beetles, represented by 17 genera containing more than 200 described species (Short and Fikáček 2011, 2013). Only two of these genera are species-rich: the aquatic genus *Coelostoma* Brullé, 1835 with slightly more than 100 described species (e.g., Short and Fikáček 2011, Jia et al. 2014), and the terrestrial genus *Dactylosternum* Wollaston, 1854 with *ca*. 70 described species (Short and Fikáček 2011). The remaining coelostomatine genera contain far fewer species, usually characterized by peculiarities of ventral morphology. In some cases, these peculiarities are likely related to the specific biology as in the case of *Lachnodacnum* Orchymont, 1937 inhabiting bromeliads in Brazil (Clarkson et al. 2014) or *Coeloctenus* Balfour-Browne, 1939 inhabiting the tidal zone of Lake Victoria (Balfour-Browne 1939). In some genera (e.g., *Phaenonotum* Sharp, 1882 and *Phaenostoma* Orchymont, 1937), new species continue to be discovered by recent faunal inventories (Gustafson and Short 2010, Deler-Hernández et al. 2013), indicating that they are not as species-poor as they currently may appear.

Elocomosta Hansen, 1989 was erected for a single aberrant species of Coelostomatini from the Malaysian province of Sarawak on the island of Borneo, at that time placed in the tribe Sphaeridiini. The genus was transferred to Coelostomatini by Hansen (1991) and remained virtually unknown, with only few series of specimens collected after the description, all from Borneo and all belonging to the type species. It was hence a big surprise when an aberrant coelostomatine species with reduced eyes collected in the Guangxi province of south China was identified as *Elocomosta* using the key by Hansen (1991). It encouraged a detailed comparison of the Chinese species with the type species of *Elocomosta*, which is summarized here.

Material and methods

Two specimens of *Elocomosta nigra* and 12 specimens of the new species have been examined for this study. The holotype and several of the paratypes of the new species were dissected. After eight hours in 10% KOH at room temperature, male genitalia were mounted in glycerol on a piece of transparent plastic pinned below each specimen. Morphological characters and aedeagi were examined with the use of Leica S8APO compound microscope. The external morphology was examined using the Hitachi S-3700N environmental electron microscope at the Department of Paleontology, National Museum in Prague. Habitus photographs were taken using Canon D-550 digital camera with attached Canon MP-E65mm f/2.8 1–5 × macro lens, and subsequently adapted in Adobe Photoshop CS2. Aedeagus photographs were taken with an Axioskop 40, and then stacked using Auto-Montage software. Morphological terminology largely follows Clarkson et al. (2014), the higher-level taxonomic nomenclature follows Hansen (1999) and Short and Fikáček (2011, 2013).

Examined specimens are deposited in the following collections:

NMPC National Museum, Prague, Czech Republic;
SHNU Shanghai Normal University, China;
SYSU Sun Yat-sen University, Guangzhou, China.

Taxonomy

Elocomosta Hansen, 1989

Elocomosta Hansen, 1989: 254.

Type species. *Elocomosta nigra* Hansen, 1989 (by original designation).

Diagnosis. The genus may be easily diagnosed from other coelostomatine genera by the combination of the following characters: antenna with thin, loosely segmented club, maxillary palpomere 2 without apparent distal widening, elytron with ten series of punctures (usually not very apparent among interval punctures) but without sutural stria, prosternum rather long in front of procoxae, mesoventrite with subpentagonal to circular plate with marginal bead, without anepisternal sutures and anteromedian pit, metaventrite very short but with long and wide metaventral process abutting posterior margin of mesoventral plate, abdominal ventrite 1 without median carina and abdominal ventrite 5 without apical emargination and/or group of stout setae.

Elocomosta is easy to distinguish from other Oriental coelostomatine genera by the morphology of the mesoventral plate, which is more or less flat and with a bead along the whole margin. In this it differs from *Coelostoma* Brullé, *Coelofletium* Orchymont, and *Dactylosternum* Wollaston, in which the mesoventral plate is keel- or roof-like and generally of the arrow-head-shape morphology. *Rhachiostethus* Hansen has the mesoventral plate flat, but it is tightly fused to the elevated metaventral keel and lacks the marginal bead. *Dactylostethus* Orchymont bears the mesoventral plate which is very similar to that of *Elocomosta* in the shape and in the presence of the marginal bead, but can be easily distinguished from *Elocomosta* by an extremely short prosternum, elytra without any traces of puncture series, abdominal ventrite 1 with median carina, more compact antennal club and mesoventrite with the anteromedian pit-like depression.

Redescription. Body widely oval, moderately convex. General coloration of dorsum blackish. Body length 2.3–2.9 mm.

Head situated in a deep anterior emargination of pronotum. Frontoclypeal suture indistinct, only partially developed; preocular portion of frons (between eye and frontoclypeal suture) rather wide. Eyes well developed and strongly constricted laterally, or largely reduced. Anterior margin of clypeus without marginal bead. Labrum weakly sclerotized, largely membranous, narrowly to largely exposed in front of clypeus. Gula very narrow, posterior tentorial pits small and inconspicuous, situated close to each other. Postocular ridges strongly developed, reaching behind cardines. Maxilla with transverse cardo and triangular basistipes, basistipes with sparsely arranged long setae; galea large, partly membranous, with pubescence arranged in series; maxillary palpus with four palpomeres, basal palpomere minute, palpomeres 2–3 only indistinctly widened apically, palpomere 4 cylindrical, palpomere 2 the longest, *ca.* 1.5 × longer than palpomeres 3 and 4, palpomeres 3-4 subequal in length. Mentum transverse, slightly widening from base anteriad, lateral sides with series of fine setae, anterior margin bisinuate and with transverse subanterior ridge, surface with sparsely arranged long setae; labial palpus with three palpomeres, palpomere 1 minute, palpomere 2 the longest, *ca.* 1.3 × as long as palpomere 3, bearing subapical fringe of setae, palpomere 2 cylindrical, with subapical setae. Antenna with nine antennomeres; scapus *ca.* twice as long as pedicellus, antennomere 3 thin and *ca.* as long as antennomeres 4–5 combined, antennomeres 4–5 slightly widening distally, cupule (antennomere 6) rather wide distally much wider than antennomere 7, antennomeres 7–9 pubescent, forming a very thin loosely segmented club.

Prothorax. Pronotum transverse, deeply excised on anterior margin, strongly widened posterially; anterior and lateral margin with complete marginal bead, posterior margin without marginal bead; posterolateral corners rectangular to acute, posterior margin nearly straight to slightly concave; sublateral portions of pronotum with minute but distinctly developed trichobothria. Prosternum in front of procoxae rather wide, medially flat, without longitudinal ridge, only with a weak transverse impression along anterior margin; prosternal process hidden below procoxae, hence posterior margin of exposed portion of prosternum widely triangular; anterior margin angulate medially, with fine marginal bead, posterior margin finely beaded; concealed portion of prosternal process slightly widened posterior of procoxae. Procoxal cavities contiguous medially, open posteriorly, anterolateral aperture of procoxae very narrowly open to completely closed. Hypomeron with wide lateral bare portion, divided by a very fine line from median pubescent portion; anteromesal portion with a rather indistinct "antennal groove" defined by a weak ridge.

Pterothorax. Scutellar shield rather small, in shape of equilateral triangle. Elytron with ten longitudinal series of punctures but without sutural stria; scutellar stria not developed. Trichobothria minute but present on alternate elytral intervals; epipleuron wide and horizontal throughout, with wide external bare portion. Punctures of elytral intervals with a characteristic structure of several concentric ridges. Mesothorax with strongly elevate mesoventral plate of elongate subpentagonal to circular shape, margins of the plate with distinct wide marginal bead; posterior margin of the plate widely abutting metaventral process; anepisternal sutures reduced, not visible, anteromedian pit absent. Mesanepimeron rather narrow but long, completely closing mesocoxal cavity laterally. Metaventrite transverse, behind mesocoxae very short, shorter than the length of mesoventrite; median portion with wide and long metaventral process, *ca.* as long as metaventrite between meso- and metacoxae. Posterior margin of mesocoxae with a postcoxal ridge which does not continue to metaventral process. Median portion of metaventrite slightly elevated, with sparse pubescence similar to lateral portions of metaventrite, without surface microsculpture. Posterior half of metaventrite with fine longitudinal median carina. Metanepisternum narrow, *ca.* of the same width throughout, sparsely pubescent, with wide and long posterolateral process contacting abdomen. Apterous species.

Legs rather short, tips of femora not overlapping body outline. Procoxa subglobular, sparsely pubescent; profemur with sharply defined tibial groove; protibia cylindrical, with strong apical spines and a sparse series of lateral spines; protarsus densely pubescent ventrally, protarsomere 1 longest, *ca.* 2 × longer than each subsequent tarsomere.

Mesocoxae rather widely divided from each other by metaventral process, transverse; metacoxae transverse, contiguous medially; meso- and metafemora rather wide basally, with sharply defined tibial grooves in distal half, ventral surface without hydrophobic pubescence, only with sparsely arranged setae; meso- and metatibiae slightly bent outwards, slightly widened distally, with short but stout spines distally and along lateral and mesal faces; meso- and metatarsomere 1 the longest, ca. 1.5–2.0 × as long as tarsomere 2; ventral face with dense pubescence, dorsal face with few isolated long setae.

Abdomen with 5 ventrites, all ventrites without median carina, abdominal apex without emargination or series/group of enlarged setae. All ventrites with dense hydrofuge pubescence.

Elocomosta lilizheni sp. n.

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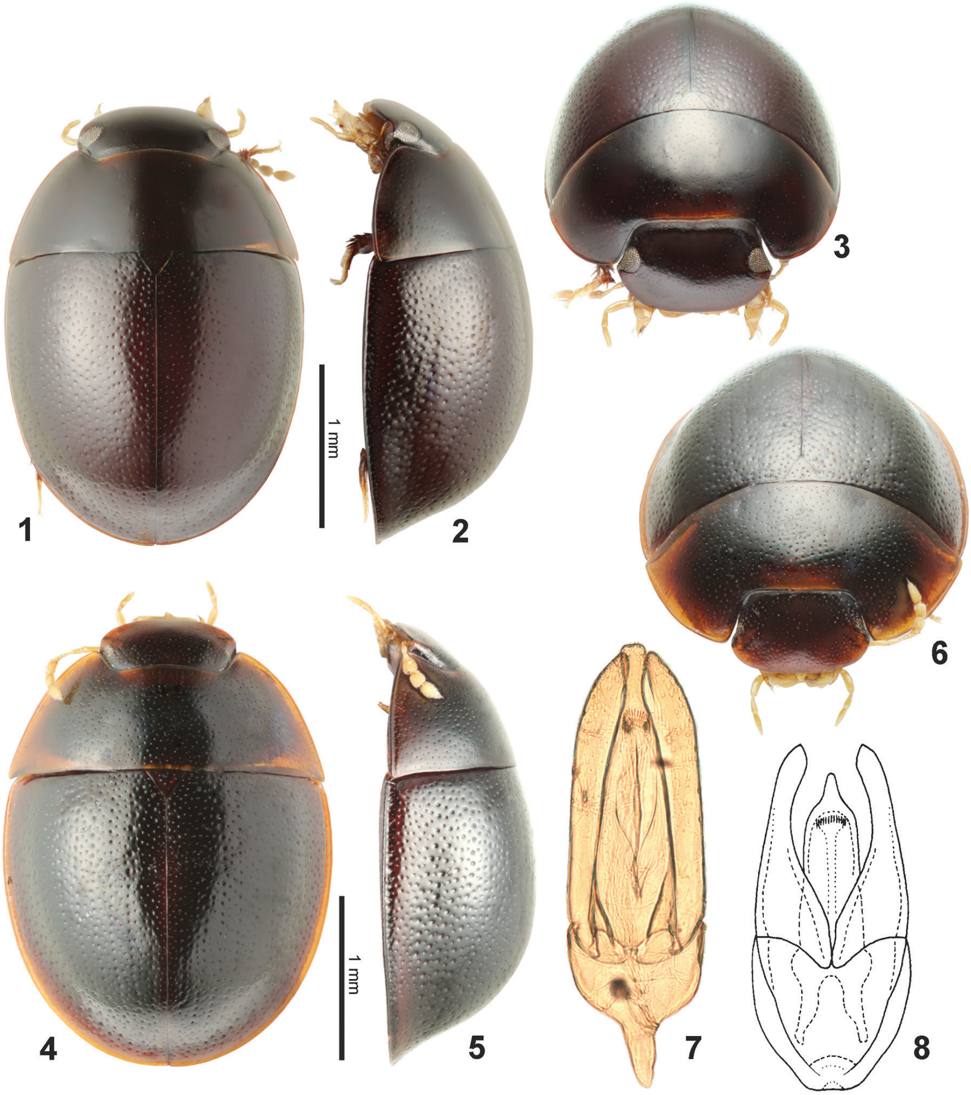
Figs 4–7, 10, 12, 14, 17, 19–20, 23, 25, 27, 29–31, 33

Type material. Holotype: male (SYSU): China, Guangxi, Jinxiu County, Yinshan Conservation Station, 24°10'01"N, 110°14'38"E, beech forest, mixed leaf litter, sifted, 1200 m, 11.vii.2014, Peng, Song, Yu & Yan leg. Paratypes (11 spec., SYSU, SHNU, NMPC): 7 spec.: same information as the holotype; 2 spec.: China, Guangxi, Jinxiu County, 7 km, 24°09'07"N, 110°12'29"E, beech forest, mixed leaf litter, humus, sifted, 1300 m, 16.vii.2014, Peng, Song, Yu & Yan leg.; 2 spec.: China, Guangxi, Jinxiu County, Laoshan Forest Farm, 24°07'02"N, 110°11'51"E, on dead wood with Polypores, caught, 950 m, 26.vii.2014, Peng, Song, Yu & Yan leg.

Diagnosis. Length 2.3–2.7 mm, widely oval. Eyes extremely reduced in size, dorsally eyes divided by distance of ca. 20 × the dorsal width of one eye. Elytra explanate laterally. Mesoventral plate subpentagonal, with strong marginal bead. Profemora without hydrofuge dense pubescence, only with sparsely arranged setae. Parameres gradually narrowing towards apex, rounded at apex. Median lobe a little longer than parameres, gradually narrowing from base, then abruptly wide and swollen subapically.

Description. *Habitus* (Figs 4–6). Body widely oval in dorsal view, moderately convex in lateral view. Length 2.3–2.7 mm (holotype: 2.5 mm), width 1.5–1.9 mm (holotype: 1.8 mm). *Coloration*. Dorsum of head, pronotum and elytron black, with lateral margins of pronotum and elytron, and anterior margin of head reddish yellow (Figs 4, 6). Maxillary palpi and antennae yellow-brown. Venter black, tarsi and mouthparts reddish yellow. *Head*. Clypeus with sparse, moderately coarse punctures, interstices smooth; anterior and lateral marginal portions of clypeus with clear microsculpture. Frons with punctation slightly denser and coarser than on clypeus. Eyes extremely reduced in size, dorsally eyes divided by distance of ca. 20 × the dorsal width of one eye, ventral portion absent. Labrum partly exposed in front of clypeus. Surface of mentum without microsculpture. *Thorax*. Pronotum with punctation consisting of punctures similar to those on frons but more or less sparser; surface between punctures smooth, without microsculpture; posterolateral corners acute, slightly projecting posteriad. Elytra explanate laterally,



Figures 1–8. General habitus and genitalia of *Elocomosta* species. **1–3** *E. nigra* Hansen, 1989, paratype (**1** dorsal **2** lateral **3** frontal view) **4–6** *E. lilizheni* sp. n., paratype (**4** dorsal **5** lateral **6** frontal view) **7–8** aedeagus (**7** *E. lilizheni* sp. n., holotype **8** *E. nigra*, adapted from Hansen (1989).

interval punctation consisting of punctures only slightly coarser than on pronotum; epipleura very wide. Mesoventral plate subpentagonal, ca. 1.2 × as long as wide, with strong marginal bead. Metaventrite short, metaventral process ca. of the same width throughout. Metanepisternum without anterolateral tooth. Profemora without hydrofuge dense pubescence, only with sparsely arranged setae. *Male genitalia.* Parameres ca. 1.9 × as long as phallobase, rather wide subapically, gradually narrowing towards apex, rounded at apex. Phallobase wide, posteriorly bearing long nearly symmetrical manubrium. Median

Table 1. Differences between two known species of *Elocomosta* Hansen.

	Elocomosta nigra **Hansen**	***Elocomosta lilizheni*** **sp. n.**
Coloration	Uniformly black	Black with orange margins of elytra and pronotum
Eyes	Well developed (head hence transverse)	Nearly completely reduced (head hence rather narrow)
Head punctation	Fine and sparse	Coarse and denser
Anterior margin of clypeus	Without microsculpture	With distinct transverse microsculpture
Labrum	Nearly completely concealed by clypeus	Partly exposed in front of clypeus
Punctation of pronotum	Much finer than on elytra	Almost as coarse as on elytra
Posterolateral corner of pronotum	Rectangular	Sharp (projecting more posteriorly)
Profemur	Basal ¾ covered by dense pubescence	Whole surface with sparse pubescence only
Elytron and epipleuron	Not explanate laterally, epipleuron moderately wide	Explanate laterally, epipleuron very wide
Mesoventral plate	Circular, almost as long as wide	Subpentagonal, 1.2 × longer than wide
Metaventral process	Narrowing anteriorly	Nearly parallel-sided
Metanepisternum	With apical lateral tooth	Without apical lateral tooth
Phallobase of the aedeagus	Long, without manubrium	Short, with long manubrium
Median lobe of the aedeagus	Reaching tips of parameres, blunt at apex	Not reaching tips of parameres, acute at apex

lobe a little longer than parameres, gradually narrowing from base, then abruptly wide and swollen subapically; gonopore situated in apical 0.25 of median lobe.

Differential diagnosis. See Table 1.

Etymology. We dedicate the species to Dr. Li-zhen Li, an entomologist at Shanghai Normal University, as thanks for the donation of specimens collected by him.

Biology. All known specimens were collected from terrestrial habitats. Holotype and nine paratypes were collected from mixed leaf litter in beech forest, and two specimens from dead wood with polypores in logging field.

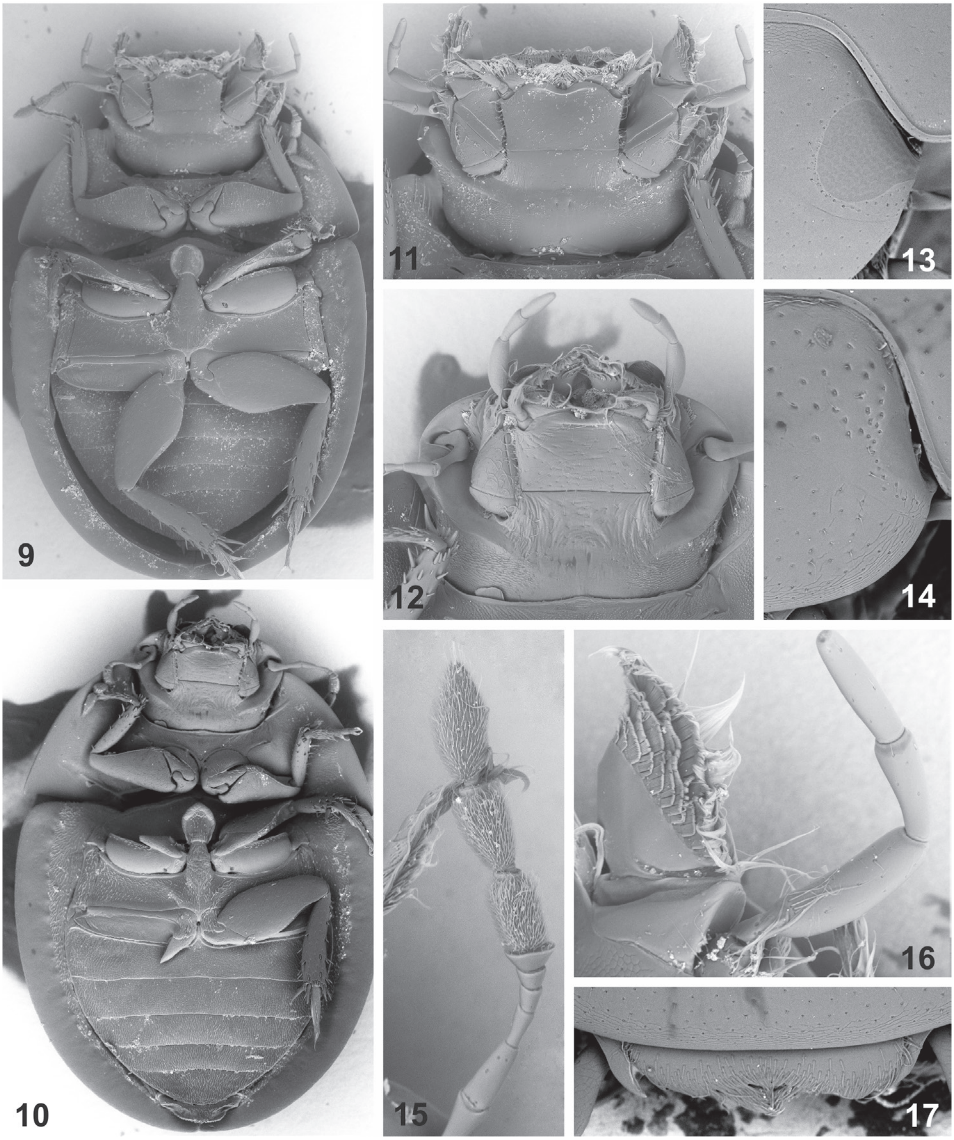
Distribution. China (Guangxi Province).

Elocomosta nigra Hansen, 1989

Figs 1–3, 8–9, 11, 13, 15–16, 18, 21–22, 24, 26, 28, 32

Elocomosta nigra Hansen, 1989: 255.

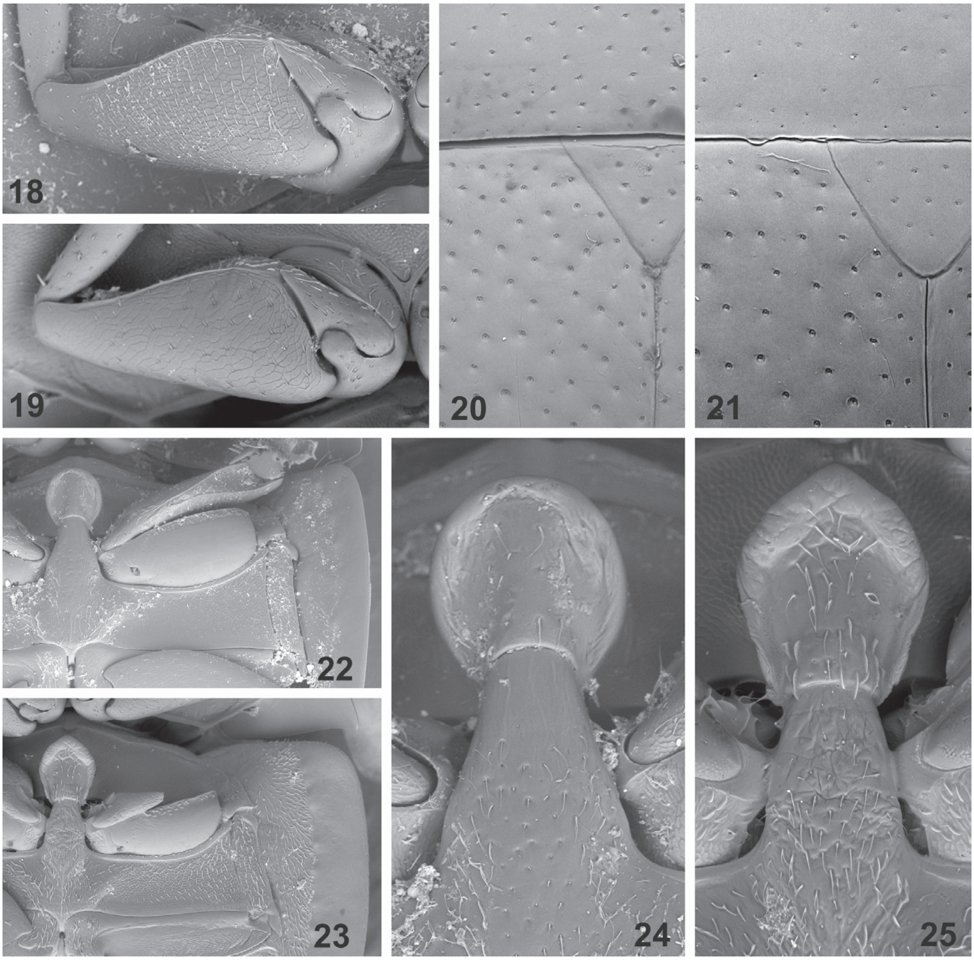
Type material examined. Paratype. 1 female (NMPC): SARAWAK / Semengoh For. / Reserve. 11 mi. / SW Kuching / 1–4.vi.1968 / R. W. Taylor // PARATYPE / Elocomosta / nigra / M. Hansen.



Figures 9–17. External morphology of *Elocomosta* species. **9–10** ventral morphology, general view (**9** *E. nigra* Hansen, 1989 **10** *E. lilizheni* sp. n.) **11–12** head, ventral view (**11** *E. nigra* **12** *E. lilizheni*) **13–14** detail of the ocular region of the head, dorsal view (**13** *E. nigra* **14** *E. lilizheni*) **15–16** head appendages of *E. nigra* (**15** antenna **16** maxillary palpus and galea) **17** anterior margin of head of *E. lilizheni* in dorsal view, showing largely exposed labrum.

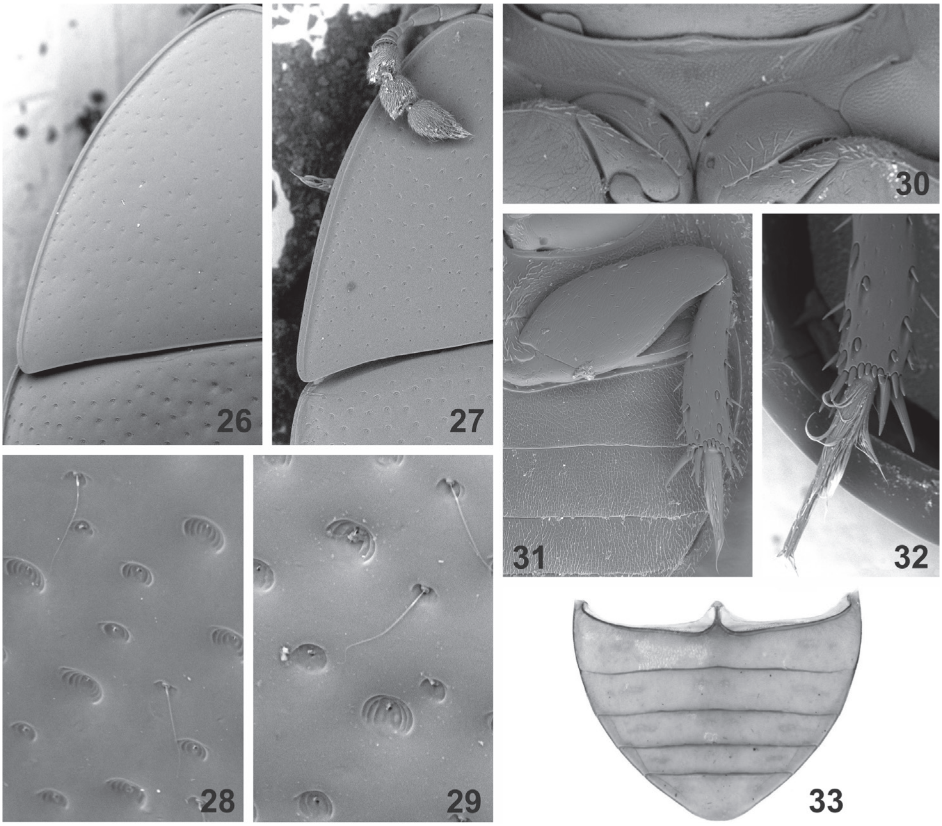
Additional material examined. 1 female (NMPC): BORNEO: Sarawak / Kuching, Santubong / 26.3.1990 / leg. A. RIEDEL.

Redescription. *Habitus*. Body widely oval in dorsal view, moderately convex in lateral view. Length 2.5–2.9 mm, width 1.7–1.9 mm. *Coloration*. Dorsum of head,



Figures 18–25. External morphology of *Elocomosta* species. **18–19** profemur (**18** *E. nigra* Hansen, 1989 **19** *E. lilizheni* sp. n.). **20–21** punctation of pronotum and elytral base (**20** *E. lilizheni* **21** *E. nigra*) **22–23** meso- and metaventral morphology (**22** *E. nigra* **23** *E. lilizheni*) **24–25** details of mesoventral plate and metaventral process (**24** *E. nigra* **25** *E. lilizheni*).

pronotum and elytron uniformly black, margins only very indistinctly and narrowly paler. Maxillary palpi and antennae yellow-brown. Venter black to dark brown, tarsi and mouthparts reddish to reddish yellow. *Head*. Clypeus with sparse and very fine punctures, interstices smooth; anterior and lateral marginal portions of clypeus without microsculpture. Frons with punctation slightly coarser than on clypeus. Eyes well developed, strongly constricted laterally by anterior and posterior projections of frons; dorsal portion large, dorsally eyes divided by distance of 4.4 × the dorsal width of one eye, ventral portion small. Labrum nearly completely concealed by clypeus. Surface of mentum without microsculpture. *Thorax*. Pronotum with very fine and sparse punctation, punctures slightly smaller than on frons; surface between punctures smooth, without



Figures 26–33. External morphology of *Elocomosta* species. **26–27** lateral portion of pronotum (**26** *E. nigra* Hansen, 1989 **27** *E. lilizheni* sp. n.). **28–29** details of elytral punctation and trichobothria (**28** *E. nigra* **29** *E. lilizheni*) **30** prosternum of *E. lilizheni* **31–32** posterior leg (**31** *E. lilizheni* **32** *E. nigra*) **33** abdomen of *E. lilizheni*.

microsculpture; posterolateral corners rectangular, not projecting posteriad. Elytra not explanate laterally, interval punctation consisting of punctures coarser than on pronotum; epipleura moderately wide. Mesoventral plate circular, ca. as long as wide, with distinct but narrow marginal bead. Metaventrite short, metaventral process wide at base, narrowing anteriad. Metanepisternum with anterolateral tooth. Profemora with hydrofuge dense pubescence in basal 0.8. *Male genitalia*. Parameres ca. 1.4 × as long as phallobase, narrowly parallel-sided subapically, pointed at apex. Phallobase wide and long, posteriorly without manubrium. Median lobe a little longer than parameres, but with basal portion deeply inserted into phallobase, nearly parallel-sided below gonopore, apically abruptly narrowed into pointed apex; gonopore situated subapically.

Biology. Terrestrial species, part of type series was collected from rainforest leaf litter (Hansen 1989). No biology data are available on locality labels in the specimens examined by us.

Distribution. Endemic to Borneo (Sarawak State, Malaysia).

Discussion

The new species of *Elocomosta* is very unusual in Hydrophilidae due to its extremely reduced eyes. The examination using the scanning electron microscope revealed that the eye is not reduced completely, as it may appear from an observation under a stereomicroscope, but that the eye is extremely reduced in size, with only few ommatidia recognizable. Interestingly, it seems that not only the eye itself is reduced in size, but that the whole lateral portion of the head is reduced, which is best seen when the relative widths of the heads are compared between *E. nigra* and *E. lilizheni* sp. n. (compare Figs 3 and 6). This is unique among known Hydrophilidae, as in all known cases of eye reduction, the shape of the head remained unaffected or nearly so.

The reduction of eye size is commonly observed in the Sphaeridiinae, probably in relationship with the cryptic leaf-litter life style of the majority of the members of the subfamily. Reduced eye size was observed for example in some species of the megasternine genera *Motonerus* Hansen and *Oosternum* Sharp (Fikáček and Short 2006, Fikáček and Hebauer 2009) and seems to be frequently correlated with the reduction of the hind wings: in both aforementioned genera reduced eyes were observed in micropterous or apterous species. In case of *Elocomosta*, both *E. nigra* with well-developed eyes and *E. lilizheni* sp. n. with extremely reduced eyes are apterous. Moreover, the extent of eye reduction observed in *E. lilizheni* is not comparable to any other known member of the Sphaeridiinae, which may indicate not only flightlessness but also some other reasons which may be responsible for the eye reduction; a specialized lifestyle would be a possible candidate. For example, the loss of eyes was recently discovered in larvae of the myrmecophilous genus *Sphaerocetum* Fikáček which live inside of the nest of the *Crematogaster* + *Camponotus* ants, likely in its pupal and larval chambers (Fikáček et al. 2015). However, the collecting circumstances of *E. lilizheni* sp. n. do not conclusively indicate any highly specialized lifestyle nor an association with ants.

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RESEARCH ARTICLE

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A new species of *Monocheres* Stock (Copepoda, Siphonostomatoida, Asterocheridae) from shallow waters off Florida, USA: an unexpected discovery

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Abstract

The rare asterocherid copepod genus *Monocheres*, ectosymbionts of corals and sponges, contains only two species, one from Mauritius (Indian Ocean) and the other one from Brazil (western Atlantic). From the analysis of the digestive caecum contents of the benthic hesionid polychaete *Hesione picta* Müller, 1858, an adult female of an undescribed species of *Monocheres* was unexpectedly recovered; it is the third species of this rare asterocherid genus. The new species, *M. sergioi* **sp. n.**, has the distinctive reduction of the fifth leg as a process with a single seta. It differs from its two other congeners by several characters including the presence of an inner basipodal spine, the armature details of the third exopodal segment of leg 1, the shape of the cephalosome and pedigerous somites 3 and 4, and the ornamentation of the postero-lateral corners of the genital double-somite. The main synapomorphies include the presence of spinules along the posterior margin of the first leg coxal sclerite and the reduced, spiniform coxal seta on leg 4. The biology and feeding habits of the polychaete containing this specimen suggests that the copepod was ingested as an ectosymbiont from sponges or coral but it is also possible that it was consumed from an ophiurid echinoderm. This finding allows an expansion of the genus geographical distribution in the northwestern Atlantic. A key to the species of *Monocheres* is also provided.

Keywords

Associated copepods, hesionid polychaetes, interstitial, taxonomy

Introduction

The copepod family Asterocheridae Giesbrecht, 1899 includes a highly diverse group of associated forms that have been recorded as ectosymbionts from a wide array of benthic invertebrates, including sponges, corals, ascidians, echinoderms, bryozoans, and mollusks (Boxshall and Halsey 2004). The type genus, *Asterocheres* Boeck, 1859 is clearly the most speciose in the family, and has more than 100 species (Kim 2010; Walter and Boxshall 2016). Several of the smallest asterocherid genera include only one or a few species that are rarely found. One of these groups is *Monocheres* Stock, 1966; it contains only two species. The first one, *M. mauritianus* Stock, 1966 was described from specimens obtained from corals collected in Mauritius, Indian Ocean (Stock 1966). More than 30 years later, a second species (*M. cagarrensis* Johnsson & Bustamante, 1997) was described from sponges in Brazilian islands off Rio de Janeiro (Johnsson and Bustamante 1997). This is a very unusual asterocherid genus, whose distinctive character is the strongly reduced fifth leg, represented by a papilla-like process fused to the pediger lateral margin and armed with a single distal seta (Stock 1966).

During a biological survey of the benthic invertebrates in the Florida Keys, benthic polychaetes of the genus *Hesione* were obtained. The taxonomical analysis of the genus includes the morphology of the enteric caeca, elongate internal sac-like structures. During the examination of dissected caeca of an individual of *H. picta* Müller, 1858, both a nereid polychaete and surprisingly, a copepod were found. The specimen was given to me for taxonomic analysis resulting in the identification of an undescribed species of *Monocheres*. In this report this specimen is described in full and compared with the other two known species of the genus; a key for the identification of the species of *Monocheres* is also provided.

Methods

The polychaete from which the copepod was extracted was obtained by hand during sampling dives in shallow littoral areas off Long Key, Florida Keys, Florida. The copepod specimen was transferred to glycerol and lightly stained with Methylene Orange for taxonomical analysis. The specimen was observed and analyzed in whole and then dissected with sharpened needles; the appendages were examined as temporary mounts in glycerin and later sealed with Entellan® as permanent mounts. Drawings were prepared using a camera lucida mounted on an E-200 Nikon compound microscope with Nomarski DIC at magnifications of 400 and 1000×. Terminology of the body parts and appendages followed Huys and Boxshall (1991); abbreviations used in this work are: EXP = exopod, ENP = endopod. Body length of the copepod was measured from the anterior margin of the rostrum to the posterior margin of the caudal rami. The polychaete and the copepod are deposited in the collection of the Florida Museum of Natural History (FLMNH).

Results

Order Siphonostomatoida Thorell, 1859
Family Asterocheridae Giesbrecht, 1899
Genus *Monocheres* Stock, 1966

***Monocheres sergioi* sp. n.**
http://zoobank.org/7FE268B2-295E-4317-8657-716A6EF50478

Material examined. Holotype. One adult female from a digestive caecum (Fig. 1A) of the hesionid polychaete *Hesione picta* Müller, 1858 (see Hartman, 1959) (UF 1594, KEYS-0778) collected in Monroe County, Florida Keys, Long Key, LONF1 tower dive site, W of Florida Keys Marine Laboratory (24.844N, 80.864W), at depth of 2 m, by Gustav Paulay. Body length of polychaete 28 mm long, 5 mm wide, 16 chaetigers (Fig. 1B, C).

Diagnosis. Asterocherid with reduced fifth leg, represented by low protuberance armed with single distal seta. Genital double-somite with acute chitinous projection on posterolateral corners. Pediger 1 with posterolateral corners rounded, not produced, pediger 3 with posterior margin weakly curved. Anal somite with crenulated posterior margin. First segment of antennary endopod shorter than basis. Coxal sclerite with spinules. Coxal seta on leg 4 reduced, spiniform, third exopod of leg 4 with four spines, shorter than segmental width.

Description of adult female holotype. Total body length from anteriormost end of cephalosome to posterior margin of caudal rami: 998 µm. Body (Fig. 2A) robust, with broad, rounded prosome, body widest at first pedigerous somite, slightly flattened dorsoventrally. Length ratio of prosome/ urosome = 2.2. First pedigerous somite with leg 1 completely fused to cephalosome. Pedigerous somites gradually tapering posteriorly. Pedigerous somite 4 narrowest, partially covered by third pedigerous somite in dorsal view. Posterolateral corners of pedigerous somites 1–3 rounded, lacking processes. Fifth pedigerous somite wider than fourth. Urosome 254 µm long, with three somites, genital double-somite 170 µm long barrel-shaped, slightly longer than wide, representing 67% of urosome (Fig. 2B). Genital openings located dorsolaterally, at widest section of somite, with adjacent row of short setules and low, rounded integumental expansion. Postero-lateral corners of genital double-somite smooth. Preanal somite subrectangular, 45 µm long, slightly shorter than succeeding anal somite (51 µm), both ornamented with spinules on lateral margin. Caudal rami 43 µm long, slightly shorter than anal somite; armed with 6 setae. Innermost terminal seta 130 µm, outermost terminal seta 185 µm, inner dorsal seta 134 µm, outer dorsal seta 167 µm, two long, relatively thicker median terminal setae, outer 315 µm and inner seta 338 µm.

Antennule (Fig. 2C) 392 µm long, excluding setae; 19-segmented. Segmentation (between brackets), segmental homologies (Roman numerals), and setation (s=setae, ae= aesthetascs) as follows: (1)I-2s, (2)II-2s, (3)III-2s, (4)IV-2s, (5)V-2s, (6)VI-2s, (7)VII-2s, (8)VIII-2s, (9)IX-XIII-7s, (10)XIV-2s, (11)XV-2s, (12) XVI-2s, (13)XVII-2s, (14)XVIII-2s, (15)XIX-0, (16)XX-2s, (17)XXI-ls+ae, (18)XXII-XXIII-1s, (19)XXIV-XXVIII-8.

Figure 1. Specimen of *Hesione picta* Müller containing the copepod *Monocheres sergioi* sp.n. from off Long Key, Florida. **A** habitus, dorsal view **B** dissected digestive caecum. Scale bars: **A** = 5 mm, **B** = 1 mm. Photograph **A** by FLMNH-IZ team, **B** by Sergio Salazar-Vallejo.

Antenna (Fig. 2D) with slender, elongate basis carrying short, 1-segmented exopod and long, well-developed endopod. EXP longer than wide, armed with one long seta. ENP1 slightly shorter than basis. ENP2 armed with 1 seta, ENP3 longer than second, armed with short seta and stout, slightly curved terminal claw.

Oral cone (Fig. 2I) with usual structure of asterocherids, produced into siphon-like distal portion, reaching insertion of leg 1.

Mandible (Fig. 2E) consisting of long, slender stylet and 2-segmented palp, bearing 2 unequal apical setae; palp segments ornamented with setules.

Maxillule (Fig. 2F) bilobed, consisting of short, narrow outer lobe, armed with 4 subequally long distal setae, and wider, medially inflate and longer inner lobe, ornamented with row of short setules, bearing 4 long and 1 short pinnate setae.

Maxilla (Fig. 2G) two-segmented, including short subrectangular proximal syncoxa and distal elongate basis, longer than proximal segment, with row of small spinules proximally. Distally curved basipodal claw ornamented with spinules.

Maxilliped (Fig. 2H) consisting of syncoxa, subrectangular basis and 4-segmented endopod; syncoxa unarmed, basis with minute inner seta and row of short spinules on distal outer margin. ENP segments armed with 1, 1, 0, and 1 setae, respectively; terminal claw thick, weakly curved.

Legs 1– 4 (Fig. 3A–D) biramous, all rami 3-segmented. Coxal sclerites subrectangular, with posterior margins smooth except for leg 1, with row of +10 spinules (arrowed in Fig. 3A). Coxae of legs 1–4 with inner coxal seta; in leg 4 seta reduced, repre-

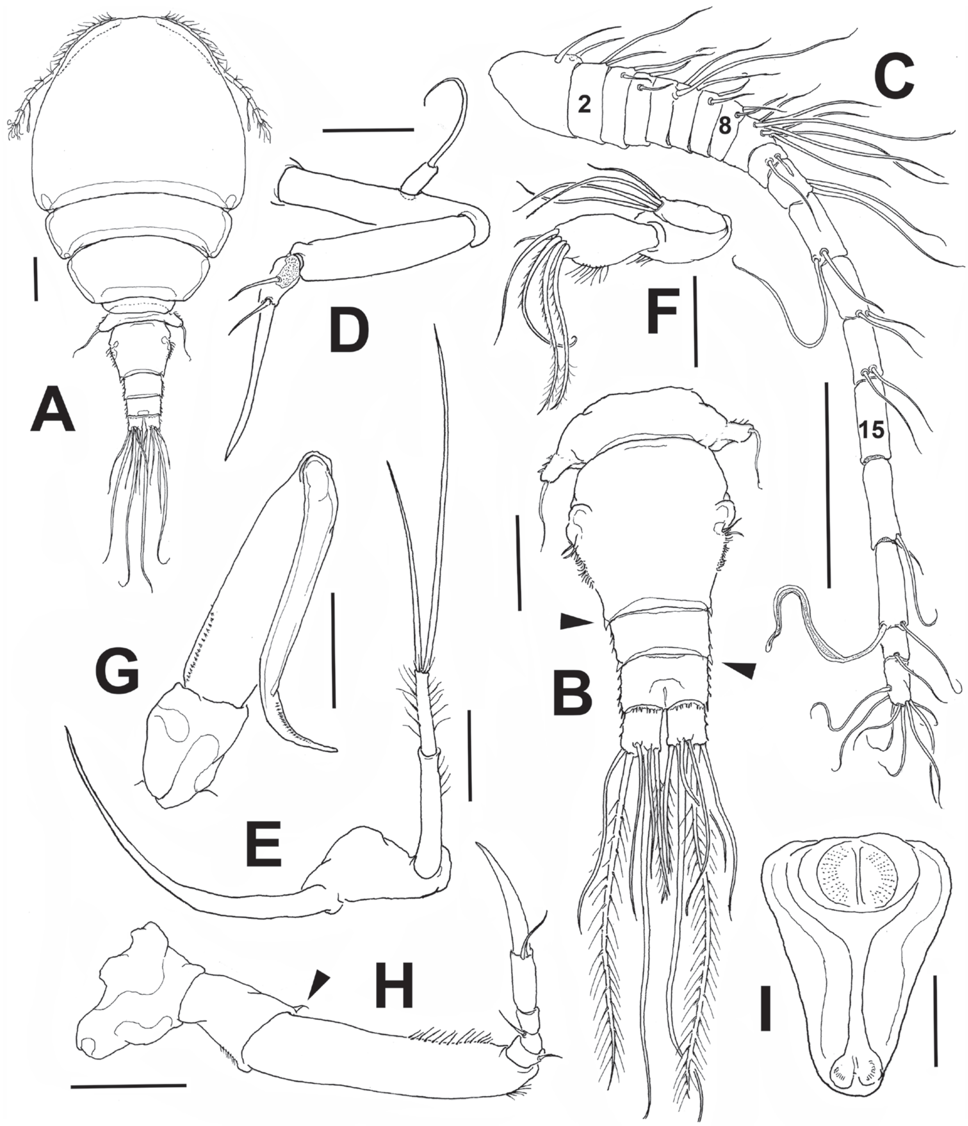

Figure 2. *Monocheres sergioi* sp. n. from Florida. Holotype female. **A** habitus, dorsal view **B** fifth pedigerous somite and urosome, dorsal view **C** antennule **D** antenna **E** mandible **F** maxillule **G** maxilla **H** maxilliped with minute basal seta arrowed **I** oral cone, ventral view. Scale bars: **A–C** = 100 µm, **D–F, I** = 20 µm, **G, H** = 50 µm.

sented by short spiniform element (Fig. 3D). Legs 1–4 with outer basipodal seta; leg 1 bearing short, stout inner basipodal seta. Leg 1 with row of small spinules along inner margin of basis. Outer spine on first exopodal segment of leg 1 strong, with curved tip, reaching insertion of proximalmost spine of third exopodal segment. Medial spine on leg 1 EXP3 being 1.5 times as long as other two spines on same segment (arrowed in

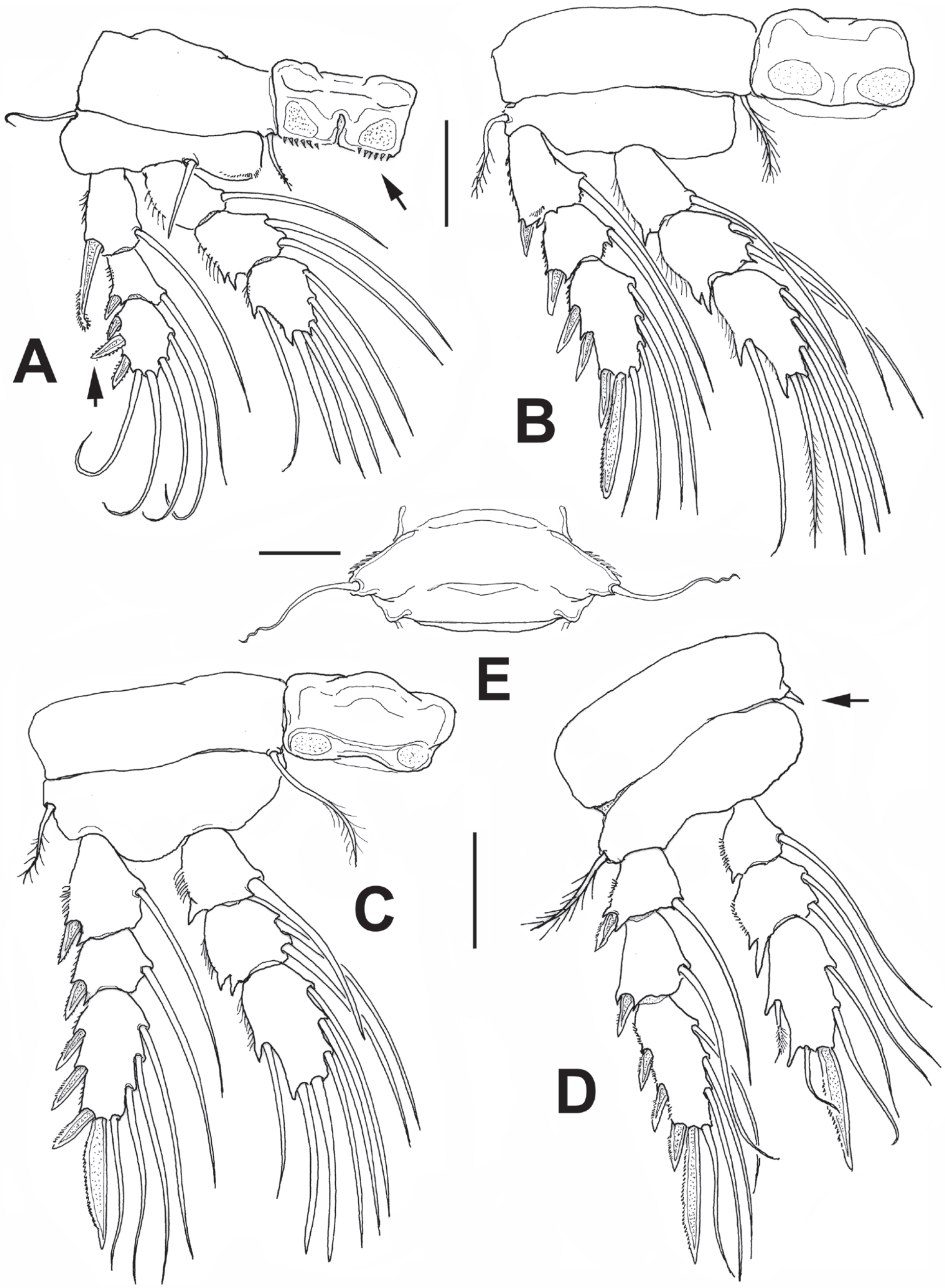

Figure 3. *Monocheres sergioi* sp. n. from Florida. Holotype female. **A** leg 1 **B** leg 2 **C** leg 3 **D** leg 4 **E** fifth pedigerous somite showing reduced fifth leg, ventral view. Scale bars: **A–E** = 50 µm.

Fig. 3A). ENP2 of legs 1–4 with bifurcate projections at outer distal corner; projection longest in leg 4. Leg 4 with reduced outer seta on third endopodal segment.

Spine and setal armature of legs 1–4 as follows:

Table 1. Table1.

Leg	coxa	basis	exopod	endopod
1	0-1	I-1	I-1; I-1;III,1,3	0-1;0-2; 1,2,3
2	0-1	0-1	I-1; I-1; III,I1,3	0-1; 0-2; 1,2,3
3	0-1	0-1	I-1; I-1; III,I1,3	0-1; 0-2; 1,2,3
4	0-I	0-1	I,1; I-1; III,I1,3	0-1; 0-2; 1,1I,2

Leg 5 (Figs. 2A, 3E): strongly reduced, fused to somite; represented by rounded lateral expansion ornamented with row of 6–7 spinules, armed with slender, smooth distal seta, 70 µm long.

Male. Unknown.

Type locality. Long Key, Florida Keys, Monroe County, Florida, USA (24.844N, 80.864W).

Etymology. The new species is named after Dr. Sergio Salazar Vallejo, senior researcher at El Colegio de la Frontera Sur, for his valuable contributions to the taxonomy and diversity of tropical benthic polychaetes and for finding the copepod specimen herein described.

Habitat. The benthic polychaete containing the copepod, *H. picta*, is a widespread species distributed in the western Atlantic Ocean from Florida to Brazil. Locally, it was found in rubble/ sand / seagrass bottom of the type locality. The original host of the copepod remains unknown.

Remarks. The specimen examined was identified as a species of *Monocheres* by its possession of a reduced fifth leg, represented by a papilla-like process arising directly from the somite and armed with a single distal seta. All other characters resemble those known in members of *Asterocheres* (Stock 1966; Kim 2010). The new species can be distinguished from the two other species of the genus, *M. mauritianus* and *M. cagarrensis*, by several differences, as presented in Table 1. Some of the characters used by Johnsson and Bustamante (1997) to compare *M. mauritianus* and *M. cagarrensis* were not included in this analysis because they rely on the accuracy of the observation and even different drawing styles, like the serrate projection of the second exopodal segment of leg 1 or the presence/absence of denticles on the first and second endopodal segments of all swimming legs. Instead, other characters that were deemed stronger were added, like the lack of an inner basipodal spine in *M. cagarrensis* and the presence of spinules along the posterior margin of the coxal sclerite of leg 1. The main apomorphies include the presence of spines along the posterior margin of the first leg coxal sclerite, the shape of the cephalosome, and the reduced, spiniform coxal seta on leg 4. The differences presented in Table 1 serve to clearly distinguish the three species of this genus.

The new species was described based on a single specimen; this is not unusual among the asterocherid copepods; the type species of *Monocheres*, *M. mauritianus*, was also described on a single female specimen collected from the cauliflower coral

Table 1. Comparison of characters of three species of *Monocheres.* Based on Johnsson & Bustamante (1997), Stock (1966), and present data.

	M. mauritianus	*M. cagarrensis*	*M. sergioi* sp. n.
Pediger 1	posterolateral corners produced, angular	posterolateral corners produced, angular	posterolateral corners not produced, rounded
Pediger 3	posterior margin straight	posterior margin straight	posterior margin weakly curved
Postero-lateral corners of genital double-somite	without processes, rounded	with group of denticles	with acute chitinous projection
Genital openings	with protuberant papilla-like chitinous process and two setae	with cluster of short setules	with low rounded process, two setae and row of setules
Postero-lateral corners of preanal somite	without denticle	with denticle	with denticle
First segment of antennary endopod	shorter than basis	longer than basis	shorter than basis
Exopodal seta of antenna	short	long	long
terminal antennary claw/ first endopodal segment length ratio	1.0	1.5	1.0
Preanal/anal somites length ratio	0.85	1.4	1.0
Posterior margin of anal somite	smooth	smooth	with crenulated hyaline fringe
Inner basipodal spine on leg1	present	absent	present
Posterior margin of leg 1 coxal sclerite	smooth	smooth	with spinules
Coxal seta on leg4	normal	normal	reduced, spiniform
Number of spines on EXP3 of leg 4	3	4	4
Exopodal spines on legs 1-4	shorter than segmental width	longer than segmental width	shorter than segmental width
Exopodal spines on EXP3 of leg 1	distalmost longest	equally long	medial longest
Length of outer lateral seta on ENP3 of leg4	no data available	reaching well beyond distal end of segment	barely reaching distal end of segment

Pocillophora damicornis (L.). This is the third species described in *Monocheres* after its description 50 years ago; there was a 31 year period between the description of the first one, *M. mauritianus*, and the finding of *M. cagarrensis* in Brazil; almost 20 years later a third species was unexpectedly found as described herein.

Ecological comments. Because of the peculiar circumstances by which this specimen was recovered, it is difficult to determine the nature of its association with any of the local benthic invertebrate groups. The associations of asterocherid copepods take place with different invertebrate taxa and the host remains unknown for many species, but asterocherids have not been reported as symbionts of polychaetes (Boxshall and Halsey 2004; Bandera and Huys 2008). These copepods are all ectosymbionts except for *Collocherides astroboae* Stock, 1971, living as an endosymbiont in the stomach of ophiurids. Hence, it is assumed that the hesionid polychaete *H. picta*, usually living under rocks, consumed this copepod as a prey or among portions of its food, possibly from sclerobiotic sponges or coral. The copepod remained in the digestive chamber for some time before the fixation of the polychaete and thus, some structures or muscles were expected to be damaged but they were not; the specimen (not an exuvia) was in good condition for taxonomical analysis. It is likely that this individual remained in the caecum for a short time before the polychaete was collected and preserved.

It is interesting to note that *H. picta* has been recorded in association with ophiurids living under rocks (De Assis et al. 2012). There are more than 20 known species of asterocherid copepods which are ectosymbiotic in ophiurids, including species of *Asterocheres*, *Collocheres* Canu, 1863, *Collocherides* Stock, 1971, and *Ophiurocheres* (Humes, 1988) (Humes 1998; Doignon et al. 2004), which supports the alternative notion that this copepod was possibly consumed by the polychaete directly from an ophiurid during this hypothetical symbiosis. Hence, the original host of this copepod remains unknown but it is expected that this finding will motivate new observations on these associations involving ophiurids and copepods in the region. A similar situation was reported by Kolbasov et al. (2007); they described a new species of a facetotectan crustacean larva from specimens found together with other food items in the gut of a fish, but in this case the larva is deemed as free-living, with no indication of a symbiotic behaviour.

Other members of the genus *Monocheres* have been known from corals and sponges and only from islands (Stock 1966; Johnsson and Bustamante 1997); this is also the case in the new species, found in the Florida Keys. It is speculated that both isolation and habitat specialization could have a role in the divergence of this genus, with a striking reduction of the fifth leg that strongly diverges from the main asterocherid pattern.

Key to the species of *Monocheres*

1	Posterolateral corners of cephalosome with angular corners posteriorly produced, leg 1 without inner basipodal spine, posterolateral corners of genital double-somite with cluster of denticles ....***M. cagarrensis* Johnsson & Bustamante, 1997**
–	Posterolateral corners of cephalosome with angular corners rounded or not posteriorly produced, leg 1 with inner basipodal spine, posterolateral corners of genital double-somite smooth or with chitinous projection and setae **2**
2	Coxal sclerite of leg 1 with smooth posterior margin; coxal seta of normal attributes; distalmost spine on leg 1 third exopodal segment longest................ ....***M. mauritianus* Stock, 1966**
–	Coxal sclerite of leg 1 with spinules along posterior margin; coxal seta reduced, spiniform, medial spine on leg 1 third exopodal segment longest....... ....***M. sergioi* sp. n.**

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My gratitude to Gustav Paulay, Curator of Invertebrates at the Florida Museum of Natural History (FLMNH), who collected the hesionid polychaete (and the copepod in it), kindly granted the specimen for examination, and provided the necessary field and sampling data to complete this contribution. Sergio Salazar-Vallejo (ECOSUR-Chetumal) also provided photographs of the caecum containing the copepod and valuable comments about the polychaete species' identity, behavior, and habitat.

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Two new species and one newly recorded species of *Uloma* Dejean, 1821 from Zhejiang, China (Coleoptera, Tenebrionidae, Ulomini)

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Abstract

Two new species of the genus *Uloma* Dejean, 1821, *Uloma fengyangensis* **sp. n.** and *Uloma acrodonta* **sp. n.**, are described and figured from Zhejiang Province of China. *Uloma bonzica* Marseul, 1876 is recorded from China for the first time. A key to the known *Uloma* species from Zhejiang of China and a list of *Uloma* species from China are provided.

Keywords

China, new species, taxonomy, Tenebrionidae, *Uloma*

Introduction

The tenebrionid genus *Uloma* was established by Dejean (1821) based on *U. culinaris* (Linnaeus, 1758) from Germany. *Uloma* includes more than 200 described species that are widely distributed in nearly all zoogeographical regions of the Old and New World and is particularly speciose in the tropics (Schawaller 2015). There are 34 species of the genus recorded in China presently. They were described by Wiedemann (1821), Hope (1831), Fairmaire (1882), Gebien (1914), Kaszab (1941a, 1941b, 1954, 1980), Nakane (1968), Masumoto (1982), Masumoto and Nishikawa (1986), Ren and Liu (2004), Ren and Yin (2004), Liu and Ren (2007, 2008, 2013) and Liu et al. (2007).

Two new species of *Uloma*, *Uloma fengyangensis* sp. n. and *Uloma acrodonta* sp. n., were collected from Mt. Fengyangshan in Zhejiang Province of China. *Uloma bonzica* Marseul, 1876, a species newly recorded from China, was also sampled at the same locality. The two new species are described and figured in this paper, and a dorsal habitus of the new record is also presented. In order to help with the identification of the *Uloma* species from Zhejiang, a key to its species known from Zhejiang Province is provided.

Materials and methods

The terminology of morphological structures follows that of Schawaller (1996) and Matthews and Bouchard (2008). The photographs were taken with a Leica M205A stereomicroscope equipped with a Leica DFC 450 digital microscope camera. All measurements were made in millimetres. The types and other examined specimens are deposited in the Museum of Hebei University (Baoding, China; MHBU), the Muséum National d'Histoire Naturelle (Paris, France; MNHN) and the National Museum of Nature and Science (now in the Masumoto Collection, Tokyo, Japan; NMNS).

Taxonomy

***Uloma fengyangensis* sp. n.**
http://zoobank.org/8251A721-A6B7-43A7-AB48-8461A4477DE4
Figs 1A, 2

Type material. Holotype, ♂ (MHBU), labelled "25 July 2007; China, Zhejiang, Longquan County, Mt. Fengyangshan; H. Y. Liu and Z. H. Gao lgt.; the Museum of Hebei University" (white, rectangular, printed, in Chinese); "Holotype; *Uloma fengyangensis* sp. n. Liu & Ren det. 2015" (red, rectangular, printed and handwritten).

Diagnosis. The new species is characterized by the following: mentum broadly cordate, with several short medial hairs and a pair of semi-circular hairy patches on near lateral margins; antennomere 5–10 sublinearly truncate, with one long groove on each inner side; pronotum with a pair of low protuberances on lateral margins and posterior margin of anterior impression respectively; metatarsomere 1 significantly longer than 4; apicale of aedeagus with a shallow depression on centre at basel 1/3, parallel–sided at apical 2/3 in dorsal view.

Description. Male (Fig. 1A). *Head* transverse, with small punctures in apical half, and with sparse large punctures in basal half. Labrum trapezoidal, sparsely punctate, scattered with long and yellow hairs. Clypeus densely and distinctly punctate, anterior margin weakly emarginate, slightly elevated with two small ridges. Frontoclypeal suture deeply impressed. Genae slightly convex and extended, temples reduced. Eyes transverse, with at least 3–4 facets at narrowest point in lateral view; distance between

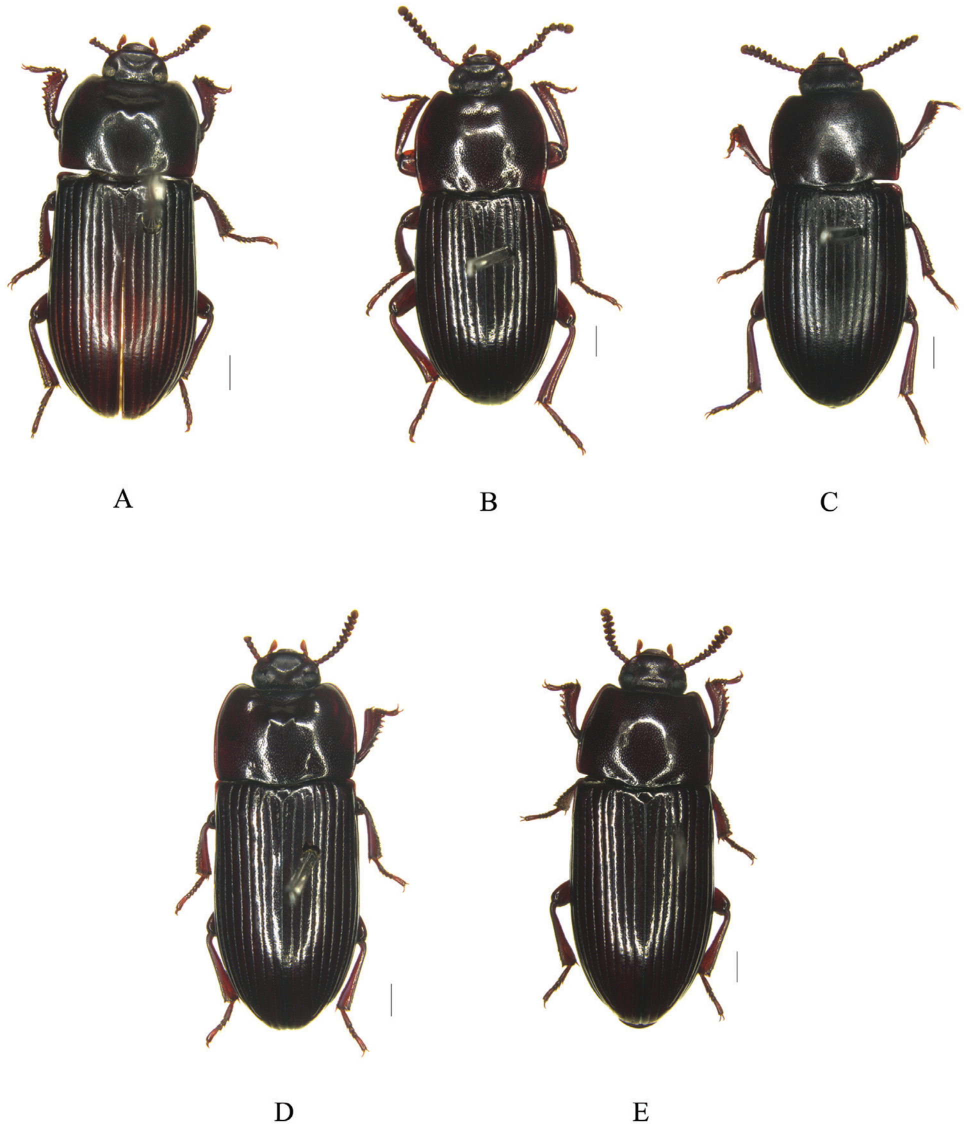

Figure 1. Habitus, dorsal view. **A** *Uloma fengyangensis* sp. n., male **B** *Uloma acrodonta* sp. n., male **C** *Uloma acrodonta* sp. n., female **D** *Uloma bonzica* Marseul, 1876, male **E** *Uloma bonzica* Marseul, 1876, female. Scale bars 1 mm.

eyes approximately 2.7 times longer than their diameter. Frons weakly convex but depressed on centre, with large punctures. Mentum (Fig. 2C) broad cordate, weakly emarginate at anterior margin, slightly concave with several short medial hairs, with a pair of semi-circular hairy patches on external sides. Ligula (Fig. 2C) deeply emarginate anteriorly, depressed in the middle with sparse long hairs. Terminal maxillary palpomere somewhat knife-shaped. Antennae (Fig. 2A) long, reaching to the middle of pronotum; antennomere 1 thick, 2 very short, 3 long and narrow, 4 short, 5 - 10 gradually widening, forming a more or less distinct club, 8–10 extremely transverse, nearly rectangular, 11 transverse-oval; 5–10 sublinearly truncate with one long groove at each innerside (Fig. 2B); ratio of the length (and the width) of antennomeres 2–11 as follows (mm): 8 (10): 9 (10): 7 (12): 7.5 (15): 7.5 (16): 8 (18): 8 (20): 9 (22): 9 (21): 12 (19).

Pronotum (Fig. 2D) transverse, nearly 1.5 times as wide as long, widest at middle, with small punctures widely spaced on centre and becoming denser toward sides, with reticulate microsculptures. Pronotum with a small and deep anterior impression and a pair of low protuberances on both sides and posterior margin of impression respectively, and with a shallow groove in the middle of posterior margin. Anterior margin emarginate with narrow border only at both apices, without border in the middle 1/3, and with dense short hair fringes. Lateral margins arcuate, strongly narrowing forward and less so from widest point to base, with narrow border. Basal margin slightly convex, with a pair of oblique shallow impressions. Anterior angles subrectangular, posterior angles obtuse. Prosternum with dense large and partly confluent punctures, posternal process (Fig. 2E) rounded in lateral view, smoothly descended at apex, with sparse small punctures centrally. Propleuron with long wrinkles and large confluent punctures.

Scutellum subtriangular, with very sparse small punctures. Elytra nearly parallel–sided; elytra distinctly punctato–striate, punctures of elytral rows small and only somewhat broader than stripes; intervals slightly convex, distinctly and sparsely punctate with several transverse wrinkles, lateral margins visible only at humeri in dorsal view. Hind wings developed.

Protibia (Fig. 2F) with two equal apical spurs; slightly concave, narrow at base, then strongly and gradually explanate on both inner and outer edges; inner edge weakly emarginate at base, slightly protruding to inner apex, fringed with yellow short hairs becoming denser and longer toward apex; outer edge with 8–9 sharp denticulations at apical 3/4 scattered with short hairs; dorsal surface with a long depression near apex and large sparse and confluent punctures; ventral surface with a row of several small sharp protuberances and short sparse hairs. Mesotibia feebly and gradually expanding toward apex, outer edge with small denticles and sparse long hairs. Metatibia feebly and gradually expanding toward apex, outer edge with sparse long hairs. Length ratios of metatarsomeres (Fig. 2G) 1 to 4 as follows: 35: 9: 9: 28.

Abdominal ventrites finely densely punctate, punctuation larger and subcontiguous towards lateral portions.

Aedeagus (Fig. 2H–I) with basale subparallel–sided; apicale slender, gradually narrowing with a shallow depression on centre at basel 1/3, parallel–sided at apical 2/3, truncate at apex in dorsal view, with a longitudinal depression on centre in ventral view, slightly curved in lateral view.

Female. Unknown.

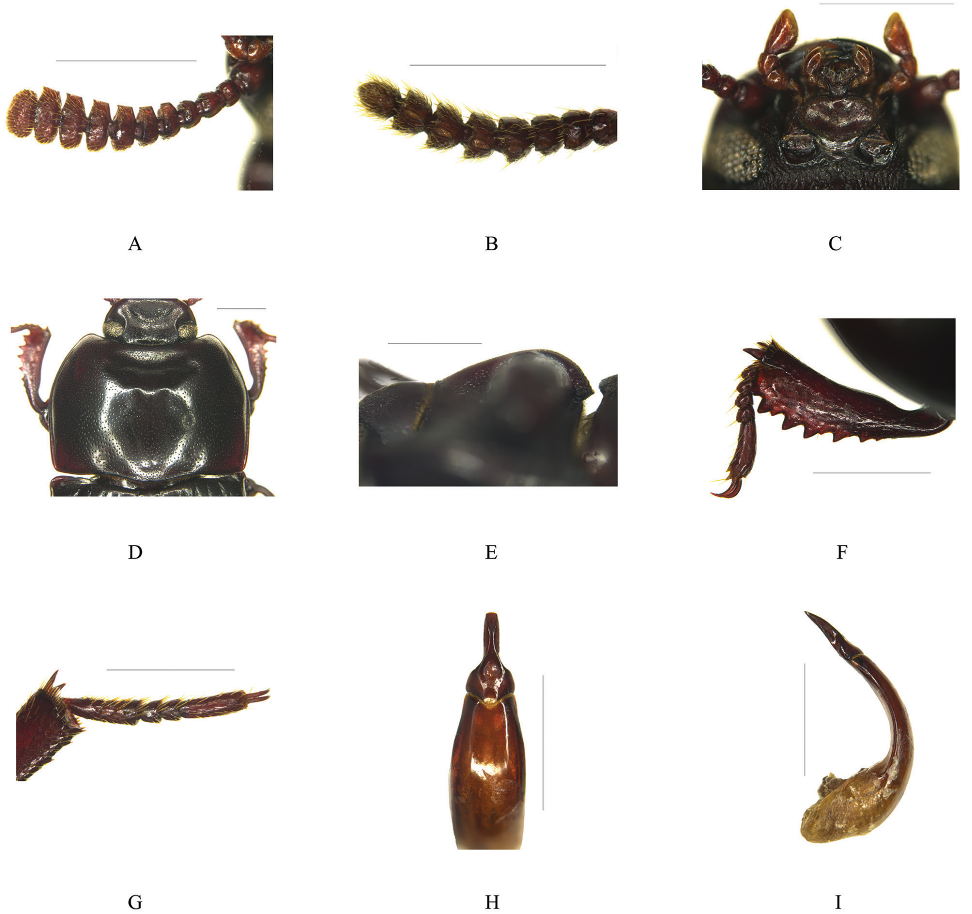

Figure 2. *Uloma fengyangensis* sp. n., male. **A** Antenna, ventral view **B** Antennomere 5 to 10, lateral view **C** Ligula and mentum, ventral view **D** Pronotum, dorsal view **E** Posternal process, lateral view **F** Protibia, dorsal view **G** Metatarsus, dorsal view **H** Apicale of aedeagus, dorsal view **I** Aedeagus, lateral view. Scale bars 1 mm.

Body length: 11.0 mm; elytral width at widest point: 4.5 mm.

Etymology. The species epithet refers to the Mt. Fengyangshan where the species was collected.

Remarks. The new species is similar to *Uloma reticulata* Liu, Ren & Wang, 2007, but can be distinguished from the latter by the following characters: (1) male mentum broadly cordate, slightly concave with several short medial hairs, with a pair of semicircular hairy patches on near lateral margins in the new species (subhexagonal, with cordate convex in middle, without hairy patch in *U. reticulata*); (2) male antennomere 5–10 sublinearly truncate, with one long groove on each inner side in the new species (5–9 sublinearly truncate with one long groove in *U. reticulata*); (3) male pronotum with a pair of low protuberances on lateral margins and posterior margin of anterior impression respectively, anterior angles subrectangular in the new species (anterior impression of pronotum without protuberance in *U. reticulata*); (4) male metatarsomere 1 significantly longer than 4 in the new species (1 almost as long as 4 in *U. reticulata*); (5) apicale of aedeagus gradually narrowing with a shallow depression on centre at basel 1/3, parallel–sided at apical 2/3 in dorsal view in the new species (gradually narrowing from base to apex, then slightly widening nearly apex in *U. reticulata*).

Uloma acrodonta sp. n.

http://zoobank.org/BA19A5DB-F014-4EAF-A958-33C507E5491A
Figs 1B–C, 3

Type material. Holotype, ♂, labelled “19 July 2012; China, Zhejiang, Longquan County, Mt. Fengyangshan; X. Wang and J. Jiao lgt.; the Museum of Hebei University” (white, rectangular, printed, in Chinese). Paratypes, 1♂1♀, labelled as holotype. All types have additional label “Holotype (and Paratype, respectively), *Uloma acrodonta* sp. n. Liu & Ren det. 2015” [red (and Paratype with yellow, respectively), rectangular, printed and handwritten], and all of them are deposited in MHBU.

Diagnosis. The new species is characterized by the following: clypeus slightly elevated with two small ridges; antennomeres 5 and 7 obviously sharply protruding at inner border; pronotum with a small and shallow anterior impression; protibia broader, with 8–9 sharp large denticulations at apical 2/3 of outer edge; last ventrite with a shallow impression.

Description. Male (Fig. 1B). *Head* nearly hexagonal, with dense small punctures in apical half, and with dense large punctures in basal half. Labrum trapezoidal, sparsely punctate, scattered with long yellow hairs. Clypeus densely and finely punctate, anterior margin weakly emarginate, slightly elevated with two small ridges. Frontoclypeal suture deeply impressed. Genae slightly convex and extended, temples reduced. Eyes transverse, with at least 2–3 facets at narrowest point in lateral view; distance between eyes approximately 3.5 times longer than their diameter. Frons convex but slightly depressed on centre, with large coarse punctures. Mentum (Fig. 3B) cordate, truncate basally, weakly emarginate at anterior margin, flat with fine transverse wrinkles in middle, with a pair of crescent-shaped hairy patches on external sides. Ligula (Fig. 3B) deeply emarginate anteriorly, depressed in middle with sparse long hairs. Terminal maxillary palpomere knife-shaped. Antennae (Fig. 3A) long, reaching to the middle of pronotum; antennomere 1 thick, 2 very short and subquadrate, 3 slender, 4 short, 5–10 gradually widening, forming a more or less distinct club, 11 semi-spherical; 5, 7 obviously sharply protruding at inner border; ratio of the length (and the width) of antennomeres 2–11 as follows: 8.5 (9): 18 (12.5): 12 (12.5): 11 (16.5): 11 (16): 11 (20.5): 11 (18): 10.5 (18): 10.5 (18): 15 (17.5).

Pronotum (Fig. 3C) slightly transverse, subquadrate, nearly 1.2 times as wide as long, widest at middle, with sparse small punctures widely spaced on centre and be-

Figure 3. *Uloma acrodonta* sp. n., male. **A** Antenna, ventral view **B** Ligula and mentum, ventral view **C** Pronotum, dorsal view **D** Posternal process, lateral view **E** Protibia, dorsal view **F** Metatarsus, dorsal view **G** Metatibia, dorsal view **H** Last ventrite, ventral view **I** Hind wing, dorsal view **J** Apicale of aedeagus, dorsal view **K** Aedeagus, lateral view. Scale bars 1 mm.

coming denser toward sides. Pronotum with a small and extremely shallow anterior impression without protuberances. Anterior margin emarginate with narrow border only at both apices, without border in the middle 1/3, and with dense short hair fringes. Lateral margins arcuate, strongly narrowing forward and less so from widest point to base, with broad border. Basal margin slightly convex. Anterior angles sharp, posterior angles rectangular. Prosternum with sparse and large punctures, posternal process (Fig. 3D) rounded in lateral view, smoothly descended at apex, with coarse transverse wrinkles and two rows of short yellow hairs on centre. Propleuron with long wrinkles and large punctures. Metasternum very short.

Scutellum subtriangular, with sparse and small punctures. Elytra nearly parallel–sided; elytra distinctly punctato–striate, punctures of elytral rows small and only somewhat broader than stripes; intervals slightly convex, distinctly and sparsely punctate with several transverse wrinkles, lateral margins visible only at humeri in dorsal view. Hind wing (Fig. 3I) vestigial, narrow, and short.

Protibia (Fig. 3E) with two equal apical spurs; nearly straight, narrow at base, then feebly and gradually explanate on both inner and outer edges; inner edge weakly emarginate at base, distinctly protruding to inner apex, fringed with yellow short hairs becoming denser and longer toward apex; outer edge with 8–9 sharp denticulations at apical 2/3 scattered with short hairs; dorsal surface with a long depression near apex and large sparse and not confluent punctures; ventral surface with a row of several small sharp protuberances and short sparse hairs. Mesotibia feebly and gradually expanding toward apex, outer edge with small denticles and sparse short hairs. Metatibia (Fig. 3G) slightly curved, feebly and gradually expanding toward apex, outer edge smooth without denticles and hairs. Length ratios of metatarsomeres (Fig. 3F) 1 to 4 as follows: 46: 10: 9.5: 32.

Abdominal ventrites finely and densely punctate, punctuation larger and subcontiguous towards lateral portions; last ventrite (Fig. 3H) with a very shallow impression.

Aedeagus (Fig. 3J–K) with basale parallel–sided; apicale broad at base, then gradually feebly narrowing towards apex, subparallel–sided near apical, truncate and semicircularly depressed at apex in dorsal view, with a longitudinal depression on centre in ventral view, slightly curved in lateral view.

Female (Fig. 1C). Mentum subcordate, with V-shaped convex on centre, without hair. Clypeus without ridges. Antennomere not protruding to inner border. Pronotum without anterior impression. Protibia with shape similar to that of male, inner edge not protruding to inner apex. Metatibia straight. Last ventrite without impression.

Body length: 12.5–13.0 mm; elytral width at widest point: 4.5 mm.

Etymology. The species epithet refers to the sharply protruding at inner border of antennomere 5 and 7.

Remarks. The new species is most similar to *Uloma quadratithoraca* Liu & Ren, 2008, but can be distinguished from the latter by the following characters: (1) male clypeus slightly elevated with two small ridges in the new species (without ridge in *U. quadratithoraca*); (2) male antennae long, reaching to the middle of pronotum, antennomeres 5 and 7 obviously sharply protruding at inner border in the new species (5 and 7 not protruding in *U. quadratithoraca*); (3) male pronotum with a small and shallow anterior impression in the new species (without anterior impression in *U. quadratithoraca*); (4) male protibia distinctly broader, with 8–9 sharp large denticulations at apical 2/3 of outer edge in the new species (narrower, with 8–9 undulant denticulations at apical 1/2 in *U. quadratithoraca*); (5) male last ventrite with a shallow impression in the new species (without impression in *U. quadratithoraca*).

Moreover, five additional species (*U. intriconicula* Liu, Ren & Wang, 2007, *U. metogana* Ren & Yin, 2004, *U. takagii* Masumoto & Nishikawa, 1986, *U. rubripes rubripes* (Hope, 1831) and *U. rubripes minor* Gebien, 1914) are known to occur in China and its surrounding areas with antennomere 5 and 7 obviously sharply protruding at inner border. The new species is easily distinguished from them based on shape differences in the male pronotum, pronotal anterior impression, protibia, metatibia, ridges of clypeus, and whether or not the pronotal anterior impression exists in female.

Uloma bonzica Marseul, 1876

Fig. 1D–E

Uloma bonzica Marseul, 1876: 114; Nakane 1956: 36; Masumoto and Nishikawa 1986: 24; Löbl et al. 2008: 302.
Uloma bonzica robustior Nakane, 1956: 167.

Material examined. Types, 1♂1♀ (MNHN, the Marseul Collection), Nzgzzalli. Others: 1♂1♀ (MHBU), China, Zhejiang, Longquan County, Mt. Fengyangshan, 25 July 2007, H. Y. Liu and Z. H. Gao lgt.; 2♂♂1♀ (NMNS), Fujitani Iga-Ueno, Mie, 3 November 1984, K. Ishida lgt.

Description. Male (Fig. 1D). Mentum subhexagonal, slightly emarginate at anterior margin, with V-shaped convex and fine transverse wrinkles in the middle, without hair. Ligula depressed in the middle with dense hairs and hairy area wide. Antennae reaching to basal 1/3 of pronotum; antennomere 11 nearly semi-spherical. Pronotum nearly 1.5 times as wide as long, widest at basal 1/3; pronotum with a small deep anterior impression and a pair of low protuberances on both sides and posterior margin of impression respectively. Protibia with two unequal apical spurs, inner edge nearly straight at base, distinctly protruding to inner apex; outer edge with 7–8 sharp denticulations at apical 2/3; dorsal surface with large, dense and confluent punctures. Female (Fig. 1E) ligula with dense hairs and hairy area wide, pronotum without anterior impression, last ventrite without apical groove.

Remarks. The Chinese specimens almost conform to the original description by Marseul (1876), but body length (11.7 mm) is slightly longer than that of the specimens from Japan (10.6 mm), and also the ratio of the distance between the eyes versus their diameter (*ca*. 2.5) less than that of the specimens from Japan (*ca*. 2.8). However, we think these two characters as intraspecific differences.

Distribution. China: Zhejiang (new record); Japan (Marseul 1876, Gebien 1940, Nakane 1956, Masumoto and Nishikawa 1986, Kwon and Choi 1986, Löbl et al. 2008); Korea (Masumoto and Nishikawa 1986, Kwon and Choi 1986, Löbl et al. 2008).

Key to known species of the genus *Uloma* from Zhejiang Province of China

1	Male protarsomere 3 with a lobed protuberance (fig. 6b, in Gebien 1914). China (Zhejiang, Guangxi, Taiwan), Himalayas, Oriental Region, Afrotropical Region	***U. polita* (Wiedemann, 1821)**
–	Male protarsus normal, protarsomere 3 without protuberance	**2**
2	Male ligula with dense hairs and hairy area wide (fig. 25, in Masumoto and Nishikawa 1986)	**3**
–	Male ligula with several sparse long hairs (Fig. 2C)	**4**
3	Inner edge of male protibia strongly and rather abruptly emarginate at base; last ventrite of female with a deep apical groove (figs 34–35, in Masumoto and Nishikawa 1986). China (Zhejiang, Guangxi, Hainan, Fujian, Taiwan), Oriental Region	***U. excisa excisa* Gebien, 1914**
–	Inner edge of male protibia nearly straight at base; last ventrite of female without apical groove (fig. 24, in Masumoto and Nishikawa 1986). China (Zhejiang), North Korea, South Korea, Japan	***U. bonzica* Marseul, 1876**
4	Male antennomere 5 and 7 obviously sharply protruding at inner border; metasternum very short; hind wings vestigial, narrow and short (Fig. 3A, I). China (Zhejiang)	***Uloma acrodonta* sp. n.**
–	Male antennomere 5 and 7 not protruding at inner border	**5**
5	Male mentum without hair; antennomere 5–9 sublinearly truncate with several long grooves at each innerside; aedeagus with particular shape, apicale extremely slender (figs 58 and 61–63, in Masumoto and Nishikawa 1986). China (Zhejiang, Fujian, Taiwan)	***U. fukiensis* Kaszab, 1954**
–	Male mentum with a pair of semi-circular hairy patches on external sides; antennomere 5–10 sublinearly truncate with one long groove at each inner side (Figs 2A–2C). China (Zhejiang)	***U. fengyangensis* sp. n.**

List of *Uloma* species from China

(1) *Uloma acrodonta* sp. n.
China: Zhejiang.

(2) *Uloma bonzica* Marseul, 1876
China: Zhejiang (new record). Korea (Masumoto and Nishikawa 1986; Kwon and Choi 1986; Löbl et al. 2008); Japan (Marseul 1876; Gebien 1940; Nakane 1956; Masumoto and Nishikawa 1986; Kwon and Choi 1986; Löbl et al. 2008).

(3) *Uloma castanea* Ren & Liu, 2004
China: Yunnan (Ren and Liu 2004; Löbl et al. 2008; Liu and Ren 2013); Guangxi (Liu and Ren 2007; Löbl et al. 2008); Henan, Anhui, Chongqing, Sichuan, Guizhou, Fujian (Liu and Ren 2013).

(4) *Uloma compressa* Liu & Ren, 2008

China: Yunnan (Liu and Ren 2008; Liu and Ren 2013); Hunan, Sichuan, Guizhou, Guangxi, Guangdong, Taiwan (Liu and Ren 2013).

(5) *Uloma contortimargina* Liu & Ren, 2007

China: Hunan, Yunnan, Guizhou (Liu and Ren 2013); Guangxi (Liu and Ren 2007; Liu and Ren 2013).

(6) *Uloma contracta* Fairmaire, 1882

China: Yunnan, Guangxi, Hainan (Liu and Ren 2007; Löbl et al. 2008; Liu and Ren 2013). Malaysia (Schawaller 2000); Indonesia (Fairmaire 1882; Gebien 1913; Gebien 1940; Schawaller 2000; Liu and Ren 2007; Liu and Ren 2013); Philippines (Gebien 1913; Gebien 1921); Oriental Region (Löbl et al. 2008).

(7) *Uloma excisa excisa* Gebien, 1914

China: Zhejiang (Ba and Ren 2009); Guangxi (Liu and Ren 2007; Löbl et al. 2008); Hainan (Löbl et al. 2008); Fujian (Kaszab 1954; Löbl et al. 2008); Taiwan (Gebien 1914; Gebien 1940; Masumoto and Nishikawa 1986; Löbl et al. 2008; Akita and Masumoto 2015); SE China (Akita and Masumoto 2015). Vietnam (Kaszab 1980; Masumoto and Nishikawa 1986; Akita and Masumoto 2015); Korea (Kim and Kim 2004); Japan (Nakane 1956; Akita and Masumoto 2015); Oriental Region (Löbl et al. 2008).

(8) *Uloma fengyangensis* sp. n.

China: Zhejiang.

(9) *Uloma formosana* Kaszab, 1941

China: Taiwan (Kaszab 1941; Masumoto and Nishikawa 1986; Löbl et al. 2008).

(10) *Uloma fukiensis* Kaszab, 1954

China: Zhejiang (Fang and Wu 2001; Ren and Dong 2001; Ba and Ren 2009); Fujian (Kaszab 1954; Löbl et al. 2008); Taiwan (Masumoto and Nishikawa 1986; Löbl et al. 2008).

(11) *Uloma gongshanica* Ren & Liu, 2004

China: Yunnan (Ren and Liu 2004; Löbl et al. 2008; Liu and Ren 2013); Hubei, Guizhou, Fujian, Taiwan (Liu and Ren 2013).

(12) *Uloma hirticornis* Kaszab, 1980

China: Yunnan (Kaszab 1980; Liu and Ren 2013). Vietnam (Kaszab 1980).

(13) *Uloma integrimargina* Liu & Ren, 2007

China: Guangxi (Liu and Ren 2007).

(14) *Uloma intricornicula* Liu, Ren & Wang, 2007
China: Guangxi (Liu and Ren 2007); Fujian (Liu et al. 2007).

(15) *Uloma kondoi* Nakane, 1968
China: Fujian (Liu et al. 2007). Japan (Nakane 1968; Masumoto and Nishikawa 1986; Liu et al. 2007; Löbl et al. 2008).

(16) *Uloma liangi* Ren & Liu, 2004
China: Yunnan (Ren and Liu 2004; Löbl et al. 2008; Liu and Ren 2013); Anhui, Chongqing, Sichuan, Guizhou, Fujian (Liu and Ren 2013).

(17) *Uloma longolineata* Liu & Ren, 2007
China: Guangxi (Liu and Ren 2007).

(18) *Uloma meifengensis* Masumoto, 1982
China: Taiwan (Masumoto 1982; Masumoto and Nishikawa 1986; Löbl et al. 2008).

(19) *Uloma metogana* Ren & Yin, 2004
China: Tibet (Ren and Yin 2004; Liu and Ren 2013); Yunnan (Liu and Ren 2013); Guangxi (Liu and Ren 2007; Liu and Ren 2013).

(20) *Uloma minuta* Liu, Ren & Wang, 2007
China: Henan, Anhui, Hunan, Sichuan, Yunnan, Guangdong (Liu and Ren 2013); Guangxi (Liu and Ren 2007); Fujian (Liu et al. 2007).

(21) *Uloma miyakei* Masumoto & Nishikawa, 1986
China: Taiwan (Masumoto and Nishikawa 1986; Löbl et al. 2008).

(22) *Uloma mulidenta* Ren & Liu, 2004
China: Yunnan (Ren and Liu 2004; Löbl et al. 2008; Liu and Ren 2013); Chongqing, Guizhou (Liu and Ren 2013).

(23) *Uloma nakanei* Masumoto & Nishikawa, 1986
China: Taiwan (Masumoto and Nishikawa 1986; Löbl et al. 2008).

(24) *Uloma nanshanchica* Masumoto & Nishikawa, 1986
China: Taiwan (Masumoto and Nishikawa 1986; Löbl et al. 2008).

(25) *Uloma nomurai* Masumoto, 1982
China: Taiwan (Masumoto 1982; Masumoto and Nishikawa 1986; Löbl et al. 2008).

(26) *Uloma polita* (Wiedemann, 1821)
China: Zhejiang (Fang and Wu 2001; Ren and Dong 2001); Guangxi (Liu and Ren 2007; Löbl et al. 2008); Taiwan (Miwa 1931; Gebien 1940; Masumoto and Ni-

shikawa 1986; Schawaller 1996; Löbl et al. 2008). India (Gebien 1912; Miwa 1931; Gebien 1940; Masumoto and Nishikawa 1986; Schawaller 1996; Löbl et al. 2008); Sri Lanka (Walker 1858; Miwa 1931; Masumoto and Nishikawa 1986; Schawaller 1996); Nepal (Schawaller 1996; Löbl et al. 2008); Bhutan (Kaszab 1975; Schawaller 1996; Löbl et al. 2008); Bangladesh (Wiedemann 1821); Burma (Gebien 1912; Masumoto and Nishikawa 1986; Schawaller 1996); Thailand (Schawaller 1996); Laos (Gebien 1912); Vietnam (Gebien 1912; Kaszab 1980; Schawaller 1996); Indonesia (Miwa 1931; Gebien 1940); Japan (Masumoto and Nishikawa 1986; Schawaller 1996; Löbl et al. 2008); Madagascar (Fairmaire 1903; Gebien 1940; Masumoto and Nishikawa 1986; Schawaller 1996; Schawaller 2015); Mauritius (Gebien 1940; Masumoto and Nishikawa 1986; Schawaller 1996; Schawaller 2015); Rodriguez Islands (Schawaller 1996; Schawaller 2015); Himalayas (Schawaller 1996); Oriental Region (Löbl et al. 2008; Schawaller 2015); Afrotropical Region (Löbl et al. 2008).

(27) *Uloma quadratithoraca* Liu & Ren, 2008
China: Hunan (Liu and Ren 2008).

(28) *Uloma reitteri* Kaszab, 1941
China: Sichuan (Kaszab 1941b; Löbl et al. 2008).

(29) *Uloma reticulata* Liu, Ren & Wang, 2007
China: Fujian (Liu et al. 2007).

(30) *Uloma rubripes rubripes* (Hope, 1831)
China: Taiwan (Miwa 1931; Löbl et al. 2008). India (Gebien 1940; Schawaller 1996; Schawaller 2000; Löbl et al. 2008); Nepal (Hope 1831; Gebien 1927; Schawaller 1996; Löbl et al. 2008); Bhutan (Kaszab 1975; Schawaller 1996; Löbl et al. 2008); Thailand (Gebien 1927; Schawaller 1996); Vietnam (Fairmaire 1893; Kaszab 1980); Malaysia (Schawaller 1996; Schawaller 2000); Indonesia (Fabricius 1801; Miwa 1931; Fairmaire 1882; Gebien 1914; Gebien 1927; Schawaller 1996; Schawaller 2000); Philippines (Gebien 1921; Gebien 1940; Schawaller 2000); New Guinea (Gebien 1940; Schawaller 2000); Himalayas (Schawaller 1996; Schawaller 2000); Oriental Region (Löbl et al. 2008); Australian Region (Löbl et al. 2008).

(31) *Uloma sauteri* Kaszab, 1941
China: Taiwan (Kaszab 1941a; Masumoto and Nishikawa 1986; Löbl et al. 2008).

(32) *Uloma splendida* Ren & Liu, 2004
China: Yunnan (Ren and Liu 2004; Löbl et al. 2008; Liu and Ren 2013); Guizhou (Liu and Ren 2013).

(33) *Uloma takagii* Masumoto & Nishikawa, 1986
China: Taiwan (Masumoto and Nishikawa 1986; Löbl et al. 2008).

(34) *Uloma tsugeae* Masumoto, 1982
China: Taiwan (Masumoto 1982; Masumoto and Nishikawa 1986; Löbl et al. 2008).

(35) *Uloma valgipes* Liu & Ren, 2013
China: Yunnan (Liu and Ren 2013).

(36) *Uloma versicolor* Ren & Liu, 2004
China: Yunnan (Ren and Liu 2004; Löbl et al. 2008; Liu and Ren 2013); Guizhou (Liu and Ren 2013).

(37) *Uloma zhengi* Liu & Ren, 2007
China: Guangxi (Liu and Ren 2007).

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RESEARCH ARTICLE

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Revision of the genus *Ptomaphagus* Hellwig (Coleoptera, Leiodidae, Cholevinae) from Japan

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Abstract

After examining Japanese material of *Ptomaphagus* Hellwig from various collections, a new species is described, *P.* (s. str.) *piccoloi* **sp. n.**, and a new subjective synonym proposed, *P.* (s. str.) *kuntzeni* Sokolowski, 1957 = *P.* (s. str.) *amamianus* Nakane, 1963, **syn. n.**, in this paper. Relevant morphological characters of examined species of *Ptomaphagus* are illustrated with colour plates, and known distributions are mapped.

Keywords

Leiodidae, Cholevinae, *Ptomaphagus*, taxonomy, new species, new synonyms, Japan

Introduction

Ptomaphagus Hellwig, 1795 is the most speciose genus (including 136 known species) in the tribe Ptomaphagini (Coleoptera, Leiodidae, Cholevinae). However, the nominotypical subgenus, which is limited to the Palaearctic and north Oriental regions has only 28 species (Perreau 2000, Nishikawa 2011).

In the fauna of Japan, only three species in the subgenus *Ptomaphagus* s. str. had been recorded before this study, namely *P.* (s. str.) *sibiricus* Jeannel, 1934, *P.* (s. str.) *kuntzeni* Sokolowski, 1957 and *P.* (s. str.) *amamianus* Nakane, 1963.

However, when we examined specimens previously identified as *Ptomaphagus* (s. str.) *kuntzeni* and *P.* (s. str.) *amamianus* from various collections, we found there are no differences at the specific level between them. After examining both holotypes, a new subjective synonym is proposed: *P.* (s. str.) *kuntzeni* Sokolowski, 1957 = *P.* (s. str.) *amamianus* Nakane, 1963, syn. n. Moreover, examined specimens previously identified as *P.* (s. str.) *sibiricus* from Japan are conspicuously different to the holotype of *P.* (s. str.) *sibiricus* which was described from Vladivostok, Russia (Jeannel 1934). Therefore, a new species from Japan is described and illustrated here: *P.* (s. str.) *piccoloi* sp. n. The dubious occurrences of *P.* (s. str.) *kuntzeni* in Myanmar and *P.* (s. str.) *sibiricus* in Japan, as well as several new island records, and the bionomics of the two species are briefly discussed in this paper. Relevant morphological characters of examined species of *Ptomaphagus* are illustrated with colour plates, and known distributions are mapped.

Material and methods

Specimens were relaxed and softened in a hot saturated solution of potassium hydroxide for 4 minutes (for mounted dry specimens) or 8 minutes (for alcohol-preserved specimens), and then transferred to distilled water to rinse the residual potassium hydroxide off and stop any further bleaching. The softened specimens were moved into glycerin and dissected there to observe morphological details. After examination, the body parts were mounted on a glass slip with Euparal Mounting Medium for future studies. Habitus photographs were taken using a Canon macro photo lens MP-E 65mm on a Canon 550D. Observations, photographs and measurements of morphological details were performed using an Axio Zoom.V16 motorized stereo zoom microscope with an AxioCam MRc 5 in Beijing, or an Olympus BX53 microscope with an Olympus DP73 in Prague. The final deep focus images were created with Helicon Focus 5.3 stacking software in Beijing or Zerene Stacker 1.04 in Prague. The program Adobe Photoshop CS6 was used for post processing. Exact label data are cited for all specimens examined. Authors' remarks and addenda are placed in square brackets, separate label lines are indicated by a slash (/) and separate labels by a double slash (//). Measurements are mean values based on 5 specimens.

The material examined for this study is deposited in the following collections and museums:

BMNH Natural History Museum (formerly British Museum), London, United Kingdom (M. Barclay)
CCBW Collection of Cheng-Bin Wang, Chengdu, China
CHHF Collection of Hideto Hoshina, Fukui University, Fukui, Japan
CJRZ Collection of Jan Růžička, Prague, Czech Republic
CMNE Collection of Masaaki Nishikawa, Ebina, Japan
CMPR Collection of Michel Perreau, Paris, France

CPJA Collection of Paweł Jałoszyński, Wrocław, Poland
CYFO Collection of Yoshifumi Fujitani, Okayama, Japan
CYHK Collection of Yasuhiko Hayashi, Kawanishi, Japan
EUM Ehime University Museum, Matsuyama, Japan (H. Yoshitomi)
HUM Hokkaido University Museum, Sapporo, Japan (M. Ôhara)
MHNG Muséum d'Histoire Naturelle, Genève, Switzerland (G. Cuccodoro)
MNHA Museum of Nature and Human Activities, Hyôgo, Japan (T. Yamauchi)
NMPC Národní museum, Prague, Czech Republic (J. Hájek)
NSMT National Museum of Nature and Science, Tsukuba, Japan (S. Nomura)
SDEI Senckenberg Deutsches Entomologisches Institut, Müncheberg, Germany (L. Behne)
ZMHB Museum für Naturkunde – Leibniz-Institut für Evolutions- und Biodiversitätsforschung an der Humboldt-Universität zu Berlin, Berlin, Germany (J. Frisch).

The following abbreviations are used for the measurements in millimetres (mm):

AL (antennal length): length from the antennal base to apex.
BTW (basitarsal width): maximum width of 1st protarsomere.
EBL (extended body length): summation of HL, PL, ELL, and length of exposed scutellum, preventing the error introduced by exposed or retracted head.
ELL (elytral length): length from the tail end of scutellum to the elytral apex.
ELW (elytral width): maximum width of two elytra combined together.
EW (eye width): width of a single compound eye in dorsal view.
HL (head length): axial length from the anterior apex of clypeus through the posterior margin of occipital carina.
HW (head width): maximum width of head (usually including eyes).
PL (pronotal length): axial length of the pronotum.
PW (pronotal width): maximum width of pronotum.
TW (tibial width): maximum width of protibia (excluding spines along outer margin etc.).

Taxonomy

Genus *Ptomaphagus* Hellwig, 1795

Distribution. Holarctic, north Oriental, north Neotropical.

Subgenus *Ptomaphagus* s. str.

Distribution. Palaearctic, north Oriental.

***Ptomaphagus* (s. str.) *kuntzeni* Sokolowski, 1957**
Figs 1A–C; 2A–F; 3A–J; 4A–G

Ptomaphagus (s. str.) *kuntzeni* Sokolowski 1957: 140 (*Ptomaphagus*; type locality: [JAPAN] Hagi (? Landschaft Jamagutshi, Honshiu); ZMHB); Szymczakowski 1964: 63 (*Ptomaphagus*; female description; taxonomic remarks); Nishikawa 1983: 1 (*Ptomaphagus* (*Ptomaphagus*); in check-list); Harusawa and Yamamoto 2000: 242 (*Ptomaphagus*; distribution); Hayashi and Nishikawa 2010: 190 (*Ptomaphagus*; distribution); Perreau 2000: 363 (*Ptomaphagus* (s. str.); in catalogue); Perreau 2004: 178 (*Ptomaphagus* (*Ptomaphagus*); in catalogue); Nishikawa 2011: 100 (*Ptomaphagus* (*Ptomaphagus*); distribution; notes); Nishikawa et al. 2012: 274 (*Ptomaphagus* (*Ptomaphagus*); distribution); Perreau 2015: 249 (*Ptomaphagus* (*Ptomaphagus*); in catalogue).

Ptomaphagus (s. str.) *amamianus* Nakane 1963: 42 (*Ptomaphagus*; type locality: [JAPAN] Naze, Amami-Oshima); Hayashi 1969: 2 (*Ptomaphagus*; characteristic figures; distribution); Nishikawa 1983: 1 (*Ptomaphagus* (*Ptomaphagus*); in check-list); Perreau 1996: 284 (*Ptomaphagus*; distribution); Perreau 2000: 362 (*Ptomaphagus* (s. str.); in catalogue); Perreau 2004: 178 (*Ptomaphagus* (*Ptomaphagus*); in catalogue); Hayashi and Nishikawa 2010: 190 (*Ptomaphagus*; distribution); Perreau 2015: 249 (*Ptomaphagus* (*Ptomaphagus*); in catalogue). **Syn. n.**

Material examined. Type material. Holotype of *P. kuntzeni*: ♂, [JAPAN] Hagi [ca. 34°24'N, 131°23'E] / Hiller [R. leg., probably collected during 1872–1875 (Esaki 1935)] // Type // 59051 // Ptomaphagus / kuntzeni Type / det. K. Sokolowski (ZMHB). **Holotype of *P. amamianus*:** ♂, HOLOTYPE // [JAPAN] NAZE [ca. 28°22'N, 129°29'E] / AMAMI[-ÔSHIMA] IS. / 4.V.1960 / T. Shibata [leg.] // Ptomaphagus / amamianus Nak. / Det. T. Nakane // NAKANE Coll. / SEHU JAPAN / 1999 // HOLOTYPE / Appended label by / N. Kobayashi / 2008 // 0000005731 / Sys. Ent / Hokkaido Univ. / Japan [SEHU] (HUM). **Allotype of *P. amamianus*:** 1♀, ALLOTYPE // [JAPAN] NAZE [ca. 28°22'N, 129°29'E] / AMAMI[-ÔSHIMA] IS. / 4.V.1960 / T. Shibata [leg.] // Ptomaphagus / amamianus Nak. / Det. T. Nakane // NAKANE Coll. / SEHU JAPAN / 1999 // PARATYPE / Appended label by / N. Kobayashi / 2008 // 0000005732 / Sys. Ent / Hokkaido Univ. / Japan [SEHU] (HUM). **Paratypes of *P. amamianus*:** 1♂, PARATYPE // [JAPAN] NAZE [ca. 28°22'N, 129°29'E], / AMAMI[-ÔSHIMA] IS. / 4.V.1960 / T. Shibata [leg.] // Ptomaphagus amamianus Nak. / Det. T. Nakane // MHNG / ENTO / 00003333 (MHNG); 1♀, same data as previous except: 00003334 (MHNG); 1♂, PARATYPE // [JAPAN] NAZE [ca. 28°22'N, 129°29'E] / AMAMI[-ÔSHIMA] IS. / 4.V.1960 / T. Shibata [leg.] // Ptomaphagus / amamianus Nak. / Det. T. Nakane // NAKANE Coll. / SEHU JAPAN / 1999 // PARATYPE / Appended label by / N. Kobayashi / 2008 // 0000005733 / Sys. Ent / Hokkaido Univ. / Japan [SEHU] (HUM); 1♀, [JAPAN] PARATYPE // // NAZE [ca. 28°22'N, 129°29'E] / AMAMI[-ÔSHIMA] IS. / 4.V.1960 / T. Shibata [leg.] // Ptomaphagus / amamianus Nak. / Det. T. Nakane // NAKANE Coll. / SEHU JAPAN / 1999 // PARATYPE / Appended label by / N. Kobayashi / 2008 // 0000005734 / Sys. Ent / Hokkaido Univ. / Japan [SEHU] (HUM); 1♂, PARATYPE // [JAPAN] NAZE [ca. 28°22'N, 129°29'E], AMAMI[-ÔSHIMA] IS. / 4.V.1960 / T. Shibata [leg.] // Ptomaphagus amamianus Nak. / Det. T. Nakane // 37–1 [Pl. 37, fig. 1 in Nakane 1963] // NAKANE Coll. / SEMU JAPAN / 1999 // PARATYPE / Appended label by / N. Kobayashi / 2008 // 0000005747 / Sys. Ent Hokkaido Univ. / Japan [SEHU] (HUM).

Additional material. JAPAN: Honshu: 3♂♂1♀, Botanic Garden [ca. 38°15'N, 140°51'E] / Sendai, Miyagi [Pref.] / 1.IX.1966 / A. NARITA // Ptomaphagus / kuntzeni / Sokolowski / Det. T. Nakane (HUM); 2♂♂, Yoshi-ga-hira [ca. 37°26'N, 139°7'E] / Niigata Pref. / 14.VIII.1987 / leg. M. NISHIKAWA // Trap // alt. 600 m (CMNE); 1♂, ASAMIGAWAKEI / KOKU [ca. 37°13'N, 140°57'E] HIRONOMACHI / FUKUSHIMA [Pref.] 1990.VIII.2 / A. IZUMI leg. (CMNE); 1♀, Mt. TORINOKO-YAMA [ca. 36°41'N, 140°14'E] / 馬頭町 [Batô-machi], 栃木県 [Tochigi Pref.] / 30.APL.1996 / H. OHKAWA leg. // 14 (CMNE); 1♂, NAGAEDANI [ca. 36°34'N, 136°41'E] / KANAZAWA [Ishikawa Pref.] / 13.V.1948 / S. TAKABA [leg.] (CYHK); 1♂, Mt. TAKAO[-YAMA: ca. 36°27'N 136°45'E] / KAGA [=Ishikawa Pref.] / 2. VII.1961 / Y. Hayashi [leg.] // Ptomaphagus / kuntzeni / Sokolowski? / Det. Y. Hayashi, 1979 (CYHK); 1♂1♀, Tohbu [ca. 36°23'N, 138°21'E], Chiisagata / Nagano [Pref.], JAPAN / 1st, June, 1986 / legit. T. Abe (CMNE); 3♀♀, ISK. [= Ishikawa Pref.] Ishikawa Co. / Shiramine Vil. Shiramine [ca. 36°09'N, 136°37'E] / N. of Mt. Ohnadare / 13.VI–6.VIII.1988 // (rotten chicken trap) / 630 m, alt. / K. Katsura & / Y. Nishikawa leg. // ♀ (CJRZ); 4♂♂, ISK. [= Ishikawa Pref.] Ishikawa Co. / Shiramine Vil. Katarashi [ca. 36°09'N, 136°38'E] / NW. of Mt. Arigata-yama / 13.VI–6.VIII.1988 // (rotten chicken trap) / 580 m, alt. / K. Katsura & / Y. Nishikawa leg. // ♂ // Ptomaphagus kuntzeni SOKOLOWSKI / Det. K. Harusawa, 1993 (CJRZ); 1♂1♀, 石川県 [Ishikawa Pref.] 白山市 [Hakusan-shi] / 白山系 [Mts. Hakusan] / 猿壁堰堤 [Sarukabe-entei: ca. 36°06'N, 136°42'E] pit fall traps / 8月2–22日2002年 [2–22.VIII. 2002] / 保科英人 [Hoshina, Hideto] 採集 [leg.] (CHHF); 1♂, GOZAISHI SPA [ca. 35°43'N, 138°21'E] / YAMANASHI [Pref.] / 12.VIII.1989 / TATEO ITO [leg.] (CYHK); 1♂, 1981–7–4 [= 4.VII.1981] / 日川林道上部 [Upper area of Hikawa-rindô: ca. 35°43'N, 138°50'E] // 大ボサツ [Mt. Daibosatsu-rei, Yamanashi Pref.] / 腐敗オサトラップ [decayed bait of carabid trap] // K. HAGA [leg.] (CMNE); 2♂♂, KAMIHIKAWA-RINDO [ca. 35°43'N, 138°50'E] / ([Mt.] DAIBOSATSU[-REI]) / Yamanashi Pref. / Aug. 29–30th 1982 / Y. Shibata leg. (CMNE); 2♂♂, 東京都西多摩郡 [Tokyo, Nishitama-gun] / 檜原村本宿 [Hinohara-mura, Motoshûku: ca. 35°43'N, 139°08'E] // Japan: Honshu / Motoshûku, / Hinohara Mura, / Tokyô To 12.IV.2008 / KAMEZAWA Hiromu leg. // KAMEZAWA Collection (CMNE); 1♂1♀, Mt. Takao[-san: ca. 35°37'N, 139°15'E] / Hachiôji, Tokyo / 16.X.1982 / M. Nishikawa leg. // Trap (CMNE); 4♂♂1♀, Mt. Mitsutoge-yama [ca. 35°32'N, 138°49'E] / 1200 m in alt., trap / Kawaguchiko-machi // Yamanashi Pref., C. / Japan, 19.VIII.1993 / M. Nishikawa leg. (CMNE); 1♂, Dohshigawa [Riv.: ca. 35°32'N, 139°06'E] / Aone, Tsukui Co. / Kanagawa [Pref.], JAPAN / 18th, May, 1986 / T. Abe & A. Sasai [leg.] (CMNE);

2♀♀, (Dôdaira [ca. 35°28'N, 139°10'E]) / E. Tanzawa / Kanagawa Pref. // 11.VII.1993 / leg. M. NISHIKAWA // carrion trap / alt. ca. 1000 m (CMNE); 1♂1♀, same data as previous except: 21.VIII.1993 (CMNE); 1♂, [JAPAN] Honshu, / Kanagawa Pref., Atsugi City, / Shimofurusawa [ca. 35°27'N, 139°19'E], / 23.III.2007. Bait trap. / Takuya FUKUZAWA leg. (CMNE); 1♀, same data as previous except: 22.III.2007 (CMNE); 2♀♀, Idenzawa [ca. 35°26'N, 138°58'E] / Nishitanzawa / Kanagawa [Pref.], Japan // 31.V.–6.VI.2006 / leg. T. Watanabe (CMNE); 1♂, Mt. OHYAMA [ca. 35°25'N, 139°14'E] / Kanagawa [Pref.], Japan / June 15th, 1974 / Coll. Y. Shibata (CMNE); 1♀, Hachikita-kôgen [ca. 35°24'N, 134°32'E] / Muraoka-machi / [A-1] baited-trap / Hyogo Pref. // W Honshu. Japan / 23.XI.2004 / Shigeru Yoshida leg. // 兵庫県村岡町 [Hyogo Pref., Muraoka-machi] / ハチ北高原 [Hachikita-kôgen] A-1 / bait-trap / 23. XI.2004 / 吉田 茂 [Yoshida Shigeru] 採集 [leg.] (CMNE); 1♂, Mt. Mikuni-yama [ca. 35°24'N, 138°54'E] / Nishitanzawa / Kanagawa [Pref.], Japan / 3–7.VIII.2003 / T. Watanabe leg. // Flight / Interception / Trap (CMNE); 1♀, (Near OHKURA [ca. 35°24'N, 139°10'E]) / Tanzawa [Mts.], Kanagawa [Pref.] / Apr. 29th, 1973 / Coll. Y. Shibata (CMNE); 3♂♂9♀♀, Kitanisawa 750 m alt. [ca. 35°19'N, 133°33'E] / Mitsukue, Kôfu / Hino-gun, Tottori // Pref., W Japan / 17.VI.2007; b.trap / Y. Fujitani leg. // 鳥取県江府町 [Tottori Pref., Kôfu-chô] / 御机 [Mitsukue] 木谷沢 [Kitanisawa] / bait-trap 750 m (CMNE); 1♂2♀♀, Takahachi [ca. 35°19'N, 138°43'E] on Mt. / Fuji (cola trap) / Shizuoka Pref. // Central Japan / 14.VII.–24.VIII.1996 / M. Nishikawa leg. (CMNE); 1♂, [Mt.] Fudohyama [ca. 35°19'N, 139°11'E] / Nakai-machi / Kanagawa [Pref.], Japan / 3–12.VI.2006 / T. Watanabe leg. (CMNE); 1♂, Hisagi [35°18'N, 139°34'E] / Zushi c. / Kanagawa pref. / 18–23.V.1983. / pit-fall Trap: No.32 / No. 2 (CMNE); 5♂♂12♀♀, Yakôdani [ca. 35°17'N, 134°18'E] / Chizu-machi / Yazu-gun, Tottori / Pref., W Honshu, Jpn / 3.VI.2007 / Y. Fujitani leg. // 鳥取県八頭郡 [Tottori Pref., Yazu-gun] / 智頭町八河谷 [Chizu-machi, Yakôdani] / bait-trap 750 m (CMNE); 6♂♂3♀♀, Near Nontaki waterfall [ca. 35°15'N, 134°08'E] / ca. 800 m in alt. / Abason, Tomata-gun / Okayama Pref., Japan / 8.IX.2002; trap / Y. Fujitani leg. (CMNE); 4♂♂2♀♀, Mt. Yamanori-yama [ca. 35°14'N, 133°49'E] / Chûka-son, Maniwa- / ca. 900 m in alt. / gun, Okayama Pref. // W Honshu, W Japan / 11.VII.2004; FIT / Y. Fujitani leg. (CMNE); 2♂♂2♀♀, Daruga-mine [ca. 35°12'N, 134°22'E] / Nishiawakura-son / 1,100 m in alt. / Aida-gun // Okayama Pref. / 7–20.VII.2006; FIT / Akihiko Watanabe leg. (CMNE); 1♂, Akazaigawa Val. [ca. 35°12'N, 134°31'E] / HYOGO Pref. / 12.V.1979 / Y. HAYASHI [leg.] // Ptomaphagus kuntzeni SOKOLOWSKI / Det. Y. HAYASHI, 2014 (CCBW); 1♂1♀, same data as previous except: 15.VII.1979 (MNHA); 1♀, nr. Mt. Suzuga-take [ca. 35°11'N, 136°27'E] / Fujiwara-chô, Mie Pref. / 3.V.2002 / Shiho Arai leg. // Ptomaphagus / kuntzeni / Sokolowski, 1957 / Det. M. Nishikawa, 2014 / #MNIC123909Ch1S (CMNE); 1♀, 千葉県 [Chiba Pref.] 君津市 [Kimitsu-shi] / 郷台畑 [Gôdaihata] / 猪の川 [Inokawa] / 滝の沢出合 [Takinosawa Deai: 35°11'N, 140°06'E] / malaise traps / 5月13–20日1997年 [13–20.V.1997] / 新田 N. [Nitta, N.] 採集 [leg.] (CHHF); 1♂2♀♀, MIZUHO T. [ca. 35°10'N, 135°22'E] / KYOTO, / 22.V.1984 / Y. HAYASHI [leg.] // trap // Ptomaphagus kuntzeni SOKOLOWSKI / Det. Y. HAYASHI, 2014 (1♂ in CCBW and 2♀♀ in CYHK);

1♂1♀, same data as previous except: 26.V.1984 (CCBW); 1♂3♀♀, same data as previous except: シズシ [Shizushi: 35°13'N, 135°20'E] // [bar code omitted] (CYHK; MNHA); 1♂, [Mt.] Takiyama [ca. 35°09'N, 134°09'E] / Nagi, Katsuta-gun / Okayama Pref. // W. Honshu, Japan / 9.V.2002 / Y. Fujitani leg. (CMNE); 8♂♂3♀♀, same data as previous except: 7.VII.2002 (CMNE); 3♂♂4♀♀, same data as previous except: 27.X.2002 (CYFO); 1♂, same data as previous except: 10.XI.2002 (CYFO); 1♀, same data as previous except: 23.XI.2002 (CYFO); 1♀, same data as previous except: 29. XII.2002 (CYFO); 19♂♂23♀♀, same data as previous except: 27.VI.2003 (CYFO); 1♀, JAPON KYOTO / Seryô-Tôgé Kyoto [ca. 35°09'N, 135°45'E] / 500–600 m 6. VIII.1980 / Cl. Besuchet [leg.] (MHNG); 1♀, SASAYAMA T. / 雨石山 [Mt. Amaishiyama: ca. 35°07'N, 135°20'E] / HYOGO [Pref.], / 28.IV.1984 / Y. HAYASHI [leg.] (CYHK); 2♂♂3♀♀, nr. Rashomon-daiichi- / do Cave [ca. 34°56'N, 133°33'E], Niimishi. / 370 m in alt. / Okayama Pref. // W Japan (carrion trap) / 18.VIII.2001 / Y. Fujitani leg. (CMNE); 1♂1♀, Shiramizu [ca. 34°58'N, 134°15'E] / Mimasaka-shi / [carrion baited-trap] / Okayama Pref. // W Honshu, Japan / 7.V.2005 / Y. Fujitani leg. (CMNE); 4♂♂1♀, Mumyôdani [ca. 34°56'N, 133°27'E], ca. 350 m / Tetta-chô, Atetsu- / gun, Okayama Pref. // W Honshu, W. Japan / 25.IV.2004; b. trap / Y. Fujitani leg. (CMNE); 1♀, 箕面市下止々呂美 [Minô-shi, Shimotodoromi: ca. 34°52'N, 135°27'E] / (OSAKA pref.) / 4.VIII.1992 / leg. 齋藤琢己 [Saito Takumi] // Ptomaphagus / kuntzeni / SOKOLOWSKY / Det. Y. HAYASHI, 1993 (CYHK); 1♂4♀♀, Kanahira National / Forest, [ca. 34°47'N, 133°37'E] Takahashi- / [carrion baited-trap] / shi, Okayama Pref. // W Honshu, Japan / 16.IV.2006 / Y. Fujitani leg. (CMNE); 1♂, Anatoyama-jinja [ca. 34°39'N, 133°29'E] / 450 m alt., Kawakami / Okayama Pref. // Honshu, W Japan / 22.IV.2001; trap / Y. Fujitani leg. (CMNE); 1♀, same data as previous except: 8. IV.2001 (CMNE); 1♀, same data as previous except: 16.IV.2001 (CMNE); 1♂3♀♀, same data as previous except: 28.IV.2001 (CMNE); 1♀, Ômukai-rindô [ca. 34°29'N, 132°07'E] / Chôjabara, Yoshiwa / 880 m in alt. / Hatsukaichi-shi // Hiroshima Pref., W / Honshu, Jpn. 28.IV. / 2007, M. Tagami leg. // 広島県廿日市市 [Hiroshima Pref., Hatsukaichi-shi] / 吉和長者原大向林道 [Yoshiwa, Chôjabara, Ômukai-rindô] / FIT 880 m / 28.IV.2007 / 田上雅生 [Tagami Masao] 採集 [leg.] (CMNE); 1♂1♀, OSAKA Pr. Tondabayashi c. / Kannobi Kongô Colony [ca. 34°29'N, 135°35'E] / 12–26. IV.1994 / leg. K. Harusawa // pit fall trap: / rotten squid // Ptomaphagus kuntzeni Sokolowski (CMPR); 6♂♂3♀♀, Kasayama, ca. 50 m / Hagi-shi, / ca. 34°26'N, 131°24'E / Yamaguchi Pref. // W Honshu, W Japan / 29.VI.2002; trap / Y. Fujitani leg. (CMNE); 2♀♀, same data as previous except: 5.VII.2002 (CMNE); 2♂♂2♀♀, Mt. Makio[-san: ca. 34°23'N, 135°30'E] / OSAKA [Pref.] / 4.VIII.1983 / F. KIMURA [leg.] (CYHK); 1♂, [OSAKA Pr.] / Kawachinagano / 天見 [Amami], alt. 260 m / 6–14.X.1981 / K. Harusawa / Y. Nishikawa leg. // 出合 [Deai]~流谷 [Nagaredani] / 流谷八幡境内 [Nagaredani-hachiman shrine's area: ca. 34°23'N, 135°35'E] / 腐肉 [carrion] Trap (牛 [beef]) // Ptomaphagus / kuntzeni / SOKOLOWSKI / Det. Y. HAYASHI, 1990 (CYHK); 1♂, Kamisuga [ca. 34°23'N, 136°22'E] / Ôdai-machi, Taki- / gun, Mie Pref. // Honshu, Japan / 22–9.V.2005 / Katsumi Akita leg. (CMNE); 3♂♂2♀♀, Kanoashikôchi [ca. 34°22'N, 131°57'E] / Muikaichi-machi / 450 m in alt. / Shimane

Pref. // W Honshu, Japan / 10.VI.2005 / Y. Fujitani leg. // 六日市町 [Muikaichi-machi] / 鹿足河内 [Kanoashikôchi] (CMNE); 1♂, HASE [ca. 34°19'N, 135°48'E] / YAMATO [=Nara Pref.] / 5.VI.1966 / Y. HAYASHI [leg.] // Ptomaphagus / kuntzeni (CYHK); 1♂4♀♀, Nodani [ca. 34°17'N, 131°38'E], Tokuji-chô / Saba-gun / Yamaguchi Pref. // W Honshu, W Japan / 21.IV.2004; b. trap / Y. Fujitani leg. (CMNE); 2♀♀, mouth of Nakao-dô / Cave [ca. 34°16'N, 131°17'E]. Aokage / Shuhô, Yamaguchi // Pref., W Japan / 28.VII.–4.VIII.2002 / Y. Fujitani leg. (CMNE); 3♂♂5♀♀, Akiyoshi-dai [ca. 34°16'N, 131°18'E] / Shuho-machi / Yamaguchi Pref. // W Honshu, W Japan / 12.IV.2002; trap / Y. Fujitani leg. (CMNE); 1♂2♀♀, Mt. Nagano-yama [ca. 34°16'N, 131°52'E] / 1,010 m in alt. / b.trap / Kano-machi // Yamaguchi Pref. / Japan, 4.VI.2005 / Y. Fujitani leg. (CMNE); Japan. / G. Lewis. / B. M. 1926–369. // Chiuzenji [ca. 36°46'N, 139°28'E]. // Ptomaphagus / sibiricus Jean. / Jeannel det. // Ptomaphagus / kuntzeni ♀ / det. WANG C.-B., 2016 (BMNH). **Kyushu:** 1♂, Hata [ca. 33°48'N, 130°46'E] / Yahata-City [Fukuoka Pref.] / 3.V.1965 / coll. M. Ueda (HUM); 1♂, 福岡県 [Fukuoka Pref.] 添田町 [Soeda-cho] / 英彦山 [Mt. Hiko-san: ca. 33°29'N, 130°54'E] / 5月2日1983年 [2.V.1983] / 野村 S. [Nomura S.] 採集 [leg.] (CHHF); 1♀, (Kinsenji [ca. 32°58'N, 130°05'E], Mt. Tara[-dake]) / Nagasaki Pref. / Kyushu, JAPAN / 10.V.1983 / S. Imasaka leg. // *Ptomaphagus* (s. str.) / *kuntzeni* Sokolowski, 1957 / Det. M. Nishikawa, 2010 / ♀ (CMNE); 1♂, Mt. Gokabaru-dake [ca. 32°57'N, 130°04'E] / (1,058 m in alt.) / Nagasaki Pref. // NW Kyushu, Japan / 11–12.V.1991 / M. Nishikawa leg. // carrion trap / alt. ca. m (CMNE); 2♂♂, Unzen-bessho [ca. 32°44'N, 130°15'E] / Nagasaki Pref. / 1.VI.1983 / leg. S. Imasaka (CMNE); 1♂, Hagi [ca. 32°32'N, 130°56'E], Gokanoshô / Kumamoto Pref. / 18.VI.1984 / leg. S. Imasaka (CMNE); 1♀, Takao [ca. 32°28'N, 131°08'E], Shimofukura / Shiiba, Miyazaki Pref. / Kyushu, SW Japan / 26.VII.2015 / Takashi Watanabe leg. // Ptomaphagus (Ptomaphagus) / kuntzeni Sokolowski, 1957 / Det. M. Nishikawa, 2016 / MNIC124950Ch1S♀ (CMNE); 1♂, Inao dake [ca. 31°07'N, 130°53'E] / Tashiro cho / Kagoshima Pref. / 14.VII.1985 / T. TANABE leg. // alt. 300 m // Trap // Ptomaphagus / kuntzeni / Sokolowski / Det. T. Nakane (HUM); 1♂, same data as previous except: 575 m (HUM); 1♀, same data as previous except: 610 m (HUM). **Ryukyus: Amami-Ôshima Is.:** 1♀, 鹿児島県 [Kagoshima Pref.] / 奄美市 [Amami-shi] / 龍郷町 [Tatsugô-chô] / 芦徳 [Ashitoku: ca. 28°25'N, 129°36'E] / 05.V.2011 / 稲垣政志 [Inagaki Masashi] Leg. (CYHK); 1♂1♀, (JAPAN) Kagoshima pref., / Amami-Ohshima Is., / Honcha pass. [ca. 28°23'N, 129°33'E] / 11–14.IV.2007 / T. FUKUZAWA et al. [leg.] (CMNE); 1♀, NAZE [ca. 28°22'N, 129°29'E] / AMAMI[-ÔSHIMA] IS. / 4.V.1960 / T. Shibata [leg.] // Ptomaphagus / ohshimensis / NAKANE / Det. Y. HAYASHI, 1969 (CYHK); 2♀♀, same data as previous but no det. label (CYHK); 1♀, same data as previous except: // Ptomaphagus / amamianus / NAKANE / Det. Y. HAYASHI, 2009 // Collection of / Y. HAYASHI // [bar code omitted] (MNHA); 2♂♂4♀♀, Ôganeku / 28.3598N 129.3403E [ca. 28°21'N, 129°20'E]; 260 m alt. / Yamato-son / Amami-Ôshima Is., Ryukyus / Kagoshima Pref., SW Japan / 27.II.–2.III.2016; trap / M. Nishikawa leg. (CMNE); 4♀♀, nr. Hôkoku-jinja, ca. 350 m / 28.362331N 129.482009E [ca. 28°21'N, 129°28'E] / Amami-shi / Amami-Ôshima Is. / Kagoshima Pref., Ryukyus / SW Japan /

27.II.–2.III.2016; trap / M. Nishikawa leg. (CMNE); 3♂♂4♀♀, around Ôkawa Dam, ca. 28°20'N, 129°29'E, 130 m alt., Amami-shi, Amami-Ôshima Is. / Kagoshima Pref., Ryukyus / SW Japan / 27.II.–2.III.2016; trap / M. Nishikawa leg. (CMNE); 1♂, Toen, nr. Amami ForestPolis / 28.3176°N 129.3297°E [ca. 28°19'N, 129°19'E]; 180 m alt. / Yamato-son, Amami-Ôshima Is. / Ôshima-gun, Kagoshima Pref. / Ryukyus, SW Japan / 3–10.III.2015; bait trap / M. Nishikawa leg. (CMNE); 11♂♂18♀♀, (JAPAN) Kagoshima Pref., / Amami-Ôshima Is., / Yamato vil., Ôdana. 310 m alt. / N28°18'40.2 E128°55'32.2 / 5.III.2008. Carrion Baited trap. / Takuya FUKUZAWA leg. (CMNE); 8♂♂5♀♀, Naon-kengyôzôrin Forest [ca. 28°18'N, 129°20'E] / 名音県行造林 [Naon-kengyôzôrin Forest]; alt. 349 m / 28.3058°N, 129.3371°E / Yamato, Amami-Ôshima Is. // Ôshima-gun, Kagoshima Pr. / Ryukyus, SW Japan / 2–10.III.2015; bait trap / M. Nishikawa leg. // Ptomaphagus (Ptomaphagus) / amamianus Nakane, 1963 / Det. M. Nishikawa, 2015 (CMNE); 1♂, Mt. Yuwan[-dake: ca. 28°17'N, 129°19'E] / Amami-Ohshima Is / 29.III.1999 // Ptomaphagus amamianus NAKANE / Det. Y. HAYASHI, 2014 (CCBW); 1♀, same data as previous except: 28.IV.2000 / 江本健一 [Emoto, Ken'ichi] 採集 [leg.] // ♀ (CMNE); 1♀, same data as previous except: 7–12.V.2006 / T. Watanabe leg. (CMNE); 1♂3♀♀, same data as previous except: // 650–680 m, / 18–26.III.2010, baited / pitfall traps, forest, / Tomáš Lackner leg. (CJRZ); 9♂♂9♀♀, (JAPAN) Kagoshima Pref., / Amami-Ôshima Is., sumiyou Vil., santarou Touge Pass, 318 m alt. / N28°17'03.9 E129°25'16.2 / Carrion Baited Trap. 6.III.2008. / Takuya FUKUZAWA leg. (CMNE); 2♂♂1♀, same data as previous except: 12–14.IV.2007 (CMNE); 1♂1♀, same data as previous except: 13–16.IV.2007. FIT / T. FUKUZAWA et al. [leg.] (CMNE); 4♂♂2♀♀, 鹿児島県大島郡 [Kagoshima Pref., Ôshima-gun] / 宇検村 [Uken-son] ヤクガチョボシ山麓 [foot of Mt. Yakugachoboshi-yama: ca. 28°15'N, 129°21'E] // Japan; Ryukyu / foot of Yakugachoboshi-yama, / Uken Son, Oshima Gun, / Kagoshima Ken // (Is. Amami-o-shima) / 27.II.2004 / KAMEZAWA, Hiromu leg. (CMNE); 1♂, HATSUNO [ca. 28°15'N, 129°22'E] / Amami[-Ôshima] Is. / 31.III.1969 / H. NOMURA [leg.] // Ptomaphagus amamianus NAKANE / Det. Y. HAYASHI, 2014 (CCBW); 1♂, same data as previous except: 1.IV.1967 (CYHK); 1♀, same data as previous except: 3.IV.1967 (CYHK); 1♂, same data as previous except: 4.IV.1967 (CYHK); 2♂♂1♀, same data as previous except: 3.IV.1969 // K. TANIZAWA [leg.] (CCBW); 2♂♂1♀, same data as previous except: // Ptomaphagus / amamianus NAKANE / Det. Y. HAYASHI, 1993 (CMNE); 1♂1♀, same data as previous except: 31.III.1969 / H. NOMURA [leg.] (CYHK); 4♂♂, same data as previous except: 1.IV.1969 (CYHK); 4♂♂1♀, same data as previous except: 2.IV.1969 (CYHK); 1♂1♀, same data as previous except: 3.IV.1969 (CYHK); 7♂♂3♀♀, same data as previous except: K. Tanizawa [leg.] (CYHK); 1♀, same data as previous except: 5.V.1969 / Y. MAEDA [leg.] (CMNE); 1♀, Nishinakama [ca. 28°15'N, 129°24'E] / AMAMI[-ÔSHIMA] Isl. / 5.IV.1969 / K. TANIZAWA [leg.] (CYHK); 3♂♂3♀♀, nr. Yakugachi Tunnel / 28.2295N 129.3599E [ca. 28°13'N, 129°21'E]; 30 m alt. / Kamiyakugachi, Amami-shi / Amami-Ôshima Is., Ryukyus / Kagoshima Pref., SW Japan / 27.II.–2.III.2016; trap / M. Nishikawa leg. (CMNE); 1♀, (由井岳 [Mt. Yui-dake: ca. 28°11'N, 129°18'E]) / 瀬戸内 [Setouchi-chô] 奄美大島 [Amami-Ôshima Is.] / 25.IV.2000 / 江

本健一 [Emoto Ken'ichi] 採集 [leg.] // ♀ (CMNE); 6♂♂, Aminoko-tôge Pass / 28.1893°N 129.3659°E [ca. 28°11'N, 129°21'E]; 350 m alt. / Setsuko, Setouchi-chô / Amami-Ôshima Is. / Ôshima-gun, Kagoshima Pref. / Ryukyus, SW Japan / 6–10. III.2015; bait trap / M. Nishikawa leg. (CMNE); 1♂3♀♀, 鹿児島県 [Kagoshima Pref.] / 大島郡 [Ôshima-gun] / 瀬戸内町 [Setouchi-chô: ca. 28°08'N, 129°18'E] / 05.V.2011 / 稲垣政志 [Inagaki, Masashi] Leg. (CYHK); 1♂, IKARI [unlocated] / AMAMI[-ÔSHIMA] IS. / 18.V.1960 / T. Shibata [leg.] (CYHK). **Ryukyus: Kume-jima Is.:** 3♀♀, Shirase-gawa [Riv.: ca. 26°20'N, 126°46'E] / Gushikawa-son / Kume-jima Is. // Ryukyus, SW Japan / 15–17.III.1998 / M. Maruyama leg. (CMNE). **Ryukyus: Okinawa-hontô Is.:** 1♂1♀, [Okinawa: JAPAN] / Uka-rindô [ca. 26°48'N, 128°14'E], alt. 250– / 300 m, Kunigami vill. / 8.II.2009 / Takashi Kurihara leg. // ベイトトラップ [bait trap] / 鳥の手羽元 [fowl wing sticks] // Ptomaphagus / kuntzeni? / Y. HAYASHI, 19 2014 (CYHK); 2♂♂, same data as previous except 7.II.2009 (CYHK); 2♂♂, Yona [ca. 26°45'N, 128°12'E] (Ohkuni 5) / Okinawa-jima Is. / Ryukyus // SW Japan / 25–27.IV.1996 / M. Nagano leg. (CMNE); 1♀, Nishime-dake [ca. 26°48'N, 128°16'E]. OKN [= Okinawa Pref.] / Date: 14.X.2002 / K. MASUMOTO leg. (CMNE); 2♀♀, [Okinawa: JAPAN] / Hama-rindô [ca. 26°43'N, 128°09'E], alt. 50– / 100 m, Kunigami vill. / 8.II.2009 / Takashi Kurihara leg. // ベイトトラップ [bait trap] / 鳥の手羽元 [fowl wing sticks] (CYHK); 4♂♂, (JAPAN, Ryukyus) / Okinawa pref. / Okinawa Is. / Kunigami Vil., Hiji [ca. 26°43'N, 128°10'E] / 13.III.2009. / Takuya FUKUZAWA leg. (CMNE); 1♂, 与那覇岳 [Mt. Yonaha-dake: ca. 26°42'N, 128°13'E] / 沖縄本島 [Okinawa-hontô Is.] / 14.iv.2000 / 保科英人 [Hoshina, Hideto leg.] / 腐肉トラップ [carrion trap] // 2 (CMNE); 7♂♂5♀♀, bank of Haneji-ô-kawa / Riv. [ca. 26°36'N, 128°01'E], 20–40 m in alt. / Nago-shi, Okinawa- // jima Is., Ryukyus / (c. trap) 18.IV.1993 / R. Yakita leg. (CMNE); 13♂♂7♀♀, same data as previous except: 8–18.IV.1993 (CMNE); 14♂♂9♀♀, (JAPAN, Ryukyus) / Okinawa Pref. / Okinawa Is. / Nago City, Genka. / 26°36'N, 128°04'E // 10–13.III.2009. / by flight Intercept Trap / T. Fukuzawa, T. Ishikawa & M. Kishi leg. (CMNE). **Ryukyus: Tokuno-shima Is.:** 1♂, (JAPAN) Kagoshima Pref. / Tokuno-shima Is., / Amagi Town, / Mt. Yamatogusuku-san [ca. 27°48'N, 128°55'E] / 29.II.–4. III.2008. (FIT) Takuya FUKUZAWA leg. (CMNE); 85♂♂67♀♀, (JAPAN) Kagoshima Pref. / Tokuno-shima Is., / Amagi Town, / Mt. Sankyô-dake, 185 m alt. / N27°46'13.6, E128°57'18.0 / Carrion Baited Trap. 4.III.2008. / Takuya FUKUZAWA leg. (CMNE); 4♂♂3♀♀, same data as previous except: 27.II.–4.III.2008. (FIT) (CMNE). **Sadoga-shima Is.:** 1♂, Mt. Donden-yama [ca. 38°07'N, 138°22'E] / Sado Is., Niigata / Pref., Honshu, Japan // 30.IV.–26.V. / 1990 / leg. M. NISHIKAWA // carrion trap / alt. ca. 200 m (CMNE). **Shikoku:** 1♀, [SHIKOKU] / Komenono [ca. 33°58'N, 132°51'E] / Matsuyama [Ehime Pref.] / 25.IV.1993 / Lizhen Li leg. (EUM); 1♂, (Ehime: Japan) / Aonamimachi [ca. 33°53'N, 132°51'E] / Matsuyama-shi / 24.V.2006 / Shôma Sejima leg. (EUM); 3♀♀, same data as previous except: 2.VI.2006 (EUM); 2♀♀, Minokoshi on Mt. / [ca. 33°51'N, 134°05'E] / Tsurugi-san / ca. 1400 m in alt. / Tokushima Pref. // Shikoku, Japan / 25.VII.2004; trap / Y. Fujitani leg. // 徳島県東祖谷山村 [Tokushima Pref., Higashiiyayama-son] / 見の越 [Minokoshi] / bait-trap (CMNE); 2♂♂2♀♀, 瓶が森 [Mt. Kamegamori: ca. 33°47'N, 133°11'E] (alt. 1670 m) / 高知県吾川郡いの町 [Kôchi Pref., Agawa-gun, Ino-chô] / 寺川 [Terakawa] 10.V.–8.VIII.2009 / 吉田 正隆 [Yoshida Masataka] 採集 [leg.] // Mt. Kamegamori (alt. 1670 / m) Terakawa Ino-chô / Agawa-gun Kôchi-Pref. / 10.V.–8. VIII.2009 / Masataka YOSHIDA leg. // 鳥ガラトラップ [fowl bone trap] / 地中 [underground] (50 cm) (CMNE); 2♂♂1♀, [SHIKOKU] / Mt. Ishizuchi [ca. 33°44'N, 133°06'E] / Ehime Pref. / 27.VIII.1990 / alt. 800 m / S. Takano leg. (EUM); 2♂♂, same data as previous except: 13.IX.1990 / alt. 500 m (EUM); 1♂, EHIME [Pref.]; Japan / Mt. Saragamine [ca. 33°43'N, 132°53'E] / Shigenobu-Town / 22.IV.1999 / Tatsuya Kan leg. (EUM); 4♀♀, 156 JAPAN, Shikoku, / Jshizuchi [Ishizuchi] Mt. Nat. Park, / OMOGO Valley, [ca. 33°42'N, 133°05'E] 700 m, / S. & J. Peck leg. // 158 mega carrion traps, / mixed warm temperate / forest, 18–25.viii.1980 (CJRZ); 1♀, Nishidani [ca. 33°31'N, 132°57'E] / Yanadani, Ehime [Pref.] / 6–8.V.1994 / Sakai, Li, Aita leg. / (bait-trap) // No. 8 (EUM); 4♂♂2♀♀, (SHIKOKU) / Odamiyama [ca. 33°31'N, 132°53'E] / Ehime Pref. / 22.VIII.1984 / E. Yamamoto [leg.] (EUM); 1♂3♀♀, same data as previous except: 14.VIII.1984 / 山本栄治 [Yamamoto Eiji] 採集 [leg.] (EUM); 1♂2♀♀, Komi [ca. 33°30'N, 132°57'E] / Yanadani, Ehime [Pref.] / 6–8.V.1994 / Ohbayashi, Nishino, Okada [leg.] / (by bait-trap) // No. 2 (EUM); 1♂1♀, same data as previous except: No.1 (EUM); 4♂♂5♀♀, Tengu-Kôgen [ca. 33°28'N, 133°00'E] (alt. 1280 m) / Kumakôgen-chô Kamiuke- / na-gun Ehime-Pref. / 9.V.–25.VII.2010 (Fowl trap) / Masataka YOSHIDA leg. // 愛媛県上浮穴郡 [Ehime Pref., Kamiukena-gun] / 久万高原町天狗高原 [Kumakôgen-chô, Tengu-Kôgen] / (alt. 1280 m) 9.V.–25.VII. / 2010 (鶏ガラトラップ [chicken bone trap]) / 吉田正隆 [Yoshida Masataka] 採集 [leg.] (CYHK); 1♀, Nagano [ca. 33°27'N, 132°56'E] / Yusuhara-chô [Kôchi Pref.] / 1–2.X.1994 / Y. Utsunomiya [leg.] / (by bait-trap) // No. 9 (EUM). **Shimokoshiki-jima Is.:** 1♀, Mt. Odake [ca. 31°43'N, 129°44'E] / Is. Shimokoshiki[-jima] / Kagoshima-pref. / 20.VI.1982 / S. Imasaka leg. (CMNE).

Redescription. *Male*. EBL: 3.5–4.4 mm (3.5 mm in holotype of *P. kuntzeni*). Length of different body parts: HL : AL : PL : ELL = 0.6 : 1.2 : 1.0 : 2.2 mm; width: HW : EW : PW : ELW = 1.0 : 0.1 : 1.6 : 1.6 mm. Proportion of antennomeres from base to tip in µm (length × width): 167 × 84, 118 × 68, 114 × 74, 67 × 80, 76 × 99, 53 × 114, 96 × 126, 42 × 128, 92 × 142, 97 × 138, 197 × 115.

Habitus (Fig. 1A, B) elongated oval, regularly convex and sublustrous. Well pigmented: mostly brown to dark brown, head darker; mouthparts, basal three or four antennomeres and apical half of ultimate antennomere, protarsi, and apical parts of meso- and metatarsi more or less paler. Dorsum continuously clothed with fine, recumbent, yellowish pubescence. Insertions of pubescence on dorsal surfaces of pronotum, elytra and femora aligned along transverse striolations; interspace between two striolations glabrous.

Head quite transverse, HW/HL = 1.6. Clypeofrontal suture absent. Clypeus with anterior margin slightly rounded. Compound eyes well developed, EW/HW = 0.1. Antennae (Fig. 3A) slender, AL/HW = 1.2; antennomere III as long as II; VI with length/width = 0.5; XI longest, elongated pear-shaped.

Figure 1. Habitus of *Ptomaphagus* (s. str.) spp. (dorsal view). **A** *P.* (s. str.) *kuntzeni* Sokolowski, 1957 ♂ (holotype) **B** *P.* (s. str.) *amamianus* Nakane, 1963, syn. n. ♂ (paratype) **C** *P.* (s. str.) *amamianus* Nakane, 1963, syn. n. ♀ (paratype) **D** *P.* (s. str.) *piccoloi* sp. n. ♂ (holotype) **E** *P.* (s. str.) *piccoloi* sp. n. ♀ (paratype) **F** *P.* (s. str.) *sibiricus* Jeannel, 1934 ♀ (holotype). Scale bar 1 mm.

Pronotum (Fig. 3B) transverse, widest just before hind angles, PW/PL = 1.5. Sides gently arched, gradually narrowing from posterior to anterior; hind angles drawn out, acute and sharp. Posterior margin widely protruding in the middle part, distinctly emarginate near hind angles.

Elytra oval, widest near basal 2/7, ELL/EW = 1.4. Sides weakly arched, gradually narrowing from widest part to apices, which widely rounded (Fig. 3G). Sutural striae present. Metathoracic wings fully developed.

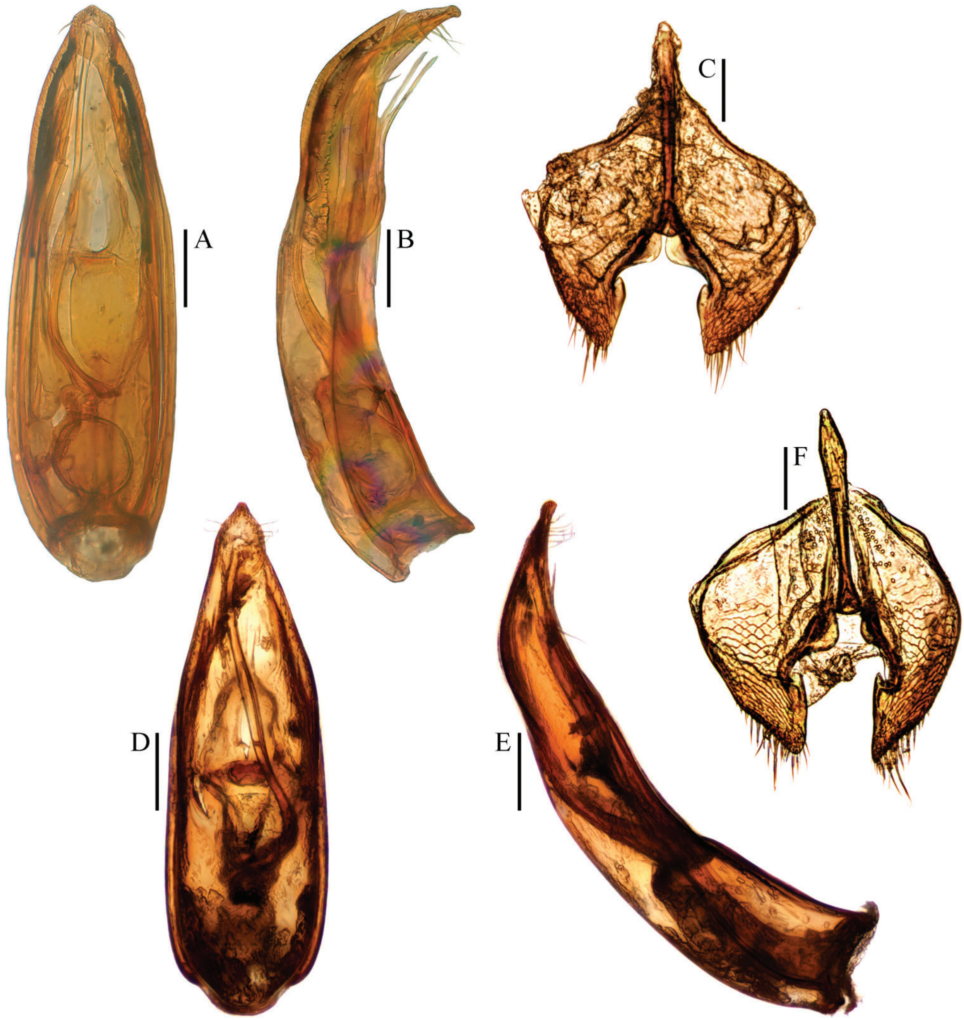

Figure 2. A–C *Ptomaphagus* (s. str.) *kuntzeni* Sokolowski, 1957 ♂ (holotype) **D–F** *P.* (s. str.) *amamianus* Nakane, 1963, syn. n. ♂ (paratype) **A, D** aedeagi (dorsal view) **B, E** aedeagi (lateral view) **C, F** genital segments (ventral view). Scale bars 0.1 mm.

Prolegs robust, with basal three protarsomeres (Fig. 3C) moderately expanded: TW/BTW = 1.4. Protibiae (Fig. 3E) distinctly expanded towards apex. Profemora (Fig. 3E) broad. Mesotibiae arcuate, mesotarsi simply linear. Metatibiae slender and straight.

Abdominal ventrite VIII (Fig. 3I) round at posterior edge and with an inconspicuous median notch. Spiculum gastrale of genital segment (Figs 2C, F; 3J) with approx. 1/3 of length protruding beyond anterior edge of epipleurite IX.

Aedeagus stout and wide, with median lobe gradually narrowing towards an oblong apex and terminated by an obtusely rounded knob in dorsal view (Figs 2A, D; 4A);

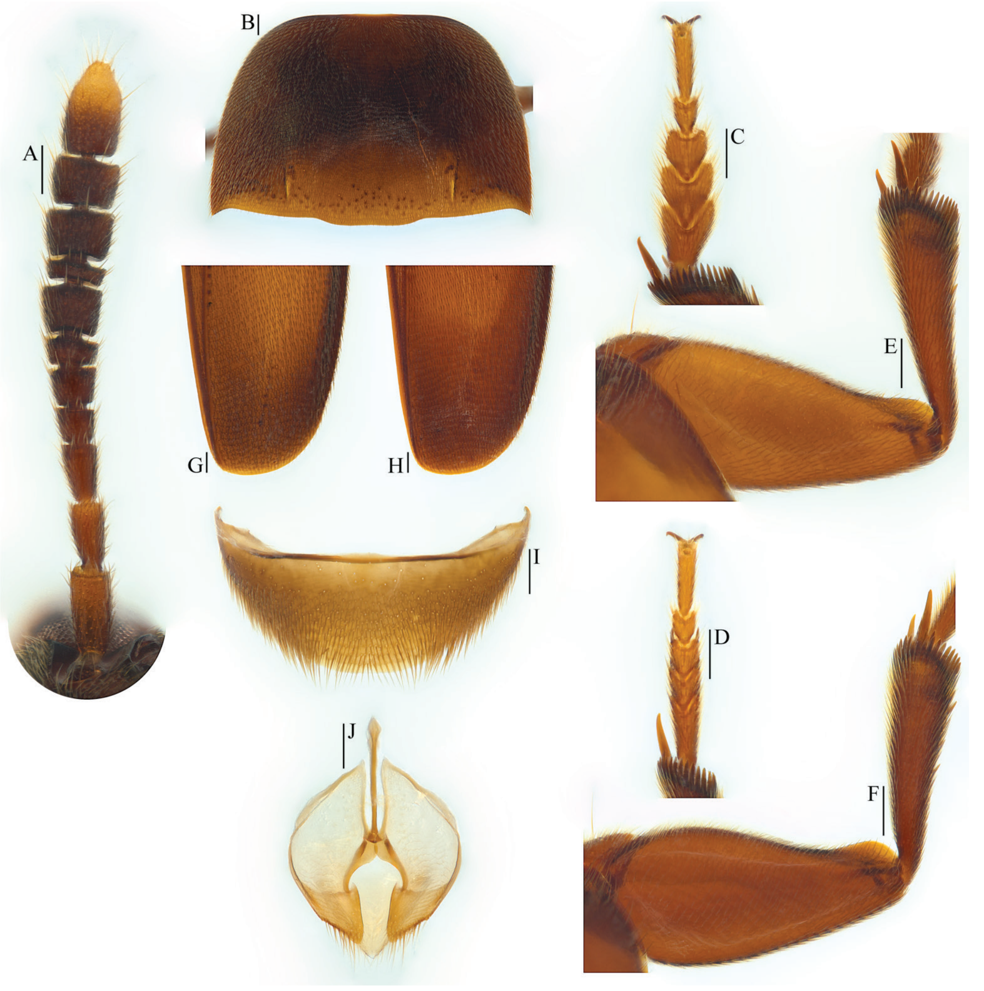

Figure 3. *Ptomaphagus* (s. str.) *kuntzeni* Sokolowski, 1957 (Amami Island). **A** antenna ♂ (dorsal view) **B** pronotum ♂ (dorsal view) **C** protarsus ♂ (dorsal view) **D** protarsus ♀ (dorsal view) **E** protibia and profemur ♂ (dorsal view) **F** protibia and profemur ♀ (dorsal view) **G** elytral apex ♂ (dorsoapical view) **H** elytral apex ♀ (dorsoapical view) **I** ventrite VIII ♂ (ventral view) **J** genital segment ♂ (ventral view). Scale bars 0.1 mm.

opening of genital orifice situated on dorsal surface, deeply cut inwards on left edge of median lobe at subapex. Ventral surface of the apex of the median lobe (Fig. 4B, D) inserted with 5 ventrally oriented setae on the left side and 4 ventrally oriented setae on the right side; parameres narrow, reaching almost to apical 1/5 of median lobe, each apex (Fig. 4E) with 2 lateral setae and 1 apical seta relatively shorter. In lateral view (Fig. 2B, E), median lobe distinctly thick, regularly bent ventrad and gradually tapering towards a subround apex. Endophallus with stylus quite slender, a cheliform complex below the base of stylus, and a circular complex at the basal region.

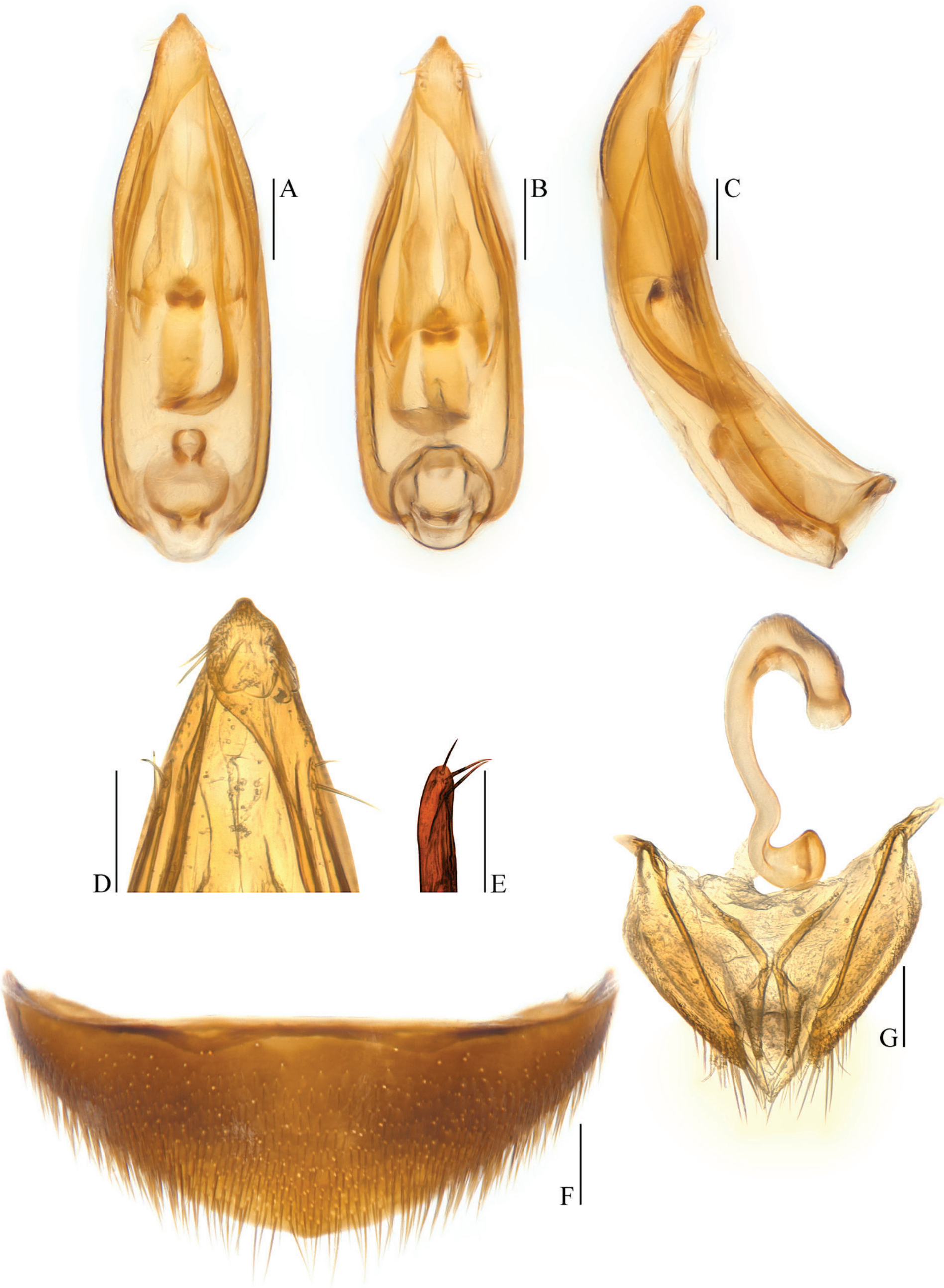

Figure 4. *Ptomaphagus* (s. str.) *kuntzeni* Sokolowski, 1957 (Amami Island). **A** aedeagus (dorsal view) **B** aedeagus (ventral view) **C** aedeagus (lateral view) **D** aedeagal apex (ventral view) **E** paramere apex (lateral view) **F** ventrite VIII ♀ (ventral view) **G** spermatheca and genital segment (ventral view). Scale bars 0.1 mm.

Female. Similar to male in general appearance (Fig. 1C), including elytral apices (Fig. 3H), but distinguished by the following characteristics: protarsi (Fig. 3D) simply linear; protibiae (Fig. 3F) narrower at apex; ventrite VIII (Fig. 4F) almost narrowly rounded at posterior edge; genital segment as shown in Fig. 4G; spermatheca (Fig. 4G) C-shaped in distal part, not coiled in proximal part.

Distribution. China (Taiwan), Japan (Fig. 8), ?Myanmar.

Remarks. Varying body size is not an unexpected intraspecific variation in *Ptomaphagus* species, and occurs in common European species such as *P.* (s. str.) *sericatus* (Chaudoir, 1845) and *P.* (s. str.) *varicornis* (Rosenhauer, 1847). Although the holotype and paratypes of *P.* (s. str.) *amamianus* (Fig. 1B, C) are larger than the holotype of *P.* (s. str.) *kuntzeni* (Fig. 1A), this does not prevent us from synonymising the two species because of their identically shaped aedeagus (Fig. 2A, B, D, E).

Ptomaphagus (s. str.) *kuntzeni* somewhat resembles *P.* (s. str.) *sibiricus* in general appearance, but the former has antennomere III as long as II (Fig. 3A), antennomere VI with length/width = 0.5 and elytral apices (Fig. 3G, H) widely rounded; while the latter has antennomere III a little shorter than II (Fig. 7A), antennomere VI with length/width = 0.4 and elytral apices (Fig. 7B) narrowly rounded.

It should be noticed that Szymczakowski (1964) described a single female specimen from Kambaiti, Myanmar (coll. Naturhistoriska Riksmuseet, Stockholm) as *Ptomaphagus* (s. str.) *kuntzeni*. We concur with the opinion of Nishikawa (2011) that the occurrence of *P.* (s. str.) *kuntzeni* in Myanmar is dubious because of the wide geographical gap and the discrepancies of the morphological description of Szymczakowski (1964) with specimens from Japan.

According to the present data, this species is one of the most widespread cholevines in Japan, known from Honshu, Shikoku, Kyushu and Ryukyus. However, we have not yet examined any specimens from the northernmost area of Honshu (above the 38th parallel) or from the southern Kume-jima Island in Ryukyus (Fig. 8). The species is recorded herein from Sadoga-shima Island, Shimokoshiki-jima Island and Kume-jima Island for the first time. Incidentally, no *Ptomaphagus* species have been recorded from Hokkaido to date. Moreover, Perreau (1996) reported the species from Taiwan Island under the name *P.* (s. str.) *amamianus*. We will deal with this area in a next paper devoted to *Ptomaphagus* from Taiwan.

Collecting methods for the material examined mostly indicate a necrophagous association, such as traps baited with decaying animal matter.

***Ptomaphagus* (s. str.) *piccoloi* sp. n.**
http://zoobank.org/AE951C06-DAB3-4FBF-8CE8-35BF2B77882D
Figs 1D, E; 5A–J; 6A–G

Type material. Holotype: ♂, [JAPAN] Mt. Yamanori-yama [ca. 35°14'N, 133°49'E] / Chûka-son, Maniwa- / ca. 900 m in alt. / gun, Okayama Pref. // W Honshu, W Japan / 26.VI.2004; FIT / Y. Fujitani leg. // 5 (NSMT). **Paratypes:** 1♀, same data as holotype except: 2.VII.2004 (NSMT); 1♀, JAPAN, Ibaraki Pref. / Tsukuba City env. [ca. 36°04'N, 140°04'E] / 12.XI.2005 / P. Jałoszyński leg. // PTOMAPHAGUS (PTOMAPHAGUS) sibiricus JEANNEL, 1934 / det. H. HOSHINA, 2006 (CPJA); 4♂♂6♀♀, Kurokura [ca. 35°25'N, 139°04'E] / ca. 400 m, Yamakita-machi / Ashigarakami-gun / Kanagawa Pref., C Japan // [trap: under stones at base of / debris slope] 29.IV.–14.V.2011 / M. Nishikawa leg. (2♂♂2♀♀ in CCBW, 1♂3♀♀ in CJRZ and 1♂1♀ in CMPR); 1♂, same data as previous except: 13.II.–18.III.2016 (CMNE); 1♂, [JAPAN] YAWATA [ca. 34°52'N, 135°42'E] / KYOTO [Pref.] / 2.II.1985 / T. ITO [leg.] // Ptomaphagus sibiricus JEANNEL / Det. Y. HAYASHI, 1985 (NMPC); 2♂♂1♀, [JAPAN] 岡山県美作市 [Okayama Pref., Mimasaka-shi] / 白水 [Shiramizu: ca. 34°58'N, 134°15'E] / bait-trap / 28.IV.2005 / 藤谷美文 [Fujitani Yoshifumi] 採集 [leg.] // Ptomaphagus sibiricus JEANNEL / Det. Y. HAYASHI, 2014 (1♂ in CMNE; 1♂ in CYHK; 1♀ in NMPC); 1♀, [JAPAN] KAKEYU [ca. 36°18'N, 138°08'E] / NAGANO. Pref. / 6.IV.1979. / Y. Hirano. leg. // ♀ (CMNE); 1♂, 東京都西多摩郡奥多摩町 [Tokyo, Nishitama-gun, Okutama-machi] / 日原 [Nippara] 一石山 [Mt. Isseki-zan] –人形山 [Mt. Ningyio-yama] // FIT (地上 [above the ground] 0.5–1 m) // Japan: Honshu [FIT No.2] / Mt. Isseki-zan–Mt. Ningyô- / yama (1040 m in alt.), Nippara / Okutama Machi, Tokyo / 35.858761, 139.036059 [ca. 35°51'N, 139°02'E] / 23.V.–8.VII.2015 / KAMEZAWA Hiromu leg. (CMNE); 1♂, same data as previous except: WFIT: 1100 m in alt. // 35.858796, 139.034128 (CMNE); 1♀, 東京都八王子市高尾山 [Tokyo, Hachiôji-shi, Mt. Takao-san: ca. 35°37'N, 139°14'E] // Japan: Honshu / Mt. Takao-san / (approx. 500 m in alt.), / Hachioji Shi, Tokyo To / 10.III.2007 / KAMEZAWA Hiromu leg. // KAMEZAWA Collection (CMNE); 1♀, same data as previous except: 14.II.2004 (CMNE); 1♂, [JAPAN] Mt. MASUGATAYAMA [ca. 35°36'N, 139°33'E] / KAWASAKI KANA / GAWA [Pref.] 1985.II.2 / Coll. A. IZUMI (CMNE); 1♂, [JAPAN] 宮ヶ瀬 [Miyagase] / 1-c // MIYAGASE [ca. 35°31'N, 139°13'E] / TANZAWA [Mts., Kanagawa Pref.] / 6.VI.1989 / H. HARADA [leg.] (CMNE); 1♂, same data as previous except: 2-c (CMNE); 1♂1♀, JAPAN Kanagawa-ken / Ashigarakami-gun / Yamakitamachi Kurokura [ca. 35°25'N, 139°04'E] / 29.iv.2011 alt. ca. 400 m / Ichiro Oshio leg. (CYFO); 1♂, [JAPAN] Mikuni-toge [ca. 35°24'N, 138°54'E] / Kanagawa [Pref.] / 7.VI.1970 / H. Takizawa [leg.] (CMNE); 1♀, [JAPAN] (Near BODAI [ca. 35°24'N, 139°11'E]) / Tanzawa [Mts.], Kanagawa [Pref.] / May 3rd 1973 / Coll. Y. Shibata (CMNE); 1♀, [JAPAN] 鳥取県 [Tottori Pref.] 西伯郡 [Saihaku-gun] / 大山町 [Daisen-chô] 三ノ沢 [Sannosawa: ca. 35°21'N, 133°32'E] / FIT alt 960 m / 6月7–23日2008年 [7–23.VI.2008] / 渡辺昭彦 [Watanabe, Akihiko] 採集 [leg.] (CYFO); 1♂, [JAPAN] 岡山県 [Okayama Pref.] 真庭市 [Maniwa-shi] / 蒜山 [Hiruzen] 蒜山大山S.L. [Hiruzen-Daisen Skyline road: ca. 35°19'N, 133°35'E] / 6月9–17日2007年 [9–17.VI.2007] / 渡辺昭彦 [Watanabe, Akihiko] 採集 [leg.] (CYFO); 1♂, [JAPAN] Jigokuana Cave [ca. 35°19'N, 135°27'E] / Mt. Chorosan / Wachi, KYOTO / 16.XI.1986 // Y. NISHIKAWA [leg.] // 仏主の地獄穴 [Hodosu-no-jigokuana Cave] / 16.XI.1986 (西川 [Nishikawa]) / Y. NISHIKAWA [leg.] (CYHK); 1♂, [JAPAN] OH-DOH [ca. 35°19'N, 139°19'E] 大堂 [Ôdô] (Tul.) / Mt. Koma-yama Ohiso town

/ Kanagawa Pref. / 23.III.2001 / Shiho ARAI leg. (CMNE); 1♀, JAPAN Kanagawa-ken / Kamakura-shi / Inamuragasaki [ca. 35°18'N, 139°31'E] / 2.i.2011 / Eimon Ueda leg. (CYFO); 1♀, Shiraishijizo-no-ana / Cave [ca. 35°14'N, 139°06'E], Hakoneyumoto / Kanagawa Pref. // C Japan, Ethanol trap / 7.IV.–18.V.1996 / M. Nishikawa leg. (CMNE); 1♀, same data as previous except: 22.VI.1996 (CMNE); 1♂, same data as previous except: 14.VIII.1996 (CMNE); 3♂♂2♀♀, same data as previous except: baited trap / 16.IV.–13.V.1995 (CMNE); 1♀, [JAPAN] Kanagawa Pref. / Odawara C. / Iriuda [ca. 35°14'N, 139°07'E] / 15 Oct.1995 / H. Miyatani Leg. (CMNE); 1♂, [JAPAN] YUGAWARA [ca. 35°09'N, 139°05'E] / HAKONE [Kanagawa Pref.] / 29.IV.1984 / Y. Hirano. leg. (CMNE); 2♀♀, [JAPAN] 岡山県 [Okayama Pref.] 新見市 [Niimi-shi] / 千屋ダム湖畔 [Chiya Dam lakeside: ca. 35°03'N, 133°27'E] / FIT alt 460 m / 6月7–23日2008年 [7–23.VI.2008] / 渡辺昭彦 [Watanabe, Akihiko] 採集 [leg.] (CYFO); 1♂, (Kusama [ca. 34°56'N, 133°32'E], Niimi-shi) / Okayama Pref., Honshu / Japan. May 7th, 1997 / Coll. Y. Watanabe (CMNE); 1♂, nr. Rashomon-daiichi- / dô Cave [ca. 34°56'N, 133°33'E], Niimi-shi. / 370 m in alt. / Okayama Pref. // W Japan (carrion trap) / 18.VIII.2001 / Y. Fujitani leg. (CMNE); 1♀, same data as previous except: 27.III.2005 (CMNE); 1♀, Mt. Arato-yama [ca. 34°55'N, 133°22'E] / ca. 600 m, Tetta-chô / litter: sieve / Atetsu-gun // Okayama Pref. / W. Japan, 25.V.2003 / Y. Fujitani leg. (CMNE); 1♂, [JAPAN] 岡山県阿哲郡 [Okayama Pref., Atetsu-gun] / 哲多町 [Tetta-chô] 無明谷 [Mumyôdani: ca. 34°53'N, 133°27'E] / bait-trap // 25.IV.2004 / 藤谷美文 [Fujitani Yoshifumi] 採集 [leg.] (CMNE); 1♂, [JAPAN] MINOO [ca. 34°50'N, 135°28'E] / Osaka / 5.iv.1961 / Y. Kimura [leg.] // Ptomaphagus / sibiricus / Det. Y. HAYASHI, 19 (CYHK); 1♀, 28.v.2007 / [JAPAN] 広島県神石高原町 [Hiroshima Pref., Jinsekikôgen-chô] / 高光 [Takamitsu: ca. 34°48'N, 133°10'E] リターより [from litter] / 妹尾鈴香 [Senoo Rinka leg.] (CYFO); 1♂, [JAPAN] (Ôdaru-onsen [ca. 34°47'N, 138°56'E]) / Shizuoka [Pref.], Honshu / March 22nd,1983 / Coll. Y. Watanabe (CMNE); 1♀, [JAPAN] Mt. AOMINE [= Mt. Aonomine-san: ca. 34°24'N, 136°49'E] / TOBA, MIE [Pref.] / 17.VIII.1988 / T. ITO [leg.] (CYHK); 1♀, [JAPAN] Mt. Hiko[-san: ca. 33°29'N, 130°54'E] / Hukuoka [= Fukuoka Pref.] / 17–19.V.1967 / H. Takizawa [leg.] (CMNE); 2♀♀, [JAPAN] Ohsé-no-ko-ana / Cave [ca. 32°16'N, 130°36'E], Ohsé / Kuma-mura / Kumamoto Pref // SW JAPAN / 26.V.1998 / S. Uéno & S. Arai leg. [recorded as Ptomaphagus (Ptomaphagus) sp. in Nishikawa 1995] (CMNE); 1♂, [JAPAN] 屋代島 [Yashiro-jima Is.]. 源明峠 [Genmei-tôge: ca. 33°53'N, 132°14'E] / 山口県周防大島町 [Yamaguchi Pref., Suo-Ôshima-chô] / 27.VI.2005 / Leg. 伴一利 [Ban Kazutoshi] (CMNE).

Description. *Male*. EBL: 2.7–3.0 mm (2.7 mm in holotype). Length of different body parts: HL : AL : PL : ELL = 0.5 : 0.8 : 0.8 : 1.7 mm; width: HW : EW : PW : ELW = 0.7 : 0.1 : 1.2: 1.3 mm. Proportion of antennomeres from base to tip in μm (length × width): 116 × 61, 91 × 56, 70 × 61, 40 × 66, 43 × 76, 44 × 95, 67 × 102, 32 × 107, 59 × 112, 68 × 113, 121 × 104.

Habitus (Fig. 1D) elongated oval, regularly convex and sublustrous. Well pigmented: mostly brown; mouthparts, apical half of ultimate antennomere, protarsi, and

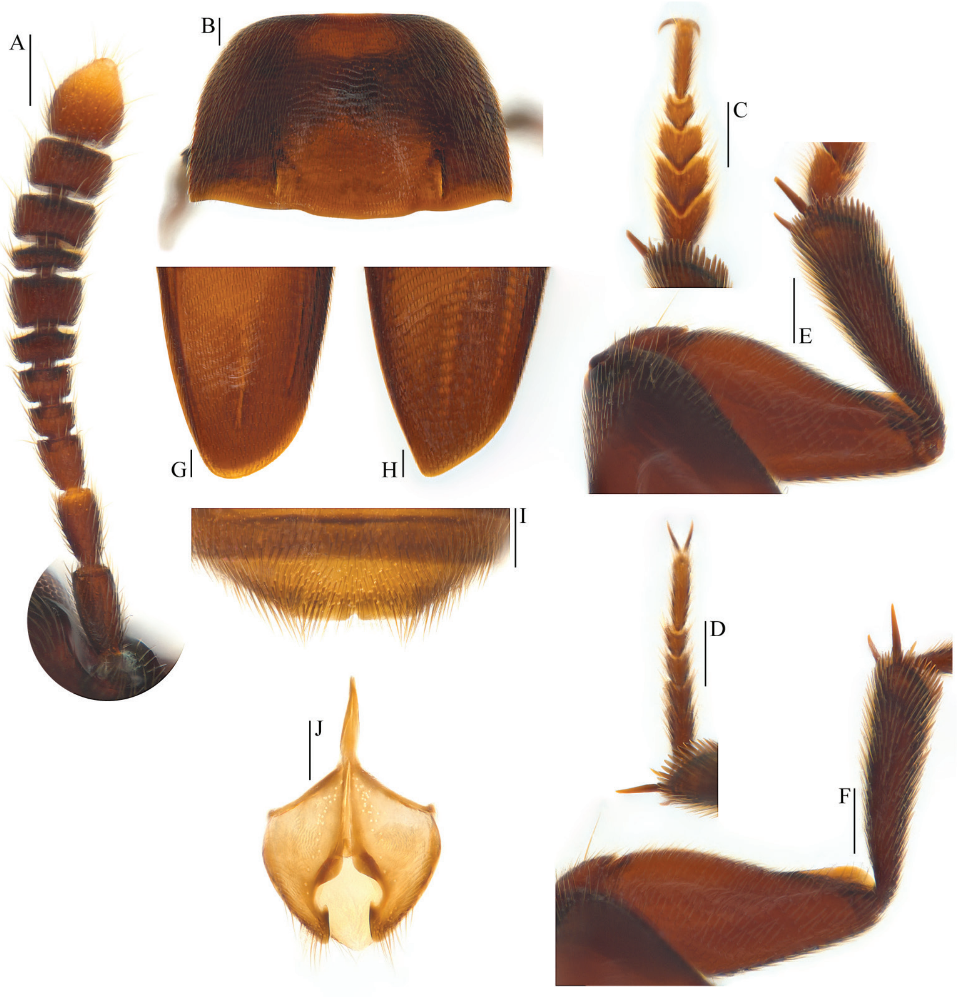

Figure 5. *Ptomaphagus* (s. str.) *piccoloi* sp. n. (paratype). **A** antenna ♂ (dorsal view) **B** pronotum ♂ (dorsal view) **C** protarsus ♂ (dorsal view) **D** protarsus ♀ (dorsal view) **E** protibia and profemur ♂ (dorsal view) **F** protibia and profemur ♀ (dorsal view) **G** elytral apex ♂ (dorsoapical view) **H** elytral apex ♀ (dorsoapical view) **I** ventrite VIII ♂ (ventral view) **J** genital segment ♂ (ventral view). Scale bars 0.1 mm.

apical parts of meso- and metatarsi more or less paler. Dorsum continuously clothed with fine, recumbent, yellowish pubescence. Insertions of pubescence on dorsal surfaces of pronotum, elytra and femora aligned along transverse striolations; interspace between two striolations glabrous.

Head transverse, HW/HL = 1.5. Clypeofrontal suture absent. Clypeus with anterior margin slightly rounded. Compound eyes small, EW/HW = 0.1. Antennae (Fig. 5A) slender, AL/HW = 1.1; antennomere III a little shorter than II; VI with length/width = 0.5; XI pear-shaped.

Pronotum (Fig. 5B) transverse, widest just before hind angles, PW/PL = 1.6. Sides gently arched, gradually narrowing from posterior to anterior; hind angles slightly drawn out and bluntly rounded. Posterior margin widely protruding in the middle part, distinctly emarginate near hind angles.

Elytra oval, widest at approx. basal 1/4, ELL/EW = 1.35. Sides weakly arched, gradually narrowing from widest part to apices, which narrowly rounded (Fig. 5G). Sutural striae present. Metathoracic wings fully developed.

Prolegs robust, with basal three protarsomeres (Fig. 5C) moderately expanded: TW/BTW = 1.5. Protibiae (Fig. 5E) distinctly expanded towards apex. Profemora broad. Mesotibiae slightly arcuate, mesotarsi simply linear. Metatibiae much thick and straight.

Abdominal ventrite VIII (Fig. 5I) almost round at posterior edge and with a distinct median notch. Spiculum gastrale of genital segment (Fig. 5J) with nearly 1/2 of length protruding beyond anterior edge of epipleurite IX.

Aedeagus small, slender and narrow, with median lobe gradually narrowing towards a leaf-shaped apex and terminated by an obtusely rounded knob in dorsal view (Fig. 6A); opening of genital orifice situated on dorsal surface, deeply cut inwards on left edge of median lobe at subapex. Ventral surface of the apex of the median lobe (Figs 6B, D) inserted with 4 ventrally oriented setae on the left side and 5 ventrally oriented setae on the right side; parameres narrow, reaching almost apical 1/8 of median lobe, each apex (Fig. 6E) with 2 lateral setae and 1 apical seta relatively shorter. In lateral view (Fig. 6C), median lobe thin, bent in basal half and almost straight in apical half, gradually tapering apically. Endophallus with stylus quite slender, a cheliform complex just below the base of stylus, and a circular complex at the basal region.

Female. Similar to male in general appearance (Fig. 1E), but distinguished by the following characteristics: protarsi (Fig. 5D) simply linear; protibiae (Fig. 5F) narrower; elytral apices (Fig. 5H) acuminate; ventrite VIII (Fig. 6F) slightly protruded in median of posterior margin; genital segment as shown in Fig. 6G; spermatheca (Fig. 6G) sinuous or coiled in distal part, not coiled in proximal part.

Distribution. Japan (Fig. 9).

Etymology. The specific epithet is from the name of "Piccolo", a fictional character in the *Dragon Ball* manga series created by Akira Toriyama, which also has an Italian origin meaning of "small" that refers to the small body size of this new species.

Remarks. Several examined specimens of this tiny species had been previously identified as *Ptomaphagus* (s. str.) *sibiricus* (maybe more specimens are deposited in different Japanese researchers' collections); however, it is conspicuously different to the holotype of *P.* (s. str.) *sibiricus*. The new species is smaller, with metatibiae much thicker (Fig. 1D, E) and female elytral apices acuminate (Fig. 5H); while *P.* (s. str.) *sibiricus* is larger, with metatibiae slender (Fig. 1F) and female elytral apices narrowly rounded (Fig. 7B).

Interestingly, the new species has the thickest metatibiae and most apparent sexual dimorphism on the elytral apices that we have encountered in any *Ptomaphagus* from East Asia and adjacent areas.

The new species has hitherto been known from Honshu and Kyushu (Hisamatsu and Hayashi 1985, for example), Japan, under the name *P.* (s. str.) *sibiricus*. Despite

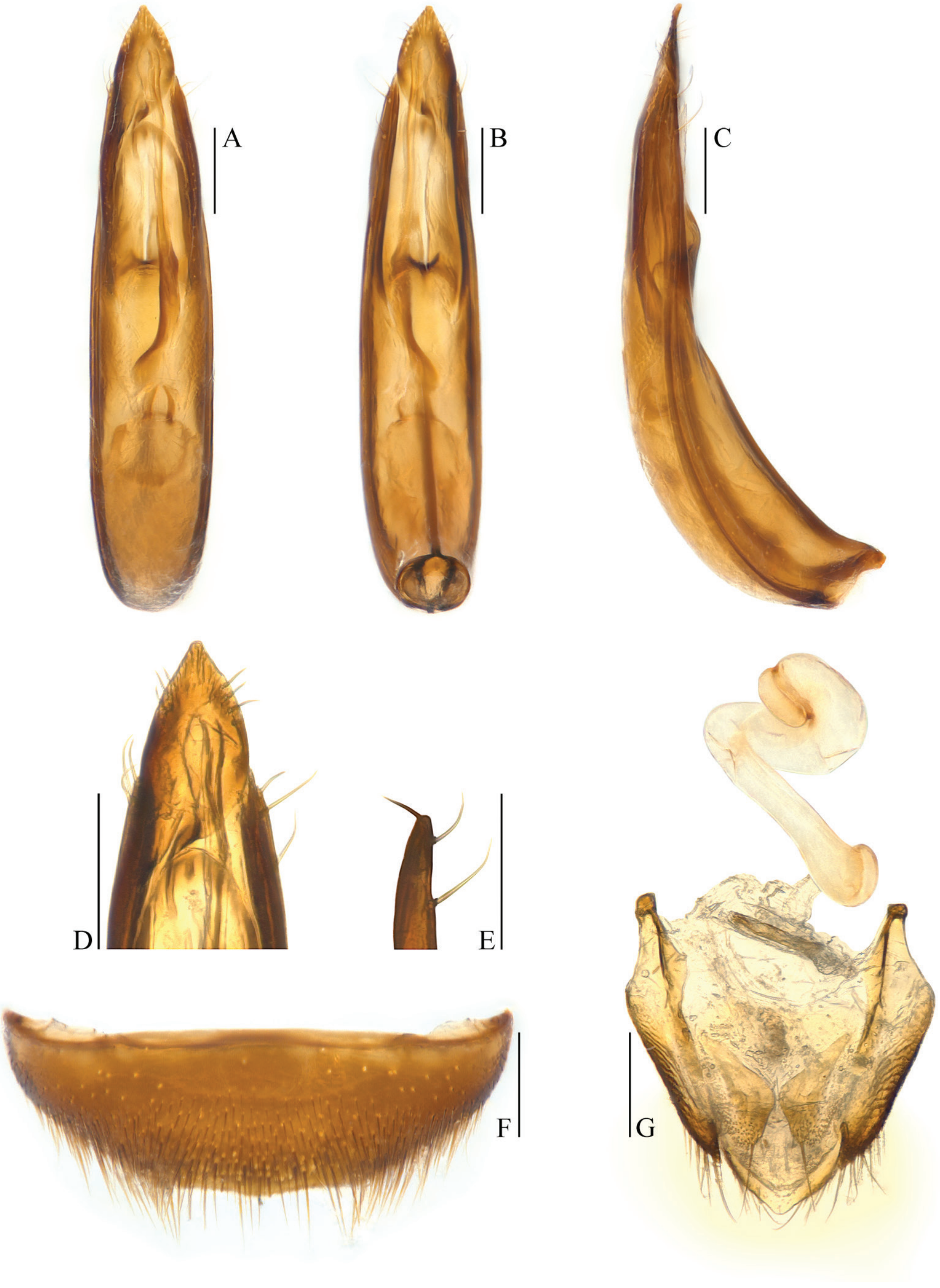

Figure 6. *Ptomaphagus* (s. str.) *piccoloi* sp. n. (paratype). **A** aedeagus (dorsal view) **B** aedeagus (ventral view) **C** aedeagus (lateral view) **D** aedeagal apex (ventral view) **E** paramere apex (lateral view) **F** ventrite VIII ♀ (ventral view) **G** spermatheca and genital segment (ventral view). Scale bars 0.1 mm.

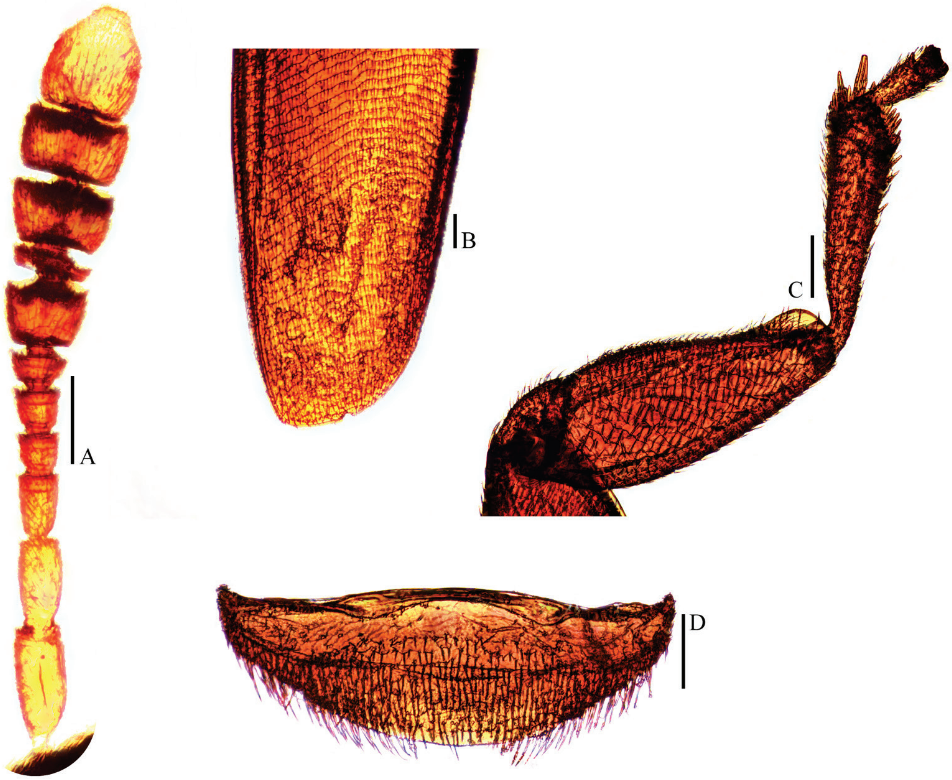

Figure 7. *Ptomaphagus* (s. str.) *sibiricus* Jeannel, 1934 ♀ (holotype). **A** antenna (dorsal view) **B** elytral apex (dorsoapical view) **C** protibia and profemur (ventral view) **D** ventrite VIII (ventral view). Scale bars 0.1 mm.

a long history of studies, it has not yet been recorded from Shikoku; also we have not examined any specimens of this new species from northern Honshu, above the 37th parallel (Fig. 9). In these two areas, the new species can be regarded as at least rare or more probably completely absent. Specimens from Yashiro-jima Island in the Setonai-kai Inland Sea were previously reported (as *P. sibiricus*) in Tanaka and Ban (2006).

As indicated in the material examined, *P.* (s. str.) *piccoloi* sp. n. has been collected from various habitats such as caves, under stones at the base of debris slopes and in litter layers.

Collecting methods for the material mostly indicate a necrophagous association, such as traps baited with decaying animal matter.

Ptomaphagus (s. str.) *sibiricus* Jeannel, 1934

Figs 1F; 7A–D

Ptomaphagus (s. str.) *sibiricus* Jeannel 1934: 165 (*Ptomaphagus* (s. str.); type locality: [RUSSIA, Far East] Wladiwostok; SDEI); Jeannel 1936: 72, 84 (*Ptomaphagus* (s. str.); in key; distribution); Nishikawa 1983: 1 (*Ptomaphagus* (*Ptomaphagus*);

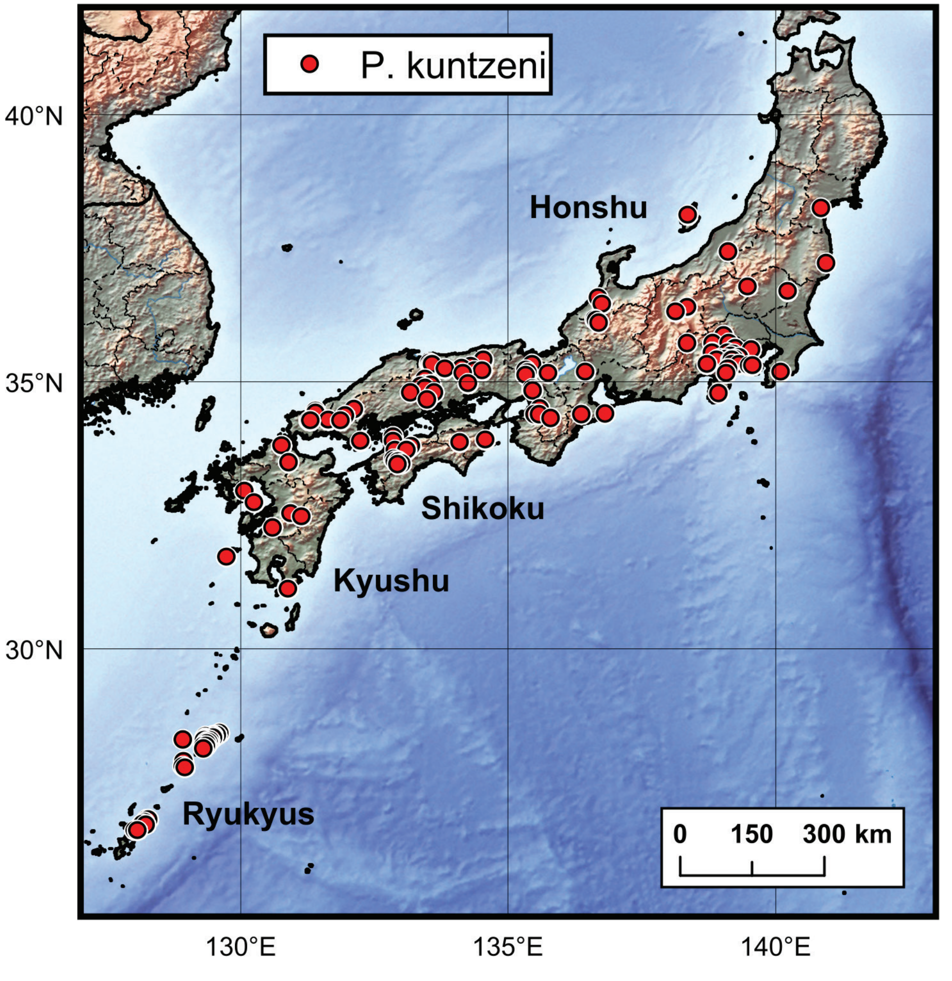

Figure 8. Distribution map of *Ptomaphagus* (s. str.) *kuntzeni* Sokolowski, 1957 in Japan.

in check-list); Perreau 2000: 364 (*Ptomaphagus* (s. str.); in catalogue); Perreau 2004: 178 (*Ptomaphagus* (*Ptomaphagus*); in catalogue); Zinchenko and Lyubechanskii 2008: 340 (*Ptomaphagus*; distribution); Perreau 2015: 249 (*Ptomaphagus* (*Ptomaphagus*); in catalogue).

Material examined. Type material. Holotype: ♀, [RUSSIA, Far East] Wladiwostok [ca. 43°10'N, 132°00'E] // Reitter // Coll. Koltze // Pt. variicornis / Rosenh. // Ptomaphagus sibiricus Jeann. / type / R. Jeannel det. // DEI Müncheberg / Col – 07069 (SDEI).

Distribution. Russia (Far East).

Remarks. Jeannel (1936) thought that *Ptomaphagus* (s. str.) *sibiricus* is also distributed in Japan based on a single female specimen from Chiuzenji (deposited in

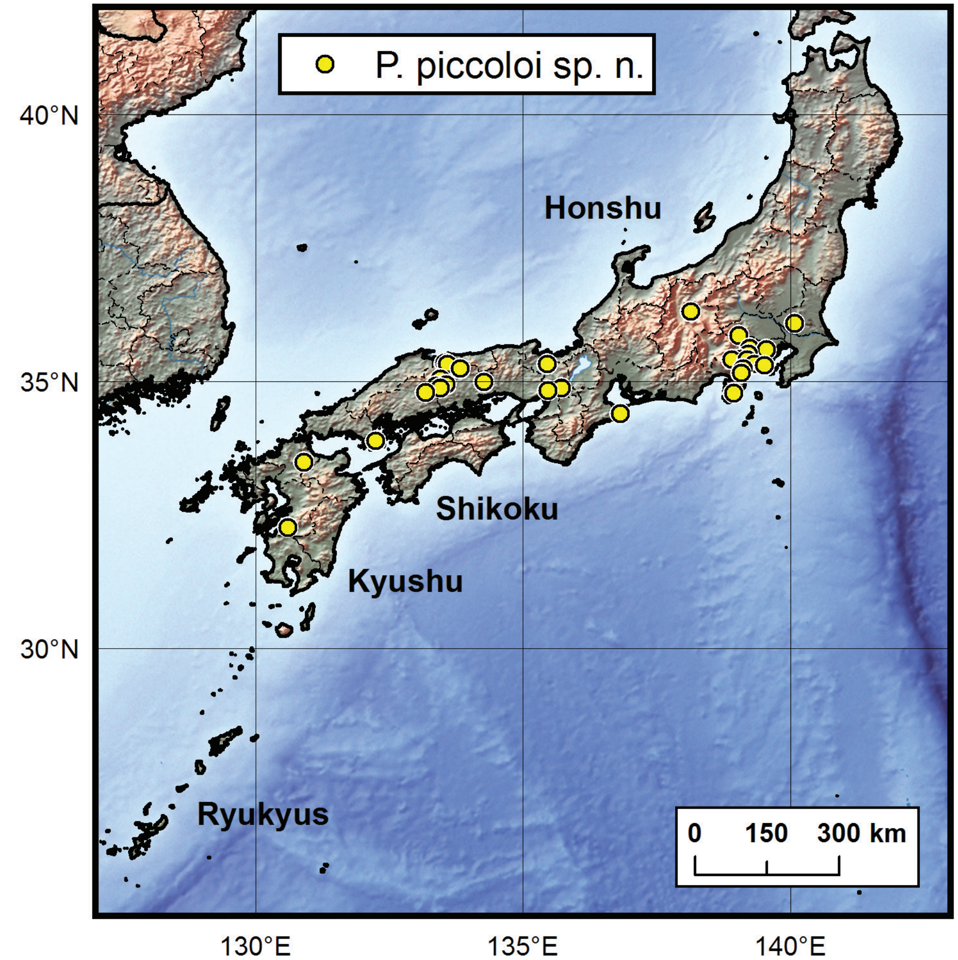

Figure 9. Distribution map of *Ptomaphagus* (s. str.) *piccoloi* sp. n. in Japan.

BMNH). So far, we have not seen any specimens from Japan identical with the holotype of *P.* (s. str.) *sibiricus*, and examined specimens previously identified as *P.* (s. str.) *sibiricus* actually belong to *P.* (s. str.) *piccoloi* sp. n. After examining this Japanese female specimen, labeled "Japan. / G. Lewis. / B. M. 1926–369. // Chiuzenji [ca. 36°46'N, 139°28'E]. // Ptomaphagus / sibiricus Jean. / Jeannel det.", we found it actually belongs to *P.* (s. str.) *kuntzeni*, so *P.* (s. str.) *sibiricus* is absent in Japan.

Unfortunately, the spermatheca and genital segment of the holotype of *P.* (s. str.) *sibiricus* are missing. This species will be described in another paper after examining more specimens from the Russian Far East and the Korean Peninsula.

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New replacement name for *Chrysotus infirmus* Wei, Zhang & Zhou, 2014 (Diptera, Dolichopodidae, Diaphorinae)

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Abstract

Chrysotus weii Zhou, **nom. n.**, the new replacement name is proposed for the species *Chrysotus infirmus* Wei, Zhang & Zhou, 2014 (Diptera: Brachycera: Dolichopodidae: Diaphorinae), which was preoccupied by *Chrysotus infirmus* Parent, 1933.

Keywords

Diptera, Dolichopodid, *Chrysotus*, homonym, replacement name

Introduction

Wei et al. (2014) described the dolichopodid species *Chrysotus infirmus* from Guizhou Province, China. However, the scientific name was preoccupied by *Chrysotus infirmus* Parent, 1933. Thus, the scientific name *Chrysotus infirmus* Wei, Zhang & Zhou, 2014 is a junior primary homonym of the species *Chrysotus infirmus* Parent, 1933. According to Article 60.3 and 57.2 of the ICZN, the new replacement name *Chrysotus weii* Zhou, **nom. n.** for *Chrysotus infirmus* Wei, Zhang & Zhou, 2014 is proposed.

Result

Chrysotus weii Zhou, nom. n.

Chrysotus infirmus Wei, Zhang & Zhou, 2014: 55. Preoccupied by Parent 1933:179.

Etymology. Specific epithet is dedicated to Prof . Wei Lianmeng, for his contributions to the systematic work of Chinese Diptera.

Distribution. China (Guizhou).

Summary of nomenclatural changes

Chrysotus weii Zhou, **nom. n.**= *Chrysotus infirmus* Wei, Zhang & Zhou, 2014 (nec Parent, 1933)

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