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A new species of *Nesotanais* Shiino, 1968 (Crustacea, Tanaidacea) from Japan, with a key to species and a note on male chelipeds

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Abstract

The new species *Nesotanais ryukyuensis* **sp. n.** is described from Japan. *Nesotanais ryukyuensis* most closely resembles *N. rugula* Bamber, Bird & Angsupanich, 2003, but can be distinguished by the length of simple seta on maxillipedal basis and the shape of cheliped in male. A key to species of the genus *Nesotanais* is given. The male chelipeds of *N. rugula* are redescribed. The serial ridges on the inner surface of the chelipedal propodus and dactylus in *Nesotanais ryukyuensis* and *N. rugula* are likely to be stridulating ridges that might produce sound.

Keywords

Nesotanais, Tanaidacea, brackish water, Japan, key, sounding organ

Introduction

At present, more than 200 genera are recognized as valid in the order Tanaidacea (Anderson 2009). Most tanaidaceans live in marine environments, though a small number of species has been reported from non-marine habitats; the latter are classified into 10

genera (Muus 1967; Shiino 1968; Boesch 1973; Băcescu and Guțu 1974; Geldiay et al. 1977; Sieg and Heard 1983; Angsupanich 2001; Jaume and Boxshall 2008). The genus *Nesotanais* is one of these genera, including three species: *N. lacustris* Shiino, 1968 from Lake Tegano, Rennell Island, Solomon Islands; *N. maclaughlinae* Guțu & Iliffe, 1989 from the Tide Rope Cave, Eil Malk Island, Palau; and *N. rugula* Bamber, Bird & Angsupanich, 2003 from Songkhla Lake, Thailand. Males in this genus commonly possess bizarre chelipeds, i.e., the chela (propodus and dactylus) is twisted at right angles with the dactylus situated inwards, and bears a "flange" or proximal extension of the outer proximal part of the propodus (Bamber et al. 2003).

Our sampling in a brackish river in Okinawa Island, southwestern Japan, in 2008, yielded one undescribed species belonging to *Nesotanais*. This paper describes and illustrates the species, and presents a key to the species of the genus.

The interesting feature found in this undescribed species was that the male had serial ridges on the inner surface of the cheliped propodus and dactylus. Among congeners, *Nesotanais rugula* has been reported to have such ridges on the cheliped dactylus. This prompted us to examine the type material of *N. rugula* to compare the cheliped between these two species. During the course of our observation, it turned out that the chelipeds in the male allotype of *N. rugula* show some features different from the original description. A redescription of the male cheliped in *N. rugula* is thus presented in this paper.

In addition to *Nesotanais rugula*, serial ridges on the cheliped were reported in the species of the genus *Imitapseudes* (a junior synonym of *Apseudomorpha*) by Menzies (1953), who as well as Bamber et al. (2003), implied a stridulating device as the possible function for these ridges. At the same time Menzies (1953) and Bamber et al. (2003) also suggested that these structures might be a coupling or locking device. Our observation on the behavior of the present new species suggests that the ridges are a stridulating apparatus, rather than a coupling or locking device. The structure and function of this stridulating apparatus is discussed.

Materal and methods

Specimens were collected at Noha River (Figs 1–3), a brackish river in Okinawa Island, Japan, on 29 February, 23 May, and 29 July 2008. Tanaidaceans were collected by a plankton net with 0.1 mm-mesh opening from muddy bottom sediment in shallow water. Specimens were fixed and preserved in 99% ethanol.

Dissections were carried out with chemically sharpened tungsten wire needles under a dissection microscope. Appendages were mounted on glass slides in glycerin and were sealed by nail polish. Digital drawings were based on draft line drawings produced by using a camera lucida, and/or digital images taken by a digital camera system. Terminology follows Larsen (2003).

The type material is deposited in the Zoological Institute, Faculty of Science, Hokkaido University, Japan (ZIHU).

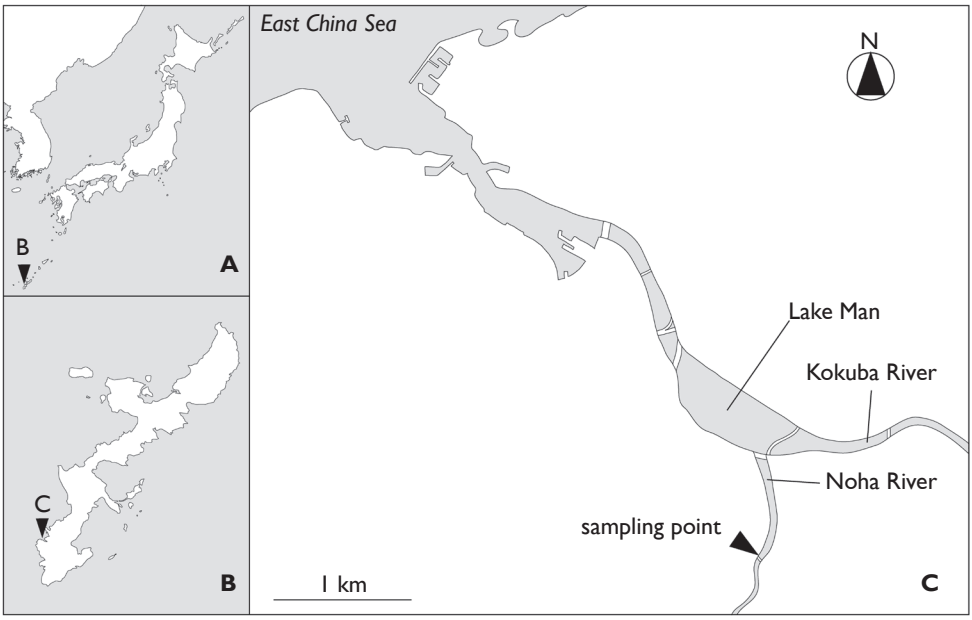

Figure 1. Maps showing the sampling point. **A** location of Okinawa in Japan **B** location of sampling area in Okinawa Island **C** location of the sampling point within Noha River.

Systematics

Order Tanaidacea Dana, 1849
Suborder Tanaidomorpha Sieg, 1980
Superfamily Paratanaoidea Lang, 1949
Family Nototanaidae Sieg, 1976

Genus *Nesotanais* Shiino, 1968
Type species: *Nesotanais lacustris* Shiino, 1968

***Nesotanais ryukyuensis* sp. n.**
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Figs 4–8

Material examined. Holotype, male (ZIHU-3822), 26°11'13.38"N, 127°41'8.84"E, Noha River (near Ishihiyabashi bridge), Naha, Okinawa, Japan, muddy bottom sediment, 50 cm depth, salinity 0‰, 29 February 2008 (dissected). Allotype, ovigerous female (ZIHU-3823), same data as holotype (dissected). Paratypes: non-ovigerous female (ZIHU-3824), same data as holotype (dissected); ovigerous female (ZIHU-3825), same data as holotype; ovigerous female (ZIHU-3826), almost the same locality as holotype, salinity not recorded, 23 May 2008; non-ovigerous female (ZIHU-

Figure 2. Photograph of the sampling point, Noha River, taken from Ishihiyabashi Bridge spanning the river.

3827), almost the same locality as holotype, salinity 20‰, 29 July 2008. All specimens were collected by Keiichi Kakui.

Accompanying fauna. *Longiflagrum nasutus* (Nunomura, 2005) and *Sinelobus* sp. (Tanaidacea); *Victoriopisa ryukyuensis* Morino, 1991 and *Corophium* sp. (Amphipoda).

Diagnosis (male). *Nesotanais* with maxillipedal basis with one pair of simple setae, the latter being apparently longer than maxillipedal palp. Maxillipedal palp without any spiniform setae. Carpus of cheliped without any outer ridges. Dactylus of cheliped with one small and two toothed processes on cutting surface. Cheliped flange short, distally rounded. Plumose setae of pleopod rami on both distal and outer margins. One "step-tipped plumose seta" on inner margin of pleopod endopod.

Etymology. The specific epithet, noun in apposition, is after "Ryukyu", the old name of the type locality, Okinawa.

Description of male (holotype, ZIHU-3822). *Body* (Fig. 4A, 4B). Cylindrical, but slightly flattened dorsoventrally; 1.97 mm in length, about 4.9 times as long as wide, white in ethanol, without any pigmentation.

Cephalothorax about 0.25 of total body length, with one pair of lateral simple setae near eyes. Eyes well defined, black. Anterior edge obtuse triangular in shape from dorsal view. Posterior end laterally swollen, with large sclerite where cheliped is attached.

Figure 3. Photograph of the close view of the sampling point. Bottom sediment was taken from underwater.

Pereon. Each pereonite with pair of lateral simple setae; pereonite 1 with one pair of dorsolateral simple setae. All pereonites laterally rectangular; pereonite 1 shortest, pereonites 2 and 3 shorter than succeeding; pereonites 4–6 subequal in length.

Pleon about 0.26 times total body length, with five pleonites and pleotelson, as wide as pereon. Pleonites all wider than long, with one pair of lateral simple setae. Pleotelson wider than long, gradually tapering posteriorly from uropodal insertion; with one pair of lateral, one pair of dorsal, and two pairs of posterior setae.

Antennule (Fig. 5A, 5a1) four-articled, about 0.9 times as long as cephalothorax. Article 1 about 0.55 times as long as cephalothorax, with two medial and two distal simple setae, several broom setae, and five proximal "feeble branching setae" (Fig. 5a1). Article 2 0.6 times length of article 1, with one simple seta and two broom setae. Article 3 shortest, naked. Article 4 with six simple setae and three aesthetascs at tip.

Antenna (Fig. 5B) six-articled, narrow, about 0.85 times as long as antennule. Article 1 naked. Article 2 long, 2.3 times as long as article 3, with one distal simple seta. Article 3 with one distal simple seta. Article 4 longest, with one distal simple seta, one medial and five distal broom setae. Article 5 with one distal simple seta. Article 6 with six simple setae.

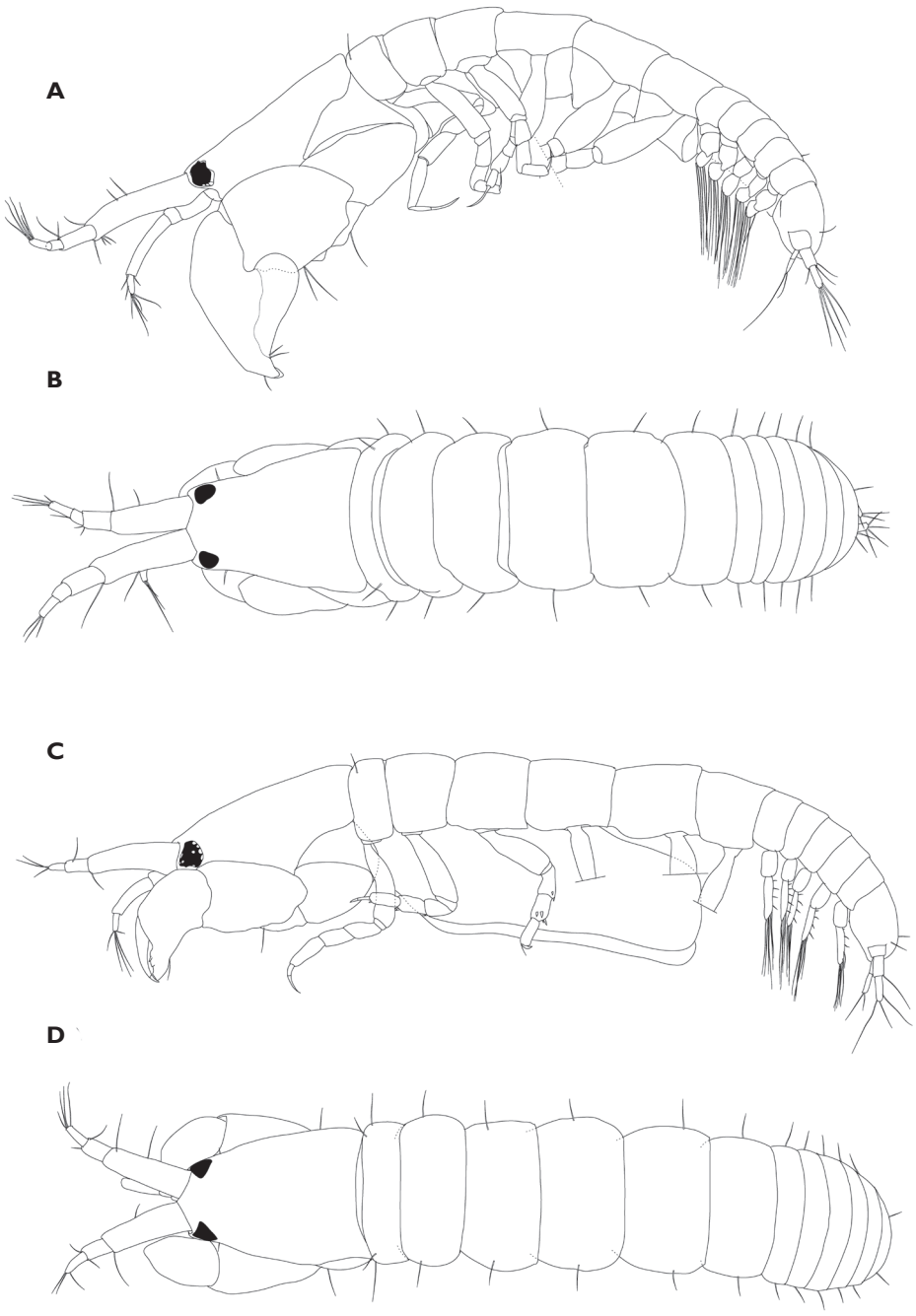

Figure 4. *Nesotanais ryukyuensis* sp. n. **A, B** holotype, male (ZIHU-3822) **C, D** allotype, ovigerous female (ZIHU-3823). **A** body, lateral view **B** body, dorsal view **C** body, lateral view **D** body, dorsal view. Scale bar equals 0.5 mm.

Mouthparts reduced. *Maxilliped* (Fig. 5C) bases completely fused, proximally widened, pear-shaped, each with one ventrodistal simple seta apparently longer than length of palp. Endites reduced. Articulation between palp articles 1–2 obscure; palp article 4 small; all palp articles naked. *Epignath* (Fig. 5C) falciform, tip broken.

Cheliped (Fig. 6A–C) basis with broad articulation with cephalothorax via sclerite, as long as wide, with no free posterior portion, and one outer simple seta. Merus triangular, with one ventral simple seta and one ventrodistal process. Carpus hexagonal, 1.27 times as long as wide, with two ventral setae, one ventroinner and one ventral processes. Chela as long as carpus, twisted about 90-degrees with dactylus situated inwards. Propodal palm with seven short and one long inner simple setae at dactylus insertion, and longitudinal parallel series of cuticular ridges in inner region. Fixed finger with one dorsoproximal, three dorsosubdistal, and two ventrosubdistal simple setae, and several inner small teeth and one inner subdistal toothed process; curving ventrally at a position just distal to the ventrosubdistal setae. Flange short, 0.67 times as long as wide, with round end, bearing inner crenulations. Dactylus slightly longer than fixed finger, gradually curving ventrally, with one ventromedial simple seta; three spiniform setae, one small and two toothed processes on cutting surface, and longitudinal parallel series of cuticular ridges in inner region.

Pereopod 1 (Fig. 5D, 5d1) about 0.7 mm long, longest among pereopods. Coxa with one long simple seta. Basis 0.34 times as long as total pereopod length, narrow (6.6 times as long as wide), cylindrical, and slightly arched; with slight dorsoproximal projection, bearing one simple seta. Ischium wider than long, with one ventral seta. Merus with one ventrodistal seta. Carpus longer than merus, with one dorsodistal, one inner distal, and one ventrodistal simple setae. Propodus longer than carpus, distally setulated (Fig. 5d1), with one ventrodistal simple seta and dorsodistal serration. Dactylus and unguis as long as propodus, falciform. Dactylus with one medial seta. Unguis 1.5 times as long as dactylus.

Pereopod 2 (Fig. 5E) 0.7 times as long as pereopod 1. Coxa like that of pereopod 1. Basis 0.4 times as long as total length, cylindrical, slightly curved; with slight dorsoproximal projection, bearing two broom setae. Ischium like that of pereopod 1. Merus with one ventrodistal simple and one spiniform setae. Carpus longer than merus, with one dorsodistal seta and two ventrodistal spiniform setae. Propodus as long as carpus, distally setulated, with one ventrodistal spiniform seta and dorsodistal serration. Dactylus and unguis slightly shorter than propodus, falciform. Dactylus naked; unguis as long as dactylus.

Pereopod 3 (Fig. 5F) shorter than pereopod 2. Otherwise like pereopod 2, except basis with one dorsoproximal broom seta.

Pereopod 4 (Fig. 5G) shorter than pereopod 3, without separate coxa. Basis 0.38 times as long as total length, inflated (1.95 times as long as wide) with two dorsoproximal and two (one lost in dissection) ventrodistal broom setae. Ischium like that of pereopod 3. Merus with two ventrodistal spiniform setae. Carpus as long as merus, with one dorsodistal simple seta, and two dorsodistal and two ventrodistal spiniform setae. Propodus longer than carpus, with one long spiniform and two ventrodistal

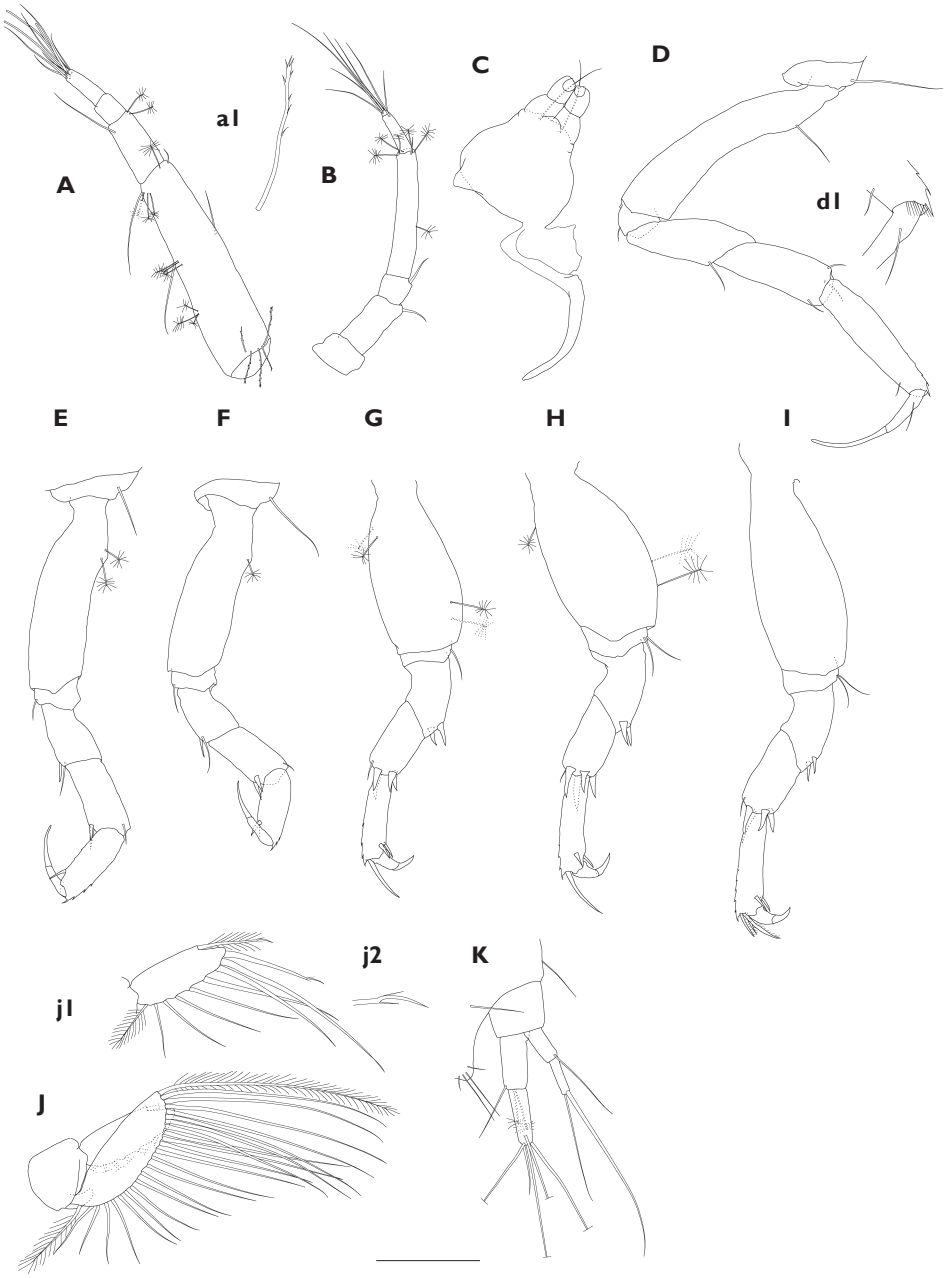

Figure 5. *Nesotanais ryukyuensis* sp. n. Holotype, male (ZIHU-3822). **A** right antennule **a1** feeble branching seta **B** right antenna **C** maxillipeds and right epignath **D** right pereopod 1 **d1** same, distal setulation of propodus **E** right pereopod 2 **F** right pereopod 3 **G** right pereopod 4 **H** right pereopod 5 **I** right pereopod 6 **J** right pleopod 1, most ornaments of setae not shown **j1** same, endopod, most ornaments of setae not shown **j2** same, distal part of step-tipped plumose seta **K** right uropod. Scale bar equals 0.1 mm.

spiniform setae, and dorsodistal serration. Dactylus and unguis shorter than propodus, claw-shaped. Dactylus naked. Unguis slightly shorter than dactylus.

Pereopod 5 (Fig. 5H) longer than pereopod 4, without separate coxa. Otherwise like pereopod 4, except basis with one dorsoproximal broom seta, and ischium with two ventrodistal simple setae.

Pereopod 6 (Fig. 5I) longer than pereopod 5, without separate coxa. Otherwise like pereopod 5, except basis naked, and propodus with three dorsodistal pinnate setae.

Pleopods (Fig. 5J, 5j1, 5j2) biramous, in five pairs, all similar. Basal article naked. Exopod uniarticulate, with 23 or 24 outer plumose setae. Endopod uniarticulate, with seven or eight outer plumose setae, and one inner and one distal "step-tipped plumose setae" (Fig. 5j2).

Uropod (Fig. 5K) basal article naked. Exopod biarticulate. Article 1 with one distal simple seta. Article 2 with two simple setae at tip. Endopod biarticulate, 1.5 times as long as exopod. Article 1 with one distal simple and two distal broom setae. Article 2 with five simple setae at tip.

Description of ovigerous female (allotype, ZIHU-3823; partially based on paratype, non-ovigerous female, ZIHU-3824): *Body* (Fig. 4C, 4D). Somewhat narrower than in male, 2.02 mm (1.70 mm in ZIHU-3824) in length, about 5.9 times as long as wide.

Cephalothorax similar to that of male, except posterior end not as swollen and anterior not as narrow behind the eyes.

Pereon and *Pleon* similar to those of male.

Antennule (Fig. 7A) three-articulated, about 0.7 times as long as cephalothorax. Article 1 about 0.45 times as long as cephalothorax, with two medial and two distal simple setae, several broom setae, and three proximal feeble branching setae. Article 2 one quarter length of article 1, with two simple setae and one broom seta. Article 3 as long as article 2, with six simple setae and one aesthetasc at tip.

Antenna (Fig. 7B) about 0.8 times as long as antennule; setation of articles 1–6 like those of male.

Mouthparts. Labrum (Fig. 7C) rounded, naked. *Mandibles* (Fig. 7D, 7E) molar process well developed, bearing distal row of denticles. Body with bumpy outer margin. Left mandible (Fig. 7D) incisor with several distal denticles; *lacinia mobilis* well developed, with seven teeth. Right mandible (Fig. 7E) crenulate at subdistal margin, incisor apex bifid. *Labium* (ZIHU-3824; Fig. 7F) inner lobe tapering distally, naked. Outer lobe rounded, naked. *Maxillule* (Fig. 7G, 7g1) endite with nine distal spiniform setae and outer subdistal row of simple setae. Palp articulation obscure, with two setae. *Maxilla* lost during dissection. *Maxilliped* (Fig. 7H) bases completely fused, triangular, widest anteriorly, with one pair of distal simple setae over-reaching endites. Endites partly fused, triangular, widest anteriorly, each with one ventrodistal simple seta and two distal tubercles. Palp article1 parallelogram in shape, naked; article2 with one distal and two ventrodistal simple setae; article 3 with inner extension, bearing one inner simple and three inner ventral setulate setae; article 4 with two simple, two pinnate, and two setulate setae. *Epignath* (Fig. 7I) falciform, setulate at tip.

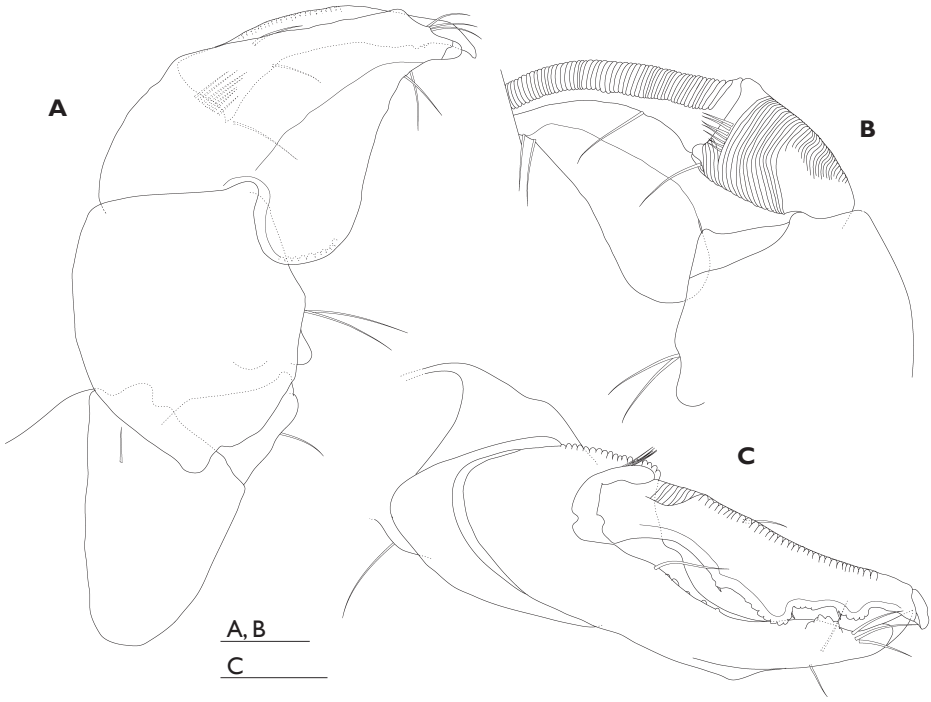

Figure 6. *Nesotanais ryukyuensis* sp. n. Holotype, male (ZIHU-3822). **A** right cheliped, outer view **B** same, inner view of chela **C** same, anterodorsal view of chela. Scale bars equal 0.1 mm.

Cheliped (Fig. 7J, 7j1) basis with broad articulation with cephalothorax via sclerite, slightly longer than wide, with no posterior free portion, and one outer simple seta. Merus triangular, with one ventral simple seta. Carpus gradually widening distally, about 1.35 times as long as wide, with one short dorsodistal and two ventral simple setae. Chela as long as carpus, in general orientation. Propodal palm with seven short and one long inner, and one outer simple setae at dactylus insertion. Fixed finger with two ventral and three dorsal simple setae, one distal bifurcate process, and one distal lamella. Dactylus slightly longer than fixed finger, with one inner proximal simple seta and three small teeth on cutting surface.

Pereopods 1–6 (Fig. 8A–G) somewhat thicker and shorter than in male, setation like those of male.

Pleopods (Fig. 8H, 8h1) biramous, in five pairs, all of them similar and like those of male.

Uropod (Fig. 8I) similar to that of male, except endopod article 2 with three simple and two broom setae at tip.

Habitat. Specimens of *Nesotanais ryukyuensis* were collected from muddy sediment together with the parapseudid *Longiflagrum nasutus* (Nunomura, 2005) and tanaid *Sinelobus* sp. The sediment consisted of upper soft and bottom stiff layers. All three tanaidacean species occurred in the upper soft layer.

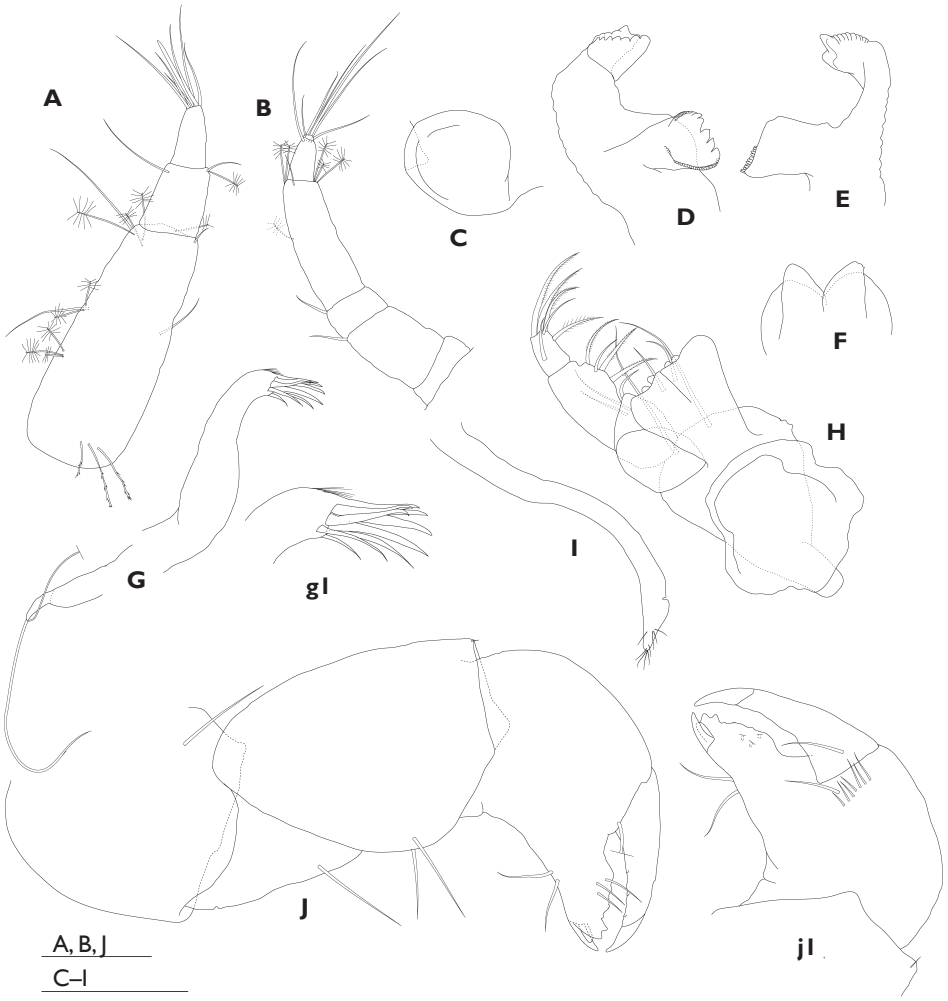

Figure 7. *Nesotanais ryukyuensis* sp. n. **A–E, G–J** allotype, ovigerous female (ZIHU-3823) **F** paratype, non-ovigerous female (ZIHU-3824). **A** right antennule **B** left antenna **C** labrum **D** left mandible **E** right mandible **F** labium **G** left maxillule **gI** same, endite **H** maxillipeds, right palp not shown **I** epignath **J** right cheliped, outer view **jI** same, inner view of chela. Scale bars equal 0.1 mm.

Nesotanais rugula Bamber, Bird & Angsupanich, 2003

Fig. 9A–D

Suplemented description of male chelipeds (allotype, NHM 2001.6687). Basis with broad articulation with cephalothorax via sclerite, as long as wide, with one outer simple seta. Merus subtriangular, with one ventral simple seta and one ventrodistal small process. Carpus hexagonal, 1.16 times as long as wide, with one short dorsodistal and two ventral simple setae, one ventroinner and one ventral processes, and longitudinal

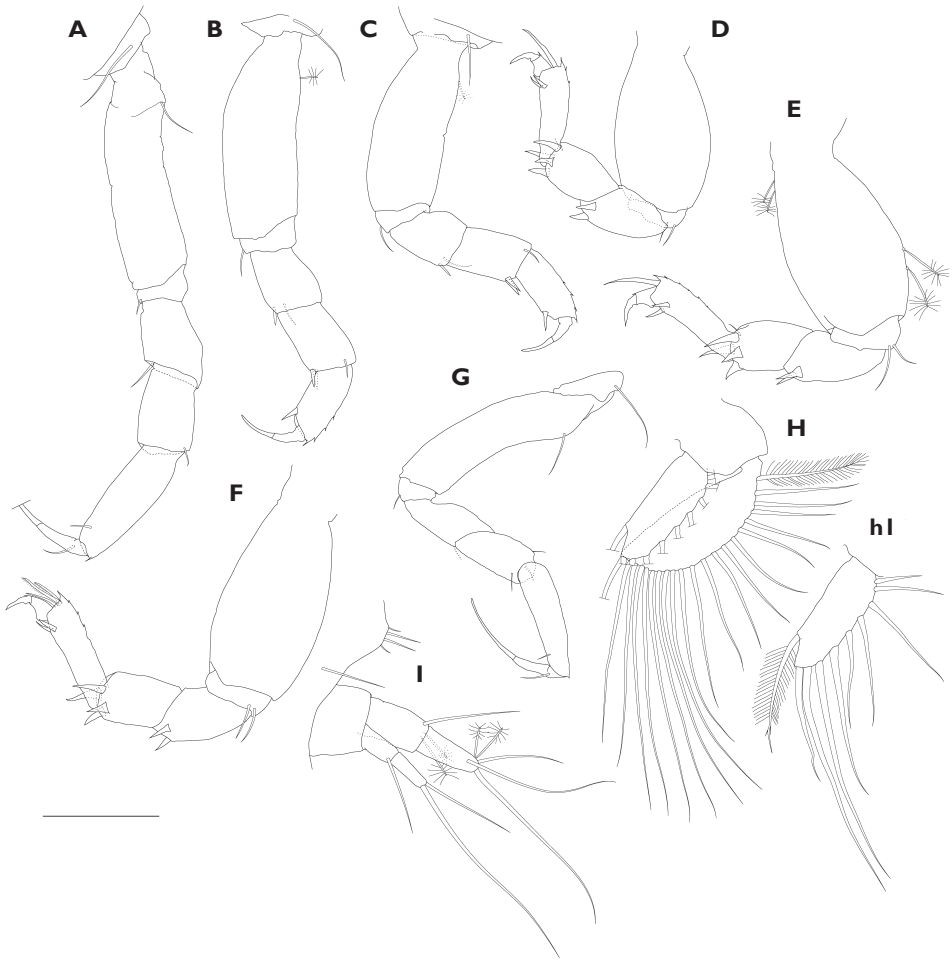

Figure 8. *Nesotanais ryukyuensis* sp. n. **A–F, H, I** allotype, ovigerous female (ZIHU-3823) **G** paratype, non-ovigerous female (ZIHU-3824). **A** right pereopod 1 **B** right pereopod 2 **C** right pereopod 3 **D** right pereopod 4 **E** right pereopod 5 **F** right pereopod 6 **G** right pereopod 1 **H** right pleopod 1, most ornaments of setae not shown **hI** same, endopod, most ornaments of setae not shown **I** left uropod. Scale bar equals 0.1 mm.

parallel series of cuticular ridges in outer region (Fig. 9A). Chela longer than carpus, twisted about 90-degrees with dactylus situated inwards. Propodal palm with nine short and one long inner simple setae at dactylus insertion, and longitudinal parallel series of cuticular ridges in inner region (Fig. 9B). Fixed finger with one dorsoproximal, three dorsosubdistal, and two ventrosubdistal simple setae, and one inner subdistal process (Fig. 9C) curving ventrally at a position just proximal to the ventrosubdistal setae; tip rounded, not bifid (right cheliped was broken, lacking its tip distal to the three dorsosubdistal setae). Flange long, 1.09 times as long as wide, with rectangular end, bearing inner crenulations. Dactylus slightly longer than fixed finger, gradually curving ventrally, with one ventromedial simple seta; three spiniform setae, and one

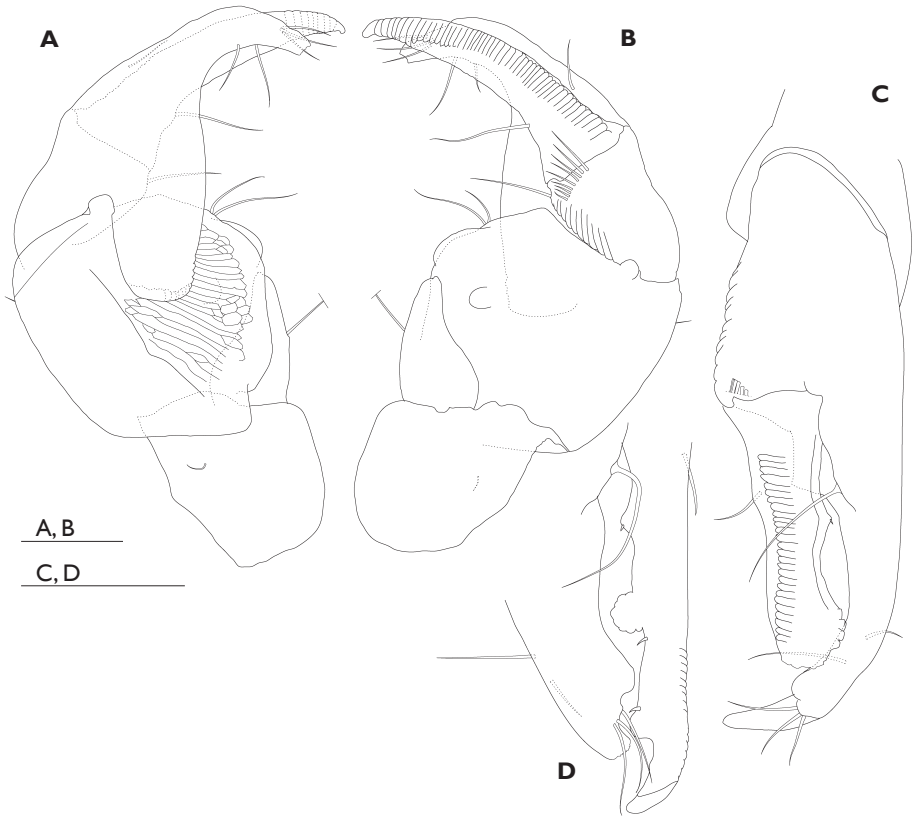

Figure 9. *Nesotanais rugula* Bamber, Bird & Angsupanich, 2003. Allotype, male (NHM 2001.6687). **A** right cheliped, outer view **B** same, inner view **C** left cheliped, anterodorsal view of chela **D** right cheliped, anterodorsal view (slightly different angle from C). Scale bars equal 0.1 mm.

small proximal triangular, one medial toothed, and one small subdistal rounded processes on cutting surface (Fig. 9D), and longitudinal parallel series of cuticular ridges in inner region (left cheliped was broken, lacking its tip distal to the toothed process).

Remarks. The original description of the male cheliped of *Nesotanais rugula* was based on the right cheliped. However, our observation revealed that both chelipeds of this species were apparently broken at different places, i.e., the left one lacks the tip of the dactylus, and the other lacks the tip of the fixed finger. Therefore, the original description is supplemented with respect to the following characters. The distal shape of the fixed finger being rounded (bifid according to Bamber et al. 2003), the number and shape of the processes on the dactylus being one small proximal triangular, one medial toothed, and one small subdistal rounded processes (one rounded op. cit.). Although the serial ridges on the inner surface of the propodal palm were illustrated by Bamber et al. (2003: fig. 20C), no statement on this structure was given in the original description.

Discussion

Nesotanais ryukyuensis sp. n. is the fourth known species of the genus. *N. ryukyuensis* most closely resembles *N. rugula*, but can be distinguished by the following male characters: 1) the length of ventrodistal simple seta on the maxillipedal basis (apparently longer than maxillipedal palp in *N. ryukyuensis* versus shorter than the palp in *N. rugula*), 2) outer cuticular ridges on chelipedal carpus (absent in *N. ryukyuensis* versus present in *N. rugula*), and 3) the shape of the chelipedal flange (short and rounded in *N. ryukyuensis* versus long and rectangular in *N. rugula*). In addition, the females of both species can be separated by the following characters: 1) the length of antenna article 2 (more than twice as long as article 3 in *N. ryukyuensis* versus slightly longer than article 3 in *N. rugula*), and 2) chelipedal carpus (that of *N. ryukyuensis* broader than that of *N. rugula*).

The new species differs from *Nesotanais lacustris* in 1) the number and the shape of processes on the dactylus of the male cheliped (one small and two toothed in *N. ryukyuensis* versus two triangular in *N. lacustris*), 2) the shape of the edge of the flange (rounded in *N. ryukyuensis* versus rectangular in *N. lacustris*) in the male cheliped, 3) the length of ventrodistal simple seta on the maxillipedal basis of the male (apparently longer than the maxillipedal palp in *N. ryukyuensis* versus apparently shorter than the palp in *N. lacustris* according to Shiino (1968) or as long as the palp according to Sieg (1978)), and 4) the number of processes on the chelipedal fixed finger of the female (two in *N. ryukyuensis* versus more than four in *N. lacustris*).

Nesotanais ryukyuensis also differs from *N. maclaughlinae* in 1) the setation of the pleopodal rami (present on distal and outer margins in *N. ryukyuensis* versus absent on outer margin in *N. maclaughlinae*), and 2) the spiniform seta ("spine" in Guțu and Iliffe (1989)) on the tip of the maxillipedal palp (absent in *N. ryukyuensis* versus present in *N. maclaughlinae*).

Nesotanais ryukyuensis and *N. rugula* bear serial ridges on the inner surface of the propodus and dactylus on both chelipeds. Menzies (1953), Bamber et al. (2003) and Larsen (2005) speculated about two different functions for such chelipedal ridges, namely "locking mechanism" or "sound production" hypotheses. While Menzies (1953) and Bamber et al. (2003) considered the "locking mechanism" was more probable, Larsen (2005) suggested that the ridges would be used for sound production. As to the inner ridges of *N. ryukyuensis* and *N. rugula*, we concur with Larsen (2005), based on 1) the position of the ridges, 2) the mobility of the cheliped, and 3) the morphological similarity with the sounding ridges in certain species of crabs. The inner ridges on the left and right chelipeds are opposed to each other, and the behavior of *N. ryukyuensis* (see Appendix 1: Moving image of live *Nesotanais ryukyuensis*) indicates that the animal can rub the chelipeds. In addition, the structure of these ridges strikingly resembles the stridulatory apparatus reported in two mangrove-dwelling sesarmid crabs, *Perisesarma eumolpe* and *P. indiarum*, used in sound production during agonistic interactions (Boon et al. 2009). Confirmation of actual sound and some hypotheses of function is needed in future studies on these tanaidaceans.

Key to males of the species of *Nesotanais*.

1. Plumose setae of pleopod rami only on distal margin.....***N. maclaughlinae***
– Plumose setae of pleopod rami on distal and outer margins **2**
2. Cheliped dactylus with two strong triangular processes.....***N. lacustris***
– Cheliped dactylus with three small or toothed processes and three spiniform setae..... **3**
3. Maxilliped bases with one pair of ventrodistal setae, shorter than the maxilliped palp; cheliped flange long, with rectangular distal margin.....***N. rugula***
– Maxilliped bases with one pair of ventrodistal setae, longer than maxilliped palp; cheliped flange short, with rounded distal margin ....***Nesotanais ryukyuensis* sp. n.**

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Appendix 1

Moving image of live *Nesotanais ryukyuensis*. doi: 10.3897/zookeys.33.296.app.1.mv.

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The mature larva of *Gonioctena variabilis* Olivier, 1790 (Coleoptera, Chrysomelidae, Chrysomelinae) and key to the larvae of the subgenus *Spartoxena*

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Abstract

Mature larva of *Gonioctena (Spartoxena) variabilis* (Olivier, 1790) is described and illustrated for the first time, based on specimens collected on *Genista scorpius* (L.) DC. [Fabaceae] in central Spain. A key to known larvae of the subgenus *Spartoxena* is provided, and the diagnostic characters are illustrated. Diagnostic characters for the identification of species within the subgenus *Spartoxena* Motschulsky, 1860 are number of dorsal tubercles of abdominal segments, shape of tarsal claw, shape of labrum and disposition of microtrichia of epipharynx. Notes on the distribution and host plant of *G. variabilis* are included.

Keywords

Chrysomelidae, *Gonioctena*, *Spartoxena*, *Gonioctena variabilis*, larva, key

Introduction

The Holarctic genus *Gonioctena* Chevrolat, 1837 (Coleoptera: Chrysomelidae: Chrysomelinae) includes more than 70 species classified into nine monophyletic subgenera (Mardulyn et al. 1997). Eight species are currently recognized within *Spartoxena* Motschulsky, 1860 (Kippenberg 2001), which are distributed in southwest Europe (especially in the Iberian peninsula; four species) and north Africa. The taxonomy of adult stages of *Spartoxena* has been subject of considerable effort, with several taxonomic

works clarifying the true status of several taxa from the Iberian Peninsula (Bechyné 1957) and North Africa (Bourdonné and Doguet 1979), besides two recent revisions based on male (Kippenberg 2001) and female genitalia (Baselga 2007).

Larval taxonomy of leaf beetles is far from complete, as we only know the larvae of about 22% of Chrysomelidae and 37% of Chrysomelinae of the Palaearctic region (Steinhausen 1996). The state of larval taxonomy of *Spartoxena* is reasonably good compared with percentages for its subfamily and family as the larvae of four species (50%) of *Spartoxena* are currently known: *G. gobanzi* (Reitter, 1902) from the Alps, which is included in the key for the Central European species (Steinhausen 1994), as well as *G. aegrota* (Fabricius, 1798), *G. leprieuri* (Pic, 1911) and *G. pseudogobanzi* Kippenberg, 2001 from the Iberian Peninsula, which were recently described and illustrated (Baselga and Novoa 2004; Baselga 2008). The aims of this paper are (i) to describe for the first time the mature larvae *G. (Spartoxena) variabilis* (Olivier, 1790), providing diagnostic characters for its identification, and (ii) to provide an identification key for the larvae of the subgenus *Spartoxena*.

Materials and methods

Mature larvae were collected along with adults by sweeping their host plants. Specimens were attributed to genus *Gonioctena* following Steinhausen (1994). The specific identity of larvae was assigned after determination of adults collected from the same plants. To ensure correct larval identification a few specimens were reared until pupation and adult emergence, confirming the assignation of larvae here described to *G. variabilis*. Larvae were preserved in 70% ethanol. Some specimens were cleared in warm 10% KOH and its tegument was mounted on microscope slides, as well as dissected cephalic and thoracic appendages. Slide mounts were prepared using dimethyl hydantoin formaldehyde resin (DMHF). Drawings were traced using CorelDraw 11 software, from images captured with a Nikon Coolpix 4500 digital camera attached to an Olympus SZ30 stereomicroscope and an Olympus BX-41 compound microscope. The morphological terminology follows Kimoto (1962) and Cox (1982).

Gonioctena (Spartoxena) variabilis Olivier, mature larva

Figs 1–3, 10

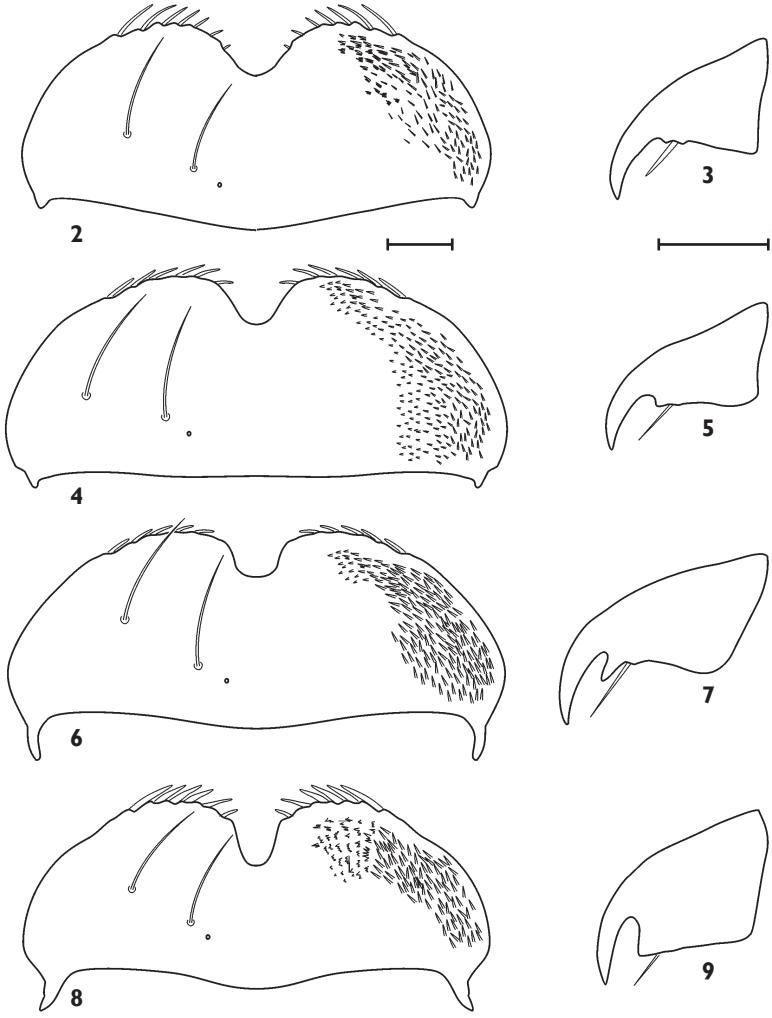
Material examined. SPAIN. Madrid, Perales de Tajuña (lat: 40.232; long: -3.888), 575 m asl, 2 June 2007, 8 mature larvae.

Description. Length: 8.0–9.5 mm. Body eruciform (Fig. 1), convex and slightly arched in preserved specimens. Inter-tubercular plates pale yellow-brown, tubercles pale brown in dorsal and ventral regions, dark brown in dorsolateral region.

Head. Hypognathous, well sclerotized. Great part of vertex and frons dark brown coloured, the anterior part of frons, clypeus and mouth parts, paler. Epicranial suture

Figure 1. Habitus of *Gonioctena variabilis*, mature larva from Perales de Tajuña. Length = 9.0 mm.

well developed and long, frontal arms distinct, V-shaped and almost straight. Endocarina present, extending almost to clypeus. Vertex bearing 5 large primary setae (v1, v3, v4, v5, v6) along with many shorter ones on each side. Frons with 5 primary setae (f1, f2, f3, f4, f6) and 8–10 slightly shorter ones on each side. Antennae very short and well



Figures 2–9. *Gonioctena* spp. **2** Labrum of *G. variabilis*, dorsal view. In the right side the setae were removed and the microtrichia of epipharynx are shown by transparency **3** Tarsal claw of *G. variabilis*, lateral view **4** Labrum of *G. aegrota*, dorsal view **5** Tarsal claw of *G. aegrota*, lateral view **6** Labrum of *G. pseudogobanzi*, dorsal view **7** Tarsal claw of *G. pseudogobanzi*, lateral view **8** Labrum of *G. leprieuri*, dorsal view **9** Tarsal claw of *G. leprieuri*, lateral view. Scale bars = 0.1 mm.

sclerotized, three-segmented: first joint highly transverse; second joint almost as long as wide, bearing a conical membranous sensillum, 3 minute setae and 1 placoid sensillum; distal joint narrow, subconical, with membranous apex bearing 5 highly minute setae and 1 placoid sensillum. Stemmata arranged in two groups, 1 pair located below the base of antenna and 2 pairs behind the antenna. Clypeus with 3 pairs of setae.

Mouthparts. Labrum (Fig. 2) bearing 2 pairs of setae and 1 pair of placoid sensilla on upper surface, anterior border with a wide V-shaped notch and 6–7 stout setae on

each side. Epipharynx with 2 bands of microtrichia situated laterally to anterior notch (Fig. 2), microtrichia completely isolated through the lateral margin but fused together to form groups of 2–3 denticles near central notch. Mandibles symmetrical, 5-toothed, bearing 2 setae on external face and 1 placoid sensillum on dorsal side. Maxillae: cardo transverse, with 1 seta in external border; stipes elongate, with 2 large setae near base of maxillary palp; mala bearing 13–15 setae on internal margin and apex, basal setae longer than apical ones, maxillary palpi 4-segmented, first joint slightly wider than long, bearing 2 long setae basally and another minute seta apically on external margin, second joint highly transverse, third joint longer than wide with 2 setae on internal face and 1 on external side, and fourth joint conical with 1 minute seta on internal face and membranous apex bearing 11–13 highly minute setae. Labium with postmentum membranous, bearing 3 pairs of setae, anterolateral one very short; prementum with 4 pairs of minute setae, 1 pair posterior and 3 pairs anterior to labial palpi along with 1 pair of placoid sensilla; palpi two-segmented, first joint transverse, distal joint conical with membranous apex bearing 10–11 highly minute setae.

Thorax. All tubercles multisetose (Fig. 10). Prothorax with tubercles D (dorsal), DL (dorsolateral) and EP (epipleural) fused together in a pronotal sclerite, pronotum (D-DL-EP) bearing 10 pairs of primary setae along with many other slightly shorter ones; tubercle P (pleural) with 4–6 setae; ventral region with slightly sclerotized tubercles, tubercle SS (sternellar) reduced to 3–4 sclerotized spots bearing 1 seta, midventral tubercle ES (eusternal) bearing 3 pairs of setae. Meso- and metathorax with 6 tubercles on each side of dorsal region: Dai (dorsal anterior interior, with 6–8 setae), Dae (dorsal anterior exterior, 6–8 setae), Dpi-Dpe (dorsal posterior interior and dorsal posterior exterior fused together, 8–10 setae), DLai (dorsolateral anterior interior, 2–4 setae), DLpi (dorsolateral posterior interior, 11–15 setae), DLae-DLpe (dorsolateral anterior exterior and dorsolateral posterior exterior fused together, 13–18 setae); epipleural region with 2 tubercles, EPa (epipleural anterior, 11–14 setae) and EPp (epipleural posterior, 5–8 setae); mesothoracic spiracle isolated from EPa tubercle, located in front of DLae-DLpe one; P tubercle bearing 4–6 setae; SS and ES tubercles reduced to numerous sclerotized dots bearing isolated setae.

Legs. All pairs similar in size; trochantin located in front of P tubercle (Fig. 10), bearing 1 minute setae in anterior half; prothoracic trochantin also with a larger seta in postero-ventral angle; coxa almost twice longer than wide in lateral view, with 10–11 large setae on dorsal face and 3–5 shorter ones in each lateral declivity; trochanter triangular in lateral view, with 2 large setae on each side, 1 minute seta and 4 placoid sensilla near coxal articulation on anterior side, and 2 placoid sensilla on posterior side; femur wider apically than basally in lateral view, with 2 large and 1 small setae dorsally, 3 large setae and 1 placoid sensillum on anterior side, and 2 large setae on posterior side; tibio-tarsus twice longer than wide, bearing 3 large and 1 minute setae dorsally and 4 ventrally; unguis wide basally, curved apically, with an extremely weak tooth and seta on lower side (Fig. 3).

Abdomen. All tubercles multisetose (Fig. 10). Segments 1–6 with 6 tubercles on each side of dorsal region: Dai (4–6 setae), Dae (6–7 setae), Dpi (6–9 setae), Dpe (7–9 setae),

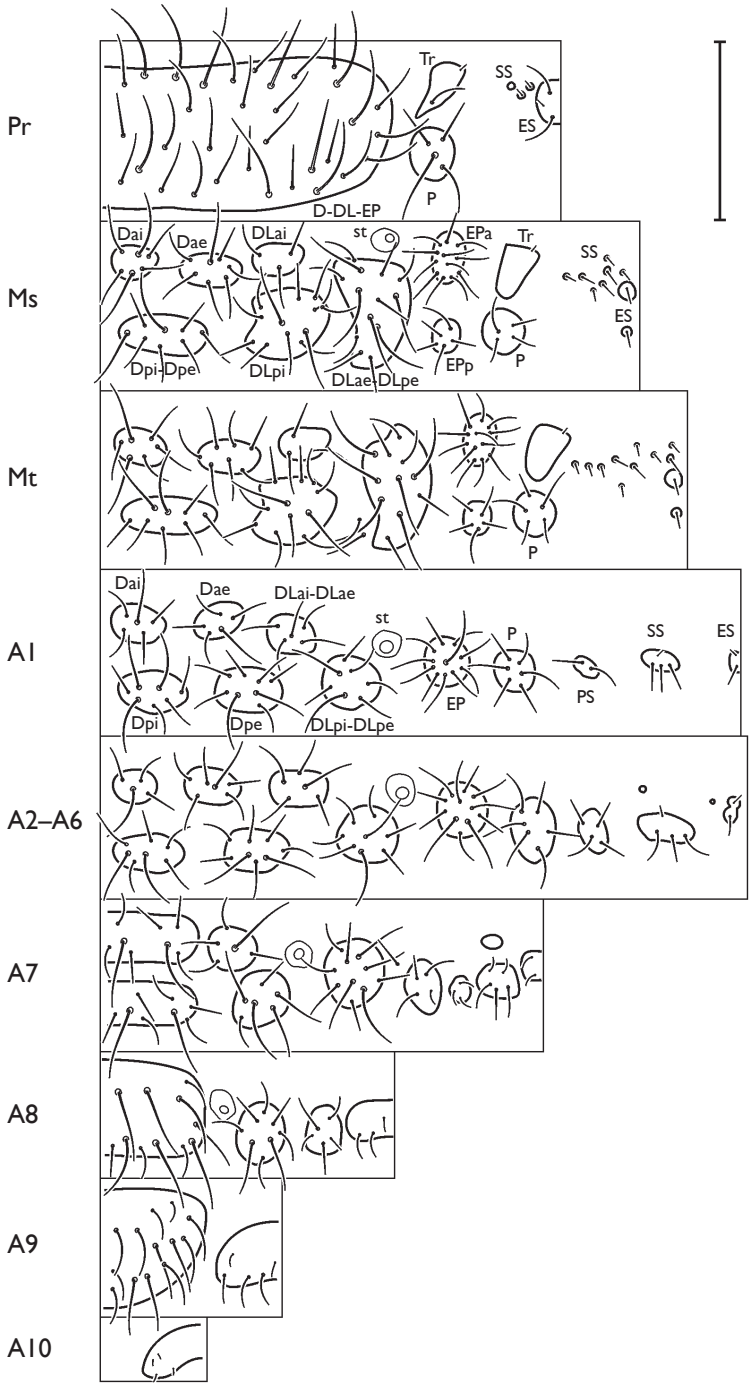


Figure 10. *Gonioctena variabilis*: location of tubercles and body chaetotaxy, right side. **Pr** prothorax **Ms** mesothorax **Mt** metathorax **A1–A10** abdominal segments 1–10. See text for definition of tubercles abbreviations. Scale bar = 1.0 mm.

DLai-DLae (4–6 setae) and DLpi-DLpe (6–9 setae); epipleural region with tubercle EP bearing 11–12 setae; spiracle isolated from EP tubercle, located in front of DLpi-DLpe one; P tubercle with 6–9 setae; sternal region presents the following tubercles: PS (parasternal, 2–5 setae), slightly reduced in segment 1, but always present and bearing 2 setae; SS (4–6 setae); ES separated in two halves, each one with 2–3 setae. Segment 7 with tubercle Dai fused to Dae, and Dpi to Dpe; segment 8 and 9 with all dorsal and dorsolateral tubercles fused together, ventral ones also fused in segment 9; segment 10 forming anal pseudopod, without dorsal tubercles, ventral ones fused together.

Distribution and ecology. *G. variabilis* is distributed in the east half of Spain and south France. In Spain it is distributed southwards to Madrid in the westernmost area and to Alicante in the easternmost range (Kippenberg 2001; Baselga 2007). Its host plant is *Genista scorpius* (L.) DC. [Fabaceae] (Kippenberg 2001). The larvae described in this paper were collected on the same plant [field identification]. *Genista scorpius* is known from the Iberian Peninsula but also from southern France and northern Morocco. Its Iberian range includes almost the whole peninsula, excepting the western third (Talavera 1999). Hence the distribution range of *G. variabilis*, seems closely related to that of its host plant, although it does not reach the western and southernmost regions where *G. scorpius* is present. This pattern could be real, as phytophagous insects usually have narrower distribution ranges than their hosts (Gaston 2003), but further research is needed to clarify to which extent southern and western limits of *G. variabilis* differ of those of its host plant.

Discussion

The mature larva of *G. variabilis* presents all the diagnostic characters given by Cox (1982) and Steinhausen (1994) for the identification of the genus *Gonioctena*: body dorsally not strongly convex, labrum with 2 pairs of setae, pronotum bearing a high number of setae on disc, dorsolateral tubercles of meso-, metathorax and abdomen without eversible glands, tarsal claws toothed on lower side. Of the 18 species of western Palaearctic *Gonioctena* with known larva (Steinhausen 1996; Baselga and Novoa 2004; Baselga 2008), four belong to the subgenus *Spartoxena*: *G. aegrota*, *G. gobanzi*, *G. leprieuri* and *G. pseudogobanzi*. The mature larva of *G. variabilis* shares the following diagnostic characters of *Spartoxena* (Baselga 2008) with other members of the subgenus: (i) frons with two dark spots, (ii) frons with 5 primary setae along with more than 7 slightly shorter setae on each side, (iii) abdomen with dorsal tubercles not fused together.

The five larvae currently known within the subgenus show a high interspecific similarity. At the larval stage, *Spartoxena* species can be accurately identified based only on a limited number of diagnostic characters: the number of dorsolateral tubercles, the shapes of labrum and tarsal claw, and the disposition of microtrichia in the epipharynx. The first character allows the separation of *G. gobanzi* from the remaining species, as *G. gobanzi* presents three dorsolateral tubercles (Steinhausen 1994: Fig. 216), instead of two dorsolateral tubercles as the four Iberian species (Baselga and Novoa 2004; Baselga

2008), including *G. variabilis* (Fig. 10). Among these species, *G. variabilis* can be distinguished by the parasternal tubercle of the first abdominal segment, which is only partially reduced and bearing 2 setae (Fig. 10), whereas it is extremely reduced and bearing only 1 seta in the remaining species (Baselga and Novoa 2004; Baselga 2008). The shape of the median V-shaped notch of the labrum (Fig. 2) and the effaced tarsal claw (Fig. 3), also allow separating *G. variabilis* from *G. leprieuri* and *G. pseudogobanzi*, in which the median notch of labrum is U-shaped (Figs 6, 8) and the tarsal claw is well marked (Figs 7, 9). By these two characters, *G. variabilis* is most similar to *G. aegrota* (Figs 4–5), from which the species described here can be distinguished by just the parasternal tubercle of the first abdominal segment and, less clearly, by the shape of tarsal claw and the disposition of microtrichia in the epipharynx: (i) tarsal claw is almost totally effaced in *G. variabilis* (Fig. 3), instead of weak but well delineated in *G. aegrota* (Fig. 5), and (ii) microtrichia of epipharynx form groups of 2–3 denticles near the central notch in *G. variabilis* (Fig. 2), whereas they are mostly isolated or sometimes paired in *G. aegrota* (Fig. 4).

Key to known larvae of the subgenus *Spartoxena*

1. Abdominal segments 1–6 with four dorsal and three dorsolateral tubercles on each side (Steinhausen 1994: Fig. 216). Southern Alps ..... ***G. gobanzi* (Reitter)**
– Abdominal segments 1–6 with four dorsal and two dorsolateral tubercles on each side (Fig. 10) **2**
2. Tarsal claws with a weak tooth on ventral side (Figs 3, 5). Labrum with a wide V-shaped notch (Figs 2, 4) **3**
– Tarsal claws with a marked tooth on ventral side (Figs 7, 9). Labrum with a wide U-shaped notch (Figs 6, 8) **4**
3. PS tubercle in abdominal segment 1 extremely reduced to an isolated seta (Baselga and Novoa 2004: Fig. 11). Tarsal claws weak but well delineated (Fig. 5). Microtrichia of epipharynx mostly isolated or sometimes paired (Fig. 4). Western and southern Iberian peninsula and northern Morocco..... ..... ***G. aegrota* (Fabricius)**
– PS tubercle in abdominal segment 1 slightly reduced but always well visible and bearing 2 setae (Fig. 10). Tarsal claws almost completely effaced (Fig. 3). Microtrichia of epipharynx isolated through lateral margins but fused together to form groups of 2–3 denticles near central notch (Fig. 2). Eastern and northern Iberian peninsula and southern France ..... ***G. variabilis* (Olivier)**
4. Tarsal claws with a broad tooth (Fig. 9). Labrum with a deep U-shaped notch (Fig. 8). Microtrichia of epipharynx isolated through lateral margins but fused together to form ridges of 3–5 denticles near the central notch (Fig. 8). Northwest quarter of the Iberian peninsula..... ***G. leprieuri* (Pic)**
– Tarsal claws with an acute tooth (Fig. 7). Labrum with a shallow U-shaped notch (Fig. 6). Microtrichia of epipharynx mostly isolated or sometimes paired (Fig. 6). South-east Iberian peninsula ..... ***G. pseudogobanzi* Kippenberg**

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Description of two new *Homoeocera* Felder from Guatemala and Mexico (Lepidoptera, Arctiidae, Arctiinae, Euchromiini)

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Abstract

Two new species of *Homoeocera* Felder from Central America are described from high-altitude, humid localities in Mexico and Guatemala, *Homoeocera georginas* **sp. n.** and *H. papalo* **sp. n.** Both are compared to the closely related *Homoeocera gigantea* Druce. Illustrations of adults and male genitalia of the three species are provided. The generic placement within the genus *Homoeocera* is discussed.

Keywords

Euchromiini, Arctiidae, Neotropics, taxonomy, *Homoeocera*.

Introduction

The general classification of the Noctuoidea superfamily followed throughout this work is that of Mitchell et al. (2006) established on nuclear genes rather than the less traditionnal and more controversial classification proposed by Lafontaine and Fibiger (2006). At the tribe level the classification used follows the recent works of Kitching and Rawlins (1998) and Jacobson and Weller (2002).

In 2007, I had the opportunity to collect in Guatemala in very well preserved localities which gave a slight idea of the richness of this country around the end

of the 19th century when the large work "*Biologia Centrali-Americana*" was written (Druce 1881–1890a). Even though Guatemala has been largely explored since 1850, it is obvious that many new species of Lepidoptera are continually awaiting description.

During this trip, we spent two nights at Fuentes Georginas, Quetzaltenango, a high altitude (2460 m) locality with cold and very wet weather. We were surprised to find two different species of *Homoeocera* Felder in abundance: one larger species with wide black wing margins and clear transparent wings, and a second, smaller species with narrow black margins and yellowish transparent wings. Moreover, the smaller species displays conspicuous yellow intersegmental abdominal lines whereas the large one displays bright blue lines (Fig. 1).

The genus *Homoeocera* was created by Felder in 1874 for a single species, *H. crassa* Felder, 1874 (*op. cit.*, Pl. 102, fig. 26) and for the moment contains between 8 and 24 species depending of the accepted limits of the genus (Draudt 1915; Global Lepidoptera Names Index website; Global Diversity Information facility website). The two species found in Guatemala are very similar to *Homoeocera gigantea* Druce, 1884, described in the first volume of "*Biologia Centrali-Americana*" (Druce 1884: 54, plate VIII fig. 5) based on a single female specimen from Costa Rica (Van Patten leg.). Later, in the second volume, Druce added two more localities: Guatemala from a specimen in Staudinger collection (Conradt leg.) and Guatemala City (Rodriguez leg.) (Druce 1897 p. 341). The holotype is in the general collection in BMNH in London (specimen examined). It is interesting to note that in addition to the type in the BMNH, there is a male from Guatemala bearing the label: Guatemala, Santa Maria, 5500', Sept, 1919–266.

Following this study it was clear that the two entities found in Guatemala represent two quite distinct species, the larger one having genitalia similar to *Homoeocera gigantea* from Costa Rica. Moreover it was also found that specimens from Oaxaca State in Mexico, also at high altitude, represent a new species different from the two species found in Guatemala. These two new species are described in the present work.

Methods and materials

Adult genitalia were prepared by boiling abdomens 15 minutes with 2 pellets of potash in 5 ml of water. After rinsing with water and then alcohol, genitalia were photographed in a natural position suspended in 95% alcohol. Types and museum specimens were mounted in Euparal, and remaining specimens were stored in glycerol in Eppendorf tubes. Photos were taken with a CoolPix 4500 Nikkon camera attached to a trinocular Nikkon stereomicroscope SMZ-10A.

In order to check the exact distribution of each species, specimens were dissected from as many localities as possible. Specimens from the collection of Xavier Lesieur

were included (Honduras and Mexico) and specimens originating from Mexico, Guatemala, Honduras and Costa Rica were dissected.

Three specimens each of *H. gigantea* and *H. georginas* were sequenced and analyzed using the barcode fragment of the mtDNA COI gene (BOLD: Barcode of Life Data Systems). DNA was extracted from legs of dried specimens in the collection of the author, then amplified and sequenced at the "Canadian Centre for DNA Barcoding" (CCDB) in Guelph, Ontario. Extraction, amplification and sequencing protocols can be found on the CCDB website (http://www.dnabarcoding.ca/pa/ge/research/protocols) and are also described in Vaglia et al. (2008).

Repository abbreviations are as follows:

BMNH The Natural History Museum (formerly British Museum [Natural History]), London.
DVUC Del Valle University, Guatemala City, Guatemala.
JMC Personal collection of José Monzon, Guatemala City, Guatemala.
MNHN Museum National d'Histoire Naturelle, Paris, France.
MLC Personal collection of Michel Laguerre, 33850 Léognan, France.
USNM National Museum of Natural History (formerly United States National Museum), Washington, D.C., USA.
XLC Personal collection of Xavier Lesieur, 95880 Enghien-les-Bains, France.

Systematics

***Homoeocera gigantea* Druce, 1884** In: Druce (1881–1890): 54 pl. VIII Fig. 5.
Figs 2a, 2b, 3a–f

Diagnosis. Generally speaking a robust and handsome species well characterized by clear (not yellowish) transparent wings with black borders and crimson red legs. Most similar to *H. georginas*; see Diagnosis under that species.

Description. Head, collar, tegulae, thorax and antennae deep black. Abdomen above entirely black with bright blue intersegmental lines, difficult to see on dried specimens Forewing length 21–24 mm (n = 13). Forewings transparent and entirely bordered by a thin black line (around 0.3 mm) with a small indentation on vein CuA2. Base of the wings largely black. Black line at the end of the cell reaching the costa. Hindwings reduced, entirely transparent, with termen bordered with a thin black line. Border wider along anal angle and with a small indentation just above the anal angle. The immediate basal area black.

The underside is almost identical to the upperside, palpi are entirely red; hindwings with a milky white iridescence just inside the anal border; all legs are crimson red except the tarsi which are dark-brown. There is a white depression at the base of the ventral abdomen in males.

Figure 1. *Homoeocera gigantea* (left) and *Homoeocera georginas* sp. n. (right) at rest, the same night, on the collecting sheet at Fuentes Georginas, Quetzaltenango, Guatemala (V. 2007).

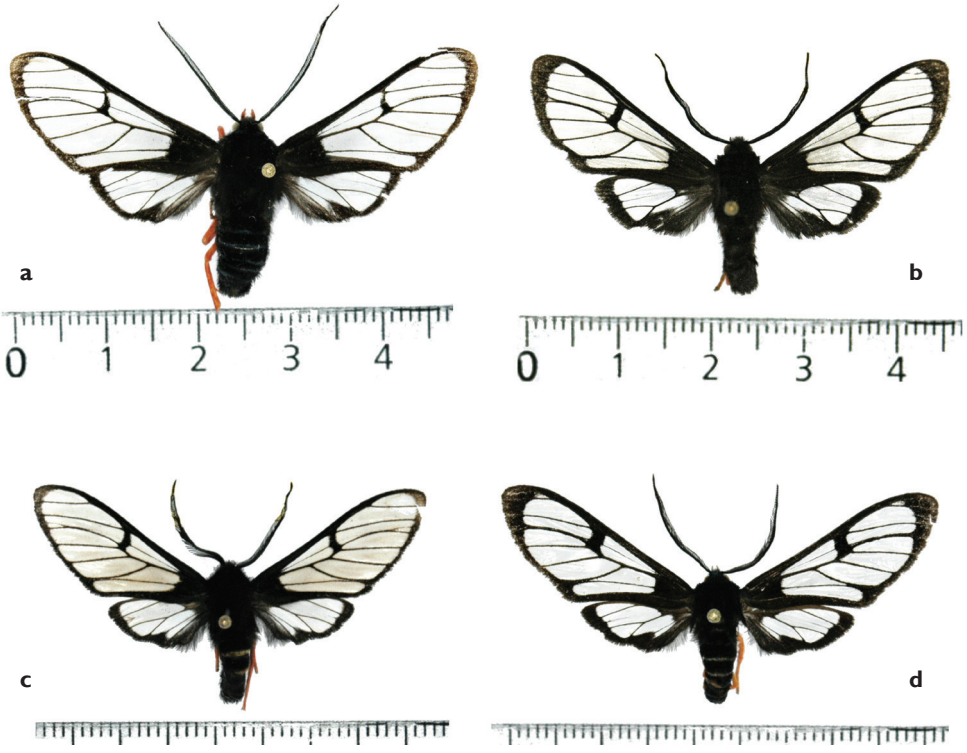

Figure 2. a Homoeocera gigantea, from Costa Rica, Cartago, Tapanti, X.1985 **b** *Homoeocera gigantea* from Guatemala, Quetzaltenango, Fuentes Georginas, 2460 m, 9.V. 2007, M. Laguerre leg. **c** *Homoeocera georginas*. sp. n., from Guatemala, Quetzaltenango, Fuentes Georginas, 2460 m, 9.V.2007, M. Laguerre leg. **d** *Homoeocera papalo*. sp. n., from Mexico, Oaxaca, Concepcion Papalo, 2275 m, 10.VII.1997, G. Nogueira leg.

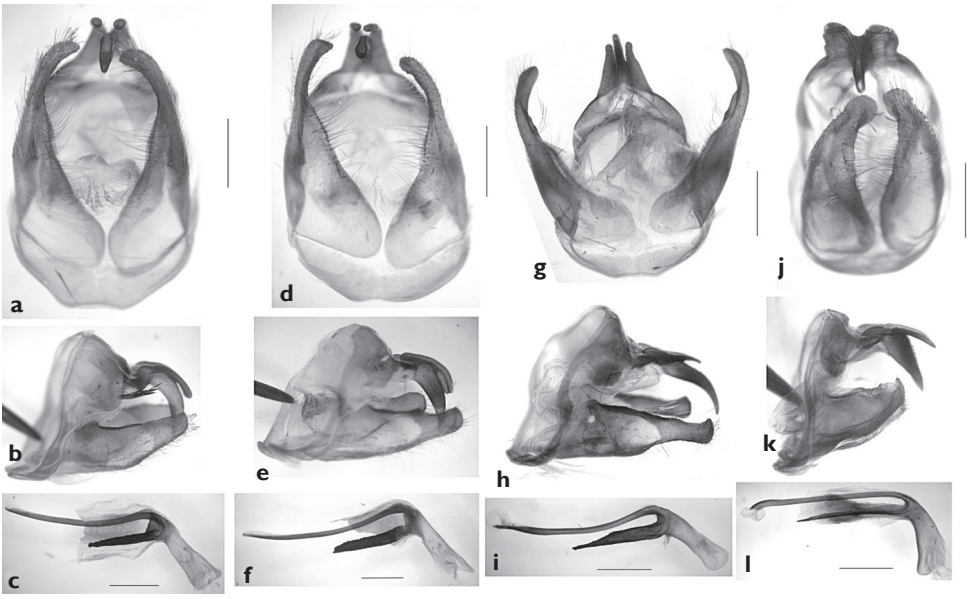

Figure 3. *Homoeocera* male genitalia with successively: ventral view, lateral view, penis in lateral view, all in natural positions for: **a–c** *H. gigantea* from Costa Rica **d–f** *H. gigantea* from Guatemala **g–i** *H. georginas* sp. n. from Guatemala **j–l** *H. papalo* sp. n. from Mexico. Scale bar = 1 mm.

Specimens examined. GUATEMALA: Quetzaltenango, Fuentes Georginas, 11 & 12.V.2007, 2460 m, 14° 45.008 N – 91° 28.820 W, M. Laguerre *leg.*, 7 ♂, one has been dissected Gen. ML1558, two have been bar-coded, GenBank accession numbers GU332713 (BOLD no. ARCTB327-08 / MILA0986) and GU332714 (ARCTB351-08 /MILA1010). All M. Laguerre *leg.* Zacapa, S.E. La Union, 15-V-2007, 1400 m, 14° 57.152 N' 89° 16.690' W, GenBank GU332715, BOLD no. ARCTA774-07 / MILA0493, M. Laguerre *leg*, 1 ♂. Suchitepéquez, Atitlan Reserve, Refugio del Quetzal, I-2009, 1570 m, 14° 32.873' N 91° 11.610' W, J. Monzon *leg.*, 1 ♂. San Marcos, Finca Esperanza, 1950 m, 30.V & 1.VI.2008, 14° 56' 03.6" N – 91° 51' 41.1" W, J. Touroult *leg.*, 3 ♂. [all in MLC]. **HONDURAS:** Prov. Morazan**,** 24 km NE Tegucigalpa, La Tigra, 1000 m, VI.1995, Porion / Lachaume *leg.*, 3 ♂, one dissection # Gen. ML1788 [XLC]. **COSTA RICA:** Cartago, Tapanti, X.1985, Gen. ML1678, 1 ♂. COSTA RICA, San Jose, Cerro La Muerte, Paraiso del Quetzal, 2722 m, 14.IX.2009, 09° 38' 40.10" N – 83° 51' 01.09" W, D. Herbin leg., 3 ♂ [MLC].

Distribution and biology. As far as is known, *H. gigantea* is distributed from Guatemala to Costa Rica, generally at high altitude in very humid biotopes. It is not presently known from Nicaragua possibly because collecting at high altitude is difficult due to the topography of the country. The biology is unknown.

Remarks. Specimens from Guatemala and Honduras exhibit wider black wing borders compared to Costa Rican specimens, but the genitalia are similar. DNA barcode divergence between *H. gigantea* and *H. georginas* samples is approximately 3.8%.

Homoeocera georginas **Laguerre, sp. n.**
urn:lsid:zoobank.org:act:226C6379-FAC5-43CE-A280-61D3E5101C79
Figs 2c, 3g–i

Type material. Holotype: 1 ♂, GUATEMALA, Quetzaltenango, Fuentes Georginas, 11 & 12.V.2007, 2460 m, 14°45.008 N – 91°28.820 W, M. Laguerre *leg*. [printed white label] / Gen. ML1539 [hand-written white label] / MILA0966 [printed yellow label] / HOLOTYPE [printed red label]; GenBank accession no. GU332717, BOLD access code ARCTB307-08 / MILA0966 [MNHN]. **PARATYPES** (21 ♂): **GUATEMALA:** same data as holotype, 9 ♂, one has been dissected: Gen. ML1833, two specimens have been bar-coded, GenBank accession no. GU332716 (BOLD access codes ARCTB335-08 / MILA0994) and GU332718 (ARCTA791-07 / MILA0510, dissection Gen. ML1833), all M. Laguerre *leg* [MLC]. Same locality as holotype, 9 ♂, 02.VII.2008, José Monzon *leg*., [JMC]; 1 ♂, same locality as holotype but 27.IX.2006, Monzon, Heppner & Sutton leg., [JMC]; 2 ♂, same locality as holotype but 24–25. VIII.2001, A. Bailey & J. Monzon *leg*. [DVUC]. One paratype will be deposited in BMNH and USNM.

Etymology. The name is a reference to the type locality: Fuentes Georginas, a popular spot with hot springs high in the mountains on the Pacific slope.

Diagnosis. Similar to *gigantea* but less robust species with a yellow cast on forewings and very characteristic deep crimson red legs. By comparison *H. gigantea* is a larger and more robust species well characterized by the wider black margin of the fore- and hindwings. There is no yellowish cast on the forewings, the black indentation in space 2 of the hindwings is more pronounced, the abdomen upperside has a bluish hue with blue intersegmental lines (very difficult to see on dried specimens), the tip on the antennae below are not white, palpi are red not black.

In *H. gigantea*, the uncus is shorter and wider, the lateral protuberances are longer, wider and rounded (tapered in *georginas*) in lateral view, cylindrical in ventral view. The valvae are asymmetrical, the left one being slightly longer than the right one which reaches the base of uncus. The tegumen is a little wider, the concavity more pronounced and always without saccus. In the aedeagus, the ventral process is less than half the length of the upper process (greater than half in *georginas*), narrower but more sclerotized (almost black), and the apex of the ventral process is abruptly cut, not tapered as in *georginas*.

Description. Female unknown. Head, collar, tegulae, thorax and antennae deep black. Abdomen above entirely black with yellow intersegmental lines, difficult to see on dried specimens. Forewing length 18–20 mm (n = 10). Forewings transparent with a slight yellowish cast and entirely bordered by a thin black line (about 0.5 mm) with a small indentation on vein CuA2. Base of the wings largely black. Black subrectangular spot at the end of the cell reaching the costa. Hindwings reduced, entirely transparent, with termen bordered with a thin black line but without the yellowish cast. Border wider along anal angle and with a small indentation just above the anal angle. The immediate basal area black.

The underside is almost identical to the upperside, except the tip of the antennae which is white, palpi are entirely black, there is a milky white iridescence just inside the anal border on the hindwings and all legs are deep crimson red except the claws which are dark-brown.

Male Genitalia (Fig. 3g–i): Uncus long, pointed and curved downward, like a bird beak with a protuberance on each side. In lateral view these protuberances are very slender with a total length less than half the length of uncus. In ventral view, these protuberances have a rounded and almost cylindrical appearance. Valvae are symmetrical slighly curved inward and slightly spatulate at tip, reaching the middle of uncus. Tegumen slightly concave and without saccus. Adaegus very characteristic, divided into two distinct parts: an upper one, long, thin, slightly curved upwards and bearing a small smooth vesica and a lower part slightly longer than half the upper one, wider and strongly sclerotized, corrugated and with a bevelled extremity.

Distribution and biology. For the moment, known only for a restricted area in Guatemala, on the Pacific slope, at high altitude. Biology is unknown.

Remarks. Although sample size of barcoded specimens is small, the relatively large genetic divergence between *gigantea* and *georginas*, at about 3.8%, fully support the recognition of these taxa as separate species.

***Homoeocera papalo* Laguerre, sp. n.**

urn:lsid:zoobank.org:act:FAD17F11-6571-4131-9297-03A3EDB2EDF5

Figs 2d, 3 j–l

Type material. Holotype: 1 ♂, MEXICO, Oaxaca, Concepcion Papalo, 2275 m, 10.VII.1997, G. Nogueira *leg*., (white printed label) / Gen. ML1672 (white handwritten label) / HOLOTYPE (red printed label) ; deposited *in* MNHN, Paris.

PARATYPES (7 ♂): 1 ♂, same data as holotype [MLC]. **MEXICO:** Oaxaca, Road Tuxtepec-Oaxaca, PK 86, 1750 m, VII.1992, J. Haxaire *leg*, 6 ♂, one dissected: Gen. ML1789. [XLC].

Etymology. The name is a reference to the type locality, Concepcion Papalo, a small city in north east Oaxaca state. The name Papalo means butterfly.

Diagnosis. Similar to *gigantea* but a less robust species with elongated forewings and orange red legs. *H. papalo* sp. n. is intermediate in size between *gigantea* and *georginas*, but the forewings are obviously narrower and elongated. There is no yellowish cast on the forewings as in *georginas*, however the underside tip of antennae is white as in *georginas*. Palpi and legs are orange not deep crimson red as in *georginas* and *gigantea*. The genitalia of *H. papalo* are also very distinct from the two other species. Here, the lateral protuberances of the uncus have a very different shape, the symmetrical valvae are very short, not reaching the base of uncus. The adaegus has two long lobes of similar length, whereas the lobes are very obviously of different lengths in *gigantea* and *georginas.*

Description. Female unknown. Head, collar, tegulae, thorax and antennae deep black. The collar displays a metallic bright blue cast. Abdomen deep black upperside

with bright line at the end of segments. Forewing length 20–21 mm (n = 2). Forewings elongated, transparent, entirely bordered by a black line wider than in *H. georginas* sp. n. specially at apex where it is enlarged and presence of a small indentation on vein CuA2. Base of wings is largely black, the subrectangular cellular spot at the end of the cell is large and conspicuous. Hindwings transparent, black border wide except on costa with an indentation on vein CuA2. The extreme base black. Underside similar to upperside, tip of the antennae white, palpi and legs orange. A milky white iridescence just inside the anal border on the hindwings.

Male Genitalia (Fig. 3 j–l). Uncus conical, stout and pointed, with a protuberance on each side. In lateral view these protuberances are very slender with a total length exceeding half the length of uncus. In ventral view, these protuberances are semi-circular not unlike "ears". Valvae are symmetrical, slighly curved inward and spatulate at tip, not reaching the base of uncus. Tegumen rounded and without saccus. Adaegus very characteristic, divided into two distinct parts: a dorsal long, thin, rectilinear process with the apex slightly curved downward and bearing a small smooth vesica and a ventral thin, pointed process reaching about ¾ length of the dorsal one.

Distribution and biology. Currently known only from a very restricted area in Oaxaca state in Mexico, at high altitude. The biology is unknown.

Discussion

The three species discussed here constitute a very homogeneous group in both habitus and genitalia. This study adds data to the BOLD project, which aims to build a DNA barcode database of all macrolepidoptera (Hebert et al. 2003), and a campaign targeting the neotropical Arctiidae has been initiated. To date, more than 2200 sequences accounting for about 750 species (i.e., more than 10% of currently described neotropical Arctiidae) from at least 16 countries have been analyzed.

The main problem in *Homoeocera* seems to be the correct generic assignment of this group of species. When he described *gigantea*, Druce included this species within the genus *Gymnelia* Walker near *torquata* Druce, which he had described sometime earlier (Druce 1883). In 1898, Hampson transferred *gigantea* to *Homoeocera* Felder whereas in 1914 he transferred *torquata* to *Dassysphinx* Felder. What is clear from dissection of the generotype of *Homoeocera* (i.e. *crassa* Felder) is that the three above species are not congeneric with *crassa*. Furthermore, based on the habitus, *torquata* seems misplaced within the genus *Dassysphinx*, but together with the three species treated here, *tarsipuncta* Schaus, *garleppi* Rothschild and *ockendeni* Rothschild (all three presently included within *Dassysphinx*) seem to constitute a rather homogeneous group. A correct generic assignment of all these species requires a complete revision of the genus *Homoeocera,* which is far beyond the scope of this work. It seems prudent at the moment to maintain the *status quo* and assign the two new species to the genus *Homoeocera*.

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RESEARCH ARTICLE

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The flower fly genus *Eosphaerophoria* Frey (Diptera, Syrphidae)

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Abstract

The flower fly genus *Eosphaerophoria* is revised. Eight new species are described (*adornata* **sp. n.** Mengual, *bifida* **sp. n.** Mengual, *brunettii* **sp. n.** Ghorpadé, *hermosa* **sp. n.** Mengual, *luteofasciata* **sp. n.** Mengual, *nigrovittata* **sp. n.** Mengual, *symmetrica* **sp. n.** Mengual, and *vietnamensis* **sp. n.** Mengual), and an identification key is provided. Redescriptions, illustrations, synonymies, diagnoses and distributional data are given for all 11 known species of *Eosphaerophoria*. The new described species increase the genus' distribution, now recorded from Nepal and Sri Lanka east to New Guinea. All information data, images and drawings, as well as additional images and relevant information, are available online via the internet as an example of the utility of international standards for biodiversity informatics.

Keywords

Taxonomy, identification key, Syrphinae, new species, cybertaxonomy

Introduction

Eosphaerophoria Frey, 1946 is a little known genus of flower flies (Diptera: Syrphidae) found in the Australasian and Oriental Regions, ranging from Nepal and Sri Lanka (but not India in between) to the Philippines and New Guinea. Less than a dozen

specimens have so far been reported in the literature, representing three described and one undescribed species (Vockeroth 1969: 135). The relationships with other genera or its closest taxon are unknown, but *Eosphaerophoria* is currently placed within the tribe Syrphini of the subfamily Syrphinae.

Frey (1946) designated a new genus, *Eosphaerophoria*, for his species *marginata* based on three males and one female collected on Mt. Banahao (Luzon, Philippines). He pointed out the similar habitus of his new genus and *Sphaerophoria* Lepeletier & Serville, 1828 (tribe Syrphini, subfamily Syrphinae), but the abdominal pattern of *E. marginata* resembled that in *Toxomerus* species (tribe Toxomerini, subfam. Syrphinae). Although *Neoascia* Williston, 1887 (tribe Brachyopini, subfam. Eristalinae) was also mentioned in his diagnosis, some differences with *Eosphaerophoria* spp. were obvious, such as their swollen metafemur and produced face without facial tubercle. Keiser (1958) erected the genus *Tambavanna* for a peculiar new species. *Tambavanna dentiscutellata* Keiser, 1958 was based on a single male collected in central Sri Lanka, and he stated its resemblance to *Sphaerophoria* and some similarities with *Ocyptamus (Calostigma)*, both members of the tribe Syrphini, but referred his new genus to the tribe Bacchini (subfam. Syrphinae) *sensu* Hull (1949), based on the slightly narrowed abdominal base and reduced alula and anal lobe.

In his major generic revision of the tribe Syrphini, Vockeroth (1969) synonymized *Tambavanna* under *Eosphaerophoria* and placed it within the tribe Syrphini indicating the absence of similarity with the genus *Baccha sensu stricto*. Vockeroth provided a general genus description where he indicated some morphological characters diagnostic of the genus, like dichoptic males, the nearly vertical apical crossvein [vein M_1 *sensu* Thompson (1999a)] and the subtriangular scutellum. The asymmetrical male genitalia and a reduced anal lobe and alula are characters shared with the genus *Giluwea* Vockeroth, 1969, but he did not think they were closely related. Vockeroth also noted that an undescribed *Eosphaerophoria* species from New Guinea had superior lobes of male genitalia symmetrical. As mentioned by Vockeroth, dichoptic males are uncommon in the tribe Syrphini, only present in some species of *Melangyna*, *Allograpta*, *Rhinobaccha* and also shared by the genera *Giluwea* and *Eosphaerophoria*.

Recently, Claussen and Wiepert (2003) described the third species of *Eosphaerophoria* from the Annapurna Region (Nepal) based on a single female. Their new species *E. punctata* has no distinct notopleural protuberance, unlike the other two described species, and has a dorsomedial yellow macula on the black 2nd abdominal tergum (Fig. 30).

The *Eosphaerophoria* species have never been revised and the only identification key to the described species was provided by Claussen and Weipert (2003). The aim of this revision is to describe the eight new species of *Eosphaerophoria* we have recognized, to provide redescriptions of two known species and to present an identification key to all. At the same time, another objective is to present an example of cybertaxonomy (Penev et al. 2008) for Syrphidae with numerous web resources.

Material and methods

Redescriptions, complete synonymies, illustrations, and distributions are given for all species, except *punctata* Claussen & Weipert, 2003. Terminology follows Thompson (1999a). New terms for the aedeagus (male genitalia) are used here for the first time, recognizing a basal and an apical part (see Fig. 44). Speight (1987) called these two parts as tubus and pyxis for apical and basal parts of aedeagus. He also named the basal appendices of aedeagus as harpes, name not recorded in Thompson (1999). More recently, Cumming and Wood (2009) used the terms basiphallus and distiphallus, equivalents to basal and apical portion of aedeagus respectively.

The format for and abbreviations in the generic synonymy follow the BioSystematic Database of World Diptera (BDWD; Thompson 1999b). The acronyms used for collections likewise follow BDWD standards and their equivalents are given in the acknowledgments. The museum or collection holding appears in square brackets after each specimen. Every specimen was registered in the Diptera database of the National Museum of Natural History (USNM) providing a unique barcode and number for easy identification. These barcodes are listed in the text after each individual, i.e. USNM ENT00036560. Moreover, names of the new species were included in the Nomenclator of the BioSystematic Database of World Diptera (http://www.diptera.org/). All listed specimens were examined, otherwise it is explicitly noted.

All measurements are in millimeters and were taken using a reticule in a Wild M5A microscope. Illustrations of male genitalia were drawn using a camera lucida mounted on an Olympus BX51 compound microscope with the help of a Nikon SMZ1500 microscope. Manual drawings were redrawn as a vectorial image using Adobe Illustrator (version CS3). Illustrations of male and female abdomens were composed using the same software but based on images of pinned specimens taken with a Canon EOS40D mounted on a Microptics Camlift and the help of Adobe Lightroom (version 2).

All images included in this publication have been deposited in MorphBank (http://www.morphbank.net). The direct hyperlink for each taxon is given and extra colour pictures of the species can be found in the online collections. New taxonomic names proposed in this paper have been registered with ZooBank (http://www.zoobank.org/) as part of the ZooKeys publication process, and all taxon names have a Life Science Identifiers number (LSID) following each name (Penev et al. 2008).

Information for all specimens is a direct copy of the labels with no modification of what was written. For all specimens, labels are indicated by quotation marks (“ ”), with each line in the label separated by a double slash (//), and handwriting information in labels is indicated by italics. Updated and more complete data for each specimen can be found in an Excel file named Appendix A. In the “Type locality” paragraph, current country names and new data, such as province or district, are given, as well as geographic coordinates. Most of the specimens lack information about geographic coordinates on their labels, but we consider these data important to locate sampling points in a map or to share them with GBIF. Google Earth was used to locate the type localities easily (see Appendix B) and to get the geographic coordinates used in this

work. When no precise data about locality were written or they defined a large area in the map (e.g. type locality for *Eosphaerophoria adornata*), an approximated point was used to represent the label locality. In these cases, registered altitude in the label helped to locate the collecting point.

Collection data has been shared (via Appendix A) with the Global Biodiversity Information Facility (GBIF, http://www.gbif.org/). A kml file for viewing distribution records interactively in Google Earth (http://earth.google.com/) is available for download as Appendix B. Our intention is that the paper edition of this work be enlarged when combined with additional material found online such as colour photographs deposited in MorphBank (Penev et al. 2009).

Genus *Eosphaerophoria* Frey

Eosphaerophoria Frey, 1946: 169. Type-species, *marginata* Frey (original designation). Vockeroth 1969: 134, map 26 (distribution), Figs 11 (wing), 89 (male genitalia) (key reference, description, distribution); Knutson et al. 1975: 313 (catalog citation); Thompson and Vockeroth 1989: 443 (catalog citation); Ghorpadé 1994: 3, 5 (citation, key); Mengual et al. 2009: 7, 8, 23 (citation, morphological characters, phylogenetic analysis).

Tambavanna Keiser, 1958: 202. Type-species, *dentiscutellata* Keiser (original designation). Synonymy by Vockeroth (1969: 134).

Description (adapted from Vockeroth 1969: 134). Small slender species with male narrowly dichoptic, mesonotum bright yellow laterally, scutellum usually subacute or acute apically, abdomen of male very slightly petiolate, abdomen of female slightly broadened from base to near apex. Length from 4.9 mm to 6.8 mm.

Head. Eye bare. Face slightly broadened below, yellow, with or without medial black vitta, with a tubercle small but well defined, rather compressed in male. Antenna short, less than head width; scape about as broad as long; pedicel broader than long; basoflagellomere oval to slightly elongate, not more than 1.3 times as long as broad; arista dorsobasal, bare. Frons of male very narrow, at antenna about 1/5 head width, narrowed to 1/8 to 1/10 head width a little below anterior ocellus, then very slightly broadened to vertex; frons of female broader, narrowed gradually to posterior ocellus, then parallel-sided to vertex. Ocellar triangle, especially in male, well before postero-median angle of eye; anterior ocellus separated from eye by much less than its diameter.

Thorax. Scutum black, with postpronotum, broad presutural stripe (notopleuron) and narrower postsutural stripe yellow; black dorsomedial area usually with opaque margin and shining or sub-shining centre. Postpronotum bare. Notopleuron with posterolateral angle sometimes produced postero-laterad into a strong blunt tubercle which extends distinctly caudad of suture (Fig. 28). Scutellum with basal black triangle and yellow margin, subtriangular in outline with apex bluntly rounded, subacute, or produced into a short, acute, sometimes upcurved tubercle. Subscutellar fringe very

short and present only laterally or entirely absent. Pleura yellow (propleuron, anepisternum, anepimeron, katepimeron and katatergum), except katepisternum black with a dorsal yellow macula and meron black. Thoracic pile extremely short and sparse. Katepisternum with dorsal and ventral pile patches broadly separated, the pile in the dorsal patch extremely short or absent, scarcely distinguishable. Metasternum bare. *Legs*. Simple; metafemur near apex sometimes with a ventral row of short strong black spine-like setae. *Wing*. Vein M_2 short, perpendicular or nearly so to M_1; vein M_1 (apical crossvein) straight or slightly sinuate, meeting R_{4+5} at approximately a right angle at more than half its own length from wing base (see Figs 22 and 23); posterior margin without black sclerotized puncta. Alula narrow, narrower than cell BM, anal lobe greatly reduced. Wing partially bare basomedially: 2nd costal cell bare; cells R_1, R_{2+3}, R_{4+5}, DM, CuA_1 and CuP bare basally; cells BM and R bare; anal lobe sparsely microtrichose distally; alula usually microtrichose (see Fig. 22). The proportion bare on each cell can vary slightly between species.

Abdomen. Abdominal pattern variable; terga without marginal sulcus; in male very slender and slightly to rather strongly narrowed on segments 2 and 3, 2nd abdominal tergum narrower than thorax; in female broader, narrowest near base of segment 2. *Male genitalia*. Usually large reaching the posterior margin of 4th sternum; typical syrphine form; cercus elongate oval; surstylus elongate, broad basally; lingula absent; aedeagus two-segmented, with apical segment flared apically; superior lobe variable, articulated with aedeagal base and with lateral surface covered with short black blunt bristles.

Etymology. *Eosphaerophoria* is derived from the prefix "*eos*", from the Greek (*heos*), meaning "east, eastern, oriental" (Brown 1956: 303) and the name *Sphaerophoria*. Thus *Eosphaerophoria* means eastern or oriental *Sphaerophoria*, clearly referring to the similar adult habitus in both genera. On the other hand, *Sphaerophoria* is a combination of "*sphaera*", from the Greek (*sphaira*), meaning "ball, globular, sphere" (Brown 1956: 736) and "*phoras*", from the Greek (*phero*), meaning "bearing, carrying" (Brown 1956: 604). Accordingly, *Sphaerophoria* adduces to the globular, spherical male genitalia of most of the species of this genus (Vockeroth 1969; Knutson 1973). *Eosphaerophoria* species also have large rounded male genitalia.

Frey (1946) did not establish the gender of his new genus, *Eosphaerophoria*, nor Keiser (1958) for *Tambavanna*, but both authors used a feminine form for species epithet (*marginata* and *dentiscutellata* respectively). According to the article 30.2.3 of the International Code of Zoological Nomenclature (ICZN 1999), and in agreement with the article 30.2.4, *Eosphaerophoria* must therefore treated as feminine, and new species names follow this gender.

Biology. Nothing is known of the biology of these flies. Keiser (1958: 204) merely stated that he collected his specimen in grass in a swampy locality. No other biological details have been published about *Eosphaerophoria*.

Distribution. *Eosphaerophoria* is only found in Oriental (Indomalayan) and Australasian biotic regions (see Fig. 21). Specimens from Nepal, Sri Lanka, Thailand, Malaysia, Vietnam, Indonesia, Philippines, and Papua New Guinea have been reported (see below in each species description).

Diagnosis. As mentioned above, the genus *Eosphaerophoria* is recognized among the syrphines (subfamily Syrphinae, tribe Syrphini) by this combination of characters: 1) nearly vertical apical vein M_1 (see Figs 22 and 23); 2) subtriangular scutellum; 3) male narrowly dichoptic; 4) slightly narrowed abdominal base in males; and 5) reduced alula and anal lobe.

Vockeroth (1969) considered this genus the most aberrant of the Syrphini based on the presence of uncommon morphological characters, such as wing venation and dichoptic males (see figs 26 and 27), but noting also the asymmetry of the superior lobes of the male genitalia. This character cannot be considered diagnostic because there are species with symmetrical superior lobes too, as pointed out by Vockeroth (1969) (see Figs 44, 45, 47 and 49).

No closely related taxa have been previously proposed. Mengual et al. (2008a) analysed the current tribal classification of the subfamily Syrphidae, but *Eosphaerophoria* was not included due to the absence of suitable material for DNA extraction. Mengual et al. (2009) in their cladistic analysis of *Allograpta* using morphological characters, included representatives of *Episyrphus*, *Meliscaeva*, *Anu*, *Citrogramma*, *Exallandra*, *Giluwea*, *Sphaerophoria* and *Eosphaerophoria* based on adult morphological similarity. *Eosphaerophoria* was resolved in a polytomy with the *Allograpta* subgenera *Antillus*, *Allograpta*, *Costarica* and *Rhinoprosopa* in the strict consensus tree. Consequently, its phylogenetic position remains incognito but if the overall morphological similarity with *Sphaerophoria* is taken under consideration, the genus might be a member of the *Allograpta-Sphaerophoria* clade recovered by Mengual et al. (2008a, 2008b). Thus we include a generic key for *Eosphaerophoria* and related genera here below.

Ghorpadé (1994: 5) placed together *Rhinobaccha* de Meijere, 1908 and *Eosphaerophoria* in couplet 13 of his identification key. Although *Rhinobaccha* was not included in previous molecular or morphological analyses and its relationships with other genera are unclear, we decided to include this genus in the following key.

Key to *Eosphaerophoria* and related genera

1. Metasternum pilose..... **7**
– Metasternum bare..... **2**
2. Scutum with lateral yellow interrupted, black after transverse suture..... **5**
– Scutum yellow laterally after transverse suture..... **3**
3. Plumula present (Fig. 1). Face broad, about 1/2 as wide as head measured at antennal base level, always more than 1/3 (Fig. 2). Male holoptic ..... ***Citrogramma***
Vockeroth, 1969: 92. Type-species, *Syrphus hervebazini* Curran, 1928, original designation
– Plumula absent (Fig. 3). Face narrower, at most 1/3 as wide as head (Figs 19, 20, 27). Male dichoptic **4**
4. Scutellum subtriangular, its apex subacute or with pointed tubercle; yellow with basomedial black triangle (Fig. 4). Vein M_1 nearly perpendicular to R_{4+5}, straight or nearly so (Figs 22, 23). Pleura entirely yellow, except meron black

and katepimeron black ventrally (Fig. 7). Metafemur yellow on basal 1/2 to 3/5, black apically (Fig. 7)..... ***Eosphaerophoria***

Frey, 1946: 169. Type-species, *Eosphaerophoria marginata* Frey, 1946 original designation

– Scutellum with posterior margin rounded, yellowish (Fig. 5). Vein M_1 sinuate (Fig. 8). Pleura completely yellow (Fig. 9). Metafemur entirely yellow (Fig. 9) (New Zealand)..... ***Allograpta*** [***A. ventralis***]

(Miller, 1921). Originally described as *Ocyptamus ventralis* Miller, 1921

5. Scutellum concave apicomedially with subscutellum greatly produced so as to be visible dorsally (Figs 6, 10). Face straight, with tubercle (Fig. 10); alula broader than second costal cell. Male terga reduced apicomedially so that the abdomen may be bent into an apicodorsal curve (almost always in dead specimens) (Fig. 10) (New Zealand) ..... ***Anu***

Thompson, 2008: 9. Type-species, *Anu una* Thompson, 2008 original designation

– Scutellum with posterior margin rounded, subscutellum normal. Face produced anteriorly (Figs 11, 14); alula as broad as or narrower than second costal cell (Fig. 13). Male abdomen without those characters **6**

6. Costa with strong black swelling at extreme base (Fig. 13). Face with medial tubercle (11). Male broadly dichoptic, separated by more than ocellar triangle width (Fig. 12). Wing completely microtrichose (New Guinea) ..... ***Giluwea***

Vockeroth, 1969: 136. Type-species, *Giluwea flavomaculata* Vockeroth, 1969 original designation

– Costa normal, without swelling. Facial tubercle absent (Fig. 14). Male narrowly dichoptic, separated by ocellar triangle width or less (Fig. 15). Wing microtrichose, bare basomedially (Sri Lanka, Southern India) .... ***Rhinobaccha***

de Meijere, 1908: 315. Type-species, *Rhinobaccha gracilis* de Meijere, 1908 monotypy

7. Abdomen distinctly margined on at least tergite 4; usually oval, broader than thorax. Scutum usually black, pollinose with medial section with bluish metallic iridescence ..... ***Citrogramma***

Vockeroth, 1969: 92. Type-species, *Syrphus hervebazini* Curran, 1928 original designation

– Abdomen unmargined; elongate with parallel sides (as wide as thorax) or petiolate. Scutum black, normally shiny..... **8**

8 Subscutellar fringe usually entire, sometimes sparse but complete. Male genitalia: superior lobe fused basally with hypandrium (Fig. 16) .... ***Allograpta***

Osten Sacken, 1875: 49, 63. Type species, *Scaeva obliqua* Say, 1823 original designation

– Subscutellar fringe completely absent or with pile restricted laterally, with median section bare. Male genitalia: superior lobe free and articulated with hypandrium; basal aedeagus simple, not swollen nor with denticules **9**

9. 5th abdominal tergum narrow, about two times as broad as long. Male genitalia small, with epandrium half as wide as abdomen or less (Fig. 17). Pleura black dorsad procoxa. Notopleuron mostly black, yellow on anterior 1/2 (Afrotropical)..... ***Exallandra***

Vockeroth, 1969: 87. Type-species, *Syrphus cinctifacies* Speiser, 1910 original designation

– 5th abdominal tergum broad, about as broad as long. Male genitalia large, with epandrium about as wide as abdomen (Fig. 18). Pleura usually with yellow macula dorsad procoxa. Notopleuron yellow (widespread but absent in Neotropics)..... ***Sphaerophoria***

Le Peletier & Serville, 1828: 513. Type-species, *Musca scripta* Linnaeus, 1758 designated by Rondani, 1845: 458

Key to species of *Eosphaerophoria*

1. Notopleuron with obtuse protuberance posterolaterally (Fig. 28)..... **4**
– Notopleuron swollen but not produced posterolaterally (Fig. 29), or at least protuberance not as evident as in Figure 28 ..... **2**
2. 2nd abdominal tergum black dorsally; 5th abdominal tergum with 2 lateral subtriangular yellow maculae (Fig. 38); scutum with lateral yellow vitta behind transverse suture narrower, with dorsal margin not in line with the dorsal margin of yellow notopleuron (Fig. 29) (Malaysia) ..... ***brunettii***
– 2nd abdominal tergum black with dorsomedial yellow macula; 5th abdominal tergum with yellow fascia (Figs 30, 31); scutum with lateral yellow vitta behind transverse suture with dorsal margin in line with the dorsal margin of yellow notopleuron (Fig. 28)..... **3**
3. 1st abdominal tergum yellow with posterodistal narrow black fascia (Fig. 30); frons black with 2 basolateral yellow areas on ventral 3/4, about 1/3 of frons width each (Figs 26, 27) (Nepal)..... ***punctata***
– 1st abdominal tergum yellow with 2 subtriangular large black maculae on posterior margin (Fig. 31); frons yellow on ventral 4/5, black on dorsal 1/5 (Vietnam) ..... ***symmetrica***
4. Scutellum with rounded or pointed posterior margin, but without tooth on medial section (Figs 28, 29, 30) **7**
– Scutellum with tooth on medial posterior margin (Fig. 4)..... **5**
5. 1st abdominal tergum yellow with posteromedial narrow black fascia (Fig. 32); face yellow with medial black vitta (Indonesia, Halmahera Island) ..... ***hermosa***
– 1st abdominal tergum black dorsomedially, yellow on anterior and lateral margins; face entirely yellow **6**
6. 2nd abdominal tergum black, yellow on anterobasal margins only (Fig. 33); 5th abdominal tergum with 2 small lateral yellow maculae (Fig. 33) (Sri Lanka) ..... ***dentiscutellata***
– 2nd abdominal tergum black with basal yellow fascia with a posterior median triangular projection, narrowly separated from anterior margin by a black fascia (Fig. 34); 5th abdominal tergum with subbasal yellow fascia (Fig. 34) (Papua New Guinea, Normanby Island) ..... ***adornata***

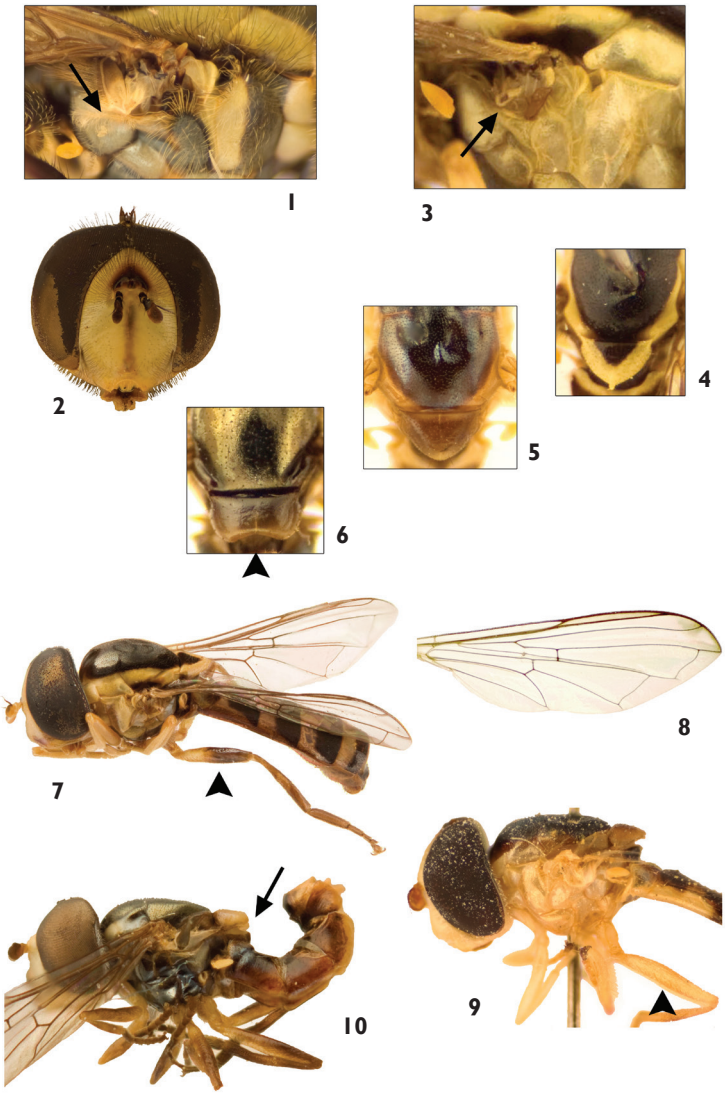
7. 2nd abdominal tergum with yellow fascia on anterior 1/2, about 1/4 of tergum length (Fig. 35); 3rd and 4th abdominal terga with basal yellow fascia broader, about 1/2 of tergum length (Fig. 35); 5th abdominal tergum with anterior yellow fascia. Scutellum triangular with tip pointed, not rounded or produced into a tooth (Papua New Guinea, New Ireland Island)..... ***luteofasciata***
– 2nd abdominal tergum withour yellow fascia, entirely black dorsally or with central yellow macula; 3rd and 4th terga usually with narrower yellow fascia but variable..... **8**
8. 5th abdominal tergum with 2 lateral small yellowish maculae (Figs 39–43).....**10**
– 5th abdominal tergum black with anterior yellow fascia (Figs 36, 37) **9**
9. Face with a medial broad black vitta; 2nd tergum black dorsally, without central yellow macula (Fig. 36) (Papua New Guinea, Indonesia – New Guinea island)..... ***nigrovittata***
– Face yellow (Fig. 24); 2nd tergum black dorsally with central elongated yellow macula (Fig. 37) (Papua New Guinea)..... ***bifida***
10. Frons yellow on basoventral 4/5 with very thin medial black vitta that may or may not reach antennal bases, black on dorsal 1/5 (Fig. 20). Face yellow. Notopleuron slightly produced posterolaterally (less evident than in Fig. 28) (Vietnam, Malaysia)..... ***vietnamensis***
– Frons black, yellow on basolateral 2/3 with medial broad black vitta; at antennal bases, central black area is about 1/3–1/2 of the face width (Fig. 19). Male: face yellow. Female: face yellow with medial black vitta. Notopleuron clearly produced posterolaterally (Fig. 28) (Philippines, Thailand) ..... ***marginata***

***Eosphaerophoria adornata* Mengual, sp. n.**
urn:lsid:zoobank.org:act:DD7DF7F2-06A4-4071-B822-6A2D466B880D
Fig. 34; MorphBank [http://www.morphbank.net/?id=478063]

Vockeroth 1969: 135 as *Eosphaerophoria* sp. (citation).

Male. Unknown.

Female. *Head*. Face straight, broad, with distinct round tubercle, yellow with a median area without pigmentation (including also ventral face and oral apex), almost transparent so that it appears to have a dark vitta, yellow pilose; gena yellow; lunula black; frons completely black on dorsal 1/3 (length between anterior ocellus and lunula), yellow on basolateral 2/3 with medial broad black vitta (about 2/5 of frons width), yellow pilose; vertex and vertical triangle black, black pilose; ocelli brownish; antenna yellow; basoflagellomere brown dorsally, elongated (no more than 1.5 times longer than broad); arista brown; occiput mainly black, yellow ventrally, yellow pilose and silvery pollinose ventrally, black pilose and golden pollinose dorsally.



Figures 1–10. 1 *Citrogramma henryi*, lateral view of pleura showing plumula **2** *Citrogramma variscutatus*, frontal view of male head **3** *Eosphaerophoria marginata*, lateral view of pleura showing the wing base **4** *Eosphaerophoria adornata*, dorsal view of scutellum **5** *Allograpta ventralis*, dorsal view of scutellum **6** *Anu una*, dorsal view of scutellum showing the subscutellum **7** *Eosphaerophoria adornata*, lateral view **8** *Allograpta ventralis*, wing **9** *Allograpta ventralis*, lateral view of male head, thorax and legs **10** *Anu una*, lateral view of male showing the subscutellum.

Thorax. Scutum mainly black, shiny medially, black pollinose sublaterally, yellow laterally with lateral broad yellow stripe from postpronotum to scutellum, narrower after transverse suture with ventral black area, golden brown pilose; postpronotum yellow; notopleuron yellow with a distinct posterolateral obtuse protuberance; scutellum triangular, yellow with dorsomedial triangular black area con-

tinuing from posterior mesonotum, with small tooth on medial posterior margin (shorter than the width of the yellow scutellar margin), golden-brown pilose; propleuron, anepisternum and anepimeron entirely yellow; katepisternum black with dorsal yellow macula; meron black; katepimeron yellow; katatergum mainly yellow, black posteriorly; calypter dark brown; halter brownish yellow. *Wing*. Wing bare basomedially.

Legs. Pro- and mesoleg entirely yellow, except mesocoxa and mesofemur dorsolaterally slightly darker, yellow pilose except tarsi with short black setulae ventrolaterally; metacoxa and trochanter dark yellow, yellow pilose; metafemur yellow on basal 1/3, black on distal 2/3, yellow and brown pilose; metatibia black, golden brown pilose; metatarsus black, golden yellow and brown pilose.

Abdomen. Fig. 34. Dorsum mainly black, black pilose except 1st tergum yellow pilose laterally; 1st tergum black with anterior and lateral yellow margin, medially reaching anterior margin of 2nd tergum dividing black area in 2 triangular maculae that become brownish anteriorly; 2nd tergum black dorsally with basomedial very narrow black fascia not reaching margins and with basal yellow fascia, about 1/3 of tergum length, produced posteriorly in small triangular emargination, narrowly yellow laterally on basal 3/4 continuing the yellow margin of 1st tergum; 3rd and 4th terga similar to 2nd tergum, 3rd tergum laterally almost entirely yellow and 4th tergum narrowly yellow laterally on basal 3/4; 5th tergum black with basal yellow fascia on anterior 1/2 or slightly broader; 6th tergum black with basomedial very narrow black fascia and basal yellow fascia on anterior 1/2; sterna brownish-yellowish, with short yellow pile; 5th, 6th and 7th sterna with long erected black hairs medially on posterior margin.

Variation. Paratype female has completely yellow antenna, and pro- and mesolegs all yellow. The 1st abdominal tergum is brownish with a yellow margin, a bit lighter than in the holotype, and the 2nd abdominal tergum is almost all yellow laterally.

Type locality. PAPUA NEW GUINEA: Milne Bay. Normanby Island, Wakaiuna, Sewa Bay. 9°59'47.79"S 150°58'08.47"E. Original labels do not have coordinates, thus this collecting point was placed in the middle of Sewa Bay in the kml file.

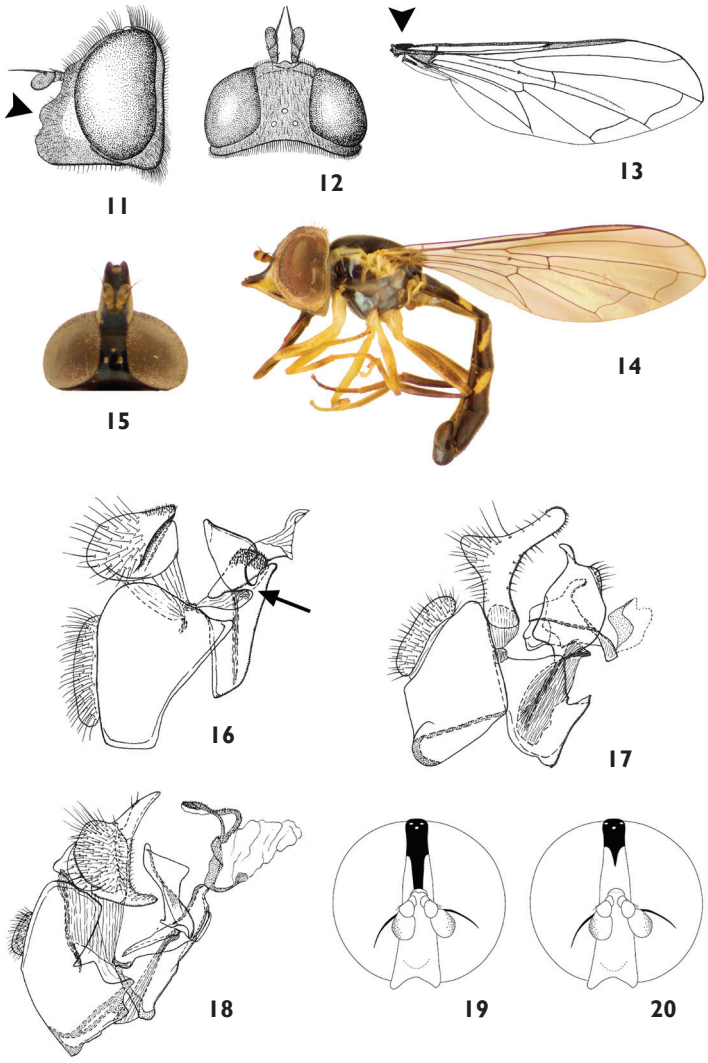
Types. ***Holotype:*** "NEW GUINEA: PAPUA // Normanby I. // Wakaiuna, Sewa Bay // Oct. 25-30-1956' "W.W. Brandt // Collector" "HOLOTYPE // *Eosphaerophoria* // *adornata* // det. X. Mengual 20*09*" [red, second and third lines handwritten] USNM ENT00036560 [1♀, BPBM]. ***Paratype:*** "NEW GUINEA: PAPUA // Normanby I. // Wakaiuna, Sewa Bay // Oct. 25-30-1956' "W.W. Brandt // Collector" "PARATYPE // *Eosphaerophoria* // *adornata* // det. X. Mengual 20*09*" [yellow, second and third lines handwritten] USNM ENT00036561 [1♀, USNM].

Length (2): body, 6.5–6.6 (6.6) mm; wing, 4.8–5.0 (4.9) mm.

Distribution: Papua New Guinea.

Etymology. The specific epithet is derived from the Latin *adornatus* meaning decorated, embellished (Brown 1956: 577), and it refers to the medial tooth present on the posterior margin of the scutellum. Species epithet to be treated as adjective.

Differential diagnosis. *Eosphaerophoria adornata* is one of the largest species of this genus. It is easily recognized by the tooth on the scutellum, a character shared with



Figures 11–20. 11–13, *Giluwea flavomacula* (from Vockeroth 1969): **11** lateral view of male head **12** dorsal view of male head **13** wing showing costal swelling. **14–15** *Rhinobaccha gracilis*: **14** lateral view of male **15** dorsal view of male head **16** *Allograpta obliqua*, lateral view of male genitalia showing the superior lobe fused with hypandrium (from Vockeroth 1969) **17** *Exallandra cinctifacies*, lateral view of male genitalia (from Vockeroth 1969) **18** *Sphaerophoria novaeangliae*, lateral view of male genitalia (from Vockeroth 1969) **19** *Eosphaerophoria marginata*, frontal view of male head **20** *Eosphaerophoria vietnamensis*, frontal view of male head.

E. dentiscutellata and *E. hermosa*. It can be separated from *E. hermosa* by having the face entirely yellow. *E. adornata* differs from *E. dentiscutellata* in having a yellow fascia on 2nd and 5th abdominal terga, while the latter has the 2nd tergum black with lateral margin yellow and 5th tergum with two lateral yellow maculae (see Figs 13 and 14).

***Eosphaerophoria bifida* Mengual, sp. n.**
urn:lsid:zoobank.org:act:CC72B15F-EB91-49C0-8B29-100D2E5D39E1
Figs 24, 37, 44; MorphBank [http://www.morphbank.net/?id=478062]

Vockeroth 1969: 135 as *Eosphaerophoria* sp. (citation).

Male. *Head*. Face straight, with distinct round tubercle, yellow, yellow pilose; gena yellow, yellow pilose; lunula black; frons completely black on dorsal 2/3 (length between anterior ocellus and lunula), yellow on basolateral 1/3 with medial broad black vitta, about 1/2 of the facial width, yellow pilose on yellow areas with some dark pile on black areas, with distinct round tubercle at medial section between anterior ocellus and lunula; dichoptic; vertex and vertical triangle black, dark pilose; ocelli brownish; antenna light brown to dark yellow, darker than face, basoflagellomere brown, darker dorsally, oval; arista dark brown; occiput mainly black, yellow ventrally, yellow pilose and silvery pollinose ventrally, and dark pilose and golden pollinose dorsally, no pile seen at medial section.

Thorax. Scutum black, shiny medially, black pollinose laterally, golden brown pilose, yellow laterally with lateral yellow vitta from postpronotum to scutellum, narrower between transverse suture and postalar callus with ventral black area; postpronotum yellow; notopleuron yellow with distinct posterolateral obtuse protuberance; scutellum triangular, yellow with dorsomedial triangular black area continuing from posterior mesonotum, brownish pilose; propleuron, anepisternum and anepimeron entirely yellow; katepisternum black with dorsal yellow macula; meron black; katepimeron yellow; katatergum mainly yellow, black posteriorly; calypter dark brown; halter yellow. *Wing*. Wing bare basomedially.

Legs. Pro- and mesoleg entirely yellow, except distal part of mesofemur and basal part of mesotibia darker, mesocoxa darker, and pro- and mesotarsus slightly darker, yellow pilose except tarsi with short black setulae ventrolaterally; metacoxa and trochanter yellow; metafemur yellow on basal 1/3, black on distal 2/3, brownish pilose; metatibia black, black pilose; metatarsus black, golden pilose ventrolaterally.

Abdomen. Fig. 37. Dorsum mainly black, dorsally black pilose except 1st tergum and anteriorly 2nd tergum yellow pilose laterally; 1st tergum black with anterior and lateral yellow margin, medially reaching anterior margin of 2nd tergum dividing the black area in 2 triangular maculae; 2nd tergum black dorsally with medial elongated yellow macula, yellow laterally on basal 3/4 continuing the yellow margin of 1st tergum; 3rd tergum black with basoanterior very narrow black fascia not reaching margins and with basal yellow fascia, about 1/5–1/4 of tergum length, produced posteriorly in a long triangular emargination reaching 2/3 length of tergum, with lateral margin yellow on anterior 4/5; 4th tergum similar to 3rd but posteromedial yellow emargination looks shorter because the tergum is shorter; 5th tergum black with anterior narrow black fascia not reaching lateral margin, with 2 lateral narrow triangular yellow maculae joining medially forming very narrow yellow fascia, laterally yellow on basal 1/3; sterna yellowish, yellow pilose except 4th sternum with posterior margin black pilose medially; male genitalia as figured (Fig. 44).

Figure 21. World distribution of *Eosphaerophoria* Frey, 1946, an estimate. The dotted line indicates that insufficient information is available and that the limit shown is only an approximation defined by collecting points. Adapted from Vockeroth (1969).

Female. Unknown.

Type locality. PAPUA NEW GUINEA: Morobe, Bulolo, Wau. 7°20'30.51"S 146°42'15.98"E.

Type. ***Holotype***: "New Guinea // Wau, 1250 m // 20.VIII.1965" "Malaise Trap // J&M. Sedlacek // BISHOP" "HOLOTYPE // *Eosphaerophoria* // *bifida* // det. X. Mengual 20*09*" [red, second and third lines handwritten] USNM ENT00036558 [1♂, BPBM].

Length (1): body, 5.7 mm; wing, 4.2 mm.

Distribution: Papua New Guinea.

Etymology. The specific epithet refers to the shape of surstylus in male genitalia, which presents the distal margin divided in two lobules posteriorly (see Fig. 44c), and it is from the Latin *bifidus* meaning split into two parts, bifurcated (Brown 1956: 345). Species epithet to be treated as adjective.

Differential diagnosis. Species easy to identify by an elongated yellow macula on 2nd abdominal tergum and the face entirely yellow. It has the male genitalia similar to *E. luteofasciata*, especially the bifurcated surstylus. The surstylus of *E. bifida* has two lobes of different sizes (Figs 44a, 44c) but *E. luteofasciata* has the surstylus divided in two similar lobes in lateral view (Figs 47a, 47d). Moreover, *E. bifida* has superior lobes with conical shape and *E. luteofasciata* has them expanded anteroventrally.

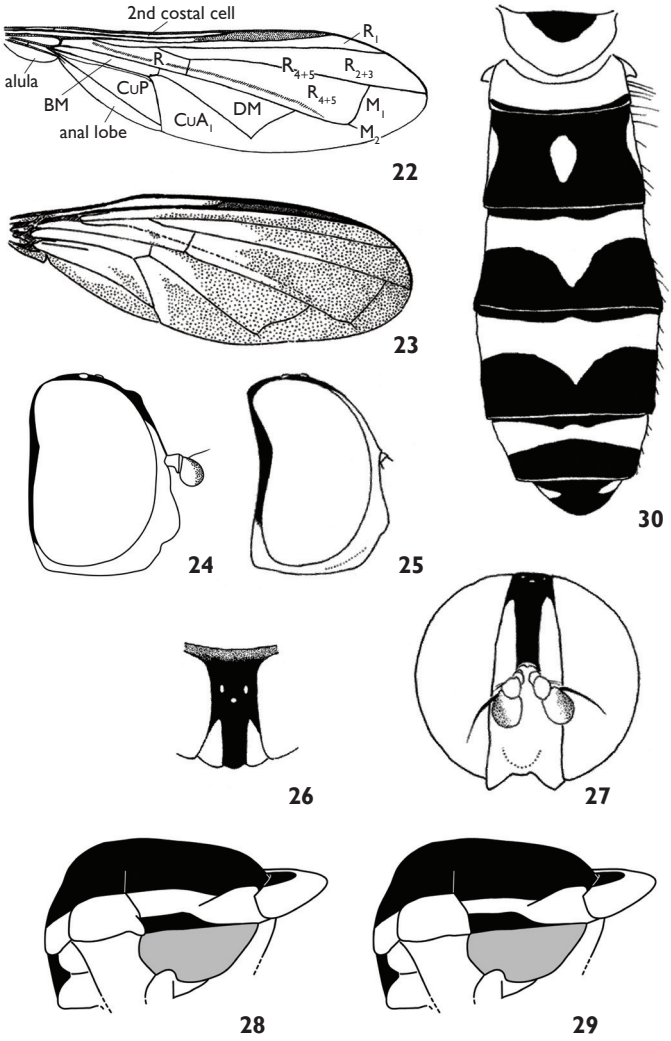
Remarks. *Eosphaerophoria bifida* is described based on a single male from Wau (Papua New Guinea). *Eosphaerophoria bifida* could be the male of *E. nigrovittata* that is described from two females, holotype also from Wau. There are differences between both species. *E. bifida* has an all yellow face, but *E. nigrovittata* has a medial broad black facial vitta. However, this character does show dimorphic variation (for example see *E. marginata*), but in this case is much more divergent. *Eosphaerophoria bifida* has a yellow macula on 2nd tergum and *E. nigrovittata* does not or it is not clear (see comments about variation of *E. nigrovittata*). In species with both sexes known, such as *E. marginata* and *E. vietnamensis*, the abdominal pattern does not display significant differences. The fact that both species, *E. bifida* and *E. nigrovittata*, were collected in the same region but in different years is not an argument to consider them the same taxon, because there is an example of different species collected from the same place and the same date, *E. vietnamensis* and *E. symmetrica*. Based on this, we consider *E. bifida* and *E. nigrovittata* as being different species.

***Eosphaerophoria brunettii* Ghorpadé, sp. n.**
urn:lsid:zoobank.org:act:42A2E387-76AE-4450-B52F-141942F857A8
Figs 29, 38, 45; MorphBank [http://www.morphbank.net/?id=478077]

Male. *Head*. Face straight, with distinct round tubercle, more prominent than in *E. marginata*, yellow; gena yellow, yellow pilose; lunula black; frons completely black on dorsal 3/8 (length between anterior ocellus and lunula), yellow on basolateral 6/8 with medial black vitta, about 1/4–1/3 of facial width, with frontal sulcus defining the dorsal completely black area, yellow pilose; dichoptic; vertex and vertical triangle black; ocelli brownish; antenna light brown to yellow, basoflagellomere darker dorsally, oval; arista brown; occiput mainly black, yellow ventrally, grey pollinose, yellow pilose.

Thorax. Scutum black, shiny medially, black pollinose laterally, golden brown pilose, yellow laterally with lateral narrow yellow stripe from transverse suture to scutellum, narrower than notopleuron and with black areas dorsally and ventrally, being located in a central position to notopleuron (Fig. 29); postpronotum yellow; notopleuron yellow without obtuse protuberance or at least not distinct as in *E. marginata*; scutellum triangular, yellow with dorsomedial triangular black area continuing from posterior mesonotum, brownish pilose; propleuron, anepisternum and anepimeron entirely yellow; katepisternum black with dorsal yellow macula; meron black; katepimeron yellow; katatergum mainly yellow, black posteriorly; calypter dark brown; halter yellowish. *Wing*. Wing bare basomedially.

Legs. Pro- and mesoleg entirely yellow, except distal part of mesofemur and basal part of mesotibia dark, mesocoxa dark, yellow pilose except tarsi with short black setulae ventrolaterally; metacoxa and trochanter yellow; metafemur yellow on basal 1/3, black on distal 2/3, with ventral short strong black spine-like setulae on the apical 2/3; metatibia black, black pilose; metatarsus black, black pilose dorsolaterally and golden pilose ventrolaterally.



Figures 22–30. 22 *Eosphaerophoria marginata*, wing (from Vockeroth 1969); cells in black, veins in red **23** *Eosphaerophoria punctata*, wing (from Claussen and Weipert 2003) **24** *Eosphaerophoria bifida*, lateral view of head **25–27** *Eosphaerophoria punctata* (from Claussen and Weipert 2003) **25** lateral view of head **26** dorsal view of head **27** frontal view of head **28** *Eosphaerophoria marginata*, lateral view of thorax **29** *Eosphaerophoria brunettii*, lateral view of thorax **30** *Eosphaerophoria punctata*, dorsal view of abdomen and scutellum (from Claussen and Weipert 2003).

Abdomen. Fig. 38. Dorsum mainly black, dorsally black pilose, 1st, 2nd and 3rd terga laterally yellow pilose; 1st tergum yellow with posterodistal narrow black fascia not reaching margins joined to lateral small brownish maculae, yellow laterally; 2nd tergum black dorsally, yellow laterally on basal 1/2 continuing the yellow margin of 1st tergum; 3rd tergum black with basoanterior very narrow black fascia not reaching margins and with basal yellow fascia, about 1/3 tergum length, produced posteriorly

in a medial triangular emargination reaching half length of tergum, with lateral margin yellow on anterior 1/2; 4th tergum similar to 3rd but yellow fascia slightly broader; 5th tergum black with 2 lateral triangular yellow maculae on basal 1/3, leaving the median 1/3 black; 6th tergum black, yellow laterally; sterna yellowish brown; male genitalia as figured (Fig. 45).

Female. Unknown.

Type locality. MALAYSIA: Pahang, Titiwangsa Mountains, Fraser's Hill. 3°42'59.16"N 101°44'30.35"E.

Type. ***Holotype:*** "FRASERS HILL // Malaya, 4,000 ft. // P. A. Buxton // 14. Feb. 1954" "Pres. by // P.A. Buxton. // B.M.1954-693" "BMNH" "Loan # // 11849" "*Eosphaerophoria* // *sp. nov.* // ♂ // K.D. Ghorpade det.19*83*" [handwritten except fourth line] "HOLOTYPE // *Eosphaerophoria* // *brunettii* // det. X. Mengual 20*09*" [red, second and third lines handwritten] USNM ENT00036557 [1♂, BMNH].

Length (1): body, 5.4 mm; wing, 4.0 mm.

Distribution: Malaysia.

Etymology. The specific epithet refers to Enrico Brunetti (1862–1927), an amateur entomologist and professional musician of Italian-British extraction who lived 17 years in India working part time on the taxonomy of Oriental (mainly Indian subcontinent) Diptera at the Indian Museum in Calcutta (now with the Zoological Survey of India) with the encouragement of its then director, Nelson Annandale. This new species is dedicated to him for his exhaustive research on Indian and Malayan Syrphidae and many other Diptera, this giving me (KG) my first guidance and stimulus for pursuing my own studies. Species epithet to be treated as a noun in the genitive case.

Differential diagnosis. Very distinct species with a characteristic lateral yellow mesonotal vitta, narrower and centred after transverse suture (see Fig. 29), notopleuron not produced posterolaterally and with male genitalia very recognizable (Fig. 45).

Remarks. Due to the position of the legs in the pinned specimen, it was not possible to know if metafemur possesses 1 or 2 ventral rows of black spine-like setulae. Based on the experience with other species of this genus and other genera, there probably are 2 rows of short strong black setulae.

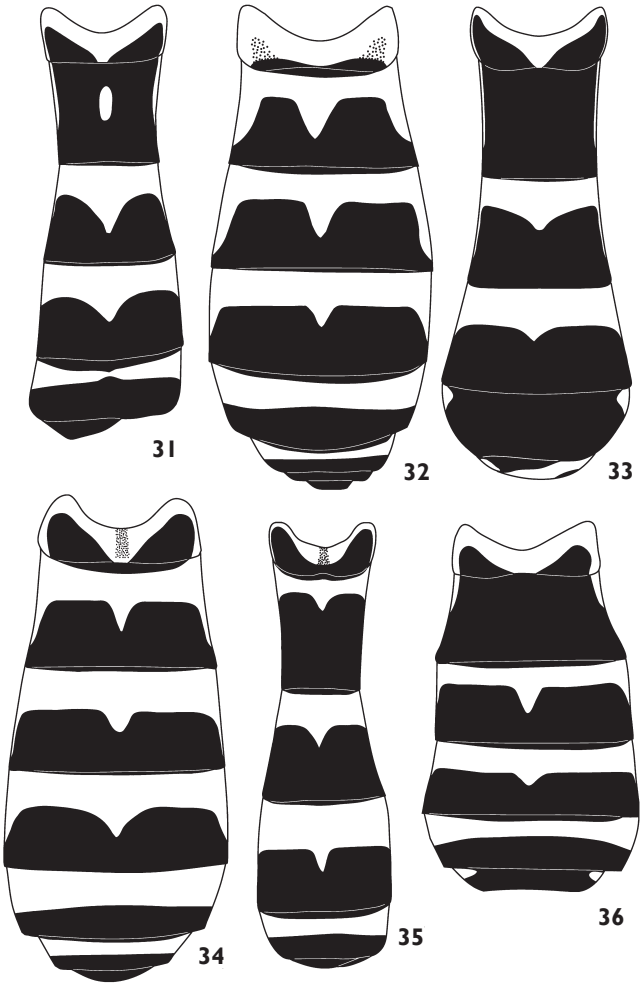
Eosphaerophoria dentiscutellata (Keiser, 1958)

Figs 33, 46; MorphBank [http://www.morphbank.net/?id=478078]

Tambavanna dentiscutellata Keiser, 1958: 202. Type locality: Sri Lanka, Kandy, Deiyannewela. Holotype 1♂ [NMB, Basel]. Keiser, 1958: 202, Fig. 3 (habitus, head, wing).

Eosphaerophoria dentiscutellata Vockeroth, 1969: 135 (new combination, species misidentified from Vietnam); Knutson et al. 1975: 313 (catalog citation); Ghorpadé 1994: 5 (key reference, citation). Claussen and Weipert 2003: 354 (identification key).

Male. *Head*. Face straight, narrow becoming broader ventrally (about 1/20 of head width at antennal basis), with distinct round tubercle, yellow, yellow pilose; gena yel-



Figures 31–36. Abdomen, dorsal view: **31** *Eosphaerophoria symmetrica*, male **32** *E. hermosa*, female **33** *E. dentiscutellata*, male **34** *E. adornata*, female **35** *E. luteofasciata*, male **36** *E. nigrovittata*, female.

low; lunula yellow; frons completely black on dorsal 1/4–1/3 (length between anterior ocellus and lunula), yellow on ventral 2/3–3/4, with frontal sulcus defining the dorsal completely black area, with few yellow and dark hairs; dichoptic; vertex and vertical triangle black, black pilose; ocelli brownish; antenna yellow, basoflagellomere brown dorsally, oval; arista brown; occiput mainly black, yellow ventrally, yellow pilose and silvery pollinose ventrally, black pilose and golden pollinose dorsally.

Thorax. Scutum mainly black, shiny medially, black pollinose laterally, yellow laterally with lateral broad yellow stripe from postpronotum to scutellum, narrower after transverse suture with ventral black area, golden brown pilose; postpronotum yellow; notopleuron yellow with distinct posterolateral obtuse protuberance; scutellum triangular, with a tooth on medial posterior margin, yellow with dorsomedial triangular

black area continuing from posterior mesonotum, golden brown pilose; propleuron, anepisternum and anepimeron entirely yellow; katepisternum black with dorsal yellow macula; meron black; katepimeron yellow; katatergum mainly yellow, black posteriorly; calypter dark brown; halter yellowish. *Wing*. Wing bare basomedially.

Legs. Pro- and mesoleg entirely yellow, except probasitarsomere slightly brownish laterodorsally, and distal part of mesofemur and basal part of mesotibia slightly darker, yellow pilose except tarsi with short black setulae ventrolaterally; metacoxa and trochanter yellow, yellow pilose; metafemur yellow on basal 1/2, black on distal 1/2, yellow and brown pilose, with 2 ventral rows (anteroventral and posteroventrally) of short strong black spine-like setulae on the apical 2/3; metatibia black, golden brown pilose; metatarsus black, golden yellow and brown pilose.

Abdomen. Fig. 33. Dorsum mainly black, black pilose except 1st tergum and anteriorly 2nd tergum yellow pilose laterally; 1st tergum black with anterior and lateral yellow margin, medially reaching the anterior margin of 2nd tergum dividing the black area in 2 triangular maculae; 2nd tergum black dorsally, narrowly yellow laterally on basal 3/4 continuing the yellow margin of 1st tergum; 3rd tergum black with basomedial very narrow black fascia not reaching margins and with basal yellow fascia, about 1/4–1/3 of tergum length, becoming broader medially and ending in a posteriorly pointed emargination at medial point, yellow on anterior 3/5 of lateral margin; 4th tergum black with basal yellow fascia slightly broader, about 1/3–1/2 of tergum length, produced posteriorly in a small triangular emargination, yellow on anterior 1/2 of lateral margin; 5th tergum black with 2 lateral small rounded yellow maculae on basal 1/3; 6th tergum black, yellow laterally; 7th tergum yellow; 8th tergum yellow with medial black macula; sterna yellow, yellow pilose except 4th sternum with some long thin black hairs medially and genital segments brown pilose; 3rd sternum with posterior margin slightly produced medially with black setulae; 4th sternum with posterior margin produced medially into 2 projections with black setulae; male genitalia as figured (Fig. 46).

Female. Unknown.

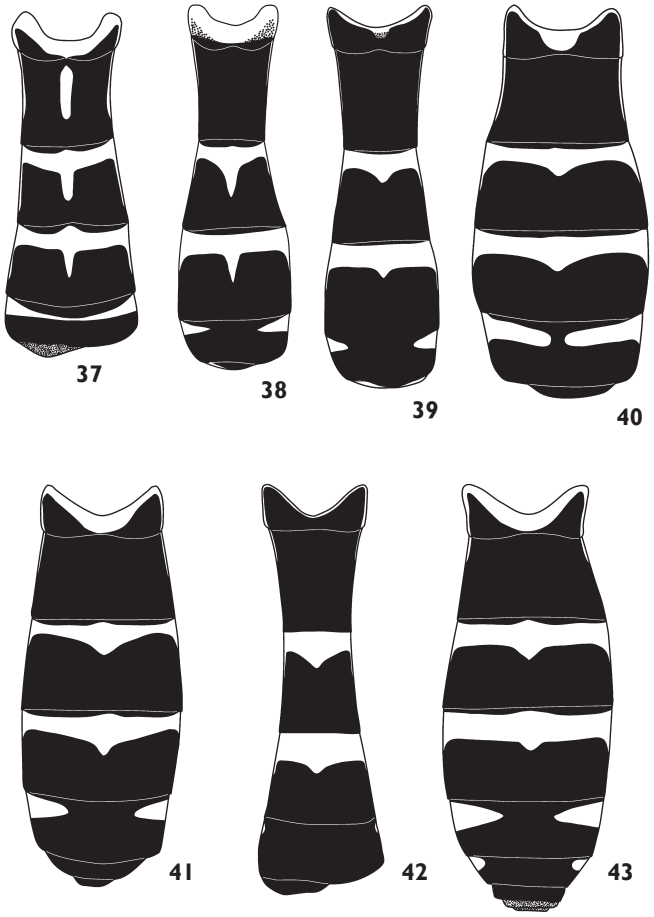
Type locality. SRI LANKA: Central Province, Kandy, Deiyannewela. 7°17'7.10"N 80°37'54.71"E.

Type. ***Holotype:*** "CEYLON C.P. // Kandy // Deiyannewela // 17.X.53F. Keiser" "TYPUS" "*Tambavanna denstiscutellata*" [handwritten] "HOLOTYPE // *Eosphaerophoria* // *dentiscutellata* // det. X. Mengual 2009" [red, second and third lines handwritten] USNM ENT00036542 [1♂, NMB].

Length (1): body, 5.5 mm; wing, 4.1 mm.

Distribution: Sri Lanka.

Differential diagnosis. Species characterized by a medial tooth in the posterior margin of the scutellum, like *E. adornata* and *E. hermosa* (see comments above). *Eosphaerophoria dentiscutellata* differs from *E. hermosa* in having a medial black facial vitta, and from *E. adornata* in having 2nd tergum black with lateral margin yellow and 5th tergum with two lateral yellow maculae (see Figs 13 and 14). Its male genitalia is similar similar to the genitalia of *E. vietnamensis*, both with asymmetrical superior



Figures 37–43. Abdomen, dorsal view: **37** *Eosphaerophoria bifida*, male **38** *E. brunettii*, male **39** *E. marginata*, male **40** *E. marginata*, paralectotype female **41** *E. marginata*, Thailand female **42** *E. vietnamensis*, male **43** *E. vietnamensis*, female.

lobes like in *E. marginata*, but *E. dentiscutellata* has superior lobe slightly larger and different surstylus shape (see Figs 46, 48, 50).

***Eosphaerophoria hermosa* Mengual, sp. n.**
urn:lsid:zoobank.org:act:3437D78B-8A38-451B-B270-DE9AE95FE239
Fig. 32; MorphBank [http://www.morphbank.net/?id=478079]

Male. Unknown.

Female. *Head*. Face straight, broad, with distinct round tubercle, yellow with medial diffuse black vitta narrowing to tubercle tip not reaching oral apex, yellow pilose; gena yellow; lunula black; frons completely black on dorsal 1/4 (length between

anterior ocellus and lunula), yellow on basolateral 3/4 with medial well-defined black vitta slightly narrowing ventrally (about 1/3 of frons width) continuing with facial vitta, yellow pilose; vertex and vertical triangle black, black pilose; ocelli brownish, anterior ocellus very small; antenna yellow, basoflagellomere brown dorsally, oval; arista brown; occiput mainly black, yellow ventrally, yellow pilose and silvery pollinose ventrally, black pilose and golden pollinose dorsally.

Thorax. Scutum mainly black, shiny medially, black pollinose laterally, yellow laterally with lateral broad yellow stripe from postpronotum to scutellum, narrower after transverse suture with ventral black area, golden brown pilose; postpronotum yellow; notopleuron yellow with distinct posterolateral obtuse protuberance; scutellum triangular, with a tooth on medial posterior margin, yellow with dorsomedial triangular black area continuing from posterior mesonotum, golden brown pilose; propleuron, anepisternum and anepimeron entirely yellow; katepisternum black with dorsal yellow macula; meron black; katepimeron yellow; katatergum mainly yellow, black posteriorly; calypter dark brown; halter yellowish. *Wing*. Wing bare basomedially.

Legs. Pro- and mesoleg entirely yellow, except distal part of mesofemur and basal part of mesotibia slightly darker, yellow pilose except tarsi with short black setulae ventrolaterally; metacoxa and trochanter yellow, yellow pilose; metafemur yellow on basal 1/2, black on distal 1/2, yellow and brown pilose; metatibia black, golden brown pilose; metatarsus black, golden yellow pilose ventrolaterally and brown pilose dorsolaterally.

Abdomen. Fig. 32. Dorsum mainly black, black pilose except 1st tergum yellow pilose laterally; 1st tergum yellow with posteromedial very narrow black fascia not reaching margins; 2nd tergum black dorsally, with anteromedial very narrow black fascia not reaching margins and basal yellow fascia, about 1/4 of tergum length, produced posteriorly in a medial triangular emargination reaching half length of tergum, with lateral margin broadly yellow on anterior 4/5, as broad as anterobasal yellow fascia; 3rd tergum black with basomedial very narrow black fascia not reaching margins and with basal yellow fascia, about 1/3 of tergum length, produced posteriorly in a medial triangular emargination reaching 2/3 length of tergum, with lateral margin yellow on anterior 3/4; 4th tergum similar to 3rd tergum, black with basomedial very narrow black fascia not reaching margins and with basal yellow fascia, about 1/3 of tergum length, produced posteriorly in a medial triangular emargination reaching half length of tergum, with lateral margin yellow on anterior 2/3; 5th tergum black with basomedial very narrow black fascia not reaching margins and with a basal yellow fascia, about 1/2 of tergum length, slightly broader laterally and narrower medially; 6th tergum similar to 5th tergum, black with basomedial broad black fascia and with basal yellow fascia, about 2/5 of tergum length; 7th and 8th terga black; sterna yellowish, black pilose; 4th sternum with some depressed long thin black hairs medially on posterior margin; 5th, 6th and7th terga with some long erected thin black hairs medially on posterior margin.

Type locality. INDONESIA: North Maluku, Jailolo, Halmahera Island, Kampung Pasir Putih. 0°53'N, 127°41'E. The coordinates place the collecting point in the sea

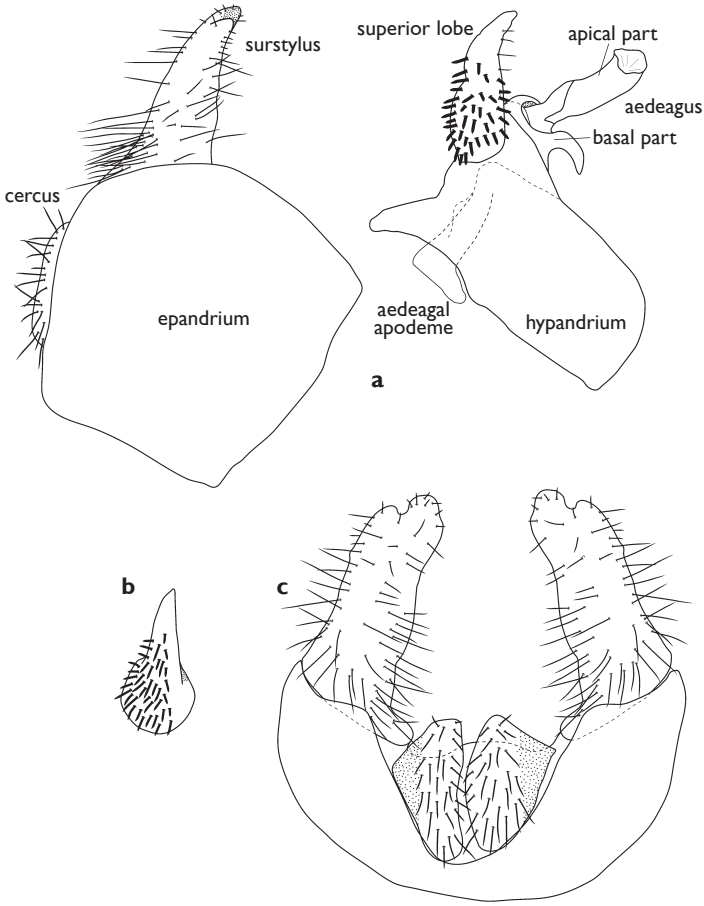


Figure 44. *Eosphaerophoria bifida*, male genitalia: **a** left lateral view **b** right superior lobe, dorsal view **c** tergite 9, cerci and surstyli, dorsal view.

due to the planetary model used, but it was moved to the closest terrestrial point in the kml file.

Type. ***Holotype:*** "INDONESIA:Halmahera // Isl.,Jailolo Dist., // Kampung Pasir Putih // 0°53'N, 127°41'E" "1–14 Feb. 1981 // AC Messer & PM Taylor" "HOLOTYPE // *Eosphaerophoria* // *hermosa* // det. X. Mengual 20*09*" [red, second and third lines handwritten] USNM ENT00036562 [1♀, USNM].

Length (1): body, 6.8 mm; wing, 5.0 mm.

Distribution: Indonesia.

Etymology. The specific epithet is derived from the Spanish *hermoso*, meaning beautiful, comely, handsome. Species epithet to be treated as adjective.

Differential diagnosis. *Eosphaerophoria hermosa*, *E. dentiscutellata* and *E. adornata* are the three species with a distinct medial tooth on the posterior scutellar margin. *Eosphaerophoria hermosa* has a medial black facial vitta, while the other species have

yellow faces and most of the 1st abdominal tergum yellow. In addition, its abdominal pattern is the mostly yellow.

***Eosphaerophoria luteofasciata* Mengual, sp. n.**
urn:lsid:zoobank.org:act:4DAAAC30-BBC4-4EF4-B6B1-7AF92BFDCDA2
Figs 35, 47; MorphBank [http://www.morphbank.net/?id=478080]

Vockeroth, 1969: 135 as *Eosphaerophoria* sp. (citation).

Male. *Head*. Face straight, with distinct round tubercle, yellow, yellow pilose; gena yellow, yellow pilose; lunula blackish medially; frons completely black on dorsal 3/5 (length between anterior ocellus and lunula), yellow on basolateral 2/5 with medial black vitta abruptly narrowed during dorsal 1/5 becoming medial very narrow simple black line during ventral 1/5 reaching lunula, with frontal sulcus about medial point between lunula and anterior ocellus, defined dorsally with a tubercle elevating vertex and with a ventral depression, yellow pilose in yellow areas and dark pilose in black areas; dichoptic; vertex and vertical triangle black; ocelli brownish; antenna yellow, basoflagellomere yellow with dorsal brown macula, oval; arista brown; occiput mainly black, yellow ventrally, silvery pollinose and yellow pilose on ventral 1/3, black pilose on dorsal 2/3 and golden pollinose on dorsal 1/3.

Thorax. Scutum black, shiny medially, black pollinose laterally, golden brown pilose with yellow pile on notopleuron, yellow laterally with lateral yellow stripe from postpronotum to scutellum, narrower after transverse suture with ventral black area; postpronotum yellow; notopleuron yellow with distinct posterolateral obtuse protuberance; scutellum triangular, pointed posteriorly with small blunt tubercle on medial posterior margin, yellow with dorsomedial triangular black area continuing from posterior of mesonotum, brownish pilose; propleuron, anepisternum and anepimeron entirely yellow; katepisternum black with a dorsal yellow macula; meron black; katepimeron yellow; katatergum mainly yellow, black posteriorly; calypter dark brown; halter yellowis). *Wing*. Wing bare basomedially.

Legs. Pro- and mesoleg entirely yellow, except distal part of mesofemur and basal part of mesotibia dark, yellow pilose except tarsi with short black setulae ventrolaterally; metacoxa and trochanter yellow; metafemur yellow on basal 1/3, black on distal 2/3; metatibia black, black pilose; metatarsus black, black pilose dorsolaterally and golden pilose ventrolaterally.

Abdomen. Fig. 35. Dorsum mainly black, dorsally black pilose, 1st tergum laterally yellow pilose; 1st tergum black with anterior and lateral yellow margin, medially reaching anterior margin of 2nd tergum dividing black area in 2 triangular maculae; 2nd tergum black with basomedial very narrow black fascia not reaching margins and with basal yellow fascia, about 1/5 of tergum length, produced posteriorly in a medial triangular emargination reaching 1/3 length of tergum, yellow on anterior 1/3 of lateral margin; 3rd tergum black with basomedial very narrow black fascia not reaching

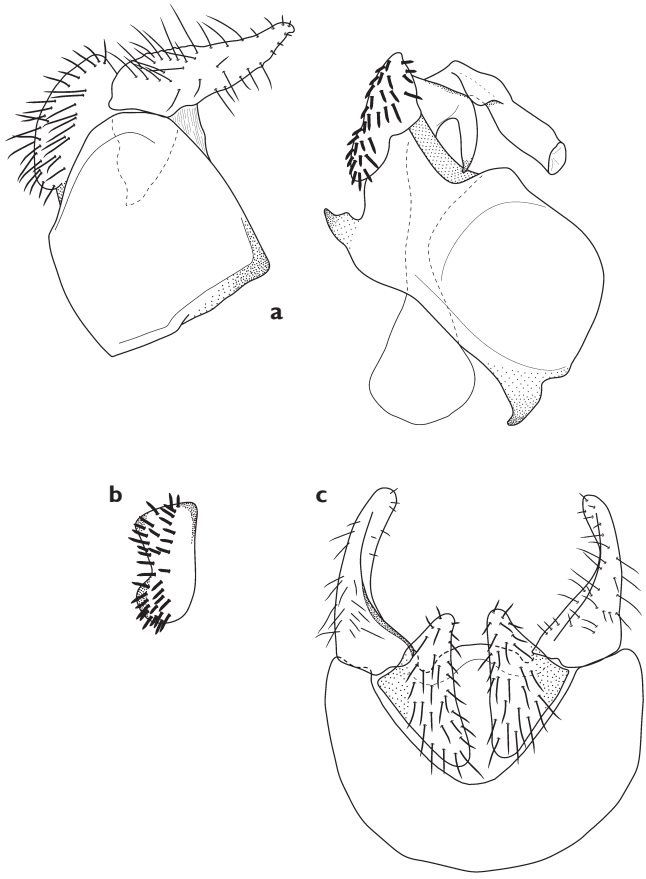


Figure 45. *Eosphaerophoria brunettii*, male genitalia **a** left lateral view **b** right superior lobe, dorsal view **c** tergite 9, cerci and surstyli, dorsal view.

margins and with basal broad yellow fascia, about 1/3 of tergum length, produced posteriorly in a medial triangular emargination reaching 1/2 length of tergum, yellow on anterior 1/3 of lateral margin; 4th tergum similar to 3rd, black with basomedial very narrow black fascia not reaching margins and with basal yellow fascia, about 2/5 of tergum length, produced posteriorly in a medial triangular emargination reaching 2/3 length of tergum, yellow on anterior 2/5 of lateral margin; 5th tergum black with basomedial very narrow black fascia and with basal broad yellow fascia, about 1/2 length tergum; 6th and 7th terga black; sterna yellowish, brownish pilose; male genitalia as figured (Fig. 47).

Female. Unknown.

Type locality. PAPUA NEW GUINEA: New Ireland, Kaveing, Schleinitz Mountains, Lelet Plateau. 3°20'0.00"S 152°0'0.00"E.

Type. ***Holotype:*** "NEW IRELAND // Schleinitz Mts. // Lelet Plateau // Oct. 1959" "W. W. Brandt // Collector // BISHOP" "HOLOTYPE // *Eosphaerophoria*

// *luteofasciata* // det. X. Mengual 20*09*" [red, second and third lines handwritten] USNM ENT00036555, [1♂, BPBM].

Length (1): body, 6.3 mm; wing, 4.7 mm.

Distribution: Papua New Guinea.

Etymology. The specific epithet is derived from the Latin *luteus* meaning yellow (Brown 1956: 872), and the Latin *fasciatus* meaning envelope with bands, swathe (Brown 1956: 138), and it refers to the yellow fascia (band) on the 2nd abdominal tergum. Species epithet to be treated as adjective.

Differential diagnosis. Species with a characteristic yellow fascia on 2nd abdominal tergum, also present in *E. hermosa* and *E. adornata*, but differs from them in the absence of a tooth on the posterior margin of the scutellum. *E. luteofasciata* has posteriorly pointed scutellum, but without tooth or blunt protuberance. Male genitalia with bifurcated surstylus, divided in two similar lobes in lateral view (Figs 47a, 47d), very similar to the male genitalia of *E. bifida*, whose surstylus has two lobes of different sizes (Figs 44a, 44c).

Remarks. Vockeroth (1969: 135) mentioned this species as undescribed.

Eosphaerophoria marginata Frey, 1946

Figs 22, 28, 39, 40, 41, 48; MorphBank [http://www.morphbank.net/?id=478081]

Eosphaerophoria marginata Frey, 1946: 169. Type locality: Philippines, Luzon, Mt. Banahao. Syntypes 3♂1♀. Lectotype ♂ here designated [ZMUH, Helsinki]. Claussen and Weipert 2003: 354, Figs 34 (abdomen), 38 (scutum and scutellum, ♀).

Male. *Head*. Face straight, with distinct round tubercle, yellow, yellow pilose; gena yellow; lunula black; frons completely black on dorsal 1/2 (length between anterior ocellus and lunula), yellow on basolateral 1/2 with medial black vitta narrowing ventrally, about 1/3 of the facial width at the narrowest point, with frontal sulcus defining dorsal completely black area, with few short yellow hairs ventrally; dichoptic; vertex and vertical triangle black; ocelli brownish; antenna yellow, basoflagellomere darker dorsally, oval; arista dark brown; occiput mainly black, yellow ventrally, yellow pilose.

Thorax. Scutum mainly black, shiny medially, black pollinose laterally, yellow laterally with a lateral broad yellow stripe from postpronotum to scutellum with some black hairs, golden brown pilose; postpronotum yellow; notopleuron yellow with distinct posterolateral obtuse protuberance; scutellum triangular, yellow with dorsomedial triangular black area continuing from posterior mesonotum, brownish pilose; propleuron, anepisternum and anepimeron entirely yellow; katepisternum black with dorsal yellow macula; meron black; katepimeron yellow; katatergum mainly yellow, black posteriorly; calypter dark brown; halter orangish yellow. *Wing*. Wing bare basomedially.

Legs. Pro- and mesoleg entirely yellow, except distal part of mesofemur and basal part of mesotibia dark, yellow pilose except tarsi with short black setulae ventrolater-

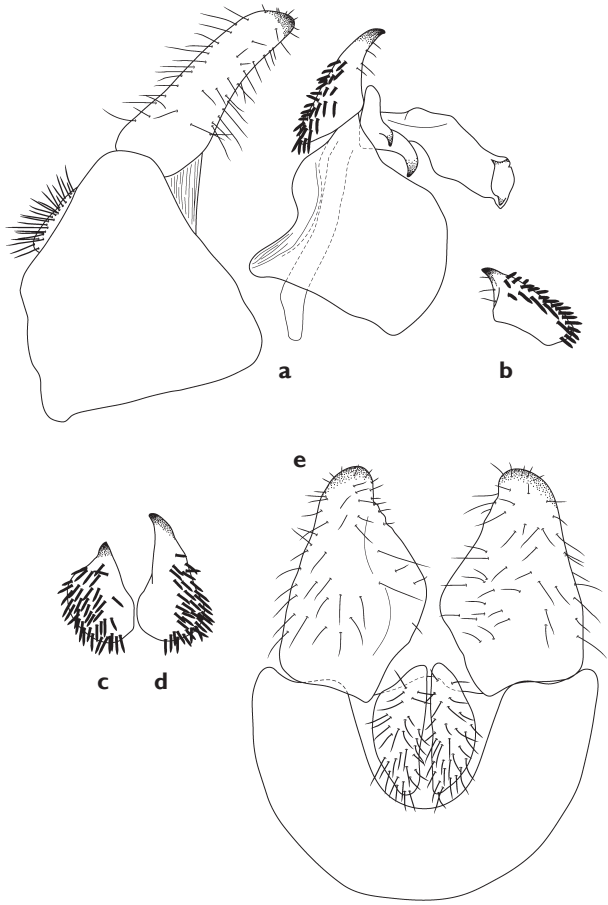


Figure 46. *Eosphaerophoria dentiscutellata*, male genitalia **a** left lateral view **b** right superior lobe, lateral view **c** right superior lobe, dorsal view **d** left superior lobe, dorsal view **e** tergite 9, cerci and surstyli, dorsal view.

ally; metacoxa and trochanter yellow; metafemur yellow on basal 1/2, black on distal 1/2; metatibia black; metatarsus black, golden yellow and black pilose.

Abdomen. Fig. 39. Dorsum mainly black, black pilose except 1st tergum and anteriorly 2nd tergum yellow pilose laterally; 1st tergum black, yellowish on basal and lateral margin; 2nd tergum black dorsally, narrowly yellow laterally on basal 3/4 continuing the yellow margin of 1st tergum; 3rd tergum black with basoanterior very narrow black fascia not reaching margins and with basal narrow yellow fascia (about 1/5 of tergum length) produced posteriorly in a medial small triangular emargination, with lateral margin yellow on anterior 1/2; 4th tergum similar to 3rd, black with basoanterior very narrow black fascia not reaching margins and with basal yellow fascia produced posteriorly in a medial small triangular emargination, broader than yellow fascia of 3rd tergum (about 1/4–1/3 of tergum length), with lateral margin yellow on anterior 1/2; 5th tergum black with 2 lateral triangular yellow maculae on basal 1/3,

leaving median 1/2 or more black; 6th tergum yellowish, black medially; sterna yellowish, yellow pilose except 4th sternum with some long thin black hairs medially on posterior margin; 3rd sternum slightly produced medially into a projection with 2 tips narrowly separated with black setulae close to posterior margin; 4th sternum with posterior margin produced medially into 2 projections with black setulae; male genitalia as figured (Fig. 48).

Female. Paralectotype female lacks the head, but some details are known from original description. Similar to male except for normal sexual dimorphism and face yellow with a medial black vitta. Legs: probasitarsomere dark yellow, darker than other tarsomeres; metafemur slightly more yellow basally, about 3/5, black on apical 2/5. Abdomen: 3rd and 4th terga similar to male but anterior yellow fascia narrower and posterior emargination smaller; 5th tergum with 2 long yellow maculae on anterior 1/2, leaving a narrow black fascia medially on anterior margin; 6th tergum black (Fig. 40). Sterna yellow pilose, with black pile after 5th sternum.

Variation. Examined paralectotype male has the 4th abdominal tergum broken, placed in a microvial with the genitalia and the rest of the terga. The non-examined paralectotype male lacks the head.

The female from Thailand presents some variation compared with the female from the Philippines: face yellow with medial black vitta narrowing down to oral apex; frons completely black on dorsal 1/4 (length between anterior ocellus and lunula), yellow on basolateral 3/4 with a media broad black vitta, about 3/4 of the facial width, without frontal sulcus. Scutellum with few short black pile on posterior margin. Mesotibia with a medial small yellowish macula, not well-defined and could be the result of the use of forceps to arrange the legs. Abdomen similar except 5th tergum with a smaller yellow maculae, leaving median 1/3–1/2 black (Fig. 41).

Type locality. PHILIPPINES: Luzon Island, Calabarzon, Mount Banahaw (alternative spelling: Banáhao). 14°3'54.90"N 121°28'48.24"E.

Types. Frey (1946) based *E. marginata* on a series of 3 male and 1 female specimens from the Philippines collected by G. Boettcher in June and July 1914, which are deposited in the Helsinki collection (ZMUH). From these syntypes, a pinned male labelled "Luzon. // Banahao // VII. 1914" "Paratype" [red label] "Mus. Zool. // Helsinki // N:o *5728*" [number handwritten] "Mus. Zool. Helsinki // Loan No. // D 2009-26" is here designated as the lectotype to fix and ensure the universal and consistent interpretation of the name. The other syntypes have been labelled as paralectotypes.

Lectotype: "Luzon. // Banahao // VII. 1914" "Paratype" [red label] "Mus. Zool. // Helsinki // N:o *5728*" [number handwritten] "Mus. Zool. Helsinki // Loan No. // D 2009-26" "LECTOTYPE // *Eosphaerophoria* // *marginata* // det. X. Mengual 20*09*" [red, second and third lines handwritten] USNM ENT00036545 [1♂, UZMH]. ***Paralectotypes:*** "Luzon. // Banahao // VI. 1914" "Mus. Zool. Helsinki // Loan No. // D*4256*" [number handwritten] "ZMUH" "*Eosphaerophoria marginata R. Frey det.*" "PARALECTOTYPE // *Eosphaerophoria* // *marginata* // det. X. Mengual 20*09*" [yellow, second and third lines handwritten] USNM ENT00036543 [1♂, UZMH]; "Lu-

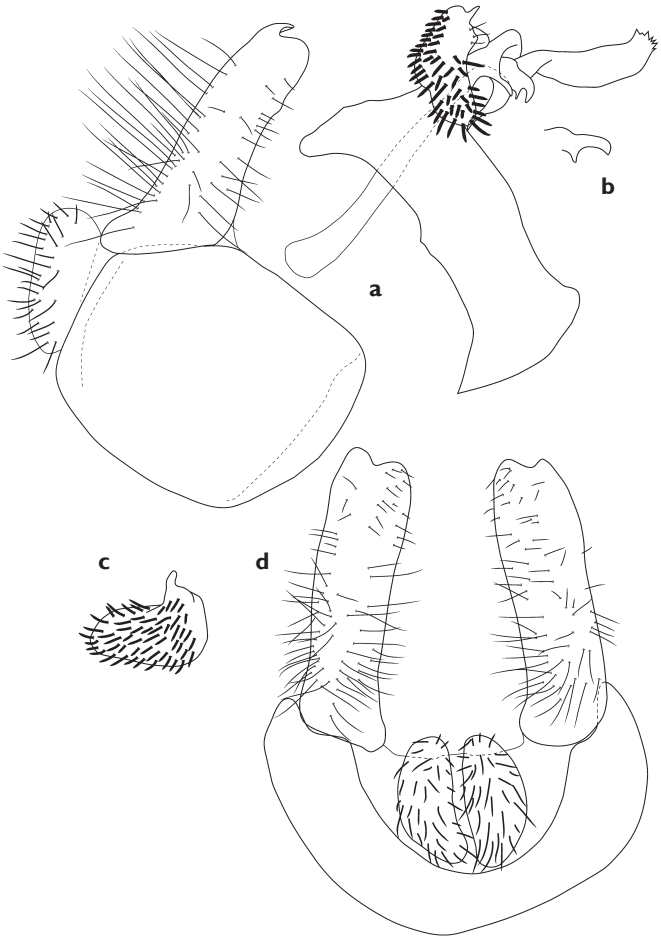


Figure 47. *Eosphaerophoria luteofasciata*, male genitalia **a** left lateral view **b** right basal appendix of aedeagus **c** right superior lobe, dorsal view **d** tergite 9, cerci and surstyli, dorsal view.

zon. // Banahao // VI 1914". "Spec. typ." [pink label] "Mus. Zool. H:fors // Spec. typ. No *14040* // *Eosphaerophoria // marginata Frey*" [number, third and fourth lines handwritten] "*Mus. Zool. Hel. // D02-181*" [handwritten] "Zool. Helsinki // Loan No. // D 2009-27" "PARALECTOTYPE // *Eosphaerophoria* // *marginata* // det. X. Mengual 20*09*" [yellow, second and third lines handwritten] USNM ENT00036544, [1♀ without head, UZMH].

Non-examined material. ***Paralectotype:*** "Luzon. // Banahao // VII. 1914" "Mus. Zool. H:fors // Spec. typ. No *14039*" [1♂, UZMH].

Non-type material. "Thailand, Doi Inthanon // natn. Park, road to summit // 800–1800 m // 28.X.1979 // Zool. Mus. Copenhagen Exped." "UZM" "*Eosphaerophoria* // *marginata* // det. X. Mengual '*09*" [first and second lines handwritten] USNM ENT00036556, [1♀, UZMC].

Length (2): body, 5.6–6.2 (5.9) mm; wing, 4.0–4.8 (4.4) mm.

Distribution: Philippines, Thailand.

Differential diagnosis. Species similar to *Eosphaerophoria vietnamensis* with 2nd abdominal tergum black dorsally and 5th tergum with 2 lateral yellow maculae. *Eosphaerophoria marginata* differs from *E. vietnamensis* in having a medial broad black vitta on frons reaching antennal bases. Moreover, *Eosphaerophoria marginata* has bigger yellow maculae on 5th abdominal tergum (see Figs 39 and 42) and narrower yellow fascia on 3rd and 4th terga. Male genitalia is also very similar between these two species, but *E. marginata* has the right superior lobe broader and without a posterior tooth (Fig. 48) being very different from left superior lobe (see comments on *E. vietnamensis*).

Remarks. Although the female from Thailand has a peculiar slightly different abdominal pattern (see variation), we consider it still conspecific with the specimens from the type series from the Philippines. Maybe when more material will be available, the status of this population can be re-evaluated.

***Eosphaerophoria nigrovittata* Mengual, sp. n.**

urn:lsid:zoobank.org:act:7977AD10-D231-40A0-9AB4-53E6952A9C8E

Fig. 36; MorphBank [http://www.morphbank.net/?id=478082]

Vockeroth 1969: 135 as *Eosphaerophoria* sp. (citation).

Male. Unknown.

Female. *Head*. Face straight, broad, with distinct round tubercle, yellow with medial broad black vitta (about 1/2 of face width) narrowing ventrally to oral apex, yellow pilose; gena yellow; oral apex and oral margin brownish; lunula black; frons completely black on dorsal 2/5 (length between anterior ocellus and lunula), yellow on basolateral 3/5 with medial broad black vitta (about 2/3 of frons width) that reaches lunula and continues laterally with black facial vitta, yellow pilose; vertex and vertical triangle black, black pilose; ocelli brownish; antenna yellow, scape brown, basoflagellomere brown dorsally, oval; arista brown; occiput mainly black, yellow ventrally, yellow pilose an silvery pollinose ventrally, black pilose and golden pollinose dorsally.

Thorax. Scutum mainly black, shiny medially, black pollinose laterally, yellow laterally with lateral yellow stripe from postpronotum to scutellum, narrower after transverse suture with ventral black area, golden brown pilose; postpronotum yellow; notopleuron yellow with distinct posterolateral obtuse protuberance, yellow pilose; scutellum triangular, yellow with dorsomedial triangular black area continuing from posterior mesonotum, golden brown pilose. Pleura mainly yellow pilose, with only 2 black pile, one on posterior anepisternum and another on anterior anepimeron; propleuron, anepisternum and anepimeron entirely yellow; katepisternum black with dorsal yellow macula; meron black; katepimeron yellow; katatergum mainly yellow, black posteriorly; calypter dark brown; halter yellow. *Wing*. Wing bare basomedially.

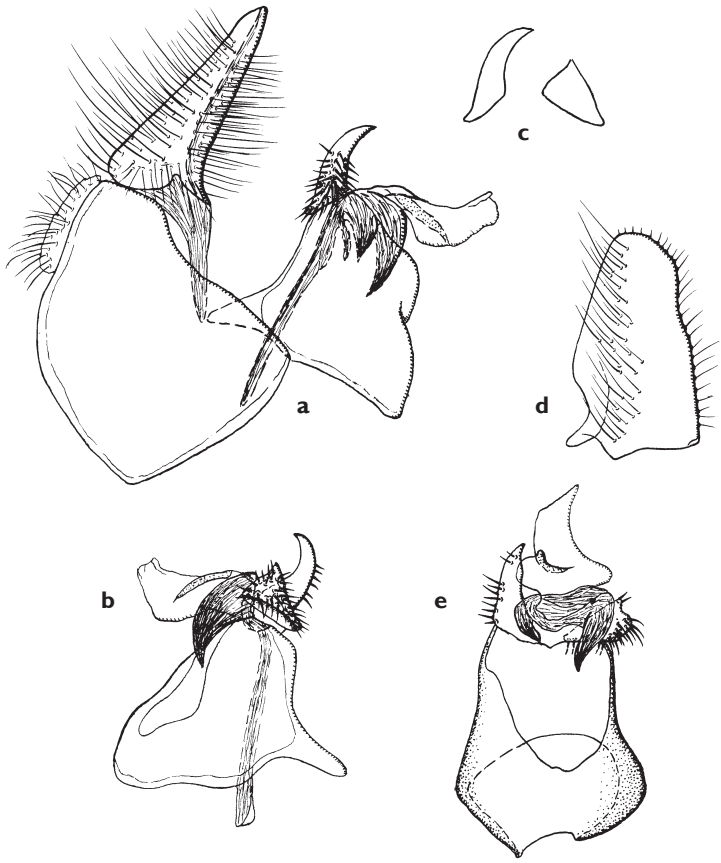


Figure 48. *Eosphaerophoria marginata*, male genitalia **a** left lateral view **b** sternite 9, superior lobes and aedeagus, right lateral view **c** left and right superior lobes, lateral view, outline only **d** left surstylus, dorsal view **e** sternite 9, superior lobes and aedeagus, ventral view (adapted from Vockeroth 1969).

Legs. Pro- and mesoleg entirely yellow, except metacoxa darker, tarsi darker and distal part of mesofemur and basal part of mesotibia slightly darker, yellow pilose except tarsi with short black setulae ventrolaterally; metacoxa and trochanter yellow, yellow pilose; metafemur yellow on less than basal 1/4, black on distal 4/5, brownish pilose; metatibia black, golden brown pilose; metatarsus black, golden yellow and brown pilose.

Abdomen. Fig. 36. Dorsum mainly black, black pilose except 1st tergum yellow pilose laterally; 1st tergum black with anterior and lateral yellow margin, medially reaching anterior margin of 2nd tergum dividing black area in 2 triangular maculae; 2nd tergum black dorsally, narrowly yellow basolaterally; 3rd tergum black with basomedial very narrow black fascia not reaching margins and with basal yellow fascia, about 1/3 of tergum length, produced posteriorly in a medial triangular emargination reaching half length of tergum, yellow on anterior 1/2 of lateral margin; 4th tergum similar to 3rd, basal yellow fascia slightly broader; 5th tergum black with basome-

dial very narrow black fascia not reaching margins and with basal broad yellow fascia (about 1/2 of tergum length) narrowing medially very much; 6th tergum black with 2 basolateral yellow maculae; sterna brownish yellow, yellowish pilose.

Variation. Paratype specimen without black pile on pleura and has the medial black frontal vitta slightly broader, probably due to drying process that darkened the frons. Paratype female has 2nd tergite black medially but with an uncertain lighter point that could be a macula or an artefact resulting from the drying process. Holotype female has a medial small hole in the 2nd abdominal tergite that obscures any existing macula if it was present. Thus, the examined material has no clear evidence to affirm that this species has a medial macula on the 2nd tergite.

Type locality. PAPUA NEW GUINEA: Morobe, Bulolo, NE Wau. 7°20'42.92"S 146°43'5.31"E.

Type. ***Holotype:*** "NEW GUINEA: NE // Wau, 1100–1200 m // VI.1968" "N.L.H. Krauss // Collector // BISHOP MUSEUM" "HOLOTYPE // *Eosphaerophoria* // *nigrovittata* // det. X. Mengual 20*09*" [red, second and third lines handwritten] USNM ENT00036559 [1♀, BPBM]. ***Paratype:*** "Neth. Ind.-American // New Guinea Exped. // Araucaria Camp 800 m // *11*.iii.1939L.J. Toxopeus" "PARATYPE // *Eosphaerophoria* // *nigrovittata* // det. X. Mengual 20*09*" [yellow, second and third lines handwritten] USNM ENT00036563 [1♀, RNH].

Length (1): body, 5.8 mm; wing, 5.1 mm.

Distribution: Papua New Guinea, Indonesia.

Etymology. The specific epithet is derived from the Latin *nigro* meaning black, blackened (Brown 1956: 149), and the Latin *vittata* meaning decorated or bound with a ribbon (Brown 1956: 660), and it refers to the characteristic broad medial black vitta of the face. Species epithet to be treated as adjective.

Differential diagnosis. Female with a medial broad black facial vitta, very distinctive. It has the largest black facial vitta in the genus. *Eosphaerophoria nigrovittata* also has a characteristic broad abdomen (see Fig. 36). Similar to *E. bifida* with 5th tergum with a yellow fascia, but *E. bifida* has yellow face and a central elongated yellow macula on 2nd abdominal tergum.

Eosphaerophoria punctata Claussen & Weipert, 2003

Figs 23, 25, 26, 27, 30.

Eosphaerophoria punctata Claussen & Weipert, 2003: 352. Type locality: Nepal, Annapurna region, Valley of Marsyangdi, 47 km northeast of Pokhara. Holotype 1♀ [Institut für Biologische Studien, J. Weipert Colln., Plaue, Germany]. Claussen & Weipert, 2003: 355, Figs 32, 33, 35, 36, 37 (abdomen, wing, face profile, frontal and dorsal head view).

Type locality. NEPAL: Gandaki, Kaski. Annapurna region, Valley of Marsyangdi, 47 km northeast of Pokhara. 28°17'10.16"N 84°01'21.27"E.

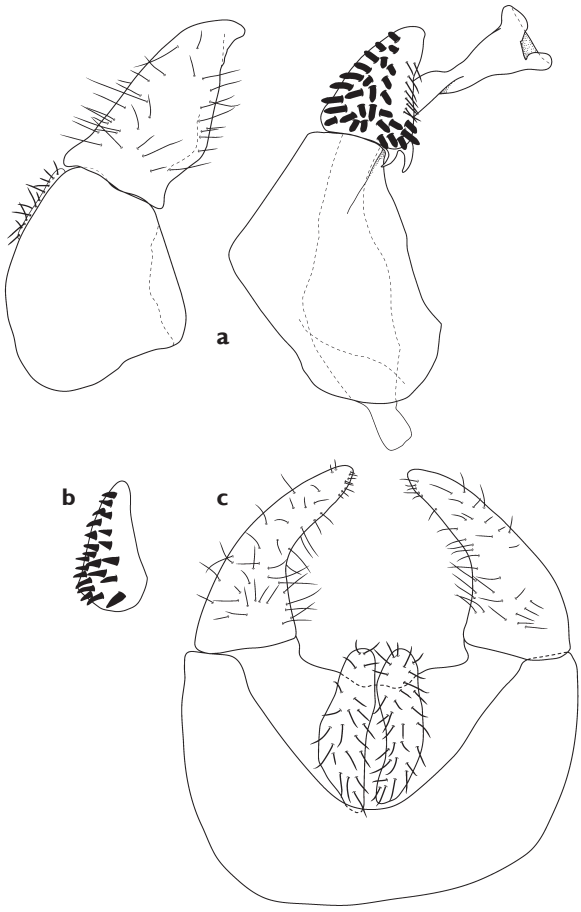


Figure 49. *Eosphaerophoria symmetrica*, male genitalia **a** left lateral view **b** right superior lobe, dorsal view **c** tergite 9, cerci and surstyli, dorsal view.

Non-examined material. ***Holotype:*** Nepal, Annapurna region, Valley of Marsyangdi, 47 km northeast of Pokhara. 1700m., 21.IX.1992, leg. J. Weipert [1♀, Institut für Biologische Studien, J. Weipert Colln., Plaue, Germany].

Distribution: Nepal.

Differential diagnosis. Species with notopleuron not produced posterolaterally, very distinctive with a medial yellow macula on 2nd abdominal tergum. Similar to *E. symmetrica*, but differs from this species by having a medial black vitta on frons (Figs 26, 27), and the 1st abdominal tergum almost entirely yellow (Fig. 30). In the original description, Claussen and Weipert (2003) gave a clear diagnosis to separate *E. punctata* from the then known species as follows: "similar to *E. dentiscutellata* (Keiser, 1958), with the following differences: a) scutellum without tooth on apical margin; b) basitarsus of fore leg pale, not darker than following tarsal segments; c) apex of f2 and base of t2 narrowly black; d) tarsomeres of p2 narrowly black basally; e) tergite 1 pale

yellow, apical margin narrowly black; f) tergite 2 with yellow median macula *(Fig. 30)*; g) tergite 5 with a complete subbasal yellow band; h) notopleuron simple, without lateral protuberance *(similar to Fig. 29)*."

Remarks. Claussen and Weipert (2003) described *E. puncatata* from a unique female collected in Nepal. The holotype is in the personal collection of Jörg Weipert in Plaue, Germany and was unavailable for the present study.

***Eosphaerophoria symmetrica* Mengual, sp. n.**
urn:lsid:zoobank.org:act:62588E50-7113-4DE3-83F9-6BA7827EC755
Figs 31, 49; MorphBank [http://www.morphbank.net/?id=478083]

Vockeroth 1969: 135, in part as *E. dentiscutellata* (citation).

Male. *Head*. Face straight, narrow becoming broader ventrally, with distinct round tubercle, yellow, yellow pilose; gena yellow, yellow pilose; lunula yellow; frons completely black on dorsal 1/3 (length between anterior ocellus and lunula), yellow on ventral 2/3, yellow pilose on yellow areas and dark pilose on black areas; dichoptic; vertex and vertical triangle black, black pilose; ocelli brownish; antenna yellow, basoflagellomere orange, brown dorsally, oval; arista brown; occiput mainly black, yellow ventrally, yellow pilose an silvery pollinose ventrally, black pilose and golden pollinose dorsally.

Thorax. Scutum mainly black, shiny medially, black pollinose anterior and laterally, yellow laterally with lateral broad yellow stripe from postpronotum to scutellum, slightly narrower after transverse suture with ventral black area, golden brown pilose except lateral yellow stripe with yellow hairs; postpronotum yellow; notopleuron yellow without posterolateral protuberance; scutellum subtriangular, more round than in other species, yellow with dorsomedial small subtriangular black area, golden brown pilose; pleura yellow pilose; propleuron, anepisternum and anepimeron entirely yellow; katepisternum black with dorsal yellow macula; meron black; katepimeron yellow; katatergum mainly yellow, black posteriorly; calypter dark brown; halter yellow. *Wing*. Wing bare basomedially.

Legs. Pro- and mesoleg entirely yellow, except distal part of mesofemur and basal part of mesotibia slightly darker, yellow pilose except tarsi with short black setulae ventrolaterally; both metalegs are broken on basal part of the femur, but metacoxa, metatrochanter and basal section of metafemur yellow, yellow pilose.

Abdomen. Fig. 31. Dorsum mainly black, black pilose except 1st, 2nd and 3rd terga yellow pilose laterally; 1st tergum black with anterior and lateral yellow margin, medially reaching anterior margin of 2nd tergum dividing black area in 2 triangular maculae; 2nd tergum black dorsally with dorsomedial elongated yellow macula, narrowly yellow laterally on basal 3/4 continuing the yellow margin of 1st tergum; 3rd tergum black with basomedial very narrow black fascia and with basal yellow fascia, about 1/4 of tergum length, becoming broader medially and produced posteriorly in a medial triangular emargination reaching half length of tergum, yellow on anterior 2/3 of lateral margin; 4th tergum black with basomedial narrow black fascia and with basal

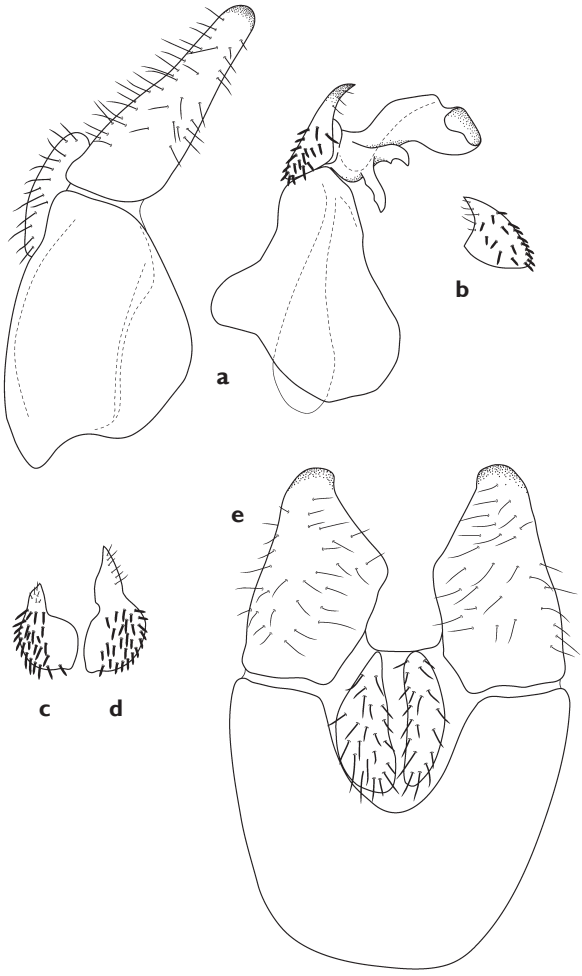


Figure 50. *Eosphaerophoria vietnamensis*, male genitalia **a** left lateral view **b** right superior lobe, lateral view **c** right superior lobe, dorsal view **d** left superior lobe, dorsal view **e** tergite 9, cerci and surstyli, dorsal view.

yellow fascia slightly broader, about 1/3 of tergum length, produced posteriorly in a medial triangular emargination reaching half length of tergum, yellow on anterior 1/2 of lateral margin; 5th tergum black with basal narrow black fascia and with anterobasal yellow fascia narrowing medially, yellow on anterior 1/2 of lateral margin; sterna yellow, yellow pilose; male genitalia as figured (Fig. 49).

Female. Unknown.

Type locality. VIETNAM: Lam Dong, Dà Lat. 11°56'43.51"N 108°26'31.59"E.

Type. ***Holotype:*** "VIET NAM // Dalat, 1500 m // *11.IX.*1960" "J.L. Gressitt // Collector // BISHOP MUSEUM" "HOLOTYPE // *Eosphaerophoria* // *symmetrica* // det. X. Mengual 20*09*" [red, second and third lines handwritten] USNM ENT00036554 [1♂, BPBM].

Length (1): body, 6.3 mm; wing, 4.5 mm.

Distribution: Vietnam.

Etymology. The specific epithet is derived from Greek *symmetros* meaning corresponding part for part, proportional, symmetrical (Brown 1956: 306), and it refers to the symmetrical superior lobes of the male genitalia. Species epithet to be treated as adjective.

Differential diagnosis. Species with notopleuron not produced posteroalterally and a yellow macula on 2nd abdominal tergum. Similar to *E. punctata*, but differs in having the frons yellow on ventral 4/5 and 1st abdominal tergum yellow with 2 posterior subtriangular black maculae.

Remarks. This species is very similar to *E. punctata*. Both species share a unique morphological character with *E. bifida*: a medial yellow macula on 2nd abdominal tergum. *Eosphaerophoria symmetrica* could be the male of *E. punctata* because they also have in common the absence of the posterolateral obtuse protuberance of notopleuron, but they differ in the abdominal pattern of the 1st tergum and the frons. Nonetheless, due to the low number of records/specimens of this genus and the morphological differences, we consider *E. symmetrica* as a species different from *E. punctata*. *Eosphaerophoria symmetrica* and *E. vietnamensis* are described from the same locality, but they present several differences that make them easy to distinguish: *E. symmetrica* has a yellow macula on 1st abdominal tergum, and a yellow fascia on 5th tergum (Fig. 31). *Eosphaerophoria vietnamesis* has 2nd tergum black with yellow lateral margin and two yellow maculae on 5th tergum (Fig. 42). Moreover, the superior lobes of the male genitalia in *E. vietnamensis* are asymmetrical (Fig. 50), unlike *E. symmetrica* which has them symmetrical (Fig. 49).

***Eosphaerophoria vietnamensis* Mengual, sp. n.**

urn:lsid:zoobank.org:act:6BE779D2-C252-4B44-AE9C-162DD0FDEBAF

Figs 42, 43, 50; MorphBank [http://www.morphbank.net/?id=478084]

Vockeroth 1969: 135, in part as *E. dentiscutellata* (citation). Mengual et al. 2009: 8, as *new species* (citation).

Male. *Head*. Face straight, with distinct round tubercle, yellow, yellow pilose; gena yellow, yellow pilose; lunula yellow; frons completely black on dorsal 2/5 (length between anterior ocellus and lunula), yellow on ventral 3/5 with medial black triangular emargination abruptly narrowed reaching the 1/2 of yellow area, not reaching lunula, with small tubercle dorsally to frontal sulcus elevating vertex, yellow pilose in yellow areas and dark pilose in black areas; dichoptic; vertex and vertical triangle black; ocelli brownish; antenna orange, basoflagellomere dark brown on dorsal 1/2, oval; arista brown; occiput mainly black, yellow ventrally, silvery pollinose and yellow pilose ventrally, black pilose and golden pollinose dorsally.

Thorax. Scutum black, shiny medially, black pollinose laterally, golden brown pilose with yellow pile on notopleuron, yellow laterally with lateral yellow stripe

from postpronotum to scutellum, narrower after transverse suture with ventral black area; postpronotum yellow; notopleuron yellow with small posterolateral protuberance, not as evident as in *E. dentiscutellata*; scutellum triangular, pointed posteriorly with small blunt tubercle on medial posterior margin, yellow with dorsomedial triangular black area continuing from posterior mesonotum, brownish pilose; propleuron, anepisternum and anepimeron entirely yellow; katepisternum black with a dorsal yellow macula; meron black; katepimeron yellow; katatergum mainly yellow, black posteriorly; calypter dark brown; halter yellowish. *Wing*. Wing bare basomedially.

Legs. Pro- and mesoleg entirely yellow, except distal part of mesofemur and basal part of mesotibia dark, yellow pilose except tarsi with short black setulae ventrolaterally; metacoxa and trochanter yellow; metafemur yellow basally, black distally on less than 1/2, with 2 ventral rows (one posteroventral and another anteroventral, less evident) of short strong black spine-like setulae on the apical 1/2; metatibia black, black pilose; metatarsus black, black pilose dorsolaterally and golden pilose ventrolaterally.

Abdomen. Fig. 42. Dorsum mainly black, dorsally black pilose, 1st tergum and anterior part of 2nd tergum laterally yellow pilose; 1st tergum black with very narrow yellow fascia on anterior margin following sclerite shape, and lateral yellow margin; 2nd tergum black, yellow on anterior 1/3 of lateral margin continuing the yellow lateral margin of 1st tergum; 3rd tergum black with basal narrow yellow fascia, about 1/5 of tergum length, becoming broader medially and ending in a posteriorly pointed emargination at medial point reaching the 1/3 of tergum length, yellow on anterior 1/2 of lateral margin; 4th tergum similar to 3rd, black with basal broader yellow fascia, about 1/3 of tergum length, produced posteriorly in a medial triangular emargination reaching half length of tergum, yellow on anterior 1/2 of lateral margin; 5th tergum black with 2 anterolateral small yellow maculae, difficult to see on dorsal view; sterna brownish yellow, yellow pilose; 4th sternum with posterior margin produced medially into 2 projections with black setulae; male genitalia as figured (Fig. 50).

Female. Similar to male except for normal sexual dimorphism and: face yellow with medial diffuse black vitta narrowing to tubercle tip not reaching oral apex; lunula black; frons completely black on dorsal 1/4 (length between anterior ocellus and lunula), yellow on basolateral 3/4 with medial broad well-defined black vitta slightly narrowing ventrally (about 3/5 of frons width) and reaching lunula; scutellum without blunt knob on posterior margin, with dorsomedial black area smaller. Metafemur apparently without ventral black setulae except one seen on left metaleg. 1st tergum black with anterior and lateral yellow margin, medially reaching the anterior margin of the 2nd tergum dividing black area in 2 triangular maculae; 3rd abdominal tergum black with basomedial very narrow black fascia and with basal yellow fascia, about 1/5 of tergum length, produced posteriorly in a medial triangular emargination reaching half length of tergum, yellow on anterior 1/2 of lateral margin; 4th abdominal tergum black with basomedial very narrow black fascia and with a basal broader yellow fascia, about 1/3 of tergum length, not produced posteriorly, yellow on anterior 1/2 of lateral margin;

5th abdominal tergum black with 2 basolateral yellow maculae, leaving the medial 1/3 black, yellow on lateral 1/2; 6th abdominal tergum black with 2 anterolateral yellow maculae (Fig. 43); 6th, 7th and 8th sterna with long black pile on posterior margin medially.

Variation. A couple of male specimens have the frons with a medial black very narrow vitta continuing from the abruptly narrowed emargination to lunula. In these cases, this thin vitta reaches lunula, and specimens have the lunula a bit darker medially. Another male individual has no posterior small blunt knob on scutellum, and its posterior margin is more rounded. Some specimens present the metafemur with short black setulae on the apical 2/3, but others on less than apical 1/2. We think that these setulae can be lost in part in dried pinned specimens.

Type locality. VIETNAM: Lam Dong, Dà Lat. 11°56'43.51"N 108°26'31.59"E.

Types. ***Holotype*:** "VIET NAM // Dalat, 1500 m // *11.IX.*1960" "J.L. Gressitt // Collector // BISHOP MUSEUM" "HOLOTYPE // *Eosphaerophoria* // *vietnamensis* // det. X. Mengual 20*09*" [red, second and third lines handwritten] USNM ENT00036546 [1♂, BPBM]. ***Paratypes:*** "VIET NAM // Dalat, 1500 m // *11.IX.*1960" "J.L. Gressitt // Collector // BISHOP MUSEUM" "PARATYPE // *Eosphaerophoria* // *vietnamensis* // det. X. Mengual 20*09*" [yellow, second and third lines handwritten] USNM ENT00036031, ...036547, ...036548, ...036549 [2♂, BPBM; 2♂, USNM]; "VIET NAM // 6km SW, Dalat // 1550 m. // 11.ix.1960" "J.L. Gressitt // Collector" "PARATYPE // *Eosphaerophoria* // *vietnamensis* // det. X. Mengual 20*09*" [yellow, second and third lines handwritten] USNM ENT00036550, ...036551 [2♂, USNM]; "VIET NAM // Dalat, 1550 m // 11.IX.1960" "J.L. Gressitt // Collector" "PARATYPE // *Eosphaerophoria* // *vietnamensis* // det. X. Mengual 20*09*" [yellow, second and third lines handwritten] USNM ENT00036552 [1♀, USNM].

Non-type material. "MALAY PENINS: // PAHANG, F.M.S. // Fraser's Hill *4200* ft. // *12.7.*19*36* // H.M. Pendlebury. // F.M.S. Museums." [fifth and sixth lines in the back] "Ex F.M.S. // Museum // B.M. 1955-354", "BMNH", "*Loan # // 11849*" [handwritten] USNM ENT00036553 [1♂, BMNH].

Length (5): body, 4.9–6.1 (5.6) mm; wing, 4.0–4.7 (4.3) mm.

Distribution: Vietnam, Malaysia (?).

Etymology. The specific epithet is derived from the country's name where the species was found abundantly, Vietnam, and the Latin suffix *-ensis* denoting place, locality, country, or belonging to, pertaining to (Brown 1956: 45, 303). Species epithet to be treated as adjective.

Differential diagnosis. Species with 2nd abdominal tergum black dorsally and 2 lateral yellow maculae on 5th tergum, with notopleuron produced posterolaterally. Similar to *E. marginata*, but *Eosphaerophoria marginata* has bigger yellow maculae on the 5th abdominal tergum (see Figs 39 and 42) and narrower yellow fasciae on the 3rd and 4th terga. The male genitalia is very similar in these two species, but *E. marginata* has the right superior lobe broader and without a posterior tooth (Fig. 48) being very different from left superior lobe. *Eosphaerophoria vietnamensis* also has asymmetrical

superior lobes, but the right superior lobe has a posterior tip or tooth and is thinner in the posterior section than that in *E. marginata* (see Fig. 50b).

Remarks. *Eosphaerophoria vietnamensis* and *E. symmetrica* were both collected in Vietnam, but they can be easily differentiated by the abdominal pattern (see Figs 11, 22, 23) and male genitalia (see Figs 49, 50).

The Malaysian specimen, collected in the same area of type locality for *E. brunettii*, is tentatively included in this species based on colour pattern of 1st and 2nd abdominal terga, the lateral yellow stripe of the scutellum and the metaleg. But because the posterior part of abdomen and male genitalia are lost, it can not be identified with certainty.

Conclusions

A total of eight new *Eosphaerophoria* species were described in this study, totalling 11 known species. Previous authors (Vockeroth 1969; Claussen and Weipert 2003) cited most of the studied specimens as undescribed or identified as other species. In this work, we reported three new specimens of *Eosphaerophoria*. Two of them belong to new species described from Indonesia and Malaysia (*Eosphaerophoria hermosa*, *E. brunettii*), constituting the first material examined of this genus from these countries. The third specimen never cited before was identified as *E. vietnamensis*, also from Malaysia. With these three new records, a total of just 25 specimens (16♂ 9♀) of *Eosphaerophoria* are known today.

The other new species were described from material published under different names. Vockeroth (1969) grouped some specimens of the new species described here under a different name. His concept of *E. dentiscutellata* has been shown here to include two new species, *E. vietnamensis* and *E. symmetrica*. Vockeroth (1969) also examined a new species from Papua New Guinea, but he did not describe it. In this revision, four new species were described from Papua New Guinea: *E. adornata*, *E. bifida*, *E. luteofasciata* and *E. nigrovittata*.

Eosphaerophoria is a unique and "aberrant" (*fide* Vockeroth 1969) endemic in the Australasian and Oriental Regions. Specimens of this genus are found in five different Biodiversity hotspots (*sensu* Myers et al. 2000), including Sundaland, Wallacea, Philippines, Indo-Burma and Sri Lanka. However, New Guinea is not included in any hotspot but is the area with the highest number of described species. This presence in very biodiverse regions prompts us to consider that more new species of this genus could be sampled in the future, especially by operating Malaise traps which have taken most of the presently known specimens. More collecting effort in this area, especially New Guinea Island, is needed to understand the diversity of Diptera (including Syrphidae), which probably is underestimated due to the low number of field surveys; most of them carried out in the mid 20th century.

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Appendix A

General information (XLS format) about localities and elinks of *Eosphaerophoria* specimens of the World. File format: Microsoft Excel (1997–2003). doi: 10.3897/zookeys.33.298.app.1.ds.

Note: The spreadsheet contains updated information about the localities of all known specimens of the genus *Eosphaerophoria*. We have not included the coordinates because the exact location is difficult to establish in some cases, but they are provided in the main text using Google Earth. USNM numbers correspond to barcode labels present in all the specimens. The last column provides the MorphBank elinks for the collections of images of each taxon.

Appendix B

World distribution for *Eosphaerophoria* specimens. File format: Google Earth Placemark. doi: 10.3897/zookeys.33.298.app.2.ds.

Note: The kml file contains all the information about every specimen of *Eosphaerophoria* in the World. For each specimen, data of locality, altitude, collecting date, collector and sex are provided. Additionally, the holding institution, the USNM collection number, the type material and the elink to MorhpBank images are also included for each *Eosphaerophoria* specimen.

Citations of the datasets:

Dataset published as Appendix A:

Citation: Mengual X, Ghorpadé K (2010) The flower fly genus *Eosphaerophoria* Frey (Diptera, Syrphidae). DATASET. File format: Microsoft Excel (1997–2003). doi: 10.3897/zookeys.33.298.app.1.ds. ZooKeys 33: 39–80. doi: 10.3897/zookeys.33.298

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