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Four new species of the primitively segmented spider genus *Qiongthela* from Hainan island, China (Mesothelae, Liphistiidae)

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Abstract

Four species of the primitively segmented spider genus *Qiongthela* Xu & Kuntner, 2015 collected from Hainan Island, China are diagnosed and described as new to science based on their genital morphology: *Q. bawang* **sp. n.** (♀), *Q. jianfeng* **sp. n.** (♂♀), *Q. yini* **sp. n.** (♀), *Q. wuzhi* **sp. n.** (♂♀). Together with the type species of *Qiongthela*, *Q. baishensis* Xu, 2015, five species are found and described from Hainan, China, and seven species are now known in the genus.

Keywords

China, primitively segmented spiders, *Qiongthela*, taxonomy, trapdoor spiders

Introduction

The primitively segmented spider family Liphistiidae (Araneae, Mesothelae), an ancient lineage that retains plesiomorphic arachnid traits such as the abdominal tergites and spinnerets located in the middle of abdominal venter, currently contains 101 species in eight genera (World Spider Catalog 2017; Xu et al. 2015a, b). These extant species are restricted to Southeast and East Asia and display an extremely high level of endemism and disjunct distribution (Xu et al. 2015a, b, 2016). They are divided into two subfamilies, Heptathelinae and Liphistiinae (Xu et al. 2015a, b). While the subfamily Liphistiinae contains a single genus (*Liphistius* Schiödte, 1849) with species in Southeast Asia (Sumatra, Laos, Malaysia, Myanmar, Thailand), Heptathelinae has seven genera. Two of them (*Heptathela* Kishida, 1923 and *Ryuthela* Haupt, 1983) are confined to Japan (Ryukus islands and Kyushu), and the other five are distributed between mainland China and Vietnam: *Ganthela* Xu & Kuntner, 2015, *Qiongthela* Xu & Kuntner, 2015, *Sinothela* Haupt, 2003, *Songthela* Ono, 2000 and *Vinathela* Ono, 2000) (World Spider Catalog 2017; Xu et al. 2015a, b). Since the genus level revision of the family (Xu et al. 2015a, b), species-level revisions have been proposed for two genera, *Ganthela* (Xu et al. 2015c) and *Ryuthela* (Xu et al. 2017).

In this study, we focus on the genus *Qiongthela* from Hainan Island, China, located in the transitional zone between tropical and temperate zones in the South China sea. *Qiongthela* was diagnosed in 2015 (Xu et al. 2015a, b), but so far, only three *Qiongthela* species have been named: *Q. baishensis* Xu, 2015, the type species from Hainan, and *Q. australis* (Ono, 2002) and *Q. nui* (Schwendinger & Ono, 2011) from southern Vietnam (Xu et al. 2015b). Even though no molecular data were available for the two Vietnamese species of *Qiongthela* in our previous studies (Xu et al. 2015a), the genital morphology confirms their inclusion in *Qiongthela* (Ono 2002; Schwendinger and Ono 2011; Xu et al. 2015b). Here, four new species of *Qiongthela* collected from Hainan are diagnosed and described. Their taxonomy is based on male and female genital morphology combined with the results from prior phylogenetic analyses, which support the four new species (fig. 2 in Xu et al. 2015a).

Materials and methods

All *Qiongthela* specimens in this study were collected at the roadside of forest (Figs 1A, 2A, 4A). They were collected alive and fixed in absolute alcohol if they were adults. The subadults were brought back to the laboratory and reared until they reached maturation. All specimens were then preserved in 80% ethanol after the right four legs were removed for molecular work.

Specimens were studied using an Olympus SZX16 stereomicroscope. Anatomical details were examined and photographed with on Olympus BX53 compound microscope and a Canon 7D camera. Genitalia were cleared in boiling KOH for a few minutes to dissolve soft tissues. All the specimens were deposited at the Centre for Behavioural

Ecology and Evolution (CBEE), College of Life Sciences, Hubei University, Wuhan, China. All lengths are given in millimetres. Leg and palp measurements are given in the following order: total length (femur + patella + tibia + metatarsus + tarsus).

Abbreviations used:

ALE	anterior lateral eyes,	**E**	embolus,
AME	anterior median eyes,	**OL**	opisthosoma length,
BL	body length,	**OW**	opisthosoma width,
CL	carapace length,	**PLE**	posterior lateral eyes,
Co	conductor,	**PME**	posterior median eyes,
CT	contrategulum,	**RC**	receptacular cluster,
CW	carapace width,	**T**	tegulum.

Taxonomy

Genus *Qiongthela* Xu & Kuntner, 2015

Type species. *Qiongthela baishensis* Xu, 2015

Diagnosis. *Qiongthela* males can be distinguished from all other Heptathelinae genera by the blade-like conductor narrowing to a slightly hooked apex (Fig. 2M–O; Fig. 4F–J), and by the tegulum with two distinct apophyses (Fig. 2L–O; Fig. 4F–J). The females differ from all other Heptathelinae genera by two paired receptacular clusters, all with numerous granula (e.g. Fig. 1C–H) (Xu et al. 2015b).

Species composition. *Q. australis* (Ono, 2002), *Q. nui* (Schwendinger & Ono, 2011), *Q. baishensis* Xu, 2015, *Q. bawang* sp. n., *Q. jianfeng* sp. n., *Q. yini* sp. n., *Q. wuzhi* sp. n.

Distribution. China (Hainan), Vietnam.

Qiongthela bawang sp. n.

http://zoobank.org/154A4D7B-7EF4-411C-8AAD-EE1952264EB5
Fig. 1

Holotype. Female (XUX-2011-001), Bawangling, Changjiang County, Hainan Province, China, 19.04°N, 109.09°E, 657 m, collected 19 June 2011 by D. Li, F. Liu, M. Kuntner and X. Xu, deposited at CBEE, College of Life Sciences, Hubei University, Wuhan, China.

Paratypes. 2 females and 2 juveniles (XUX-2012-(094-097)), Bawangling Nature Reserve, Bawangling, Changjiang County, Hainan Province, China, 19.24°N, 109.38°E, 462 m, collected 19–20 July 2012 by D. Li, F. Liu and X. Xu; 1 female (XUX-2014-012) collected at the same locality, 19.03°N, 109.10°E, 711 m, collected 23 March 2014 by F. Liu and C. Xu.

Etymology. The species epithet, a noun in apposition, refers to the type locality.

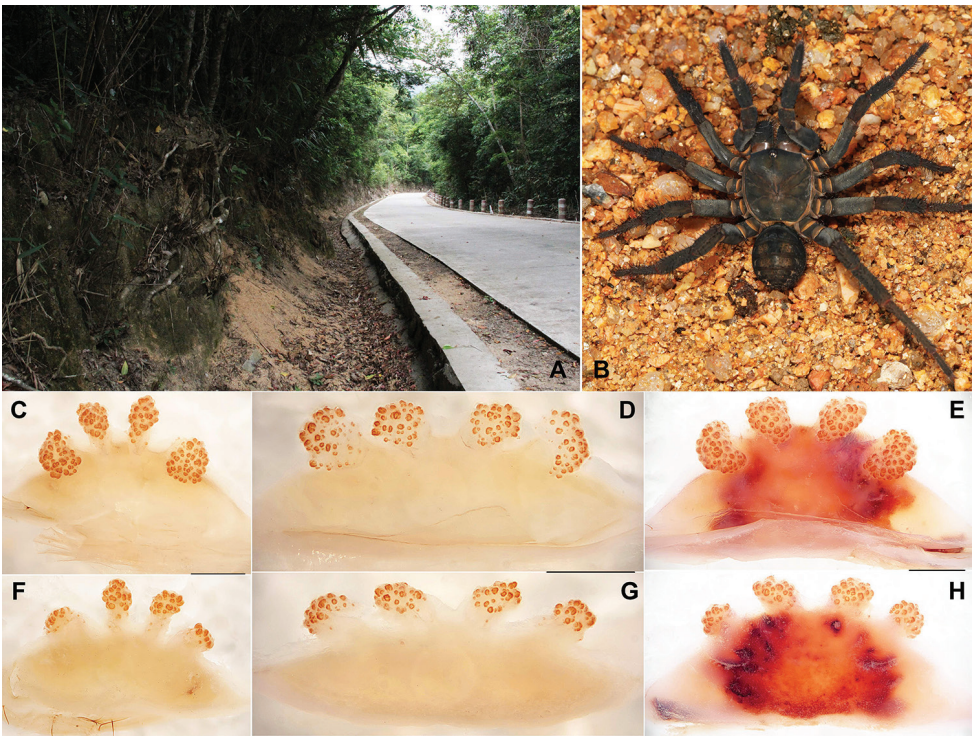

Figure 1. Macrohabitat, general somatic morphology and genital anatomy of *Qiongthela bawang* sp. n. **A** Macrohabitat of *Qiongthela bawang* sp. n. at the type locality **B** Female (XUX-2012-097) **C–E** vulva dorsal view **F–H** vulva ventral view **C, F** (XUX-2014-012) **D, G** (XUX-2012-097) **E, H** (XUX-2011-001). Scale bars: 0.5 mm.

Diagnosis. Females of the new species differ from *Q. jianfeng* sp. n. by the two pairs of receptacular clusters along the anterior margin of bursa copulatrix, which are visible in both dorsal and ventral views (Fig. 1C-H). It can be distinguished from *Q. baishensis* and *Q. nui* by its receptacular clusters with similar size or the middle pair being slightly smaller than the lateral pair. It also differs from all other *Qiongthela* species in Hainan by its receptacular clusters, all of which have short genital stalks (Fig. 1C-H). The male is unknown. To facilitate future identification of the species, we provided the DNA barcode for the holotype (XUX-2011-001), which is available on GenBank (Genbank accession code KP229897).

Description. Female (Fig. 1B). Carapace dark brown; opisthosoma darker than carapace; sternum narrow; a few long pointed hairs running over ocular mound in a longitudinal row; chelicerae robust with promargin of cheliceral groove containing 9-10 denticles of variable size; legs with strong hairs and spines; opisthosoma with 12 tergites, close to each other, the fifth largest; seven spinnerets. Measurements: BL 15.75-30.35, CL 8.37-15.95, CW 7.88-12.50, OL 7.42-16.50, OW 5.75-15.50; ALE > PLE > PME > AME; palp 24.10 (8.25 + 4.35 + 5.15 + 6.35), leg I 25.80 (8.45 + 4.75

+ 5.05 + 5.00 + 2.55), leg II 24.70 (7.65 + 4.50 + 4.85 + 5.00 + 2.70), leg III 26.80 (7.85 + 4.80 + 4.70 + 6.10 + 3.35), leg IV 37.80 (11.00 + 5.85 + 6.95 + 9.45 + 4.55).

Female genitalia. Two pairs of receptacular clusters along the anterior margin of bursa copulatrix, similar size or the middle pair slightly smaller, with short genital stalks (Fig. 1C–D)

Distribution. Hainan (Bawangling), China

***Qiongthela jianfeng* sp. n.**

http://zoobank.org/91D190C7-2C68-4C7A-B957-D6E89E68AF4E

Fig. 2

Holotype. Male (XUX-2014-005), Jianfeng National Forest Park, Jianfeng Town, Ledong County, Hainan Province, China; 18.70°N, 108.84°E, 508 m, collected 20 March 2014 by F. Liu and C. Xu, deposited at CBEE, College of Life Sciences, Hubei University, Wuhan, China.

Paratypes. One female (XUX-2014-002) and one male (XUX-2014-004, matured 2 August 2014 at CBEE, College of Life Sciences, Hubei University) collected at the same locality, 20 March 2014, by F. Liu and C. Xu; 1 male (XUX-2012-107) collected at the same locality, 18.70°N, 108.84°E, 500 m, collected 22 July 2012 by D. Li, F. Liu and X. Xu; 1 female (XUX-2012-098) and 1 male (XUX-2012-100, matured 10 October 2012 at CBEE, College of Life Sciences, Hubei University) collected at the Forest Research Station, Jianfeng Town, Ledong County, Hainan Province, China, 18.70°N, 108.78°E, 145 m, collected 21 July 2012 by D. Li, F. Liu and X. Xu; 1 female (XUX-2014-008) collected at the same locality, collected 21 March 2014 by F. Liu and C. Xu.

Etymology. The species epithet, a noun in apposition, refers to the type locality.

Diagnosis. Males of the new species differ from all other *Qiongthela* species by the semioval apophysis at the basal conductor (Fig. 2N, O), from *Q. wuzhi* sp. n. by a similar rectangular, rather than the basal angle between the two apophyses of tegulum more than 90° (Fig. 2L), by the distal part of contrategulum with two edges, the inner one being dentate and the outer one being sharp (Fig. 2L, M), and by the distal edge of embolus slightly curved (Fig. 2M). Females of the new species differ from all other *Qiongthela* species by the receptaculuar clusters located slightly on the dorsal wall of the bursa copulatrix, especially the lateral pair being indistinct from the dorsal view (Fig. 2D-I). The DNA barcode of the paratype (XUX-2012-107) is available on GenBank (Genbank accession code KP229838) for future identification. The DNA barcodes of the holotype (XUX-2014-005) and paratype (XUX-2012-107) are identical (the K2P distance between the two sequences is zero).

Description. Male (Fig. 2C). Carapace dark; opisthosoma darker than carapace; sternum narrow; a few long pointed hairs running over ocular mound in a longitudinal row; chelicerae robust with promargin of cheliceral groove containing nine denticles of variable size; legs with strong hairs and spines; opisthosoma with 12 tergites, close

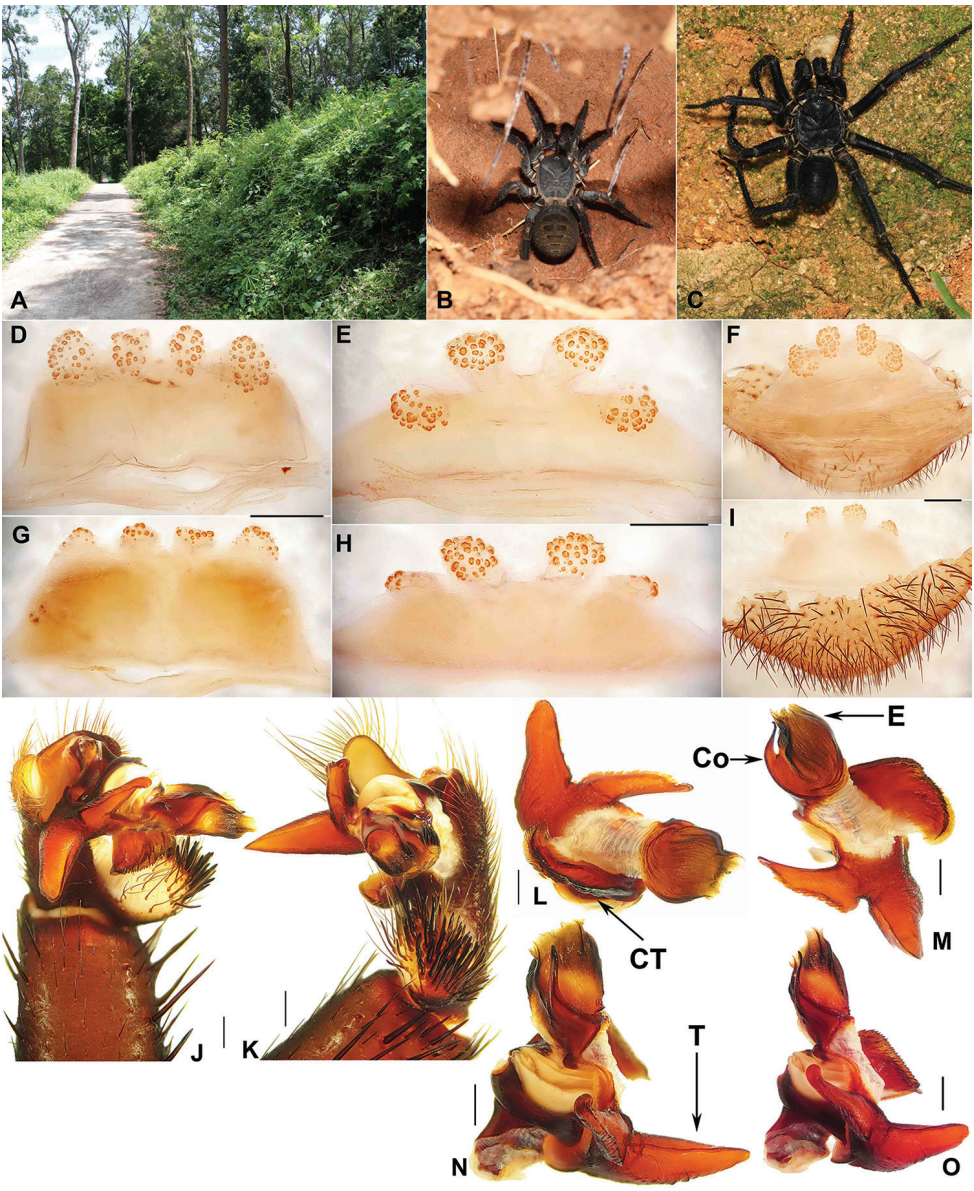

Figure 2. Macrohabitat, general somatic morphology and genital anatomy of *Qiongthela jianfeng* sp. n. **A** Macrohabitat of *Qiongthela jianfeng* sp. n. at the Forest Research Station **B** Female (XUX-2012-098) **C** male (XUX-2012-107) **D–F** vulva dorsal view **G–I** vulva ventral view **J** palp ventral view **K** palp retrolateral view **L–O** palp distal view **D, G** (XUX-2014-009) **E, H** (XUX-2014-002) **F, I** (XUX-2012-098) **J–K** (XUX-2014-004) **L–O** (XUX-2014-005). Scale bars: 0.5 mm.

to each other, the fifth largest; seven spinnerets. Measurements: BL 17.91-22.00, CL 7.35-12.2,0 CW 7.18-11.00, OL 10.35-10.00, OW 9.07-7.70; ALE > PLE > PME > AME; leg I 37.00 (10.40 + 4.90 + 8.10 + 9.60 + 4.00), leg II 36.95 (10.20 + 4.75 +

7.50 + 10.30 + 4.20), leg III 36.90 (9.70 + 4.80 + 6.80 + 11.00 + 4.60), leg IV 46.80 (12.20 + 5.30 + 9.40 + 14.20 + 5.70).

Palp. The bulb of four specimens of the new species all relatively distorted. Prolateral side of paracymbium unpigmented and unsclerotised, many setae situated at the tip of paracymbium (Fig. 2J, K). Contrategulum with a proximally irregular dentate edge and two distal edges, the inner one dentate (Fig. 2L, M), the outer one sharp (Fig. 2L, M). Tegulum with a long, pointed, distally directed marginal apophysis with a smooth edge, a proximally directed terminal apophysis narrowing to a slightly bent apex, and the dorsal side of terimal apophysis with dentate edge (Fig. 2L, M). Conductor situated ventro-proximal part of embolus, fused with embolus at the basal portion, distal free, narrowing to a slightly hooked apex (Fig. 2M–O). Embolus largely sclerotised, with a wide, flat opening, curved distal edge (Fig. 2M).

Female (Fig. 2B). Colouration of carapace and opisthosoma similar to or lighter than male according to the age of specimens; chelicerae robust with promargin of cheliceral groove with 9-10 strong denticles of variable size; legs furnished with strong hairs and spines; opisthosoma with 12 tergites, similar to male; seven spinnerets. Measurements: BL 14.75-20.00, CL 7.25-11.56, CW 6.20-10.04, OL 7.30-12.00, OW 5.60-9.50; ALE > PLE > PME > AME; palp 12.96 (4.55 + 2.25 + 2.80 + 3.36), leg I 15.47 (4.96 + 2.65 + 2.91 + 3.25 + 1.70), leg II 14.40 (4.55 + 2.30 + 2.65 + 3.25 + 1.65), leg III 15.50 (4.35 + 2.75 + 2.60 + 3.75 + 2.05), leg IV 22.51 (6.36 + 3.20 + 3.95 + 6.15 + 2.85).

Female genitalia. Two pairs of receptacular clusters located slightly on the dorsal wall of the bursa copulatrix, especial the lateral pair indistinct in dorsal view, each receptacular cluster similar size, with or without a genital stalk (Fig. 2D-I).

Distribution. Hainan (Jianfeng), China

***Qiongthela yini* sp. n.**
http://zoobank.org/DD0398BF-75CE-4ED2-9B8A-38615935DD78
Fig. 3

Holotype. Female (XUX-2012-106, matured 18 July 2013 at CBEE, College of Life Sciences, Hubei University), Jianfengling National Forest Park, Jianfeng Town, Ledong County, Hainan Province, China, 18.70°N, 108.86°E, 764 m, collected 22 July 2012 by D. Li, F. Liu and X. Xu, deposited at CBEE, College of Life Sciences, Hubei University, Wuhan, China.

Etymology. The specific epithet honors the arachnologist Changmin Yin, a pioneering liphistiid specialist in China.

Diagnosis. The female of the new species differs from the other *Qiongthela* species by the receptacular clusters with less granula, the middle pair larger than the lateral pair, the middle pair along the anterior margin of bursa copulatrix, and the lateral pair located on the dorsal wall of the bursa copulatrix (Fig. 3B-C). The male is unknown. The DNA barcode of the holotype (XUX-2012-106) is available on GenBank (Genbank accession code KP229895) for facilitating future identification of the species.

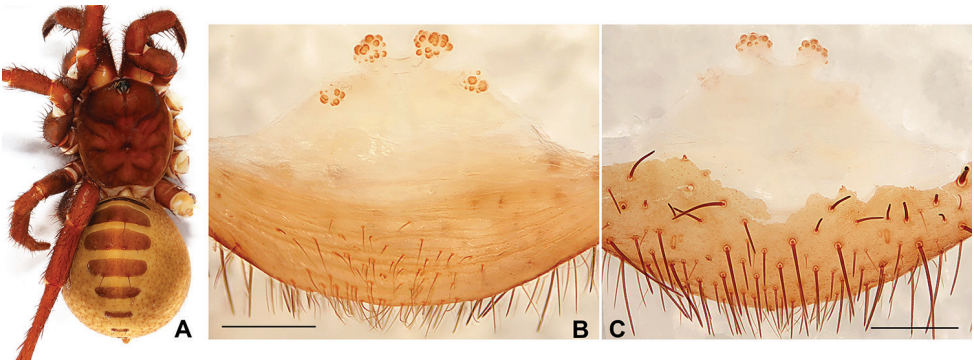

Figure 3. General somatic morphology and genital anatomy of *Qiongthela yini* sp. n. **B** Female (XUX-2012-106) **B** vulva dorsal view **C** vulva ventral view. Scale bars: 0.5 mm.

Description. Female (Fig. 3A). Carapace reddish brown in alcohol; opisthosoma light brown; sternum narrow, much longer than wide; a few long pointed hairs running over ocular mound in a longitudinal row; chelicerae robust with promargin of cheliceral groove with ten strong denticles of variable size; legs furnished with strong hairs and spines; opisthosoma with 12 tergites, separated from each other, the first 2-7 larger than others and the fifth largest; seven spinnerets. Measurements: BL 20.50, CL 8.00, CW 7.21, OL 12.40, OW 10.00; ALE > PLE > PME > AME; palp 13.54 (4.70 + 2.43 + 2.80 + 3.61), leg I 15.90 (5.10 + 2.80 + 3.11 + 3.20 + 1.69), leg II 15.35 (4.70 + 2.80 + 2.79 + 3.41 + 1.65), leg III 13.85 (4.35 + 2.10 + 2.60 + 3.00 + 1.80), leg IV 23.71 (7.00 + 3.35 + 4.18 + 6.30 + 2.88).

Female genitalia. The middle receptacular clusters along the anterior margin of bursa copulatrix, the lateral pair located on the dorsal wall of the bursa copulatrix, the middle pair larger than the lateral pair, and the middle pair with short genital stalks (Fig. 3B).

Distribution. Hainan (Jianfeng), China.

Remarks. This new species was found at the Jianfengling National Forest Park as some specimens of *Q. jianfeng* sp. n., but at a higher altitude compared with the latter.

Qiongthela wuzhi sp. n.

http://zoobank.org/19D93B63-0BD5-446F-8E4C-E2058521B02A
Fig. 4

Holotype. Male (XUX-2012-109, matured 4 October 2012 at CBEE, College of Life Sciences, Hubei University), Yongxun Village, Shuiman Town, Wuzhishan City, Hainan Province, China, 18.90°N, 109.63°E, 551 m, collected 25 July 2012 by D. Li, F. Liu and X. Xu, deposited at CBEE, College of Life Sciences, Hubei University, Wuhan, China.

Paratypes. One female (XUX-2012-108) collected at the same locality, collected 25 July 2012 by D. Li, F. Liu and X. Xu.

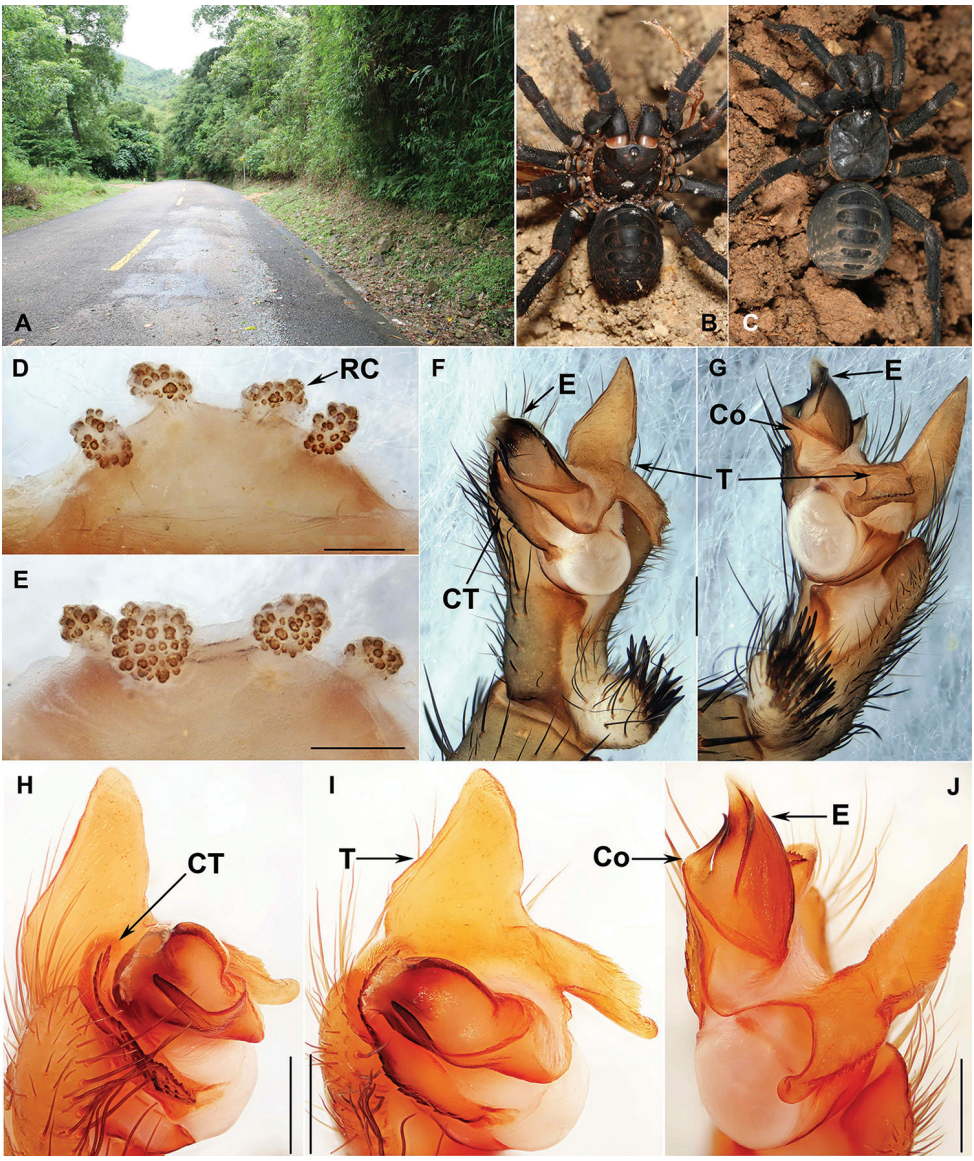

Figure 4. Macrohabitat, general somatic morphology and genital anatomy of *Qiongthela wuzhi* sp. n. **A** Macrohabitat of *Qiongthela wuzhi* sp. n. at the type locality **B** female (XUX-2012-108) **C** male (XUX-2012-109) **D** vulva dorsal view **E** vulva ventral view **F** palp prolateral view **G** palp retrolateral view **H–J** palp distal view. Scale bars: 0.5 mm.

Etymology. The species epithet, a noun in apposition, refers to the type locality.

Diagnosis. Male of this new species differs from *Q. jianfeng* sp. n. by the contrategulum with three distal edges (Fig. 4H, J), the basal angle between the two apophyses of tegulum more than 90° (Fig. 4I), and the smooth distal margin of embolus (Fig. 4I).

It differs from *Q. baishensis*, *Q. australi,s* and *Q. nui* by three distal margins of contrategulum (Fig. 4H, J). Females of this new species can be distinguished from the other species of *Qiongthela* by the receptacular clusters with very short genital stalks, and from *Q. bawang* sp. n. by the irregular shapes of receptacular clusters (Fig. 4D, E). The DNA barcode of the paratype (XUX-2012-108) is available on GenBank (Genbank accession code KP229812) for future identification. The DNA barcodes of the holotype (XUX-2012-109) and paratype (XUX-2012-108) are identical (the K2P distance between the two sequences is zero).

Description. Male (holotype) (Fig. 4C). Carapace black; opisthosoma light brown; sternum narrow, nearly twice as long as wide; a few long pointed hairs running over ocular mound in a longitudinal row; chelicerae robust with promargin of cheliceral groove with eight denticles of variable size; legs furnished with strong hairs and spines; opisthosoma with 12 tergites, the first 2-7 close to each other and larger than others; seven spinnerets. Measurements: BL 14.75, CL 6.20, CW 6.45, OL 9.65, OW 7.45; ALE > PLE > PME > AME; leg I 17.71 (5.03 + 2.52 + 3.86 + 4.50 + 1.80), leg II 17.88 (5.00 + 2.35 + 3.67 + 4.48 + 2.38), leg III 18.87 (4.65 + 2.55 + 3.52 + 5.45 + 2.70), leg IV miss.

Palp. Prolateral side of paracymbium unpigmented and unsclerotised, many setae situated at the tip of paracymbium (Fig. 4F. G). Contrategulum with a proximally irregular dentate edge and three distal edges, the inner one dentate, very short, the middle one dentate, running down to the proximally irregular dentate edge of contrategulum, the outer one sharp, fused with the inner one at the middle portion of the middle edge (Fig. 4H–J). Tegulum with a wide base, pointed, distally directed marginal apophysis with a sharp edge, with a proximally directed terminal apophysis narrowing to a slightly bent apex, and the dorsal side of terminal apophysis with dentate edge (Fig. 4F, G, I, J). Embolus largely sclerotised, with a wide, flat opening, and a sharp distal edge (Fig. 4F–J).

Female (Fig. 4B). Colouration of carapace and opisthosoma reddish dark; female similar to male except larger than male in size; chelicerae robust with promargin of cheliceral groove with 10 strong denticles of variable size; legs furnished with strong hairs and spines; opisthosoma with 12 tergites, tergites larger than that of male; 7 spinnerets. Measurements: BL 20.35, CL 10.35, CW 8.55, OL 11.25, OW 8.65; ALE > PLE > PME > AME; palp 18.28 (6.35 + 3.18 + 4.00 + 4.75), leg I 21.27 (7.05 + 3.75 + 4.12 + 4.48 + 1.87), leg II 20.06 (6.67 + 3.27 + 3.62 + 4.45 + 2.05), leg III 20.82 (6.18 + 3.75 + 3.35 + 5.07 + 2.47), leg IV 30.54 (8.90 + 4.50 + 5.51 + 8.13 + 3.50).

Female genitalia. The two pairs of receptacular clusters along the anterior margin of bursa copulatrix, irregular receptacular clusters with very short genital stalks (Fig. 4D, E).

Distribution. Hainan (Wuzhishan), China.

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The cockroaches of *Balta* Tepper from China, with the description of four new species (Blattodea, Ectobiidae, Pseudophyllodromiinae)

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Abstract

Four new species of cockroach genus *Balta* Tepper, 1893 are described and illustrated: *B. crena* **sp. n.**, *B. maculata* **sp. n.**, *B. tangi* **sp. n.**, and *B. yaoi* **sp. n.** *Balta picea* (Bey-Bienko, 1958) is now regarded as a new synonym of *Balta hwangorum* (Bey-Bienko, 1958), which is redescribed and illustrated. Two new combinations are proposed: *B. nodigera* (Bey-Bienko, 1958), **comb. n.** and *B. valida* (Bey-Bienko, 1958), **comb. n.**, and both species are redescribed and illustrated. A key to all species from China is provided.

Keywords

Dictyoptera, distribution, key, new combination, new synonym

Introduction

Balta Tepper, 1893 is a large genus comprising 98 species, 40 of which are distributed in Australia, and 14 in Mainland China and Taiwan. The others are distributed in Pacific islands, Africa, and India. Bey-Bienko (1958) described three species of *Lupparia* Walker, 1868 and two species of *Balta* from China. Roth (1991) thought that *Balta* and *Lupparia* are quite similar. The genera *Balta* and *Lupparia* are distinguished by the size of the apical triangle of the hind wing (*Balta* spp. with smaller apical triangle). Che et al.

(2010) briefly reviewed the research history of the genus; they also mentioned the relationship between *Balta* and *Lupparia* and some difficulty existing in discriminating these two genera. From then on, no one reported new species of the genus *Lupparia*. Recently, many cockroach specimens were received from Prof. Shuqiang Li (IOZCAS, Institute of Zoology, The Chinese Academy of Sciences), which were collected by means of canopy spraying conducted mainly in Yunnan and Hainan Provinces from 2009 to 2012. Material was also received from Prof. Shunxiang Ren and Zaifu Xu (SCAU, South China Agricultural University) that was collected from Guangdong Province.

After examining the specimens and comparing them with the original descriptions of Bey-Bienko (1958) and Asahina (1965), descriptions of four new species are appropriate, and are included here. Additionally, *Balta picea* (Bey-Bienko, 1958) is placed as a junior synonym of *Balta hwangorum* (Bey-Bienko, 1958), and two new combinations are proposed.

Materials and methods

The terminology mainly follows Roth (2003). The terms for wing-veins are according to Li and Wang (2015). Morphological terms referring to spines are as follows: spines on the antero-ventral margin of the front femur with one or more proximal stout spines succeeded by a row of spinules of uniform length, terminating in two (B_2) or three (B_3) large spines (Type B); while the proximal stout spines absent (Type C) (Roth 2003). Genital segments of the examined specimens were macerated in 10% NaOH and observed in glycerin jelly using a Motic K400 stereomicroscope. All drawings were made with the aid of a Motic K400 stereomicroscope. Photographs of the specimens were taken using a Canon 50D plus a Canon EF 100mm f/2.8L IS USM Macro lens with the aid of Helicon Focus software. Material examined, including types of new species, is deposited in the Institute of Entomology, Southwest University (IESWU) in Beibei, Chongqing, China.

Taxonomy

Balta Tepper, 1893

Balta Tepper, 1893: 39. Type species: *Balta epilamproides* Tepper, 1893: 39. Kirby 1904: 106; Shelford 1908: 19; Hebard 1943: 37; Princis 1951: 68; 1969: 968; Roth 1991: 967; Che et al. 2010: 56.

Mareta Bolívar, 1895: 371. Type species: *Mareta conspicienda* Bolívar; by monotype. Kirby 1904: 97; Shelford 1908: 10 (under *Phyllodromia* synonymy); Rehn 1922: 14; Hebard 1929: 18; Rehn 1931: 300. Synonymized with *Balta* by Princis 1969: 968.

Eoblatta Shelford, 1911: 155 (nec *Eoblatta* Handlirsch, 1906). Type species: *Blatta notulata* Stål, 1860; by monotype. Hebard 1917: 26. As a synonym of *Balta* in Beccaloni 2014.

Allactina Hebard, 1929: 18 (nec *Allactina* Curran, 1924). Type species: *Allactina jacobsoni* Hebard, 1929. Synonymized with *Balta* by Princis 1969: 968.

Graptoblatta Hebard, 1929: 23. Type species: *Blatta notulata* Stål, 1860. Princis 1969: 957 (as a synonym of *Lupparia*). Synonymized with *Balta* by Princis 1969: 968.

Diagnosis. See Che et al. (2010).

Discussion. The characters of *L. nodigera* Bey-Bienko and *L. valida* Bey-Bienko were compared with the generic diagnosis of *Lupparia*: the hind wing of the two species with the apical triangle small or not distinct differs from the main generic characters of *Lupparia,* and are consistent with *Balta*. The two species also share the following characters: 1) abdominal tergites unspecialized, tarsal claws strongly asymmetrical and unspecialized; 2) median phallomere appendage present and with brush-like structure; 3) front femur type B or C, which are also consistent with *Balta*. Therefore the two species are transferred to the genus *Balta*.

Checklist of *Balta* species from China.

B. barbellata Che & Chen, 2010 China (Hainan)
B. curvirostris Che & Chen, 2010 China (Hainan)
B. crena sp. n. China (Yunnan)
B. dissecta Che & Wang, 2010 China (Fujian)
B. hwangorum Bey-Bienko, 1958 China (Yunnan)
B. jinlinorum Che & Wang, 2010 South China
B. maculata sp. n. China (Yunnan)
B. nodigera (Bey-Bienko, 1958), comb. n. China (Yunnan)
B. notulata Stål, 1860 (Oriental region islands, Indian Ocean islands, Korean Peninsula, Australasian islands)
B. spinea Che & Chen, 2010 China (Hainan)
B. spinescens Che & Wang, 2010 (Southeast China)
B. tangi sp. n. China (Yunnan)
B. valida (Bey-Bienko, 1958), comb. n. China (Yunnan)
B. vilis Brunner von Wattenwyl, 1865 (Southeast Asia, East Asia)
B. yaoi sp. n. China (Yunnan)

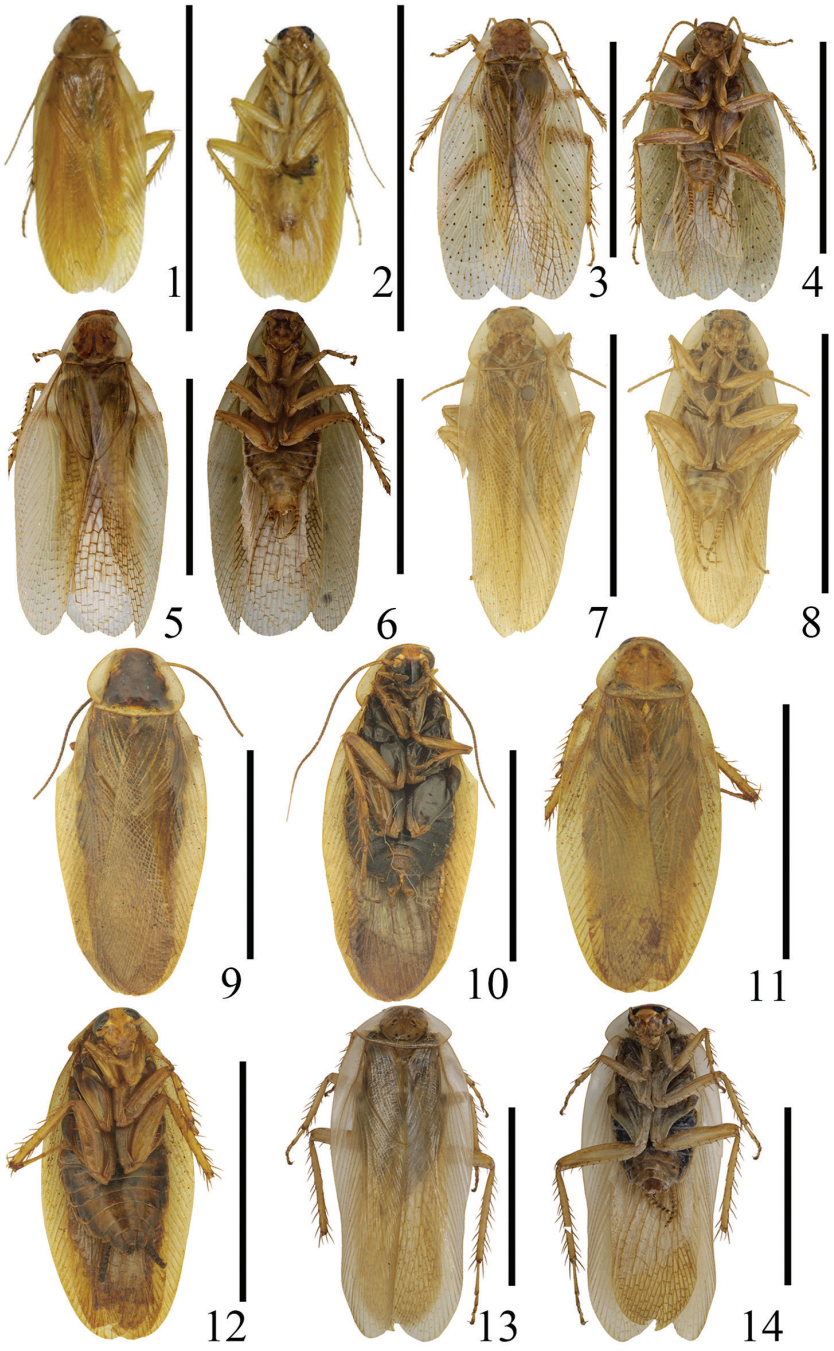
Key to species of *Balta* from China (males).

1 Tegmina with round black spots (Figs 3, 7).....**2**
– Tegmina without black spots (Figs 1, 5, 9, 11, 13).....**3**
2 Median phallomere appendage simple, arched, and without brush-like structure (Fig. 62) .....***B. yaoi* sp. n.**
– Median phallomere appendage with brush-like structure (Fig. 38)..... ..... ***B. maculata* sp. n.**

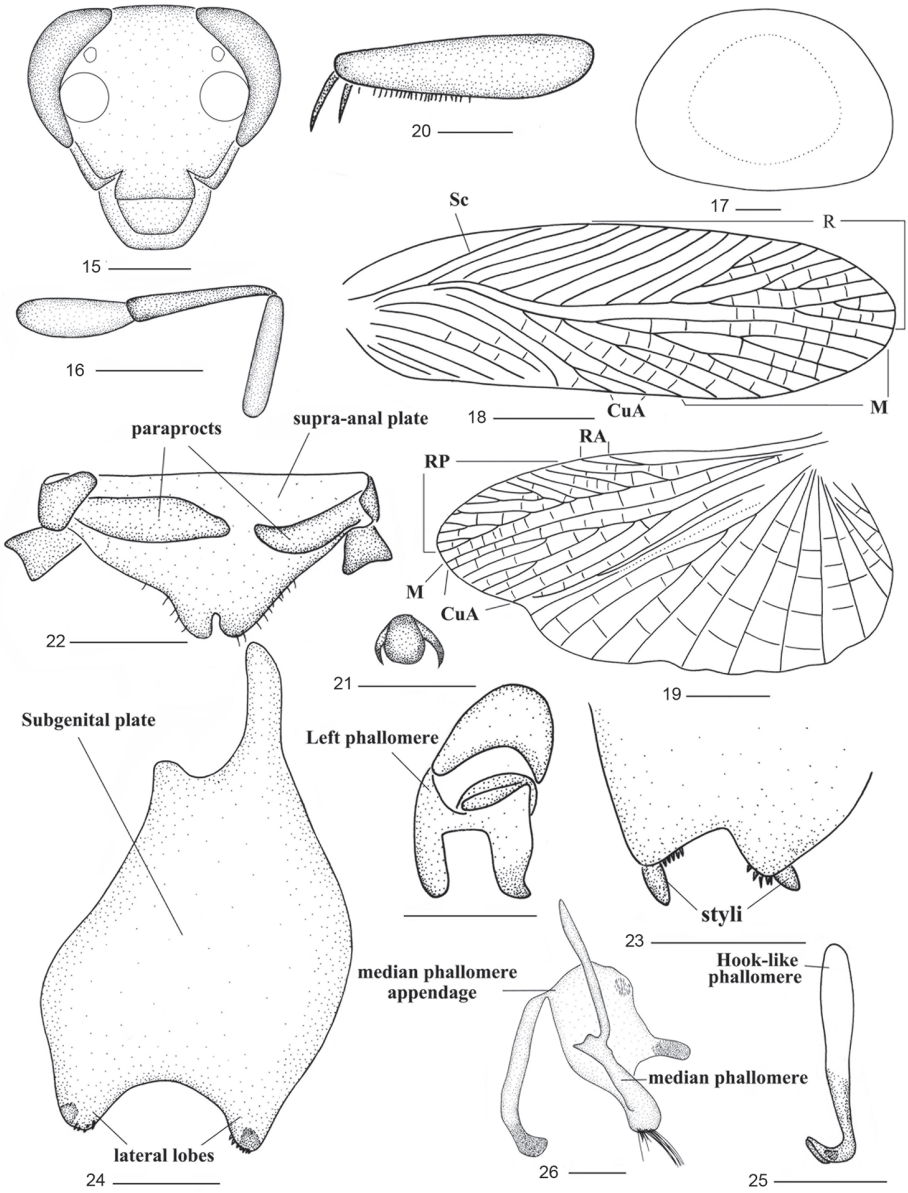
3	Vertex with dark stripes or bands **4**
–	Vertex unicolored, without stripes (Figs 40, 64, 76, 88) **5**
4	Styli triangular, median phallomere long, sticklike, with blunt base, and bifurcated near apex, one arched appendage present ..... ***B. spinea***
–	Styli elliptical, with scattered fine spines, median phallomere long, sticklike and curved with base blunt and apex brush-like, one arched appendage with apex and base brushlike..... ***B. spinescens***
5	Styli globular ..... ***B. notulata***
–	Styli finger-like or conical (Figs 23, 48, 72, 84, 96)..... **6**
6	Face black (Fig. 10)..... ***B. hwangorum***
–	Face brownish yellow (Figs 2, 6, 12, 14), or with brown stripes (Figs 40)..... **7**
7	Styli arising on the inner side of lateral lobes of subgenital plate (Fig. 96) **8**
–	Styli arising on the apex of lateral lobes of subgenital plate (Figs 24, 48, 84) **12**
8	Front femur type B_2 or B_3 (Fig. 93)..... **9**
–	Front femur type C_2 or C_3 (Figs 45, 81) **11**
9	Front femur type B_2 ..... ***B. jinlinorum***
–	Front femur type B_3 (Fig. 93)..... **10**
10	Styli short, the posterior part of subgenital plate strongly protruding in the middle and with trapezoid shape..... ***B. valida* comb. n.**
–	Styli short, the posterior part of subgenital plate arced in the middle of emargination but without trapezoid shape..... ***B. barbellata***
11	Face without stripes (Fig. 76), front femur type C2 (Fig. 81)..... ..... ***B. nodigera* comb. n.**
–	Face with stripes (Fig. 40), front femur type C3 (Fig. 43) ..... ***B. tangi* sp. n.**
12	Subgenital plate with spines (Figs 23, 24) **13**
–	Subgenital plate without spines..... **14**
13	Hind margin of supra-anal plate with U-shape concavity medially (Fig. 22), the apex of median phallomere with some long setae (Fig. 26)..... ***B. crena* sp. n.**
–	Hind margin of supra-anal plate broadly rounded, the apex of median phallomere with some long setae ..... ***B. dissecta***
14	Pronotum length 3.0–3.8mm ..... ***B. curvirostris***
–	Pronotum length 1.9–2.0mm ..... ***B. vilis***

***Balta crena* sp. n.**
http://zoobank.org/8E6159A0-9A4C-4CF7-BBF3-D3243E37B559
Figs 1, 2, 15–27

Type material. Holotype: China, Yunnan: male (IESWU), Xishuangbanna, Menglun Botanical Garden, Lvshilin, 640 m, 21°54.600'N, 101°17.084'E, 17 November 2009, coll. Guo Tang and Zhiyuan Yao. **Paratypes**: 1 male, same collection event as holotype; 10 males and 14 females, Xishuangbanna, Menglun, G213 (National road) secondary forest, 644 m, 21°54.439'N, 101°17.755'E, 20 November 2009, coll. Guo Tang and



Figures 1–14. 1–2 *Balta crena* sp. n., male: holotype **1** dorsal view **2** ventral view **3–4** *Balta maculata* sp. n., male: holotype **3** dorsal view **4** ventral view **5–6** *Balta tangi* sp. n., male: holotype **5** dorsal view **6** ventral view **7–8** *Balta yaoi* sp. n., male: holotype **7** dorsal view **8** ventral view **9–10** *Balta hwangorum* Bey-Bienko, 1958, male **9** dorsal view **10** ventral view **11–12** *Balta nodigera* (Bey-Bienko, 1958) comb. n., male **11** dorsal view **12** ventral view **13–14** *Balta valida* (Bey-Bienko, 1958), comb. n., male **13** dorsal view **14** ventral view.



Figures 15–27. *Balta crena* sp. n. **15** head **16** maxillary palps **17** pronotum **18** tegmen **19** hind wing **20** front femur **21** tarsal claws and arolium **22** supra-anal plate and paraprocts, ventral view **23** subgenital plate, ventral view **24** subgenital plate, dorsal view **25** right phallomere **26** median phallomere **27** left phallomere. Scale bars: 0.5 mm (**15–17, 20–27**), 2.0 mm (**18, 19**).

Zhiyuan Yao; 4 males and 1 female, Mengla County, Bubeng monsoon forest, 690 m, 21.61379°N, 101.58079°E, 10 August 2012, coll. Guo Zheng, Xue Li and Wenyue Zhu.

Differential diagnosis. This species resembles *Balta notulata* (Stål, 1860) in appearance, but can be distinguished from the latter by the following characters: 1) hind

margin of subgenital plate concave and without produced medial lobe (Fig. 24) while that in *B. notulata* with produced medial lobes; 2) some fine spines present on either apex of lateral lobes of subgenital plate (Fig. 24), which are lacking in *B. notulata*.

Description. ***Male*****.** Body brownish yellow (Figs 1, 2). Third and fourth maxillary palpomeres almost the same length, both distinctly longer than the fifth (Fig. 16). Tegmen with M and CuA oblique (Fig. 18); hind wing with M simple; CuA with three or four complete branches and without incomplete ones (Fig. 19). Front femur type C_2 (Fig. 20), tarsal claws strongly asymmetrical and unspecialized (Fig. 21). Abdominal tergites unspecialized.

Male genitalia**.** Supra-anal plate with posterior margin distinctly produced and concave in U-shape in the middle, right and left paraprocts simple (Fig. 22). Subgenital plate with hind margin strongly concave medially; two lateral lobes with styli on either apex direct dorsally and with fine spines (Figs 23, 24). Hook-like phallomere on right side and with preapical concavity (Fig. 27). Median phallomere with base acuminate, apex blunt with some long setae, median phallomere appendage with some fine spines (Fig. 26). Left phallomere complex, consisted of several irregular sclerites (Fig. 27).

Female**.** Both tegmina and hind wings slightly beyond the end of abdomen. Subgenital plate with hind margin rounded.

Measurements (mm). Overall length: male 13.5–14.0, female 9.5–10.0; tegmen length male 11.0–12.0, female 7.9–8.2; pronotum length × width male 2.5–2.7 × 3.5–3.8, female 2.5–2.7 × 3.4–3.7.

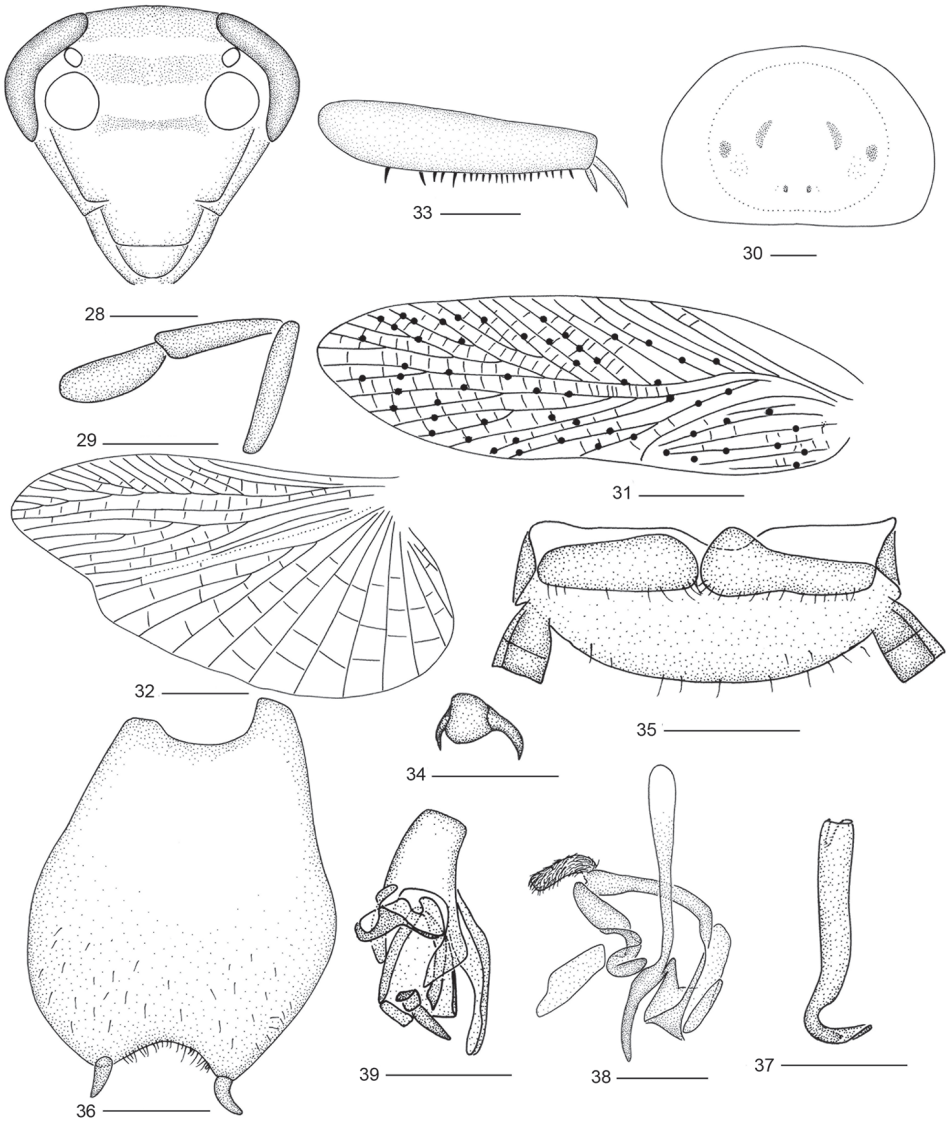
Etymology. Latin word *crena* means "nick", referring to subgenital plate with its hind margin strongly concave medially.

Distribution. China (Yunnan).

Balta maculata **sp. n.**
http://zoobank.org/AD8E7309-BB79-4AF2-915D-9FECA65EAB6E
Figs 3, 4, 28–39

Type material. Holotype: China, Yunnan: male (IESWU), Xishuangbanna, Menglun, 21 November 2009, coll. Guo Tang. **Paratypes**: 5 males and 5 females, Xishuangbanna, Menglun, 21 November 2009, coll. Guo Tang; 35 males and 63 females, Xishuangbanna, Menglun, G213 (National road) bamboo forest, 581 m, 21°53.622'N, 101°16.955'E, 26 November 2009, coll. Guo Tang and Zhiyuan Yao; 14 males and 50 females, Xishuangbanna, Menglun, G213 (National road) bamboo forest, 2–26 November 2009, coll. Guo Tang and Zhiyuan Yao; 9 males and 12 females, Xishuangbanna, Menglun Botanical Garden, Lvshilin, 652 m, 21°54.710'N, 101°16.941'E, 16 November 2009, coll. Guo Tang and Zhiyuan Yao.

Differential diagnosis. This species resembles *Balta yaoi* sp. n. in appearance, but can be distinguished from the latter by the following characters: 1) tegmen with more obvious black spots, cells slightly more hyaline and without yellowish brown spots (Fig. 31); while in the latter species, the tegmen has fewer and less obvious black spots,



Figures 28–39. *Balta maculata* sp. n. **28** head **29** maxillary palps **30** pronotum **31** tegmen **32** hind wing **33** front femur **34** tarsal claws and arolium **35** supra-anal plate and paraprocts, ventral view **36** subgenital plate, dorsal view **37** right phallomere **38** median phallomere **39** left phallomere. Scale bars: 0.5 mm (**28–30, 33–39**), 2.0 mm (**31, 32**).

cell with yellowish brown spots; 2) median phallomere complex, the appendage base with brush-like structure (Fig. 38); while the latter with median phallomere simple, the appendage arched and without brush-like structure.

Description. Male. Body tawny. Face between eyes brown, between ocelli and antenna sockets with a light brown stripe, under antennal sockets also with a light brown

stripe (Fig. 28). Pronotum with some small scattered and symmetrical spots or inconspicuous stripes, with tawny disk, lateral borders hyaline (Fig. 30). Tegmen and hind wing tawny, tegmen with black spots (most distributed on veins) (Fig. 31). The middle of anterior margin of abdominal tergites blackish brown. Third and fourth maxillary palpomeres approximately same length, both distinctly longer than the fifth (Fig. 29). Tegmen with M and CuA oblique (Fig. 31). CuA of hind wing with three complete branches and without incomplete ones (Fig. 32). Front femur of type C_2 (Fig. 33), tarsal claws strongly asymmetrical and unspecialized (Fig. 34). Abdominal tergites unspecialized.

Male genitalia. Supra-anal plate short, hind margin rounded; right and left paraprocts similar (Fig. 35). Subgenital plate with hind margin strongly concaved; styli conical, arising on apexes of lateral lobes and slightly curved laterally (Fig. 36). Hook-like phallomere on the right side and with preapical concavity (Fig. 37). Median phallomere stick-like, curved near acuminated apex, median phallomere appendage present and with brush-like structure (Fig. 38). Left phallomere complex (Fig. 39).

Female. Supra-anal plate longer than subgenital plate, hind margin of the former with triangular process in the middle. Subgenital plate simple with hind margin rounded.

Measurements (mm). Overall length male 14.0–15.0, female 9.8–10.2; tegmen length male 12.1–12.5, female 8.0–8.5; pronotum length × width male 2.4–2.9 × 3.4–3.8, female 2.5–3.0 × 3.6–4.0.

Etymology. Latin word *maculata* meaning "with dots", referring to the tegmina with dots.

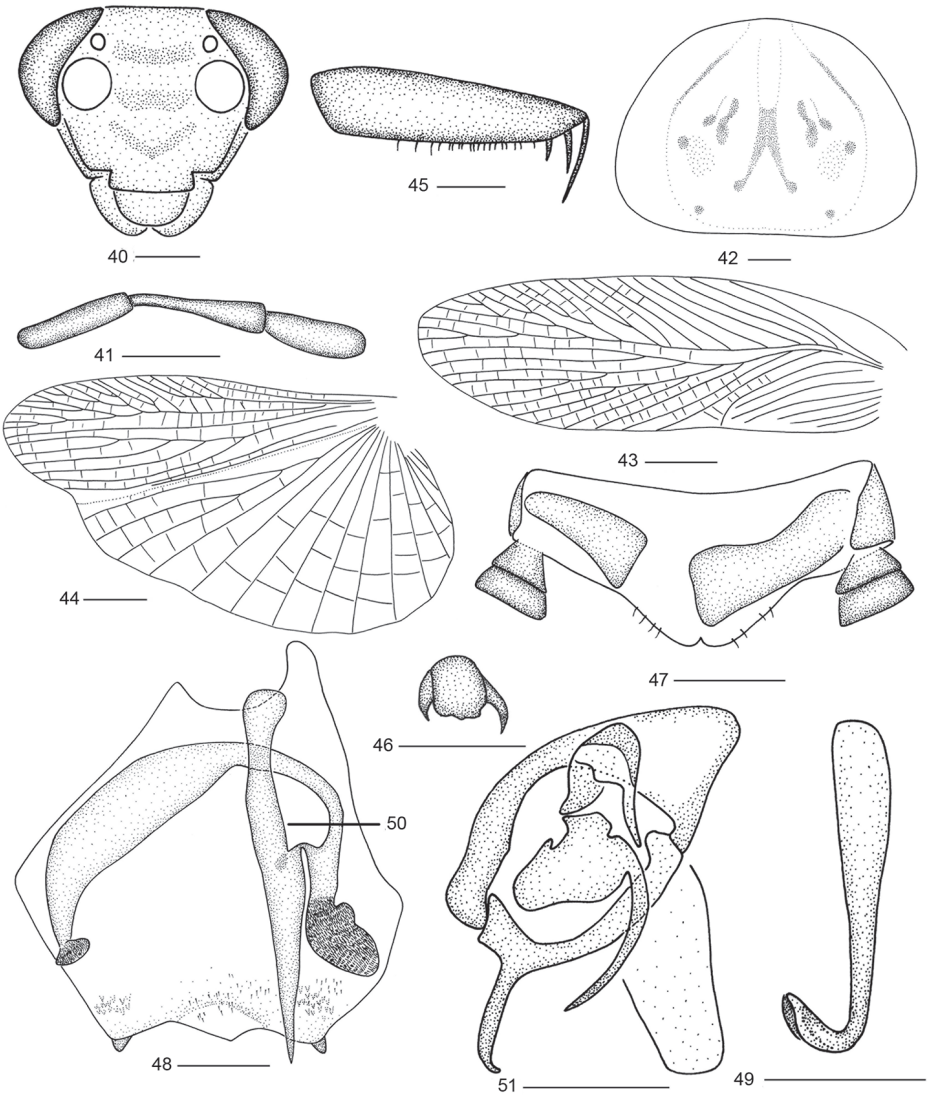
Distribution. China (Yunnan).

***Balta tangi* sp. n.**
http://zoobank.org/511EDAE2-8FC8-48CC-8A94-FAE64D43E411
Figs 5, 6, 40–51

Type material. Holotype: China, Yunnan: male (IESWU), Xishuangbanna, Menglun Botanical Garden, Lvshilin, 652 m, 21°54.710'N, 101°16.941'E, 16 November 2009, coll. Guo Tang and Zhiyuan Yao. **Paratypes**: 25 males and 16 females, same collection event as holotype; 8 males and 8 females, Xishuangbanna, Menglun, G213 (National Road) bamboo forest, 21–26 November 2009, coll. Guo Tang and Zhiyuan Yao; 11 males and 21 females, Xishuangbanna, Menglun Botanical Garden, Lvshilin, 656 m, 21°54.705'N, 101°16.898'E, 13 November 2009, coll. Guo Tang and Zhiyuan Yao.

Differential diagnosis. *Balta tangi* species resembles *B. spinea* in appearance, but can be distinguished from the latter by the following characters: 1) face with transversal stripes between interocular space (Fig. 40) while face of *B. spinea* without transversal stripes but having two longitudinal stripes, each of them with one small rounded white spot; 2) subgenital plate in ventral view between the styli slightly emarginated and with a protrusion in the middle (Fig. 48) but in *B. spinea* without the protrusion.

Description. Male. Body yellowish brown. Vertex brownish yellow. Face with three stripes (Fig. 40). Disk of pronotum yellowish brown and with some small scat-



Figures 40–51. *Balta tangi* sp. n. **40** head **41** maxillary palps **42** pronotum **43** tegmen **44** hind wing **45** front femur; **46** tarsal claws and arolium **47** supra-anal plate and paraprocts, ventral view **48** subgenital plate, dorsal view **49** right phallomere **50** median phallomere **51** left phallomere; Scale bars: 0.5 mm (**40–42, 45–51**), 2.0 mm (**43, 44**).

tered and symmetrical blackish brown spots, lateral borders of pronotum hyaline (Fig. 42). Lateral border of abdomen sterna with round blackish brown spots (Fig. 6). Third and fourth maxillary palpomeres nearly the same length, distinctly longer than the fifth (Fig. 41). Hind wing with triangle apical, near apex of R with posterior branches, CuA with three complete branches (Fig. 44). Front femur type C_3 (Fig. 45), tarsal claws strongly asymmetrical and unspecialized (Fig. 46). Abdominal tergites unspecialized.

Male genitalia. Supra-anal plate symmetrical with hind margin slightly concave in the middle, paraprocts simple (Fig. 47). Subgenital plate with hind margin slightly emarginated and with process in the middle, conical styli located on the apex of either lateral lobes respectively, ventral side of subgenital plate with some fine spines near the stylus (Fig. 48). Hook-like phallomere on right side and with preapical concavity (Fig. 49). Median phallomere sticklike, base thick and strong, apex gradually becomes sharp-pointed, near the middle part of median phallomere with an arc-shaped appendage, base, and apex with short setae (Fig. 50). Left phallomere complex, apex with spinous structure (Fig. 51).

Female. Sexual dimorphism, female body thicker and stronger than male, both tegmina and hind wings degraded, just extending to supra-anal plate, RA with one or two branches.

Measurements (mm). Overall length male 14.5–16.0, female 12.0–13.5; tegmen length male 13.5–14.0, female 9.4–9.6; pronotum length × width male 2.9–3.0 × 3.9–4.1, female 2.8–3.0 × 3.9–4.2.

Etymology. This species is named in honor of Mr. Guo Tang, who collected the holotype of the species.

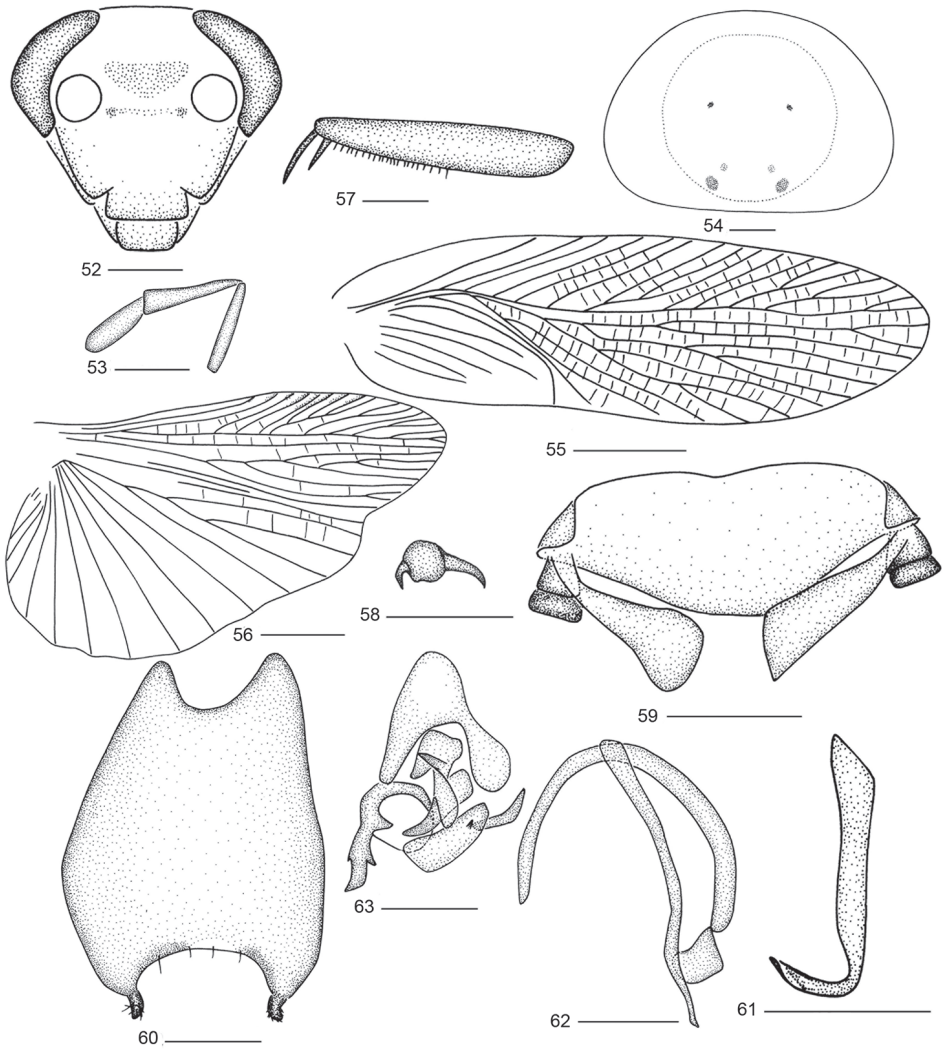
Distribution. China (Yunnan).

***Balta yaoi* sp. n.**
http://zoobank.org/AA25257D-4E10-4C22-99EA-4808E7FF794A
Figs 7–8, 52–63

Type material. Holotype: China, Yunnan: male (IESWU), Xishuangbanna, Menglun, 2010, coll. Zhiyuan Yao. **Paratypes**: 4 males, same collection event as holotype; 14 males and 22 females, Xishuangbanna, Menglun, garbage dump, 627 m, 21°54.380'N, 101°16.815'E, 23 November 2009, coll. Guo Tang and Zhiyuan Yao; 3 males, Xishuangbanna, Menglun, 2010, coll. unknown;

Differential diagnosis. This species is similar to *B. valida* comb. n. in appearance, but can be distinguished in the following characteristics: 1) For the former, median phallomere appendage without brush-like structure (Fig. 62), while in the latter with brush-like structure; 2) subgenital plate with hind margin curved concave (Fig. 60), while in the latter not concaved medially.

Description male. Body yellowish brown (Figs 7, 8). Vertex slightly yellow, between eyes with a slightly brown stripe, under the stripe with a slightly brown triangular spot, under antennal sockets with or without a stripe (Fig. 52). Disk of pronotum yellowish brown, with some small scattered and symmetrical blackish brown spots, two lateral border hyaline (Fig. 54). Tegmen yellowish brown, with a few small round black spots, cell with yellowish brown spots. The lateral border of abdomen with round blackish brown spots. Third and fourth maxillary palpomeres nearly same length, longer than the fifth (Fig. 53). Tegmen with M and CuA oblique (Fig. 55). Hind wing with M simple, without branches, CuA with three complete branches and



Figures 52–63. *Balta yaoi* sp. n. **52** head **53** maxillary palps **54** pronotum **55** tegmen **56** hind wing **57** front femur **58** tarsal claws and arolium **59** supra-anal plate and paraprocts, ventral view **60** subgenital plate, dorsal view **61** right phallomere **62** median phallomere **63** left phallomere. Scale bars: 0.5 mm (**52–54, 57–63**), 2.0 mm (**55, 56**).

without incomplete ones, hind wing with small apical triangle (Fig. 56). Front femur Type C_2 (Fig. 57), tarsal claws strongly asymmetrical and unspecialized (Fig. 58). Abdominal tergites unspecialized.

Male genitalia. Supra-anal plate short, hind margin finely rounded, right and left paraprocts slightly unsymmetrical (Fig. 59). Subgenital plate with hind margin strongly emarginated, styli located on the apex of each lateral lobe respectively and slightly

curved laterally (Fig. 60). Hook-like phallomere on the right side and with preapical concavity (Fig. 61). Median phallomere sticklike, slightly curved, apex acuminate, median phallomere appendage arched (Fig. 62). Left phallomere complex, without brush-like structure (Fig. 63).

Female. Both tegmina and hind wings slightly beyond the end of abdomen. The end of abdomen rounded.

Measurements (mm). Overall length of male 12.0–13.0, female 10.0–10.3; tegmen length male 10.0–11.0, female 7.9–8.0; pronotum length × width male 2.3–2.6 × 3.4–3.6, female 2.2–2.5 × 2.8–3.0.

Etymology. This species is named in honor of Mr. Zhiyuan Yao, who collected the holotype of the species.

Distribution. China (Yunnan).

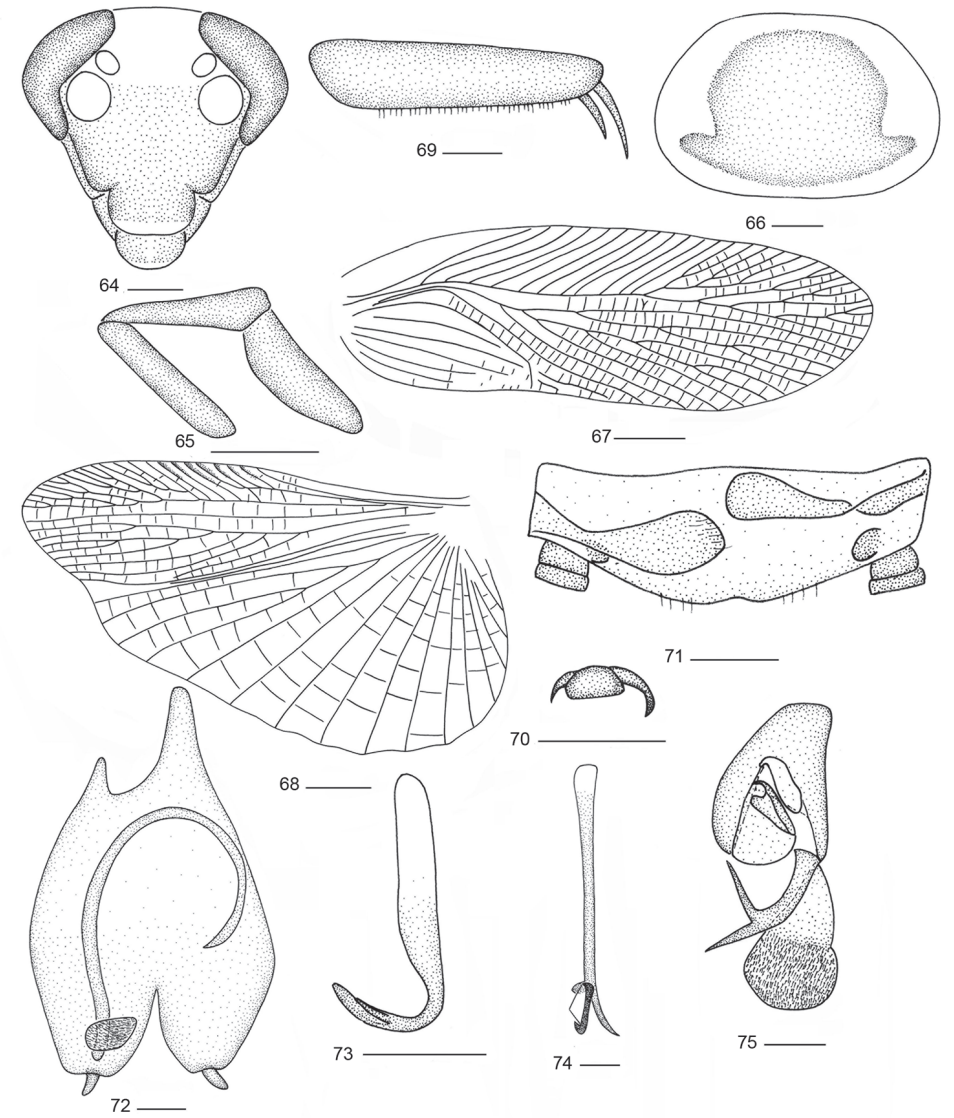
Balta hwangorum Bey-Bienko, 1958

Figs 9, 10, 64–75

Balta hwangorum Bey-Bienko, 1958: 676, 688 (Type locality: Yunnan, China); Princis 1969: 978.

Balta picea Bey-Bienko, 1958: 677 (Holotype, female) (Type locality: Yunnan, China). Syn. n.

Material examined. Deposited in IESWU. **China**, Yunnan Prov.: 3 males, Xishuangbanna, Damenglong, 650 m, 13 April 1958, coll. Zhizi Chen; 5 males, Xishuangbanna, Menghun, 650–750 m, 9 June 1958, coll. Xuwu Meng; 1 male and 1 female, Xishuangbanna, Jinghong, 650 m, 6–24 July 1958, coll. Junhua He; 1 male, Xishuangbanna, Menghun, 650–750m, 1 June 1958, coll. Leyi Zheng; 1 male, Xishuangbanna, Menghun, 650–1080 m, 7 June 1958, coll. Chunpei Hong and Shuyong Wang; 1 male, Xishuangbanna, Damenglong, 650 m, 14 April 1958, coll. Chunpei Hong; 1 male, Xishuangbanna, Menghun, 650–750 m, 3 February 1958, coll. Shuyong Wang; 2 males, Xishuangbanna, Menga, 1050–1080 m, 20 May 1958, coll. Fuji Pu; 1 male, Xishuangbanna, Menghun, 650–750 m, 13 June 1958, coll. Yiran Zhang; 1 male, Xishuangbanna, Menghun, 650–750 m, 18 April 1958, coll. Leyi Zheng; 1 male, Xishuangbanna, Xiaomengyang, 850 m, 13 June 1958, coll. Lingchao Zang; 2 males and 1 female, Xishuangbanna, Menglun, G213 (National road) bamboo forest, 627 m, 21°54.380'N, 101°16.815'E, 21–26 November 2009, coll. Guo Tang and Zhiyuan Yao; 2 males and 2 females, Xishuangbanna, Menglun, G213 (National road) bamboo forest, 627 m, 21°54.380'N, 101°16.815'E, 22 November 2009, coll. Guo Tang and Zhiyuan Yao; 2 males and 2 females, Xishuangbanna, Menglun, G213 (National road) secondary forest, 644 m, 21°54.439'N, 101°16.755'E, 20 November 2009, coll. Guo Tang and Zhiyuan Yao; 1 male, Mojiang, 1 May 2013, coll. Zongqing Wang. China: Guangxi: 1 female, Pingxiang, 850 m, 11 May 1963, coll. Sikong Liu.



Figures 64–75. *Balta hwangorum* Bey-Bienko, 1958. **64** head **65** maxillary palps **66** pronotum; **67** tegmen **68** hind wing **69** front femur **70** tarsal claws and arolium **71** supra-anal plate and paraprocts, ventral view **72** subgenital plate, dorsal view **73** right phallomere **74** median phallomere **75** left phallomere. Scale bars: 0.5 mm (**64–66, 69–75**), 2.0 mm (**67, 68**).

Redescription. Male. Body yellowish brown (Figs 9, 10). Vertex to anterior margin of antennal sockets reddish brown, face yellowish brown to blackish brown (Figs 9, 10). Pronotum with inconspicuous black brindle or two oblique and symmetrical stripes, with disk reddish brown to black brown, two lateral borders, anterior and posterior margin yellowish brown and hyaline (Fig. 66). Legs yellowish brown to blackish

brown. Abdomen blackish brown. Apex of subgenital plate with reddish brown spots or without. Fourth and fifth maxillary palpomeres approximately same length, both distinctly shorter than the third (Fig. 65). Tegmen with M and CuA slightly oblique (Fig. 67). Hind wing with M without branches, CuA with five complete branches and without incomplete ones (Fig. 68). Front femur type C_2 (Fig. 69), tarsal claws strongly asymmetrical and unspecialized (Fig. 70). Abdominal tergites unspecialized.

Male genitalia. Supra-anal plate in ventral view short, hind margin arched, slightly emarginated in the middle; right and left paraprocts similar (Fig. 71). Subgenital plate symmetrical throughout except at the base, hind margin with deep V-shape emargination, styli similar, conical, arising on lateral lobes (Fig. 72). Hook-like phallomere on right side, hook slender (Fig. 73). Median phallomere sticklike, slightly curved, apex acuminate, near the apex part with a sclerite, base of arc appendage with brush-like structure (Fig. 74). Left phallomere complex, apex with a bifurcate spinous structure and a slender hairs structure (Fig. 75).

Female. Slight sexual dimorphism in that the female body is smaller than the male. Supra-anal plate symmetrical, rounded, hind margin divided in the middle. Subgenital plate broad and rounded.

Measurement (mm). Overall length male 15.0–18.5, female 14.0–17.1; tegmen length male 13.5–16.0, female 11.2–14.0; pronotum length × width male 2.9–3.5 × 4.1–4.9, female 3.0–3.1 × 5.0–5.1.

Remarks. Several specimens were separated as two species by Bey-Bienko, mainly based on the body color (1958). However, after examining a large number of specimens, the results show that body color of *B. hwangorum* varies. Moreover, in Bey-Bienko's records, in *B. hwangorum*, the length of lobes of the subgenital plate is different among the species, but in fact we find no difference.

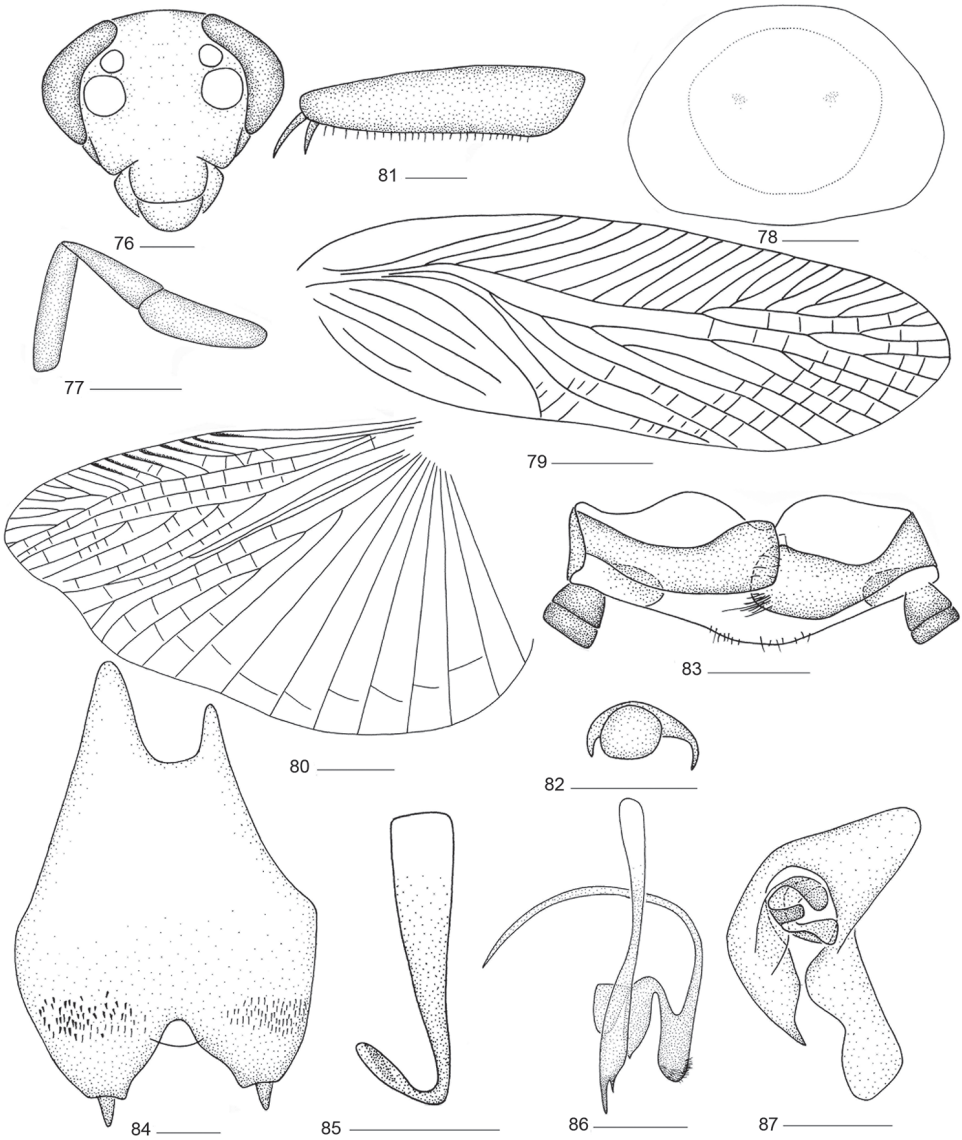
Distribution. China (Yunnan, Guangxi).

***Balta nodigera* (Bey-Bienko, 1958), comb. n.**
Figs 11, 12, 76–87

Onychostylus nodiger Bey-Bienko, 1958: 679 (Type locality: Yunnan, China).
Lupparia nodigera: Princis 1969: 960.

Material examined. Deposited in IESWU. **China**, Fujian Prov.: 1 male, Putian, 7 June 1979, coll. Jingying Liu; 1 male, Putian, 5 July 1978, coll. Bangkan Huang.

Redescription. Male. Body medium-size, yellowish brown (Figs 11, 12). Third and fourth maxillary palpomeres yellowish brown, the fifth light brown. Pronotum yellowish brown and disk with two unobvious black spots, lateral borders hyaline. Tegmina and hind wings light brown. Abdomen brown. Third and fifth maxillary palpomeres almost same length, distinctly longer (Fig. 77). Tegmen with M and CuA oblique (Fig. 79). Hind wing with small triangle apical, CuA with four complete branches and without incomplete ones (Fig. 80). Front femur type C_2 (Fig. 81),



Figures 76–87. *Balta nodigera* (Bey-Bienko, 1958) comb. n. **76** head **77** maxillary palps **78** pronotum **79** tegmen **80** hind wing **81** front femur **82** tarsal claws and arolium **83** supra-anal plate and paraprocts, ventral view **84** subgenital plate, dorsal view **85** right phallomere **86** median phallomere **87** left phallomere. Scale bars: 0.5 mm (**76–78, 81–87**), 2.0 mm (Figs **79, 80**).

tarsal claws strongly asymmetrical and unspecialized (Fig. 82). Abdominal tergites unspecialized.

Male genitalia. Supra-anal plate posterior margin slightly convex in the middle, paraprocts simple (Fig. 83). Subgenital plate in ventral view with hind margins strong-

ly emarginated in the middle, conical styli located on the distal of lateral lobes, ventral side of subgenital plate with some fine spines (Fig. 84). Hook-like phallomere on right side, the hook structure short and thick (Fig. 85). Median phallomere sticklike, thick and strong at base, apex with two different size spines; one associated median phallomere appendage stronger and with setae at apex, (Fig. 86). Left phallomere with left side apex spine-like (Fig. 87).

Measurements (mm). Overall length male 14.5; tegmen length male 12.0; pronotum length × width male 3.0 × 4.0.

Distribution. China (Fujian, Yunnan).

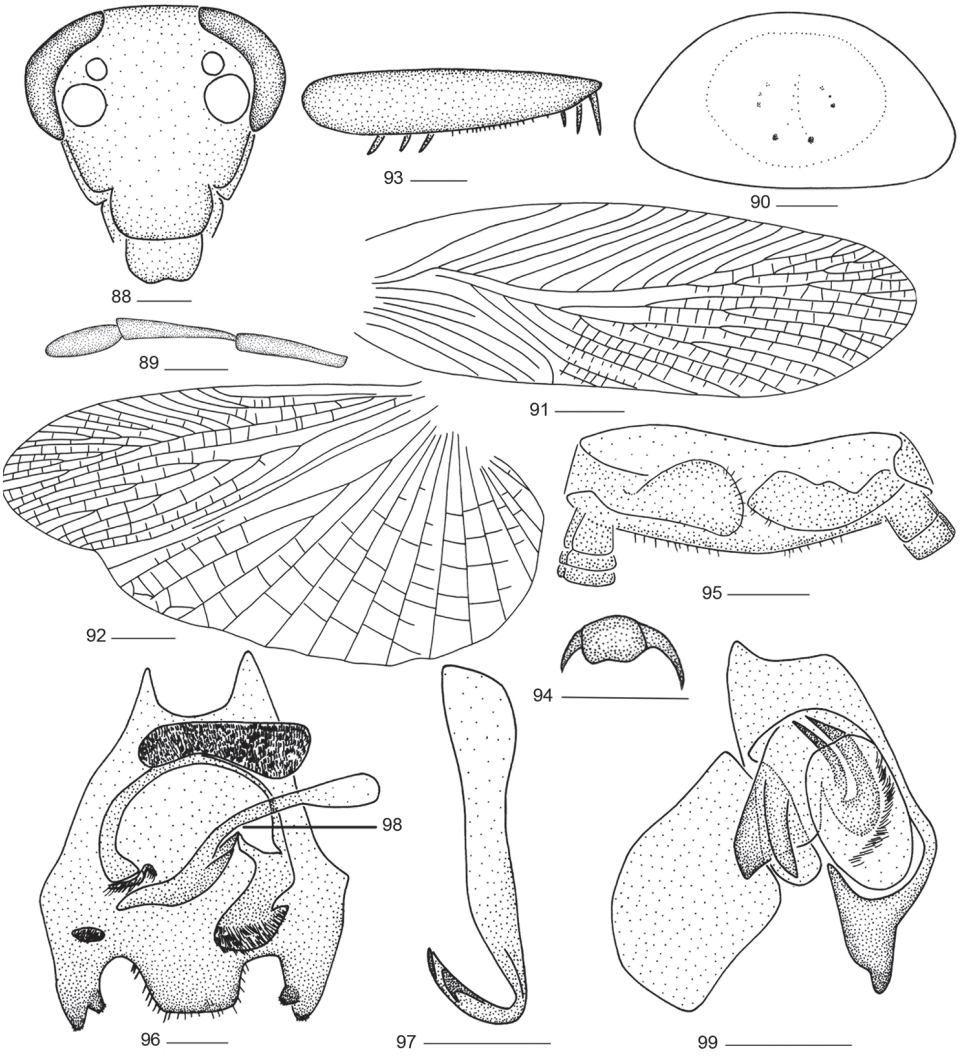
***Balta valida* (Bey-Bienko, 1958), comb. n.**
Figs 13, 14, 88–99

Onychostylus validus Bey-Bienko, 1958: 589 (Type locality: Yunnan, China).
Lupparia valida: Princis 1969: 957.

Material examined. Deposited in IESWU. **China**, Yunnan Prov.: 19 males, Xishuangbanna, Menghun, 650 m, 4–9 April 1958, coll. Yiran Zhang and Xuwu Meng; 1 male and 1 female, Xishuangbanna, Dadugang, 22°22.190'N, 100°56.977'E, 29 May 2014, coll. Xinran Li and Hongguang Liu; 5 males and 5 females, Puer, Meizihu park, 20 May 2016, coll. Zhiwei Qiu and Lu Qiu; 2 males and 1 female, Xishuangbanna, Wangtianshu, 22 May 2016 coll. Zhiwei Qiu and Lu Qiu. China, Hainan Prov.: 1 male, Wuzhi Mountain, 18°54.290'N, 109°41.081'E, 795 m, 18 May 2014, coll. Shunhua Gui and Xinran Li. 1 male, Limu Mountain, 16 April 2016, coll. Jianyue Qiu.

Redescription. Male. Body yellowish brown (Figs 13, 14). Vertex between eyes brick-red, between two ocelli yellow, remainder of face yellowish brown and without stripes (Figs 13, 14). Maxillary palpomeres yellowish brown with either base blackish brown. Base of antenna yellowish brown and the rest blackish brown to black. Pronotum yellowish brown and disc with some black spots, lateral borders hyaline. Legs yellowish brown. Base and two borders of abdominal sternites black (Fig. 14). Third and fourth maxillary palpomeres approximately same length, both distinctly longer than the fifth (Fig. 89). Tegmen with M degeneration and CuA with more branches (Fig. 91). Hind wing with M without branches, near apex of R with short branches, CuA with four to six complete branches and two or three branches of them bifurcated near apex (Fig. 92). Front femur type B_3 (Fig. 93), tarsal claws strongly asymmetrical and unspecialized (Fig. 94). Abdominal tergites unspecialized.

Male genitalia. Supra-anal plate in ventral view short, hind margin finely rounded, right and left paraprocts unsymmetrical (Fig. 95). The hind margin of subgenital plate concave near lateral sides and with densely setae; styli conical, with densely scattered short setae, located on lateral lobes (Fig. 96). Hook-like phallomere on right side and with preapical concavity (Fig. 97). Median phallomere thick and strong and near apex



Figures 88–99. *Balta valida* (Bey-Bienko, 1958) comb. n. **88** head **89** maxillary palps **90** pronotum **91** tegmen **92** hind wing **93** front femur; **94** tarsal claws and arolium; **95** supra-anal plate and paraprocts, ventral view **96** subgenital plate, dorsal view **97** right phallomere **98** median phallomere **99** left phallomere. Scale bars: 0.5 mm (**88–90, 93–99**), 2.0 mm (**91, 92**).

with a brush-like structure; base of appendage also with long strip brush-like structure (Fig. 98). Left phallomere complex, with brush-like structure (Fig. 99).

Measurements (mm). Overall length male 16.3–20.5, female 14.5–17.0; tegmen length male 14.2–17.0, female 12.0–14.1; pronotum length × width male 2.3–4.0 × 3.3–5.3, female 3–4.3 × 3.3–5.1.

Distribution. China (Hainan, Yunnan).

Acknowledgements

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RESEARCH ARTICLE

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A new species of the genus *Teloganopsis* with setaceous mouthparts and forelegs from southern China (Ephemeroptera, Ephemerellidae)

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Abstract

The nymph and reared male and female of a new ephemerellid species, which was collected from southern China and named *Teloganopsis setosa* Zhou, **sp. n.**, are described. The nymph is unique because of its long and dense setae on labrum, mandibles, maxillae, labium, and forelegs as well as the elongated segments II of labial palpi and expanded paraglossae. The male can be differentiated from close relatives by its larger penis lobes with dorsolateral projections, and the more pigmented tergum IV and caudal filaments. The nymph described in this paper represents a new adaptive and ecological type in the family Ephemerellidae.

Keywords

evolution, filter, Mayfly, new species, taxonomy

Introduction

Jacobus and McCafferty (2008) redefined the genus *Teloganopsis* Ulmer (1939) and synonymized it with *Amurella* Kluge (1997) (nymphs have single abdominal tubercles), *Uracanthella* Belov (1979) (with brush-like maxillae but without maxillary palpi), and

Kangella Sartori (2004) (= *Eburella* Kang & Yang, 1995, with enlarged mandible incisors). Subsequently, Ubero-Pascal and Sartori (2009) revised this genus and placed 15 species into it. The nymphs of this genus include several ecological and adaptive types, each with differing morphologies, especially mouthparts. They may be filter-feeders using maxillae (like *Uracanthella*), biters or shredders (*Amurella*), or cutters and predators having enlarged mandibles (*Kangella*).

In this study, a new ecological type and evolutionary lineage of this genus is found in Hainan Island, southern China. The nymphs have large labia, elongated labial palpi with long setae, and forelegs with rows of long setae. The setaceous mouthparts and forelegs show this species can filter particle food items in running water.

Materials and methods

The nymphs were collected by hand net. Some adults were reared from mature nymphs indoor but most were attracted by ultraviolet collecting light. The materials were stored into ethanol (more than 75%) immediately. All specimens were photographed with a digital camera (Single Lens Reflex) and examined under a stereomicroscope. Some small structures, such as mouthparts, claws, and gills were observed and photographed with a microscope camera.

Eggs were dissected out from females. Before being placed on the stage of the SEM (scanning electron microscope) for photographs, they were prepared with a standard protocol: fixed in 4% glutaraldehyde for 4–8 hours, rinsed with PBS (physiological saline) 2–3 times (10–15 minutes each), dehydrated in concentration gradient acetone (30%, 50%, 70%, 80%, 90%, 100%, 10 to 15 minutes each), and coated with gold film in a vacuum.

Comparative material used in this study includes:

Teloganopsis punctisetae (Matsumura, 1931) (=*Ephemerella rufa* Imanishi, 1937, synonymized by Ishiwata, 2001): 2♂♂3♀♀4L, Xin-Huang county (27°19.10'N, 109°14.05'E, alt. 352 m), Hunan Province, China, collected by Peng LI, Jia-Yong ZHANG, 16 Aug 2004.

Teloganopsis jinghongensis (Xu et al., 1984): 2♂♂3♀♀3L, Er-Yuan town (26°15.26'N, 99°58.55'E, alt. 2093 m), Da-Li, Yunnan Province, China, collected by Hui XIE, Ping CHEN, Yan-Yan JIA, 7 July 2008.

Abbreviations used in text: **C**, costal vein; **Sc**, subcostal vein; **SEM**, scanning electron microscope.

All specimens are deposited in the Mayfly Collection, College of Life Sciences, Nanjing Normal University, China.

Results

***Teloganopsis setosa* Zhou, sp. n.**
http://zoobank.org/507C1DC5-0D06-41BF-9320-74B75695901D
Figs 1–7

Holotype. ♂, Ba-Wang-Ling National Forest Park (19°12.12'N, 109°09.35'E, alt. 300 m), Chang-Jiang county, Hainan Province, China, collected by Qin SI, Jun-Zhi SUN, Juan-Yan LUO, 16 Nov 2015; **Paratypes**: 2♂♂1♂subimago 2♀♀30L, same as the holotype.

Diagnosis. Nymph: Inner margins of forelegs and mouthparts (labrum, mandibles, and labium) have dense and long setae. Paraglossae and palpi of labium are enlarged. Abdominal tergum IV has two dark spots. **Male adults**: The dorsolateral projections of the penes are visible in ventral view. The caudal filaments have wide reddish-brown bands. Two pigmented spots or dots are on tergum IV.

Description. ***Nymph*** (in alcohol, Figs 1–4): *Body length* 3.0–5.0 mm, caudal filaments 1.2–1.6 mm, cerci subequal to terminal filament (Figs 1, 2). Body reddish to dark brown. Head hypognathous, antennae located near front margin of head, with very tiny setae on articulations of flagellae; antennal length approximately 1.5X head width. Dark base of ocelli and male compound eyes clear.

Mouthparts: *labrum* with relatively long setae on dorsal surface and free margin, ventral surface with shorter but stouter setae (Figs 3A, 4A). Both *mandibles* with long setae on outer surface; outer and inner incisors of left mandible divided into three teeth apically, but inner incisor of right mandible serrated into two teeth only; prosthecae of mandibles with a tuft of spines on common base (Figs 3B–C, 4C–D). *Maxillae*: dense long setae and bristles on apex and dorsal surface (Fig. 4F); two rows of bristles on apical half of inner margin; basal half of outer margin and cardo also with shorter setae (Figs 3D, 4E). *Labium*: paraglossae enlarged, its posterolateral angle projected significantly, this makes paraglossae triangular; ventral surface of glossae with denser and longer setae than dorsal surface; labial palpi elongated remarkably into long broad filamentous process-like structure, 3-segmented, basal and apical one smooth; basal one slightly longer than half of segment II; apical one very short, less than half of basal one; segment II with very long and distinct setae on lateral margins and dorsal surface (Figs 3E, 4G); *hypopharynx* with denser and longer setae on superlinguae surface, other parts of lingua and superlinguae with shorter setae (Figs 3F, 4B).

Legs (Figs 3G, 4K–M): femora of all legs slightly shorter than tibiae, tarsi slightly longer than half tibiae; basal half of femora, tibiae and tarsi darker or more reddish brown than other parts, an additional reddish to dark ring on median tibiae; foreleg with blunt but relatively long bristles on outer margin of femora, 4–5 more bristles lined up a row sub-apically on femoral surface; inner surface of fore-tibiae and tarsi with rows of setae, those setae of tibiae longer than others; outer margin of them with shorter setae (Figs 1, 2, 3G, 4K); mid- and hind legs similar in structure: outer margin of femora with 3–5 bristles, tibiae with 2–4 bristles on dorsal surface, rows of spines

Figure 1. Digital photograph of male nymph of *Teloganopsis setosa* sp. n.

on inner margin while outer margin with tiny setae; setae and spine pattern of tarsi similar to tibiae but without bristle; inner margin of all femora with tiny setae too (Fig. 4L, M); *claws* of all legs similar, with six denticles from middle to apex, apical one larger than others (Figs 3G, 4J).

Abdomen: reddish brown to brown, tergum IV with a pair of clear reddish to dark dots, terga V–VI distinctly paler than others; terga washed with brown to dark pigments without regular markings (Figs 1, 2). Sterna generally brown to dark brown but with pale median line, especially on posterior half; an additional pair of oblique dark stripes present laterally. *Gills* on terga III–VII, anterior four pairs of gills similar in structure: dorsal lamellae plate-like, with tri-lobed marking dorsally; ventral lamellae bifurcated into two parts, each one with 4–6 leaf-like lobes (Fig. 4H); gills on tergum VII much smaller than anterior ones, ventral lamellae divided into three lobes (Fig. 4I). All posterolateral corners of terga IV–IX extended into small but sharp angles, progressively larger posteriorly (Figs 1, 2). Posterior and lateral margins of each tergum with tiny spines. Caudal filaments with reddish to dark median band (Figs 1, 2); articulations with distinct spines (Fig. 4N).

Male imago (in alcohol, Figs 5–6). *Body length* 5.0–6.0 mm, caudal filaments 7.0–8.0 mm, forewing 6.5–7.0 mm, hindwing only approx. 1/5 of forewing in length. Upper portion of compound eyes reddish, basal portion dark, two eyes separated with a distance less than width of median ocellus (Fig. 5A). *Forewings* hyaline, but subcostal brace and bulla of Sc pigmented with reddish brown dots; cross veins in stigma area

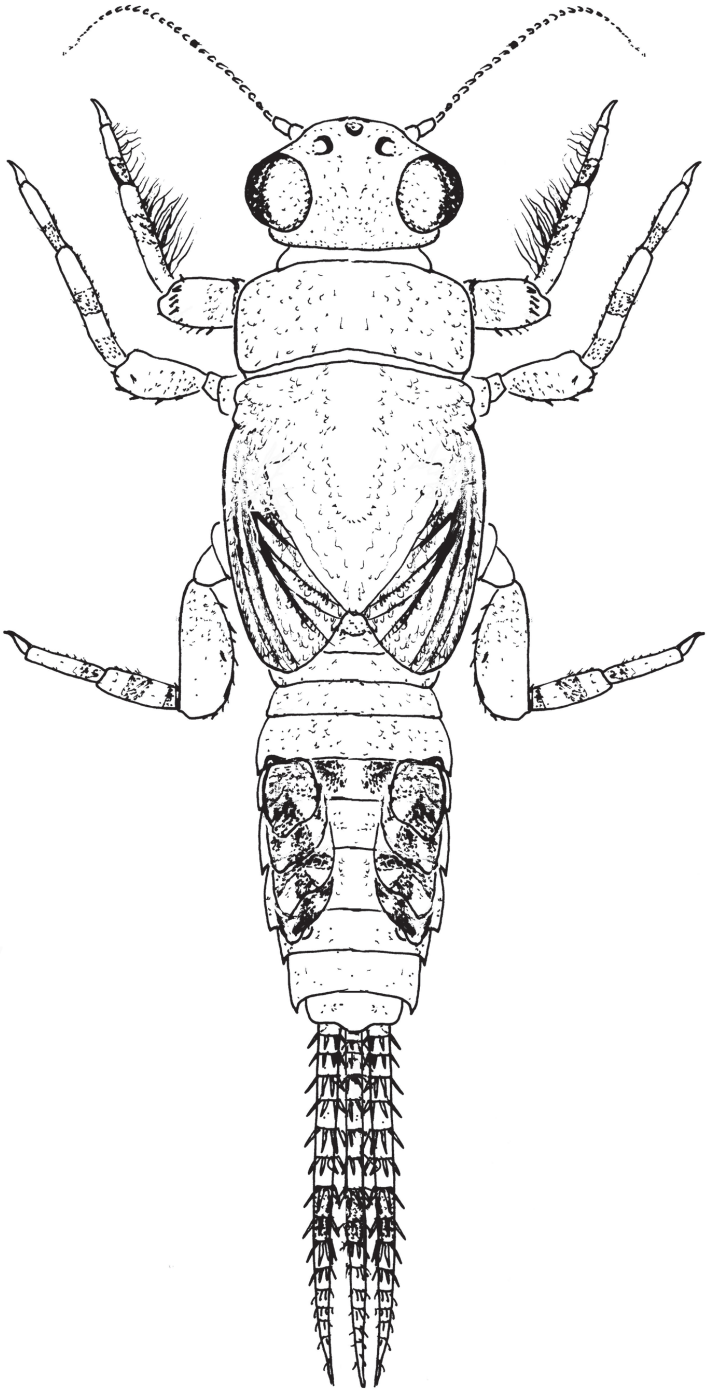

Figure 2. Male nymphal habitus of *Teloganopsis setosa* sp. n.

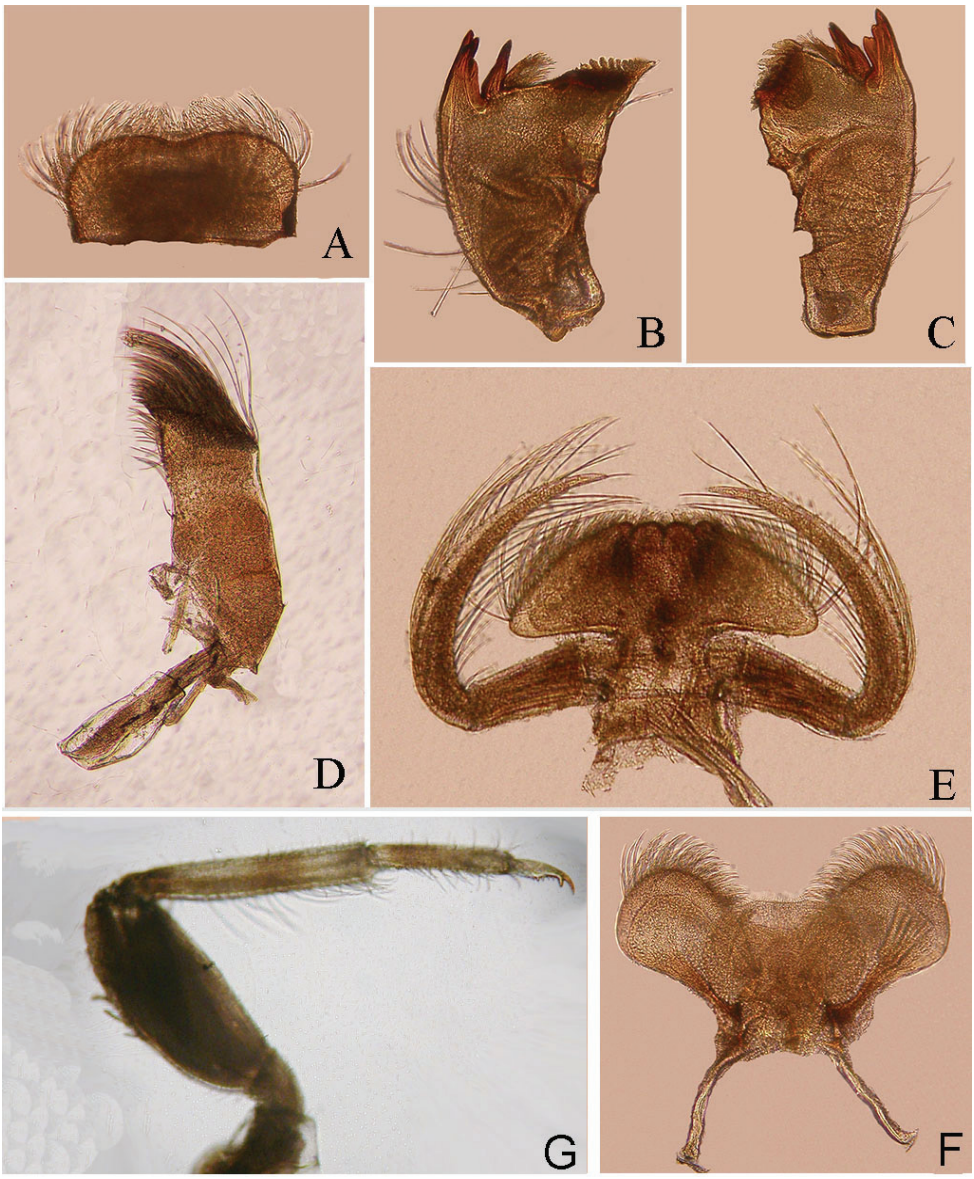

Figure 3. Structures of *Teloganopsis setosa* sp. n. nymph (digital photographs) **A** labrum (dorsal view) **B** right mandible **C** left mandible **D** maxilla **E** labium (ventral view) **F** hypopharynx (dorsal view) **G** foreleg.

oblique, those between C and Sc separated into two parts by a short vein (Figs 5B, 6A). *Hindwings* transparent, with a projection at median leading margin (Figs 5C, 6B). Femora subequal to tarsi in length of foreleg, each of them approx. 2/3 of tibiae. Tarsi 5-segmented, basal one the shortest, with hook-like structure near tibiae (Figs 5D, 6C); other segments of fore-tarsi progressively shorter apically. Mid- and hind-leg similar: femora distinctly shorter than tibiae, tarsi less than half of tibiae; tarsi 4-segmented,

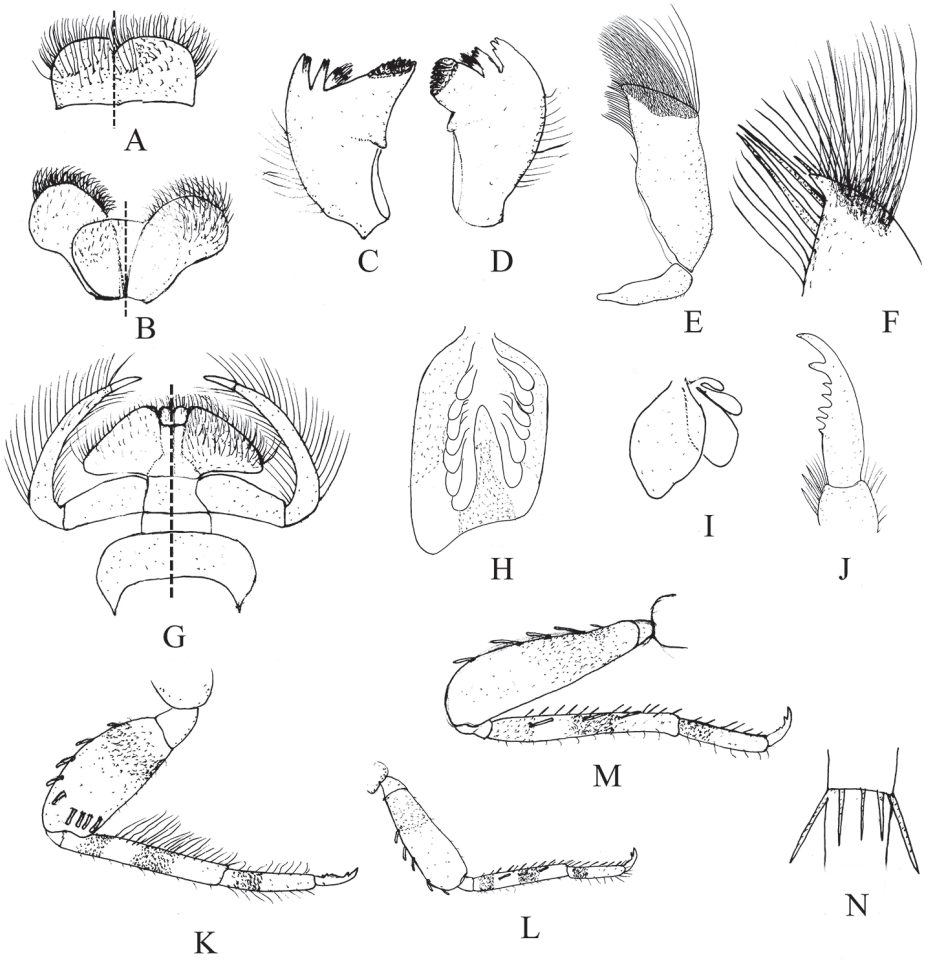

Figure 4. Nymphal characters of *Teloganopsis setosa* sp. n. **A** labrum (dorsal view on left; ventral view on right) **B** hypopharynx (dorsal view on left; ventral view on right) **C** right mandible **D** left mandible **E** maxilla **F** apex of maxilla **G** labium (dorsal view on left; ventral view on right) **H** gill I (ventral view) **I** gill V (dorsal view) **J** claw **K** foreleg **L** midleg **M** hindleg **N** articulation of caudal filaments.

length arrangement in decreasing order as 4, 1, 2, 3. All *claws* of legs similar, one blunt and one hooked. *Abdominal terga* pale to brown, tergum IV with a pair of reddish to dark dots dorsally (Fig. 5A). *Sterna* pale but with reddishly pigmented lateral margins. Basal half of each segment of caudal filaments reddish, apical half pale (Fig. 5A).

Genitalia (Figs 5E, 6D): basal segment of forceps very short, less than 1/6 of segment II; the latter straight, narrowed progressively from base to apex, with tiny projections on inner margin; apical segment approx. 1/6 to 1/5 of segment II, mesal margin emarginated at base, making segment III appear somewhat pointed or hooked; penes fused at 2/3 base and separated at apical 1/3; each penis with broad lobe-like projection dorsally; posterior margin of subgenital plate convex.

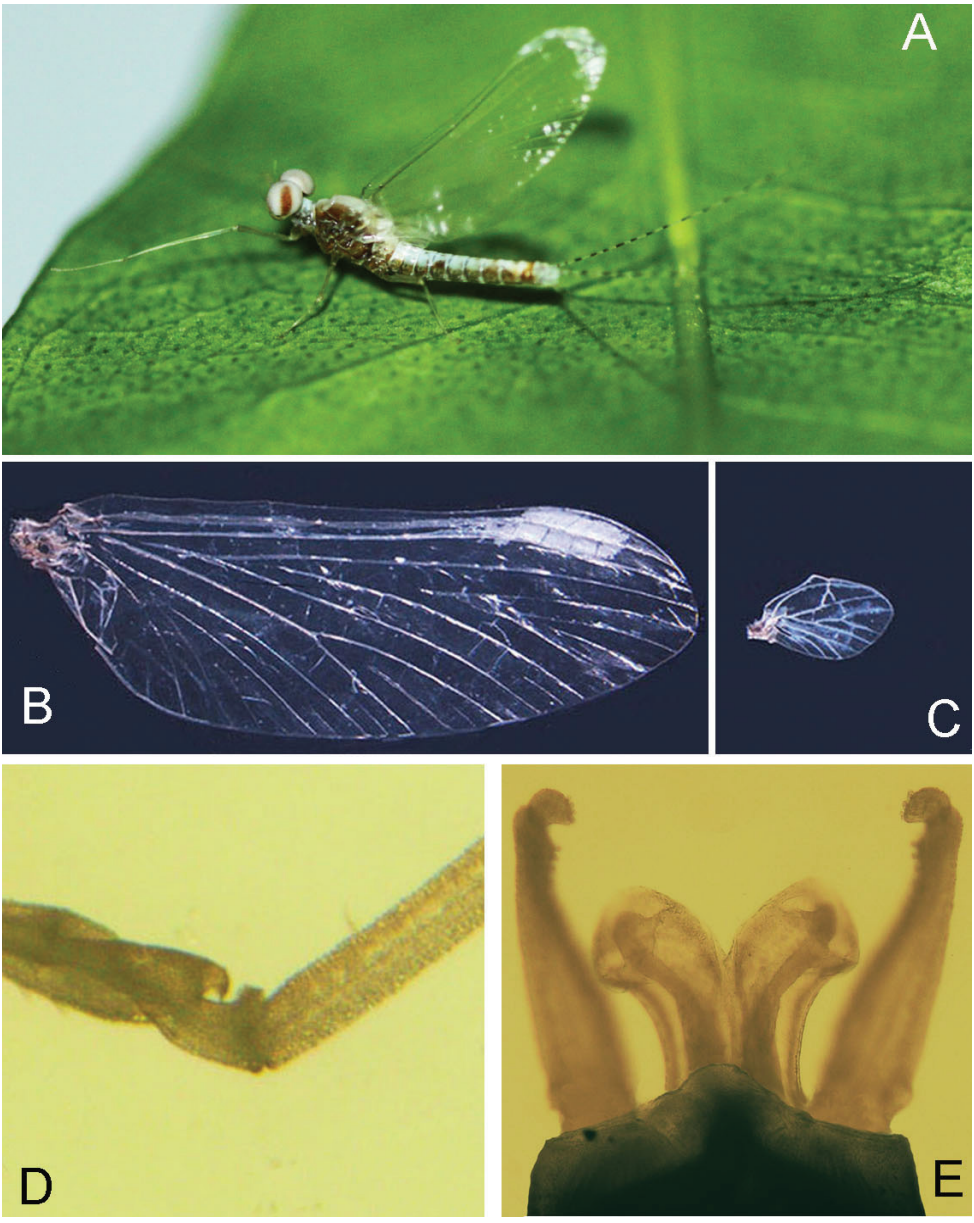

Figure 5. Male structures of *Teloganopsis setosa* sp. n. (digital photographs) **A** male adult **B** forewing **C** hindwing **D** proximal hook of foreleg **E** genitalia (ventral view).

Female imago (in alcohol). *Body length* 6.5–7.0 mm, forewing 7.5–8.0 mm, caudal filaments 6.5–7.0 mm. Body pale to pale reddish, washed with reddish brown dots and markings laterally. *Forewings* transparent but subcostal brace and bulla of Sc with dark pigments; *Tergum* IV also with a pair of brown dots but much smaller and indistinct

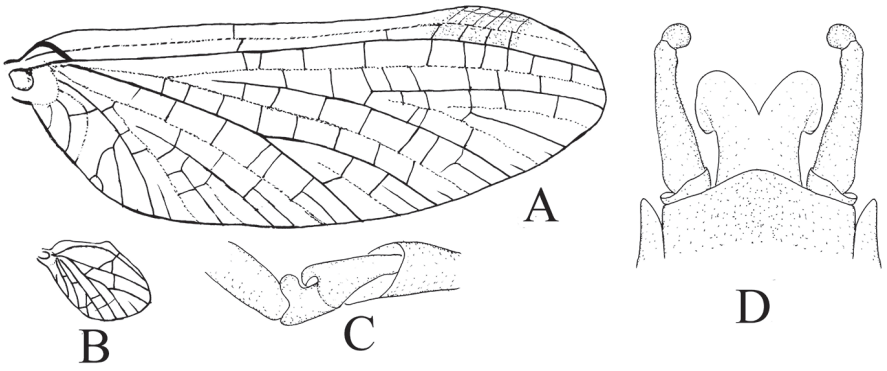

Figure 6. Male structures of *Teloganopsis setosa* sp. n. **A** forewing **B** hindwing **C** joint of tarsi and tibiae of foreleg **D** genitalia (ventral view).

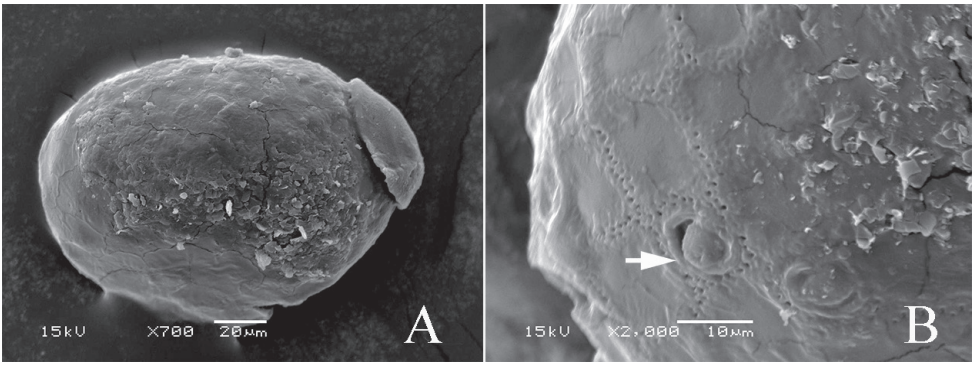

Figure 7. *Teloganopsis setosa* sp. n. Egg morphology (SEM photos) **A** whole egg **B** egg surface enlarged (arrow indicates the projection).

than those of male. *Sterna* dark brown with pairs of pale dots. Tibiae longer than femora, the latter much longer than tarsi. One of *claws* blunt, the other hooked and sharp.

Male Subimago (in alcohol). *Body length* 5.0 mm, forewing 6.5–7.0 mm, caudal filaments 5.0 mm; resembles male imago except dull; veins and cross veins of wings much clearer than male imago.

Egg (Fig. 7). Egg scanned with length 0.133 mm, width 0.084 mm. Egg oval with one polar helmet-shaped cap (Fig. 7A). Egg surface sculptured with hexagonal structures and decorated with sparse tubercle-like projections (Fig. 7B).

Distribution. China (Hainan Province).

Etymology. The name *setosa* (from Latin epithet *setosus*) means having numerous setae. It indicates here that the nymphs of the new species have long and dense setae on the mouthparts and forelegs.

Remarks

Based on the following characters (gills on abdominal segments III–VII, ventral lamellae of gills IV (on segment VI) bifurcated, body without any tubercles or projections, maxillae without palpi and shape of claw), the nymph of this new species belongs to the genus *Teloganopsis* based on the nymphal keys provided by Jacobus and McCafferty (2008) and Ubero-Pascal and Sartori (2009). The proximal hook of the forelegs, the shape of the penis, and forceps also imply that the male imagoes of this new species belong to the genus *Teloganopsis*.

In the nymphal key of all known species of the genus *Teloganopsis* prepared by Ubero-Pascal and Sartori (2009), *T. setosa* sp. n. is most similar to the species *T. puigae* because of their uniform body color pattern, missing maxillary palpi, and without any tubercles on body. However, the setal pattern on the forelegs and the shapes of maxillae and labia are different. The nymphs of *T. setosa* sp. n. have longer setae on forelegs and longer labial palpi. In the imaginal stage of these two species, the shape of their hindwings and abdominal colour patterns are dissimilar. The hindwing of *T. setosa* sp. n. has a shallow marginal projection while the counterpart in *T. puigae* has a larger and sharper projection. Furthermore, the imaginal abdomen of the latter species is uniformly dark while that of *T. setosa* sp. n. is pale with a pair of reddish brown dots on tergum IV.

Among Chinese ephemerelliids belonging to the genus *Teloganopsis*, the nymphs of *T. setosa* sp. n. is closest to *T. punctisetae* (Matsumura, 1931) and *T. jinghongensis* (Xu et al., 1984) as they have no maxillary palpi nor any tubercles on the body. As imagoes, they are also similar because of their longer tibiae (distinctly longer than the femora and tarsi) on the forelegs and the morphology of the genitalia (penis with dorsal projection).

However, the nymph of *T. setosa* sp. n. is unique because of its setaceous mouthparts and forelegs. Four diagnostic characters are remarkable: 1) the outer margin of mandible has long setae (Figs 3B–C, 4C–D); 2) the paraglossae of the labium are expanded and bear dense setae ventrally (Figs 3E, 4G); 3) segment II of the labial palpi are greatly elongated and have setae dorsally (Figs 3E, 4G); 4) forelegs possess long setae (Figs 1, 2, 3G, 4K). The absence of projections, spines, or tubercles on nymphal body also contributes to its identification (Figs 1, 2). Besides these characters, when compared to the similar species *T. punctisetae* and *T. jinghongensis*, the nymph of this new species has more and longer setae on its mouthparts (the setae on the labrum, maxillae, hypopharynx, and labium are more numerous and denser). The nymphal femora of the new species are broader, with fewer spines compared to those of *T. punctisetae* and *T. jinghongensis*, and their color pattern is different. Tergum IV of *Teloganopsis setosa* sp. n. is more colorful than that of these two species (Fig. 1), while the latter two species have longitudinal pale stripes on body (Fig. 8A, B), which are not present in the new species.

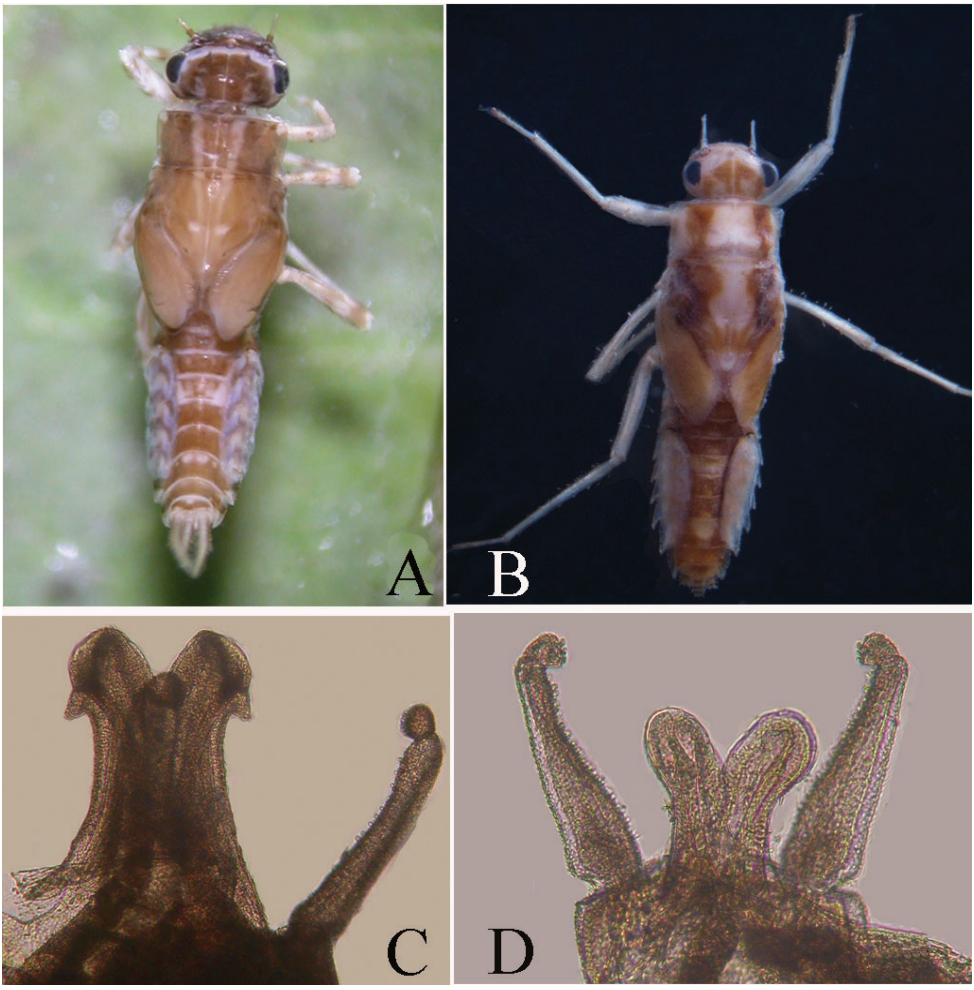

Figure 8. Structures of *Teloganopsis punctisetae* and *T. jinghongensis* (digital photographs) **A** *T. punctisetae* nymph (dorsal view) **B** *T. jinghongensis* nymph (dorsal view) **C** *T. punctisetae* genitalia (ventral view) **D** *T. jinghongensis* genitalia (ventral view).

In male imagoes, however, the distinguishing characters of the new species mostly rely on color; 1) the penes and dorsolateral projections of the penes are larger and more distinctive than those of *T. punctisetae* and *T. jinghongensis* (Figs 5E, 6D, 8C, 8D); 2) the caudal filaments of *T. setosa* sp. n. have broad reddish brown bands on the basal half of each segment (Fig. 5A) while those of the *T. punctisetae* and *T. jinghongensis* have rings on the articulations, while broad bands are rare; 3) both the male and female of *T. setosa* sp. n. have relatively obvious and big spots on tergum IV (Fig. 5A) but in *T. punctisetae* and *T. jinghongensis* there are no recognizable markings on the terga.

Key to the three close Chinese *Teloganopsis* species (adult)

1 Projection of penis broad, visible in ventral view (Figs 5E, 8C) **2**
– Projection of penis smaller, invisible in ventral view (Fig. 8D) .... ***Teloganopsis jinghongensis***
2 Tergum IV with clear reddish spots (Fig. 5A); caudal filaments with reddish brown bands on basal half segment (Fig. 5A) ..... ***Teloganopsis setosa* sp. n.**
– Tergum without spots; only articulations of caudal filaments with rings .... ***Teloganopsis punctisetae***

Key to the three close Chinese *Teloganopsis* species (nymph)

1 Inner margin of forelegs with long setae (Figs 1, 2, 3G, 4K); paraglossae of labium and labial palpi greatly enlarged (Figs 3E, 4G)..... ***Teloganopsis setosa* sp. n.**
– Forelegs without long setae; paraglossae of labium and its palpi not enlarged.... **2**
2 Head to abdominal segment III with three longitudinal pale stripes (Fig. 8A); maxillae brush-like..... ***Teloganopsis punctisetae***
– One broad pale line on dorsal body (Fig. 8B); maxillae with less setae but more spines dorsally..... ***Teloganopsis jinghongensis***

Discussion

Mayflies with setaceous mouthparts, elongated maxillary labial palpi, and long setae on the forelegs have been found in several lineages in the order Ephemeroptera, such as *Isonychia* (Isonychiidae), *Nathanella* (Leptophlebiidae), *Rhoenanthus* (Potamanthidae), *Oligoneuriella* (Oligoneuriidae), *Tricorythus* (Tricorythidae), and *Clypeocaenis* (Caenidae). In the Ephemerellidae, as far as we know, no similar form has been reported. This new species represents a new evolutionary type in the family, but compared to related species such as *T. punctisetae* and *T. jinghongensis*, their nymphal body patterns are similar, and the adults are alike. Most importantly, the setaceous mouthparts and brush-like maxillae are also found in *T. punctisetae* at least, so there is no need to erect a new generic level for it. Based on the habit, habitat, and behavioural information provided by Needham et al. (1935), Edmunds et al. (1976), and Elpers and Tomka (1995), the mayfly nymphs with setaceous mouthparts and forelegs are usually filter-feeding. Based upon its characters, the new species described in this paper is also believed to be filter-feeder. Most ephemerellid nymphs usually live in and feed on the aquatic spirogyra or branches and leaves stacked in the lentic or lotic water. The *Teloganopsis setosa* sp. n. nymph may have evolved the ability to collect organic particles from flowing water using their long and dense setae on forelegs and mouthparts, just like the *Isonychia* and *Clypeocaenis* mayflies.

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RESEARCH ARTICLE

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A new species of *Helionothrips* from China (Thysanoptera, Panchaetothripinae)

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Abstract

Helionothrips lushanensis **sp. n.** is described from China. The new species is characterised by the head entirely dark brown, antennal segments I–VIII almost uniformly yellowish brown and III–IV strongly vasiform, metascutellum without produced posterior margins, and male has no pore plate on the abdominal sternites.

Keywords

Helionothrips, new species, Thripidae, thrips

Introduction

Helionothrips Bagnall, 1932, is one of the most species rich taxa in the subfamily Panchaetothripinae, currently comprises 28 described species in the world (ThripsWiki 2017). The species of the genus are mainly restricted in the Old World tropics and subtropics except for *H. funebris* (Hood, 1928) which is reported from South America. Of the described species, the majority of species (more than 80%) in the genus are known from the Asian region (Bhatti 1968; Wilson 1975; Zhang 1980;

Kudô 1992, 1995; Wang 1993, 2002; Reyes 1994; Feng et al. 2007; Mirab-balou et al. 2017; ThripsWiki 2017). The review of the Panchaetothripinae species from China is available (Mirab-balou et al. 2017). In the present paper, a new species of the genus is added to the Chinese fauna.

Materials and methods

The thrips were collected by beating vegetation over a white plastic tray using a stick, and then sorted and preserved in 90 % alcohol. Examined specimens were mounted in Canada balsam using the method outlined by Zhang et al. (2006). Details of the morphological structures were examined with a ZEISS Imager A1 microscope; the photos were taken by a Photometrics CoolSNAP camera. All type specimens are deposited in the Insect Collection, South China Agricultural University (**SCAU**).

Taxonomy

***Helionothrips lushanensis* sp. n.**
http://zoobank.org/7481BEA8-A3C4-4C92-A378-B723D6C04AF7
Figs 1–10

Material examined. Holotype female (in SCAU): **CHINA**, Jiangxi province, Jiujiang City, Mt. Lushan (29°33'N, 115°59'E), collected from older leaves of *Ligustrum sinense* (Oleaceae), 9.xi.2015, leg. Xiaoli Tong.

Paratypes (in SCAU). 2 males from older leaves of *Ligustrum sinense* (Oleaceae), 4 males from older leaves of *Viburnum* sp. (Caprifoliaceae), 1 female from older leaves of *Rhododendron simiarum* (Ericaceae), all taken with holotype. Hunan province, Liuyang City, Daweishan National Forest Park (28°25'N, 114°06'E), 1 male from older leaves of *Rhododendron latoucheae* (Ericaceae), 15.viii.2016, leg. Zhaohong Wang.

Diagnosis. Both sexes macropterous; body dark brown; head entirely dark brown; antennal segments I–VIII yellowish brown; fore wing brown with two pale bands. Head entirely reticulate without internal wrinkles within the reticules; antennae 8-segmented, segments III and IV strongly vasiform with forked sensoria, that on IV reach near the apex of V. Pronotum, meso- and metanotum completely reticulate, all lacking internal wrinkles within the reticles. Antecostal line on abdominal tergites III–VIII divided into broad arched sculpture with heavy anterior margin; tergite VIII with complete comb of microtrichia on posterior margin. Male similar to female in structure and colour but smaller; abdominal sternites without pore plates.

Description. Female (*macropterous*): Body dark brown (Fig. 1), head entirely dark brown; antennal segments I–VIII yellowish brown or pale brown, I and VI slightly darker than other segments (Fig. 5). Fore legs yellowish brown, mid and hind legs dark

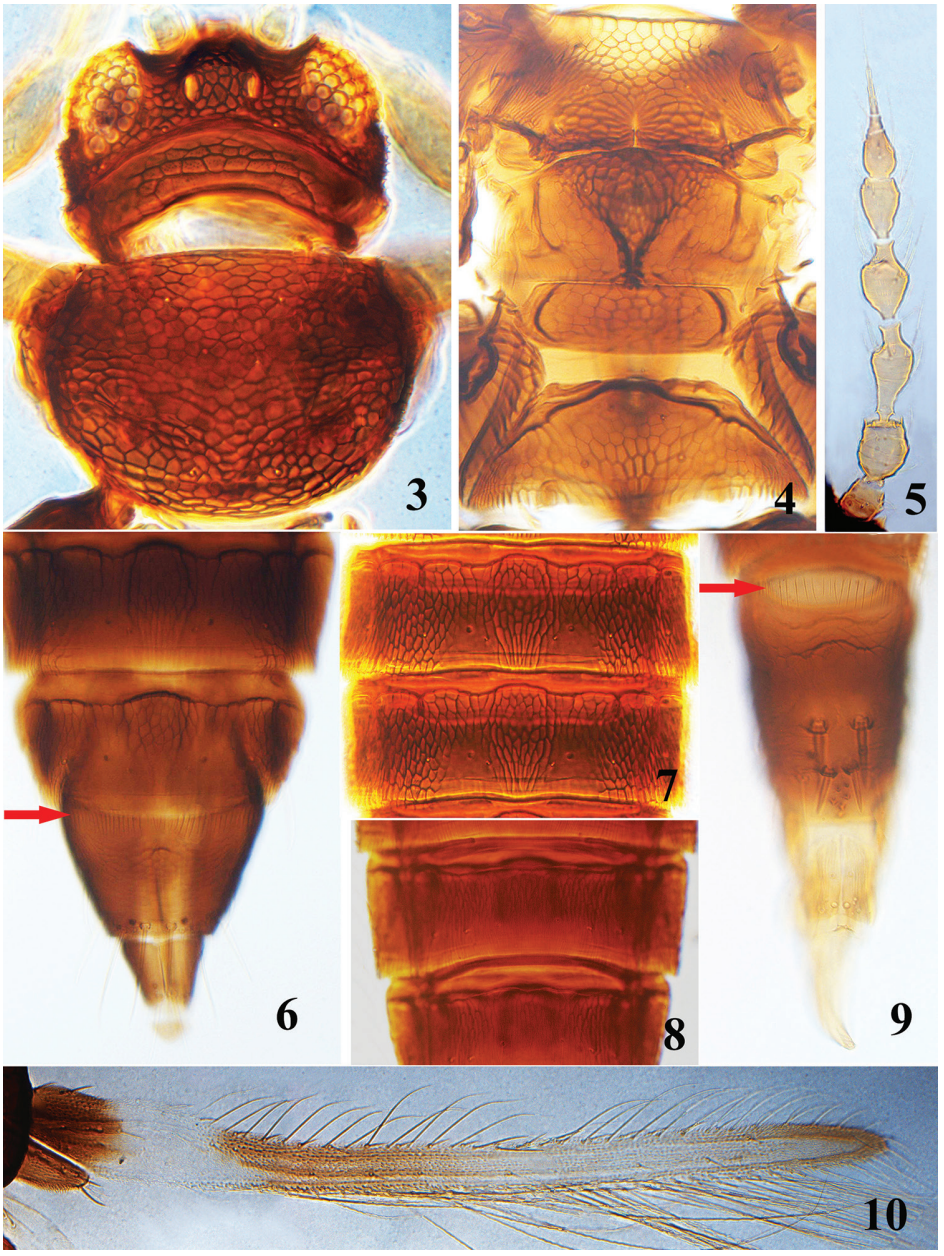
Figures 1–2. *Helionothrips lushanensis* sp. n. **1** female **2** male.

brown except for the extremities of femora and tibiae yellowish brown; all tarsi yellow. Fore wing (Fig. 10) brown at base with white band sub-basally, brown at fork of veins and gradually fading apically, subapical pale band longer than sub-basal white band, ambient vein darker than surface of wing at apex, clavus dark brown.

Head approximately twice as wide as long, sculptured with polygonal reticulations and without internal wrinkles within the reticules (Fig. 3); head with short, convex cheeks; occipital ridge strong and close to margin of eyes; occipital collar with numerous granules in posteromedian reticules; ocelli larger than any of the ommatidia and situated on the sides of an elevated hump. Antennae 8-segmented and stout, segments III and IV strongly vasiform with short apical neck, segment III longest with long pedicel, segment IV approximately 1.6 times as long as wide with very short basal pedicel (Fig. 5); segments III–IV with forked sensoria, that on IV reach near the apex of V; segments IV–VI with microtrichia rows on ventral surface, IV and V with 3 rows, VI with two rows. Mouth-cone rounded and moderately long, palps 2-segmented.

Pronotum wider than long, slightly ovoid (Fig. 3), with about 13–15 long and pale setae; pronotum, meso- and metanotum, metascutellum completely reticulate, all lacking internal wrinkles within the reticules (Fig. 4); metanotal median setae and campaniform sensilla arranging in a transverse line, median setae wide apart and far from anterior margin; metascutellum approximately three times as wide as long and posterior margins not produced. Fore wing first vein with approximately seven basal setae and two apical setae, second vein with 5–6 setae, clavus with four veinal and one discal setae; posterior marginal fringe cilia wavy. Legs with reticules, tarsi 1-segmented.

Abdominal tergites I and II covered with polygonal reticulations, III–VIII entirely reticulate except for the submedian smooth areas behind campaniform sensilla, with weak internal wrinkles within posterolateral reticules; antecostal line on tergites III–VIII



Figures 3–10. *Helionothrips lushanensis* sp. n. **3** head and pronotum **4** meso- and metanotum and abdominal tergite I **5** antenna **6** abdominal tergites VII–X **7** abdominal tergites IV–V **8** abdominal sternites VI–VII **9** abdominal tergites VIII–X of male **10** fore wing.

divided into broad arched sculpture with heavy margin (Fig. 7); tergite VIII with complete comb of long microtrichia on posterior margin (Fig. 6); tergite IX with a pair of campaniform sensilla close to posterior margin and three pairs of stout and pointed setae

along posterior margin, S1 and S2 setae subequal in length, but longer than S3 setae; tergite X smooth with median split complete. Abdominal sternites sculptured with longitudinal narrow reticules (Fig. 8).

Measurements (holotype female, in microns). Distended body length 1870. Head length (width) 100 (210); eye length (width) 70 (50). Pronotum length (width) 175 (250). Fore wing length 1040. Antennal segments I–VIII length (width) as follows: 26(25), 40(33), 65(29), 53(33), 40(25), 31(21), 10(9), 30(6).

Male (macropterous) (Fig. 2). Similar to female in structure and colour but smaller, abdomen more slender. Abdominal tergite VIII with complete comb of microtrichia on posterior margin (Fig. 9), tergite IX with two pairs of thorn-like setae, posterior pair shorter and closer to each other than anterior pair, a longitudinal cluster of 6–7 wart-like tubercles behind posterior pair (Fig. 9). Abdominal sternites without pore plates.

Measurements (paratype male, in microns). Distended body length 1570. Head length (width) 100 (175); eye length (width) 60 (40). Pronotum length (width) 140 (200). Fore wing length 840. Antennal segments I–VIII length (width) as follows: 20(22), 35(29), 58(27), 48(33), 33(24), 28(20), 8(9), 30(5).

Etymology. The specific epithet is named after the type locality, Mt. Lushan, Jiujiang City, Jiangxi province, China.

Distribution. China (Jiangxi, Hunan).

Remarks. The new species is most similar to *H. errans* (Williams) in colour and structure, particularly in the pronotum lacking internal wrinkles within the reticules and abdominal tergite VIII having a complete comb on its posterior margin, but it can be distinguished from the latter by (1) head entirely dark brown (head anterior of fore ocellus yellow in *H. errans*); (2) antennal segments I–VIII almost uniformly yellowish brown (antennal segments I and III-V yellow, II and VI brown in *H. errans*); (3) antennal segments stouter, especially III and IV strongly vasiform, segment IV approximately 1.6 times as long as wide (in *H. errans*, the antennal segments slender, III and IV stalk-like, segment IV more than twice as long as wide); (4) metascutellum normal, lacking produced posterior margins (metascutellum with posterior margins produced in *H. errans*) and (5) male has no pore plate on the abdominal sternites (while the male has pore plates on sternites VII and VIII in *H. errans*).

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Morphological anomalies of endangered Korean relict long-horned beetle *Callipogon relictus* (Cerambycidae, Coleoptera) during ontogenesis and possible causes of their occurrence

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Abstract

This paper describes for the first time cases of exogenous morphological anomalies that occur during rearing of *Callipogon relictus* Semenov, 1899 in a laboratory setting. The highest frequency of the anomalies has been observed during pupation. It can be assumed that in beetles of this group, at final stages of ontogenesis, some abiotic factors such as humidity and temperature play an important role.

Keywords

Callipogon relictus, Korean relict long-horned beetle, morphological abnormalities, teratology

Introduction

Morphological anomalies are common in different groups of insects but there occurrence is scarce. A detailed classification and terminology of morphological anomalies and teratism in beetles was proposed by J. Balazuc (1948). Later, different authors described cases of atypical body structures (mostly in imago) in many groups of insects: lice (Blagoveshenskiy 1969), weevils (Stachowiak 1982, Chadwick and Brunet 1985, Cmoluch 1985, Read 1994, Nazarenko 2006, 2014), ground beetles (Ferreira 2008, Kamal et al., 2008), road beetles (Frank 1981, Ferreira 2011), leaf beetles (Prisniy 1983, Abdullah and Abdullah 1969), hymenoptera (Balazuc 1958, Akre et al. 1982), as well as specimens obtained during laboratory breeding (Savini and Furth 2004). Some authors noted morphological anomalies in some representatives of the family Cerambycidae (Balazuc 1952, Floch de Gallaix 1974, Cofais 1976, Osuna 1992, Schneider &Thoma 2004, Rahola 2005). For adults of *Stictosomus semicostatus* Audinet-Serville, 1832, *Ctenoscelis ater* (Olivier, 1795), *Enoplocerus armillatus* (L., 1767), and *Acanthinodera cumingii* (Hope, 1833), cases of antennal aberrations and deformations of the pronotum and elytra were described (Thouvenot 2006, Vitali 2007). In most cases, the causes of developmental anomalies of various parts of the body are still unclear but, following the outcomes of these experiments, some outwardly similar anomalies may be a consequence of various environmental factors (Vasilieva 2005).

The purpose of this paper is to describe the cases of morphological anomalies identified in the preimaginal stages and adult of *Callipogon relictus* that have been bred in a laboratory setting.

Materials and methods

Specimens for this article were obtained during the course of elaboration of methods for laboratory breeding and maintenance of a rare representative of the family of long-horned beetles, *Callipogon relictus* Semenov, 1899, which is widespread in East Asia and is a rare and endangered species (Kim et al. 1976, Kuprin and Bezborodov 2012, Li et al. 2012, Kuprin 2016, Yi et al. 2017a). The elaborated methods of laboratory breeding of this species are detailed in our works (Kuprin et al. 2014, Yi et al. 2017b).

In addition, specimens collected in various habitats and species that are stored in the scientific institutions have been examined:

ZIN RAS	Zoological Institute of the Russian Academy of Sciences, St. Petersburg, Russia,
ZMMU	Zoological Museum of M.V. Lomonosov State University, Moscow, Russia,
IBSS FEB RAS	Institute of Biology and Soil Science, Far East Branch of the Russian Academy of Sciences, Vladivostok, Russia,

UNR FEB RAS	Ussuri Nature Reserve, Far East Branch of the Russian Academy of Sciences, Ussuriysk, Russia,
KU	Korea University, Seoul, South Korea,
YIM	Yangpyeong Insect Museum, Yangpyeong-gun, Gyeonggi-do, South Korea,
PHS	Paichai High School, Seoul, South Korea,
HRCI	Hampyeong Research Center of Insects, Hampyeong-gun, Junranam-do, South Korea,
IZAS	Institute of Zoology, Chinese Academy of Sciences, Beijing, China.

The collection of adults and preimaginal stages obtained by us in the laboratory is stored in the Center for the Study of Insects Ecology of Yeongwol Insect Museum, Yeongwol, Korea.

Results and discussion

As a result of the investigation, more than 200 specimens of *Callipogon relictus* adults collected in various habitats and approximately 120 specimens of preimaginal stages and adults obtained in a laboratory setting have been studied. The most common anomalies in adults, larvae, and pupae have been grouped and are presented in Figures 1–3.

Anomalies of larvae. In the specimens studied, annular anomalies were identified of the body segments (Figure 1) and in some cases, isolated indurations in the form of tumours formed after molting of the larva and associated with delayed sclerotization of the teguments. It can also be assumed that occurrence of these anomalies is due to activity of xylobiontic mites. Notably, after a certain time, the larvae shown in Figure 1 started to lose weight and eventually died.

Figure 1. Larvae of *Callipogon relictus* with various deformations of the teguments.

Anomalies of pupae and adults. Figures 2 and 3 show various complex anomalies of pupae and imago of *Callipogon relictus*. The most common anomaly in the adults (both in a laboratory setting and in nature) is the trematelytria, i.e., perforation of the elytra as a result of local necrosis of hypoderm before the formation of imaginal cuticle (Fig. 3). Similar cases are frequent in representatives of other groups of beetles, e.g., *Carabus cancellatus* Ill., *Silpha carinata* Hbst., *Silpha obscura* L., *Tenebrio molitor* L. (Prisniy 2009). There have been cases of brachelytria, i.e., shortening or reduction of the distal part, a decrease in the size of the elytra and, as a consequence, incomplete expansion of the elytra when the adult emerges. In a laboratory experiment, crossing of a male with brachelytria with a normal female led to development of larvae, which produced adult without morphological anomalies. In addition to the above-mentioned anomalies of the elytra, other deformities of the appendages of the body (mandibles, antennae, palps, and legs) have been found in adults (Fig. 3).

In the course of inspection of the collection material from the ZIN RAS, a dwarf specimen was found (1 male, Primorsky (Ussuriisky) krai, village of Yakovlevka, 23.VII.1926, D. Filipjev det.) with a body length of 3.18 cm. Dwarfism in insects can be caused both by exogenous factors (food deficiency and decrease in average temperatures and humidity during ontogenesis, population density) and endogenous factors (cumulative effect of many genes or pathologies of endocrine glands) (Wigglesworth 1967).

Figure 2. Pupae *C. relictus* with various deformations of teguments and limbs.

The nature of the described cases of morphological anomalies of *C. relictus*, as well as analysis of the literature data (Ortuño and Hernández 1993), suggest that they can occur in all representatives of the Prioninae. The most common deviations include all cases of deformation of elytra, perforation of elytra, disorder of innervation, and abnormalities of the legs (nearly 80% of the specimens studied). These investigations have shown that, as a rule, occurrence of such anomalies is caused by a change in the temperature and humidity regime or by mechanical damage to larvae and pupae (during biomorphological measurements).

It can be assumed that in natural conditions the occurrence of anomalies at the late stages of development of this species is also associated with a sharp change in the microclimate inside the pupal chamber built by instar-VI, or with a partial and complete destruction of the chamber by both animals and plants. In case of reduction in humidity, the pupal teguments dry up, which makes it difficult to release the adult from the exuvia residues and consequently, anomalies occur in total or partial deformation of the elytra, atrophy of the limbs, antennae and other appendages of the body. The increase in humidity, when the beetle has already been formed, leads to its death or damages to the integument in the process of sclerotization of the teguments in young

Figure 3. Adults of *C. relictus* with various developmental deformations of the body.

beetles and to the development of various hematomas and indurations in the form of tumors and warts in larvae. It should also be noted that in a laboratory setting, pupae undergo a rhythmic change in color (the chestnut brown color of the body becomes lighter or darker) if the humidity level changes. Spraying of pupae with distilled water leads to darkening of the teguments within 40–50 minutes, and when the moisture level decreases, the color of the body becomes lighter. This phenomenon can explain the presence of dark specimens of imago in some collections (Korean peninsula) in contrast to northeast China and the south of the Russian Far East where chestnut brown samples have been found.

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RESEARCH ARTICLE

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Hyboptera Chaudoir, 1872 of the Cryptobatida group of subtribe Agrina: A taxonomic revision with notes on their ways of life (Insecta, Coleoptera, Carabidae, Lebiini)

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Abstract

Hyboptera Chaudoir, 1872 of the Cryptobatida group of subtribe Agrina, Lebiini, living in the Neotropics and southernmost Nearctic realms are diagnosed, described, and illustrated, and new species are assigned to two inclusive species groups. Occurrences of species range from Texas, USA, to the state of Santa Caterina in Brazil. Seven new species of *Hyboptera* are described:

Hyboptera biolat Erwin & Henry, **sp. n.**; Type locality – Perú, Madre de Dios, Manu Reserved Zone, Río Manu, BIOLAT Biological Station, Pakitza; *Hyboptera vestiverdis* Henry & Erwin, **sp. n.**; Type locality – Perú, Madre de Dios, Manu Reserved Zone, Río Manu, BIOLAT Biological Station, Pakitza; *Hyboptera lucida* Henry & Erwin, **sp. n.**; Type locality – French Guiana, Cayenne, Commune de Roura, Montagne des Chevaux; *Hyboptera scheelea* Erwin & Henry, **sp. n.**; Type locality – Perú, Loreto, Pacaya-Samiria National Reserve, Río Samiria (South Branch), Camp Terry; *Hyboptera shasta* Erwin, **sp. n.**; Type locality – Brazil, Amazonas, north of Manaus on Amazonas 010 at Km 26, Reserva Ducke;

Hyboptera tepui Erwin & Henry, **sp. n.**; Type locality – Venezuela, Amazonas, Cerro de la Neblina, Río Baria Basecamp; *Hyboptera tiputini* Erwin & Henry, **sp. n.**; Type locality – Ecuador, Orellana, Yasuni National Park (edge), 95.43 km E (heading 101.46°) Coca, Tiputini Biodiversity Station. A revised identification key is provided to the genera of the Cryptobatida group and another to the species of *Hyboptera*

Chaudoir and distributional data are provided for all known species of the latter. Adults of these species often occur in the canopy of many tropical tree species and records are reported where known. In addition, adults are found under the webbing of Psocoptera and in fleshy anther rings of Bombacaceae (*Pseudobombax septenatum* (Jacq.) Dugand), on the rain forest floor in the dry season. Larval and pupal stages of one species from Panamá are known from under bark of living fence posts; however, these immature stages are not treated in the current paper.

Resumen

Hyboptera Chaudoir, 1872, del grupo Cryptobatida, perteneciente a la subtribu Agriina, Lebiini, viviendo en los Neotrópicos y en las áreas meridionales del Neártico se diagnostican, describen e ilustran y nuevas especies se asignan a dos grupo-especies inclusivos. La distribución de las especies recorre desde Texas, EE.UU., hasta el estado de Santa Caterina en Brasil. Siete nuevas especies de *Hyboptera* se describen:

Hyboptera biolat Erwin & Henry, **sp. n.**; Type locality – Perú, Madre de Dios, Manu Reserved Zone, Río Manu, BIOLAT Biological Station, Pakitza; *Hyboptera vestiverdis* Henry & Erwin, **sp. n.**; Type locality – Perú, Madre de Dios, Manu Reserved Zone, Río Manu, BIOLAT Biological Station, Pakitza; *Hyboptera lucida* Henry & Erwin, **sp. n.**; Type locality – French Guiana, Cayenne, Commune de Roura, Montagne des Chevaux; *Hyboptera scheelea* Erwin & Henry, **sp. n.**; Type locality – Perú, Loreto, Pacaya-Samiria National Reserve, Río Samiria (South Branch), Camp Terry; *Hyboptera shasta* Erwin, **sp. n.**; Type locality – Brazil, Amazonas, north of Manaus on Amazonas 010 at Km 26, Reserva Ducke;

Hyboptera tepui Erwin & Henry, **sp. n.**; Type locality – Venezuela, Amazonas, Cerro de la Neblina, Río Baria Basecamp; *Hyboptera tiputini* Erwin & Henry, **sp. n.**; Type locality – Ecuador, Orellana, Yasuni National Park (edge), 95.43 km E (heading 101.46°) Coca, Tiputini Biodiversity Station. Se provee una clave revisada para los géneros dentro del grupo Cryptobatida y otra para las especies del género *Hyboptera* Chaudoir y se incluye información sobre la distribución de todas las especies conocidas de éste último. Los adultos de estos comúnmente se encuentran en el dosel de muchas especies de árboles tropicales y registros se reportan cuando se conocen. Además, los adultos pueden estar debajo de las telas de sócidos y en los anteridios carnosos de los Bombacaceae (*Pseudobombax septenatum* (Jacq.) Dugand) en el suelo del bosque lluvioso. Las etapas de larva y pupa de una de las especies de Panamá se conocen viviendo debajo de la corteza de postes vivos de cercas; sin embargo, estos so se tratan en este artículo.

Keywords

Neotropics, Nearctic, Texas, Embioptera, Psocoptera, rain forest, *Hyboptera* Chaudoir, *Thoasia* Liebke, *Straneotia* Mateu

Palabras claves

Neotrópicos, Neártico, Texas, Embioptera, Psocoptera, bosque lluvioso, *Hyboptera* Chaudoir, *Thoasia* Liebke, *Straneotia* Mateu

Introduction

The Cryptobatida Group of Lebiini was proposed to include a number of genera including *Hyboptera* Chaudoir (Erwin 2004). This genus was treated most recently by Reichardt (1971, 1973) and those reports were brief and superficial, not full revisions. Before that, only five isolated species descriptions by Chaudoir, Reiche and Oberthür existed. Hence, this small group of very attractive and biologically interesting beetles requires an initial taxonomic revision. The purpose of this paper is to rapidly validate some new

species names (Erwin and Johnson 2000) with descriptions and provide more complete re-descriptions of known species, so that the group is available for further study, particularly their way of life in association with Psocoptera. *Hyboptera* are members of the Cryptobatida group by virtue of the structure of their mouthparts, elytral transverse depression, and the male genitalia with a flagellum. Herein, we provide full descriptions of all known taxa, including color images, an up-to-date map of their known distributions, and what is known of their ways of life including host tree species.

Methods and materials

(modified from Erwin and Zamorano 2014)

As noted in several past contributions, methods and species concepts follow those previously described (Erwin and Kavanaugh 1981; Kavanaugh and Erwin 1991). The species validation and diagnosis format follows as closely as possible that suggested in Erwin and Johnson (2000). For measurements, images of the specimens were taken using a Leica M420 stereoscope coupled to an EntoVision™ system. The resulting image was processed using the software Cartograph version 7.2.5 by Microvision Instruments. The magnification on the zoom was set to calibrate the system and it is embedded into the file of the image. The image was then opened with the software program Archimed version 6.1.4, also by Microvision, and the Measure tool was then used to determine the lengths of the various parts. A total of 239 images were obtained. Measurements of length (ABL, SBL) and width (TW) follow those of Ball (1972) and Kavanaugh (1979): ABL (apparent body length), measured from apex of labrum to apex of longer elytron (in adults of this genus, the abdomen often protrudes beyond the elytral apex, thus the ABL often is much larger that the SBL; SBL (standardized body length), equals the sum of the lengths of the head (measured from apex of clypeus to a point on midline at level of the posterior edge of compound eyes); PL (pronotum length) is measured from apical to basal margin along midline; LE (elytron length) is measured from apex of scutellum to apex of the longer elytron; TW (total width) is measured across both elytra at their widest point with suture closed; and WH (head width) is measured from extreme margin of protuberant eyes left to right. Note that not all specimens available were measured because more than 33 specimens were available, thus we limited "n" to 33 as a statistically valid sample size. Sexes were measured separately, we found slight differences among the species sexes, and hence we report measurements for both sexes in our Tables (see Appendix 1). For the *Hyboptera* treatment below, we provide relative size terms based on the SBL as follows: small-size < 3.3 mm, medium-size 3.3 mm to 4.3 mm, and large-size > 4.3 mm. For an explanation of the measurements and their incorporation in Appendix 1, see Erwin (2011) and Erwin and Ball (2011). For the present study, we report the harmonic mean, as we believe it better reflects the central tendency than the arithmetic mean.

Attributes of the abdominal ventral sterna are referred to using the numbering system generally accepted in carabid studies, i.e., the sternum divided medially by the hind

coxae is sternum II (the first being hidden) and the last visible is sternum VII (Liu et al. 2011). In a revision of the genus *Pericompsus* (Erwin 1974), a problem was encountered with the term "stria" for features of their punctate elytra (i.e., the so-called striae were *not* actually striae, rather they were rows of punctures). The result was the use of the term "interneur" to apply to the attribute lying between intervals. Through use of this term, one could describe the feature as interneur striate, punctate, striatopunctate, etc.

A similar problem exists for the proximal end of the median lobe of the male genitalia. In Snodgrass (1935), the term "phallobase" is used, and we have adopted it here (see Erwin 2011). Therefore, by extension, in Carabidae, we can say phallobase hooded (e.g., Lebiini, Pseudomorphini), phallobase of two parallel sclerotized struts (basal trechines and *Andinodontis*), phallobase of two uneven struts (*Bembidion*), etc. Kavanaugh (pers. comm.) points out that with struts there are still connecting membranes surrounding the struts forming a "bulb." We have chosen the aedeagal illustration of a male *H. angulicollis* Chaudoir (Fig. 5A) and *H. apollonia* Erwin (Fig. 10A) to display the identifying code letters and these apply to all illustrations of male genitalia of *Hyboptera* included.

This study includes 738 adult specimens of *Hyboptera*, all currently at the National Museum of Natural History, Washington, DC (NMNH) and, where appropriate, returned to their corresponding institutions upon publication. Among these specimens, some were received from:

AMNH	American Museum of Natural History, New York, NY, USA (Lee Herman)
BMNH	Natural History Museum, London, UK (Beulah Garner)
CAS	California Academy of Sciences, Berkeley, CA, USA (David H. Kavanaugh)
CMNH	Carnegie Museum of Natural History, Pittsburgh, PA, USA (Robert L. Davidson)
HESP	Henry Hespenheide Private Collection, Los Angeles, CA, USA (Henry Hespenheide)
IAvH	Instituto de Investigación de Recursos Biológicos, Alexander von Humboldt, Bogotá, Colombia (Arturo González)
INBIO	Instituto Nacional de Biodiversidad, Santo Domingo, Costa Rica (Angel Solis)
LACM	Los Angeles County Museum, Los Angeles, CA, USA (Brian V. Brown)
MCZ	Museum of Comparative Zoology, Harvard University, Boston, MA, USA (Philip Perkins)
MNHP	Muséum national d'Histoire naturelle, Paris, France (Thierry Deuve)
NBCL	Naturalis Bidiversity Center, Lieden, Netherlands (Luc Willemse)
OSU	C.A. Triplehorn Insect Collection, Ohio State University, Columbus, OH, USA (Charles A.Triplehorn)
SEMC	Snow Entomological Museum, University of Kansas, Lawrence, Kansas, USA (Zachary Falin)
UASM	EH Strickland Entomological Museum, University of Alberta, Edmonton, Canada (George E. Ball & Danny Shpeley)
UCD	Bohart Museum of Entomology, University of California, Davis, CA, USA (Lynn Kimsey)
UNMSM	Universidad Nacional Mayor de San Marcos, Lima, Perú (Gerardo Lamas)

Primary type specimens of new species will be deposited in their countries of origin if required by legal agreements, or museums of ownership at the conclusion of our studies on this tribe.

The enhanced habitus images of the adult beetles portray most of the character states referred to in the key provided. Illustrations of male genitalia are standard for descriptive taxonomy of carabid beetles in both preparation and aspects presented, as is the presentation of the female genitalia (one example per genus, in this case *H. lucida* sp. n.). The habitus images of the adults were made with a Visionary Digital™ high resolution imaging system rendered using Photoshop to become "Digital Photo-illustrations." Figure captions include an ADP number, which is a unique identification number for the specimen that was imaged and links the specimen and associated illustrations and/or images to additional information, such as collecting notes, in electronic databases at the NMNH.

Geographical data are presented for species based on all known specimens available at the time of manuscript preparation, including those in the literature. Georeferenced data have been determined from locality information provided on specimen labels; only those exact geo-references reported in decimal degrees that are provided on the label are placed in quotes. Otherwise, we have estimated others as closely as possible from places, mileage, or other locality data listed on the label and searched with Google Earth Pro. Latitude and longitude for those are reported in decimal degrees and have been corrected from those reported on the labels, if necessary; our bottom line is that georeferenced locality data reported herein are far more accurate than those provided on specimens labels.

A distribution map is provided for the species of *Hyboptera* (Fig. 11). Here, vernacular names in English are proposed, as common names are becoming increasingly needed in conservation reports and studies, and/or agricultural and forestry applications. These names are based on criteria set forth in Erwin (2011a) and applied in Erwin (2011b).

Host occurrences of rainforest trees are reported using the names provided by botanists who inventoried two fogging transects established by the senior author (TLE) in Ecuador. These names have not been elaborated with author names herein, as is traditional in botanical literature, however, they can be readily found on the internet.

Accounts of taxa

Tribe Lebiini, Subtribe Agrina, Cryptobatida Group

Diagnosis. Adults. Head ventrally without suborbital setigerous punctures, neck not markedly narrowed, except somewhat in *Thoasia*. Mandible widened near base, scrobe wide, lateral margin markedly rounded; dentition of occlusal margins reduced, typical for Lebiini (cf. Shpeley and Ball 2001: figs 6–9); palpi with ultimate articles subsecuriform or securiform, paraglossae broad, glabrous, adherent, extended to anterior angle of glossal sclerite. Elytron usually with transverse depression at anterior third, appearing deformed; penultimate setigerous puncture of elytron umbilicate series not

displaced laterally nor medially. Posterior tibial spurs subequal, their margins smooth; tarsomere 4 usually bilobed. Except in one genus (i.e., some species of *Aspasiola*), endophallus with flagellum [the absence from males of some species of *Aspasiola* species probably represents a reversal (secondary loss)].

Notes. Subtribe Agrina consists of those species formerly included in the Subtribe Calleidina (cf. Lorenz 2005). The Cryptobatida Group, by virtue of the attributes above, has the type genus *Cryptobatis* Eschscholtz. Many records of species in most genera refer to collections on fungus arrayed on sides or the bottom of fallen tree trunks. It is probable that the Cryptobatida Group contains many species whose adults are predators on other shelf fungus inhabitants (cf. Erwin and Erwin 1976, wherein adults and larvae of a species of *Eurycoleus*, which is a member of the subtribe Pericalina, are predaceous on fungal feeders; other pericalines are also associated with fungi). *Hyboptera* and its adelphotaxon *Hybopteroides* are exceptions (Erwin and Ball 2012), as the adults are likely predators on psocids and embiids beneath silken webs, respectively.

Below, we have added to the Cryptobatida Group the genus *Straneotia* Mateu 1961 by virtue of a study of new specimens collected by fogging and flight intercept traps (FIT) in Ecuador and French Guiana, respectively. Mateu erected this genus based on a single female specimen from eastern Amazonian Brazil (*Straneotia freyi* Mateu) and described a second species in the genus based on a single female from western Amazonian Brazil (*Straneotia amazonica* Mateu). These two species soon will be redescribed and the new species described (Erwin and Aldebron, in prep).

Key to the genera of the Cryptobatida Group, Subtribe Agrina (Lebiini)

(Enhanced from Erwin 2004 and Erwin and Ball 2012)

1	Elytron at basal third depressed, surface uneven, tuberculate or not, and/or margin of pronotum angulate or sub-angulate at mid-lateral setiferous pore, or tubular ..... **Cryptobatida Group**...**2**
1’	Elytron neither depressed nor tuberculate, surface smooth with normal interneurs and intervals (or interneurs effaced); side of pronotum evenly rounded ..... **Plochionida Group, Calleidida Group, Agrida Group**
2(1)	Elytron markedly tuberculate overall, or with a series of small setiferous tubercles on intervals 3 and 5, lateral marginal intervals without callus **3**
2’	Elytron without trace of discal tubercles; lateral marginal intervals with or without callus **6**
3(2)	Prothorax somewhat tubular, much narrower than head ....***Otoglossa* Chaudoir, 1872**
3’	Prothorax wider than head.....**4**
4(3’)	Sides of pronotum narrowly reflexed except at mid-lateral seta, there wide; neck well-defined, narrow; elytra metallic blue, fore-body all or mostly rufous..... ***Thoasia* Liebke, 1939**
4’	Sides of pronotum broad and margins broadly reflexed throughout; neck broad; color otherwise.....**5**

5(4') Elytron with numerous tubercles on at least three intervals; head dorsum transversely rugose; side margins of pronotum subtly angulate or not; labrum large, broadly bilobed; tarsomere 4 bilobed..... ***Hyboptera*** **Chaudoir, 1872**

5' Elytron not tuberculate; head dorsum longitudinally strigose (wrinkled); side margins of pronotum markedly angulate; labrum normal, rectangulate, slightly emarginate or truncate apically; tarsomere 4 not bilobed ..... ***Hybopteroides*** **Erwin & Ball, 2012**

6(2') Antennomere 4 glabrous except for apical ring setae **7**

6' Antennomere 4 multisetiferous from basal third to apex, in addition to apical ring setae **8**

7(6) Elytron laterally with callus at apical third; male endophallus without flagellum..... ***Valeriaaschero*** **Erwin, 2004**

7' Elytron laterally without callus at apical third; male endophallus with or without flagellum..... ***Aspasiola*** **Chaudoir, 1877**

8 (6') Head markedly narrow, elongate, and tubular; eyes more or less flat ..... ***Straneotia*** **Mateu, 1961**

8' Head normal with large hemispheric eyes **9**

9(8') Head and pronotum densely and evenly punctate..... ***Cylindronotum*** **Putzeys, 1845**

9' Head and pronotum smooth **10**

10 (9') Pronotum with lateral margin narrowly reflexed from base to apex ..... ***Pseudotoglossa*** **Mateu, 1961**

10' Pronotum with lateral margin moderately or markedly reflexed from base to apex **11**

11(10') Elytron laterally at apical third with large callus ..... ***Cryptobatis*** **Eschscholtz, 1829**

11' Elytron laterally at apical third without callus ..... ***Onota*** **Chaudoir, 1872**

Hyboptera **Chaudoir, 1872**

Humps-backed beetles

Figs 1–11

Hyboptera Chaudoir, 1872: 161. Type species: *Hyboptera angulicollis* Chaudoir, 1872: 164, designated by Reichardt (1973:50).

Aspasia Reiche, 1842: 310 (not Dejean 1831). Type species: *Aspasia verrucosa* Reiche, 1842: 310. Synonymized by Chaudoir 1872: 161.

Diagnosis. (cf. Figs 1–10). Neck broad; eyes very large, hemispherical; frons markedly rugose, more or less anteriorly depressed. Prothorax wider than head; sides of pronotum broadly reflexed throughout, rounded or subangulate at mid-lateral setigerous pore. Elytron at basal third very slightly transversely depressed, surface uneven, markedly tuberculate overall. Flight wings of a dusky color. Basitarsus of mid and hind legs markedly elongate, coequal to length of tarsomeres 2-5 combined; males with adhesive

setae on tarsomeres 1–3. Endophallus with flagellum; flagellum extruded at apex in many specimens.

Dispersal potential. The wings are fully developed in adults of all known species, thus it is likely these beetles are moderate to strong flyers.

Geographic distribution. A widespread southern Nearctic and Neotropical genus known from Texas, USA, south to southeastern Brazil, in the west to Bolivia, and east to French Guiana.

Ways of life. Much is known about the species in this genus and that is reported here for the first time. Adults of various species are regularly collected in both the wet and dry seasons using insecticidal fogging techniques in many species of trees reaching the forest canopy in the Amazon Basin, thus they are certainly mainly arboreal. They are good flyers as evidenced by their capture in Malaise traps, C.D.C. mosquito traps, FITs, and at different types of light traps. At Barro Colorado Island in Panamá, one of us (TLE) collected adults from the forest floor amongst the large shed anther rings of trees of the species *Pseudobombax septenatum* (Jacq.) Dugand; these rings being a moisture source on the forest floor during the dry season (Erwin 1991, 2004). Warren E. Steiner collected several larvae and pupae along with emerging adults of *Hyboptera verrucosa* (Reiche) under bark of a living fence post in Panamá. These immature stages have yet to be described and illustrated (Erwin and Steiner, in prep).

Notes. Five species have been previously described in this genus, along with three species in its adelphotaxon, *Hybopteroides* Erwin & Ball, 2012. Apparently, Lorenz (1998) was unaware of the Reichardt (1973) paper designating a type species (*H. angulicollis* Chaudoir) for the genus and unnecessarily designated *H. tuberculata* (Dejean), as the type species. The former stands.

Included species. The species list below, as well as the arrangement of descriptions that follows, is ordered alphabetically within two species groups.

angulicollis species group

Hyboptera angulicollis Chaudoir, 1872:164; Brazil – Pará; Colombia; Ecuador; French Guiana; Perú; Suriname.
Hyboptera biolat Erwin & Henry, **sp. n.**; Perú.
Hyboptera vestiverdis Henry & Erwin, **sp. n.**; Ecuador; Perú.
Hyboptera scheelea Erwin & Henry, **sp. n.**; Perú.
Hyboptera shasta Erwin, **sp. n.**; Brazil – Amazonas.
Hyboptera tepui Erwin & Henry, **sp. n.**; Venezuela.
Hyboptera tiputini Erwin & Henry, **sp. n.**; Colombia; Ecuador; Perú.
Hyboptera viridivittis Chaudoir, 1872:164; Brazil – Minas Gerais, Rio de Janeiro, Santa Catarina.

***tuberculata* species group**

Hyboptera apollonia Erwin, 2004: 33; Costa Rica; Panamá.
Hyboptera auxilidora Erwin, 2004: 35; Costa Rica; Honduras; México – VC; Panamá, USA – TX.
Hyboptera dilutior Oberthür, 1884: 52; Brazil – Amazonas, Pará, Rondônia; Ecuador; French Guiana; Perú; Venezuela.
Hyboptera lucida Henry & Erwin, **sp. n.**; Ecuador; French Guiana.
Hyboptera tuberculata (Dejean), 1825: 272; Bolivia; Brazil – Amazonas, Sergipe; Colombia; Ecuador; Guyana; French Guiana; Perú; Suriname.
Hyboptera verrucosa (Reiche), 1842: 311; Brazil – Amazonas; Colombia; Ecuador; French Guiana; Panamá; Perú; Suriname; Trinidad and Tobago; Venezuela.

Accounts of taxa

Key to the species of *Hyboptera* Chaudoir, 1872

1	Adults with only dark non-metallic markings on the pronotal disc **2**
1’	Adults with patches of bright metallic green para-medially on pronotum....**7**
1”	Adults without or with only slightly darker, non-metallic pronotal marking ...**11**
2(1)	Pronotum with discal rugae etched horizontally and linear (Fig. 6A) .... ***H. apollonia* Erwin**
2’	Pronotum with discal rugae etched at an angle aimed medio-posteriorly, or somewhat chaotically without clear order.....**3**
3(2’)	Elytra black with 4 small medio-apical tubercles pale (Fig. 7B) .... ***H. lucida* Henry & Erwin, sp. n.**
3’	Elytra mostly testaceous or pale brownish with darkly marked tubercles; small medio-apical tubercles pale or not.....**4**
4(3’)	Elytron with sutural margin at apical sixth black markedly contrasting with testaceous background color (Fig. 7A).....***H. dilutior* Oberthür**
4	Elytron with sutural margin at apical sixth pale, not black, if brownish not contrasting with background color.....**5**
5(4’)	Elytron just posterior to scutellum with only the suture pale in color otherwise markedly infuscate (Fig. 9A).....***H. tuberculata* (Dejean)**
5’	Elytron just posterior to scutellum with a V-shaped pale area encompassing the suture and the first interval **6**
6(5’)	Elytron narrow, almost parallel sided. Distribution from Panamá south into the Amazon Basin and across to French Guiana and Trinidad & Tobago (Fig. 9B) .....***H. verrucosa* (Reiche)**
6’	Elytron broad with markedly arcuate lateral margin. Distribution from Panamá north to southernmost Texas (Fig. 6B) .....***H. auxilidora* Erwin**

7(1') Elytra entirely metallic bronzy-green **8**
7' Elytra dark matte black or dark and markedly shiny, some individuals with hint of metallic green spots near basal margin **9**
8(7) Venter with meso- and metathorax mostly infuscated (Fig. 1B) ..... ***H. biolat* Erwin & Henry, sp. n.**
8' Venter entirely rufotestaceous (Fig. 1A) ..... ***H. angulicollis* Chaudoir**
9(7') Elytra dark matte black (Fig. 4B) ..... ***H. viridivittis* Chaudoir**
9' Elytra markedly shiny **10**
10(9') Elytron violaceous, broad; meso- and metathorax pale not contrasting with pale abdomen (Fig. 4A) ..... ***H. tiputini* Erwin & Henry, sp. n.**
10' Elytron dark olivaceous, narrow; meso- and metathorax infuscated, markedly contrasting with pale abdomen (Fig. 2A) ..... ***H. vestiverdis* Henry & Erwin, sp. n.**
11(1") Elytron with lateral margin broadly testaceous from humerus to sutural apex; apical abdominal tergite testaceous with slight infuscation at extreme posterior-lateral corners (Fig. 3B) ..... ***H. tepui* Erwin & Henry, sp. n.**
11'. Elytron with lateral margin narrowly testaceous to latero-apical corner, not reaching sutural apex; apical abdominal tergite mostly infuscated with narrow median testaceous stripe **12**
12(11') Elytra brilliant metallic green throughout, size larger (Fig. 3A) ..... ***H. shasta* Erwin, sp. n.**
12'. Elytra blackish-blue with metallic green highlights across the humeri and green points at some larger tubercles (Fig. 2B) ..... ***H. scheelea* Erwin & Henry, sp. n.**

angulicollis species group

(recognized by Reichardt 1973)

The most distinctive attribute of species in this group is that the pronotum has marked discal rugae etched almost horizontally and linear, as opposed to angulate. Adults of all have metallic green coloration somewhere on the dorsal surface and the general adult size is small to medium for the genus. Male phallus apex elongate, somewhat acuminate.

Hyboptera angulicollis Chaudoir, 1872

Angled-neck humps-backed beetle
Figs 1A, 5A, 11

Hyboptera angulicollis Chaudoir, 1872: 164.

Holotype. Sex unknown. **Brazil**, Amazonas, Ega (Tefé), (HW Bates)(MNHP). Not seen by us; however, we have seen a "homotype" labelled by George E. Ball who studied the holotype in Paris.

Derivation of specific epithet. The epithet, *angulicollis*, is a Latinized singular feminine adjective meaning "angled neck" referring to the angulate lateral sides of the pronotum.

Proposed english vernacular name. Angled-neck humps-backed beetle.

Diagnosis. With the attributes of the genus and *angulicollis* species group as described above and adults with patches of bright metallic green para-medially on pronotum, elytra entirely with metallic green reflection, and venter entirely rufotestaceous.

Description. (Figs 1A, 5A). *Size*: See Appendix 1. Length (SBL) long for genus, ABL = 3.943–4.800 mm, SBL = 3.34–4.15 mm, TW = 1.92–2.53 mm.

Color: See diagnosis, above.

Luster: Metallic highlights, partially iridescent.

Microsculpture: Mostly isodiametric or slightly stretched, well-impressed, cells somewhat more stretched around elytral tubercles.

Head: Rugae moderately coarse, mostly transverse. Eye very large, sub-hemispheric, and evenly rounded anteriorly, subtly more prolonged posteriorly. Antenna short, barely reaching humerus. Labrum rectangulate, shallowly bilobed, anterior margin slightly emarginate. Neck finely transversely rugose.

Prothorax: Pronotum moderately broad, disc centrally planar with dense transverse rugae. Lateral margins broadly explanate and obtusely angled medially then subtly arcuate to broadly obtuse hind angle, base medially produced and rounded posteriorly.

Pterothorax: Normal for Agrina, fully winged. Elytron intervals 3 with 6, and 5 with 5 (4) discal unisetiferous tubercles, other intervals moderately convex, side margin moderately explanate laterally only at middle third. Elytron broad and moderately short, moderately narrower than the pronotum at the broadest part, apex truncate, slightly rounded with distal corner broadly and obtusely rounded, disc not significantly convex, basal third slightly depressed. All interneurs well-impressed.

Legs: Femur dorso-ventrally moderately depressed, tibia coequal in length, more depressed; tarsus less than half the length of the tibia, fourth tarsomere markedly bilobed and with tarsal pad of setae.

Abdomen: Sparsely setiferous; normal ambulatory setae on sterna 3–5; female with two pairs of ambulatory setae on sternum 6, medial pair of setae less than the length of lateral pair; males with only the lateral pair of longer setae on sternum 6.

Male genitalia: Phallus (Fig. 5A) with ostium of 1/5 its length, catopic, apex long, narrowly rounded; endophallus with flagellum (not obvious in illustration), flagellum not barbed. Parameres asymmetric, right very small, left larger.

Female genitalia: Not investigated, likely similar to that of *H. lucida* (Fig. 8).

Variation: In the large series of specimens of this species available to us for this study from many localities, we noted that the pronotal explanate margins vary considerably in width, the more narrow they are the more prominent the midpoint angle, the broader the explanation the more obtuse the midpoint angle.

Dispersal potential. These beetles are macropterous and capable of flight. They are moderately swift and agile runners. Specimens have been acquired using most modern collecting methods, including insecticidal foggings, UV light sheets and traps, Malaise traps, SLAM Malaise traps, and flight intercept traps (FITs).

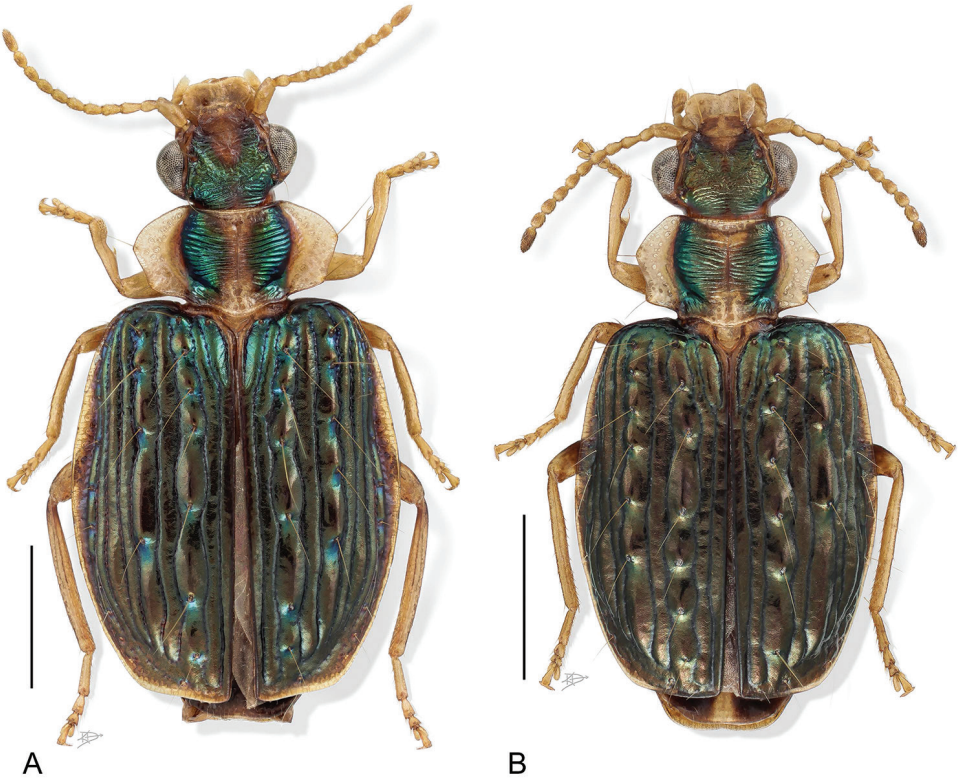

Figure 1. Digital Photo-illustration. Habitus, dorsal aspect. **A** *Hyboptera angulicollis* Chaudoir, female, ADP052729 **B** *Hyboptera biolat* Erwin & Henry, sp. n., female, ADP007398.

Way of life. Adults are common in the lowlands (8 to 700 m a.s.l.) and appear to be generalists in a variety of rainforest biotopes including terra firme, várzea, igapó, second growth, subtropical moist and white sand forests. In these forests, they are commonly found in big trees with vines and epiphytes, in suspended dry leaves, under lianas close to the trunk, in dry *Scheelea* sp. and *Astrocaryum chambira* Burret palm fronds, in very large suspended dry *Cecropia* leaves, and in dry bamboo leaves of the genera *Guadua* [*G. weberbaueri* Pilg.] and *Elytrostachys* [sp.] Individuals can be found in all months of the year, in both the rainy and dry seasons. Member of this species have been recorded from the canopy of the following tree species using insecticidal fogging techniques: *Allophyllus* sp.; *Pourouma bicolor* ssp. *bicolor* cf., *Pourouma cecropiifolia* aff., *Pourouma mollis* ssp. *triloba* cf.; *Virola obovate*, *Virola decorticans* cf.; *Brosimum utile* ssp. *ovatifolium* cf., *Aspidosperma darienense* cf.; *Crepidospermum rhoifolium*; *Castilla ulei* cf.; *Pseudolmedia laevis*, *Pseudolmedia macrophylla* cf.; *Hymenaea oblongifolia*; *Matisia malacocalyx* cf.; *Oenocarpus bataua*; *Siparuna decipiens*; *Trattinnickia rhoifolia* var. *lancifolia* cf.; *Cecropia herthae*, *Cecropia ficifolia*; *Pentagonia spathicalyx* cf.; *Pouteria reticulata* ssp. *reticulata* cf., *Pouteria cuspidata* ssp. *robusta* cf., *Pouteria baehniana* cf., *Pouteria rostrata* aff. añangu; *Gustavia longifolia*; *Leonia glycicarpa*; *Protium sagotianum*

cf., *Protium nodulosum* cf.; *Sloanea cordia*; *Iriartea deltoidea*; *Browneopsis ucayalina*; *Eschweilera coriacea* cf., *Eschweilera juruensis* cf.; *Batocarpus orinocensis* cf.; *Pachira aquatica* cf.; *Sarcaulus brasiliensis* aff. burnt; *Blakea* sp. 1; *Parkia multijuga* cf.; *Swartzia león*; *Rhodostemonodaphne kunthiana* cf.; *Nectandra* sp. 1, *Nectandra crassiloba* cf.; *Inga olivaceae*, *Inga capitate*, *Inga bourgonii* cf., *Inga cuadra*; *Rinorea viridifolia*; *Talisia* bitter; *Coussapoa orthoneura* cf., *Coussapoa herthae*; *Aspidosperma darienense* cf.; *Vismia* weedy; *Astrocaryum chambira*; *Tabebuia moby*; *Wittmackanthus stanleyanus* cf.; *Alchornea triplinervia* cf.; *Maquira calophylla*; *Trichilia elsae* cf., *Trichilia solitudinis*; *Trichilia solitudinis*; *Simira cordifolia*/*rubescens* cf.; *Catatola costaricana* aff.; *Brownea grandiceps* cf.; *Pausandra trianae*; *Micropholis venulosa* cf.; *Sagotia racemosa*; *Diospyros sericea*; *Guarea silvatica*; *Sorocea pubivena* ssp. *oligotricha* cf.; *Grias neuberthii*; *Simaba guianensis* cf.; *Tapura peruviana* cf.; *Neea* dive-tuberculate; *Semaphyllanthe megistocaula* cf., *Semaphyllanthe garcinia macrophylla* cf.; *Guatteria* sp. 3, sect.; *Meiocarpus*, long petiole.

Other specimens examined. **Brazil**, Pará, Belém, Mocambo, 1.555°S, 48.429°W, 25m, 10 January 1978 (NMNH: ADP007291, female), 20 May 1978 (NMNH: ADP007290, female), 23 June 1978 (NMNH: ADP007289, female). **Colombia**, Amazonas, PNN Amacayacu, February 1989 (M Kelsey)(IAvH: IAvH-E-2434, ADP145214, IAvH-E-2435, ADP145200, males), IAvH-E-2436, ADP145206, IAvH-E-2437, ADP145202, IAvH-E-2438, ADP145204, IAvH-E-73774, ADP145210, females), 100m, July 1988 (M Kelsey)(IAvH: IAvH-E-40649, ADP145215, female), 100m, 19 January 1998 (A Alvarado)(IAvH: IAvH-E-2439, ADP145217, female), 150–200m, 31 August 1997 (D Campos)(IAvH: IAvH-E-73773, ADP145149, male), 1 September 1997 (D Campos, F Fernandez)(IAvH: IAvH-E-73773, ADP145147, male, IAvH-E-2442, ADP145191, female), Boca Caño Matamata, 3.3839°S, 70.0999°W, 150m, 30 August 1997 (Brown, G Kung)(IAvH: IAvH-E-2441, ADP145209m, female), Caño Matamata, 3°23'S, 070°06'W, 150m, 11-17 December 2000 (A Parente)(IAvH: IAvH-E-3534, ADP145195, male), San Martin, 3.776°S, 070.301°W, 80m, 22-30 April 2000 (B Amado)(IAvH: IAvH-E-73757, ADP145189, female), 2-7 July 2000 (B Amado)(IAvH: IAvH-E-73763, ADP145211, female), 13-21 December 2000 (B Amado)(IAvH: IAvH-E-3533, ADP145197, female), Caquetá, Florencia, Santa Rosita, 01°20'N, 076°6'W, 600m, 7-22 July 2000 (E González)(IAvH: IAvH-E-2284, ADP145160, IAvH-E-40757, ADP145162, males), 22 July - 4 August 2000 (F Ruales)(IAvH: IAvH-E-73770, ADP145164, female), PNN Chiribiquete, Puerto Abeja, 00°4'N, 072°26'W, 310m, 29 October - 12 November 2000, M Ospina, E González)(IAvH: IAvH-E-2699, ADP145167, IAvH-E-73765, ADP145156, IAvH-E-73766, ADP145158, females), PNN Chiribiquete, Puerto Solano, 00°12'N, 072°25'W, 300m, 19-22 February 2001 (M Ospina, E González)(IAvH: IAvH-E-73771, ADP145198, male), 26 February - 3 March 2001 (M Ospina, E González)(IAvH: IAvH-E-73772, ADP145192, female), 12-19 November 2000 (J Forero)(IAvH: IAvH-E-73767, ADP145172, female), PNN Chiribiquete, Rio Cuñare, 00°30'N, 072°37'W, 300m, 1-4 November 2000 (E González, M Ospina)(IAvH: IAvH-E-73760, ADP145144, female), 1-5 November 2000 (E González, M Ospina)(IAvH: IAvH-E-73768, ADP145150, male), Meta, 8

km SW San Jaun de Arama, 4.2242°S, 69.9449°W, 70m, 27 July 2015 (Jäch) (NMNH, ADP140534, female), Nariño, Territoio Kofan, Orito, 0.499°N, 77.216°W, 700m, 28 September 1998 (E González)(IAvH: IAvH-E-2440, ADP145146, male). **Ecuador**, Napo, Tena, 0.989°S, 77.812°W, 500m, 22 -27 May 1987 (BV Brown)(LACM: ADP006159, male), Orellana, Reserva Ethnica Huaorani, 39 km S Pompeya, Estación Científica Yasuní - Onkone Gare Camp, Erwin Piraña Plot: transect 6, station 2, 0.6561°S, 76.4483°W, 220-250m, 15 January 1994 (TL Erwin, et al.)(NMNH: ADP138234, male), Erwin Piraña Plot: transect 4, station 8, 0.6570°S, 76.4498°W, 220-250m, 16 January 1994 (TL Erwin, et al.) (NMNH: ADP135890, female), Erwin Piraña Plot: transect 7, station 9, 0.6556°S, 76.4475°W, 220-250m, 20 January 1994 (TL Erwin, et al.)(NMNH: ADP135903, male), Erwin Piraña Plot: transect 7, station 6, 0.6556°S, 76.4475°W, 220-250m, 20 January 1994 (TL Erwin, et al.)(NMNH: ADP135905, males), Erwin Piraña Plot: transect 8, station 1, 0.6551°S, 76.4403°W, 220-250m, 24 January 1994 (TL Erwin, et al.)(NMNH: ADP138676, male), Erwin Piraña Plot: transect 8, station 6, 0.6551°S, 76.4403°W, 220-250m, 24 January 1994 (TL Erwin, et al.)(NMNH: ADP135960, male), Erwin Piraña Plot: transect 4, station 9, 0.6570°S, 76.4498°W, 220-250m, 25 June 1994 (TL Erwin, et al.)(NMNH: ADP135968, female), Erwin Piraña Plot: transect 5, station 10, 0.6566°S, 76.4490°W, 220-250m, 25 June 1994 (TL Erwin, et al.)(NMNH: ADP135978, male), Erwin Piraña Plot: transect 2, station 2, 0.6556°S, 76.4475°W, 220-250m, 20 June 1994 (TL Erwin, et al.)(NMNH: ADP135899, ADP135984, males), Erwin Piraña Plot: transect 10, station 6, 0.6540°S, 76.4453°W, 220-250m, 29 June 1994 (TL Erwin, et al.)(NMNH: ADP135958, male), Erwin Piraña Plot: transect 8, station 5, 0.6551°S, 76.4403°W, 220-250m, 21 June 1994 (TL Erwin, et al.)(NMNH: ADP135956, male), Erwin Piraña Plot: transect 9, station 9, 0.6545°S, 76.4460°W, 220-250m, 21 June 1994 (TL Erwin, et al.)(NMNH: ADP135909, female), Erwin Piraña Plot: transect 10, station 10, 0.6540°S, 76.4453°W, 220-250m, 29 June 1994 (TL Erwin, et al.) (NMNH: ADP135904, female), Erwin Piraña Plot: transect 1, station 10, 0.6586°S, 76.4521°W, 220-250m, 3 July 1994 (TL Erwin, et al.)(NMNH: ADP135791, male, ADP135856, female), Erwin Piraña Plot: transect 1, station 8, 0.6586°S, 76.4521°W, 220-250m, 4 October 1994 (TL Erwin, et al.)(NMNH: ADP135895, female), Erwin Piraña Plot: transect 2 station 7, 0.6581°S, 76.4513°W, 220-250m, 4 October 1994 (TL Erwin, et al.)(NMNH: ADP135893, male), Erwin Piraña Plot: transect 10, station 10, 0.6540°S, 76.4433°W, 220-250m, 6 October 1994 (TL Erwin, et al.) (NMNH: ADP137733, female), Erwin Piraña Plot: transect 8, station 10, 0.6551°S, 76.4403°W, 220-250m, 7 October 1994 (TL Erwin, et al.)(NMNH: ADP006160, females), Erwin Piraña Plot: transect 5, station 7, 0.6566°S, 76.4490°W, 220-250m, 9 October 1994 (TL Erwin, et al.)(NMNH: ADP135907, female), Erwin Piraña Plot: transect 4, station 10, 0.6570°S, 76.4498°W, 220-250m, 10 October 1994 (TL Erwin, et al.)(NMNH: ADP137736, female), Erwin Piraña Plot: transect 9, station 4, 0.6545°S, 76.4460°W, 220-250m, 8 February 1995 (TL Erwin, et al.)(NMNH: ADP135972, male), Erwin Piraña Plot: transect 9, station 10, 0.6545°S, 76.4460°W,

220-250m, 8 February 1995 (TL Erwin, et al.)(NMNH: ADP135944, male, ADP135936, female), Erwin Piraña Plot: transect 10, station 3, 0.6540°S, 76.4473°W, 220-250m, 8 February 1995 (TL Erwin, et al.)(NMNH: ADP135942, male), Erwin Piraña Plot: transect 2, station 8, 0.6581°S, 76.4513°W, 220-250m, 9 February 1995 (TL Erwin, et al.)(NMNH: ADP137846, female), Erwin Piraña Plot: transect 6, station 10, 0.6561°S, 76.4483°W, 220-250m, 9 February 1995 (TL Erwin, et al.) (NMNH: ADP137357, female), Erwin Piraña Plot: transect 7, station 8, 0.6556°S, 76.4475°W, 220-250m, 10 February 1995 (TL Erwin, et al.)(NMNH: ADP137740, male), Erwin Piraña Plot: transect 4, station 2, 0.6566°S, 76.4490°W, 220-250m, 11 February 1995 (TL Erwin, et al.)(NMNH: ADP137379, male, ADP137339, female), Erwin Piraña Plot: transect 4, station 7, 0.6570°S, 76.4498°W, 220-250m, 3 July 1995 (TL Erwin, et al. (NMNH: ADP006172, female), Erwin Piraña Plot: transect 3, station 9, 0.6566°S, 76.4490°W, 220-250m, 6 October 1995 (TL Erwin, et al.) (NMNH: ADP135952, male), Erwin Piraña Plot: transect 5, station 7, 0.6566°S, 76.4490°W, 220-250m, 6 October 1995 (TL Erwin, et al.)(NMNH: ADP137325, ADP137373, males, ADP137365, female), Erwin Piraña Plot: transect 6, station 1, 0.6561°S, 76.4483°W, 220-250m, 6 October 1995 (TL Erwin, et al.)(NMNH: ADP137327, female), Erwin Piraña Plot: transect 6, station 6, 0.6561°S, 76.4483°W, 220-250m, 6 October 1995 (TL Erwin, et al.)(NMNH: ADP137391, female), Erwin Piraña Plot: transect 6, station 10, 0.6561°S, 76.44838°W, 220-250m, 6 October 1995 (TL Erwin, et al.)(NMNH: ADP137375, female), Erwin Piraña Plot: transect 8, station 7, 0.6551°S, 76.4403°W, 220-250m, 7 October 1995 (TL Erwin, et al.) (NMNH: ADP135988, female), Erwin Piraña Plot: transect 9, station 8, 0.6545°S, 76.4460°W, 220-250m, 8 October 1995 (TL Erwin, et al.)(NMNH: ADP135982, male), Erwin Piraña Plot: transect 9, station 9, 0.6545°S, 76.4460°W, 220-250m, 8 October 1995 (TL Erwin, et al.)(NMNH: ADP135946, male), Erwin Piraña Plot: transect 10, station 2, 0.6540°S, 76.4453°W, 220-250m, 8 October 1995 (TL Erwin, et al.)(NMNH: ADP135938, male, ADP135948, female), Erwin Piraña Plot: transect 10, station 4, 0.6540°S, 76.4453°W, 220-250m, 8 October 1995 (TL Erwin, et al.)(NMNH: ADP135966, male), Erwin Piraña Plot: transect 10, station 5, 0.6540°S, 76.4453°W, 220-250m, 8 October 1995 (TL Erwin, et al.)(NMNH: ADP135964, female), Erwin Piraña Plot: transect 2, station 3, 0.6581°S, 76.4513°W, 220-250m, 9 October 1995 (TL Erwin, et al.)(NMNH: ADP135915, male), Erwin Piraña Plot: transect 2, station 7, 0.6581°S, 76.4513°W, 220-250m, 4 February 1996 (TL Erwin, et al.)(NMNH: ADP137696, male), Erwin Piraña Plot: transect 2, station 8, 0.6581°S, 76.4513°W, 220-250m, 4 February 1996 (TL Erwin, et al.)(NMNH: ADP135980, female), Erwin Piraña Plot: transect 4, station 6, 0.6576°S, 76.4498°W, 220-250m, 5 February 1996 (TL Erwin, et al.)(NMNH: ADP136473, male), Erwin Piraña Plot: transect 6, station 8, 0.6561°S, 76.4483°W, 220-250m, 7 February 1996 (TL Erwin, et al.)(NMNH: ADP137329, female), Erwin Piraña Plot: transect 10, 0.6586°S, 76.4521°W, 220-250m, 13 February 1996 (TL Erwin, et al.)(NMNH: ADP147731, male), Erwin Piraña Plot: transect 4, station 7, 0.6570°S, 76.4498°W, 220-250m, 21 June 1996 (TL Erwin, et al.)(NMNH: ADP137363, male), Erwin

Piraña Plot: transect 9, station 4, 0.6570°S, 76.4498°W, 220-250m, 21 June 1996 (TL Erwin, et al.)(NMNH: ADP137343, male), Erwin Piraña Plot: transect 5, station 3, 0.6566°S, 76.4490°W, 220-250m, 22 June 1996 (TL Erwin, et al.)(NMNH: ADP137345, male), Erwin Piraña Plot: transect 5, station 9, 0.6566°S, 76.4490°W, 220-250m, 22 June 1996 (TL Erwin, et al.)(NMNH: ADP137347, male), Erwin Piraña Plot: transect 6, station 9, 0.6561°S, 76.4483°W, 220-250m, 22 June 1996 (TL Erwin, et al.)(NMNH: ADP137688, female), Erwin Piraña Plot: transect 9, station 7, 0.6545°S, 76.4460°W, 220-250m, 23 June 1996 (TL Erwin, et al.)(NMNH: ADP137744, male, ADP137742, female), Erwin Piraña Plot: transect 9, station 9, 0.6595°S, 76.4460°W, 220-250m, 23 June 1996 (TL Erwin, et al.)(NMNH: ADP137734, male), Erwin Piraña Plot: transect 1, station 3, 0.6586°S, 76.4521°W, 220-250m, 25 June 1996 (TL Erwin, et al.)(NMNH: ADP137748, male), Erwin Piraña Plot: transect 1, station 10, 0.6586°S, 76.4521°W, 220-250m, 30 September 1996 (TL Erwin, et al.)(NMNH: ADP137331, ADP137359, males), Erwin Piraña Plot: transect 2, station 7, 0.6581°S, 76.4513°W, 220-250m, 30 September 1996 (TL Erwin, et al.)(NMNH: ADP137361, female), Erwin Piraña Plot: transect 8, station 7, 0.6561°S, 76.4483°W, 220-250m, 2 October 1996 (TL Erwin, et al.)(NMNH: ADP135928, male), Erwin Piraña Plot: transect 7, station 3, 0.6566°S, 76.4490°W, 220-250m, 3 October 1996 (TL Erwin, et al.)(NMNH: ADP135913, male), Erwin Piraña Plot: transect 8, station 5, 0.6551°S, 76.4403°W, 220-250m, 3 October 1996 (TL Erwin, et al.)(NMNH: ADP135920, male), Erwin Piraña Plot: transect 8, station 10, 0.6551°S, 76.4403°W, 220-250m, 3 October 1996 (TL Erwin, et al.) (NMNH: ADP137385, male, ADP137367, female), Erwin Piraña Plot: transect 9, station 5, 0.6545°S, 76.4460°W, 220-250m, 4 October 1996 (TL Erwin, et al.) (NMNH: ADP137351, female), Erwin Piraña Plot: transect 5, station 2, 0.6566°S, 76.4490°W, 220-250m, 6 October 1996 (TL Erwin, et al.)(NMNH: ADP135862, female), Erwin Piraña Plot: transect 4, station 7, 0.6570°S, 76.4498°W, 220-250m, 20 January 2006 (TL Erwin, et al.)(NMNH: ADP133848, female), Erwin Piraña Plot: transect 5, station 1, 0.6566°S, 76.4490°W, 220-250m, 20 January 2006 (TL Erwin, et al.)(NMNH: ADP133854, female), Erwin Piraña Plot: transect 8, station 4, 0.6556°S, 76.4475°W, 220-250m, 28 January 2006 (TL Erwin, et al.)(NMNH: ADP133866, male), Erwin Piraña Plot: transect 1, station 1, 0.6586°S, 76.4421°W, 220-250m, 7 July 2006 (TL Erwin, et al.)(NMNH: ADP133856, male), Erwin Piraña Plot: transect 1, station 2, 0.6586°S, 76.4421°W, 220-250m, 7 July 2006 (TL Erwin, et al.)(NMNH: ADP133858, male), Erwin Piraña Plot: transect 6, station 7, 0.6561°S, 76.4483°W, 220-250m, 9 July 2006 (TL Erwin, et al.)(NMNH: ADP133850, male), Erwin Piraña Plot: transect 9, station 5, 0.6545°S, 76.4460°W, 220-250m, 12 July 2006 (TL Erwin, et al.)(NMNH: ADP133862, male), Yasuni National Park (edge), 95.43 km E (heading 101.46°) Coca, Tiputini Biodiversity Station, Erwin Harpia Plot: transect 3, station 9, 0.63327°S, 76.1443°W, 207m, 20 June 1998 (TL Erwin, et al.)(NMNH: ADP135860, ADP135906, females), Erwin Harpia Plot: transect 4, station 8, 0.63167°S, 76.1443°W, 208m, 30 June 1998 (TL Erwin,

et al.)(NMNH: ADP135795, male), Erwin Harpia Plot: transect 6, station 10, 0.6295°S, 76.1443°W, 199m, 1 July 1998 (TL Erwin, et al.)(NMNH: ADP135834, male), Erwin Harpia Plot: transect 7, station 10, 0.6287°S, 76.1443°W, 203m, 4 July 1998 (TL Erwin, et al.)(NMNH: ADP135868, male), Erwin Harpia Plot: transect 8, station 5, 0.6278°S, 76.1443°W, 203m, 4 July 1998 (TL Erwin, et al.)(NMNH: ADP135910, male), Erwin Harpia Plot: transect 9, station 7, 0.6269°S, 76.1443°W, 203m, 5 July 1998 (TL Erwin, et al.)(NMNH: ADP135841, male), Erwin Harpia Plot: transect 10, station 6, 0.6262°S, 76.1443°W, 214m, 5 July 1998 (TL Erwin, et al.)(NMNH: ADP135854, male), Erwin Harpia Plot: transect 10, station 8, 0.6287°S, 76.1443°W, 214m, 5 July 1998 (TL Erwin, et al.)(NMNH: ADP135838, male), Erwin Harpia Plot: transect 9, station 6, 0.6269°S, 76.1443°W, 203m, 21 October 1998 (TL Erwin, et al.)(NMNH: ADP136756, female), Erwin Harpia Plot: transect 9, station 9, 0.6269°S, 76.1443°W, 203m, 21 October 1998 (TL Erwin, et al.) (NMNH: ADP135866, male), Erwin Harpia Plot: transect 10, station 3, 0.6262°S, 76.1443°W, 214m, 21 October 1998 (TL Erwin, et al.)(NMNH: ADP135882, female), Erwin Harpia Plot: transect 10, station 6, 0.6262°S, 76.1443°W, 215m, 21 October 1998 (TL Erwin, et al.)(NMNH: ADP135846, male), Erwin Harpia Plot: transect 7, station 1, 0.6287°S, 76.1443°W, 203m, 22 October 1998 (TL Erwin, et al.)(NMNH: ADP135884, male, ADP135888, female), Erwin Harpia Plot: transect 8, station 8, 0.6273°S, 76.1443°W, 203m, 22 October 1998 (TL Erwin, et al.) (NMNH: ADP136798, male), Erwin Harpia Plot: transect 8, station 10, 0.6287°S, 76.1443°W, 203m, 22 October 1998 (TL Erwin, et al.)(NMNH: ADP135864, female), Erwin Harpia Plot: transect 2, station 4, 0.6332°S, 76.1443°W, 197m, 23 October 1998 (TL Erwin, et al.)(NMNH: ADP135839, male), Erwin Harpia Plot: transect 2, station 8, 0.6332°S, 76.1443°W, 197m, 23 October 1998 (TL Erwin, et al.)(NMNH: ADP135880, female), Erwin Harpia Plot: transect 3, station 2, 0.6332°S, 76.1443°W, 207m, 24 October 1998 (TL Erwin, et al.)(NMNH: ADP135878, male), Erwin Harpia Plot: transect 3, station 3, 0.6332°S, 76.1443°W, 207m, 24 October 1998 (TL Erwin, et al.)(NMNH: ADP135769, male), Erwin Harpia Plot: transect 3, station 4, 0.6332°S, 76.1443°W, 207m, 24 October 1998 (TL Erwin, et al.)(NMNH: ADP135892, male), Erwin Harpia Plot: transect 3, station 9, 0.6332°S, 76.1443°W, 207m, 24 October 1998 (TL Erwin, et al.)(NMNH: ADP135912, female), Erwin Harpia Plot: transect 4, station 5, 0.6316°S, 76.1443°W, 208m, 24 October 1998 (TL Erwin, et al.)(NMNH: ADP137335, male, ADP135872, female), Erwin Harpia Plot: transect 6, station 5, 0.6295°S, 76.1443°W, 199m, 26 October 1998 (TL Erwin, et al.)(NMNH: ADP135837, male), Erwin Harpia Plot: transect 5, station 2, 0.6304°S, 76.1443°W, 209m, 2 February 1999 (TL Erwin, et al.)(NMNH: ADP139104, female), Erwin Harpia Plot: transect 10, station 6, 0.6262°S, 76.1443°W, 214m, 5 February 1999 (TL Erwin, et al.)(NMNH: ADP135886, male), Erwin Harpia Plot: transect 10, station 7, 0.6262°S, 76.1443°W, 214m, 5 February 1999 (TL Erwin, et al.)(NMNH: ADP135815, male), Erwin Harpia Plot: transect 7, station 3, 0.6287°S, 76.1443°W, 203m, 6 February 1999 (TL

Erwin, et al.)(NMNH: ADP135876, female), Erwin Harpia Plot: transect 8, station 4, 0.6278°S, 76.1443°W, 203m, 6 February 1999 (TL Erwin, et al.)(NMNH: ADP135842, female), Erwin Harpia Plot: transect 5, station 7, 0.6304°S, 76.1443°W, 209m, 7 February 1999 (TL Erwin, et al.)(NMNH: ADP135817, male), Erwin Harpia Plot: transect 6, station 2, 0.6295°S, 76.1443°W, 199m, 7 February 1999 (TL Erwin, et al.)(NMNH: ADP135914, female), Erwin Harpia Plot: transect 6, station 6, 0.6295°S, 76.1443°W, 199m, 7 February 1999 (TL Erwin, et al.)(NMNH: ADP135894, female), Erwin Harpia Plot: transect 4, station 6, 0.6316°S, 76.1443°W, 208m, 8 February 1999 (TL Erwin, et al.)(NMNH: ADP135852, female), Erwin Harpia Plot: transect 1, station 2, 0.6342°S, 76.1443°W, 218m, 9 February 1999 (TL Erwin, et al.)(NMNH: ADP135858, male), Erwin Harpia Plot: transect 1, station 3, 0.6332°S, 76.1443°W, 207m, 21 October 1999 (TL Erwin, et al.)(NMNH: ADP135918, female), Erwin Harpia Plot: transect 10, station 5, 0.6262°S, 76.1443°W, 214m, 22 October 1999 (TL Erwin, et al.)(NMNH: ADP135901, male), Erwin Harpia Plot: transect 10, station 6, 0.6262°S, 76.1443°W, 214m, 22 October 1999 (TL Erwin, et al.)(NMNH: ADP137694, male), Erwin Harpia Plot: transect 3, station 8, 0.6232°S, 76.1443°W, 207m, 23 October 1999 (TL Erwin, et al.)(NMNH: ADP139521, male), Erwin Harpia Plot: transect 6, station 9, 0.6287°S, 76.1443°W, 199m, 24 October 1999 (TL Erwin, et al.)(NMNH: ADP137754, male), Erwin Harpia Plot: transect 6, station 3, 0.6295°S, 76.1443°W, 199m, 25 October 1999 (TL Erwin, et al.)(NMNH: ADP137758, female), Erwin Harpia Plot: transect 9, station 8, 0.6269°S, 76.1443°W, 203m, 28 September 2000 (TL Erwin, et al.)(NMNH: ADP139152, female), Erwin Harpia Plot: transect 9, station 9, 0.6269°S, 76.1443°W, 203m, 28 September 2000 (TL Erwin, et al.)(NMNH: ADP139160, male), Erwin Harpia Plot: transect 10, station 4, 0.6262°S, 76.1443°W, 214m, 28 September 2000 (TL Erwin, et al.)(NMNH: ADP139154, ADP139142, ADP139144, males), Erwin Harpia Plot: transect 4, station 5, 0.6316°S, 76.1443°W, 208m, 1 October 2000 (TL Erwin, et al.)(NMNH: ADP139162, female), Erwin Harpia Plot: transect 4, station 6, 0.6316°S, 76.1443°W, 208m, 1 October 2000 (TL Erwin, et al.)(NMNH: ADP139158, male), Erwin Harpia Plot: transect 5, station 3, 0.6316°S, 76.1443°W, 214m, 1 October 2000 (TL Erwin, et al.)(NMNH: ADP139136, female), Erwin Harpia Plot: transect 6, station 1, 0.6304°S, 76.1443°W, 199m, 1 October 2000 (TL Erwin, et al.)(NMNH: ADP139126, female), Erwin Harpia Plot: transect 6, station 3, 0.6304°S, 76.1443°W, 199m, 1 October 2000 (TL Erwin, et al.)(NMNH: ADP139092, ADP139164, females), Erwin Harpia Plot: transect 6, station 5, 0.6295°S, 76.1443°W, 199m, 1 October 2000 (TL Erwin, et al.)(NMNH: ADP139130, male), Erwin Harpia Plot: transect 1, station 3, 0.6316°S, 76.1443°W, 214m, 2 October 2000 (TL Erwin, et al.)(NMNH: ADP139122, male), Erwin Harpia Plot: transect 1, station 5, 0.6342°S, 76.1443°W, 214m, 2 October 2000 (TL Erwin, et al.)(NMNH: ADP139146, female), Erwin Harpia Plot: transect 1, station 6, 0.6342°S, 76.1443°W, 214m, 2 October 2000 (TL Erwin, et al.)(NMNH: ADP139094, male), Erwin Harpia Plot: transect 6, station 1, 0.6342°S, 76.1443°W,

214m, 2 October 2000 (TL Erwin, et al.)(NMNH: ADP139096, female), Erwin Harpia Plot: transect 3, station 10, 0.6330°S, 76.1443°W, 207m, 4 October 2000 (TL Erwin, et al.)(NMNH: ADP139148, female), Erwin Harpia Plot: transect 10, station 4, 0.6332°S, 76.1443°W, 207m, 4 October 2000 (TL Erwin, et al.)(NMNH: ADP139156, male), Erwin Harpia Plot: transect 1, station 4, 0.6342°S, 76.1443°W, 214m, 16 February 2001 (TL Erwin, et al.)(NMNH: ADP139114, female), Erwin Harpia Plot: transect 2, station 2, 0.6332°S, 76.1443°W, 197m, 16 February 2001 (TL Erwin, et al.)(NMNH: ADP139110, male), Erwin Harpia Plot: transect 9, station 7, 0.6269°S, 76.1443°W, 203m, 17 February 2001 (TL Erwin, et al.)(NMNH: ADP139116, female), Erwin Harpia Plot: transect 9, station 8, 0.6269°S, 76.1443°W, 203m, 17 February 2001 (TL Erwin, et al.)(NMNH: ADP139102, female), Erwin Harpia Plot: transect 9, station 9, 0.6268°S, 76.1443°W, 203m, 17 February 2001 (TL Erwin, et al.)(NMNH: ADP139120, male, ADP139118, female), Erwin Harpia Plot: transect 1, station 2, 0.6342°S, 76.1443°W, 214m, 19 July 2001 (TL Erwin, et al.)(NMNH: ADP139463, female), Erwin Harpia Plot: transect 1, station 3, 0.6342°S, 76.1443°W, 214m, 19 July 2001 (TL Erwin, et al.)(NMNH: ADP139469, male), Erwin Harpia Plot: transect 1, station 8, 0.6342°S, 76.1443°W, 214m, 19 July 2001 (TL Erwin, et al.)(NMNH: ADP139106, male), Erwin Harpia Plot: transect 10, station 1, 0.6262°S, 76.1443°W, 214m, 20 July 2001 (TL Erwin, et al.)(NMNH: ADP139523, male), Erwin Harpia Plot: transect 10, station 3, 0.6269°S, 76.1443°W, 214m, 20 July 2001 (TL Erwin, et al.)(NMNH: ADP139465, male), Erwin Harpia Plot: transect 9, station 7, 0.6269°S, 76.1443°W, 203m, 20 July 2001 (TL Erwin, et al.)(NMNH: ADP139467, male), Erwin Harpia Plot: transect 10, station 4, 0.6262°S, 76.1443°W, 214m, 20 July 2001 (TL Erwin, et al.)(NMNH: ADP139525, male), Erwin Harpia Plot: transect 3, station 1, 0.6332°S, 76.1443°W, 207m, 24 July 2001 (TL Erwin, et al.)(NMNH: ADP139461, male); Sucumbíos, Río Napo, Sacha Lodge, Pilchicocha, 0.472°S, 76.459°W, 228m, 12-22 February 1994 (P Hibbs) (SEMC: ADP006158, female) Río Napo, Sacha Lodge, Pilchicocha, 0.472°S, 76.459°W, 228m, 22 February - 4 March 1994 (P Hibbs)(SEMC: ADP006156) Río Napo, Sacha Lodge, Pilchicocha, 0.472°S, 76.459°W, 228m, 4-14 March 1994 (P Hibbs)(SEMC: ADP006112, ADP006131, ADP006155, females) Río Napo, Sacha Lodge, Pilchicocha, 0.472°S, 76.459°W, 228m, 14-24 March 1994 (P Hibbs)(SEMC: ADP006114, ADP006154, females) Río Napo, Sacha Lodge, Pilchicocha, 0.472°S, 76.459°W, 228m, 3-13 April 1994 (P Hibbs)(SEMC: ADP006137, male, ADP006128, ADP006136, females) Río Napo, Sacha Lodge, Pilchicocha, 0.472°S, 76.459°W, 228m, 13-23 April 1994 (P Hibbs)(SEMC: ADP006151, male, ADP006152, female) Río Napo, Sacha Lodge, Pilchicocha, 0.472°S, 76.459°W, 228m, 23 April - 4 May 1994 (P Hibbs)(SEMC: ADP006129, ADP006134, males, ADP006113, ADP006135, female), 13-25 July 1994 (P Hibbs)(SEMC: ADP006115, male, ADP006153, female), 3-16 August 1994 (P Hibbs)(SEMC: ADP006157, male), 20-30 September 1994 (P Hibbs)(SEMC: ADP006130, ADP006150, females), Río Napo, Sacha Lodge, Pilchicocha, 0.472°S, 76.459°W, 228m, 3-16 August

1994, P Hibbs, SEMC, 006138, female paratype) Limoncocha National Biological Reserve, Limoncocha, 0.4069°S, 76.6134°W, 235m, 11 June 1977 (PJ Spangler, D.R Givens)(NMNH: ADP005800, female). **French Guiana**, Cayenne, Mont Itoupe, placette, 3.0220°N, 53.0947°W, 600m, 26 November 2014 (S Brule, PH Dalens, E Poirier)(NMNH: ADP148089, female),16 January 2016 (S Brule, PH Dalens, E Poirier)(NMNH: ADP148830, ADP148831, females), 800m, 2 December 2014 (S Brule, PH Dalens, E Poirier)(NMNH: ADP148201, female); Commune de Roura, Montagne des Chevaux, 4.7127°N, 52.3966°W, 90, 3 January 2010 (S Brule, PH Dalens, E Poirier)(NMNH: ADP128009, female), 3 January 2015 (S Brule, PH Dalens, E Poirier)(NMNH: ADP148090, female), 1 August 2015 (S Brule, PH Dalens, E Poirier)(NMNH: ADP148101, male), 15 km west, Regina, Petit Montagne Tortue, 4.3204°N, 52.2404°W, 94m, 10 June 2010 (G Lamarre)(NMNH: ADP130780, male), Region de Saul, Commune de Saul, Belvedere de Saul, 3.6223°N, 53.2159°W, 283-325m, 5 February 2010 (S Brule, PH Dalens, E Poirier)(NMNH: ADP130778, female), 9 September 2010 (S Brule, PH Dalens, E Poirier)(NMNH: ADP130777, female), 14 February 2011 (S Brule, PH Dalens, E Poirier)(NMNH: ADP134141, male), 11 December 2012 (S Brule, PH Dalens, E Poirier)(NMNH: ADP134138, male), 16 January 2013 (S Brule, PH Dalens, E Poirier)(NMNH: ADP134136, male, ADP134139, female), 6 February 2013 (S Brule, PH Dalens, E Poirier)(NMNH: ADP134140, female) Region de Saul, Commune de Saul, Belvedere de Saul (point de vue), 3.6223°N, 53.2159°W, 283-325m, 19 August 2010 (S Brule, PH Dalens, E Poirier)(NMNH: ADP130779, female), 7 March 2011 (S Brule, PH Dalens, E Poirier)(NMNH: ADP135284, female), 11 December 2012 (S Brule, PH Dalens, E Poirier)(NMNH: ADP134137, female), Camp Inselberg, Nouragues, Commune de Regina, 4.0334°N, 52.6786°W, 411m, 5 September 2013 (S Brule, PH Dalens, E Poirier)(NMNH: ADP147737, female). **Perú**, Junin, Satipo, 11.265°S, 74.634°W, 865m, July 1941 (A. Maller)(AMNH: ADP007287, male paratype); Loreto, Rio Napo, ACEER, Rio Sucusari, 3.2601°S, 72.9161°W, 100m, 3 June 1992 (TL Erwin, E Pfuno S, F Pfuno S)(NMNH: ADP052156, male, ADP052134, female), 15 June 1992 (TL Erwin, E Pfuno S, F Pfuno S)(NMNH: ADP052729, female), 11 June 1992 (TL Erwin, E Pfuno S, F Pfuno S)(NMNH: ADP051235, male, ADP052671, female), 15 June 1992 (TL Erwin, E Pfuno S, F Pfuno S)(NMNH: ADP052704, ADP052730, females), ACEER-Explonapo Camp, Rio Sucusari, 3.2601°S, 72.9161°W, 100m, 3 June 1992 (TL Erwin, E Pfuno S, F Pfuno S) (NMNH: ADP052134, female), 6 June 1992 (TL Erwin, E Pfuno S, F Pfuno S) (NMNH: ADP053140, male), Pacaya-Samiria National Reserve, Río Samiria, Cocha Shinguito, 5.1775°S, 76.6556°W, 112m, 26 May 1990 (TL Erwin, et al.)(NMNH: ADP067108, male, ADP067084, female), 27 May 1990 (D. Silva)(NMNH: ADP007573, female), 20 June 1990 (TL Erwin, et al.)(NMNH: ADP092866, male, ADP066883, ADP066937, females), 27 August 1991 (TL Erwin, MG Pogue, et al.) (NMNH: ADP050386, female), Río Samiria (South Branch), Camp Terry, 5.6951°S, 75.2243°W, 129m, 14 May 1990 (TL Erwin)(NMNH: ADP093061, male, ADP093060, female), 1 km E Hamburgo, Boca del Ingles Camp, 0.5226°S,

75.1192°W, 125m, 20 August 1991 (TL Erwin, MG Pogue)(NMNH: ADP070664, female), 1.5 km N Teniente Lopez, 2.3566°S, 76.0692°W, 210-240m, 22 July 1993 (R Leschen)(SEMC: ADP007288, female), nr. Iquitos, Porvenir, 3.8918°S, 73.5603°W, 24 June 2011 (G. Lamarre)(NMNH: ADP135887, ADP135889, males), nr. Requena, Jenaro Herrera, 4.900°S, 73.6303°W, 1 August 2011 (G. Lamarre) (NMNH: ADP135885, male); Madre de Dios, Reserva Nacional Tambopata, 30 km (air) SW, Pto. Maldonado, Explorer's Inn, 12.8364°S, 69.2936°W, 209m, 11-15 November 1979 (JB Heppner, et al.)(NMNH: ADP007286, female), 28 February 1984 (TL Erwin, et al.)(NMNH: ADP007269, male, ADP007270, female), 9 March 1984 (TL Erwin, et al.)(NMNH: ADP007271, male), 4 May 1984 (TL Erwin, et al.) (NMNH: ADP007265, female), 10 May 1984 (TL Erwin, et al.)(NMNH: ADP007248, male), 6 September 1984 (TL Erwin, et al.)(NMNH: ADP007267, female), 10 September 1984 (TL Erwin, et al.)(NMNH: ADP007249, female), Manu Reserved Zone, Río Manu, BIOLAT Biological Station, Pakitza, 11.9446°S, 71.2831°W, 356m, 7 September 1988 (TL Erwin (NMNH: ADP007488, male), 2 September 1989 (TL Erwin, BD Farrell)(NMNH: ADP007487, male), 18 September 1988 (TL Erwin, BD Farrell)(NMNH: ADP007489, male), 19-23 September 1989 (N Adams)(NMNH: ADP007508, female), 22 September 1989 (TL Erwin (NMNH: ADP007446, female), 11 October 1989 (TL Erwin, GP Servat)(NMNH: ADP007485, female), 20 September 1991 (TL Erwin)(NMNH: ADP007403, male, ADP007418, female), 21 September 1991 (TL Erwin, et al.)(NMNH: ADP007464, female), 22 September 1991 (TL Erwin (NMNH: ADP007463, ADP007469, males), 26 September 1991 (TL Erwin (NMNH: ADP007381, ADP007335, males), 28 September 1991 (TL Erwin, MG Pogue)(NMNH: ADP007422, male), 30 September 1991 (TL Erwin (NMNH: ADP007424, ADP007309, ADP007330, ADP007396, ADP007400, ADP007425, males), 2 October 1991 (TL Erwin, MG Pogue)(NMNH: ADP007397, female), 4 October 1991 (TL Erwin, MG Pogue)(NMNH: ADP007462, male), 16 October 1991 (TL Erwin, MG Pogue)(NMNH: ADP007419, ADP007420, males), 13-18 February 1992 (B Brown, D Feener)(NMNH: ADP007510, female), 4-9 March 1992, (B Brown, D Feener)(NMNH: ADP007509, female), 22 June 1993 (TL Erwin, F Pfuno S)(NMNH: ADP007465, ADP007468, males), 23 June 1993 (TL Erwin, F. Pfuno S)(NMNH: ADP007491, male, ADP007490, ADP007506, ADP007467, females). **Suriname**, Brokopondo, Phedra, 5.232°N, 55.050°W, 8m, 1-7 November 1964 (DC Geijskes)(NBCL: ADP005804, male),

Geographic distribution. (Fig. 11). This species is currently known from the type locality in the Amazonian lowlands near Tefé, Brazil, and in Brazil – Amazonas, Pará, Goias; Colombia; Ecuador; French Guiana; Perú; Suriname.

Notes. Reichardt (1971, 1973) reported the following additional specimens that we did not see: **Brazil –** Amazonas: Manaus (13 exs. MZSP), Maturacá, alto Rio Cauaburi (2 exs. MZSP), São Paulo de Olivença (1 ex. MZSP), Tefé (2 exs. MNHP), Titirico (1 ex. FAUCV); Pará: Belém (1 ex. MNHP, 1 ex. MZSP), Icoraci (l ex. MNHP). Goias: Jatar (1 ex. MNHP), Rio Verde (1 ex. MNHP). **Perú** – Loreto: Chambiruyaca, near Yurimaguas (1 ex. MNHP), Pebas (2 exs. MNHP).

Hyboptera biolat **Erwin & Henry, sp. n.**
http://zoobank.org/896D1B12-7939-4277-8C55-A975042F72D9
Biolat humps-backed beetle
Figs 1B, 5B, 11

Holotype. Male. **Perú**, Madre de Dios, Manu Reserved Zone, Río Manu, BIOLAT Biological Station, Pakitza, 11.9446°S, 71.2831°W, 356m, 20 September 1991 (TL Erwin)(NMNH: ADP007447).

Derivation of specific epithet. The specific epithet, *biolat,* is used as a noun in apposition based on the acronym of the Smithsonian Institution's past Program "Biodiversity in Latin America" (BIOLAT) which sought to field-train young Latin American biology students in biodiversity techniques and did so for over 200 of them between 1987 and 1991 in Perú and Bolivia. These beetles were collected under the auspices of the BIOLAT Program.

Proposed English vernacular name. Biolat humps-backed beetle.

Diagnosis. With the attributes of the genus and *angulicollis* species group as described above and adults with patches of bright metallic green para-medially on pronotum, elytra entirely with metallic green patches, and venter with meso- and metathorax mostly infuscated.

Description. (Fig. 1B, 5B). *Size*: See Appendix 1. Length (SBL) short for genus, ABL = 3.64–4.17 mm, SBL = 3.16–3.74 mm, TW = 1.68–2.33 mm.

Color: See diagnosis, above.

Luster: Metallic highlights, partially iridescent.

Microsculpture: Mostly isodiametric or slightly stretched, shallowly impressed, cells somewhat more stretched around elytral tubercles.

Head: Rugae moderately coarse, mostly transverse. Eye very large, sub-hemispheric, evenly rounded anteriorly, subtly more prolonged posteriorly. Antenna short, barely reaching humerus. Labrum rectangulate, shallowly bilobed, anterior margin slightly emarginate. Neck finely and transversely rugose.

Prothorax: Pronotum moderately broad, disc centrally planar with dense transverse rugae. Lateral margins moderately explanate and obtusely angulate medially then straight to narrowly obtuse hind angle, base medially produced and rounded posteriorly.

Pterothorax: Normal for Agrina, fully winged. Elytron interval 3 with 7(8), and interval 5 with 5 (4) discal unisetiferous tubercles, other intervals moderately convex, side margin moderately explanate laterally only at middle third. Elytron broad and moderately short, moderately narrower than the pronotum at the broadest part, apex truncate, slightly rounded with distal corner broadly and obtusely rounded, disc not significantly convex, basal third slightly depressed. All interneurs well-impressed.

Legs: Femur dorso-ventrally moderately depressed, tibia coequal in length, more depressed; tarsus less than half the length of the tibia, fourth tarsomere markedly bilobed and with tarsal pad of setae.

Abdomen: Sparsely setiferous; normal ambulatory setae on sterna 3–5; female with two pairs of ambulatory setae on sternum 6, medial pair of setae less than the length of lateral pair; males with only the outer pair of longer setae on sternum 6.

Male genitalia: Phallus (Fig. 5B) with ostium of 1/5 its length, catopic, apex moderately long, narrowly rounded, narrow in dorsal aspect; endophallus with flagellum (apex extruded in illustration), flagellum not barbed. Parameres asymmetric, right very small, left larger.

Female genitalia: Not investigated, likely similar to that of *H. lucida* (Fig. 8).

Dispersal potential. These beetles are macropterous and probably capable of flight. They are moderately swift and agile runners. Specimens have been acquired using insecticidal fogging methods.

Way of life. Adults are common in the lowlands (356 m.a.s.l.) and appear to be generalists in a variety of rainforest biotopes including terra firme and upper floodplain forests. In these forests, they are commonly found in suspended dry leaves in *Guadua weberbaueri* Pilg. bamboo patches and among *Astrocaryum chambira* Burret palm dry leaf-skirts. Adults have been obtained in September–October; hence, they are active in the late dry and early rainy seasons.

Other specimens examined. Perú, Madre de Dios, Manu Reserved Zone, Río Manu, BIOLAT Biological Station, Pakitza, 11.9446°S, 71.2831°W, 356m, 4 October 1989 (TL Erwin)(NMNH, ADP007486, male paratype), 10 October 1991 (TL Erwin, MG Pogue)(NMNH: ADP007398, female paratype), 11 October 1991 (TL Erwin, MG Pogue)(NMNH: ADP007353, ADP007354, ADP007356, ADP007443, male paratypes, ADP007355 ADP007399, female paratypes), 14 October 1991 (TL Erwin, MG Pogue)(NMNH: ADP007336, male paratype), 16 October 1991 (TL Erwin)(NMNH: ADP007331, male paratype), 23 September 1991 (TL Erwin) (NMNH: ADP007466, male paratype), 28 September 1991 (TL Erwin, MG Pogue) (NMNH: ADP007315, male paratype), 9 October 1991 (TL Erwin, MG Pogue) (NMNH: ADP007311, male paratype).

Geographic distribution (Fig. 11). This species is currently known only from the type locality in Perú in the Río Manu watershed at the Pakitza Vigilante Post where the BIOLAT Biological Station operated from 1987 to 1992.

Notes. The holotype will be deposited in UNMSM and is currently held in trust until the completion of studies at NMNH. Specimen ADP007443 is missing its fore body.

Hyboptera vestiverdis Henry & Erwin, sp. n.

http://zoobank.org/54DF5437-5E03-4BA5-AE7F-8352ED2FDA11
Leprechaun humps-backed beetle
Figs 2A, 5C, 11

Holotype. Male. **Perú**, Madre de Dios, Manu Reserved Zone, Río Manu, BIOLAT Biological Station, Pakitza, 11.9446°S, 71.2831°W, 356m, 16 October 1991 (TL Erwin, MG Pogue)(NMNH: ADP007421).

Derivation of specific epithet. The species epithet "vestiverdis" is a Latinized feminine noun meaning green vest, referring to the two lobes of color on the pronotal disc on individuals of this species with central line of pale color bisecting the pattern and appearing as an open vest.

Proposed English vernacular name. Leprechaun humps-backed beetle.

Diagnosis. With the attributes of the genus and *angulicollis* species group as described above and adults with only dark slightly-metallic markings on the pronotal disc, elytra olivaceous, markedly shiny, some individuals with hint of metallic green near basal margin, narrow, with slightly arcuate lateral margin.

Description. (Figs 2A, 5C) *Size*: See Appendix 1. Length (SBL) short for genus, ABL = 3.46–4.62 mm, SBL = 3.14–3.99 mm, TW = 1.83–2.55 mm.

Color: See diagnosis, above.

Luster: Very shiny elytra, not iridescent.

Microsculpture: Mostly isodiametric and slightly stretched, shallowly impressed, cells somewhat more stretched around elytral tubercles.

Head: Rugae moderately coarse, mostly transverse, somewhat curved on occiput. Eye very large, nearly perfectly hemispheric, evenly rounded. Antenna short, barely reaching humerus. Labrum rectangulate, shallowly bilobed, anterior margin slightly emarginate. Neck finely transversely rugose.

Prothorax: Pronotum markedly broad, disc planar, with dense transverse rugae. Lateral margins broadly explanate and obtusely angulate medially, then markedly arcuate to obtuse hind angle, base medially produced and rounded posteriorly.

Pterothorax: Normal for Agrina, fully winged. Elytron intervals 3 with 7 and 5 with 5(6) elongate unisetiferous tubercles, other intervals moderately convex, side margin broadly explanate laterally only at middle third. Elytron broad and short, slightly narrower than the pronotum at the broadest part, apex truncate, slightly rounded with distal corner broadly and obtusely rounded, disc not significantly convex, basal third slightly depressed. All interneurs well-impressed.

Legs: Femur dorso-ventrally moderately depressed, tibia coequal in length, more depressed; tarsus less than half the length of the tibia, fourth tarsomere markedly bilobed and with tarsal pad of setae.

Abdomen: Sparsely setiferous; normal ambulatory setae on sterna 3–5; female unknown; males with only the lateral pair of longer setae on sternum 6.

Male genitalia: Phallus (Fig. 5C) with ostium of 1/5 its length, catopic, apex moderately long, narrowly rounded; endophallus with flagellum (mid-part obvious in illustration), flagellum not barbed. Parameres asymmetric, right very small, left larger.

Female genitalia: Not investigated, likely similar to that of *H. lucida* (Fig. 8).

Dispersal potential. These beetles are macropterous and capable of flight. They are moderately swift and agile runners. Specimens have been acquired in Malaise traps and using insecticidal fogging methods.

Way of life. Adults are common in the lowlands (116 to 356 m.a.s.l.) and appear to be generalists in a variety of rainforest biotopes including terra firme and várzea. In these forests, they are commonly found in big trees with vines and epiphytes, in

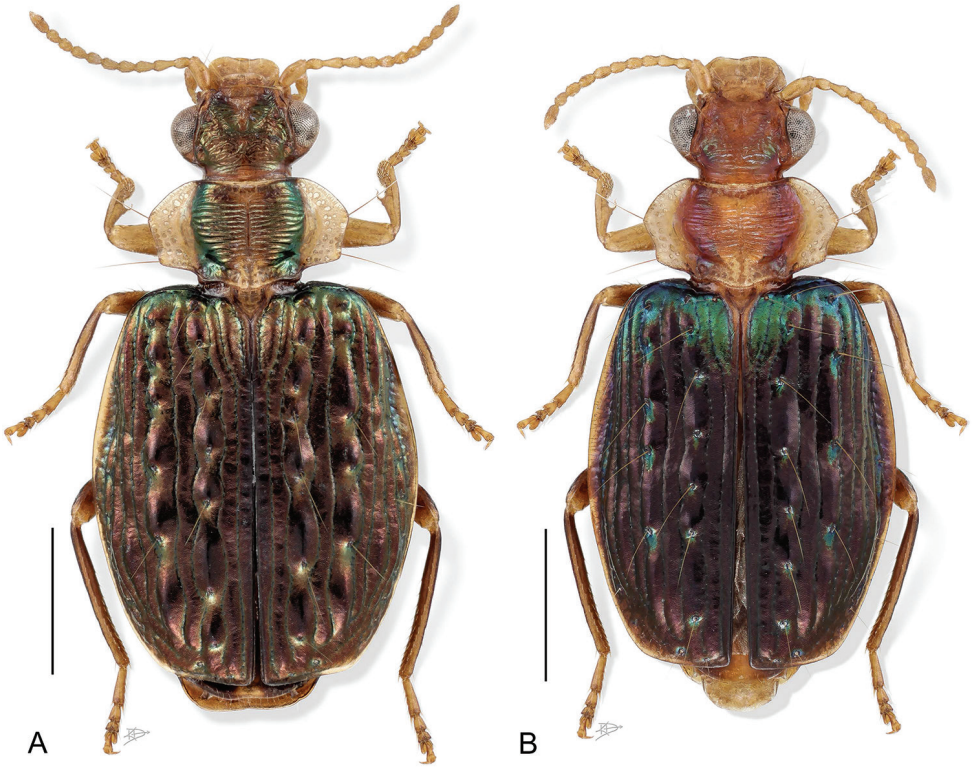

Figure 2. Digital Photo-illustration. Habitus, dorsal aspect. **A** *Hyboptera vestiverdis* Henry & Erwin, sp. n., female, ADP007334 **B** *Hyboptera scheelea* Erwin & Henry, sp. n., female, ADP007575.

suspended dry leaves, in dry *Scheelea* sp. and *Astrocaryum chambira* Burret palm frond skirts, in dry leaves scattered in vine tangles, and in dry leaves of the bamboo *Guadua weberbaueri* Pilg. Individuals can be found in January-February, May-July, and September-October, in both the rainy and dry seasons. Member of this species have been recorded from the canopy of the following tree species using insecticidal fogging techniques: *Grias neuberthii*; *Eschweilera coriacea* cf.; *Icicopsis* sp. ; *Pentaplaris huaoranica* sp. nov. *Rhodostemonodaphne kunthiana* cf.; *Nectandra* sp.; *Iriartea deltoidea*; *Protium sagotianum* cf.; *Talisia* bitter; *Mouriri guapira*; *Eriotheca globosa* cf.; *Sloane* sp., *Matisia malacocalyx* cf.; *Tabebuia moby*; *Pourouma bicolor* ssp. *bicolor* cf.; *Alchornea triplinervia* cf.?; *Naucleopsis krukovii* cf.; *Hyeronima oblonga*; *Brownea grandiceps* cf.; *Virola decorticans* cf.; *Pouteria cuspidata* ssp. *robusta* cf.; *Duguetia surinamensis* cf.; *Trichilia rubra* cf.; *Coccoloba densifrons* cf. *Eschweilera coriacea* cf.; *Virola obovata*; *Brosimum utile* ssp. *ovatifolium* cf.; *Pseudolmedia laevis*; *Patinoa paraensis*|*sphaerocarpa* cf.; *Matisia bracteolosa* stellate; *Simaba guianensis* cf.; *Trichilia elsae* cf.; *Icicopsis* sp. nov.

Other specimens examined. **Ecuador**, Orellana, Reserva Ethnica Huaorani, 39 km S Pompeya, Estación Científica Yasuní – Onkone Gare Camp, Erwin Piraña Plot, transect 2, station 10, 0.6581°S, 76.4513°W, 220-250m, 4 October 1995 (TL

Erwin, et al.)(NMNH: ADP135922, female paratype), Erwin Piraña Plot, transect 3, station 1, 0.6575°S, 76.4505°W, 220-250m, 1 July 1995 (TL Erwin, et al.)(NMNH: ADP135976, male paratype), Erwin Piraña Plot, transect 3, station 9, 0.6575°S, 76.4505°W, 220-250m, 21 January 2006 (TL Erwin, et al.)(NMNH: ADP133860, female paratype), Erwin Piraña Plot, transect 4, station 3, 0.6570°S, 76.4498°W, 220-250m, 11 February 1995 (TL Erwin, et al.)(NMNH: ADP137321, male paratype), Erwin Piraña Plot, transect 4, station 3, 0.6570°S, 76.4498°W, 220-250m, 11 February 1995 (TL Erwin, et al.)(NMNH: ADP135848, female paratype), Erwin Piraña Plot, transect 4, station 3, 0.6570°S, 76.4498°W, 220-250m, 11 February 1995 (TL Erwin, et al.)(NMNH: ADP135908, female paratype), Erwin Piraña Plot, transect 4, station 3, 0.6570°S, 76.4498°W, 220-250m, 16 January 1994 (TL Erwin, et al.)(NMNH: ADP135934, female paratype), Erwin Piraña Plot, transect 5, station 10, 0.6566°S, 76.4490°W, 220-250m, 6 October 1996 (TL Erwin, et al.)(NMNH: ADP135896, female paratype), Erwin Piraña Plot, transect 5, station 5, 0.6575°S, 76.4505°W, 220-250m, 6 January 1995 (TL Erwin, et al.)(NMNH: ADP135962, female paratype), Erwin Piraña Plot, transect 6, station 10, 0.6561°S, 76.4483°W, 220-250m, 2 October 1996 (TL Erwin, et al.)(NMNH: ADP135932, female paratype), Erwin Piraña Plot, transect 6, station 3, 0.6561°S, 76.4481°W, 220-250m, 6 October 1995 (TL Erwin, et al.)(NMNH: ADP137333, male paratype), Erwin Piraña Plot, transect 8, station 10, 0.6551°S, 76.4403°W, 220-250m, 3 October 1996 (TL Erwin, et al.)(NMNH: ADP137371, male paratype), Erwin Piraña Plot, transect 8, station 8, 0.6551°S, 76.4403°W, 220-250m, 8 February 1996 (TL Erwin, et al.)(NMNH: ADP137381, male paratype), Erwin Piraña Plot, transect 9, station 7, 0.6545°S, 76.4460°W, 220-250m, 8 October 1995 (TL Erwin, et al.)(NMNH: ADP135986, female paratype); Yasuni National Park (edge), 95.43 km E (heading 101.46°) Coca, Tiputini Biodiversity Station, Erwin Harpia Plot, transect 1, station 6, 0.6342°S, 76.1443°W, 214m, 2 October 2000 (TL Erwin, et al.)(NMNH: ADP139098, male paratype), Erwin Harpia Plot, transect 5, station 8, 0.6309°S, 76.1443°W, 220-250m, 1 July 1998 (TL Erwin, et al.)(NMNH: ADP135870, female paratype), Erwin Harpia Plot, transect 7, station 6, 0.6287°S, 76.1443°W, 203m, 22 October 1998 (TL Erwin, et al.)(NMNH: ADP135855, male paratype), Erwin Harpia Plot, transect 7, station 9, 0.6287°S, 76.1443°W, 203m, 29 September 2000 (TL Erwin, et al.)(NMNH: ADP139138, male paratype); Sucumbíos, Río Napo, Sacha Lodge, Pilchicocha, 0.472°S, 76.459°W, 228m, 12-22 February 1994 (P Hibbs)(SEMC: ADP006133, male paratype). **Perú**, Loreto, Pacaya-Samiria National Reserve, Rio Samiria, Pithecia, 5.2116 S, 74.6991 W, 116m, 9 May 1990 (TL Erwin, GP Servat, et al.)(NMNH: ADP007293, male paratype), Boca del Ingles Camp, Hamburgo, 5.6951°S, 75.2243°W, 150m, 10 May 1990 (TL Erwin, et al.)(NMNH: ADP007292, male paratype, ADP007574, female paratype); Madre de Dios, Manu Reserved Zone, Río Manu, BIOLAT Biological Station, Pakitza, 11.9446°S, 71.2831°W, 356m, 11 October 1991 (TL Erwin, MG Pogue)(NMNH: ADP005780, male paratype), 11 October 1991 (TL Erwin)(NMNH: ADP007314, ADP007359, ADP007374, ADP007375, ADP007376, ADP007377, ADP007378,

ADP007379, ADP007380, male paratypes, ADP007358, ADP007357, female paratypes), 14 October 1991 (TL Erwin, MG Pogue, NMNH: ADP007333, ADP007334, ADP007337, ADP007352, male paratypes), 16 October 1991 (TL Erwin)(NMNH: ADP007332, male paratype), (TL Erwin, MG Pogue)(NMNH: ADP007402, male paratype, ADP007313, ADP007401, female paratypes), 22 June 1993 (TL Erwin, F Pfuno S)(NMNH: ADP007484, female paratype), 23 June 1993 (TL Erwin, F Pfuno S)(NMNH: ADP007507, female paratype), 9 September 1988 (TL Erwin) (NMNH: ADP007445, male paratype), 30 September 1991 (TL Erwin, MG Pogue) (NMNH: ADP007423, male paratype), 9 October 1991 (TL Erwin, MG Pogue) (NMNH: ADP007442, male paratype, ADP007308, ADP007310, ADP007312, ADP007440, ADP007441, female paratypes); Reserva Nacional Tambopata, 30km (air) SW Pto. Maldonado, 12.8364°S, 69.2936°W, 209m, 28 February 1984 (TL Erwin, et al.)(NMNH: ADP007268, male paratype), 4 May 1984 (TL Erwin, et al.) (NMNH: ADP007266, male paratype).

Geographic distribution (Fig. 11). This species is currently known from the western Amazon Basin in lowland Ecuador and Perú.

Notes. The holotype will be deposited in UNMSM and is currently held in trust until the completion of studies at NMNH.

***Hyboptera scheelea* Erwin & Henry, sp. n.**
http://zoobank.org/6F9E1741-7310-4CB0-843F-0771EE17059F
Palm-frond humps-backed beetle
Figs 2B, 11

Holotype. Female. **Perú**, Loreto, Pacaya-Samiria National Reserve, Río Samiria (South Branch), Camp Terry, 5.6951°S, 75.2243°W, 129m, 14 May 1990 (TL Erwin) (NMNH: ADP007575).

Derivation of specific epithet. The species epithet "scheelea" is used as a noun in apposition which is based on the genus of palm upon which the holotype was found.

Proposed English vernacular name. Palm-frond humps-backed beetle.

Diagnosis. With the attributes of the genus and *angulicollis* species group as described above and adults without pronotal markings, pronotal surface rufotestaceous, elytron blackish-blue with metallic green highlights across the humeri and green points at some larger tubercles with lateral margin narrowly testaceous to latero-apical corner but not reaching sutural apex. Apical abdominal tergite mostly infuscated with narrow median testaceous stripe. Size smaller than *H. shasta* adults.

Description. (Fig. 2B). *Size*: See Appendix 1. Length (SBL) short for genus, ABL = 4.54 mm, SBL = 3.68 mm, TW = 2.10 mm.

Color: See diagnosis, above.

Luster: Metallic highlights, partially iridescent.

Microsculpture: Mostly isodiametric, shallowly impressed, cells somewhat stretched around elytral tubercles.

Head: Rugae moderately coarse, mostly transverse. Eye very large, sub-hemispheric, evenly rounded anteriorly, subtly more prolonged posteriorly. Antenna short, barely reaching humerus. Labrum rectangulate, shallowly bilobed, anterior margin slightly emarginate. Neck finely and transversely rugose.

Prothorax: Pronotum markedly broad, disc centrally depressed with dense transverse rugae. Lateral margins broadly explanate and obtusely angulate medially then moderately arcuate to obtuse hind angle, base medially produced and rounded posteriorly.

Pterothorax: Normal for Agrina, fully winged. Elytron intervals 3 and 5 each with (4)5 discal unisetiferous tubercles, interval 3 with one such tubercle near apex, other intervals moderately convex, side margin broadly explanate laterally only at middle third. Elytron broad and short, slightly narrower than the pronotum at the broadest part, apex truncate, slightly rounded with distal corner broadly and obtusely rounded, disc not significantly convex, basal third slightly depressed. All interneurs well-impressed.

Legs: Femur dorso-ventrally moderately depressed, tibia coequal in length, more depressed; tarsus less than half the length of the tibia, fourth tarsomere markedly bilobed and with tarsal pad of setae.

Abdomen: Sparsely setiferous; normal ambulatory setae on sterna 3–5; female with two pairs of ambulatory setae on sternum 6, medial pair of setae less than the length of lateral pair; males unknown.

Male genitalia: Unknown.

Female genitalia: Not investigated, likely similar to that of *H. lucida* (Fig. 8).

Dispersal potential. These beetles are macropterous and probably capable of flight. They are moderately swift and agile runners. The holotype was acquired by insecticidal fogging of a *Sheelea* palm.

Way of life. The single known adult was found in May in lowlands (129 m.a.s.l.) in the secondary floodplain of igapó forests.

Other specimens examined. None.

Geographic distribution (Fig. 11). This species is currently known only from the type locality in the lowland of Amazonian Perú.

Notes. The holotype will be deposited in UNMSM and is currently held in trust until the completion of studies at NMNH.

***Hyboptera shasta* Erwin, sp. n.**

http://zoobank.org/F618555F-D7D8-43BA-B762-2E362948D342

Shasta's humps-backed beetle

Figs 3A, 11

Holotype. Male. **Brazil**, Amazonas, north of Manaus on Amazonas 010 at Km 26, Reserva Ducke, 2.918°S, 59.971°W, 70m, 4 July 1978 (J Arias)(NMNH: ADP135875).

Derivation of specific epithet. The species epithet "shasta" is an eponym based on the first name of the coauthor of this paper and former Intern in the laboratory of the senior author of this paper at the Smithsonian Institution.

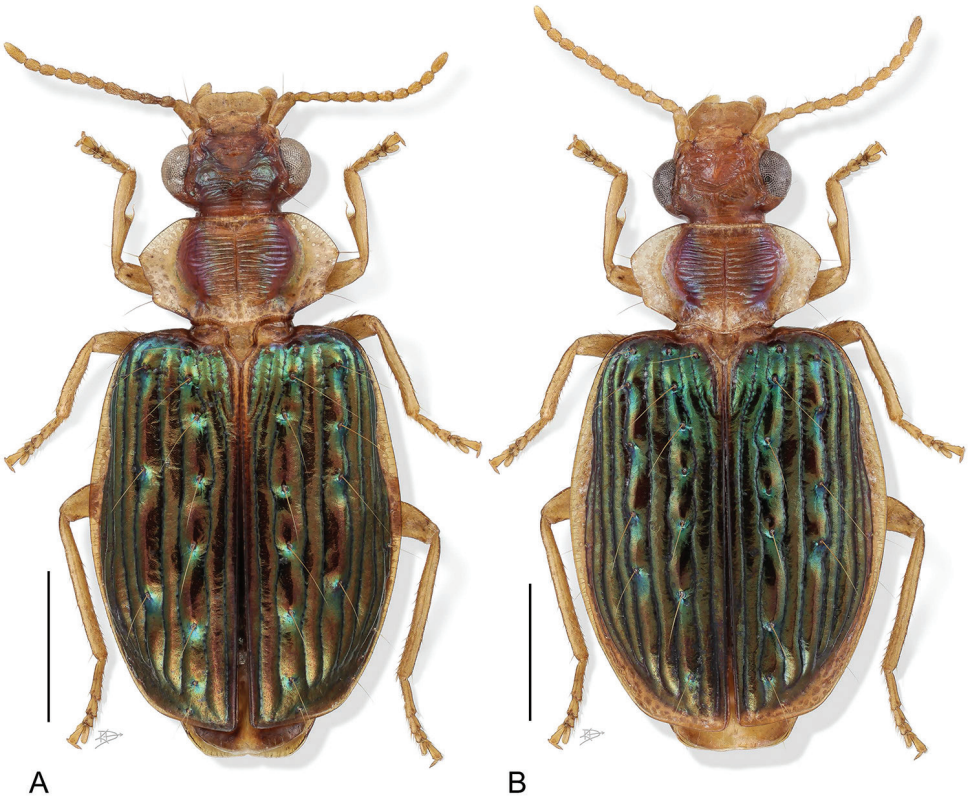

Figure 3. Digital Photo-illustration. Habitus, dorsal aspect. **A** *Hyboptera shasta* Erwin, sp. n., male, ADP135875 **B** *Hyboptera tepui* Erwin & Henry, sp. n., male, ADP007676.

Proposed English vernacular name. Shasta's humps-backed beetle.

Diagnosis. With the attributes of the genus and *angulicollis* species group as described above and adults without pronotal markings, pronotal surface rufotestaceous, elytron brilliant metallic green throughout with lateral margin testaceous to latero-apical corner, not quite reaching sutural apex; apical abdominal tergite mostly infuscated with narrow median testaceous stripe; size larger than *H. scheelea* adults.

Description. (Fig. 3A). *Size*: See Appendix 1. Length (SBL) medium for genus, ABL = 4.82 mm, SBL = 3.86 mm, TW = 2.17 mm.

Color: See diagnosis, above.

Luster: Very shiny elytra, substantially iridescent.

Microsculpture: Mostly isodiametric and slightly stretched, shallowly impressed, cells somewhat more stretched around elytral tubercles.

Head: Rugae moderately coarse, mostly transverse. Eye very large, nearly perfectly hemispheric, evenly rounded. Antenna short, barely reaching humerus. Labrum rectangulate, shallowly bilobed, anterior margin slightly emarginate. Neck finely transversely rugose.

Prothorax: Pronotum markedly broad, disc not centrally depressed, with dense transverse rugae. Lateral margins broadly explanate and obtusely angulate medially, then moderately arcuate to obtuse hind angle, base medially produced and rounded posteriorly.

Pterothorax: Normal for Agrina, fully winged. Elytron intervals 3 with 7 and 5 with 3/4 elongate unisetiferous tubercles, other intervals moderately convex, side margin broadly explanate laterally only at middle third. Elytron broad and short, slightly narrower than the pronotum at the broadest part, apex truncate, slightly rounded with distal corner broadly and obtusely rounded, disc not significantly convex, basal third slightly depressed. All interneurs well-impressed.

Legs: Femur dorso-ventrally moderately depressed, tibia coequal in length, more depressed; tarsus less than half the length of the tibia, fourth tarsomere markedly bilobed and with tarsal pad of setae.

Abdomen: Sparsely setiferous; normal ambulatory setae on sterna 3–5; female unknown; males with only the lateral pair of longer setae on sternum 6.

Male genitalia: Not investigated as only the holotype male is available, likely similar to that of *H. angulicollis* (Fig. 5A).

Female genitalia: Not investigated, likely similar to that of *H. lucida* (Fig. 8).

Dispersal potential. These beetles are macropterous and capable of flight. They are moderately swift and agile runners. The holotype was acquired in a C.D.C. light trap.

Way of life. The single known adult was found in July in lowlands (70 m.a.s.l.) in the terra firme forests.

Other specimens examined. None.

Geographic distribution (Fig. 11). This species is currently known only from the type locality in lowland Amazonian Brazil.

***Hyboptera tepui* Erwin & Henry, sp. n.**
http://zoobank.org/C3DF93E5-F8A5-452F-BDBD-ED2EF3D1F438
Tepui humps-backed beetle
Figs 3B, 11

Holotype. Female. **Venezuela**, Amazonas, Cerro de la Neblina, Río Baria Basecamp, 0.837°N, 66.162°W, 138m, 20 February 1985 (PJ Spangler, PM Spangler, et al.) (NMNH: ADP007576).

Derivation of specific epithet. The species epithet "tepui" is used as a noun in apposition and is based on the type of Venezuelan flat-topped upland near which the holotype was found.

Proposed English vernacular name. Tepui humps-backed beetle.

Diagnosis. With the attributes of the genus and *angulicollis* species group as described above and adults without pronotal markings, pronotal surface rufotestaceous. Elytron with lateral margin broadly testaceous from humerus to sutural apex; apical abdominal tergite testaceous with slight infuscation at extreme posterior-lateral corners.

Description. (Fig. 3B). *Size*: See Appendix 1. Length (SBL) long for genus, ABL = 5.16 mm, SBL = 4.29 mm, TW = 2.458 mm.

Color: See diagnosis, above.

Luster: Metallic green highlights, partially iridescent.

Microsculpture: Mostly irregular isodiametric, often stretched, shallowly impressed, cells especially stretched around elytral tubercles.

Head: Rugae moderately coarse, mostly transverse. Eye very large, sub-hemispheric, evenly rounded anteriorly, subtly more prolonged posteriorly. Antenna short, barely reaching humerus. Labrum rectangulate, shallowly bilobed, anterior margin slightly emarginate. Neck finely transversely rugose.

Prothorax: Pronotum markedly broad, disc with dense transverse rugae. Lateral margins broadly explanate and obtusely angulate medially then moderately arcuate to obtuse hind angle, base medially produced and rounded posteriorly.

Pterothorax: Normal for Agrina, fully winged. Elytron intervals 3 and 5 each with 6 discal unisetiferous tubercles, interval 3 with one subtle tubercle near apex, other intervals shallowly to moderately convex, side margin broadly explanate laterally only at middle third. Elytron broad and short, slightly narrower than the pronotum at the broadest part, apex truncate, slightly rounded with distal corner broadly and obtusely rounded, disc not significantly convex, basal third slightly depressed. All interneurs well-impressed.

Legs: Femur dorso-ventrally moderately depressed, tibia coequal in length, more depressed; tarsus less than half the length of the tibia, fourth tarsomere markedly bilobed and with tarsal pad of setae.*Abdomen*: Sparsely setiferous; normal ambulatory setae on sterna 3–5; female with two pairs of ambulatory setae on sternum 6, medial pair of setae less than the length of lateral pair; males unknown.

Male genitalia: Unknown.

Female genitalia: Not investigated, likely similar to that of *H. lucida* (Fig. 8).

Dispersal potential. These beetles are macropterous and capable of flight. They are moderately swift and agile runners. The holotype was acquired at black light in a rainforest clearing.

Way of life. The single known adult was found in February in lowland (138 m.a.s.l.) terra firme forests.

Other specimens examined. None.

Geographic distribution (Fig. 11). This species is currently known only from the type locality in lowland Venezuela.

***Hyboptera tiputini* Erwin & Henry, sp. n.**

http://zoobank.org/04C99837-BEFF-4F3E-BE65-69CA3562A4A0

Tiputini humps-backed beetle

Figs 4A, 5D, 11

Holotype. Male. **Ecuador**, Orellana, Yasuni National Park (edge), 95.43 km E (heading 101.46°) Coca, Tiputini Biodiversity Station, Erwin Harpia Plot: transect 4, station 4, 0.6316°S, 76.1443°W, 208m, 8 February 1999 (TL Erwin, et al.)(NMNH: ADP135781).

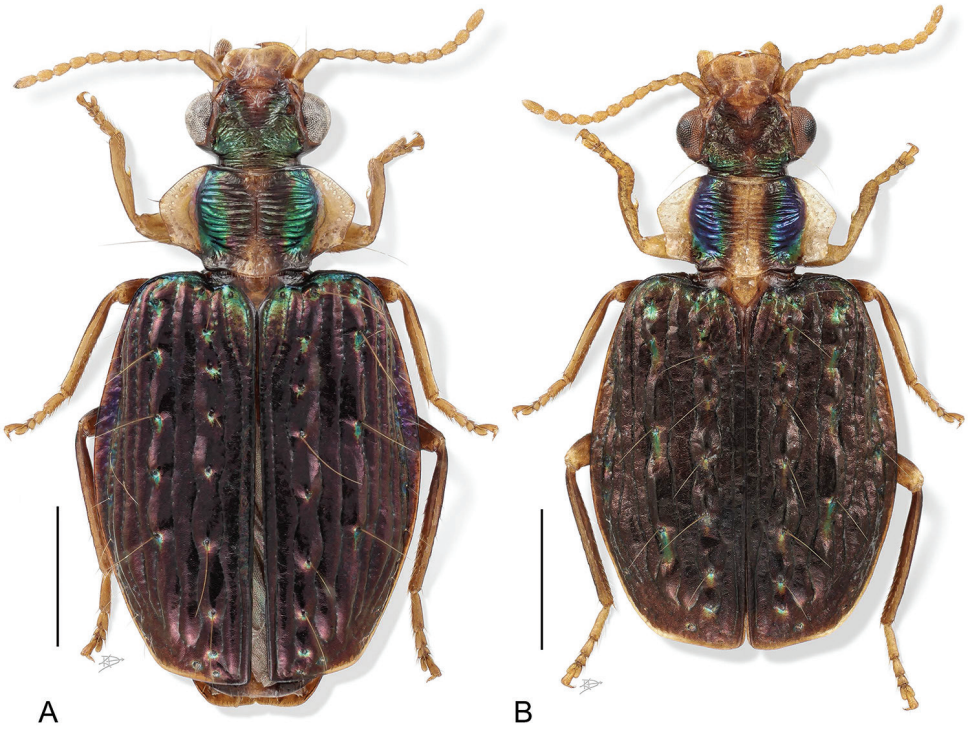

Figure 4. Digital Photo-illustration. Habitus, dorsal aspect. **A** *Hyboptera tiputini* Erwin & Henry, sp. n., male, ADP135850 **B** *Hyboptera viridivittis* Chaudoir, male, ADP007599.

Derivation of specific epithet. The specific epithet, "tiputini" is used as a noun in apposition and is based on the Tiputini Biodiversity Station in the Yasuni area of eastern Ecuador in reference to one of the places in which members of this species are found.

Proposed English vernacular name. Tiputini humps-backed beetle.

Diagnosis. With the attributes of the genus and *angulicollis* species group as described above and adults with patches of bright metallic green para-medially on pronotum, elytra markedly shiny, violaceous, some individuals with hint of metallic green near basal margin, broad, with markedly arcuate lateral margin.

Description. (Figs 4A, 5D). *Size*: See Appendix 1. Length (SBL) long for genus, ABL = 4.21–5.64 mm, SBL = 3.33–4.72 mm, TW = 1.868–2.92 mm.

Color: See diagnosis, above.

Luster: Matte with a few green reflections, markedly iridescent.

Microsculpture: Mostly irregular isodiametric, often stretched, shallowly impressed, cells especially stretched around elytral tubercles.

Head: Rugae moderately coarse, transverse. Eye very large, sub-hemispheric, evenly rounded anteriorly, subtly more prolonged posteriorly. Antenna short, barely reaching humerus. Labrum rectangulate, shallowly bilobed, anterior margin slightly emarginate. Neck finely transversely rugose.

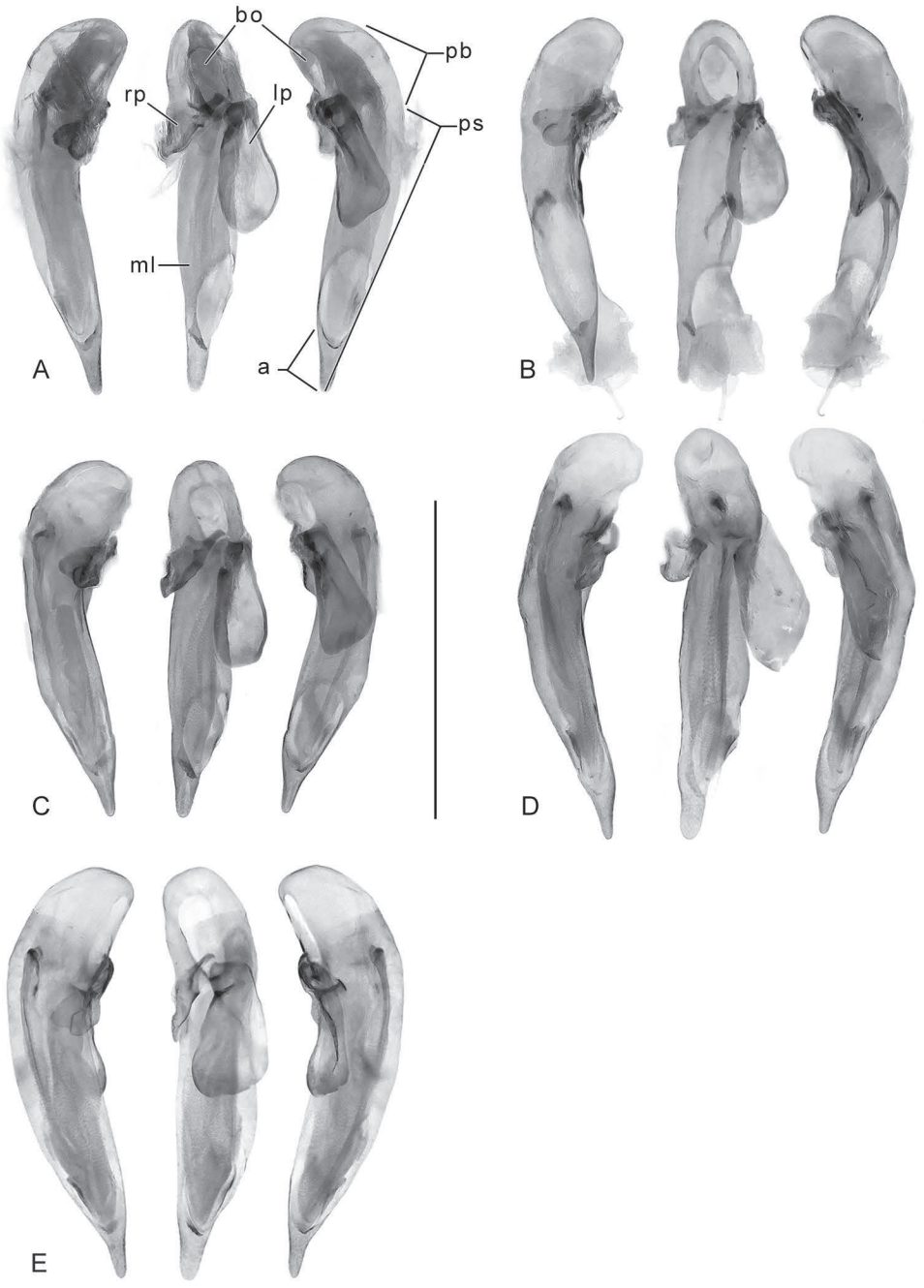

Figure 5. Digital Photo-illustration, male aedeagus in repose, dorsal, ventral, left lateral aspects. **A** *Hyboptera angulicollis* Chaudoir, ADP007330 **B** *Hyboptera biolat* Erwin & Henry, sp. n., ADP007443 **C** *Hyboptera vestiverdis* Henry & Erwin, sp. n., ADP014856 **D** *Hyboptera tiputini* Erwin & Henry, sp. n., ADP135845 **E** *Hyboptera viridivittis* Chaudoir, ADP007601. Legend, lp, left paramere; rp, right paramere; pb, phallobase; bo, phallobase orifice; ps, phalloshaft; a, phalloapex. Scale line = 0.25 mm.

Prothorax: Pronotum markedly broad, disc medially shallowly depressed along midline, and with dense transverse rugae. Lateral margins broadly explanate and obtusely angulate medially then subtlely arcuate to obtuse hind angle, base medially produced and rounded posteriorly.

Pterothorax: Normal for Agrina, fully winged. Elytron interval 3 with 7(8) and interval 5 with 5 unisetiferous tubercles, other intervals shallowly to moderately convex, side margin broadly explanate laterally only at middle third. Elytron broad and short, slightly narrower than the pronotum at the broadest part, apex truncate, slightly rounded with distal corner broadly and obtusely rounded, disc not significantly convex, basal third slightly depressed. All interneurs well-impressed.

Legs: Femur dorso-ventrally moderately depressed, tibia coequal in length, more depressed; tarsus less than half the length of the tibia, fourth tarsomere markedly bilobed and with tarsal pad of setae.

Abdomen: Sparsely setiferous; normal ambulatory setae on sterna 3–5; female with two pairs of ambulatory setae on sternum 6, medial pair of setae less than the length of lateral pair; males unknown.

Male genitalia: Phallus (Fig. 5D) with ostium of 1/5 its length, catopic, apex moderately long, narrowly rounded, broad in dorsal aspect; endophallus with flagellum (mid-part obvious in illustration), flagellum not barbed. Parameres asymmetric, right very small, left larger.

Female genitalia: Not investigated, likely similar to that of *H. lucida* (Fig. 8).

Dispersal potential. These beetles are macropterous and probably capable of flight. They are moderately swift and agile runners.

Way of life. Adults are common in the lowlands and lower midlands (20 to 900 m a.s.l.) and appear to be generalists in a variety of rainforest biotopes including terra firme, várzea, and igapó. In these forests, they are commonly found in big trees with vines and epiphytes, in suspended dry leaves, in dry *Astrocaryum chambira* Burret palm frond skirts. Individuals can be found in January-November, in both the rainy and dry seasons. Member of this species have been recorded from the canopy of the following tree species using insecticidal fogging techniques: *Pseudolmedia laevis*; *Iriartea deltoidea*; *Castilla ulei* cf.; *Sorocea steinbachii* cf.; *Matisia malacocalyx* cf. *Swartzia león*; *Eschweilera coriacea* cf.; *Mouriri guapira*; *Trichilia solitudinis*; *Eriotheca globosa* cf.; *Sloanea* 1; *Vismia* weedy; *Tabebuia moby*; *Pourouma bicolor* ssp. *bicolor* cf.; *Alchornea triplinervia* cf.?; *Naucleopsis krukovii* cf.; *Hyeronima oblonga*; *Clarisia biflora*; *Pouteria baehniana* cf.; *Inga cuadra*; *Maquira calophylla*; *Brownea grandiceps* cf.; *Talisia* bitter; *Virola decorticans* cf.; *Pouteria cuspidata* ssp. *robusta* cf.; *Diospyros sericea*; *Guarea silvatica*; *Scheelea* sp.

Other specimens examined. Colombia, Amazonas, PNN Amacayacu, Mocagua, 3.84°S, 70.22°W, 76m, 14-21 August 2000 (A Parente)(IAvH: AvH-E-73764, ADP145179, female paratype), 12-19 March 2000 (A Parente)(IAvH: AvH-E-2971, ADP145201, female paratype), 19-26 June 2000 (A Parente)(IAvH: AvH-E-73760, ADP145205, ADP145213, female paratypes), 2-8 May 2000 (A Parente)(IAvH: AvH-E-73762, ADP145199, female paratype), 29 May - 6 June 2000 (A Parente) (IAvH: AvH-E-73759, ADP145207, female paratype), 3-9 April 2000 (A Parente)

(IAvH: AvH-E-73758, ADP145185, female paratype); Chocó, Ensenada de Utría Cocalito, 6.046°N, 77.352°W, 20m, 1 August - 10 October 2000 (S Sarria)(IAvH: IAvH-E-10943, ADP145168, female paratype); Valle del Cauca, PPN Farallones de Cali, 3.527°N, 76.848°W, 650-900m, 1 August - 10 October 2000 (S Sarria)(IAvH: IAvH-E-3531, ADP145212, male paratype, IAvH-E-10942, ADP145208, IAvH-E-40743, ADP145216, female paratypes). **Ecuador**, Orellana, Reserva Ethnica Huaorani, 39 km S Pompeya, Estación Científica Yasuní - Onkone Gare Camp, 0.6551°S, 76.4403°W, 220-250m, 4-14 October 1995 (GE Ball, D.Shpeley)(UASM: ADP135771, male paratype), Erwin Piraña Plot: transect 6, station 9, 0.6561°S, 76.4483°W, 220-250m, 15 January 1994 (TL Erwin, et al.)(NMNH: ADP138483, male paratype), Erwin Piraña Plot: transect 2, station 8, 0.6581°S, 76.4513°W, 220-250m, 20 June 1994 (TL Erwin, et al.)(NMNH: ADP135847, male paratype), Erwin Piraña Plot: transect 4, station 9, 0.6570°S, 76.4498°W, 220-250m, 25 June 1994 (TL Erwin, et al.)(NMNH: ADP135954, male paratype), Erwin Piraña Plot: transect 5, station 9, 0.6566°S, 76.4490°W, 220-250m, 12 February 1995 (TL Erwin, et al.)(NMNH: ADP137319, female paratype), Erwin Piraña Plot: transect 5, station 10, 0.6566°S, 76.4490°W, 220-250m, 6 October 1995 (TL Erwin, et al.) (NMNH: ADP137341, male paratype, ADP137377, female paratype), Erwin Piraña Plot: transect 10, station 1, 0.6540°S, 76.4453°W, 220-250m, 8 October 1995 (TL Erwin, et al.)(NMNH: ADP135950, female paratype), Erwin Piraña Plot: transect 6, station 8, 0.6561°S, 76.4483°W, 220-250m, 7 February 1996 (TL Erwin, et al.)(NMNH: ADP137389, female paratype), Erwin Piraña Plot: transect 4, station 4, 0.6570°S, 76.4498°W, 220-250m, 21 June 1996 (TL Erwin, et al.)(NMNH: ADP137323, female paratype), Erwin Piraña Plot: transect 5, station 5, 0.6566°S, 76.4490°W, 220-250m, 22 June 1996 (TL Erwin, et al.)(NMNH: ADP137738, male paratype, ADP137349, female paratype), Erwin Piraña Plot: transect 1, station 9, 0.6586°S, 76.4521°W, 220-250m, 30 September 1996 (TL Erwin, et al.)(NMNH: ADP137337, male paratype), Erwin Piraña Plot: transect 5, station 10, 0.6566°S, 76.4490°W, 220-250m, 2 October 1996 (TL Erwin, et al.)(NMNH: ADP137750, female paratype), Erwin Piraña Plot: transect 5, station 8, 0.6566°S, 76.4490°W, 220-250m, 6 October 1996 (TL Erwin, et al.)(NMNH: ADP135857, female paratype); Yasuni National Park (edge), 95.43 km E (heading 101.46°) Coca, Tiputini Biodiversity Station, Erwin Harpia Plot: transect 1, station 6, 0.6342°S, 76.1443°W, 218m, 23 October 1998 (TL Erwin, et al.)(NMNH: ADP135902, ADP135874, female paratypes), Erwin Harpia Plot: transect 3, station 9, 0.63327°S, 76.1443°W, 207m, 24 October 1998 (TL Erwin, et al.)(NMNH: ADP135843, female paratype), Erwin Harpia Plot: transect 6, station 9, 0.6295°S, 76.1443°W, 199m, 26 October 1998 (TL Erwin, et al.)(NMNH: ADP135850, male paratype), Erwin Harpia Plot: transect 9, station 8, 0.6269°S, 76.1443°W, 203m, 5 February 1999 (TL Erwin, et al.) (NMNH: ADP135844, male paratype, ADP135853, ADP135898, female paratypes), Erwin Harpia Plot: transect 6, station 7, 0.6295°S, 76.1443°W, 199m, 7 February 1999 (TL Erwin, et al.)(NMNH: ADP135849, male paratype), Erwin Harpia Plot: transect 4, station 4, 0.6316°S, 76.1443°W, 208m, 8 February 1999 (TL Erwin, et

al.)(NMNH: ADP135851, ADP135845, male paratypes), Erwin Harpia Plot: transect 6, station 9, 0.6295°S, 76.1443°W, 199m, 25 October 1999 (TL Erwin, et al.)(NMNH: ADP135916, female paratype). **Perú**, Loreto, Pacaya-Samiria National Reserve, 1 km E Hamburgo, Boca del Ingles Camp, 0,5226°S, 75.1192°W, 125m, 10 May 1990 (TL Erwin, et al.)(NMNH: ADP005785, female paratype); Río Samiria (South Branch), Camp Terry, 5.6951°S, 75.2243°W, 129m, 12 May 1990 (TL Erwin, et al.)(NMNH: ADP005786, female paratype); Madre de Dios, Manu Reserved Zone, Río Manu, BIOLAT Biological Station, Pakitza, 11.9446°S, 71.2831°W, 356m, 7 September 1988 (TL Erwin, et al.)(NMNH: ADP005778, ADP005779, male paratypes), 9 September 1988 (TL Erwin, et al.)(NMNH: ADP005763, female paratype), 12 September 1988 (TL Erwin, et al.)(NMNH: ADP005776, male paratype), 15 February 1990 (TL Erwin, GP Servat)(NMNH: ADP005777, male paratype), 21 September 1991 (TL Erwin, et al.)(NMNH: ADP005764, male paratype), 16 October 1991 (TL Erwin, MG Pogue)(NMNH: ADP007444, male paratype), Reserva Nacional Tambopata, 30 km (air) SW Puerto Maldonado, Explorer's Inn, 12.8364°S, 69.2936°W, 209m, 14 September 1984 (TL Erwin, et al.)(NMNH: ADP005781, female paratype), 25 October 1982 (TL Erwin, et al.)(NMNH: ADP005798, female paratype), 5-6 November 1982 (R Wilkerson)(NMNH: ADP067693, male paratype), 30 April 1984 (TL Erwin, et al.)(NMNH: ADP005784, male paratype), 8 September 1984 (TL Erwin, et al.)(NMNH: ADP005783, female paratype), 14 September 1984 (TL Erwin, et al.)(NMNH: ADP005782, male paratype).

Geographic distribution (Fig. 11). This species is currently known from the type locality and other localities in Ecuador and various localities in Colombia and Perú.

Notes. The holotype will be deposited in Escuela Politécnica Nacional, Quito, Ecuador and is currently held in trust until the completion of studies at NMNH.

Hyboptera viridivittis Chaudoir, 1872

Green-lined humps-backed beetle
Figs 4B, 5E, 11

Hyboptera viridivittis Chaudoir, 1872: 164.

Lectotype. (Here designated) Sex unknown. **Brazil**, Rio de Janeiro, Cantagallo (RF Sahlberg)(MNHP).

Derivation of specific epithet. The specific epithet, *viridivittis*, is a feminine Latin adjective referring to the green line pattern of the pronotum.

Proposed English vernacular name. Green-lined humps-backed beetle.

Diagnosis. With the attributes of the genus and *angulicollis* species group as described above and adults with patches of bright metallic green para-medially on pronotum, elytra dark matte black, some individuals with hint of metallic green near basal margin. Venter with gular region, prosternal region, meso- and metathroax, and margins of abdominal sterna infuscated, otherwise rufous.

Description. (Figs 4B, 5E). *Size*: See Appendix 1. Length (SBL) medium for genus, ABL = 4.65–5.27 mm, SBL = 3.76–4.17 mm, TW = 2.18–2.59 mm.

Color: See diagnosis, above.

Luster: Matte, pronotum and elytra with metallic highlights.

Microsculpture: Mostly isodiametric or stretched, shallowly impressed, cells more stretched around elytral tubercles.

Head: Rugae moderately coarse, mostly transverse or angulate. Eye large, sub-hemispheric, evenly rounded anteriorly, subtly more prolonged posteriorly. Antenna short, barely reaching humerus. Labrum rectangulate, shallowly bilobed, anterior margin slightly emarginate. Neck finely transversely rugose.

Prothorax: Pronotum moderately broad, disc centrally depressed along midline with dense transverse rugae. Lateral margins broadly explanate and obtusely angulate medially then moderately arcuate to obtuse hind angle, base medially produced and rounded posteriorly.

Pterothorax: Normal for Agrina, fully winged. Elytron interval 3 with 8 and interval 5 with 6 unisetiferous tubercles, other intervals moderately convex, side margin narrowly explanate laterally, slightly more so medially. Elytron moderately broad and short, slightly narrower than the pronotum at the broadest part, apex truncate, slightly rounded with distal corner broadly and obtusely rounded, disc not significantly convex, basal third slightly depressed. All interneurs well-impressed.

Legs: Femur dorso-ventrally moderately depressed, tibia coequal in length, more depressed; tarsus less than half the length of the tibia, fourth tarsomere markedly bilobed and with tarsal pad of setae.

Abdomen: Sparsely setiferous; normal ambulatory setae on sterna 3–5; female with two pairs of ambulatory setae on sternum 6, medial pair of setae less than the length of lateral pair; males with only the lateral pair of longer setae.

Male genitalia: Phallus (Fig. 5E) with ostium of 1/5 its length, catopic, apex moderately long, narrowly rounded, broad in dorsal aspect; endophallus with flagellum (mid-part obvious in illustration), flagellum not barbed. Parameres asymmetric, right very small, left larger.

Female genitalia: Not investigated, likely similar to that of *H. lucida* (Fig. 8).

Dispersal potential. These beetles are macropterous and probably capable of flight. They are moderately swift and agile runners.

Way of life. Adults are found in April-June, the early dry season, in lowlands (75-846 m.a.s.l.) in the Mata Atlântica.

Other specimens examined. Brazil, Rio de Janeiro, Rio de Janeiro, 22.9522°S, 43.2109°W, 459m, 1883 (P Germain)(NMNH: ADP136142, female), Santa Catarina, Nova Teutonia, 27.1833°S, 52.3833°W, 300-500m, April 1977 (F Plaumann)(CAS: ADP007617, male), May 1977 (F Plaumann)(CAS: ADP007597, ADP007601, males, ADP007599, ADP007618, females), June 1977 (F Plaumann) (CAS: ADP007600, ADP007616, females).

Geographic distribution (Fig. 11). This species is currently known from the states of Minas Gerais, Rio de Janeiro, Santa Catarina, and São Paulo in the Mata Atlântica of Brazil.

Notes. Reichardt (1971, 1973) reported the following additional specimens that we did not see: **Brazil** – Minas Gerais: no locality (2 exs. MNHP). Rio de Janeiro: Nova Friburgo (l ex. BMNH). Guanabara, (5 exs. BMNH, MNHP, MZSP). São Paulo: Barueri (l ex. MZSP). Santa Catarina: Nova Teutonia (1 ex. BMNH), Corupá (1 ex. MCZ). Additionally, Chaudoir (1872) mentioned he had two specimens; therefore, a lectotype needs to be designated. Reichardt (1973) mistakenly writes he saw the "holotype." We have chosen the first of Chaudoir's specimens as the Lectotype (see above).

tuberculata species group

(recognized by Reichardt 1973)

The most distinctive attribute of species in this group is that the pronotum has discal rugae etched at an angle aimed medio-posteriorly, or somewhat chaotically seemingly without order. Adults of all species have no metallic coloration (except *H. apollonia* with subtle traces only) on the dorsal surface and the general adult size is medium to large for the genus. Male phallus apex short, broadly or narrowly blunt.

Hyboptera apollonia Erwin, 2004

Apollonia's humps-backed beetle
Figs 6A, 10A, 11

Hyboptera apollonia Erwin, 2004: 33.

Holotype. Male. **Panamá**, Colón, 30 km NE Colón, Porto Bello, 9.555°N, 79.653°W, 9m, 23 February 1911)(EA Schwarz)(NMNH: ADP007943).

Derivation of specific epithet. The specific epithet, *apollonia,* is an eponym based on the first name of Michael Corleone's beautiful young Italian wife in the movie *The Godfather* whose death in a car explosion perpetrated by Mafia competition signifies the useless instantaneous death of so many species when humans put fire to the tropical rain forest in time of drought.

Proposed English vernacular name. Apollonia's humps-backed beetle.

Diagnosis. With the attributes of the genus and *angulicollis* species group as described above and with only dark non-metallic markings on the pronotal disc; pronotum with discal rugae etched horizontally and linear. Elytra black with paler margin not reaching suture. Mouthparts, appendages, margin of prothorax, venter of head and prothorax, abdominal segments II–V testaceous; meso- and metathorax, and abdominal segment VI infuscated.

Description. (Figs 6A, 10A). *Size*: See Appendix 1. Length (SBL) medium for genus, ABL = 4.19–5.14mm, SBL = 3.53–4.26 mm, TW = 2.09–2.57 mm.

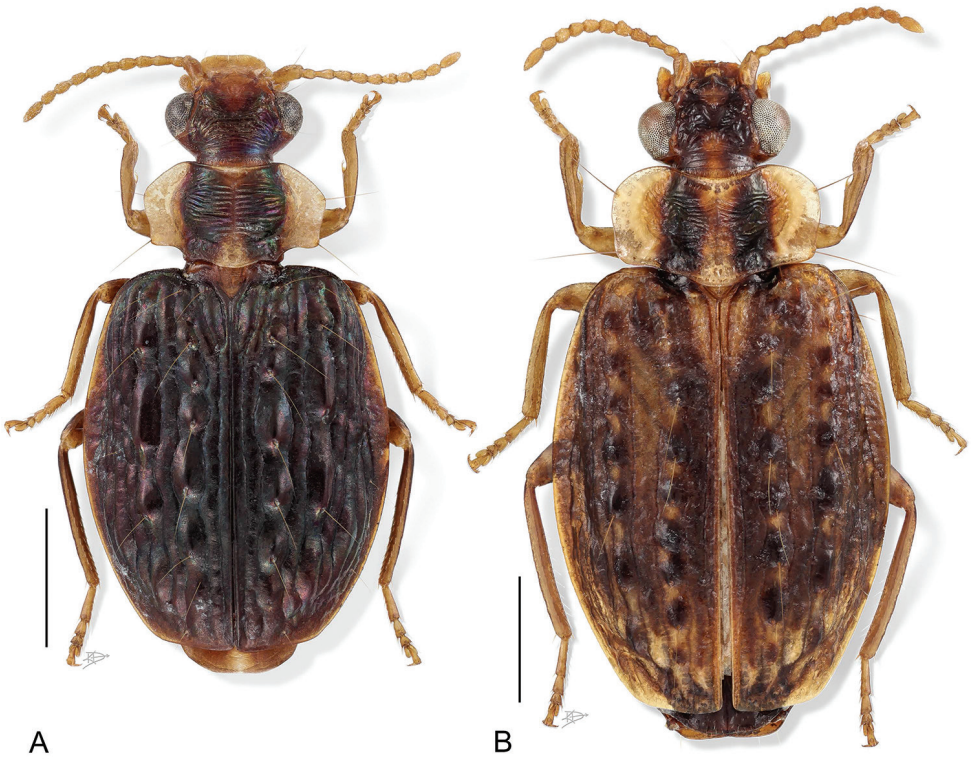

Figure 6. Digital Photo-illustration. Habitus, dorsal aspect. **A** *Hyboptera apollonia* Erwin, male, ADP007944 **B** *Hyboptera auxilidora* Erwin, male, ADP007622.

Color: See diagnosis, above.

Luster: Shiny, no metallic highlights, subtle iridescent around tubercles.

Microsculpture: Mostly isodiametric or slightly stretched, well-impressed, cells somewhat stretched around elytral tubercles.

Head: Rugae moderately coarse, mostly not arranged. Eye very large, sub-hemispheric, evenly rounded anteriorly, subtly more prolonged posteriorly. Antenna short, barely reaching humerus. Labrum rectangulate, shallowly bilobed, anterior margin slightly emarginate. Neck finely transversely rugose.

Prothorax: Pronotum markedly broad, disc centrally slightly depressed with dense transverse rugae. Lateral margins very broadly explanate and obtusely rounded medially then nearly straight to obtuse hind angle, base medially produced and rounded posteriorly.

Pterothorax: Normal for Agrina, fully winged. Elytron intervals 3 with 7, and interval 5 with 6 (5) discal unisetiferous tubercles, other intervals moderately convex, side margin moderately explanate laterally only at middle third. Elytron broad and moderately short, moderately narrower than the pronotum at the broadest part, apex truncate, slightly rounded with distal corner broadly and obtusely rounded, disc not significantly convex, basal third slightly depressed. All interneurs well-impressed.

Legs: Femur dorso-ventrally moderately depressed, tibia coequal in length, more depressed; tarsus less than half the length of the tibia, fourth tarsomere markedly bilobed and with tarsal pad of setae.

Abdomen: Sparsely setiferous; normal ambulatory setae on sterna 3–5; female with two pairs of ambulatory setae on sternum 6, medial pair of setae less than the length of lateral pair; males with only the lateral pair of longer setae on sternum 6.

Male genitalia: Phallus (Fig. 10A) with ostium of 1/6 its length, catopic, apex very short, moderately rounded; endophallus with flagellum (base obvious in illustration), flagellum not barbed. Parameres asymmetric, right very small, left larger.

Female genitalia: Not investigated, likely similar to that of *H. lucida* (Fig. 8).

Dispersal potential. These beetles are macropterous and capable of flight. They are moderately swift and agile runners. Modern collecting methods have acquired specimens, including insecticidal foggings and malaise traps.

Way of life. An adult of this species was fogged from a tree in the genus *Guarea* at La Selva and another caught in a Malaise trap as part of the ALAS Project. F. Nevermann collected a specimen on a rotten log. The known elevational range of this species is between 9 and 815 m.a.s.l. Adults have been obtained in January–April, and September–October; hence they are active in both the dry and rainy seasons in the lowlands and lower middle altitudes, both on the east and west sides of the Cordillera Central.

Other specimens examined. Costa Rica, Heredia, 11 km SE La Virgin, 10.4313°N, 84.0056°W, 450-650m, 11 May 2003 (Proy. ALAS)(INBIO: ADP135881, female), 250-350m, 22 February 2004 (Proy. ALAS)(INBIO: ADP140501, female), 3 km S Pto. Viejo, Estación Biológica La Selva, 10.4313°N, 84.0056°W, 150m, 18 May 1993, (Proy. ALAS)(HESP: ADP102312, female), 13 January 1996 (Proy. ALAS)(INBIO-OET: ADP135879, female); Limón, Rio Reventazon, Ebene, Hamburg Farm, 10.4149°N, 83.7506°W, 50m, 4 October 1928 (F Nevermann)(NMNH: ADP007942, female), 20 April 1932 (F Nevermann)(NMNH: ADP007945, female), P.N. Tortuguero, Tortuguero, Estación Cuatro Esquinas, 10.5338°N, 83.5071°W, sea level, June 1991 (J Solano)(INBIO, 007578, male); Puntarenas, Peninsula de Osa, Rancho Quemado, 8.6790°W, 83.5667°W, 200m, September 1991 (F Quesada)(INBIO: ADP100266, male). **Panamá**, Colón, 30 km NE Colón, Porto Bello, 9.555°N, 79.653°W, 9m, 2-11 March 1911 (EA Schwarz)(NMNH: ADP007944, male), Gamboa, Pipeline Road, 9.124°N, 79.749°W, 37m, 17-22 June 1993 (SW Lingafelter)(SEMC: ADP007577, female); Panamá, Cerro Jefe, 9.2373°N, 79.3549°W, 815m, 20 May 1972 (RT Allen)(NMNH: ADP011167, female).

Geographic distribution (Fig. 11). This species is currently known from the type locality in Panamá and throughout southern Central America north to Costa Rica.

Notes. Adults of this species are unusual in that they subtly bear two attributes similar to species in the *angulicollis* species-group: faint traces of metallic green and a short narrow nubnen-like apex of the phallus, rather than short and broadly blunt. Adults of the *angulicollis* species-group are extensively green and the phallus apex, while narrow is elongate.

***Hyboptera auxilidora* Erwin, 2004**
Maria's humps-backed beetle
Figs 6B, 11

Hyboptera auxilidora Erwin, 2004: 35.

Holotype. Male. **USA**. Texas, Hidalgo County, nr. Mission, Bentson Rio Grande State Park, 26.176°N, 98.385°W, 38m, 18 July 1981 (WE Steiner)(NMNH: ADP007623).

Derivation of specific epithet. The specific epithet, *auxiliadora,* is an eponym based on the middle name of María Auxiliadora Sanchez, who for many years was responsible for the welfare of participating visiting taxonomists at INBio and its facilities and who made life easy therein while we undertook our studies of the rich Costa Rican fauna and flora.

Proposed English vernacular name. Maria's humps-backed beetle.

Diagnosis. With the attributes of the genus and *tuberculata* species group as described above and adults with only dark non-metallic markings on the pronotal disc, venter substantially infuscated, pronotum with discal rugae etched at an angle aimed medio-posteriorly, or somewhat chaotically; elytron with sutural margin at apical sixth pale, not black, if brownish not contrasting with background color, and elytra just posterior to scutellum with a V-shaped pale area encompassing the sutures and first intervals. Elytron broad with markedly arcuate lateral margin.

Description. (Fig. 6B). *Size*: See Appendix 1. Length (SBL) long for genus, ABL = 5.06–5.93 mm, SBL = 4.39–4.98 mm, TW = 2.42–3.28 mm.

Color: See diagnosis, above.

Luster: Shiny, not metallic.

Microsculpture: Mostly isodiametric or stretched, shallowly impressed, cells somewhat stretched around elytral tubercles.

Head: Rugae moderately coarse, mostly chaotic. Eye markedly large, sub-hemispheric, evenly rounded anteriorly, subtly more prolonged posteriorly. Antenna short, barely reaching humerus. Labrum rectangulate, shallowly bilobed, anterior margin slightly emarginate. Neck transversely rugose.

Prothorax: Pronotum markedly broad, disc centrally depressed along midline with dense arcuate rugae directed anteriorly in apical half, posteriorly in posterior half of disc. Lateral margins broadly explanate and subtly produced at lateral seta, but not acute medially then straight to obtuse hind angle, base medially slightly produced and rounded posteriorly.

Pterothorax: Normal for Agrina, fully winged. Elytron interval 3 with 10 discal unisetiferous tubercles and interval 5 with 9(8) discal unisetiferous tubercles, interval 3 with one such tubercle near apex, other intervals moderately convex, side margin broadly explanate laterally at middle third. Elytron moderately broad and short, moderately narrower than the pronotum at the broadest part, apex truncate, slightly rounded with distal corner broadly and obtusely rounded, disc not significantly convex, basal third slightly depressed. All interneurs well-impressed.

Legs: Femur dorso-ventrally moderately depressed, tibia coequal in length, more depressed; tarsus less than half the length of the tibia, fourth tarsomere markedly bilobed and with tarsal pad of setae.

Abdomen: Sparsely setiferous; normal ambulatory setae on sterna 3–5; female with two pairs of ambulatory setae on sternum 6, medial pair of setae less than the length of lateral pair; males with only the lateral pair of longer setae.

Male genitalia: Phallus (see fig. 20 in Erwin, 2004) with ostium 1/4 length, catopic and apex short and evenly rounded, endophallus with flagellum, flagellum not barbed. Parameres asymmetric, right very small, left very large.

Female genitalia: Not investigated, likely similar to that of *H. lucida* (Fig. 8).

Dispersal potential. These beetles are macropterous and capable in flight. They are moderately swift and agile runners. Specimes have been collected from light traps (white and UV light) and Malaise traps.

Way of life. Adults are found in July in lowlands (10–240 m.a.s.l.) in terra firme forests. The holotype was collected by W. Steiner from under bark of the tree *Celtis levigata* Willd. Vogt collected another individual from under the web tent of a psocid colony (Psocoptera). Adults have been obtained in March, April, May, July, August, and September; hence they are active in both the dry and rainy seasons in the lowlands on both sides of the Cordillera Central.

Other specimens examined. Costa Rica, Guanacaste, P.N. Guanacaste, 30 km N Liberia, Finca Jenny, 10.8655°N, 85.5735°W, 240m, 14-21 August 1993 (E Araya)(INBIO: ADP007640, female); Limón, Rio Reventazon, Ebene, Hamburg Farm, 10.4149°N, 83.7506°W, 50m, 6 November 1925 (F Nevermann) (NMNH: ADP007947, female); Puntarenas, P.N. Carara, Estación Quebrada Bonita, 9.7737°N, 84.6122°W, 100m, 17 March - 30 April ---- (P Campos)(INBIO: ADP007639, male). **Honduras**, Atlantida, Tela, 15.719°N, 87.458°W, 85m, 15 May 1995 (R Cave)(NMNH: ADP135859, female). **México**, Veracruz, 3.58 km NE Catemaco, Lake Catemaco, 18.444 N, 95.078 W, 355m, 23 August 1967 (GE Ball, TL Erwin, et al.)(UASM: ADP007621, female). **Panamá**, Canal Zone, Barro Colorado Nature Monument, Barro Colorado Island, Barro Colorado Research Station, Mess Hall, 9.1652°N, 79.8368°W, 70m, 19 February 1975 (TL Erwin, JL Lawrence)(NMNH: ADP027570, male); Cocle, El Valle, 8.603°N, 80.152°W, 829m, 26 May 1983 (WE Steiner)(NMNH: ADP135861, ADP135863, males, ADP135865, ADP005801, females). **USA**, Texas, southeast Hidalgo County, 1 December 1946 (GB Vogt)(NMNH: ADP007638, female), Bentson Rio Grande State Park, Mission, 26.176°N, 98.385°W, 38m, 16 July 1975 (CA Triplehorn)(OSU: ADP007622, female), Sabal Palm Grove Sanctuary, nr. Southmost, 25.8419°N, 97.4247°W, 8m, 1 May 1979 (R.Turnbow)(UASM: ADP007620, male).

Geographic distribution (Fig. 11). This species is currently known only from the type locality and nearby areas in Texas, and from Panamá, and in between those extremes only from México, Honduras, and Costa Rica. It likely is to be found in other Central American countries with further sampling.

***Hyboptera dilutior* Oberthür, 1884**
Oberthür's humps-backed beetle
Figs 7A, 10B, 11

Hyboptera dilutior Oberthür, 1884: 52.

Holotype. Sex unknown. **Brazil**. Amazonas: Tefé (MNHP).

Derivation of specific epithet. The specific epithet, *dilutior,* is an adjective referring to the "washed out" appearance of the color of adults of this species in comparison with those of other species.

Proposed English vernacular name. Oberthür's humps-backed beetle.

Diagnosis. With the attributes of the genus and *tuberculata* species group as described above and adults with only dark non-metallic markings on the head and pronotal disc, pronotum with discal rugae in basal half etched at an angle aimed medioposteriorly, or somewhat chaotically. Elytra mostly testaceous with darkly marked tubercles; small medio-apical tubercles also infuscated; with sutural margin at apical sixth infuscated markedly contrasting with testaceous background color. Venter of head and thorax substantially infuscated; abdominal sterna mostly pale with subtle infuscation.

Description. (Figs 7A, 10B). *Size*: See Appendix 1. Length (SBL) long for genus, ABL = 3.92–5.98 mm, SBL = 3.55–4.67 mm, TW = 1.95–3.21 mm.

Color: *See* diagnosis, above.

Luster: Without any metallic highlights, shiny.

Microsculpture: Mostly isodiametric and stretched, shallowly impressed, cells somewhat more stretched around elytral tubercles.

Head: Rugae moderately coarse, mostly without patterned arrangement. Eye moderately large, hemispheric, evenly rounded. Antenna short, barely reaching humerus. Labrum rectangulate, shallowly bilobed, anterior margin slightly emarginate. Neck finely transversely rugose.

Prothorax: Pronotum markedly broad, disc centrally markedly depressed with coarse angulate rugae. Lateral margins broadly explanate and evenly rounded to obtuse hind angle, base medially produced and rounded posteriorly.

Pterothorax: Normal for Agrina, fully winged. Elytron intervals 3 and 5 each with 7 promient discal unisetiferous tubercles, other intervals moderately convex, side margin broadly explanate laterally only at middle third. Elytron broad and short, much narrower in width to that of the pronotum at the broadest part, apex truncate, slightly rounded with distal corner broadly and obtusely rounded, disc not significantly convex, basal third slightly depressed. All interneurs well-impressed.

Legs: Femur dorso-ventrally moderately depressed, tibia coequal in length, more depressed; tarsus less than half the length of the tibia, fourth tarsomere markedly bilobed and with tarsal pad of setae.

Abdomen: Sparsely setiferous; normal ambulatory setae on sterna 3–5; female with two pairs of ambulatory setae on sternum 6, medial pair of setae less than the length of lateral pair; males with only the lateral pair of longer setae.

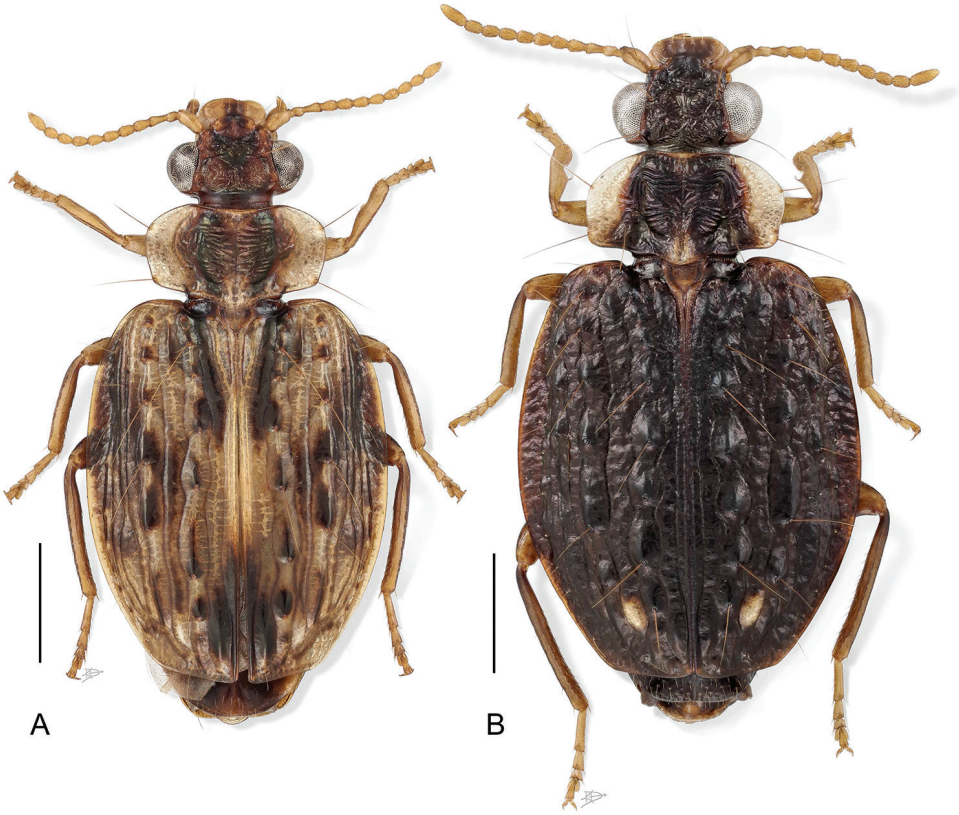

Figure 7. Digital Photo-illustration. Habitus, dorsal aspect. **A** *Hyboptera dilutior* Oberthür, male, ADP094021 **B** *Hyboptera lucida* Henry & Erwin, sp. n., female, ADP135783.

Male genitalia: Phallus (Fig. 10B) with ostium of 1/6 its length, catopic, apex very short, narrowly pointed, broadly rounded in dorsal aspect; endophallus with flagellum (obvious in illustration), flagellum not barbed. Parameres asymmetric, right very small, left larger.

Female genitalia: Not investigated, likely similar to that of *H. lucida* (Fig. 8).

Dispersal potential. These beetles are macropterous and capable of flight. They are moderately swift and agile runners. Adults of this species are attracted to C.D.C. light traps and captured in SLAM Malaise traps.

Way of life. Adults are common in the lowlands (7 to 356 m a.s.l.) and appear to be generalists in a variety of rainforest biotopes including terra firme and várzea. In these forests, they are commonly found in big trees with vines and epiphytes, in suspended dry leaves, in dry *Sheelea* sp. and *Astrocaryum chambira* Burret palm frond skirts. Individuals can be found from January to December, in both the rainy and dry seasons. Member of this species have been recorded from the canopy of the following tree species using insecticidal fogging techniques: *Chrysophyllum argenteum* cf.; *Sterculia colombiana* cf.; *Parkia multijuga* cf.; *Naucleopsis herrerensis* cf.; *Matisia malacoca-*

lyx cf.; *Pseudolmedia laevigata*; *Cecropia herthae*; *Pentagonia spathicalyx* cf.; *Eschweilera coriacea* cf.; *Batocarpus orinocensis* cf.; *Zanthoxylum riedelianum* ssp. *kellermanii* cf.; *Cecropia ficifolia*; *Inga capitata*; *Leonia glycicarpa*; *Coussapoa herthae*; *Pourouma mollis* ssp. *triloba* cf.; *Pausandra trianae*; *Coussapoa orthoneura* cf.; *Alchornea triplinervia* cf.; *Protium sagotianum* cf.; *Guatteria* sp.; *Meiocarpus*, long petiole; *Oenocarpus bataua*; *Neea* dive-tuberculate; *Semaphyllanthe megistocaula* cf.; Lauraceae redvein; *Siparuna decipiens*; *Trichilia solitudinis*.

Other specimens examined. Brazil, Amazonas, Parana do Xiboreninho, 3.2482°S, 59.9791°W, 7m, 7 August 1979 (TL Erwin, J Adis, et al.)(NMNH: ADP006180, female), 40 km SW Manaus, Paraña Costa da Ilha de Curarí, 3.4165°S, 60.2508°W, 17m, 3 August 1979 (TL Erwin, J Adis)(NMNH: ADP005799, male), north of Manaus, on Amazonas 010 at Km 26, Reserva Ducke, 2.918°S, 59.971°W, 70m, 2 May 1978 (J Arias)(NMNH: ADP135826, female), 11 May 1978 (J Arias) (NMNH: ADP135786, male), 1 August 1978 (J Arias)(NMNH: ADP135804, female), 6 September 1978 (J Arias)(NMNH: ADP135792, male), 13 September 1978 (J Arias)(NMNH: ADP135790, ADP135818, females), 20 September 1978 (J Arias) (NMNH: ADP135778, male); Pará, Belém, 1.555°S, 48.429°W, 25m, 25 January 1969 (L O'Brien, CW O'Brien)(NMNH: ADP006178, female), Parque Estadual do Utinga, Belém, 1.406°S, 48.399°W, 21m, 20 January 1977 (N Guimaraes)(NMNH: ADP006179, female); Rondonia, 7 km E Costa Marques, 12.435°S, 64.292°W, 153m, 11-23 April 1987 (T Klein)(NMNH: ADP135883, female). **Ecuador**, Orellana, Reserva Ethnica Huaorani, 39 km S, Pompeya, Estación Científica Yasuní - Onkone Gare Camp, Erwin Piraña Plot: transect 4, station 7, 0.6570°S, 76.4498°W, 220-250m, 16 January 1994 (TL Erwin, et al.)(NMNH: ADP137700, female), Erwin Piraña Plot: transect 5, station 7, 0.6566°S, 76.4490°W, 220-250m, 26 January 1994 (TL Erwin, et al.)(NMNH: ADP135940, male), Erwin Piraña Plot: transect 10, station 10, 0.6540°S, 76.4453°W, 220-250m, 8 February 1995 (TL Erwin, et al.) (NMNH: ADP006175, male), Erwin Piraña Plot: transect 8, station 5, 0.6551°S, 76.4403°W, 220-250m, 30 June 1995 (TL Erwin, et al.)(NMNH: ADP137756, male), Erwin Piraña Plot: transect 1, station 4, 0.6586°S, 76.4521°W, 220-250m, 4 February 1996 (TL Erwin, et al.)(NMNH: ADP137692, female), Erwin Piraña Plot: transect 5, station 7, 0.6566°S, 76.4490°W, 220-250m, 9 February 1996 (TL Erwin, et al.)(NMNH: ADP135974, male), Erwin Piraña Plot: transect 2, station 7, 0.6581°S, 76.4513°W, 220-250m, 30 September 1996 (TL Erwin, et al.)(NMNH: ADP137698, male), Erwin Piraña Plot: transect 6, station 2, 0.6561°S, 76.4483°W, 220-250m, 2 October 1996 (TL Erwin, et al.)(NMNH: ADP135926, female), Erwin Piraña Plot: transect 8, station 5, 0.6551°S, 76.4403°W, 220-250m, 3 October 1996 (TL Erwin, et al.)(NMNH: ADP135930, male), Erwin Piraña Plot: transect 9, station 8, 0.6545°S, 76.4460°W, 220-250m, 4 October 1996 (TL Erwin, et al.)(NMNH: ADP137387, ADP137690, males), Erwin Piraña Plot: transect 3, station 7, 0.6575°S, 76.4505°W, 220-250m, 21 January 2006 (TL Erwin, et al.)(NMNH: ADP133846, male), Yasuni National Park (edge), 95.43 km E (heading 101.46°) Coca, Tiputini Biodiversity Station, Erwin Harpia Plot: transect 10, station 2, 0.6262°S, 76.1443°W, 214m, 5 Febru-

ary 1999 (TL Erwin, et al.)(NMNH: ADP135832, female), Orellana, Yasuni National Park (edge), 95.43 km E (heading 101.46°) Coca, Tiputini Biodiversity Station, Erwin Harpia Plot: transect 3, station 9, 0.6332°S, 76.1443°W, 207m, 30 June 1998 (TL Erwin, et al.)(NMNH: ADP135782, female), Erwin Harpia Plot: transect 10, station 8, 0.6262°S, 76.1443°W, 214m, 21 October 1998 (TL Erwin, et al.)(NMNH: ADP135836, male), Erwin Harpia Plot: transect 10, station 3, 0.6262°S, 76.1443°W, 214m, 5 February 1999 (TL Erwin, et al.)(NMNH: ADP135784, female), Erwin Harpia Plot: transect 6, station 5, 0.6295°S, 76.1443°W, 199m, 7 February 1999 (TL Erwin, et al.)(NMNH: ADP135840, male, ADP135806, female), Erwin Harpia Plot: transect 5, station 6, 0.6332°S, 76.1443°W, 207m, 8 February 1999 (TL Erwin, et al.) (NMNH: ADP135794, female), Erwin Harpia Plot: transect 10, station 4, 0.6262°S, 76.1443°W, 214m, 28 September 2000 (TL Erwin, et al.)(NMNH: ADP139140, male), Erwin Harpia Plot: transect 6, station 1, 0.6304°S, 76.1443°W, 199m, 1 October 2000 (TL Erwin, et al.)(NMNH: ADP139128, ADP139134, ADP139150, males), Erwin Harpia Plot: transect 1, station 3, 0.6342°S, 76.1443°W, 214m, 2 October 2000 (TL Erwin, et al.)(NMNH: ADP139124, male), Erwin Harpia Plot: transect 10, station 5, 0.6262°S, 76.1443°W, 214m, 17 February 2001 (TL Erwin, et al.)(NMNH: ADP139112, male), Erwin Harpia Plot: transect 3, station 1, 0.6332°S, 76.1443°W, 207m, 24 July 2001 (TL Erwin, et al.)(NMNH: ADP139527, female); Sucumbíos, Río Napo, Sacha Lodge, Pilchicocha, 0.472°S, 76.459°W, 228m, 22 February - 4 March 1994 (P Hibbs)(SEMC: ADP006174, male), 14-24 March 1994 (P Hibbs) (SEMC: ADP006173, female), 13-23 April 1994 (P Hibbs)(SEMC: ADP006132, female), 24 March - 3 June 1994 (P Hibbs)(SEMC: ADP007645, female). **French Guiana**, Cayenne, Foret de Maya, Commune Macouria, 4.9535°S, 52.4566°W, 32m, 19 December 2016 (S Brule, PH Dalens, E Poirier)(NMNH: ADP148976, male, Mitaraka, Commune Maripasoula, 2.2723°S, 54.5152°W, 445m, 4 March 2016 (S Brule, PH Dalens, E Poirier)(NMNH: ADP148975, female), Commune de Roura, Montagne des Chevaux, 4.7127°N, 52.3966°W, 90m, 19 June 2010 (S Brule, PH Dalens, E Poirier)(NMNH: ADP135774, male, ADP135788, female), 2 January 2011 (S Brule, PH Dalens, E Poirier)(NMNH: ADP130786, female), 28 March 2011 (S Brule, PH Dalens, E Poirier)(NMNH: ADP135814, male), 14 August 2011 (S Brule, PH Dalens, E Poirier)(NMNH: ADP135802, female), 21 August 2011 (S Brule, PH Dalens, E Poirier)(NMNH: ADP135820, female), 11 September 2011 (S Brule, PH Dalens, E Poirier)(NMNH: ADP135776, ADP135824, females), 25 September 2011 (S Brule, PH Dalens, E Poirier)(NMNH: ADP135770, female), 8 October 2011 (S Brule, PH Dalens, E Poirier)(NMNH: ADP135816, female), 23 October 2011 (S Brule, PH Dalens, E Poirier)(NMNH: ADP140522, male, ADP135772, female), 30 October 2011 (S Brule, PH Dalens, E Poirier)(NMNH: ADP135796, female), 12 November 2011 (S Brule, PH Dalens, E Poirier)(NMNH: ADP135780, female), 11 December 2011 (S Brule, PH Dalens, E Poirier)(NMNH: ADP135830, female), 18 December 2011 (S Brule, PH Dalens, E Poirier)(NMNH: ADP135800, ADP135810, females), 21 December 2011 (S Brule, PH Dalens, E Poirier)(NMNH: ADP135768, ADP135808, females), 24 December 2011 (S Brule, PH Dalens, E Poirier)(NMNH:

ADP135798, female), 18 February 2012 (S Brule, PH Dalens, E Poirier)(NMNH: ADP128634, female), 3 November 2012 (S Brule, PH Dalens, E Poirier)(NMNH: ADP135828, male), 3 January 2013 (S Brule, PH Dalens, E Poirier)(NMNH: ADP135822, male), 27 January 2013 (S Brule, PH Dalens, E Poirier)(NMNH: ADP135811, male), 31 March 2013 (S Brule, PH Dalens, E Poirier)(NMNH: ADP135812, female), 20 April 2013 (S Brule, PH Dalens, E Poirier)(NMNH: ADP148093, male), 12 April 2014 (S Brule, PH Dalens, E Poirier)(NMNH: ADP140520, male), 19 July 2014 (S Brule, PH Dalens, E Poirier)(NMNH: ADP140531, male), 27 December 2014 (S Brule, PH Dalens, E Poirier)(NMNH: ADP148092, male), 3 January 2015 (S Brule, PH Dalens, E Poirier)(NMNH: ADP148091, male), 17 October 2015 (S Brule, PH Dalens, E Poirier)(NMNH: ADP148094, male), 2 January 2016 (S Brule, PH Dalens, E Poirier)(NMNH: ADP148095, ADP148096, ADP148097, males), 9 January 2016 (S Brule, PH Dalens, E Poirier)(NMNH: ADP148102, male), 30 April 2016 (S Brule, PH Dalens, E Poirier) (NMNH: ADP148871, male), Commune Matoury, Mont Grand, 4.862°N, 52.355°W, 215m, 17 December 2012 (S Brule, PH Dalens, E Poirier)(NMNH: ADP135801, female), Inselberg, Nouragues, Commune de Regina, Saut Parare, 4.0334°N, 52.6786°W, 51m, 13 October 2010 (S Brule, PH Dalens, E Poirier)(NMNH: ADP128636, female), Camp Inselberg, Nouragues, Commune de Regina, 4.0839°N, 52.6813°W, 411m, 22 November 2012 (S Brule, PH Dalens, E Poirier)(NMNH: ADP147735, female), Region de Saul, Commune de Saul, Belvedere de Saul (point de vue), 3.6223°N, 53.2159°W, 283-325m, 5 February 2010 (S Brule, PH Dalens, E Poirier)(NMNH: ADP130781, female), 5 February 2010 (S Brule, PH Dalens, E Poirier)(NMNH: ADP130782, female), 20 December 2010 (S Brule, PH Dalens, E Poirier)(NMNH: ADP130784, female), 24 January 2011 (S Brule, PH Dalens, E Poirier) (NMNH: ADP130783, female), 4 February 2011 (S Brule, PH Dalens, E Poirier) (NMNH: ADP134146, female), 7 February 2011 (S Brule, PH Dalens, E Poirier) (NMNH: ADP130785, ADP134155, females), 22 March 2011 (S Brule, PH Dalens, E Poirier)(NMNH: ADP134142, ADP134150, males, ADP134148, ADP134149, females), 30 March 2011 (S Brule, PH Dalens, E Poirier)(NMNH: ADP134147, male), 15 June 2011 (S Brule, PH Dalens, E Poirier)(NMNH: ADP134296, female), 11 August 2011 (S Brule, PH Dalens, E Poirier)(NMNH: ADP134154, female), 13 December 2011 (S Brule, PH Dalens, E Poirier)(NMNH: ADP134144, female), 3 October 2012 (S Brule, PH Dalens, E Poirier)(NMNH: ADP134298, male), 11 December 2012 (S Brule, PH Dalens, E Poirier)(NMNH: ADP134153, male, ADP134151, ADP134152, females), 16 January 2013 (S Brule, PH Dalens, E Poirier)(NMNH: ADP134145, female), 27 January 2013 (S Brule, PH Dalens, E Poirier)(NMNH: ADP147733, female), Foret de Maya, Commune Macouria, 4.9552°N, 52.4603°W, 30m, 19 December 2016 (S Brule, PH Dalens, E Poirier)(NMNH: ADP151236, male). **Perú**, Loreto, Pacaya-Samiria National Reserve, Río Samiria, Cocha Shinguito, 5.1775°S, 76.6556°W, 112m, 29 August 1991 (TL Erwin, MG Pogue)(NMNH: ADP051385, ADP051413, males, ADP051412, ADP051415, females), 19 June 1990 (TL Erwin, et al.)(NMNH: ADP094114, ADP094121, males, ADP094067, female),

Río Samiria (South Branch), Camp Terry, 5.6951°S, 75.2243°W, 129m, 14 May 1990 (TL Erwin, et al.)(NMNH: ADP007644, female), 16 May 1990 (TL Erwin)(NMNH: ADP094121, ADP094084, females); Madre de Dios, Manu Reserved Zone, Río Manu, BIOLAT Biological Station, Pakitza, 11.9446°S, 71.2831°W, 356m, 14 October 1991 (TL Erwin, MG Pogue)(NMNH: ADP007512, ADP007513, females), 16 October 1991 (TL Erwin, MG Pogue)(NMNH: ADP007530, female), 23 June 1993 (TL Erwin, F. Pfuno)(NMNH: ADP007531, male, ADP007529, ADP007551, females), 28 September 1991 (TL Erwin, MG Pogue)(NMNH: ADP007528, female), 6 October 1991 (TL Erwin, MG Pogue)(NMNH: ADP007511, female), Reserva Nacional Tambopata, 30 km (air) SW Puerto Maldonado, Explorer's Inn, 12.8364°S, 69.2936°W, 209m, 16 March 1982 (TL Erwin, et al.)(NMNH: ADP007642, male), 3 October - 15 November 1983, NE Stork, et al.)(NMNH: ADP135873, female), 2 March 1984 (TL Erwin, et al.)(NMNH: ADP007643, male), 8 September 1984 (TL Erwin, et al.)(NMNH: ADP007641, female).**Venezuela**, Amazonas, Cerro de la Neblina, Rio Baria Basecamp, 0.837°N, 66.162°W, 138m, 10-20 February 1985 (PJ Spangler, PM Spangler, et al.)(NMNH: ADP006177, female), 20 February 1985 (PJ Spangler, PM Spangler, et al.)(NMNH: ADP006176, female), 21-28 February 1985 (PJ Spangler, PM Spangler, et al.)(NMNH: ADP005803, male).

Geographic distribution (Fig. 11). This species is currently known from the type locality at Tefé, Brazil, and from Brazil – Amazonas, Pará, Rondonia; Ecuador, French Guiana, Perú, and Venezuela.

Notes. Reichardt (1973) reported the following additional specimens that we did not see: **Brazil** – Amazonas: Itaituba (3 exs. MNHP); Manaus (1 ex. MZSP); Matuxadi, alto Rio Cauaburi (1 ex. MZSP): Tefé (4 exs. MNHP). Pará: Tapajos (2 exs. MNHP). Lorenz (1998, 2005) failed to record this species.

Hyboptera lucida Henry & Erwin, sp. n.

http://zoobank.org/BC3B2B01-C53D-48A6-B2B1-342CA9D2E53A
Pied humps-backed beetle
Figs 7B, 8, 10C, 11

Holotype. Female. **French Guiana**, Cayenne, Commune de Roura, Montagne des Chevaux, 4.7127°N, 52.3966°W, 90m, 17 April 2011 (S Brule, PH Dalens, E Poirier) (NMNH: ADP128638).

Specific epithet. The epithet "*lucida*" is a Latinized singular feminine adjective of lucid, for clear, referring to the translucent patch near the apex of the elytron on adult members of this species.

Proposed english vernacular name. Pied humps-backed beetle.

Diagnosis. With the attributes of the genus and *tuberculata* species group as described above and adults with only dark non-metallic markings on the pronotal disc; elytra black with 4 small pale medio-apical tubercles. Venter completely piceous. Largest adults in the genus.

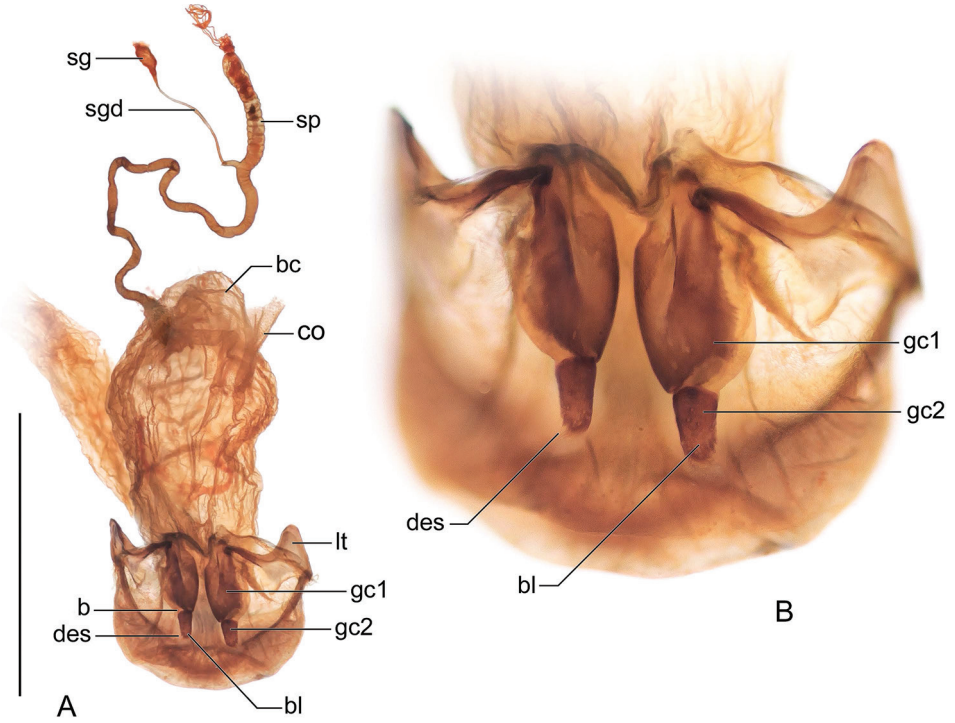

Figure 8. Digital Photo-illustration, female reproductive system dorsal and ventral aspects. *Hyboptera lucida* Henry & Erwin sp. n., ADP148100. Legend, bc, bursa copulatrix; sg, spermathecal gland; sgd, spermathecal gland duct; sp, spermatheca. Dorsal aspect; lt, laterotergite; gc1, gonocoxite 1; gc2, gonocoxite 2, des, dorsal ensiform seta, b, base of gonocoxite 2; bl, blade of gonocoxite 2. Scale line = 0.25 mm.

Description. (Figs 7B, 8, 10C). *Size*: See Appendix 1. Length (SBL) long for genus, ABL = 5.51–6.67 mm, SBL = 4.38–5.27 mm, TW = 2.36–3.25 mm.

Color: See diagnosis, above.

Luster: Without any metallic highlights, matte.

Microsculpture: Mostly isodiametric and stretched, well-impressed, cells somewhat more stretched around elytral tubercles.

Head: Rugae moderately coarse, mostly without patterned arrangement. Eye very large, hemispheric, evenly rounded. Antenna short, barely reaching humerus. Labrum rectangulate, shallowly bilobed, anterior margin slightly emarginate. Neck coarsely transversely rugose.

Prothorax: Pronotum markedly broad, disc centrally shallowly depressed with coarse angulate rugae. Lateral margins broadly explanate and evenly rounded to level of lateral seta then straight to obtuse hind angle, base medially produced and rounded posteriorly.

Pterothorax: Normal for Agrina, fully winged. Elytron intervals 3 with 10 and interval 5 with 7 prominent discal unisetiferous tubercles, interval 4 with sub-apical pale colored "lens," other intervals moderately convex, side margin broadly explanate

laterally only at middle third. Elytron broad and moderately short, much narrower in width than that of the pronotum at the broadest part, apex truncate, slightly rounded with distal corner broadly and obtusely rounded, disc not significantly convex, basal third slightly depressed. All interneurs well-impressed.

Legs: Femur dorso-ventrally moderately depressed, tibia coequal in length, more depressed; tarsus less than half the length of the tibia, fourth tarsomere markedly bilobed and with tarsal pad of setae.

Abdomen: Sparsely setiferous; normal ambulatory setae on sterna 3–5; female with two pairs of ambulatory setae on sternum 6, medial pair of setae less than the length of lateral pair; males with only the lateral pair of longer setae.

Male genitalia: Phallus (Fig. 10C) with ostium of 1/6 its length, catopic, apex very short, narrowly pointed, broadly rounded in dorsal aspect; endophallus with flagellum (obvious in illustration), flagellum not barbed. Parameres asymmetric, right very small, left larger.

Female genitalia: (Fig. 8). Ovipositor with broad triangular laterotergite (lt) and two robust gonocoxites (gc 1, gc 2); gonocoxite 1 apicolaterally not setose; gonocoxite 2 apically rounded, base (b) medium-size co-equal in width with blade (bl) which is short, blunt, with several dorsal ensiform setae (des), ventral ensiform seta absent, ensiform setae moderately short and robust; without ventral preapical nematiform setae. Reproductive tract proximally with moderately long, broad bursa copulatrix (bc), common oviduct (co) enters the bursa ventrally just anterior to bursal midlength, and long narrow corregated spermatheca (sp) distal to villous canal; spermathecal gland small, cylindrical; spermathecal gland duct (sgd) very narrow, attached to oviduct at base of its broadened portion.

Dispersal potential. These beetles are macropterous and capable of flight. They are moderately swift and agile runners. Adults of this species are attracted to light traps, and have been collected in FIT, Malaise, and SLAM traps.

Way of life. Adults are found in January-March, May-December, in all seasons, in lowlands (13–325 m.a.s.l.) in the lowland forests of Guyane.

Other specimens examined. **French Guiana**, Cayenne, Commune de Roura, Montagne des Chevaux, 4.7127°N, 52.3966°W, 90m, 16 July 2011 (S Brule, PH Dalens, E Poirier)(NMNH: ADP135813, male paratype), 2 January 2016 (S Brule, PH Dalens, E Poirier)(NMNH: ADP148100, female paratype), 26 March 2016 (S Brule, PH Dalens, E Poirier)(NMNH: ADP148222, male paratype), 20 May 2015 (S Brule, PH Dalens, E Poirier)(NMNH: ADP148099, male paratype), 23 October 2011 (S Brule, PH Dalens, E Poirier)(NMNH: ADP135793, female paratype), 23 September 2011 (S Brule, PH Dalens, E Poirier)(NMNH: ADP135785, male paratype), 25 September 2011 (S Brule, PH Dalens, E Poirier)(NMNH: ADP135825, female paratype), 31 March 2013 (S Brule, PH Dalens, E Poirier)(NMNH: ADP135807, male paratype), 4 February 2013 (S Brule, PH Dalens, E Poirier)(NMNH: ADP135831, male paratype), 16 April 2016 (S Brule, PH Dalens, E Poirier)(NMNH: ADP152487, female paratype), Commune Matoury, La Desiree, 4.8449°N, 52.3484°W, 20m, 27 September 2014 (S Brule, PH Dalens, E Poirier)(NMNH: ADP148098, female para-

type), Trou Poisson, 5.4206°N, 53.0716°W, 13m, 7 May 2014 (S Brule, PH Dalens, E Poirier)(NMNH: ADP135783, female paratype), 7 May 2014 (S Brule, PH Dalens, E Poirier)(NMNH: ADP135829, female paratype), Inselberg Nouragues, Commune de Regina, Saut Parare, 4.0334°N, 52.6786°W, 51m, 30 September 2009 (S Brule, PH Dalens, E Poirier)(NMNH: ADP126231, female paratype), Region de Saul, Commune de Saul, Belvedere de Saul (point de vue), 3.6223°N, 53.2159°W, 283-325m, 11 December 2012 (S Brule, PH Dalens, E Poirier)(NMNH: ADP134135, female paratype), 20 December 2010 (S Brule, PH Dalens, E Poirier)(NMNH: ADP130776, female paratype), 21 June 2011 (S Brule, PH Dalens, E Poirier)(NMNH: ADP134134, female paratype), Cirque Orfion, Orapu RN2 PK65, Commune de Regina, 4.4962°N, 52.3454°W, 81m, 17 September 2016 (S Brule, PH Dalens, E Poirier)(NMNH: ADP151235, male paratype).

Geographic distribution (Fig. 11). This species is currently known from the type locality in French Guiana and nearby areas.

Hyboptera tuberculata (Dejean), 1825

Tuberculate humps-backed beetle
Figs 9A, 10D, 11

Lebia tuberculata Dejean, 1825: 272.
Cryptobatis tuberculata; Gemminger and Harold (1868: 135).
Hyboptera tuberculata (Dejean); Chaudoir (1872: 162).
Aspasia verrucosa Reiche; Reichardt (1973: 53).

Lectotype. Here designated. Male. **French Guiana**, Cayenne, (MNHP).

Derivation of specific epithet. The species epithet "*tuberculata*" is a Latinized singular feminine adjective, referring to the bumpy attributes of the elytra.

Proposed English vernacular name. Tuberculate humps-backed beetle.

Diagnosis. With the attributes of the genus and *tuberculata* species group as described above and adults with only dark non-metallic markings on the pronotal disc, elytron just posterior to scutellum with only the suture pale in color, otherwise markedly infuscate.

Description. (Figs 9A, 10D). *Size*: See Appendix 1. Length (SBL) long for genus, ABL = 4.32–5.88 mm, SBL = 3.94–4.85 mm, TW = 2.18–3.12 mm.

Color: See diagnosis, above.

Luster: Without any metallic highlights, shiny.

Microsculpture: Mostly isodiametric and stretched, shallowly impressed, cells somewhat more stretched around elytral tubercles.

Head: Rugae moderately coarse, mostly chaotic. Eye markedly large, sub-hemispheric, evenly rounded anteriorly, subtly more prolonged posteriorly. Antenna short, barely reaching humerus. Labrum rectangulate, shallowly bilobed, anterior margin slightly emarginate. Neck transversely finely rugose.

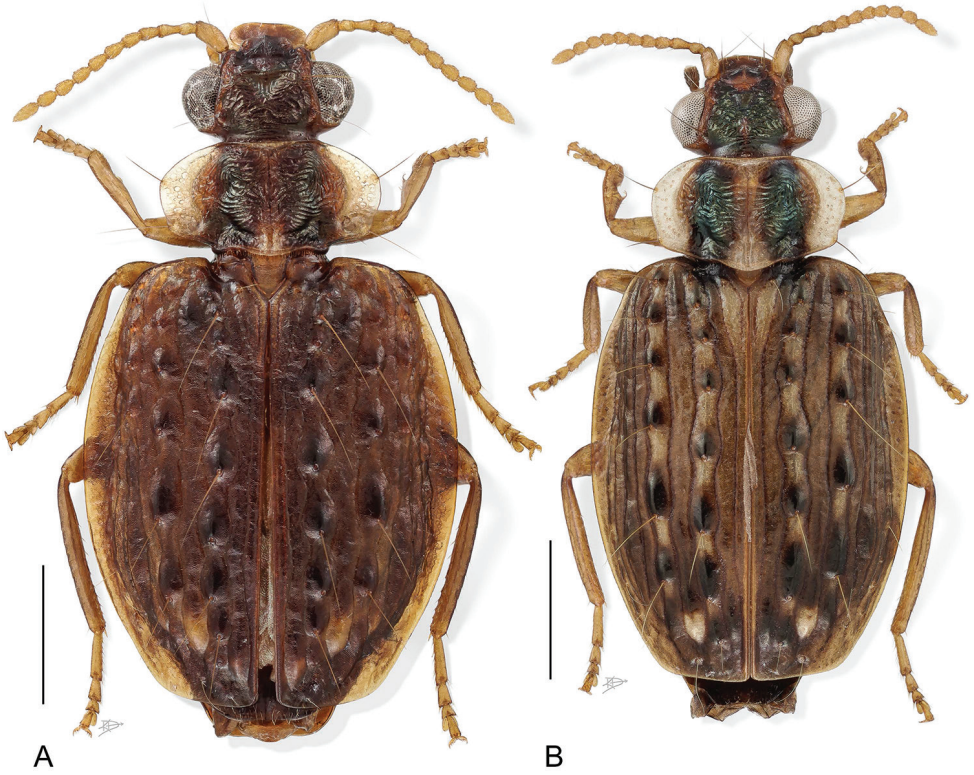

Figure 9. Digital Photo-illustration. Habitus, dorsal aspect. **A** *Hyboptera tuberculata* (Dejean), female, ADP007533 **B** *Hyboptera verrucosa* (Reiche), female, ADP086946.

Prothorax: Pronotum markedly broad, disc centrally moderately depressed with coarse angulate rugae. Lateral margins broadly explanate and evenly rounded then straight to obtuse hind angle, base medially produced and rounded posteriorly.

Pterothorax: Normal for Agrina, fully winged. Elytron intervals 3 with 8(9) and interval 5 with 6(7) prominent discal unisetiferous tubercles, interval 4 and 6 with subapical pale colored "lens," other intervals moderately convex, side margin broadly explanate laterally only at middle third. Elytron broad and moderately short, moderately narrower in width than that of the pronotum at the broadest part, apex truncate, slightly rounded with distal corner broadly and obtusely rounded, disc not significantly convex, basal third slightly depressed. All interneurs well-impressed.

Legs: Femur dorso-ventrally moderately depressed, tibia coequal in length, more depressed; tarsus less than half the length of the tibia, fourth tarsomere markedly bilobed and with tarsal pad of setae.

Abdomen: Sparsely setiferous; normal ambulatory setae on sterna 3–5; female with two pairs of ambulatory setae on sternum 6, medial pair of setae less than the length of lateral pair; males with only the outer pair of longer setae.

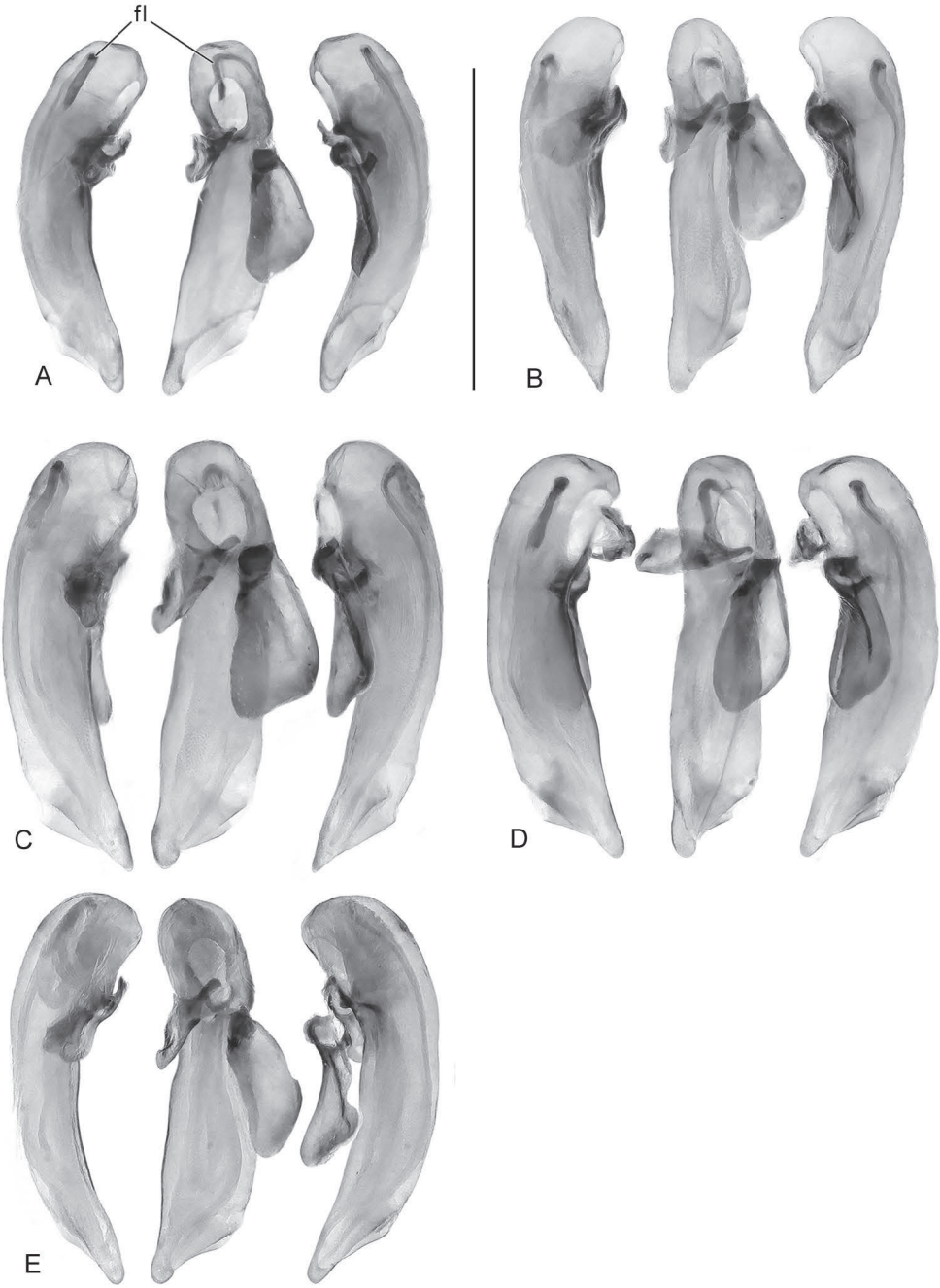

Figure 10. Digital Photo-illustration, male aedeagus in repose, dorsal, ventral, left lateral aspects: **A** *Hyboptera apollonia* Erwin, ADP100266 **B** *Hyboptera dilutior* Oberthür, ADP134143 **C** *Hyboptera lucida* Henry & Erwin, sp. n., ADP135785 **D** *Hyboptera tuberculata* (Dejean), ADP135797 **E** *Hyboptera verrucosa* (Reiche), ADP082523. Legend, fl, flagellum. Scale line = 0.25 mm.

Figure 11. Distribution map for known localities of *Hyboptera* species.

Male genitalia: Phallus (Fig. 10D) robust with ostium of 1/6 its length, catopic, apex very short, broadly rounded in dorsal and lateral aspects; endophallus with flagellum (obvious in illustration), flagellum not barbed. Parameres asymmetric, right very small, left larger.

Female genitalia: Not investigated, likely similar to that of *H. lucida* (Fig. 8).

Dispersal potential. These beetles are macropterous and capable of flight. They are moderately swift and agile runners. Adults of this species are attracted to C.D.C. Light traps.

Way of life. Adults are common in the lowlands and lower midlands (7–914 m a.s.l.) and appear to be generalists in a variety of rainforest biotopes including terra firme, dry and humid tropical forests, in gallery forests, and savanna forest patches. In these forests, they are commonly found in big trees with vines and epiphytes, in suspended medium to large-sized dry leaves, and in dense vine tangle plus leaves with light bamboo occurrence. Individuals can be found from January to December, in both the rainy and dry seasons. Member of this species have been recorded from the canopy of the following tree species using insecticidal fogging techniques: *Pouteria reticulata* ssp. *reticulata* cf.; *Sloanea cordia*; *Browneopsis ucayalina*; *Talisia* bitter; *Mouriri guapira*; *Trichilia solitudinis*; *Eriotheca globosa* cf.; *Sloanea* 1; *Trichilia solitudinis*; *Simira cordifolia/rubescens* cf.; *Sarcaulus brasiliensis* aff. "burnt"; *Catatola costaricana* aff.; *Pourouma mollis* ssp. *triloba* cf.; *Alchornea triplinervia* cf.; *Duguetia surinamensis* cf.; *Casearia avitensis* cf.; *Nectandra crassiloba* cf.; *Trichilia rubra* cf.; *Coccoloba densifrons* cf. traditional; *Iriartea deltoidea*; *Micropholis venulosa* cf.; *Sagotia racemosa*; *Virola obovata*; *Pouteria baehniana* cf.; *Pourouma bicolor* ssp. *bicolor* cf.; *Inga bourgonii* cf.; *Garcinia macrophylla* cf.; *Chrysobalanaceae surreptitious*; *Oenocarpus bataua*; *Neea* divetuberculate; *Semaphyllanthe megistocaula* cf.; Lauraceae redvein.

Other specimens examined. Bolivia, Beni, 53 km E San Borja, Estación Biológica Beni, Palm Camp, 14.8676°S, 66.3265°W, 177m, 25-30 July 1988 (TL Erwin)(NMNH: ADP005759, male, ADP135777, female). **Brazil**, Amazonas, north of Manaus, on Amazonas 010 at Km 26, Reserva Ducke, 2.918°S, 59.971°W, 70m, 27 October 1977 (J Arias)(NMNH: ADP005758, female), 8 August 1978 (J Arias)(NMNH: ADP135819, female); Sergipe, Estação Ecológica da Serra de Itabaiana, 10.7297°S, 37.3064°W, 166m, 14-20 September 1999 (A Bonaldo)(NMNH: MCM166.415, ADP144921, male). **Colombia**, Amazonas, PNN Amacayacu, Mocagua, 3.84°S, 70.22°W, 76m, 3-9 April 2000 (A Parente)(IAvH: IAvH-E-3063, ADP145177, male)(IAvH: IAvH-E-10944, ADP145183, female), 6-12 June 2000 (A Parente)(IAvH: IAvH-E-73787, ADP145145, male), 12-19 June 2000 (A Parente)(IAvH: IAvH-E-3056, ADP145193)(IAvH: IAvH-E-3093, ADP145203)(IAvH: IAvH-E-3095, ADP145173, males)(IAvH: IAvH-E-3096, ADP145187, female), 26 June - 6 July 2000 (A Parente)(IAvH: IAvH-E-73786, ADP145175, male), 7-19 July 2000 (A Parente)(IAvH: IAvH-E-40755, ADP145171)(IAvH: IAvH-E-73785, ADP145169, males)(IAvH: IAvH-E-73775, ADP145181, female); Bolivar, Zambrano, Hda. Monterrey - Rio Magdalena, 9.6293°N, 74.9123°W, 70m, 16-30 August 1993 (F Fernanadez, G Ulloa)(IAvH: IAvH-E-2449, ADP145154, female), September 1993 (F Fernanadez, G Ulloa)(IAvH: IAvH-E-73780, ADP145186, male), 8 October 1993 (G Ulloa, F Fernanadez)(IAvH: IAvH-E-2449, ADP145182, female), SFF Los Colorados, Diana, 9.90°N, 75.11°W, 237m, 2-16 January 2001 (E Deulufeut)(IAvH: IAvH-E-2320, ADP145194)(IAvH: IAvH-E-73779, ADP145180, males)(IAvH: IAvH-E-73778, ADP145196, female), La Suiris, 9.900°N, 75.1154°W, 236m, 1-15

September 2001 (E Deulufeut)(IAvH: IAvH-E-40756, ADP145184, male), SFF Los Colorados Venado, 9.900°N, 75.1153°W, 235m, 2-17 October 2000 (E Deulufeut) (IAvH: IAvH-E-73776, ADP145190)(IAvH: IAvH-E-73777, ADP145188, females); Casanare, Aguazul, 5.18°N, 72.55°W, 701m, 22 September 1995 (F Fernanadez) (IAvH: IAvH-E-2450, ADP145152, female); Magdelena, PNN Tayrona, Canaveral, 11.342°N, 074.031°W, 25m, 17 October - 3 November 2000 (R Henriquez) (IAvH: IAvH-E-73781, ADP145178, male)(IAvH: IAvH-E-73782, ADP145174) (IAvH: IAvH-E-73783, ADP145170, females), 4-15 December 2000, R Henriquez) (IAvH: IAvH-E-3532, ADP145176)(IAvH: IAvH-E-73784, ADP145166, females), Vichada, PNN Tuparro, 5.36°N, 67.84°W, 71m, 8-14 December 2000 (W Villalba) (IAvH: IAvH-E-2741, ADP145148, male). **Ecuador**, Orellana, Reserva Ethnica Huaorani, 39 km S Pompeya, Estación Científica Yasuní - Onkone Gare Camp, Erwin Piraña Plot, transect 10, station 2, 0.6590°S, 76.453°W, 220-250m, 8 October 1995 (TL Erwin, et al.)(NMNH: ADP137752, female paratype), Erwin Piraña Plot, transect 10, station 5, 0.6540°S, 76.453°W, 220-250m, 4 October 1996 (TL Erwin, et al.)(NMNH: ADP137369, male paratype), Erwin Piraña Plot, transect 10, station 9, 0.6540°S, 76.453°W, 220-250m, 23 January 2006 (TL Erwin, et al.)(NMNH: ADP133868, male paratype), Erwin Piraña Plot, transect 4, station 4, 0.6570°S, 76.498°W, 220-250m, 3 July 1995 (TL Erwin, et al.)(NMNH: ADP135805, male paratype), Erwin Piraña Plot, transect 5, station 2, 0.6566°S, 76.490°W, 220-250m, 12 February 1995 (TL Erwin, et al.)(NMNH: ADP005762, female paratype), Erwin Piraña Plot, transect 5, station 2, 0.6566°S, 76.496°W, 220-250m, 9 October 1994 (TL Erwin, et al.)(NMNH: ADP138806, male paratype), Erwin Piraña Plot, transect 6, station 1, 0.6561°S, 76.483°W, 220-250m, 7 February 1996 (TL Erwin, et al.)(NMNH: ADP137383, male paratype), Erwin Piraña Plot, transect 6, station 1, 0.6561°S, 76.485°W, 220-250m, 29 January 2006 (TL Erwin, et al.)(NMNH: ADP133852, female paratype), Erwin Piraña Plot, transect 6, station 4, 0.6561°S, 76.4483°W, 220-250m, 22 June 1996 (TL Erwin, et al.)(NMNH: ADP137355, female paratype), Erwin Piraña Plot, transect 6, station 6, 0.6561°S, 76.483°W, 220-250m, 22 July 1996 (TL Erwin, et al.)(NMNH: ADP137746, male paratype), Erwin Piraña Plot, transect 6, station 7, 0.6561°S, 76.4483°W, 220-250m, 2 October 1996 (TL Erwin, et al.)(NMNH: ADP135891, male paratype), Erwin Piraña Plot, transect 6, station 8, 0.6561°S, 76.4483°W, 220-250m, 7 February 1996 (TL Erwin, et al.)(NMNH: ADP137353, female paratype), Erwin Piraña Plot, transect 8, station 4, 0.6551°S, 76.4403°W, 220-250m, 7 October 1995 (TL Erwin, et al.)(NMNH: ADP135970, male paratype), Erwin Piraña Plot, transect 8, station 6, 0.6551°S, 76.4483°W, 220-250m, 7 October 1995 (TL Erwin, et al.)(NMNH: ADP137760, female paratype); Yasuni National Park (edge), 95.43 km E (heading 101.46°) Coca, Tiputini Biodiversity Station, Erwin Harpia Plot: transect 4, station 8, 0.6316°S, 76.1443°W, 208m, 24 October 1998 (TL Erwin, et al.)(NMNH: ADP135821, male), Erwin Harpia Plot: transect 8, station 4, 0.6278°S, 76.1443°W, 203m, 4 July 1998 (TL Erwin, et al.)(NMNH: ADP135797, male). Yasuni National Park (edge), 95.43 km E (heading 101.46°) Coca, Tiputini Biodiversity Station, Erwin Harpia Plot, tran-

sect 10, station 6, 0.6262°S, 76.1443°W, 214m, 21 October 1998 (TL Erwin, et al.) (NMNH: ADP135775, female paratype), Erwin Harpia Plot, transect 10, station 9, 0.6269°S, 76.1443°W, 214m, 5 July 1998 (TL Erwin, et al.)(NMNH: ADP135803, female paratype), Erwin Harpia Plot, transect 3, station 10, 0.6332°S, 76.1443°W, 207m, 8 February 1999 (TL Erwin, et al.)(NMNH: ADP135773, male paratype), Erwin Harpia Plot, transect 4, station 1, 0.6316°S, 76.1443°W, 208m, 24 October 1998 (TL Erwin, et al.)(NMNH: ADP135779, female paratype), Erwin Harpia Plot, transect 6, station 9, 0.6295°S, 76.1443°W, 199m, 7 February 1999 (TL Erwin, et al.)(NMNH: ADP135835, female paratype), Erwin Harpia Plot, transect 7, station 1, 0.6295°S, 76.1443°W, 203m, Erwin Harpia Plot: transect 4, station 4, 0.6316°S, 76.1443°W, 208m, 20 February 2001 (TL Erwin, et al.)(NMNH: ADP139100, female), 29 September 2000 (TL Erwin, et al.)(NMNH: ADP139132, female paratype), Erwin Harpia Plot, transect 7, station 6, 0.6287°S, 76.1443°W, 203m, 6 February 1999 (TL Erwin, et al.)(NMNH: ADP135827, male paratype); Sucumbíos, Río Napo, Sacha Lodge, Pilchicocha, 0.472°S, 76.459°W, 228m, 12-22 February 1994 (P Hibbs)(SEMC: ADP005757, female paratype), 24 May - 3 June 1994 (P Hibbs) (SEMC: ADP005756, female paratype). **French Guiana**, Cayenne, Commune de Roura, Montagne des Chevaux, 4.7127°N, 52.3966°W, 90m, 23 January 2016 (S Brule, PH Dalens, E Poirier)(NMNH: ADP144920, male). **Guyana**, Bartica, 6.3970°N, 58.6268°W, 20m, 12 May 1924 (AMNH: ADP005760, male). **Panamá**, Chiriqui, Volcan de Chiriqui, 610-914m, 26 May 1983 (GC Champion)(BMNH: ADP144995, male); Cocle, El Valle, 8.603°N, 80.152°W, 800m, 25-28 May 1983 (WE Steiner) (NMNH: ADP144994, male). **Perú**, Loreto, Pacaya-Samiria National Reserve, Río Samiria, Cocha Shinguito, 5.1775°S, 76.6556°W, 112m, 22 May 1990 (TL Erwin, et al.)(NMNH: ADP086940, male, ADP086960, female); Madre de Dios, Manu Reserved Zone, Río Manu, BIOLAT Biological Station, 11.9446°S, 71.2831°W, 356m, August-September 1988 (TL Erwin)(NMNH: ADP007532, ADP007535, males, ADP007533, ADP007534, females), 7 September 1988 (TL Erwin)(NMNH: ADP007550, female), 21 September 1991 (TL Erwin)(NMNH: ADP007552, male), 30 September 1991 (TL Erwin, MG Pogue)(NMNH: ADP135823, male), 22 June 1993 (TL Erwin, F. Pfuno S)(NMNH: ADP007553, ADP007554, females), Reserva Nacional Tambopata, 30 km (air) SW Puerto Maldonado, Explorer's Inn, 12.8364°S, 69.2936°W, 209m, 30 April 1984 (TL Erwin, et al.)(NMNH: ADP005754, male), 2 May 1984 (TL Erwin, et al.)(NMNH: ADP005755, female). **Suriname**, Paramaribo, Combe, 5.8427°N, 55.1600°W, 15m, 6 January 1956 (DC Geijskes)(NBCL: ADP005761, male); Wanica, Lelydorp, Sumatra weg, 5.700°N, 55.198°W, 7m, 28 November 1939 (DC Geijskes)(NBCL: ADP005805, male).

Geographic distribution (Fig. 11). This species is currently known from the type locality in French Guiana and nearby areas and from Bolivia, Brazil – (Amazonas, Sergipe), Colombia, Ecuador, Guyana, Perú, and Suriname.

Notes. Reichardt (1971) synonomized the following species with *H. tuberculata* Dejean. We do not agree with this based on the numerous attributes we studied and included in the descriptions.

***Hyboptera verrucosa* (Reiche), 1842, stat. rest.**
Verrucose humps-backed beetle
Figs 9B, 10E, 11

Aspasia verrucosa Reiche, 1842: 311.
Hyboptera verrucosa (Reiche); Chaudoir (1872: 164).
Lebia tuberculata Dejean; Reichardt (1971: 53).

Holotype. Sex unknown. **Colombia** ("Nouvelle-Grenade"), (MNHP). Type locality herewith restricted to **Colombia**, Amazonas, Leticia, 4.2242°S, 69.9449°W, 70 m.s.a.l.

Derivation of specific epithet. The specific epithet, *verrucosa*, is a feminine Latin adjective referring to the tuberculate elytra.

Proposed English vernacular name. Verrucose humps-backed beetle.

Diagnosis. With the attributes of the genus and *tuberculata* species group as described above and adults with only dark non-metallic markings on the pronotal disc, pronoum with rounded margins, elytron just posterior to scutellum with a V-shaped pale area encompassing the scutellum and sutural and first interval, venter substantially infuscate, and elytra narrow, not broadly arcuate.

Description. (Figs 9B, 10E). *Size*: See Appendix 1. Length (SBL) long for genus, ABL = 4.47–5.66 mm, SBL = 3.79–4.90 mm, TW = 2.06–2.85 mm.

Color: See diagnosis, above.

Luster: Without any metallic highlights, shiny and matte.

Microsculpture: Mostly isodiametric and stretched, shallowly impressed, cells somewhat more stretched around elytral tubercles.

Head: Rugae moderately coarse, mostly without patterned arrangement. Eye markedly large, sub-hemispheric, evenly rounded anteriorly, subtly more prolonged posteriorly. Antenna short, barely reaching humerus. Labrum rectangulate, shallowly bilobed, anterior margin slightly emarginate. Neck finely transversely rugose.

Prothorax: Pronotum moderately broad, disc centrally depressed with coarse angulate rugae. Lateral margins broadly explanate and evenly rounded to obtuse hind angle, base medially produced and rounded posteriorly.

Pterothorax: Normal for Agrina, fully winged. Elytron intervals 3 with 8, and interval 5 with 6 prominent discal unisetiferous tubercles, interval 4 with sub-apical pale colored "lens," other intervals moderately convex, side margin broadly explanate laterally only at middle third. Elytron broad and moderately short, much narrower in width than that of the pronotum at the broadest part, apex truncate, slightly rounded with distal corner broadly and obtusely rounded, disc not significantly convex, basal third slightly depressed. All interneurs well-impressed.

Legs: Femur dorso-ventrally moderately depressed, tibia coequal in length, more depressed; tarsus less than half the length of the tibia, fourth tarsomere markedly bilobed and with tarsal pad of setae.

Abdomen: Sparsely setiferous; normal ambulatory setae on sterna 3–5; female with two pairs of ambulatory setae on sternum 6, medial pair of setae less than the length of lateral pair; males with only the lateral pair of longer setae.

Male genitalia: (Fig. 10E). With ostium of 1/5 its length, catopic, apex short, rounded; endophallus with flagellum, flagellum not barbed. Parameres asymmetric, right very small, left larger.

Female genitalia: Not investigated, likely similar to that of *H. lucida* (Fig. 8).

Dispersal potential. These beetles are macropterous and capable of flight. They are moderately swift and agile runners. Adults of this species are attracted to C.D.C. light traps.

Way of life. Adults are common in the lowlands (6 to 829 m.a.s.l.) and appear to be generalists in rainforest biotopes such as terra firme and secondary rain/pine forest. In these forests, they are commonly found in big trees with vines and epiphytes, in suspended dry *Cecropia* leaves, and in dry *Astrocaryum chambira* Burret palm frond skirts. Individuals can be found in January-November, in both the rainy and dry seasons. Member of this species have been recorded from the canopy of the following tree species using insecticidal fogging techniques: *Chrysophyllum argenteum* cf.; *Sterculia colombiana* cf.; *Parkia multijuga* cf.; *Naucleopsis herrerensis* cf.; *Matisia malacocalyx* cf.; *Pseudolmedia laevigata*; *Browneopsis ucayalina*; *Simira cordifolia/rubescens* cf.; *Brownea grandiceps* cf.; *Talisia* bitter; *Virola decorticans* cf.; *Pouteria cuspidata* ssp. *robusta* cf.; *Diospyros sericea*; *Guarea silvatica*; *Lacistema nena* cf.; *Guatteria glaberrima* cf.; *Luehea seemanni*; *Cordia alliodora*.

Other specimens examined. **Brazil**, Amazonas, km 60 N Manaus, 18.1 km W Campinas Field Station, 2.468°N, 60.156°W, 113m, 22 February 1979 (TL Erwin, et al.) (NMNH: ADP007595, male), north of Manaus, on Amazonas 010 at Km 26, Reserva Ducke, 2.918°S, 59.971°W, 70m, 29 November 1977 (J Arias)(NMNH: ADP007619, male). **Colombia**, Amazonas, Leticia, 4.2242°S, 69.9449°W, 70m, 19-25 February 1972 (HF Howden, A Howden)(NMNH: ADP007579, male). **Ecuador**, Orellana, Reserva Ethnica Huaorani, 39 km S, Pompeya, Estación Científica Yasuní - Onkone Gare Camp, Erwin Piraña Plot: transect 2, station 6, 0.6581°S, 76.4513°W, 220-250m, 22 January 1994 (TL Erwin, et al.)(NMNH: ADP138694, male), Erwin Piraña Plot: transect 10, station 9, 0.6540°S, 76.4453°W, 220-250m, 23 January 1994 (TL Erwin, et al.)(NMNH: ADP138588, male), Erwin Piraña Plot: transect 8, station 3, 0.6551°S, 76.4403°W, 220-250m, 24 January 1994 (TL Erwin, et al.)(NMNH: ADP138834, male), Erwin Piraña Plot: transect 7, station 10, 0.6556°S, 76.4474°W, 220-250m, 7 October 1994 (TL Erwin, et al.)(NMNH: ADP135867, female), Erwin Piraña Plot: transect 6, station 9, 0.6561°S, 76.4483°W, 220-250m, 12 February 1995 (TL Erwin, et al.)(NMNH: ADP135871, male), Erwin Piraña Plot: transect 1, station 4, 0.6586°S, 76.4521°W, 220-250m, 4 October 1995 (TL Erwin, et al.)(NMNH: ADP135911, male), Erwin Piraña Plot: transect 6, station 10, 0.6561°S, 76.4483°W, 220-250m, 2 October 1996 (TL Erwin, et al.)(NMNH: ADP135924, female), Yasuni National Park (edge), 95.43 km E (heading 101.46°), Coca, Tiputini Biodiversity Station, Erwin Harpia Plot: transect 6, station 1, 0.6295°S, 76.1443°W, 220-250m, 26 October 1998 (TL Erwin, et al.)(NMNH: ADP135869, female). **French Guiana**, Cayenne, Commune de Roura, Montagne des

Chevaux, 4.7127°N, 52.3966°W, 90m, 19 October 2013 (S Brule, PH Dalens, E Poirier) (NMNH: ADP140530, male), 29 March 2014 (S Brule, PH Dalens, E Poirier)(NMNH: ADP140518, female), Region de Saul, Commune de Saul, Belvedere de Saul, 3.6223°N, 53.2159°W, 283-325m, 23 February 2011 (S Brule, PH Dalens, E Poirier)(NMNH: ADP134156, female), 17 October 2012 (S Brule, PH Dalens, E Poirier)(NMNH: ADP134297, male), Foret de Maya, Commune Macouria, 4.9552°N, 52.4603°W, 30m, 19 December 2016 (S Brule, PH Dalens, E Poirier)(NMNH: ADP151234, female), Cirque Orfion, Orapu RN2 PK65, Commune de Regina, 4.4962°N, 52.3454°W, 81m, 24 September 2016 (S Brule, PH Dalens, E Poirier)(NMNH: ADP151233, male). **Panamá**, Canal Zone, Ancón, 8.9588°N, 79.5541°W, 36m, 5 November 1921 (H Osborn) (NMNH: ADP058099, female), Lion Hill Island, 9.2266°N, 79.8916°W, 68m, 29 June 1981 (RB Kimsey)(UCD: ADP056612, female), Paraiso, 9.033°N, 79.628°W, 106m, 11 January 1911 (EA Schwarz)(NMNH: ADP007952, female), 24 April 1911 (EA Schwarz) (NMNH: ADP007950, male), 2.2 km W Frijoles, 9.1736°N, 79.7966°W, 37m, 25 July 1977 (RB Kimsey, LS Kimsey)(UCD: ADP058775, female), 4.8 km W Cocoli, 8.980°N, 79.629°W, 188m, 30 August 1974, HP Stockwell, 046080, female), 8 km NW Gamboa, 9.1639°N, 79.7492°W, 100m, 15 July 1976 (TL Erwin, et al.)(NMNH: ADP055841, male), Barro Colorado Nature Monument, Barro Colorado Island, Barro Colorado Research Station, 9.1652°N, 79.8368°W, 70m, 26 June 1926 (NMNH: ADP 007951, female), May 1929 (PJ Darlington Jr.)(MCZ: ADP007948, male, 007957, female), 2 July 1938 (EC Williams)(CMNH: ADP007956, male), January 1941 (KW Cooper) (MCZ: ADP007949, ADP007955, females), April - May 1942 (NMNH: ADP007954, female), 19 February 1975 (TL Erwin, JL Lawrence)(NMNH: ADP027571, female), March 1975 (TL Erwin, JL Lawrence)(NMNH: ADP042850, male), 10 May 1977 (H Wolda)(NMNH: ADP079070, male), 2 June 1977 (H Wolda)(NMNH: ADP077804, female), 5 June 1977 (H Wolda)(NMNH: ADP078274, female), 25 September 1977 (H Wolda)(NMNH: ADP076934, male), 1 November 1977 (H Wolda)(NMNH: ADP082523, male), 24 April 1978 (H Wolda)(NMNH: ADP089657, male), 24 April 1978 (H Wolda)(NMNH: ADP089660, female), 19 May 1978 (H Wolda)(NMNH: ADP062493, male), 22 May 1978 (H Wolda)(NMNH: ADP066554, male), 13 June 1978 (H Wolda)(NMNH: ADP065729, female), 4 October 1978 (H Wolda)(NMNH: ADP080371, female), Parque Nacional Soberania, Madden Forest, 9.098°N, 79.616°W, 50m, 3 July 1974 (C O'Brien, L O'Brien, B Marshall)(NMNH: ADP027330, male); Cocle, El Valle, 8.603°N, 80.152°W, 800m, 16 May 1973 (HP Stockwell)(NMNH: ADP047483, female), El Valle, 8.603°N, 80.152°W, 829m, 26 May 1983 (WE Steiner) (NMNH: ADP005802, female); Panamá, Parque Natural Metropolitano, Panamá City, 8.9946º N, 79.5428º W, 67m, 13 May 1996 (F. Ødedegaard)(NMNH: ADP140497, male), 27 September 1995, (F. Ødedegaard)(NMNH: ADP140507, male), Portobelo, 9.555°N, 69.653°W, 10m, 11 March 1911 (EA Schwarz)(NMNH: ADP007953, female). **Perú**, Loreto, Pacaya-Samiria National Reserve, Río Samiria, Cocha Shinguito, 5.1775°S, 76.6556°W, 112m, 19 June 1990 (TL Erwin, et al.)(NMNH: ADP094065, female), 20 August 1991 (TL Erwin, MG Pogue)(NMNH: ADP051383, female), 22 May 1990 (TL Erwin, et al.)(NMNH: ADP086946, ADP086980, ADP086980, females);

Madre de Dios, Reserva Nacional Tambopata, 30 km (air) SW, Puerto Maldonado, Explorer's Inn, 12.8364°S, 69.2936°W, 209m, 25 February 1984 (TL Erwin, et al.) (NMNH: ADP007594, female), Manu Reserved Zone, Río Manu, BIOLAT Biological Station, Pakitza, 11.9446°S, 71.2831°W, 356m, 9 September 1988 (TL Erwin)(NMNH: ADP007556, male), 14 October 1991 (TL Erwin, MG Pogue)(NMNH: ADP007555, male), 10 July 1992 (TL Erwin, GP Servat, D Silva, F Pfuno S, E Pfuno S)(NMNH: ADP007572, female), 22 June 1993 (TL Erwin, F Pfuno S)(NMNH: ADP007557, female). **Suriname**, Kwatta, Warwabos, weg nr zee, 5.8437°N, 55.1586°W, 6m, 28 January - 1 February 1964 (DC Geijskes)(NBCL: ADP005808, male, ADP005806, female); Paramaribo, Ma Retraite, 5.8437°N, 55.1586°W, 6m, 12-14 February 1964 (DC Geijskes)(NBCL: ADP005807, male), Wanica, Lelydorp, Sumatra weg, 5.700°N, 55.198°W, 7m, 26-31 March 1964 (DC Geijskes)(NBCL: ADP007598, female). **Trinidad and Tobago**, Tunapuna, Mt. St. Benedict Monastery, nr. PAX House, 10.6624°N, 61.3984°W, 204m, 8-9 July 1999 (GB Edwards)(NMNH: ADP112207, male, ADP112233, female). **Venezuela**, Bolivar, 22 km E Upata, 7.960°N, 62.212°W, 359m, 18-19 June 1996 (HF Howden, A Howden)(NMNH: ADP007596, female).

Geographic distribution (Fig. 11). This species is currently known from the restricted type locality (see above) in Colombia, and from Brazil – Amazonas; Ecuador, French Guiana, Panamá, Perú, Suriname, Trinidad and Tobago, and Venezuela.

Notes. Reichardt (1973) reported additional localities under his treatment for this name; however, he also synonymized *H. verrucosa* with *H. tuberculata* in Reichardt (1971). Since we do not accept his action and regard them both as good species, we cannot use his locality records without access to the specimens he saw in order for us to correct his identifications.

Summary and future directions

Most of the 738 specimens used in this study were taken from the rainforest canopy, or upper understory, using insecticidal fogging techniques. One *H. auxilidora* adult was found by George Vogt in Texas under the webbing of a live colony of Psocoptera, reminiscent of adults of *Hyboteroides* Erwin & Ball species that live in the colonies of Embioptera (Embiidina) under their webbing (Erwin and Ball 2012). These rather flattened "blattiform" beetles with dorso-ventrally flattened legs and depressed bodies may live normally under the silken nets of their hosts on tree trunks and branches in the canopy and understory. If so, they may prey on the hosts with their long stiletto-like galea apices and lacinial teeth and numerous long setae on the mouthparts (reminding one of the Collembola-seizing adults of *Loricera* and *Leistus*). Such mouthparts may aid in capturing soft-bodied psocids and embiids. Adults of *Hyboptera* are also known from large bombacaceous anther rings on the forest floor in the dry season (Barro Colorado Island, Panamá – *Pseudobombax septenatum* (Jacq.) Dugand) and from FITs, malaise traps, SLAM traps, and UV/White lights. Amongst the lineages of Cryptobatida, both *Hybopteroides* and *Thoasia* adults share several structural attributes, in addition to the

mouthparts mentioned above, with *Hyboptera* adults, such as a serial row of long setae on three or more elytral intervals, angulate (or, subangulate) lateral margin of the pronotum, short antennae, broadly depressed mandibles, etc.

With regard to the genus *Hyboptera*, the recent discoveries of several new species in remote parts of the upper Amazon Basin suggests that further sampling in such areas will increase the species richness of this markedly (structurally and behaviorally) interesting (architecturally and behaviorally) lineage of Carabidae. We also note that even though at present there are not many species known and adults are morphologically markedly modified from more "typical" carabids, and have a unique way of life preying on insects under webbing, the lineage is widely dispersed from Texas to southeastern Brazil with many species that are widespread in their distributions.

Adults of the (currently) monobasic *Thoasia* Liebke, 1939 are exceedingly common in canopy fogging samples (Erwin 1991); however, nothing is known about their way of life and they are only known with precise location from foggings in Perú and Ecuador and FIT samples in French Guiana. Feeding specializations such as those hypothesized herein for adult *Hyboptera* and *Hybopteroides* and commonality of morphological attributes offer a fertile field of study on *Thoasia* for coleopterists eager to spend long periods of time in the rainforest canopies. However, before that, *Thoasia* is in need of a taxonomic revision and three undescribed species need to be treated (cf. Erwin et al. 2012; Erwin, in prep). Liebke's holotype of the type species, *Thoasia rugifrons*, is in the Polish Academy of Sciences Collection according to Mroczkowski (1960).

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Appendix 1

Morphological measurements and ratios for adults of species of *Hyboptera* Chaudoir 1872. All values are in millimeters. Apparent body length (ABL) is also provided in the descriptions. Means provided for ratios are "harmonic means."

angulicollis specigroup

A. *Hyboptera angulicollis* Chaudoir

	Males (N19)		Females (11)	
	Range	**Mean**	**Range**	**Mean**
Total Length (SBL)	3.344–6.958	3.695	3.353–4.148	3.724
Maximum Width	1.944–2.284	2.135	1.924–2.532	2.204
Width of Head / Width of Left Elytron	0.836–0.977	0.914	0.814–0.963	0.891
Pronotum: Width (at widest part) / Length	1.647–1.978	1.81	1.718–1.909	1.802
Length of Pronotum / Length of Head	1.256–1.495	1.364	1.279–1.515	1.381
ABL	3.943–4.800	4.296	4.015–4.795	4.377

B. *Hyboptera apollonia* Erwin

	Males (N2)		Females (N6)	
	Range	**Mean**	**Range**	**Mean**
Total Length (SBL)	3.723–4.263	3.975	3.534–4.123	3.835
Maximum Width	2.168–2.502	2.327	2.098–2.574	2.3
Width of Head / Width of Left Elytron	0.889–0.927	0.908	0.810–0.914	0.888
Pronotum: Width (at widest part) / Length	1.703–1.714	1.709	1.799–1.955	1.861
Length of Pronotum / Length of Head	1.230–1.353	1.288	1.211–1.407	1.32
ABL	4.534–5.144	4.82	4.199–5.067	4.566

C. *Hyboptera biolat* Erwin & Henry, sp. n.

	Males (N9)		Females (N2)	
	Range	**Mean**	**Range**	**Mean**
Total Length (SBL)	3.159–3.744	3.458	3.207–3.482	3.339
Maximum Width	1.728–2.328	1.981	1.676–1.996	1.822
Width of Head / Width of Left Elytron	0.832–0.996	0.937	0.964–1.058	1.009
Pronotum: Width (at widest part) / Length	1.738–1.965	1.85	1.793–1.943	1.865
Length of Pronotum / Length of Head	1.300–1.429	1.345	1.396–1.518	1.455
ABL	3.714–4.166	3.969	3.638–3.855	3.743

D. *Hyboptera vestiverdis* Henry & Erwin, sp. n.

	Males (N15)		Females (N15)	
	Range	**Mean**	**Range**	**Mean**
Total Length (SBL)	3.339–3.992	3.611	3.135–3.956	3.65
Maximum Width	1.896–2.548	2.115	1.826–2.428	2.127
Width of Head / Width of Left Elytron	0.834–1.016	0.93	0.845–0.983	0.924
Pronotum: Width (at widest part) / Length	1.698–2.003	1.861	1.680–1.993	1.82
Length of Pronotum / Length of Head	1.225–1.533	1.354	1.284–1.519	1.389
ABL	3.958–4.623	4.272	3.461–4.550	4.201

E. *Hyboptera scheelea* Erwin & Henry, sp. n.

	Males (N0)		Females (N1)	
	Range	**Mean**	**Range**	**Mean**
Total Length (SBL)				3.683
Maximum Width				2.1
Width of Head / Width of Left Elytron				0.956
Pronotum: Width (at widest part) / Length				1.921
Length of Pronotum / Length of Head				1.306
ABL				4.544

F. *Hyboptera shasta* Erwin, sp. n.

	Males (N1)		Females (N0)	
	Range	**Mean**	**Range**	**Mean**
Total Length (SBL)		3.885		
Maximum Width		2.174		
Width of Head / Width of Left Elytron		0.966		
Pronotum: Width (at widest part) / Length		1.873		
Length of Pronotum / Length of Head		1.361		
ABL		4.819		

G. *Hyboptera tepui* Erwin & Henry, sp. n.

	Males (N0)		Females (N1)	
	Range	**Mean**	**Range**	**Mean**
Total Length (SBL)				4.289
Maximum Width				2.458
Width of Head / Width of Left Elytron				0.878
Pronotum: Width (at widest part) / Length				1.741
Length of Pronotum / Length of Head				1.309
ABL				5.155

H. *Hyboptera tiputini* Erwin & Henry, sp. n.

	Males (N15)		Females (N15)	
	Range	**Mean**	**Range**	**Mean**
Total Length (SBL)	3.331–4.421	4.017	3.511–4.724	4.166
Maximum Width	2.008–2.924	2.363	1.868–2.902	2.432
Width of Head / Width of Left Elytron	0.796–0.987	0.897	0.819–1.017	0.899
Pronotum: Width (at widest part) / Length	1.699–2.076	1.823	1.688–1.936	1.812
Length of Pronotum / Length of Head	1.293–1.517	1.373	1.299–1.476	1.367
ABL	4.241–5.301	4.819	4.211–5.640	4.965

I. *Hyboptera viridivittis* Chaudoir

	Males (N3)		Females (N5)	
	Range	**Mean**	**Range**	**Mean**
Total Length (SBL)	3.785–4.052	3.933	3.759–4.167	4.003
Maximum Width	2.34–2.458	2.399	2.184–2.586	2.374
Width of Head / Width of Left Elytron	0.841–0.892	0.871	0.842–0.922	0.893
Pronotum: Width (at widest part) / Length	1.729–1.853	1.798	1.765–1.930	1.84
Length of Pronotum / Length of Head	1.262–1.517	1.355	1.199–1.316	1.278
ABL	4.787–5.089	4.934	4.646–5.272	5.003

***tuberculata* species group**

J. *Hyboptera auxilidora* Erwin

	Males (N6)		Females (N6)	
	Range	**Mean**	**Range**	**Mean**
Total Length (SBL)	4.389–4.938	4.654	4.408–4.983	4.755
Maximum Width	2.42–3.28	2.77	2.524–2.922	2.726
Width of Head / Width of Left Elytron	0.727–0.980	0.88	0.875–0.936	0.906
Pronotum: Width (at widest part) / Length	1.774–1.988	1.881	1.743–2.019	1.868
Length of Pronotum / Length of Head	1.208–1.297	1.252	1.243–1.573	1.361
ABL	5.058–5.923	5.483	5.265–5.925	5.539

K. *Hyboptera dilutior* Oberthür

	Males (N15)		Females (N15)	
	Range	**Mean**	**Range**	**Mean**
Total Length (SBL)	3.545–4.665	4.256	3.888–4.559	4.339
Maximum Width	1.952–2.772	2.416	2.708–3.208	3.024
Width of Head / Width of Left Elytron	0.909–1.012	0.959	0.743–0.850	0.786
Pronotum: Width (at widest part) / Length	1.709–1.925	1.811	1.701–2.003	1.827
Length of Pronotum / Length of Head	1.236–1.403	1.333	1.210–1.350	1.292
ABL	3.916–5.979	5.035	4.760–5.772	5.129

L. *Hyboptera lucida* Henry & Erwin, sp. n.

	Males (N5)		Females (N9)	
	Range	**Mean**	**Range**	**Mean**
Total Length (SBL)	4.376–5.066	4.752	4.690–5.265	5.029
Maximum Width	2.362–3.218	2.849	2.820–3.248	3.054
Width of Head / Width of Left Elytron	0.845–0.976	0.887	0.828–0.957	0.883
Pronotum: Width (at widest part) / Length	1.713–1.924	1.84	1.742–1.981	1.88
Length of Pronotum / Length of Head	1.130–1.274	1.207	1.150–1.351	1.266
ABL	5.641–6.294	5.852	5.514–6.667	6.093

M. *Hyboptera tuberculata* (Dejean)

	Males (N15)		Females (N15)	
	Range	**Mean**	**Range**	**Mean**
Total Length (SBL)	3.942–4.853	4.471	4.196–4.843	4.533
Maximum Width	2.178–2.928	2.609	2.206–3.116	2.689
Width of Head / Width of Left Elytron	0.819–1.058	0.899	0.839–1.029	0.893
Pronotum: Width (at widest part) / Length	1.731–2.223	1.876	1.726–1.993	1.859
Length of Pronotum / Length of Head	1.103–1.379	1.264	1.181–1.354	1.277
ABL	4.321–5.883	5.231	4.745–5.763	5.325

N. *Hyboptera verrucosa* (Reiche)

	Males (N14)		Females (N16)	
	Range	**Mean**	**Range**	**Mean**
Total Length (SBL)	3.824–4.587	4.203	3.793–4.898	4.417
Maximum Width	2.060–2.636	2.352	2.190–2.846	2.478
Width of Head / Width of Left Elytron	0.893–1.025	0.954	0.862–1.024	0.928
Pronotum: Width (at widest part) / Length	1.774–1.997	1.882	1.797–2.012	1.865
Length of Pronotum / Length of Head	1.186–1.359	1.269	1.185–1.398	1.268
ABL	4.493–5.511	4.932	4.474–5.660	5.06

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New species of *Metachela* Coquillett (Diptera, Empididae) from the Atlantic Forest, Brazil and a key to the Neotropical species

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Abstract

Two new species of *Metachela* Coquillett from the Brazilian Atlantic Forest, *M. danitakiyae* **sp. n.** from Rio de Janeiro and Minas Gerais and *M. spinulosa* **sp. n.** from Minas Gerais, are described and illustrated. A key to the Neotropical species is provided.

Keywords

Empidoidea, Hemerodromiinae, *Metachela danitakiyae* sp. n., *Metachela spinulosa* sp. n., Neotropical realm, taxonomy

Introduction

Metachela Coquillett [type species *M. collusor* (Melander)] is part of the tribe Hemerodromiini, and contains 12 previously described species, plus two species described here (see Table 1) with representatives in Western Europe, and the Neotropical and Nearctic regions (Yang et al. 2007). However, specimens of the genus are also known from Australia (pers. obs.). Collin (1933) and Smith (1962) described some South American species of *Metachela*, but considered them to be atypical in terms of antennal characters, thoracic shape, and head setation. MacDonald (1989) revised the genus; however, he covered only the three North American species.

Table 1. Checklist of world species of *Metachela*, with known sex and geographical records.

Species	Known sex		Geographical records
	Male	Female	
Metachela albipes (Walker, 1849)	x		Canada and USA
M. barueri Smith, 1962	x	x	Brazil (São Paulo)
M. breviradius Smith, 1962		x	Brazil (Santa Catarina)
M. circumdata Collin, 1933	x	x	Argentina (Bariloche)
M. collusor (Melander, 1902)	x	x	Canada and USA
M. convexa MacDonald, 1989	x		USA (California)
M. danitakiyae sp. n.	x	x	Brazil (Rio de Janeiro, Minas Gerais)
M. flavella Collin, 1933	x		Chile (Casa Pangue)
M. hexachaeta Collin, 1933	x	x	Chile (Casa Pangue, Puerto Varas, Puerto Montt, Peulla)
M. inornata Collin, 1933	x		Argentina (Bariloche)
M. instabilis Collin, 1933	x		Chile (Puerto Varas)
M. nigriventris (Loew, 1864)	x	x	Austria, Germany, Hungary, Italy?
M. patula Collin, 1933	x	x	Argentina (Bariloche)
M. spinulosa sp. n.	x	x	Brazil (Minas Gerais)

Yang et al. (2007) catalogued only eight species of *Metachela* for the Neotropical Realm; however, more species still await description as Cumming and Sinclair (2009) mention an undescribed species from Costa Rica. There are two species recorded for Brazil: *M. barueri* Smith from São Paulo and *M. breviradius* Smith from Santa Catarina (Smith 1962). The remaining Neotropical species were described from the extreme south of South America, in southern Argentina and southern Chile (Collin 1933). Herein, two new species are described from southeastern Brazil, and a key to the Neotropical species is provided.

Materials and methods

This study is based on the examination of specimens housed at Instituto Nacional de Pesquisas da Amazônia, Manaus, Amazonas, Brazil (**INPA**). Species with long series of representatives will also be deposited in the Museu Nacional do Rio de Janeiro (**MNRJ**), and Museu de Zoologia da Universidade de São Paulo (**MZUSP**). The specimens were collected using Malaise traps placed over small streams.

Dissected structures were macerated in heated 85% lactic acid (Cumming 1992) and examined on excavated slides. Wings were mounted on microslides, terminalia were placed in microvials with glycerin, and these were pinned with their associated specimens. Terminology follows Cumming and Wood (2009).

The holotype label data was cited in full before the description, with original spelling and punctuation. Data from each label was enclosed by quotation marks (“ ”). Information presented within square brackets ([ ]) is supplementary data not present on the labels.

Taxonomy

Metachela

Metachela Coquillett, 1903: 253, 263. Type species: *Hemerodromia collusor* Melander, 1902 (original designation). Melander 1928: 262 (cat.); Collin 1933: 285 (Patagonian fauna); Melander 1947: 260 (cat.); Smith 1962: 261 (Brazilian fauna); Smith 1967: 42 (Neotropical cat.); MacDonald 1989: 513 (Nearctic fauna); Yang et al. 2007: 276 (world cat.); Cumming and Sinclair 2009:667 (undescribed Costa Rican species).

Diagnosis. Face with some pale setae, front tibiae with apical rather trowel-like projection beneath and no spine, crossvein *h* present, cells bm and dm fused (crossvein bm-cu absent), M_1 and M_2 with common petiole arising from anterior end of crossvein dm-cu and cell *CuP* present. The Neotropical *Metachela* differs from the typical northern species by lacking a distinct stylus, having the thorax more pointed anteriorly, possessing four to equally spaced vertical setae and lacking spine below the front tibia. Although there are the differences mentioned, we still think that the Neotropical species are congeneric with the northern species.

Key to the Neotropical species of *Metachela*

1 Pterostigma semi-circular, almost closed by a veinlet (Fig. 24). Records: Argentina, Bariloche..... ***M. circumdata*** **Collin**

– Pterostigma absent (Figs 2, 20) **2**

2 Ground colour of thorax tawny or yellow, never black **3**

– Ground colour of thorax black..... **8**

3 Scutum with a mid-longitudinal brown stripe (Fig. 12) **4**

– Scutum without a mid-longitudinal stripe 7

4 Vein R_{2+3} ending on C; fore femur very stout. Records: Argentina, Bariloche.... ..... ***M. patula*** **Collin**

– Vein R_{2+3} fused to vein R_1 (Figs 2, 9, 20); fore femur not stout..... **5**

5 Scutellum yellow. Records: Brazil, Santa Catarina..... ***M. breviradius*** **Smith**

– Scutellum brown (Figs 1, 8, 12)..... **6**

6 Male cercus with acute apex (Fig. 5), without spine-like setae (Fig. 3); epandrium with posterodorsal sinus; female tergite 10 bilobate on posterior margin (Fig. 11). Records: Brazil, Minas Gerais and Rio de Janeiro .... ***M. danitakiyae*** **sp. n.**

– Male cercus with truncate apex, and with scattered spine-like setae (Figs 15 and 16); epandrium without posterodorsal sinus; female tergite 10 divided into two sclerotized plates separated by a membranous area (Fig. 22). Records: Brazil, Minas Gerais..... ***M. spinulosa*** **sp. n.**

7 Scutum entirely yellow. Abdominal segments 4 and 5 brownish. Records: southern Chile ..... ***M. flavella*** **Collin**
– Scutum with a short dark streak below the notopleural setae and slightly dark anterior to the scutellum. Abdomen segments 4 and 5 yellowish. Records: Brazil, São Paulo ..... ***M. barueri*** **Smith**
8 Head with six vertical setae. Records: southern Chile ..... ***M. hexachaeta*** **Collin**
– Head with four vertical setae **9**
9 Scutum with alternating dark and pale stripes. Mid femora with yellow posteroventral setae at base and an anteroventral row of denticles towards the apex. Records: southern Chile ..... ***M. instabilis*** **Collin**
– Scutum entirely black. Mid femora without distinctive setae or denticles. Records: Argentina, Bariloche ..... ***M. inornata*** **Collin**

Metachela danitakiyae **sp. n.**
http://zoobank.org/D957CD88-DFBC-4544-A465-1BB95F63082F
Figs 1–11

Type-locality. BRAZIL, Rio de Janeiro: Itatiaia, Parque Nacional de Itatiaia, 22°25'38.6"S–44°37'9.7"W, 1140 m,

Type-specimen. Holotype male, pinned, not dissected: "BRAZIL, RJ [Rio de Janeiro], Itatiaia, Parque Nacional de Itatiaia. Córrego Maromba, abaixo da Cachoeira Véu de Noiva. Malaise trap, 22°25'38.6"S–44°37'9.7"W, 1140 m. 10.i–02.II.2015. D.M. Takiya, A.P.M. Santos & M.F. Monné" (INPA). Paratypes**.** Same data as holotype (8 males, 2 females, INPA, 5 males, 2 females, MNRJ, 3 males, 4 females, MZUSP). BRAZIL, MG[Minas Gerais], Alto Caparaó, Parque Nacional do Caparaó, Vale Verde. Malaise, 17–20.i.2014. 20°25'09.7"S–41°50'47"W, 1364m. J.L. Nissimian & A.P.M. Santos. (2 males, 1 female, INPA).

Diagnosis. Scutum with a mid-longitudinal brown stripe; vein R_{2+3} fused to R_1 (Figs 2 and 9); male cercus arched, in dorsal view, acute at extreme apex (Figs 3, 4); epandrium with a dorsoapical sinus (Fig. 5); hypandrium membranous midventrally on basal ¾ and sclerotized apically (Fig. 7); female tergite 10 with bilobate posterior margin (Fig. 11); female sternite 8 elongate, concave on anterior margin, membranous on apical half (Fig. 11).

Male (Fig. 1). *Head* (Fig. 1): Dark brown to black, setae whitish. Ocellar triangle with two pairs of proclinate bristles, anterior pair stouter. Eyes iridescent black, separated on face. Occiput with scattered fine setae. Mouth parts yellow; proboscis short, slightly curved and with yellow setae. Antenna yellow, with scape and pedicel bearing distinct short ventral setulae; postpedicel nearly 2× as long as wide; stylus very short, ~ 0.1× as long as postpedicel.

Thorax (Fig. 1): Elongate, slightly arched dorsally; scutum yellowish except for mid-longitudinal brown stripe, wider posteriorly, and brownish posterolateral spot above wing base; scutum with very small and fine yellow setae except for one notopleural, one postalar, and two pairs of small parallel scutellars; scutellum and mediotergite brown.

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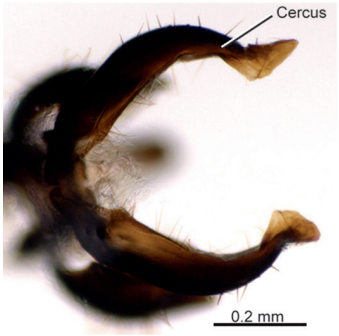

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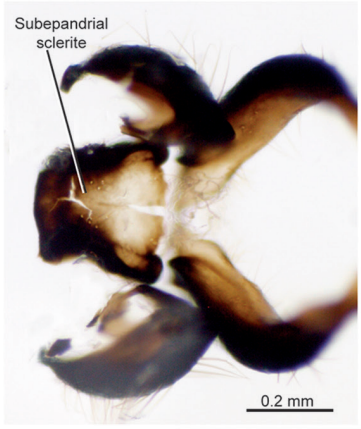

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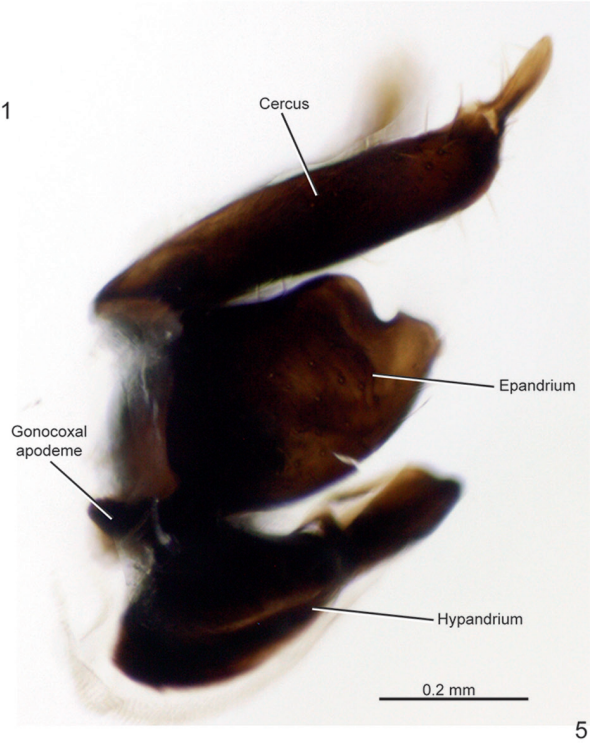

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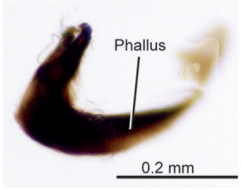

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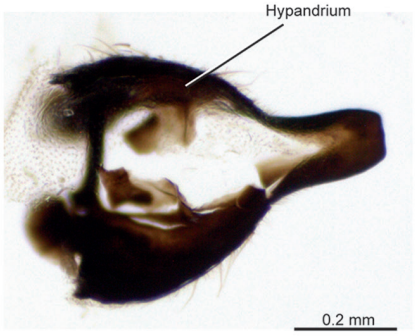

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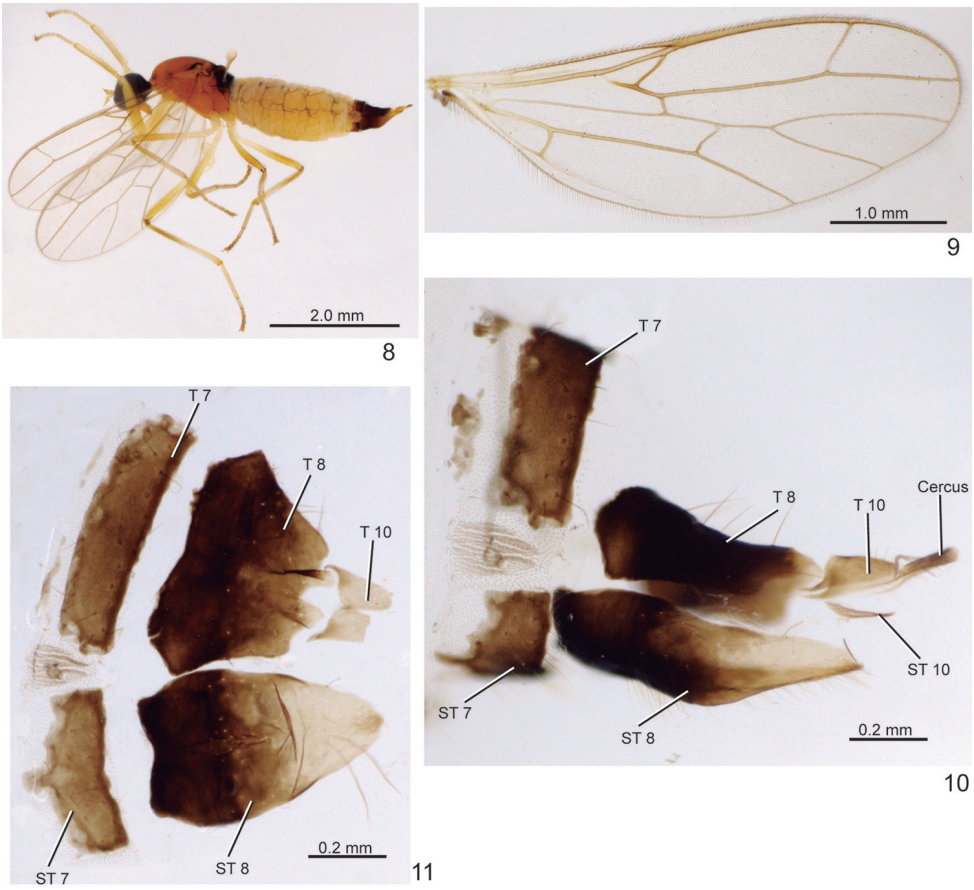
Figures 1–7. *Metachela danitakiyae* sp. n., **1–2** holotype male **3–7** paratype ♂ **1** Habitus, lateral view **2** Wing **3** Cercus, dorsal view **4** Subepandrial sclerite, epandrium and cercus, anteroventral view **5** Cercus, epandrium and hypandrium, lateral view **6** Phallus, lateral view **7** Hypandrium, ventral view.



Figures 8–11. *Metachela danitakiyae* sp. n., paratype female from Itatiaia. **8** Habitus, lateral view **9** Wing **10** Segments 7-11, lateral view **11** Tergites 7, 8, and 10, dorsal view, sternites 7 and 8, ventral view.

Legs (Fig. 1): Yellow, except fore tibia with narrow anteroventral brown stripe distally, and hind femur at distal 2/3 and tarsomeres 4–5 brown. Fore coxa as long as distance between fore- and mid coxae, 4× as long as wide, with some dorso-apical pale setae. Fore femur approximately 1.3× as long as fore coxa, 4.5× as long as wide, with anteroventral row of 3–5 spines, anteroventral row of 6–8 denticles, and posteroventral row of 18–20 denticles, with basal ones stouter; anteroventral row of denticles placed on distal half and posteroventral row restricted to distal 0.9, and both rows without apical discontinuity and diverging at apex. Fore tibia approximately 0.8× as long as fore femur; with decumbent short pale bristles dorsally, more densely distributed apically. Mid femur with two anteroventral and 12 posteroventral spines, basal pair stouter. Hind legs slender, with fine setae, except hind tibia with dorsoapical comb of short setae.

Wings (Fig. 2): Membranous, veins yellowish; vein R_{2+3} short, fused to vein R_1; R_{4+5} fork angle around 70°; R_5 and M_1 slightly divergent at extreme apex; cell bm+dm ending beyond apex of R_1, ~1.3× as long as cell br; cup cell closed. Halter whitish yellow.

Abdomen (Fig. 1): Tergites and sternites membranous, yellow, except anterior margin of all tergites and sternite 8 brownish; sternite 8 strongly sclerotized, U-shaped posteriorly.

Male terminalia: Brown. Cercus arched, in dorsal view (Figs 3, 4) narrower on basal 1/4, expanded apically, extending beyond epandrium apex (Fig. 5); left and right cerci closely approximated anterodorsally (Fig. 3); distinctly setose. Epandrium subrectangular, with a posterodorsal sinus (Fig. 5), with distinct strong setae on outer face. Hypandrium membranous midventrally on basal 3/4, sclerotized and fused posteriorly (Fig. 7); gonocoxal apodeme projecting anteriorly as a small protuberance (Fig. 5). Subepandrial sclerite subrectangular, more sclerotized basally and laterally (Fig. 4). Phallus strongly sclerotized, except less sclerotized apically (Fig. 6), abruptly pointed apically. Ejaculatory apodeme present. Holotype: body length. 3.3 mm; wing length. 2.7 mm.

Female (Figs 8, 9). Similar to male. Terminalia: Tergite 7 brown, shorter than tergite 8 (Figs 10, 11); tergite 8 brown, subtrapezoidal, with anterior margin slightly concave in dorsal view (Fig. 11); tergite 10 slightly light brown, bilobate on posterior margin (Fig. 11). Cercus brown, apex pale (Fig. 10). Sternite 7 brown, with small median projection on anterior margin (Fig. 11); sternite 8 dark brown on basal 2/3 and with pale apex, elongate, concave on anterior margin (Fig. 11); sternite 10 very narrow, v-shaped.

Geographical records. Brazil (Minas Gerais and Rio de Janeiro states).

Etymology. The specific epithet is a tribute to Daniela Maeda Takiya, friend of the authors and collector of the specimens.

Remarks. *Metachela danitakiyae* sp. n. differs from other species by the elongate male cercus, narrower on the apical 1/4 (usually short in other species, if elongate then with broad apex); epandrium with a posterodorsal sinus (without sinus in other species).

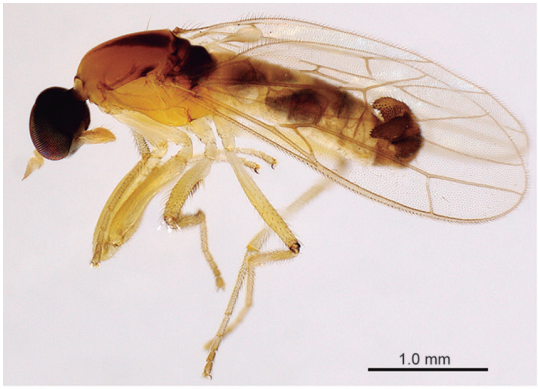
***Metachela spinulosa* sp. n.**
http://zoobank.org/740F1C97-E46A-40DE-8F24-97FE22ECBEF5
Figs 12–23

Type-locality. BRAZIL, Minas Gerais, São Roque de Minas, Parque Nacional Serra da Canastra, Rio Rolador.

Type-specimen. Holotype male, pinned, with abdomen in a microvial. Original label: "BRAZIL, **MG[Minas Gerais]**, São Roque de Minas, Parque Nacional Serra da Canastra, Rio Rolador. Malaise, 15–18.xi.2014. J.L.Nissimian, A.L. Oliveira & A.P.M. Santos." (INPA). Paratypes. Same data as holotype (1 male, 3 females, INPA).

Diagnosis. Scutum with a mid-longitudinal brown stripe; vein R_{2+3} fused to R_1; male cercus with truncate apex and somewhat scattered spine-like setae; epandrium with an apicoventral acute projection; female tergite 8 with bilobate apex; female tergite 10 divided into two sclerotized plates separated by a membranous area.

Male (Fig. 12). Holotype: body length: 3.5 mm; wing length: 2.7 mm.



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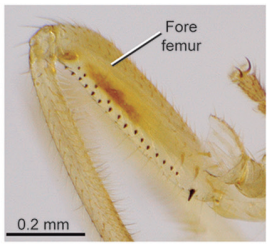

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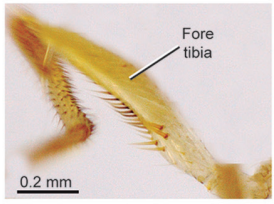

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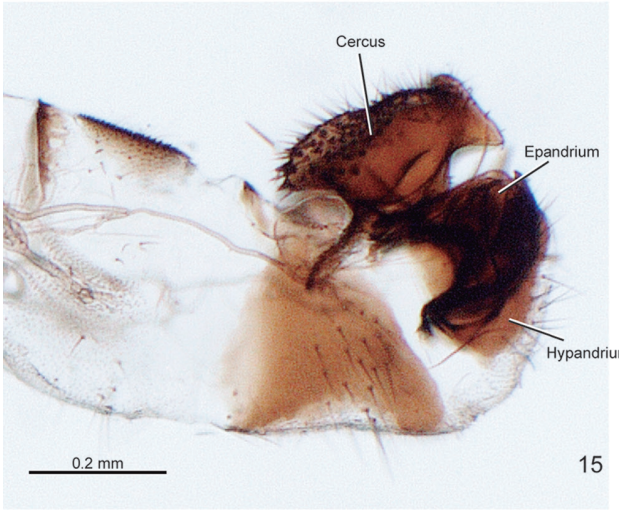

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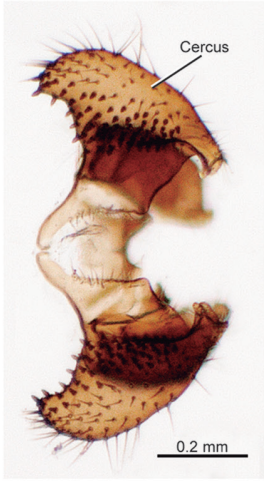

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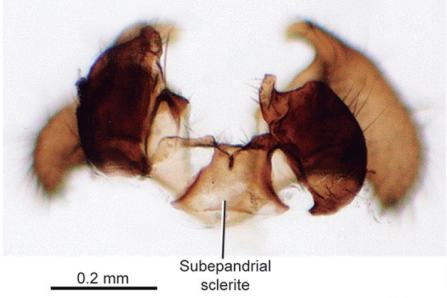

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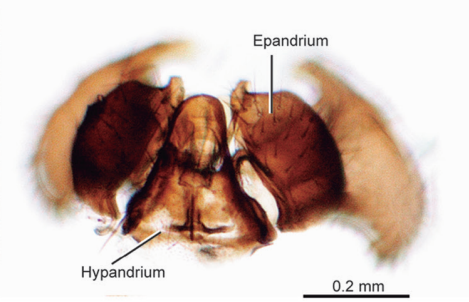

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Figures 12–18. *Metachela spinulosa* sp. n., holotype male. **12** Habitus, dorsolateral view **13** Right fore femur, anteroventral view **14** Right fore tibia, anteroventral view **15** Abdomen from segments 7–11, lateral view **16** Cercus, dorsal view **17** Subepandrial sclerite and epandrium, dorsal view **18** Hypandrium and epandrium, ventral view.

Head (Fig. 12): Dark brown to black, setae whitish. Ocellar triangle with two pairs of proclinate bristles, anterior pair stouter. Eyes iridescent black, separated on face. Occiput with scattered fine setae. Mouth parts yellow; proboscis short, right and with yellow setae. Antenna yellow, with scape and pedicel bearing distinct short ventral setulae; postpedicel approximately 2× as long as wide; stylus very short, 0.1× as long as postpedicel.

Thorax (Fig. 12): Elongate, slightly arched dorsally; scutum yellowish except for mid-longitudinal brown stripe, darker posteriorly, and brownish posterolateral spot above wing base; scutum with very small and fine yellow setae except for one notopleural, one postalar, and two pairs of small parallel scutellars; scutellum and mediotergite brown;

Legs (Fig. 12): Yellow. Fore coxa as long as distance between fore- and mid coxae, 3× as long as wide, with some dorsoapical pale setae. Fore femur (Fig. 13) 1.2× as long as fore coxa, 3.5× as long as wide, with anteroventral row offour spines, anteroventral row of 4 denticles, and posteroventral row of 17 denticles, with basal one stouter; anteroventral row of denticles placed on distal half and posteroventral row restricted to distal 0.9, and both rows without apical discontinuity and diverging at apex. Fore tibia (Fig. 14) ~ 0.8× as long as fore femur; with decumbent short pale setulae dorsally, denser apically. Mid femur with 2 anteroventral and 15 posteroventral spines, basal pair stouter. Hind legs slender with fine setae, except hind tibia with dorsoapical 'comb' of short setae.

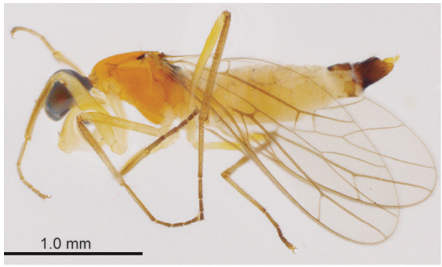
Wings (Figs 12 and similar to 20 of female): Membraous, veins yellowish; vein R_{2+3} short, fused to R_1; R_{4+5} fork angle around 70°; R_5 and M_1 slightly divergent at extreme apex; cell bm+dm ending beyond apex of R_1, ~ 1.4× as long as cell br. Halter whitish yellow.

Abdomen (Fig. 12): Tergites and sternites 1–6 and anterior margin of tergite 7 yellowish, membranous; posterior margin of tergite 7, tergite 8 and sternite 8 brownish; sternite 8 strongly sclerotized, U-shaped with lateral side upward directed posteriorly.

Male terminalia: Brown. Cercus wider on basal 1/3, apex truncate in lateral view (Fig. 15), with somewhat scattered spine-like setae (Fig. 16); left and right cerci closely approximated anterodorsally (Fig. 16). Epandrium with a posterodorsal pointed projection apically (Figs 17 and 18) and distinct strong setae on outer face (Fig. 17). Hypandrium membranous medially on basal half, with strong setae (Figs 15 and 18); gonocoxal apodeme projecting anteriorly as a small protuberance. Subepandrial sclerite subrectangular, more sclerotized basally and laterally (Fig. 17). Phallus strongly sclerotized, abruptly acute apically. Ejaculatory apodeme short, trilamellar.

Female (Fig. 19, 20). Similar to male. Tergite 7 brown, rectangular, shorter than tergite 8 (Figs 21 and 22); tergite 8 brown, elongate, bilobate posteriorly (Fig. 22); tergite 10 light brown, divided into two sclerotized plates separated by membranous area medially (Fig. 22). Cercus light brown, apex pale (Figs 21, 22 and 23). Sternite 7 light brown, concave on posterior margin (Fig. 23); sternite 8 brown, subrectangular (Fig. 23); sternite 10 light brown, v-shaped (Fig. 23). Body length: 3.9 mm; wing length: 3.1 mm.

Geographical records. Brazil (Minas Gerais).



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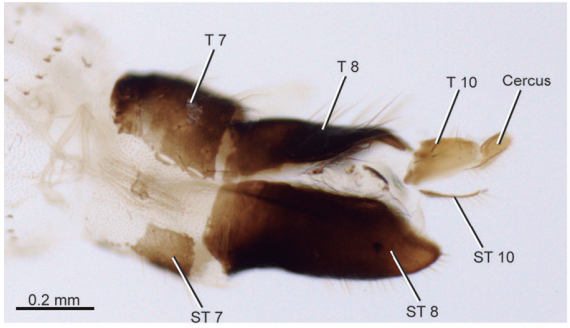

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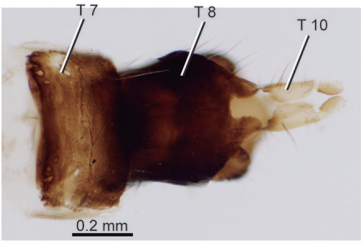

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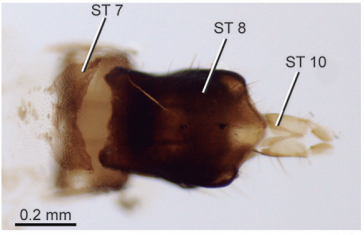

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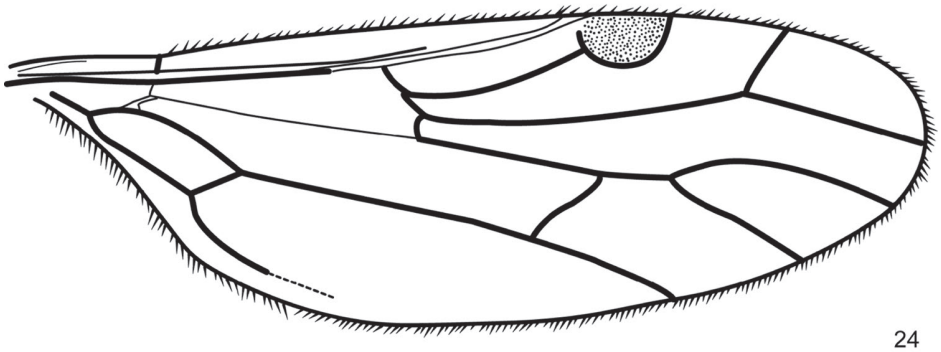

24

Figures 19–24. 19–23 *Metachela spinulosa* sp. n., paratype female **19** Habitus, lateral view **20** Wing **21** Segments 6-11, lateral view **22** Tergite 7 until cercus, dorsal view **23** Segments 7-11, ventral view **24** *Metachela circumdata*, wing modified from Collin (1933).

Etymology. From the Latin *spinosus* (spine), referring to the spine-like setae on the male cercus.

Remarks. *Metachela spinulosa* sp. n. differs from other species especially by the male cercus with scattered spine-like setae (absent in other species) and epandrium with an apicoventral acute projection (absent in other species).

Discussion

The Atlantic forest is one of the five most important biodiversity hotspots in the world (Myers et al. 2000). In face of the rapid anthropic changes to this area, it is important that its fauna be studied, including Diptera, before of it is lost. Prior to the current study, there were only two species of *Metachela* described from this biome, and no doubt there are certainly new species still left to be described.

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RESEARCH ARTICLE

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The little-known genus *Dahliphora* Schmitz, 1923 of China (Diptera, Phoridae)

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Abstract

The genus *Dahliphora* Schmitz, 1923 is recorded from China for the first time. Three *Dahliphora* species are reported, namely *D. sigmoides*, *D. zaitzevi*, and a new species here described, *D. chaetocauda* **sp. n.** Some new morphological data are reviewed and illustrated for the first time, and an identification key to species present in China is presented.

Keywords

Dahliphora chaetocauda, identification key, morphological data, new record, new species, scuttle fly

Introduction

The small genus *Dahliphora* Schmitz, 1923 is one of the least well known genera in the family Phoridae (Diptera). All species of the genus are tiny and with less than 1 mm body length. At present only five species are known, namely *D. sigmoides* Schmitz, 1923 from the Bismarck Archipelago (Schmitz 1923, 1928) and Malaysia (Zuha et al. 2014); *D. crenaticornis* Borgmeier, 1961 and *D. dispar* Borgmeier, 1961 from Brazil and Dominica (Borgmeier 1961, 1969), and Mali (Mostovski, pers. comm. 2017); *D. antennalis* Borgmeier & Prado, 1975 from Ecuador (Borgmeier and do Prado 1975); and *D. zaitzevi* Michailovskaya, 2002 from Russia Far East (Michailovskaya 2002). The life cycles of most species are unknown, except that *D. sigmoides* was found on an animal carcass (Zuha et al.

2014). The genus is characterized by the presence of pseudo-arista or a long, thick, and unsegmented arista in male antenna, reduction of frons bristles and absence of isolated bristles and hair palisades of the mid and hind tibia. The supra-generic classification of *Dahliphora* was less involved. Schmitz (1923) classified the genus in subfamily Metopinae and considered that it is closely related with *Metopina*, based on the similarity of wing veins (Schmitz 1928, 1929). This arrangement was followed by Borgmeier (1961, 1969) and Borgmeier and do Prado (1975). A further morphological study will be needed to better understand its relationship. In present paper, the genus *Dahliphora* is reported from China for the first time, with three recorded species, one of them new to science and described here. Some new morphological data are firstly reviewed and illustrated, and an identification key to the males of the known species of the Oriental and Palaearctic regions is presented.

Materials and methods

Since 2001, a series of specimen collection has been made by author and his team for studying Chinese phorid fauna and the project was funded by the National Nature Science Foundation of China. Specimens were collected into 80% ethanol using sweep nets and Malaise traps. The head, legs and wing were detached and made slides according to the method of Disney (1994). Line drawings were made using Leica M205C with a drawing appendage. Photos were made using microscope Leica M205A and Leica DM2500B with the help of a CCD 450 multi-focus imaging system. The terms used was followed Schmitz (1938) and modified by Disney (1994). The species recognition is mostly based on male specimens, as is typical for treatments of this genus. Males and females are dimorphic in many characters, and cannot be confidently associated in most situations. The type specimens are deposited in Natural History Museum of Shenyang University (**NMSU**), Shenyang, China.

Results

Key to Oriental and Palaearctic species (males only)

1 Antenna postpedicel drawn out a long pseudo-arista, without arista (Fig. 7); frons with pre-ocellar bristles **2**

– Antenna postpedicel onion-form, with a long, thick and unsegmented arista (Fig. 4); frons without pre-ocellar bristles (Fig. 3); four subequal scutellar bristles; costa with 19–21dorsal cilia; thin veins very obscure (Figs 9–10) .... ***D. chaetocauda* sp. n.**

2 Notopleura with two bristles; hind metatarsus with four transverse hair combs (Fig. 8); costa with 16 dorsal cilia (Fig. 11); wing 0.55 mm long .... ***D. sigmoides* Schmitz**

– Notopleura with three bristles; hind metatarsus with five transverse hair combs(Fig. 6); costa with 20 dorsal cilia (Fig. 12); wing 0.64 mm long .... ***D. zaitzevi* Michailovskaya**

Taxonomy

***Dahliphora chaetocauda* sp. n.**
http://zoobank.org/CFFA065F-CD5D-471D-B1A4-E17415D527E8
Figs 1–6, 9–10, 13–14

Diagnosis. Male. Frons without pre-ocellar bristles; postpedicel onion-form, with a long thick and unsegmented arista; notopleura with three bristles; scutellum with four subequal bristles; costa with 19–21 dorsal cilia; wing hyaline, thin veins very obscure. Female. Frons with two supra-antennal bristles.

Description. *Male.* Body (Fig. 1) brown, 0.81–0.82 mm long. Frons brown, covered with dense microtrichia and about 70–80 hairs. Frons (Fig. 3) bristles reduced, only two ocellar bristles and two convergent postero-lateral bristles present. Postpedicel (Fig. 4) brown and onion-shaped, with a long, thick and unsegmented arista, bearing sparsely long hairs. Palpus yellow, 0.1 mm long and 0.02 mm wide, with four long and thin bristles on apex and some short hairs along lower margin. Thorax brown. Mesopleuron bare. Notopleura with three bristles. Scutellum with four subequal bristles. Legs yellow, only hind femur light brown. Front tarsus with postero-dorsal hair palisade on tarsomeres 1–4, tarsomere 5 longer than tarsomere 4. Mid and hind tibiae without dorsal longitudinal hair palisades. Hind metatarsus (Fig. 6) with five transverse hair combs. Wing (Fig. 9) 0.66–0.68 mm long. Membrane hyaline, thin veins very obscure and almost inconspicuous. Costal index 0.47–0.48. Costal ratio 1.08–1.10:1. Costa with 19–21 dorsal cilia and each of them approx. 0.03 mm long. Vein sc free. No hair at base of Rs. Vein M_2 strongly curved near base, distal half nearly straight. Vein CuA_1 slightly S-form. No axillary bristles. Halter brown. Abdominal tergites brown, wider than long, with sparse short hairs along rear margin. Venter yellow, with tiny sparse microtrichia. Hypopygium (Fig. 2) yellowish brown, asymmetrical. Epandrium with short hairs and five to six bristles. Hypandrium (Figs 13,14) bifurcated. Left hypandrial lobe with a large and long-hairy process, which strongly excavated ventrally. Aedeagus complex drawn out in a long curved process. Anal tube short.

Female. Body (Fig. 5) 0.83–0.88 mm long. Similar to the male, but differs as follows: frons with a pair of supra-antennal bristles. Postpedicel rounded, with 3-segmented apical arista. Palpus 0.08 mm long, 0.02 mm wide. Wing (Fig. 10) 0.66–0.68mm long. Costal index 0.48. Costal ratio 0.94:1. Costa with 15–16 dorsal cilia and each of them about 0.03 mm long. No Dufour's crop mechanism and abdominal glands discharge.

Etymology. The species name refers to the character of left hypopygial lobe. To be treated as an adjective.

Material examined. *Holotype*, ♂, China, Yunnan, Ruili (24°6'36.55"N, 97°19'12.53"E; 960 m), 04–Aug–2009, Jian-Feng Wang. *Paratypes*, 84 ♂ and 26 ♀, same data as holotype.

Remarks. In the key to world species (Borgmeier and do Prado 1975), this new species runs to couplet 2 to *D. dispar* (described from Brazil and Dominica). It can be differentiated from the latter by the frons without pre-ocellar bristles, wing costa with 19–21 dorsal cilia, vein sc shorter and longer setation on hypopygial lobe.

***Dahliphora sigmoides* Schmitz, 1923**
Figs 8, 11

Dahliphora sigmoides Schmitz, 1923: 188.

Diagnosis. Male. Body brown, 0.68 mm long. Frons with two pre-ocellar bristles, two ocellar bristles and two convergent postero-laterial bristles. Postpedicel brown and drawn out a long, apical pseudo-arista. Palpus yellow. Thorax brown. Notopleura with two bristles. Scutellum with four subequal bristles. Legs yellow. Hind metatarsus (Fig. 8) with four transverse hair combs, the basal hair comb has only three hairs in a row. Wing (Fig. 11) 0.55 mm long. Membrane nearly hyaline, thin veins whitish yellow. Costal index 0.49. Costal ratio 1:1. Costa with 16 dorsal cilia and each of them approx. 0.03 mm long. Vein sc free. No hair at base of Rs. Vein M_2 strongly curved near base, distal half nearly straight. Vein CuA_1 slightly S-form. Vein A_2 almost inconspicuous. Abdominal tergites brown, wider than long, with sparse short hairs along the rear margin. Venter yellow, with tiny sparse microtrichia. Hypopygium yellowish brown, asymmetrical. Epandrium without bristles. Aedeagus complex drawn out a long, curved process. Anal tube short.

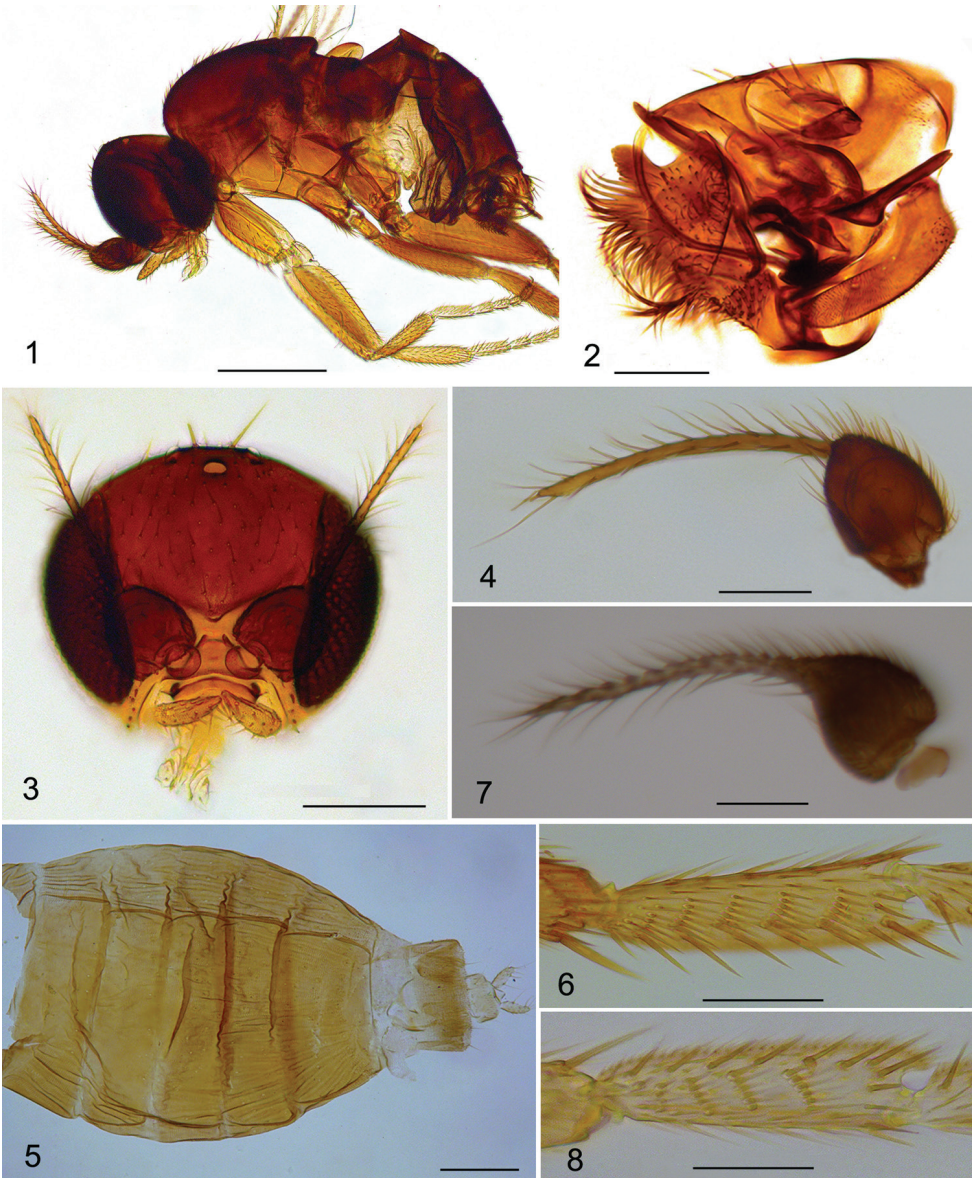
Material examined. 1 ♂, China, Guangxi, Shiwandashan (21°54'40.01"N, 107°54'51.18"E; 684 m), 18–Aug–2011, Jian-Feng Wang.

Remarks. This species is similar to *D. zaitzevi* (described from Russian Far East, see below). It can be distinguished from the latter in having two bristles on notopleura, four transverse hair combs on hind metatarsus, 16 dorsal costal cilia and by smaller size.

***Dahliphora zaitzevi* Michailovskaya, 2002**
Figs 7, 12, 15, 16

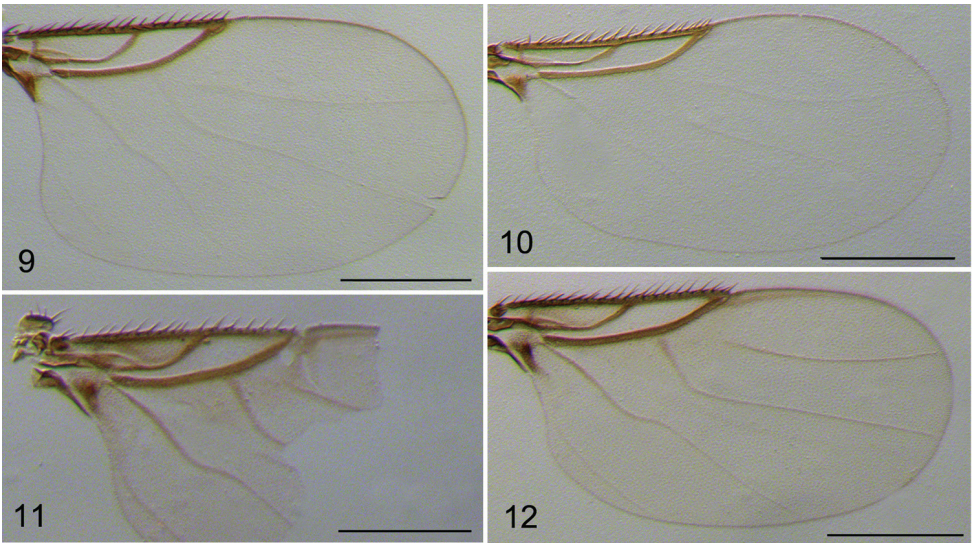
Dahliphora zaitzevi Michailovskaya, 2002: 1.

Diagnosis. Male. Body brown, 0.78 mm long. Frons brown, with two pre-ocellar bristles, two ocellar bristles and two convergent postero-laterial bristles. Postpedicel (Fig. 7) brown and drawn out a long, apical pseudo-arista. Thorax brown. Notopleura with three bristles. Scutellum with four subequal bristles. Legs yellow, only hind femur light brown. Hind metatarsus with five transverse hair combs. Wing (Fig. 12) 0.64 mm long. Membrane nearly hyaline, thin veins whitish yellow. Costal index 0.5. Costal ratio 1.0:1.1. Costa with 20 dorsal cilia and each of them approx. 0.03 mm long. Vein M_2 strongly curved near base, distal half nearly straight. Vein CuA_1 slightly S-form. Vein A_2 almost inconspicuous. Halter brown. Abdominal tergites brown, wider than long, with sparse short hairs along the rear margin. Venter yellow, with tiny sparse microtrichia. Hypopygium (Figs 15,16) yellowish brown, asymmetrical. Epandrium with two or three bristle-like hairs on each side. The tip of right epandrium with a very strong bristle. Aedeagus complex drawn out in a long, curved process.

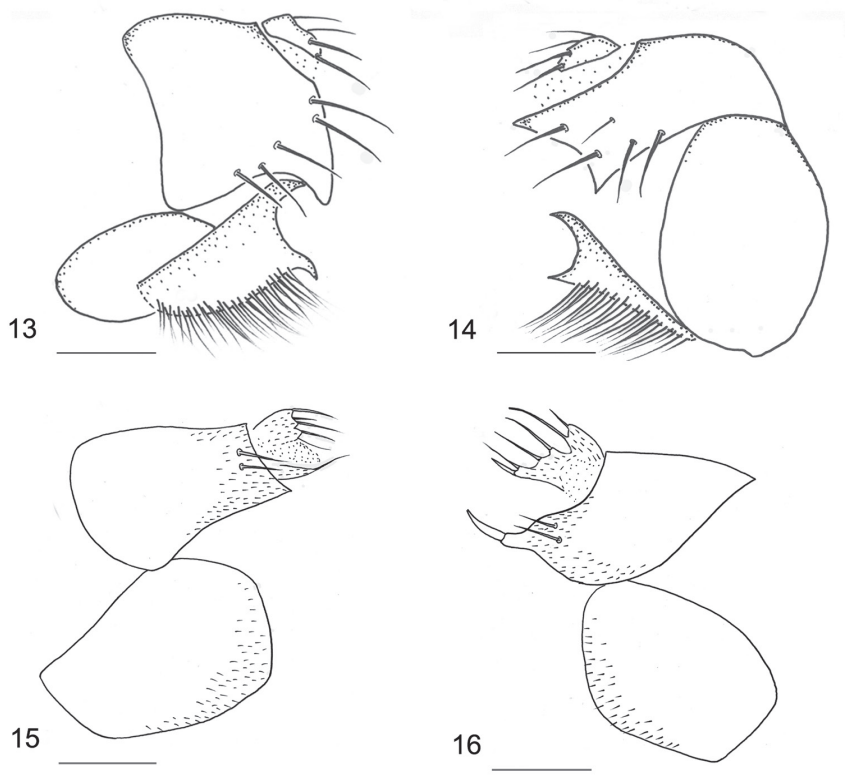


Figures 1–8. *Dahliphora* species. **1–6** *D. chaetocauda*. **1** body, male, lateral view **2** hypopygium, posterior view **3** head, male, frontal view **4** antenna, male **5** abdominal tergites, female, dorsal view **6** hind metatarsus, male, ventral view **7** *D. zaitzevi*, male, antenna **8** *D. sigmoides*, male, hind metatarsus, ventral view. Scale bars 0.2 mm (**1, 5**); scale bars 0.05 mm (**2–4**, **6–8**).

Material examined. 1 ♂, China, Liaoning, Mt. Qianshan (40°59'44.58"N, 123°07'23.85"E; 590 m), 31–Aug–2013, Zhuo Zhang; 1 ♂, China, Jilin, Huicun (42°54'27.33"N, 130°50'25.19"E; 164 m), 3–Aug–2014, Jian-Feng Wang.



Figures 9–12. Wings. **9–10** *D. chaetocauda*. **9** male **10** female **11** *D. sigmoides*, male **12** *D. zaitzevi*, male. Scale bars 0.2 mm.



Figures 13–16. Hypopygia. **13–14** *D. chaetocauda*. **13** left view **14** right view **15–16** *D. zaitzevi* **15** left view **16** right view. Scale bars 0.05 mm.

Remarks. This species is similar to *D. sigmoides,* differing from the latter by three bristles on notopleura, five transverse hair combs on hind metatarsus, 21 dorsal costal cilia, and a larger size. *Dahliphora zaitzevi* is the only species of the genus which is distributed in the temperate area.

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