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RESEARCH ARTICLE

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A new genus and species of narrow-range millipede (Diplopoda, Polydesmida, Dalodesmidae) from Tasmania, Australia

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Abstract

Kebodesmus zonarius **gen. nov. et sp. nov.** is only known from a small area on the Great Western Tiers in northern Tasmania, Australia, and like species of *Paredrodesmus* Mesibov, 2003 has no detectable paranota on the diplosegments. The gonopod telopodite of the new species is divided into a large, lateral, cowl-like structure, a solenomere and a medial branch with three processes.

Keywords

Australia, Dalodesmidae, Diplopoda, Polydesmida, Tasmania

Introduction

The millipede described below is locally abundant and lives in easily accessed forest close to a major road. Nevertheless, it was overlooked in repeated faunal sampling in the area by the senior author and others until its discovery in 2019 during a flora and fauna survey conducted by the Department of Primary Industries, Parks, Water and Environment, Tasmania. Relationships of the new species are currently being studied using molecular genetic methods (Rodriguez et al., in prep.), as neither the gonopod structure nor the non-sexual character states suggest an affinity with any previously described Tasmanian Dalodesmidae.

Materials and methods

For analysis of defensive secretion, several specimens were gently picked up with soft forceps in the field and dropped into 1–2 ml of ca 100% methanol in a screw-capped glass vial. Other specimens were taken live to the laboratory and preserved in ca 95% ethanol or RNAlater (Ambion, Inc) for molecular analysis, or in ca 80% ethanol for examination, photography and museum storage. Specimens for genetic and chemical analysis are deposited in the Australian National Insect Collection, Canberra, and all others (in 80% ethanol) in the Queen Victoria Museum and Art Gallery, Launceston. Ring 7 of a male (ANIC 64:000360) was dissected, air-dried and dry-mounted on a conductive carbon tab attached to a stub for scanning electron microscopy. Scanning electron micrographs were obtained using a Hitachi TM3030Plus tabletop microscope at 5 KV with mixed imaging (backscatter + secondary electron). Gonopods of two paratype males were cleared in ca 80% lactic acid, temporarily mounted in a 1:1 glycerol:water mixture and imaged using an eyepiece video camera mounted on an Amscope binocular microscope. Focus-stacked images were assembled into composites with Zerene Stacker software version 1.04. Preliminary drawings were traced from printed copies of the composite images, then corrected by reference to the actual gonopods. Figures were composed using GIMP 2.10 and the map in Fig. 1B with QGIS 2.18.

Locations in the text are given in decimal degrees based on the WGS84 datum and were determined in the field with a handheld GPS unit. Elevations a.s.l. are from a topographic layer in LISTmap (https://maps.thelist.tas.gov.au/listmap/app/list/map). Specimen locality data are also provided in Suppl. material 1 in Darwin Core format.

Abbreviations: **ANIC** Australian National Insect Collection, Canberra, Australian Capital Territory, Australia; **QVMAG** Queen Victoria Museum and Art Gallery, Launceston, Tasmania, Australia.

Results

Order Polydesmida Pocock, 1887
Suborder Dalodesmidea Hoffman, 1980
Family Dalodesmidae Cook, 1896

***Kebodesmus* Mesibov & Rodriguez, gen. nov.**
http://zoobank.org/0B0CE131-A35A-4C03-85B4-FB2834CA7BDC

Type species. *Kebodesmus zonarius* sp. nov., by present designation.

Other assigned species. None.

Diagnosis. Closely similar in general appearance to species of *Paredrodesmus* Mesibov, 2003, but distinguished from *Paredrodesmus* species in having H+20 body plan rather than H+19; normal pore formula rather than 5, 7–18; sphaerotrichomes on legs rather than no sphaerotrichomes; dorsal spinnerets within depression below epiproct tip rather than on epiproct rim; and a phenolic defensive secretion rather than no

odour detectable from living specimens. Distinguished from all other Tasmanian Dalodesmidea (apart from *Paredrodesmus*) by the complete absence of paranota or traces of paranota on the diplosegments, and by the deep division of the gonopod telopodite.

Description. As for the type species.

Name. In honour of Kevin Bonham (Ke – bo), Tasmanian naturalist, collector and identifier, who emailed the senior author in May 2020 to say he had collected a millipede "whose gonopods I couldn't even remotely match to anything".

Remarks. In gonopod structure *Kebodesmus* gen. nov. is unlike any of the undescribed Dalodesmidae so far examined in mainland Australian collections, and unlike any of the New Zealand Dalodesmidae described by Johns (1964, 1970). The gonopod in the new species is similar to that of *Abatodesmus velosoi* Demange & Silva, 1971, a H+20 dalodesmid from the Cordillera de Nahuelbuta in southern Chile, but differs in having the solenomere base clearly separated from the other telopodite processes.

***Kebodesmus zonarius* Mesibov & Rodriguez, sp. nov.**
http://zoobank.org/348F8840-84F7-428D-8541-5D783B95F659
Figures 1A, 2

Holotype. Male, Mountain Road (State Forest), Great Western Tiers, Tasmania, Australia, -41.6830, 146.7434 ± 25 m, 820 m a.s.l., 2 June 2020, R. Mesibov, QVMAG QVM:2020:23:0001.

Paratypes. All from Great Western Tiers, Tasmania, Australia: 9 males, 5 females, details as for holotype, QVMAG QVM:2020:23:0002; 2 males, 2 females, Mountain Road (private property), -41.6855, 146.7515 ± 25 m, 770 m a.s.l., 29 May 2020, R. Mesibov, in 95% ethanol, ANIC 64:000351–64:000354; 9 males (2 dissected), 15 females (1 dissected), same details, QVMAG QVM:2020:23:0003; 1 male, 1 female, Mountain Road (private property), same details but -41.6865, 146.7509 ± 25 m, 780 m a.s.l., in 95% ethanol, ANIC 64:000355–64:000356; 1 male, Mountain Road, -41.6867, 146.7485 ± 25 m, 800 m a.s.l., 12 November 2019, K. Bonham, QVMAG QVM:2020:23:0004.

Other material. 3 females, Mountain Road (private property), -41.6865, 146.7509 ± 25 m, 780 m a.s.l., 29 May 2020, R. Mesibov, in methanol, ANIC 64:000357–64:000359; 5 males, 2 females, Mountain Road (State Forest), -41.6830, 146.7434 ± 25 m, 820 m a.s.l., 2 June 2020, R. Mesibov, in methanol, ANIC 64:000360–64:000366; 6 females, same details but in RNAlater, ANIC 64:000367–64:000372.

Description. Male and female (Fig. 1A) both with head + 19 body rings + telson (H+20). Male/female approximate measurements: length 17/20 mm, midbody vertical diameter 1.4/1.9 mm. Freshly collected specimens pale yellow to pale reddish-brown, with reddish-brown speckling concentrated at rear of body rings and in distinct halo around ozopore; head pale and telson reddish-brown.

Male with clypeus and frons sparsely setose, vertex bare. Antennal sockets separated by ca 2× socket diameter. Antenna short, slender, just reaching anterior margin of ring 3 when manipulated backwards; relative length of antennomeres 6>(2,3)>(4,5), antennomere 6 widest. Collum in dorsal outline with anterior and posterior margins

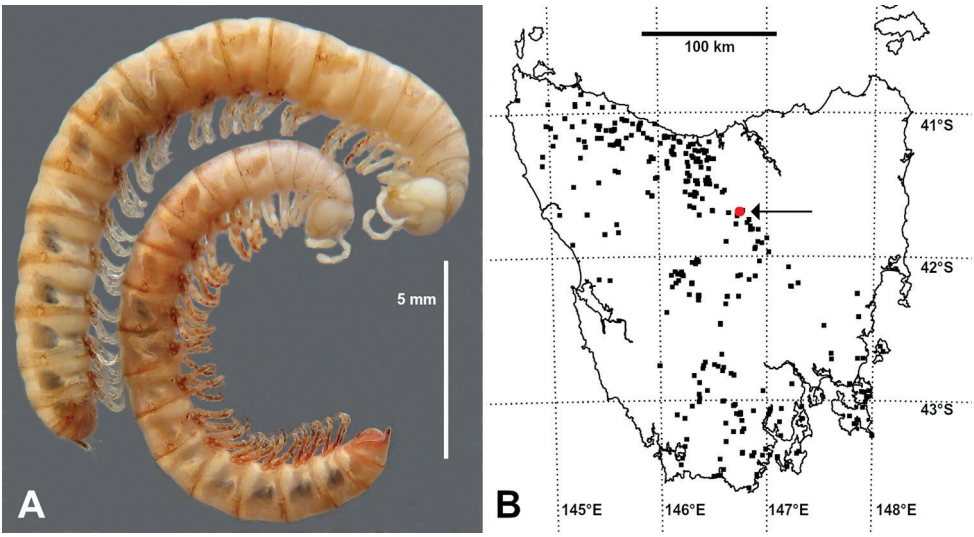

Figure 1. A *Kebodesmus zonarius* gen. nov., sp. nov. female (top) and male (bottom) paratypes ex QVMAG QVM:2020:23:0003 after two days in 80% ethanol **B** mercator projection of Tasmania with *K. zonarius* gen. nov., sp. nov. localities (red circle marked with arrow) and *Paredrodesmus* localities with spatial uncertainty ±1 km or less (black squares). Localities for named *Paredrodesmus* species are from the Atlas of Living Australia (https://www.ala.org.au/) and for undetermined *Paredrodesmus* (females and juveniles) from the QVMAG collection database.

subparallel, corners smoothly rounded; a few long setae near anterior collum margin. Head slightly wider than ring 2; ring widths 2–17 almost uniform, slightly narrower on rings 2–4. Body cylindrical, waist only slightly impressed in lateral view. Prozonites and metazonites bare, unsculptured; limbus a narrow, uniform lamella. No trace of paranota on diplosegments; paranotum on rings 2, 3 reduced to thin, narrow ridge low on ring, longer on ring 2. Ozopore small, round, opening laterally at ca 2/3 ring height close to posterior metazonite margin; pore formula 5, 7, 9, 10, 12, 13, 15–19 (normal). Spiracles on diplosegments small, round; anterior spiracle on slightly produced process; posterior spiracle about midway between leg bases. Sternites slightly longer than wide, with deep transverse and longitudinal impressions, sparsely setose. Legs slender, about as long as maximum ring diameter at midbody; anterior legs with prefemur only very slightly swollen dorsally; relative podomere lengths (femur, tarsus)>prefemur>(postfemur, tibia) on midbody legs; tarsus straight. Sphaerotrichomes on tarsus, tibia and postfemur of anterior legs; sphaerotrichome numbers rapidly diminishing posteriorly with only a few sphaerotrichomes on tibia and tarsus of posterior legs; sphaerotrichome hemispherical with sharply pointed seta inclined distoventrally. No brush setae on any legs. Pre-anal ring with sparse, long setae; hypoproct trapezoidal; epiproct extending well past anal valves, tapering to truncate tip ca 1/6 maximum width of ring 19; spinnerets in square array in shallow cavity just ventral to epiproct tip.

Gonopore small, opening distomedially on leg 2 coxa. Bases of legs 6 and 7 well separated by shallowly concave sternite with sparse long setae. Aperture ovoid, wider

than long, about 1/3 width of ring 7 prozonite, rim not produced. Gonocoxae subcylindrical, lightly joined basomedially; posteromedially with broad oblique depression bearing very short setae, cannula arising at distomedial end of depression, looping basally and inserted into deep, wide anterobasal groove on telopodite.

Telopodite (Fig. 2) extending just past leg 6 bases when retracted, erect, divided at ca 1/2 telopodite height into a solenomere and complicated medial and lateral branches. Telopodite base below branching point subconical, posterolaterally depressed with field of long setae, at branching point on medial surface with rounded, tab-like extension.

Solenomere arising from anterior surface of telopodite, subcircular in cross-section, bending posteriorly at base, then slightly laterally, tapering gradually to sharply pointed tip at ca 7/8 of telopodite height.

Medial branch of telopodite divided into three processes. Medial processes from anterior to posterior: (a) large, thin, "fishtail"-shaped process bent anteriorly with rounded distal and basal margins, the distal tip of process approaching solenomere but bent away from it and terminating at ca 2/3 solenomere height; (b) short, thick, tab-like process directed posterobasally, terminating at same level as lower portion of process (a); (c) long, flattened process arising posteriorly, bending distomedially, then anterodistally, gradually tapering with minutely tricuspid apex distal to tip of solenomere and basal to tip of lateral branch of telopodite. Right and left (c) processes cross each other in gonopods in situ (Fig. 2A).

Lateral branch of telopodite expanded distally into lamellar, cowl-like structure, concave posteromedially, with two groups of apical marginal teeth; posterior margin of cowl produced as large triangular tooth approaching process (c) of medial branch of telopodite; anterior margin of cowl produced as large, rounded tab approaching solenomere; anterolateral (convex) surface of cowl with oblique, triangular tab.

Prostatic groove running from anterobasal groove along anteromedial surface of telopodite to base of solenomere, then along solenomere to tip.

Female resembling male but distinctly stouter (Fig. 1A). Genital aperture with posterior margin produced as rounded triangle medially; cyphopods not examined.

Name. Latin *zonarius*, zonal, adjective. This species appears to be restricted to a narrow altitudinal zone on Tasmania's Great Western Tiers.

Distribution and ecology. So far known from four sites in wet eucalypt forest at ca 800 m a.s.l. on the Great Western Tiers in northern Tasmania, south of the town of Deloraine, with a linear range extent of less than 1 km (Fig. 1B). Adults and juveniles are found in patches of richly organic soil and humus in the forest, which is dominated by *Eucalyptus delegatensis* subsp. *tasmaniensis* Boland. The new species co-occurs in humus with the native dalodesmids *Lissodesmus alisonae* Jeekel, 1984 and *L. perporosus* Jeekel, 1984, but was found in greater numbers than the other two species during searches in 2020.

Remarks. *Kebodesmus zonarius* gen. nov., sp. nov. closely resembles a *Paredrodesmus* species in appearance and habits, and the new species occurs just on the eastern edge of the *Paredrodesmus* range (Fig. 1B). Although a juvenile *Paredrodesmus* was collected together with the new species at the 2019 site (QVMAG QVM:2020:23:0008), the senior author saw no *Paredrodesmus* individuals while searching for the new species

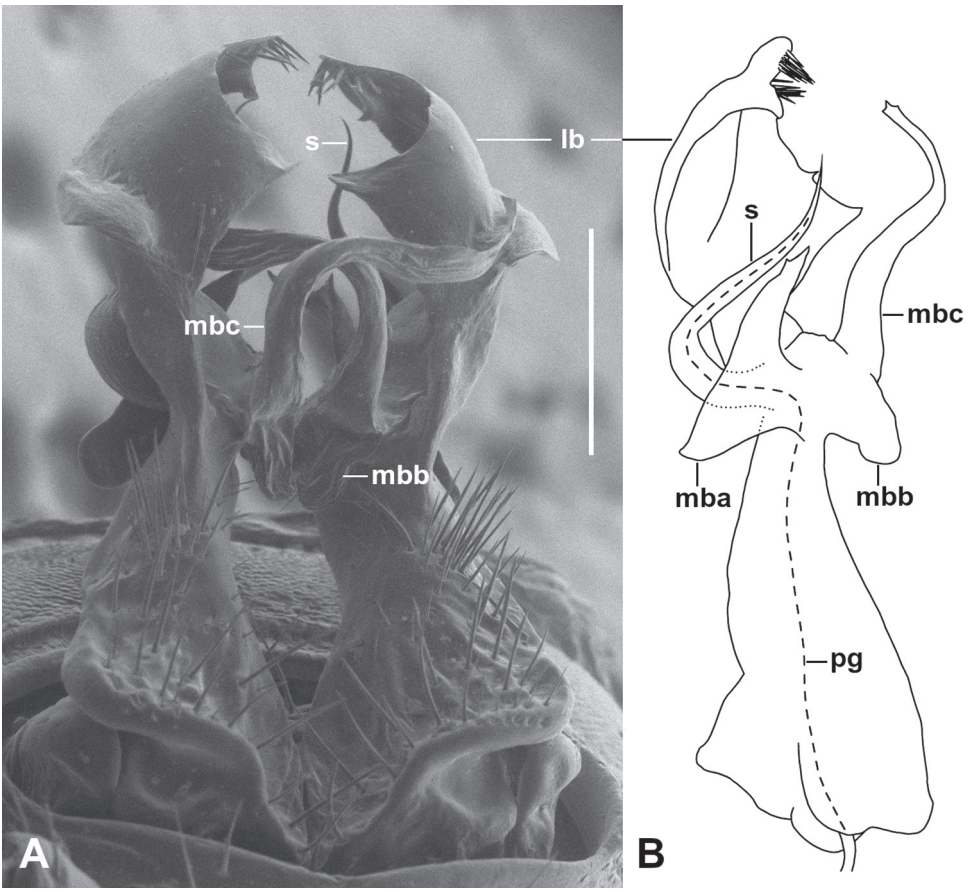

Figure 2. *Kebodesmus zonarius* gen. nov., sp. nov. **A** right posterolateral view of gonopods in situ; ANIC 64:000360 **B** medial view of left gonopod telopodite; paratype ex QVMAG QVM:2020:23:0003. **lb** = lateral branch, **mba** = process "a" of medial branch, **mbb** = process "b" of medial branch, **mbc** = process "c" of medial branch, **pg** = prostatic groove, **s** = solenomere. Scale bars: 0.25 mm (**A**, **B**).

in 2020. The interesting juxtaposition of ranges suggests that the two genera may exclude each other as competitors in the humus microhabitat.

Only a few of the adult *K. zonarius* gen. nov., sp. nov. collected in 2020 produced a strongly pungent defensive secretion in the field, even when disturbed, but the alcohol in which 2019 and 2020 specimens were first preserved had a phenolic smell.

Acknowledgements

RM thanks Kevin Bonham for advice and the first known specimen, David Maynard (QVMAG) for registering specimens, Tanya Adams (Ulverstone Secondary College) for the loan of equipment, and the owner of the Mountain Road private property (see specimen details) for permission to collect specimens on 29 May 2020.

References

Cook OF (1896) *Cryptodesmus* and its allies. Brandtia (A series of occasional papers on Diplopoda and other Arthropoda), 5: 19–28. https://doi.org/10.5962/bhl.title.125177

Demange J-M, Silva F (1971) *Abatodesmus velosoi* nov. sp., nouvelle espèce chilienne de la famille des Sphaerotrichopidae (Myriapode, Diplopodae: Polydesmoidea). Bulletin du Muséum national d'histoire naturelle, 2e Série 42(5): 881–886. https://www.biodiversitylibrary.org/page/56079065

Hoffman RL (1980) [1979] Classification of the Diplopoda. Muséum d'Histoire Naturelle, Geneva, 237 pp.

Jeekel CAW (1984) Millipedes from Australia, 7: The identity of the genus *Lissodesmus* Chamberlin, with the description of four new species from Tasmania (Diplopoda, Polydesmida, Dalodesmidae). Papers and Proceedings of the Royal Society of Tasmania 118: 85–101. https://doi.org/10.26749/rstpp.118.85

Johns PM (1964) The Sphaerotrichopidae (Diplopoda) of New Zealand. 1. Introduction, revision of some known species and description of new species. Records of the Canterbury Museum 8(1): 1–49. [Available to view online by searching at http://www.bugz.org.nz/]

Johns PM (1970) New genera of New Zealand Dalodesmidae (Diplopoda). Transactions of the Royal Society of New Zealand 12(20): 217–237. https://paperspast.natlib.govt.nz/periodicals/TRSBIO19701224.2.2

Mesibov R (2003) Two new and unusual genera of millipedes (Diplopoda: Polydesmida) from Tasmania, Australia. Zootaxa 368: 1–32. Pocock RI (1887) On the classification of the Diplopoda. Annals and Magazine of Natural History, ser. 5, 20: 283–295. https://doi.org/10.11646/zootaxa.368.1.1

Supplementary material 1

Specimen data for *Kebodesmus zonarius* gen. nov. et sp. nov.

Authors: Robert Mesibov, Juanita Rodriguez

Data type: occurrence

Explanation note: Data file Specimen_data_Kebodesmus_zonarius_2020.tsv for 9 specimen lots of *Kebodesmus zonarius* gen. nov. et sp. nov. in the Queen Victoria Museum and Art Gallery, Launceston, Tasmania, Australia and the Australian National Insect Collection, Canberra, Australian Capital Territory, Australia. The file is a tab-separated table in UTF-8 encoding with the following Darwin Core fields: institutionCode, catalogNumber, phylum, class, order, family, genus, specificEpithet, scientificName, typeStatus, organismRemarks, preparations, locality, locationRemarks, country, stateProvince, decimalLatitude, decimalLongitude, geodeticDatum, coordinateUncertaintyInMeters, georeferenceSources, georeferencedBy, minimumElevationInMeters, recordedBy, occurrenceRemarks and eventDate.

Link: https://doi.org/10.3897/zookeys.966.56308.suppl1

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Quasitagalis afonsoi, a new genus and a new species of Saicinae (Hemiptera, Reduviidae) inhabiting a cave in Brazil, with an updated key to the genera of Saicinae of the New World

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Abstract

Quasitagalis afonsoi **gen. et sp. nov.** of Saicinae (Hemiptera, Reduviidae) is described based on a male and three female specimens collected in a cave in the State of Tocantins, Brazil. Additionally, some characteristics from two nymphs of different instars of the same species are also recorded. An updated key to the New World genera of Saicinae is provided.

Keywords

Heteroptera, male genitalia, Neotropics, *Paratagalis*, *Tagalis*

Introduction

There are ten genera of Saicinae in the Neotropical region, five of which are currently monotypic (Gil-Santana et al. 2015). A summary of the taxonomy of this group and a key to the genera of the New World were provided by Gil-Santana et al. (2015).

Little is known of the biology and natural history of Saicinae (Gil-Santana et al. 2010). Specimens have been most commonly collected at lights (Schuh and Weirauch 2020) or swept and beaten from vegetation (Gil-Santana et al. 2015). Gil-Santana et al. (2010) included a synopsis of the biological and ecological information available for New World Saicinae, recording *Tagalis evavilmae* Gil-Santana, Gouveia & Zeraik, 2010 as an inhabitant of birds' nests, a first for Saicinae.

Among Neotropical Saicinae, sexual dimorphism consisting of larger eyes and longer, ciliated setae on the first antennal segment of males was observed in *Paratagalis spinosus* Monte, 1943 (Gil-Santana and Costa 2009), and it was confirmed in the following species of *Tagalis* Stål, 1860: *T. evavilmae*, and *T. seminigra* Champion, 1899 (Gil-Santana et al. 2010). In *T. inornata inornata* Stål, 1860, however, the male eyes were shown not to be much larger than those of females and the long ciliated setae on the first antennal segments were shorter than those of some other species (Gil-Santana 2011). Large eyes and long ciliated setae on the first antennal segments of males have also been recorded in the following species of *Tagalis*: *T. baenai* Gil-Santana, 2011, *T. grossii* Gil-Santana, 2011, *T. marquesi* Gil-Santana, 2011 (Gil-Santana 2011), *T. dichroa* Castro-Huertas & Forero, 2014 (Castro-Huertas and Forero 2014) and *T. drakkar* Varela & Melo, 2017 (Varela and Melo 2017). However, since no females of these species are known, the possible sexual dimorphism could not be verified. Longer ciliated setae on the first third of the second antennal segment of males was also observed in *P. spinosus* (Gil-Santana and Costa 2009), while they were recorded on both the first and the second antennal segments in males of the species of *Oncerotrachelus* Stål, 1868 studied by Gil-Santana (2013).

On the other hand, McAtee and Malloch (1923) recorded that the length of the spines on the fore femora for *Tagalis* was sexually dimorphic and, to some extent, also exhibited intraspecific variation, and therefore would not seem to be of taxonomic importance. The armature of the fore femora in *T. i. inornata* was shown to have smaller spines in males when compared to those of the females (Gil-Santana 2011). However, the apparent sexual variation in length of the spines of the fore femora (McAtee and Malloch 1923) may be related to the size of the individual, since the females are usually larger. This characteristic and individual variation would be better evaluated through examination of more specimens, including other species.

A scopula, previously documented for some taxa of Emesinae (Wygodzinsky 1966), was recently recorded in several Saicinae (Weirauch and Forero 2007a; Weirauch 2007, 2008a). In Saicinae, the scopula is present as a hairy attached structure on the ventral surface of the apex of the third tarsomere of all pairs of legs. It was recorded in several species of Saicinae (Weirauch 2007), among which only two were from the New World, *Saica recurvata* (Fabricius, 1803) (Weirauch 2007) and *Kiskeyana palassaina*

Weirauch & Forero, 2007 (Weirauch and Forero 2007a, b). Later, Castro-Huertas and Forero (2014) recorded the presence of the scopula on the apex of the third tarsomere in all the legs on both species of *Tagalis* described by them. Regarding its function, Weirauch and Forero (2007a) speculated that the scopula might be a structure that assists in movement on smooth (e.g., plant) surfaces, while Weirauch (2007) although arguing that the scopula in Saicinae could be exclusively used for locomotion or that it could play a certain role in prey capture, concluded that its primary function is probably during locomotion. Yet, it was considered as a synapomorphy of part of the Saicinae by Weirauch (2008a).

Our knowledge of immature stages of Saicinae is very limited (Rédei 2004). Among the Saicinae from the New World, nymphal stages have only been described in one species, *Tagalis evavilmae* (Gil-Santana et al. 2010). On one hand, the latter authors recorded that the nymphs of *T. evavilmae* show common features found in immature Heteroptera, such as a bi-segmented tarsi and smaller eyes in younger instars (Schuh and Weirauch 2020; Rédei 2004). On the other hand, Gil-Santana et al. (2010) also recorded the presence of different patterns of features with taxonomical significance in nymphs when compared with adults (like an additional spine on the ventral side of the head, more than three spines on tibiae) and argued that these characteristics which are observed in adults of other related genera, might help to understand the relationships among the genera of Saicinae in future studies.

Quasitagalis afonsoi gen. et sp. nov. of Saicinae (Hemiptera, Reduviidae) is described based on a male and three female specimens collected in a cave in the State of Tocantins, Brazil. Additionally, some characteristics from two nymphs of different instars of the same species are recorded too. An updated key to the New World genera of Saicinae is provided.

Materials and methods

All fieldwork, including the collection of the specimens inside a cave, was undertaken by the third author (RAZ), who also provided Figs 60–63.

Photographs of the male holotype and a female paratype of *Quasitagalis afonsoi* gen. et sp. nov. (Figs 1, 21) were taken by João Paulo Sales Oliveira Correia ("Laboratório Nacional e Internacional de Referência em Taxonomia de Triatomíneos" (LNIRTT), Instituto Oswaldo Cruz (IOC), Rio de Janeiro, Brazil), with a Leica DMC 2900 camera attached to a Leica M205C stereomicroscope. Several images were stacked using the LAs software version 4.9.

Scanning electron microscopy images (Figs 23–28, 31, 32, 38, 40–43, 45–59, 64, 65) were obtained by the second author (JO). A female, two nymphs of different instars of the new species, and a female of *Tagalis inornata inornata* Stål, 1860 were cleaned in an ultrasound machine. Subsequently, the samples were dehydrated in alcohol, dried in an incubator at 45 °C for 20 min, and fixed in small aluminium cylinders with transparent glaze. Sputtering metallisation was then performed on the samples for 2 min at

10 mA in an Edwards sputter coater. After this process, the samples were studied and photographed using a high-resolution field emission gun scanning electron microscope (FEG-SEM; JEOL, JSM-7500F), similarly as described by Rosa et al. (2010, 2014).

All remaining figures were produced by the first author (HRG-S). The fixed adults, microscopic preparations, and genitalia were photographed using a digital camera (Sony DSC-W830). Drawings were made using a camera lucida. For clarity, the general vestiture (setation) in several ink drawings was completely (Figs 2, 3, 6, 7, 11, 22, 33, 34, and 44) or almost completely (Figs 4, 5, and 39) omitted. Images were edited using Adobe Photoshop CS6. Dissections of the male genitalia were made by first removing the pygophore from the abdomen with a pair of forceps and then clearing it in 20% NaOH solution for 24 hours. The dissected structures were studied and photographed or drawn in glycerol.

Observations were made using a stereoscope microscope (Zeiss Stemi) and a compound microscope (Leica CME). Measurements were made using a micrometer eyepiece. General morphological terminology mainly follows Lent and Wygodzinsky (1979) and Schuh and Weirauch (2020). The (visible) segments of labium are numbered as II to IV, given that the first segment is lost or fused to the head capsule in Reduviidae (Weirauch 2008b, Schuh et al. 2009). Gil-Santana et al. (2010) and Gil-Santana (2011) were mostly followed in the case of the terms applied to structures that are characteristic or peculiar to Saicinae.

The holotype and two female paratypes will be deposited in the Entomological Collection of the "Museu Nacional da Universidade Federal do Rio de Janeiro", Rio de Janeiro, Brazil (MNRJ) and the female paratype, the nymphs and a female of *Tagalis i. inornata* used for obtain SEM images were deposited in the Dr Jose Maria Soares Barata Triatominae Collection (CTJMSB) of the São Paulo State University Julio de Mesquita Filho, School of Pharmaceutical Sciences, Araraquara, São Paulo, Brazil. All measurements are in millimetres (mm).

Results

Taxonomy

Subfamily Saicinae

***Quasitagalis* gen. nov.**
http://zoobank.org/1549BE8A-08FE-455F-A9BB-FB42A97E373A

Type species. *Quasitagalis afonsoi* sp. nov., by present designation.

Diagnosis. *Quasitagalis* gen. nov. can be separated from other genera of Saicinae of the New World by the combination of the characters presented in the key below; among them, *Quasitagalis* gen. nov. seems to be closer to *Tagalis*. However, these two genera can be promptly separated by the following set of characters: ventral portion

of the head (gula) with a distal pair of strong setigerous spines, posterior to the eyes, in both genera, while only in *Quasitagalis* gen. nov., another pair is present below (between) the eyes; scutellum tapering into an erect spine in *Tagalis* and slightly elevated, subtriangular, without a spine in *Quasitagalis* gen. nov.; and inner surface of fore tibia with three or four (*T. femorata* Melo, 2008) very strong setigerous spines implanted close to dorsal surface (*Tagalis*) or with a simple (male) or double (female) longitudinal median row of numerous shorter spines (*Quasitagalis*).

Description. Adults. ***Head:*** transversal sulcus deep, reaching eyes at hind margin; postocular portion subglobose, faintly depressed at median portion. Eyes globose in dorsal view, suboval in lateral view; strong setigerous spines anteroventrally and posteroventrally from eyes, the former somewhat smaller than the latter and ventrally, on gula, two pairs of similar setigerous spines: one pair below (between) the eyes and other pair, posterior to the eyes, somewhat closer to the neck than to the eyes. Antennal segments slender; segment I longest, clothed with long fine (ciliated) setae in males; segment II and III longer than half or half as long as the first segment; segment IV approximately one third as long as the first segment. Labium: segment II slender, elongate, curved, almost reaching posterior margin of eyes, with a pair of stout spines slightly basal to midpoint; segment III swollen mainly in the first third, where another pair of stout spines are located; segment IV slender, tapering. ***Thorax:*** prothorax divided by a transverse deep furrow between fore and hind lobes of pronotum, interrupted at median portion, above which there is a deep small excavation; anterolateral angles prominent as rounded tubercles; fore lobe subquadrate with pairs of lateral somewhat acute dorsal swellings or humps anteriorly and posteriorly, the latter more prominent; a longitudinal shallow and narrow median furrow, slightly larger at midportion, its posterior portion ending at the median deep excavation mentioned above; disc of fore lobe finely rugose; hind lobe trapezoidal, becoming larger to the posterior margin; integument more coarsely rugose on disc, which is slightly depressed; humeral angles rounded. Lateral shallow ridge reaching from tubercles of anterolateral angles towards posterior swellings of fore lobe, prominent at anterior half and shallower posteriorly. Scutellum base broad, apex slightly elevated, subtriangular, spineless. Metanotum with a short erect tubercle followed by a short obliquely erect spine larger at base and blunt at apex. Proepisternal processes projected with a pair of strong setigerous spines, anterodorsal spine moderately curved, posteroventral almost straight. Supracoxal lobes of propleura prominent. Prosternum larger on anterior margin; stridulitrum long, narrow. Mesosternum larger than prosternum and metasternum; meso and metasternum with a longitudinal, thin, shallow median keel. Fore legs stouter and shorter than others; fore coxa elongated, cylindrical, with a long spine on basal third of anterior surface, and three or five spines on inner face; mid and hind coxae ovoid; trochanters triangular, tapering; fore trochanter with four spines on inner side, three of which closer to each other at approximately basal half and the fourth spine variably set more or less apart and more ventrally at the apical half of the segment; fore femur stout, slightly curved in lateral view, armed ventrally with a few short spines and a variable number of few longer ones intermixed, a small subapical ventral protuberance with two or three small

spines; a row of short spines on upper margin of inner surface; between the latter and the ventral line of spines, in the females, a row of somewhat more numerous, setigerous spines; fore tibia slightly curved in lateral view, apically expanded, with a single (male) or double (female) longitudinal median row of numerous spines running on approximately 1/2 (male) or 2/3 (female) of the median portion of inner surface. Middle and hind legs long and slender. Tarsi with three segments; first the longest; claws simple; scopula present on ventral portion of apex of third tarsomere of all legs. Forewings with two closed cells; distal cell much larger than basal one. ***Abdomen*** elongated, cylindrical in the male and ovoid in the female. In male, pygophore with a medial distal process; parameres symmetrical, short, apex rounded with an apical elongate acute spine acute at its centre.

Distribution. Brazil, State of Tocantins.

Etymology. The name of the new genus was composed by the Latin word *quasi*, meaning almost, nearly, like, and *Tagalis*, in reference to its apparent proximity to the latter genus. The gender is feminine.

Quasitagalis afonsoi sp. nov.

http://zoobank.org/8006DD5A-3868-4742-B152-86B2640437E2
Figures 1–51

Type material. Brazil, Tocantins, Lavandeira, Gruta da Gia [Gia's Cave], 12°49'42"S, 46°20'43"W, 05–10.i.2009, Robson A. Zampaulo leg.: ***Holotype*** (male), 2 ***Paratypes*** (females) (MNRJ), 1 ***Paratype*** (female), (CTJMSB, 861).

Description. Male. Figures 1–20. Measurements are given in Table 1.

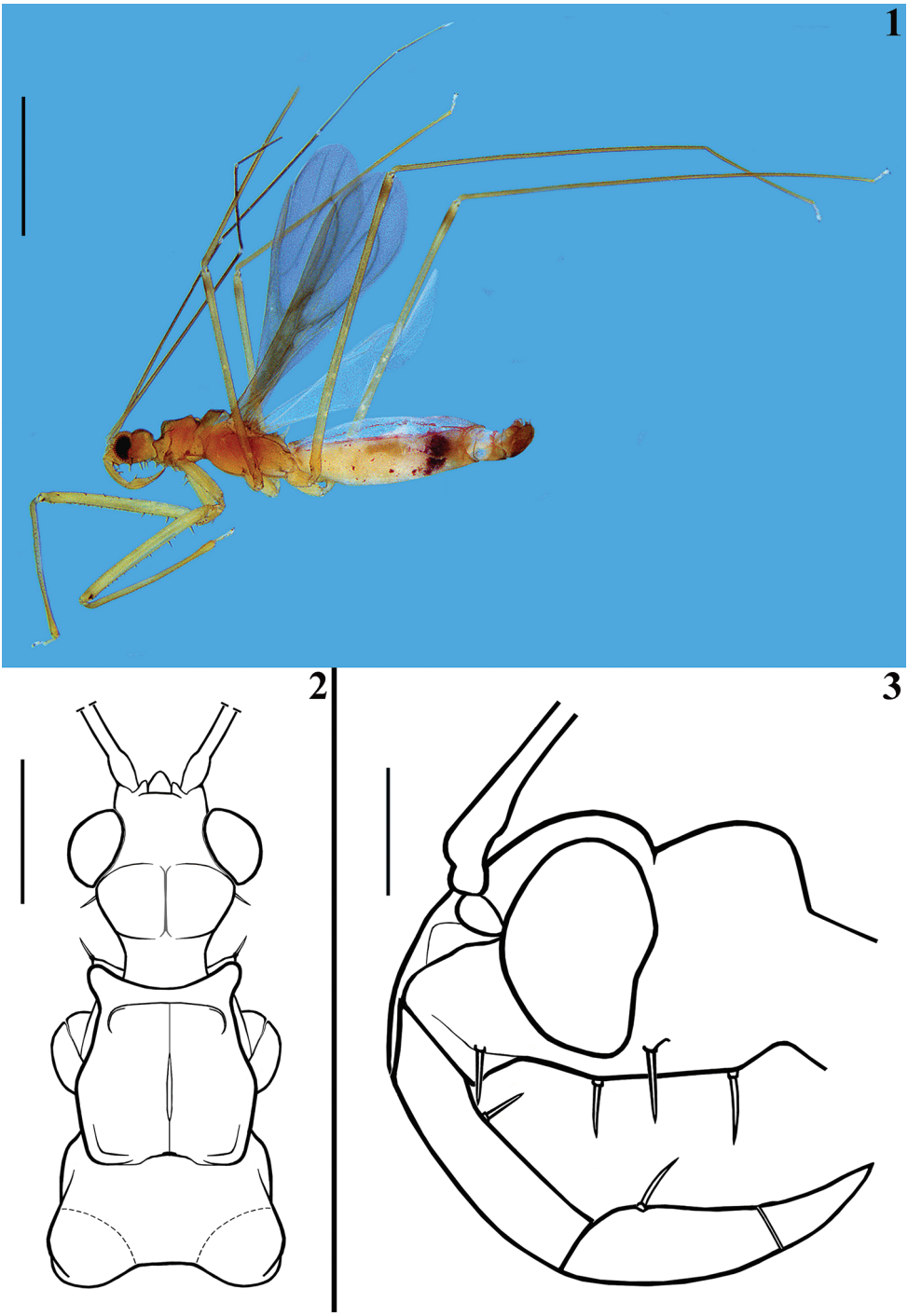
Coloration. General coloration testaceous; approximately distal half of first antennal segment and the other antennal segments darkened; articulations between the segments and extreme apex of antennal segment IV pale; femora somewhat paler, the fore pair even more; fore femora with a small subapical pair of lateral dark spots on inner and outer surfaces just distal or above a small spiny protuberance; middle and hind femora with a subapical faint darkened ring; tarsi pale to whitish; forewings greyish, with the veins slightly darkened; hind wings translucent, veins pale yellowish; abdomen with a reddish tinge on the connexivum and on adjacent portion of tergites; most abdominal segments paler, darkened to the apex, including the ventral visible portion of segment VIII and the genital capsule (Fig. 1).

Vestiture. *Body* generally covered by sparse, thin, pale, suberect, obliquely erect or adpressed setae. *Head* with somewhat longer and more numerous setae on anterior portion, clypeus, labrum and anterolateral surfaces of first visible labial segment; on ventral portion of head (gula), several rows of shorter, more numerous, obliquely erect setae as a pubescence; antennal segments I and II covered with adpressed or obliquely semi-erect thin pale setae; on segment I, much longer fine (ciliated) setae, which are approximately three to four times as long as the transverse width of the segment (Fig. 4); segments III and IV covered with more numerous and shorter, adpressed, straight

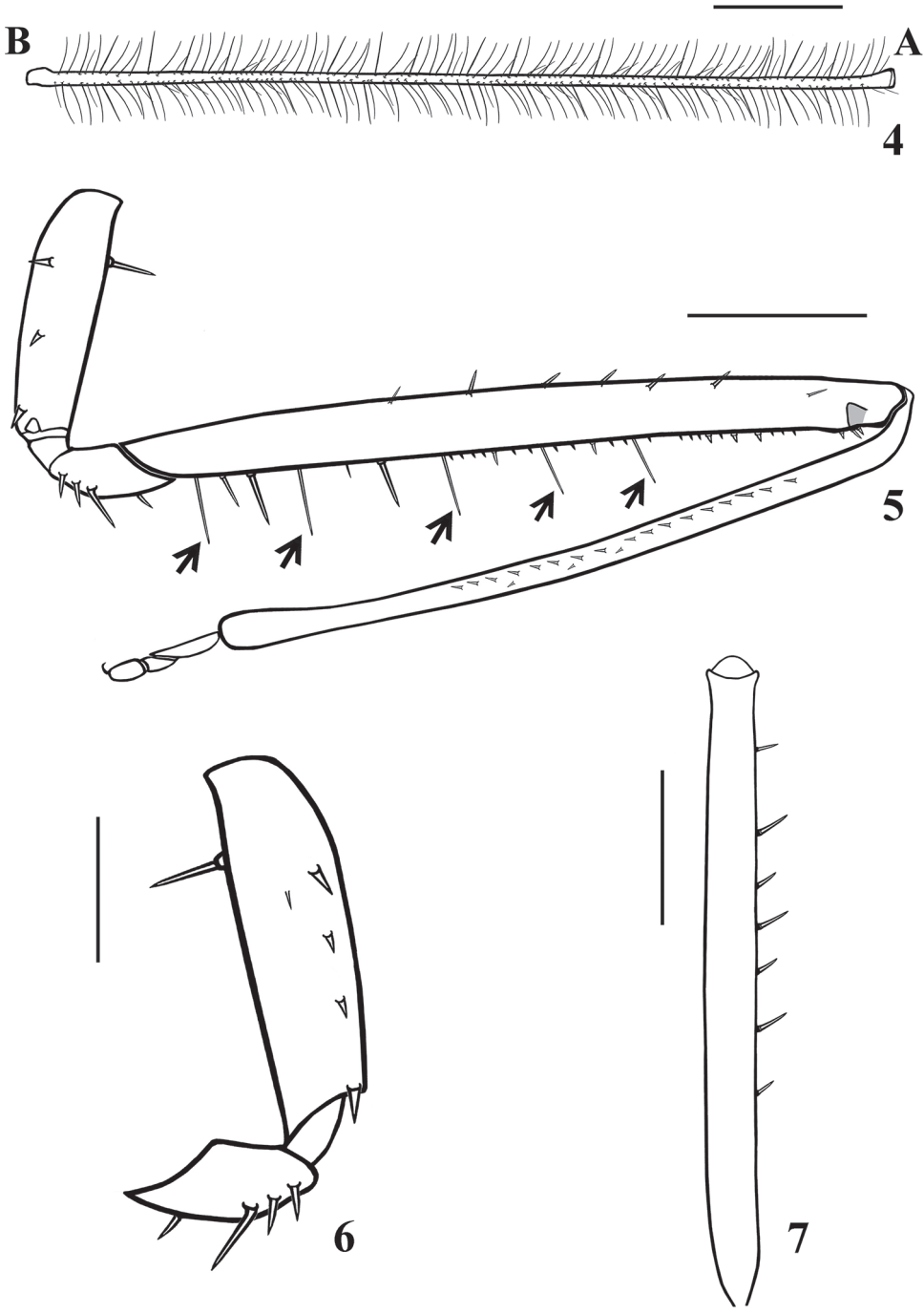
Table 1. Measurements (mm) of adult types of *Quasitagalis afonsoi* gen. et sp. nov.

	Male holotype	Female paratypes (N = 3)		
		Maximum	Minimum	Mean
Body length to tip of forewing	6.00	6.40	6.00	6.20
Body length to tip of abdomen	5.50	6.20	5.70	5.90
Head length (excluding neck)	0.70	0.70	0.70	0.70
Anteocular portion length	0.20	0.30	0.20	0.23
Postocular portion length	0.20	0.30	0.20	0.25
Head width across eyes	0.60	0.60	0.60	0.60
Interocular distance (synthlipsis)	0.30	0.30	0.30	0.30
Transverse width of eye	0.20	0.20	0.10	0.17
Length of eye	0.25	0.25	0.20	0.23
Antennal segment I length	3.10	3.30	3.10	3.20
Antennal segment II length	1.80	2.00	1.90	1.93
Antennal segment III length	1.80	1.80	1.50	1.67
Antennal segment IV length	1.00	1.00	0.90	0.97
Labial segment II length	0.50	0.50	0.50	0.50
Labial segment III length	0.30	0.30	0.30	0.30
Labial segment IV length	0.20	0.25	0.20	0.21
Fore lobe of pronotum length	0.60	0.60	0.60	0.60
Fore lobe of pronotum max. width	0.65	0.70	0.65	0.68
Hind lobe of pronotum length	0.50	0.50	0.50	0.50
Fore lobe of pronotum max. width	0.90	1.00	0.90	0.97
Forewing length	4.10	4.70	4.00	4.37
Fore coxa length	0.80	0.80	0.70	0.76
Fore femur length	2.10	2.20	1.90	2.06
Fore tibia length	1.90	2.00	1.70	1.86
Fore tarsus length	0.30	0.30	0.30	0.30
Mid femur length	2.90	3.10	2.50	2.86
Mid tibia length	3.80	3.80	3.40	3.66
Mid tarsus length	0.25	0.25	0.25	0.25
Hind femur length	4.10	4.50	3.80	4.23
Hind tibia length	6.00	6.30	5.50	5.93
Hind tarsus length	0.25	0.30	0.20	0.23
Abdomen length	3.10	3.50	3.00	3.20
Abdomen maximum width	0.90	1.40	0.70	1.06

or slightly curved thin setae. ***Thorax*:** dorsal portion mostly glabrous, except in the anterior and lateral portions of mesoscutum which are covered by setae; median portion of meso- and metasternum covered with numerous short, erect setae forming a pubescence. Legs: coxae and trochanters covered with thin, decumbent, pale setae; armature of inner face of left fore coxa with three spines, lined on the same direction, at submedian basal, submedian distal and apical positions (Fig. 5); right fore coxa with five spines, four lined at similar positions as the other coxa and other smaller spine more anteriorly located, at the level between the two more basal spines (Fig. 6); fore femora covered with numerous thin, long, obliquely erect setae and more abundant erect setae on ventral surface; among the latter, five setae are even longer, approximately as long as the width of the segment, straight and somewhat larger (Fig. 5); armature with seven spines on upper margin of inner surface (Figs 5, 7); ventrally, at approximately



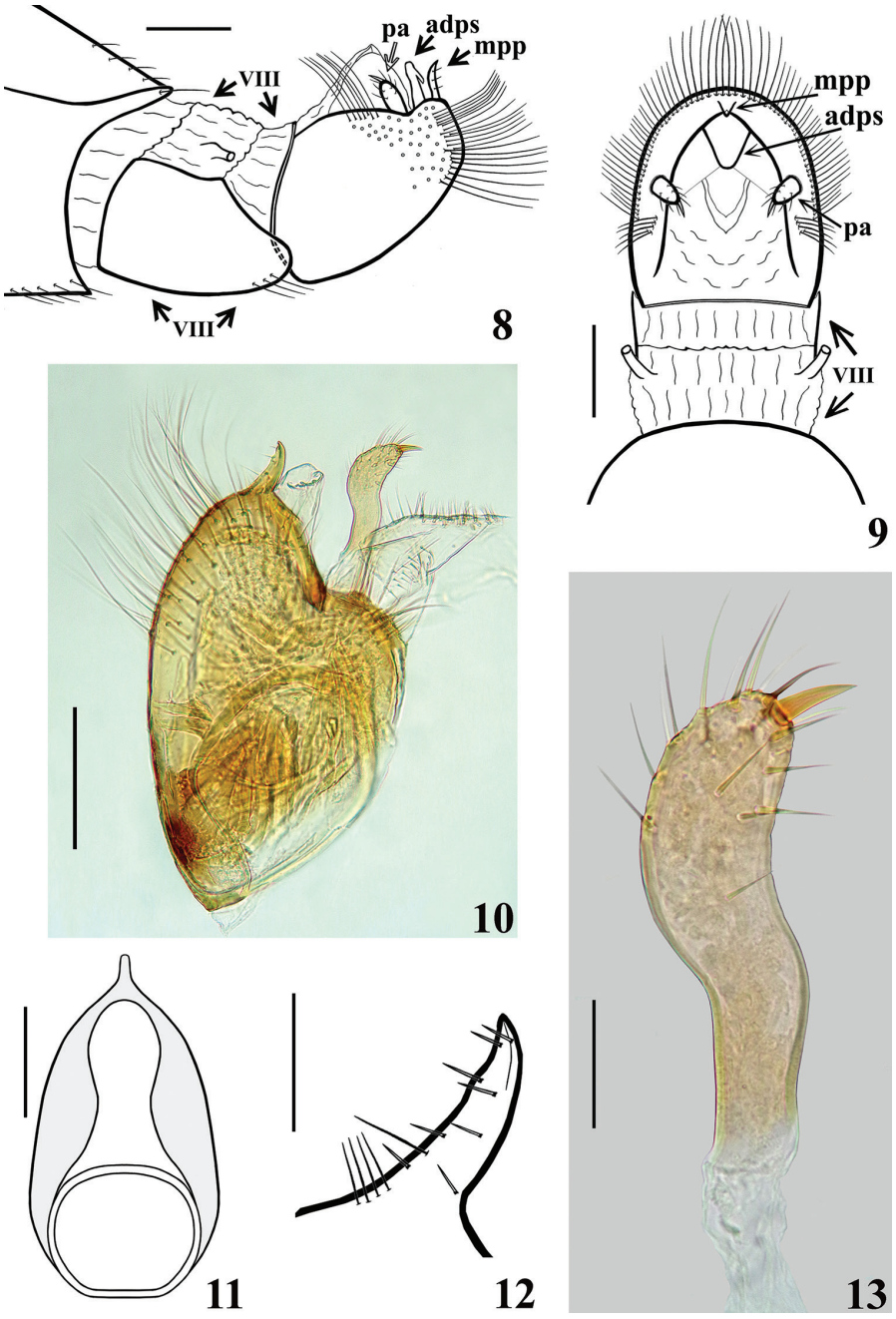
Figures 1–3. *Quasitagalis afonsoi* gen. et sp. nov., male holotype **1** lateral view **2** head and pronotum, dorsal view **3** head, lateral view. Scale bars: 2.0 mm (**1**); 0.5 mm (**2**); 0.2 mm (**3**).



Figures 4–7. *Quasitagalis afonsoi* gen. et sp. nov., male holotype **4** first antennal segment (general vestiture omitted, except the ciliated setae) (**A** apex, **B** base) **5** left fore leg, lateral view, inner face (setae omitted, except the longer setae, pointed by arrows) **6** right fore coxa and trochanter, lateral view, inner face **7** left fore femur, dorsal view. Scale bars: 0.5 mm (**4, 5, 7**); 0.2 mm (**6**).

the basal third, two long spines preceded by one spine half as long as the others and very short spines along the approximately distal two thirds of the segment (Fig. 5); a subapical ventral protuberance shallow with three minute spines (Fig. 5); middle and hind femora, tibiae and tarsi generally covered with thin, short and long setae, which are even more numerous towards apical portion of tibiae. Armature of fore tibiae with a single longitudinal median row of 17 (left tibia) (Fig. 5) or 18 (right tibia) spines at inner face, beginning somewhat far from base and ending far from apex of the segment, running by a distance of approximately 1/2 of the length of the segment; the spines are somewhat larger basally, becoming smaller towards distal portion of the row; additionally, three small spines, slightly positioned anteriorly, intercalated with spines which form the row at approximately its distal half (Fig. 5). The distal portion of the fore tibiae generally more densely covered by numerous stout adpressed setae; on inner face, distally to the end of the rows, these are even more numerous and subapically, a small subapical pecten. Forewing mostly glabrous, with thin, long setae on the costal vein, basal portion of the area subjacent to the anal vein, and short sparse setae on the margins of the pterostigma. Hind wing glabrous. *Abdomen* covered by thin, pale setae, which are generally shorter on the tergites and longer on sternites. Ventral portion of distal third of pygophore covered by very long, thin and numerous setae (Figs 8–10); a tuft of setae anterior to the implantation of parameres (Figs 8–10); posterior surface of medial process of the pygophore with a few short erect setae (Figs 8, 10, 12).

Structure. Venation of both wings similar to that of the female (Figs 34, 37). Segment VIII sclerotised on ventral portion, dorsal portion membranous; spiracles above dorsal margin of sclerotised ventral portion (Figs 8, 9). *Male genitalia* (Figs 8–20): genital capsule in situ (Figs 8, 9) with the apex of dorsal phallothecal sclerite (adps) prominent, just anterior to medial process of pygophore (mpp) and only the distal third of parameres (pa) visible, within pygophore rim. Pygophore in dorsal view (Fig. 11): somewhat elongated and ovoid in shape; between anterior and posterior genital openings, a dorsal (transverse) narrow bridge; margins of anterior opening subrounded; margins of posterior opening sinuous; in lateral view (Fig. 10): ventral margin rounded; dorsal margin rounded at approximately basal half and almost straight at distal half. Medial process of pygophore (mpp) (Figs 8, 10–12) narrow, somewhat elongated, curved in lateral view, tapering. Paramere (pa) (Figs 8, 9, 10, 13) short, strongly curved at approximately middle third, somewhat wider at distal two thirds; rounded at apex, in which a strong median apical acute spine is implanted in the same direction of the body of the paramere; glabrous at approximately basal two thirds and with sparse elongated somewhat curved thin setae scattered on distal third. Phallus (Figs 14–20): articulatory apparatus with short, stout basal arms (ba) (Figs 14, 15, 19), connected by a narrow basal bridge (bb) (Fig. 14); basal arms with a small, pointed inferior prolongation (Fig. 14, ip). Dorsal phallothecal sclerite (dps) (Figs 14–19) faintly sclerotised, elongated, curved in lateral view (Figs 15, 17); in dorsal view (Fig. 14): larger at basal portion, subtriangular at basal third, progressively narrowing towards middle third and somewhat enlarged at distal third, the latter surpassing the other elements of the phallus (Figs 15, 16); apical margin rounded (Figs 14–16). Ventrally to the dorsal phal-



Figures 8–13. *Quasitagalis afonsoi* gen. et sp. nov., male holotype **8, 9** apical margin of abdominal segment VII, abdominal segment VIII and genital capsule **8** lateral view **9** dorsal view **10–13** male genitalia **10** pygophore and left paramere, lateral view **11** pygophore without parameres, dorsal view **12** medial process of pygophore, lateral view **13** right paramere. Abbreviations: adps apex of dorsal phallothecal sclerite, mpp medial process of pygophore, pa paramere, VIII abdominal segment VIII. Scale bars: 0.2 mm (**8–11**); 0.05 mm (**12, 13**).

lothecal sclerite, numerous, elongated, sclerotised, curved, laminar processes (lp) (Figs 14–18, 20). These processes are larger at their bases, narrowing, not uniformly, towards their apices, which vary between presenting from a thin to a wider width as well as their tips which also vary as being rounded to acutely pointed (Fig. 20).

Female. Figures 21–51. Measurements are given in Table 1. Similar to male in general. The recorded differences in size are given in Table 1.

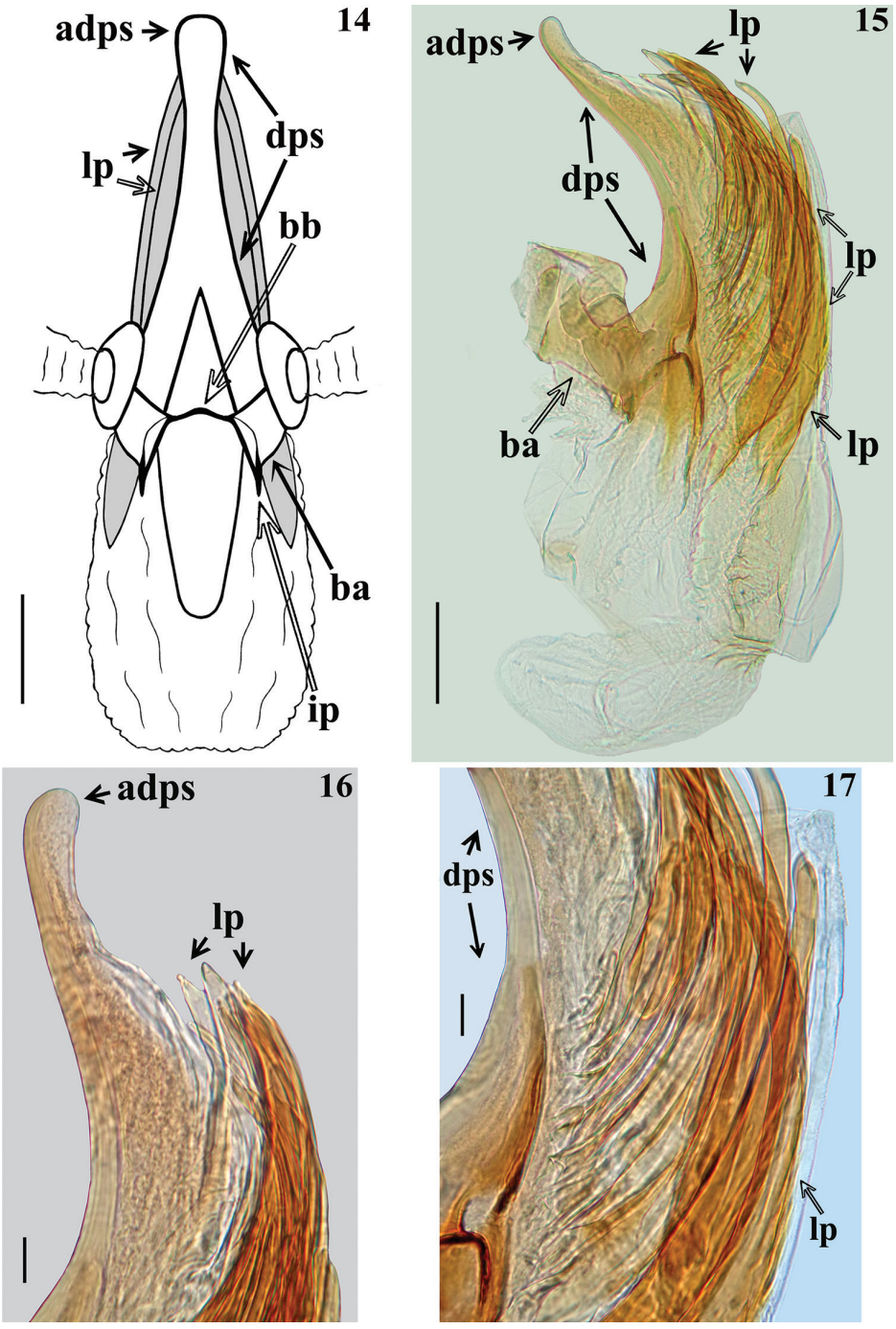
Vestiture. first antennal segment without long ciliated setae (Figs 25, 27); armature of inner face of both coxae with three spines, lined in a same direction, at submedian basal, submedian distal and apical positions (Figs 38, 39, 42); armature of fore femora (Figs 38–40, 43–46) with nine (Figs 39, 44) to ten (Figs 38, 43) spines on upper margin of inner surface; between the latter and the ventral line of spines, an intermediate row with 19 spines, similar in size (Figs 38, 39, 43); ventrally, at approximately the basal two thirds, four to seven long spines intermixed with four or five shorter spines; at approximately distal third, four to eight shorter spines, similar in size or progressively smaller towards the apex of the segment (Figs 38, 39, 43, 45, 46). Armature of fore tibiae (Figs 38, 39, 48, 49) with a double row of numerous spines, the posterior row begins closer to the base of the segment and runs by approximately 2/3 along of the inner surface; the anterior row begins more distally, approximately posteriorly to the third or fifth posterior spine; both rows ending far from the apex; the spines are generally stronger than those recorded in the male; the approximately 11–15 anterior and 16 posterior spines are mostly implanted intercalated in relation to each other and the former are generally smaller than the latter (Figs 38, 39, 48, 49); in one specimen there were five or six small additional spines randomly distributed at the mid portion of the rows and the two or three distal spines of the posterior row are thinner than the other posterior spines.

Structure. Venation of both wings as shown in Figs 34, 37. Female genitalia: posterior view of external genitalia as in Fig. 51.

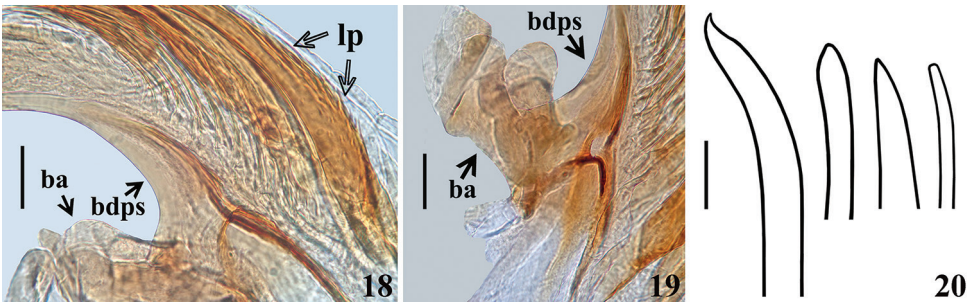
Distribution. Brazil, State of Tocantins, Lavandeira municipality, Gruta da Gia [Gia's Cave], 12°49'42"S, 46°20'43"W.

Etymology. The new species is named in honour to Professor and Researcher Dr Luiz Afonso Vaz de Figueiredo for his role as an environmentalist, responsible for the training of countless educators; a great supporter of Speleology in Brazil.

Comments. Among the two common sexual dimorphic characteristics recorded among Saicinae, such as in species of *Tagalis* (e.g., Gil-Santana et al. 2010, Gil-Santana 2011), the larger eyes and longer, ciliated setae on the first antennal segment of males, only the latter was undoubtedly recorded in the specimens of *Quasitagalis afonsoi* examined here (Fig. 4). The eyes of the male holotype showed the same measurements as one female and did not seem much larger (Figs 1–3, 21–23) as it was recorded in males of some species of *Tagalis* (e.g., Gil-Santana et al. 2010; Gil-Santana 2011; Castro-Huertas and Forero 2014), but not in *Tagalis i. inornata* in which, the male eyes were shown not to be much larger than those of the females (Gil-Santana 2011). On the other hand, the armature of the fore femora of the females had more spines in general, including an additional row of spines (intermediate between those of upper margin



Figures 14–17. *Quasitagalis afonsoi* gen. et sp. nov., male holotype, phallus **14** dorsal view **15–17** lateral view **16** distal portion **17** median portion. Abbreviations: adps apex of dorsal phallothecal sclerite, ba basal arm, bb basal bridge, dps dorsal phallothecal sclerite, ip inferior prolongation of the basal arm, lp laminar process (es). Scale bars: 0.1 mm (**14, 15**); 0.02 mm (**16, 17**).



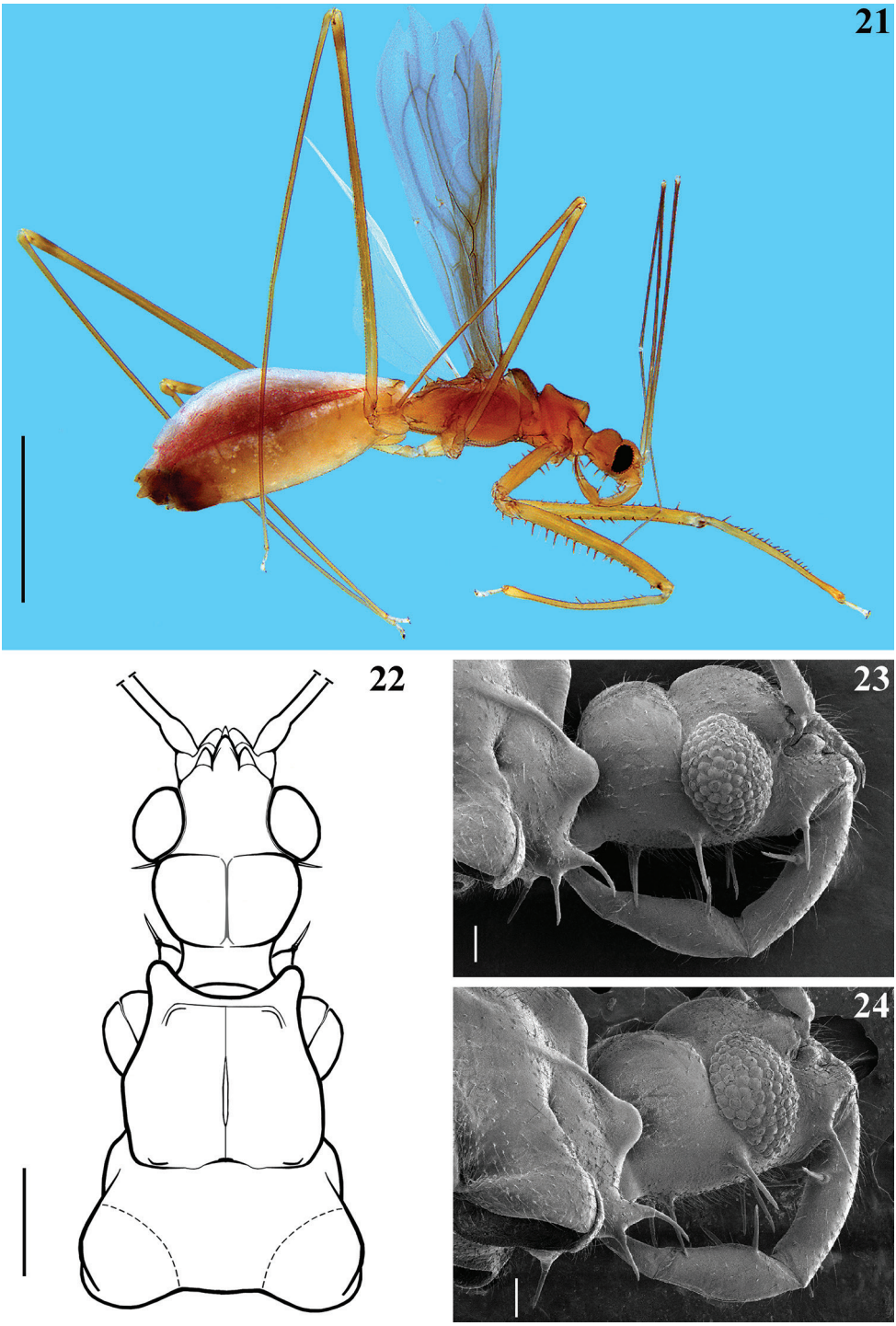
Figures 18–20. *Quasitagalis afonsoi* gen. et sp. nov., male holotype, phallus. **18, 19** Basal portion, lateral view **20** shape of apical portion of some laminar processes of endosoma. Abbreviations: ba basal arm, bdps basal portion of dorsal phallothecal sclerite, lp laminar process. Scale bars: 0.05 mm (**18, 19**); 0.02 mm (**20**).

and ventral margin of inner face) (e.g., Figs 5, 38, 39). Yet, in the females, the armature of the fore tibiae was more prominent, formed by a double row of much stronger spines, extending comparatively for a longer distance on the inner surface (Figs 38, 39, 48, 49), while in the male holotype, although there were three small, anterior spines analogous to that of the anterior row of the female, the armature was basically formed by a single row of generally smaller spines, extending for a shorter distance on the inner surface of its tibiae (Fig. 5). Similarly, for *Tagalis*, McAtee and Malloch (1923) argued that the spines on the fore femora were sexually dimorphic, while the armature of the fore femora showed smaller spines in the males of *Tagalis i. inornata* than in the females of this species examined by Gil-Santana (2011). However, both the confirmation that the eyes are of similar size in both sexes as well as if the differences in the armature of the fore legs are part of sexual dimorphism or a part of individual variation in *Quasitagalis afonsoi* would be better evaluated through examining more specimens.

Additional material examined. *Quasitagalis afonsoi* gen. et sp. nov. **Brazil,** Tocantins, Lavandeira, Gruta da Gia [Gia's Cave], 05–10.i.2009, 12°49'42"S, 46°20'43"W, Robson A. Zampaulo leg., 2 nymphs (CTJMSB, 861). *Tagalis inornata inornata* Stål, 1860. **Brazil,** Rio de Janeiro, Nova Friburgo, 22°17'S, 42°29'W, 1.049 m, 01 female, 09.xii.1997 (CTJMSB, 862).

Remarks on nymphs. Two nymphs of *Quasitagalis afonsoi* were collected with the adults. They were from different and undetermined instars and were not in good condition for formal or complete descriptions. However, the head of the smaller (earlier instar) nymph and fore legs of both of them were well conserved and were used to obtain SEM images (Figs 52–59). Their measurements are given in Table 2.

They are shown to have bi-segmented tarsi (Figs 54, 57) and smaller eyes (Fig. 52), common features found in immature Heteroptera (Schuh and Weirauch 2020; Rédei 2004) and also in the nymphs of *Tagalis evavilmae* (Gil-Santana et al. 2010). The armature of the head is like those recorded in the adults, i.e., with strong setigerous spines anteroventrally and posteroventrally from eyes, the former somewhat smaller than the latter and ventrally, on the gula, two pairs of similar setigerous spines: one pair below (between) the eyes and other pair, posterior to the eyes, somewhat closer to the neck than to eyes (Fig. 52); labial segments II and III with a pair of stout spines, slightly

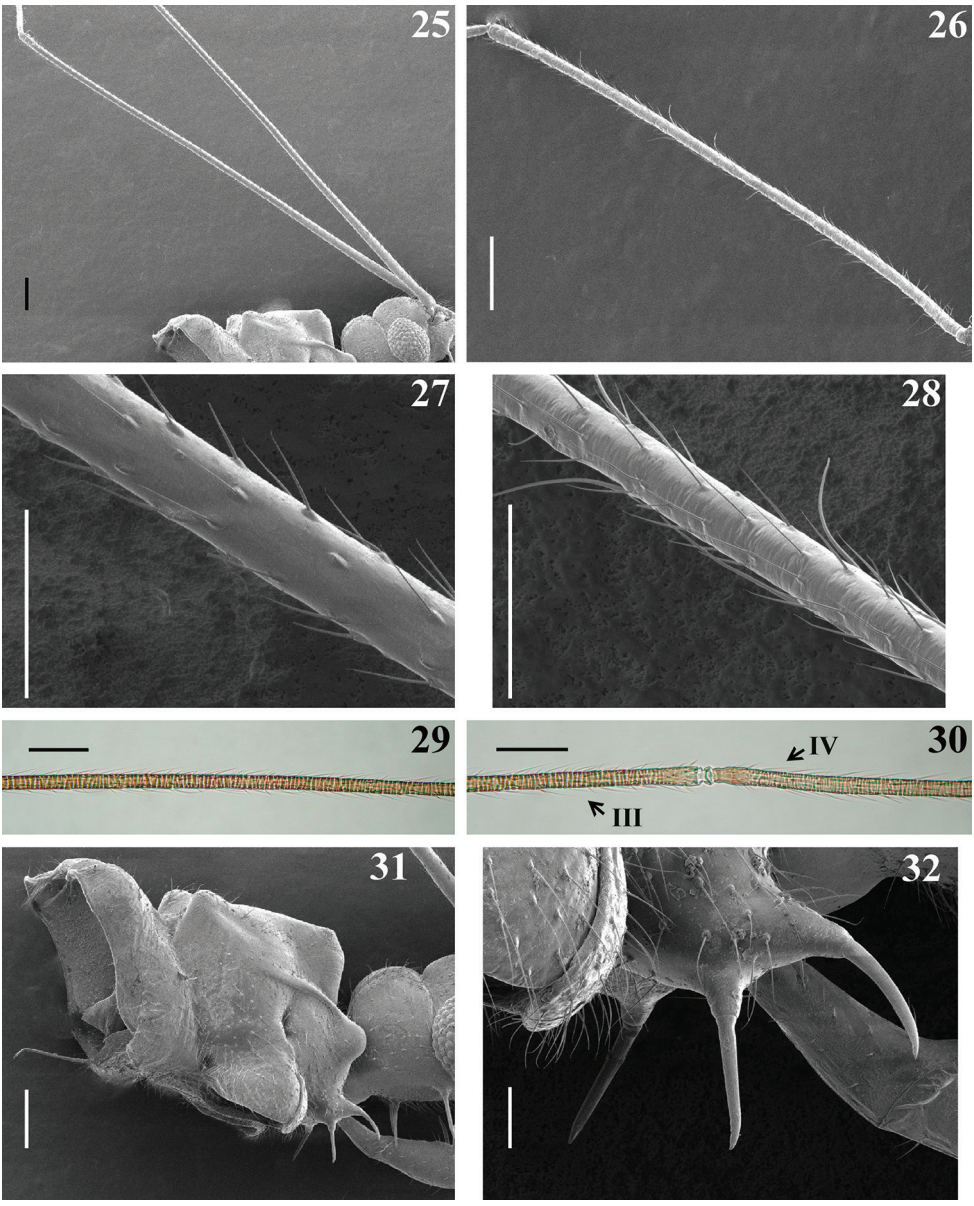


Figures 21–24. *Quasitagalis afonsoi* gen. et sp. nov., female paratypes **21** lateral view **22** head and pronotum, dorsal view **23, 24** head and anteroinferior portion of prothorax **23** lateral view **24** posterolateral view. Scale bars: 2.0 mm (**21**); 0.5 mm (**22**); 0.1 mm (**23, 24**).

Table 2. Measurements (mm) of nymph specimens of *Quasitagalis afonsoi* gen. et sp. nov.

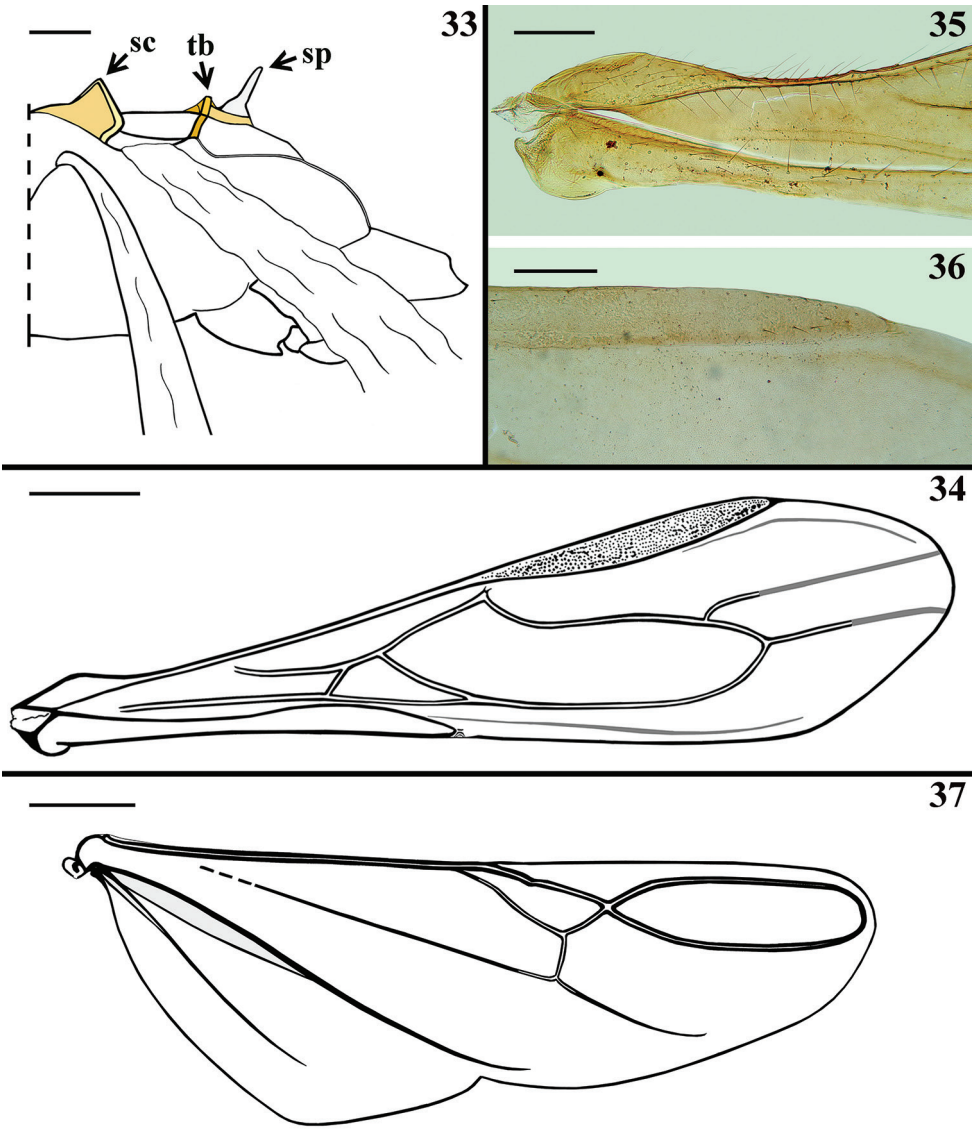
	Earlier instar nymph	Later instar nymph
Body length to tip of abdomen	3.50	4.90
Head length (excluding neck)	0.50	0.60
Anteocular portion length	0.20	0.20
Postocular portion length	0.25	0.30
Head width across eyes	0.40	0.50
Interocular distance (synthlipsis)	0.30	0.30
Transverse width of eye	0.05	0.10
Length of eye	0.10	0.15
Antennal segment I length	2.10	2.60
Antennal segment II length	1.00	1.40
Antennal segment III length	1.20	1.50
Antennal segment IV length	0.90	1.00
Labial segment II length	0.35	0.40
Labial segment III length	0.20	0.30
Labial segment IV length	0.15	0.20
Pronotum length	0.50	0.60
Pronotum maximum width	0.60	0.60
Wing pad length	0.70	1.30
Fore coxa length	0.50	0.60
Fore femur length	1.40	1.70
Fore tibia length	1.20	1.50
Fore tarsus length	0.25	0.25
Mid femur length	1.80	2.40
Mid tibia length	2.30	3.10
Mid tarsus length	0.20	0.20
Hind femur length	absent	3.40
Hind tibia length	absent	4.20
Hind tarsus length	absent	0.20
Abdomen length	1.00	2.50
Abdomen maximum width	0.40	0.80

basal to midpoint and on swollen portion, respectively (Figs 52, 53). The structure and armature of the fore coxa is also like those of the adults in general (a long spine on basal third of anterior surface and three spines on its inner surface) (Figs 54, 55). The armature of the fore trochanter is similar, but with small differences: the apical (fourth) spine is comparatively smaller and there is an additional spine below the third spine in the nymph of earlier instar (Fig. 54). The armature of the fore femora is equivalent to that of the adult female (Figs 54–56, 58): armed ventrally with a few short spines and a variable number of few longer ones intermixed at approximately the basal two thirds and a small subapical ventral protuberance with small spines; a row of spines on the upper margin of the inner surface, which are comparatively longer than those of adults (with ten elements in the earlier instar nymph and nine in the later instar nymph); between the latter and the ventral line of spines, a row of setigerous spines, more variably in size, with approximately 14 elements in both nymphs. The armature of the fore tibia, however, is conspicuously different from that of the adults, with a submedian (somewhat lateral to the median portion of the segment) row of six (earlier



Figures 25–32. *Quasitagalis afonsoi* gen. et sp. nov., female paratypes **25** upper portion of head and pronotum and antennal segment I, lateral view **26** antennal segment II **27–29** median portion of antennal segments **27** segment I **28** segment II **29** segment III **30** distal and basal portions of antennal segments III and IV (III and IV, respectively) **31** posterior portion of head and prothorax, lateral view **32** proepisternal process, lateral view. Scale bars: 0.2 mm (**25, 26, 31**); 0.1 mm (**27–30**); 0.05 mm (**32**).

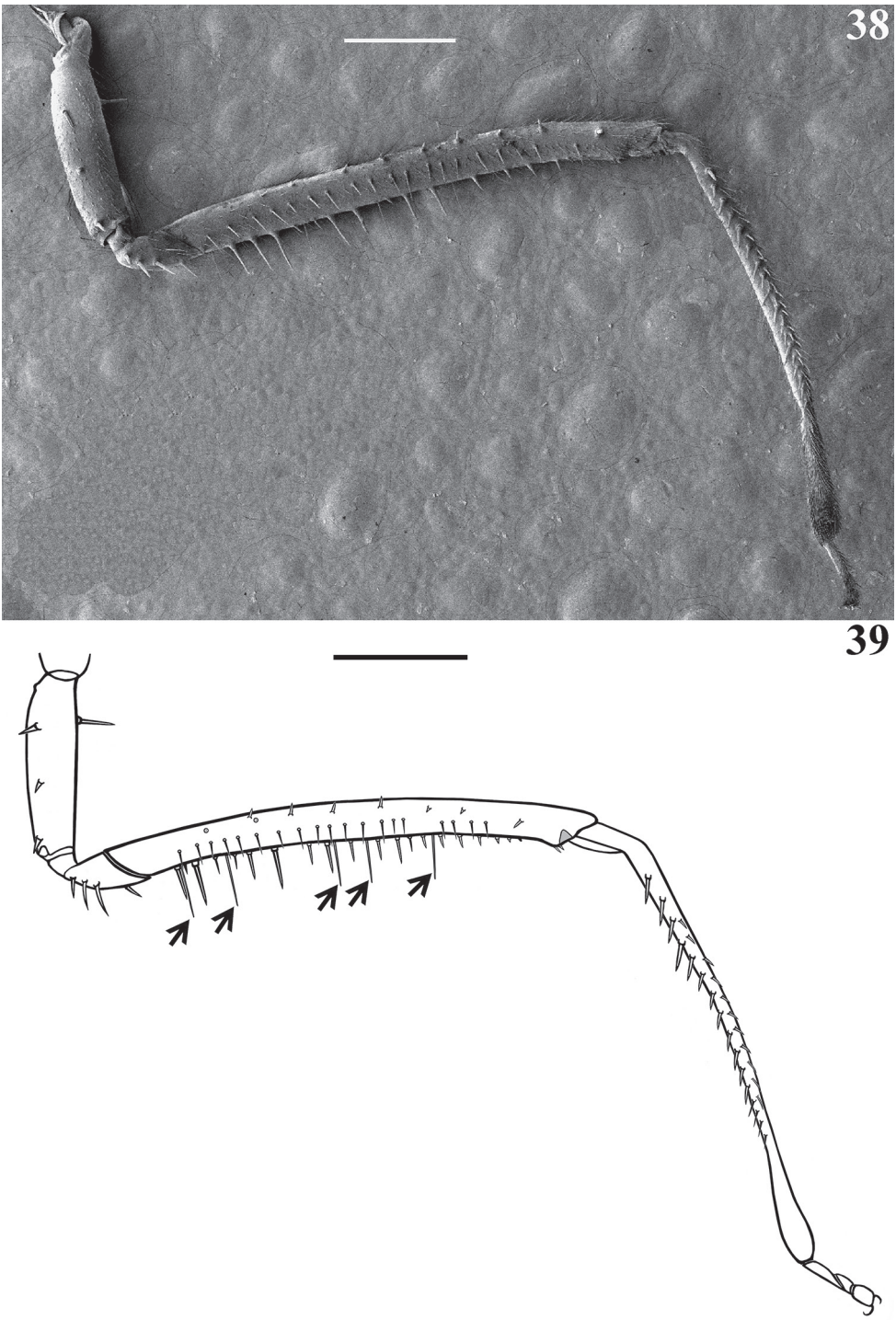
instar nymph) (Fig. 54) or eight (later instar nymph) (Figs 55, 56) strong, long spines on the inner surface (besides the more distal spine in both nymphs which is shorter and smaller); at the lateral border of the inner surface, three larger but shorter setiger-



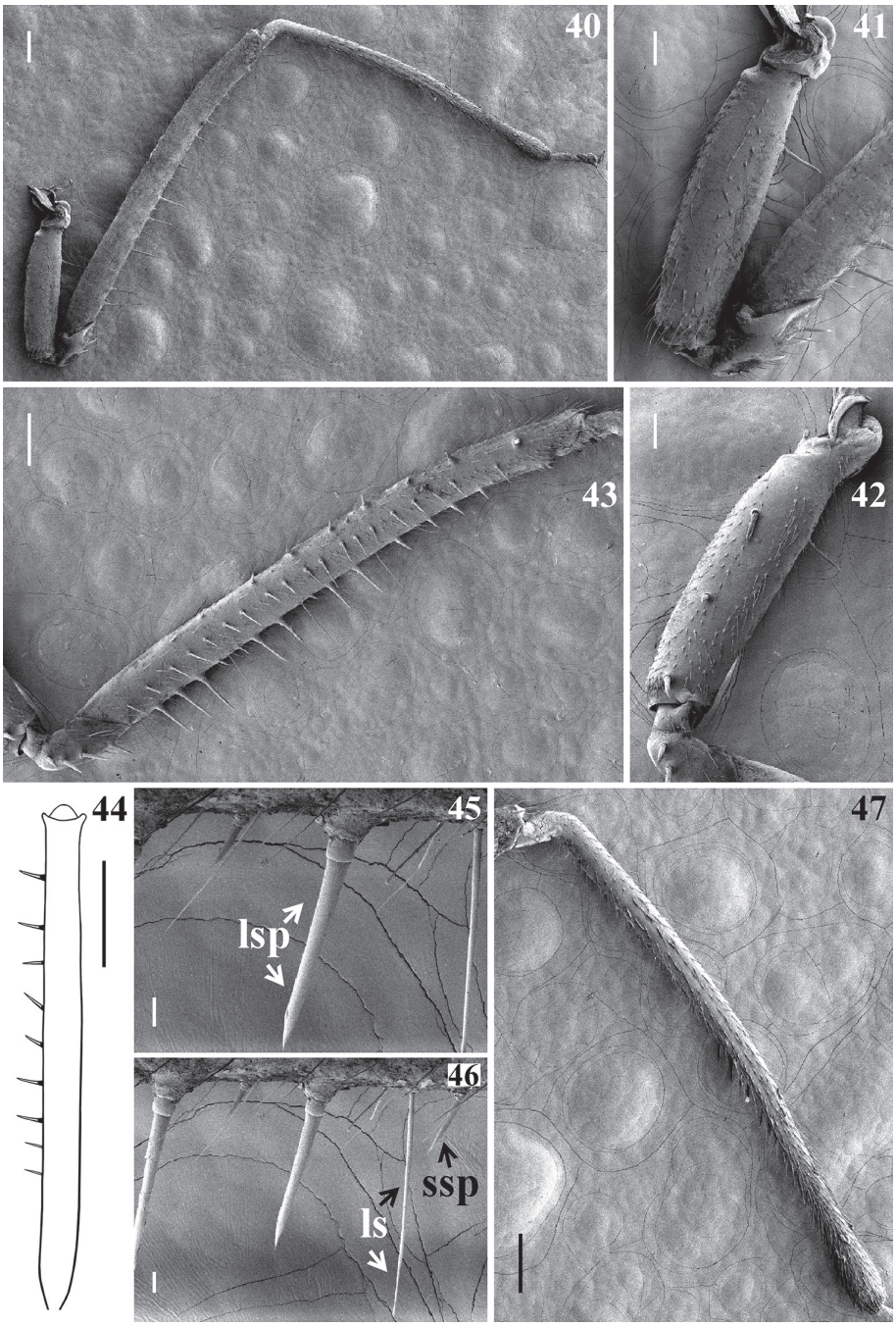
Figures 33–37. *Quasitagalis afonsoi* gen. et sp. nov., female paratypes **33** meso- and metathorax (wings moved down), lateral view **34–36** forewing **35** basal portion **36** apical half of pterostigma and subjacent portion **37** hind wing. Abbreviations: sc scutellum, sp spine of metanotum, tb tuberculum of metanotum. Scale bars: 0.5 mm (**34, 37**); 0.2 mm (**33, 35, 36**).

ous spines (Figs 54–56); at the apical portion of the dorsal surface, two or three small curved spines (Figs 54, 56, 57).

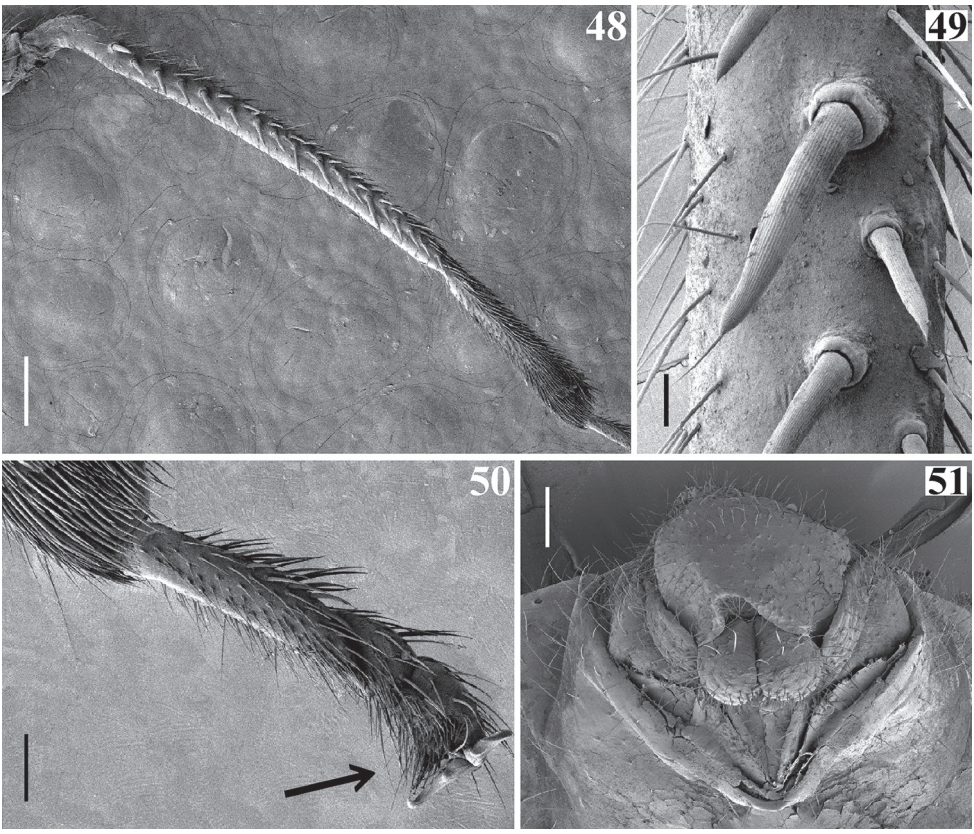
Habitat. The municipality of Lavandeira is located at 12°47'19"S, 46°24'28"W, in the southeast of the State of Tocantins and Northern Brazil (Figs 60, 61, 63) with an altitude of approximately 330 meters and an area of 519,614 km². The climate in



Figures 38, 39. *Quasitagalis afonsoi* gen. et sp. nov., female paratypes **38, 39** fore leg, inner face, lateral view **39** setae omitted, except the longer setae of femur, pointed by arrows. Scale bars: 0.5 mm.



Figures 40–47. *Quasitagalis afonsoi* gen. et sp. nov., female paratypes, fore leg **40–43, 45–47** lateral view **40, 41** outer face **41** coxa, trochanter and base of femur **42, 43** inner face **42** coxa and basal portion of trochanter **43** trochanter and femur **44** right femur, dorsal view **45, 46** segment of ventral portion of femur **47** tibia, outer face. Abbreviations: ls longer seta, lsp long spine, ssp short spine. Scale bars: 0.5 mm (**44**); 0.2 mm (**40, 43, 45–47**); 0.1 mm (**41, 42**).

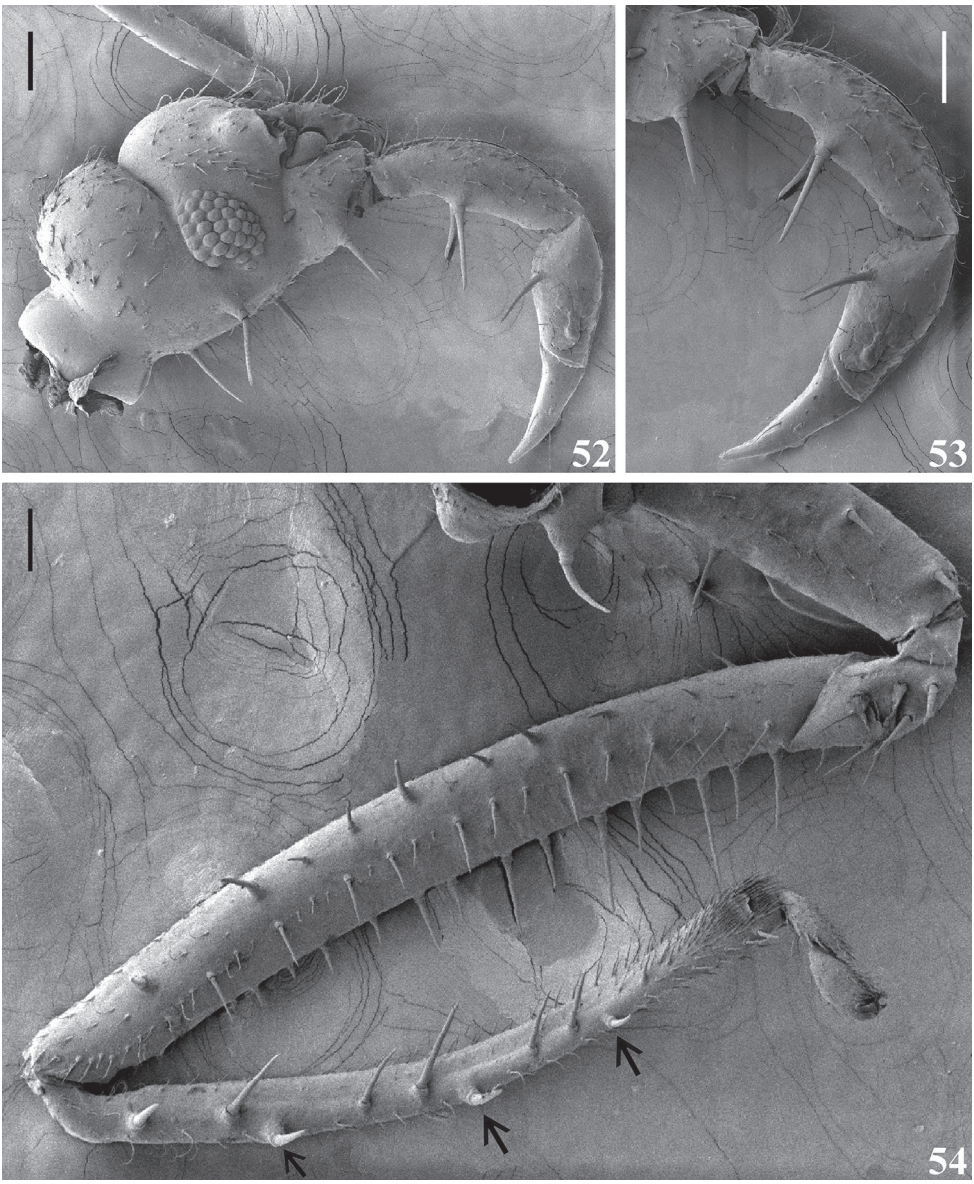


Figures 48–51. *Quasitagalis afonsoi* gen. et sp. nov., female paratypes **48, 49** fore tibia, lateral view, inner face **49** portion of the double row of spines; at the center a pair of the latter in which the posterior spine is larger and longer than the anterior one **50** fore tarsus, ventral view, the arrow points to the scopula **51** genitalia, posterior view. Scale bars: 0.2 mm (**48**); 0.1 mm (**51**); 0.05 mm (**50**); 0.02 mm (**49**).

the region is tropical with average annual rainfall ranging from 1,400 to 1,600 mm and average temperature ranging from 25 to 27 °C (SEPLAN 2008). The predominant vegetation is the Cerrado (Brazilian savannas), covering 87.8 % of the state's area, the rest is occupied by forests. It is noteworthy that the Cerrado is considered one of the main biodiversity hotspots (priority areas for biodiversity conservation) worldwide (Myers et al. 2000; Mittermeier et al. 2011; Williams et al. 2011).

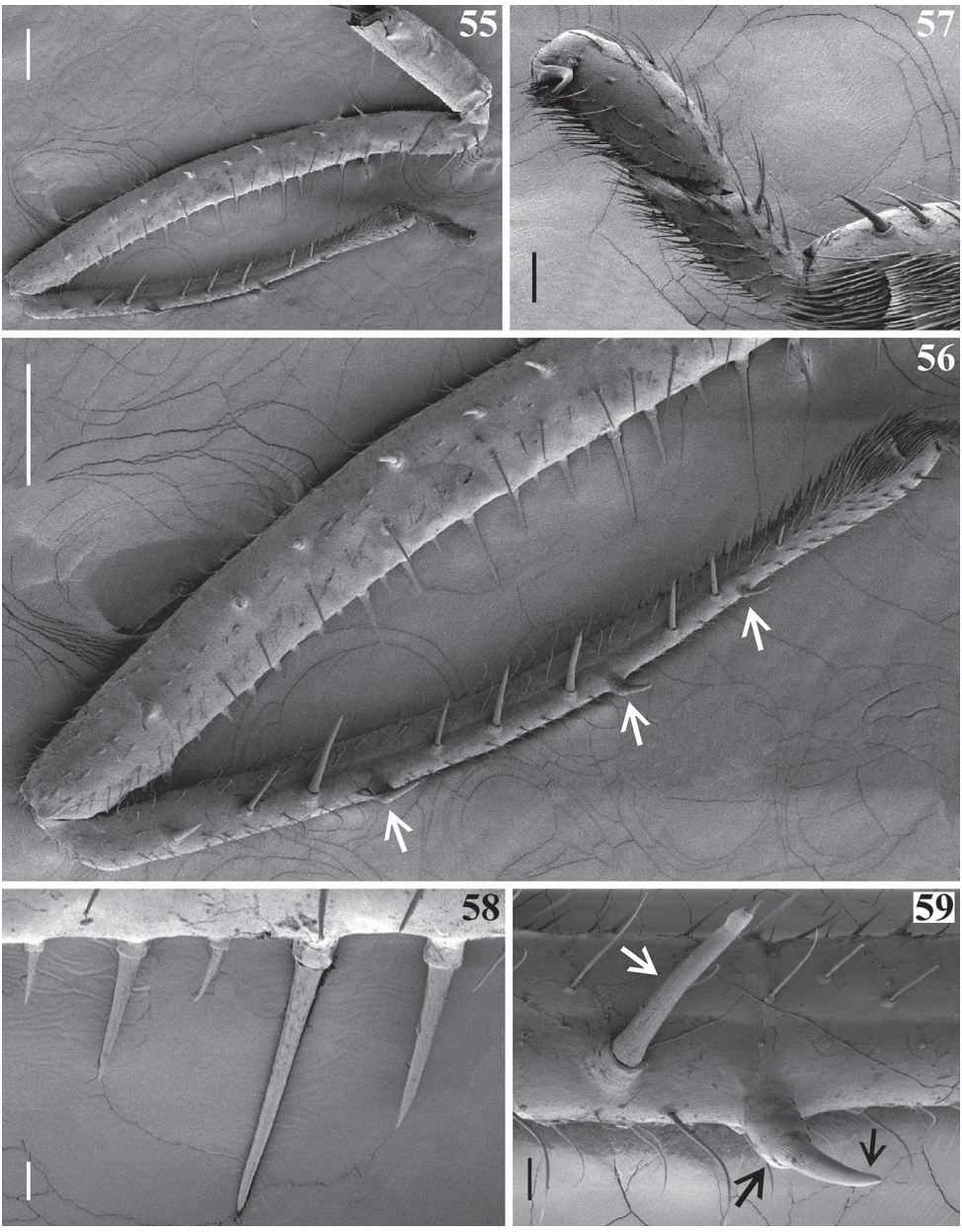
The carbonates present in the region are located in the Speleological Province of the Bambuí Group (São Domingos District) and distributed in a north-south direction. At this portion, elevations vary between 400 and 600 m, while elevations below 400 m dominate the northwestern portion of the study area. The Bambuí Group constitutes the largest set of limestone occurrences, favourable to the presence of caves in Brazil (Karmann and Sánchez 1979).

Currently, the State of Tocantins has 939 caves registered in the official government databases (CECAV 2019), with approximately 350 known caves in the southeastern region.

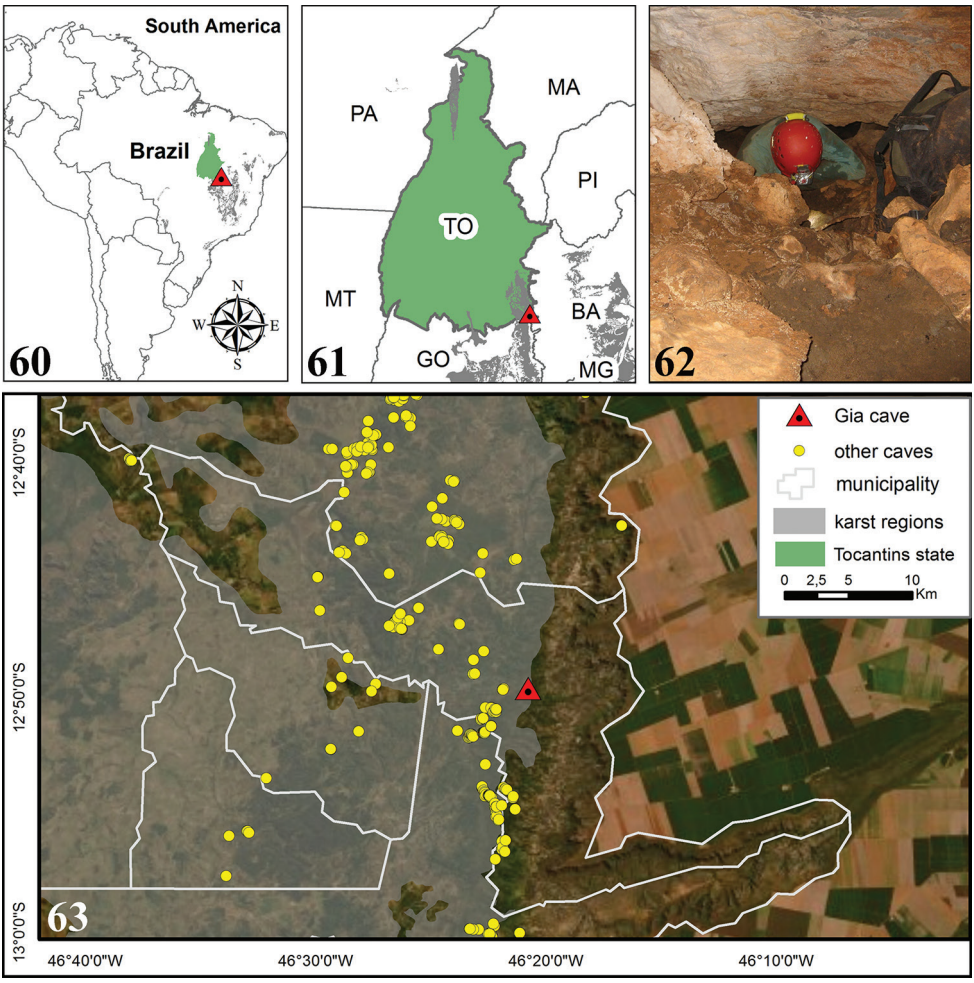


Figures 52–54. *Quasitagalis afonsoi* gen. et sp. nov., earlier instar nymph **52–54** lateral view **52** head **53** labium **54** fore leg, inner face, the setae point to the larger setigerous spines on inner surface of fore tibiae, close to its dorsal surface. Scale bars: 0.1 mm.

However, karst in the region has the potential for thousands of caves. Gruta da Gia [Gia's Cave] is located in the central portion of the municipality of Lavandeira (Fig. 63) under the 12°49'42"S, 46°20'43"W at 503 m high. Inserted at the top of the limestone massif,

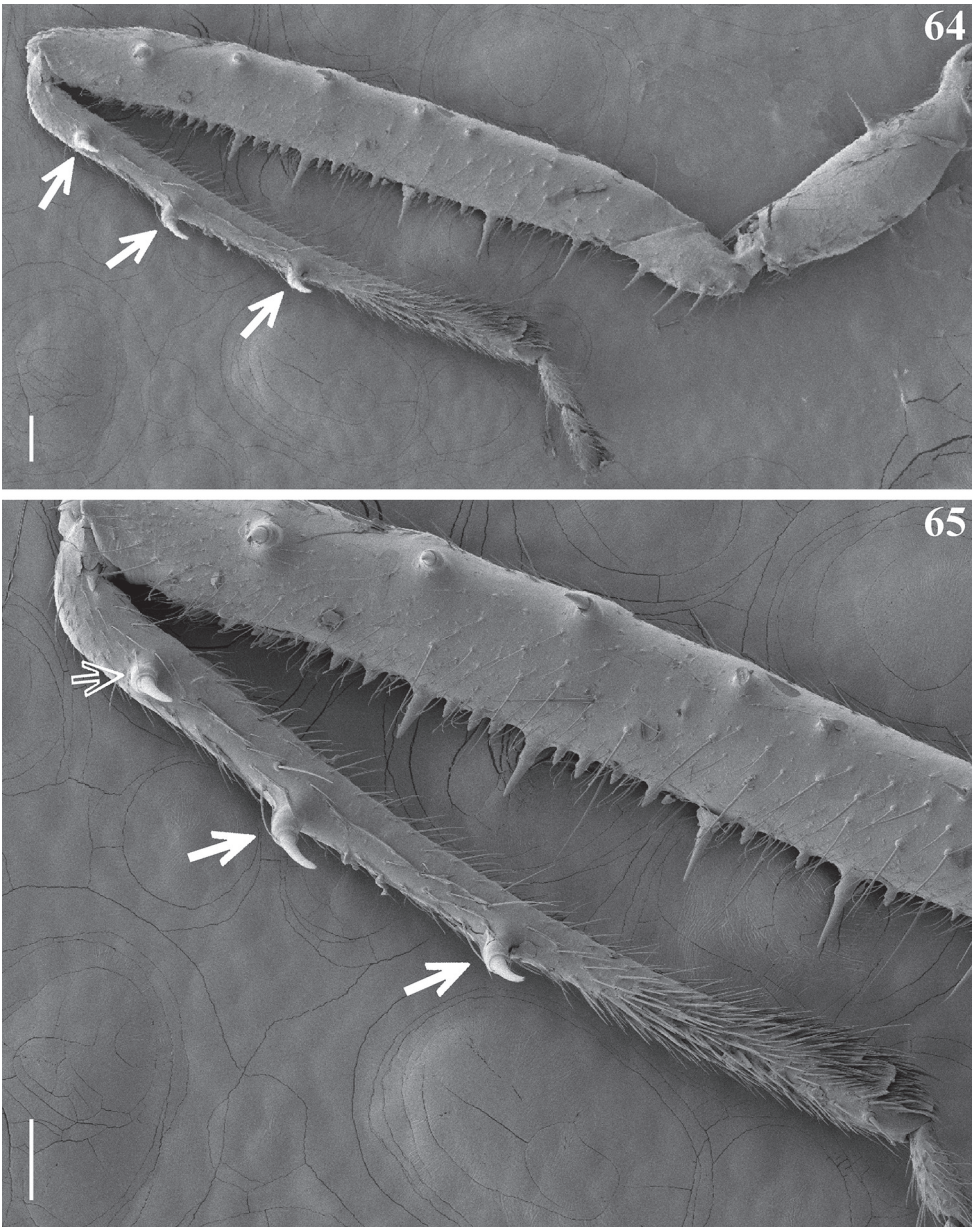


Figures 55–59. *Quasitagalis afonsoi* gen. et sp. nov., later instar nymph, fore leg, lateral view **55, 56** inner face **55** entire leg **56** approximately distal two thirds of femur and tibia; the setae point to the larger setigerous spines on inner surface of fore tibiae, close to its dorsal surface **57** tarsus **58** basal portion of the ventral armature of femur **59** portion of tibia in which the second lateral spine (pointed by black arrows) is inserted; adjacent long submedian spine pointed by a white arrow. Scale bars: 0.2 mm (**55, 56**); 0.04 mm (**57**) 0.02 mm (**58, 59**).



Figures 60–63. 60, 61 Position of the Gruta da Gia [Gia's Cave], the type locality of *Quasitagalis afonsoi* sp. nov., in relation to Brazil and the State of Tocantins **62** the entrance to Gruta da Gia [Gia's Cave] **63** Position of the Gruta da Gia [Gia's Cave] in relation to the municipality of Lavandeira, other caves identified in the region and the delimitation of carbonate rocks (the Bambuí Geological Group in light gray). Abbreviations: Brazilian States: BA Bahia, GO Goiás, MA Maranhão, MG Minas Gerais, MT Mato Grosso, PA Pará, PI Piauí, TO Tocantins.

this cave is approximately 200 m of long and has only one entrance (Fig. 62). It is a humid cave with clay soil, extensive aphotic zones and low availability of trophic resources. The surrounding landscape is made up of pasture areas, but there are still extensive fragments of native forest associated with karst outcrops and springs areas. In general, the caves in the region have small dimensions, the majority of which are less than 50 m long. They have a predominantly flat floor, and few have underground lakes or rivers.



Figures 64, 65. *Tagalis inornata inornata* Stål, 1860, female, fore leg, lateral view, inner face; the setae point to the larger setigerous spines on inner surface of fore tibiae, close to its dorsal surface **64** entire leg **65** portion of femur and tibia. Scale bars: 0.1 mm.

Discussion

Gil-Santana et al. (2010) argued that the revised description of *Tagalis* when compared to the one of *Paratagalis* Monte, 1943 (Gil-Santana and Costa 2009) showed many similarities, suggesting that they were closely related genera, what was reinforced by Gil-Santana (2011), while studying additional species of *Tagalis*. A similar situation is revealed in relation to *Tagalis* and *Quasitagalis*, both sharing many common characteristics, suggesting that they are also closely related genera.

It is noteworthy that, while *Paratagalis* and *Quasitagalis* have in common the presence of two pairs of setigerous spines on the gula (Figs 3, 23, 24), all other differential characteristics of the latter genus presented in relation to *Tagalis*, are also valid as such in relation to *Paratagalis*. On the other hand, some additional characteristics of *Quasitagalis afonsoi* sp. nov. were not recorded in any species of *Paratagalis* or *Tagalis* so far. Those are the additional row of spines (intermediate between those of the upper margin and ventral margin of the inner face) of the fore femora in the females (Figs 38, 39, 43) and the shape of parameres in the male (Fig. 13).

Regarding the male genitalia, it is noteworthy that the shape of the pygophore, its process, the endosoma portions (articulatory apparatus, dorsal phallothecal sclerite, curved elongated processes of endosoma) (Figs 10–12, 14–20) have many similarities to what was recorded in other species of *Tagalis* (e.g., Gil-Santana et al. 2010; Gil-Santana 2011). However, while in some species of the latter genus, the pygophore showed a conspicuous lateral apophysis, it was not recorded in *Q. afonsoi*.

More importantly, in all species of *Paratagalis* and *Tagalis* in which the paramere was described (Blinn 2008; Melo 2008; Gil-Santana and Costa 2009; Gil-Santana et al. 2010; Gil-Santana 2011; Castro-Huertas and Forero 2014; Varela and Melo 2017), it showed to be elongated, strongly curved apically, or with an apical large teeth, which was implanted laterally, forming a right to an acute angle with the body of the paramere, while in *Q. afonsoi*, the paramere is short, rounded at apex, in which the strong apical acute spine is implanted in the same direction of the body of the paramere (Fig. 13).

The presence of the scopula on the apex of the third tarsomere on all the legs in *Q. afonsoi* (Fig. 50) is in accordance with the statements of Weirauch and Forero (2007a) and Weirauch (2008a) that this character seems to be widespread among Saicinae and is a synapomorphy of part of this subfamily, respectively. As such, it has been recorded in species belonging to several genera of Saicinae (Weirauch 2007; Weirauch and Forero 2007a, b), including two species of *Tagalis* (Castro-Huertas and Forero 2014), genus which seems to be closer to *Quasitagalis*

The three larger lateral setigerous spines on the inner surface of the fore tibiae, close to its dorsal surface, present in the nymphs of *Q. afonsoi* (Figs 54–56, 59) are striking, because they are very similar to those recorded in almost all species of *Tagalis* (Figs 64, 65) (*T. femorata* Melo, 2008 has four spines) and also in *Paratagalis* (Gil-Santana and Costa 2009), while they are completely absent in the adults of the new species (Figs 5, 38, 39, 48, 49). Similarly, Gil-Santana et al. (2010) recorded features in the nymphs of *T. evavilmae* not present in adults of *Tagalis* but observed in adults of other related genera, what they argued might help to understand the relationships among the genera of

Saicinae in future studies. It is noteworthy that the mentioned features in the nymphs of *T. evavilmae* included two pairs of spines on the ventral side of the head as present both in adults and nymphs of *Q. afonsoi* sp. nov. (Fig. 52) and five (*T. evavilmae*) to six (*Q. afonsoi*) (Fig. 54) strong long spines on the inner face of the fore tibiae recorded in the nymphs of earlier stage of both species.

Future phylogenetic analyses should be carried out to assess all these similarities and differences and the taxonomic validity of the genera and their systematic positions, and the relationships among species of New World genera of Saicinae.

Several species of Emesinae, a group considered as close related to Saicinae (e.g., Wygodzinsky 1966; Weirauch 2008a; Schuh and Weirauch 2020), are occasionally found or consistently live in caves (Wygodzinsky 1966; Pape 2013; Gil-Santana and Ferreira 2017). On the other hand, as far as it seems, this is the first record of a species of Saicinae, at least in the New World, found inside or as a possible inhabitant of caves. The presence of a male, females and immature forms make believe that the presence of *Q. afonsoi* inside the cave was not an incidental finding, but more probably their life cycle was, at least, partially being carried out there, possibly the species might be reproducing in such habitats, as it occurs with some emesines (Wygodzinsky 1966; Pape 2013). However, more than a dozen caves were sampled in the region and few specimens were found in only one of them (Gia's Cave), which gives this species a certain rarity. In any case, a more extensive study would be necessary, including more frequent collecting and searches around the cave in the epigean environment to determine the importance of caves as a habitat for *Q. afonsoi*. On the other hand, for similar reasons, and also because of the fact that part of the surrounding landscape is made up of pasture areas, which tend to extend, the distribution of the new species was considered here strictly restricted to the Gia´s Cave (Figs 62, 63), which should be also considered its type locality.

Key to the New World genera of Saicinae

Based on Weirauch and Forero (2007a, b), Gil-Santana and Costa (2009), and Gil-Santana et al. (2015)

1 Foreleg without spines, at most with erect setae **2**

– Fore femur with two or three rows of spines, fore tibiae either with setae or with spines **5**

2 Posterior pronotal lobe with upward projecting spines or tubercles; mesoscutum (scutellum) and metanotum apically with vertical spines or tubercles... **3**

– Pronotum generally unarmed, but sometimes with humeral spines; apex of mesoscutum produced into a long horizontal tapering spine, metanotum without spine or tubercle ..... ***Oncerotrachelus* Stål, 1868**

3 Opposed surfaces of labium and head with spine-like setae or bristles; forewing with two to three cells; metapleura without a tubercle near coxal cavity **4**

– Opposed surfaces of labium and head without spine-like setae or bristles; forewing with four cells; metapleura with a tubercle near coxal cavity..... ..... ***Saicireta* Melo & Coscarón, 2005**

4 Process on lower anterior angle of prothorax acute to subacute; second antennal segment approximately half as long as first antennal segment; medial process of male pygophore bifurcate; posterior margin of seventh abdominal sternite in females vertical or subvertical ..... ***Saica*** **Amyot & Serville, 1843**

– Process on lower anterior angle of prothorax subconical; second antennal segment approximately 3/4 as long as first antennal segment; medial process of male pygophore a single, erect spine; posterior margin of seventh abdominal sternite in females sloping ventrocephalad..... ***Pseudosaica*** **Blinn, 1990**

5 Humeral angles of pronotum without processes, rounded..... **6**

– Humeral angles of pronotum with spine-like processes **7**

6 Ventral portion of the head below (between) the eyes spineless; fore tibiae with a three or four (*T. femorata*) stronger, setigerous spines implanted on external border of inner surface, close to dorsal surface .... ***Tagalis*** **Stål, 1860**

– Head with a ventral pair of spines below (between) the eyes; fore tibiae with a single or double longitudinal row of numerous short spines on median portion of inner surface..... ***Quasitagalis*** **gen. nov.**

7 Fore coxae and anterior pronotal lobe unarmed .... ***Bagriella*** **McAtee & Malloch, 1923**

– Fore coxae spined, anterior pronotal lobe with four spines or rounded humps **8**

8 Fore lobe of pronotum with four spines..... ***Paratagalis*** **Monte, 1943**

– Fore lobe of pronotum with four humps..... **9**

9 Two first (visible) labial segments spiny; only apterous females known..... ..... ***Kiskeyana*** **Weirauch & Forero, 2007**

– Only the first (visible) or all three labial segments spiny; females macropterous..... **10**

10 Only the first (visible) labial segment spiny; forewings with four closed cells... ..... ***Buninotus*** **Maldonado, 1981**

– All three (visible) labial segments spiny; forewings with two closed cells..... ..... ***Caprilesia*** **Gil-Santana, Marques & Costa, 2006**

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References

Blinn RL (2008) *Tagalis inornata cubensis* McAtee & Malloch (Hemiptera: Heteroptera: Reduviidae: Saicinae): first record from de continental United States. Zootaxa 1912: 66–68. https://doi.org/10.11646/zootaxa.1912.1.4

Castro-Huertas V, Forero D (2014) First record of the genus *Tagalis* Stål, 1860 (Hemiptera: Reduviidae: Saicinae) from Colombia with the description of two new species. Zootaxa 3838: 475–485. https://doi.org/10.11646/zootaxa.3838.4.6

CECAV [Centro Nacional de Pesquisa e Conservação de Cavernas] (2019) Cadastro Nacional de Informações Espeleológicas (CANIE). Brasília. https://www.icmbio.gov.br/cecav/canie.html

Gil-Santana HR (2011) Three new species of *Tagalis* Stål (Hemiptera: Heteroptera: Reduviidae: Saicinae) from Brazil. Zootaxa 2996: 33–48. https://doi.org/10.11646/zootaxa.2996.1.2

Gil-Santana HR (2013) Two new species of *Oncerotrachelus* Stål (Hemiptera: Heteroptera: Reduviidae: Saicinae), from Amazonas, Brazil, with taxonomical notes. Zootaxa 3626: 268–278. https://doi.org/10.11646/zootaxa.3626.2.4

Gil-Santana HR, Costa LAA (2009) A new species of *Paratagalis* Monte from Brazil with taxonomical notes and a key to New World genera of Saicinae (Hemiptera: Heteroptera: Reduviidae: Saicinae). Zootaxa 2197: 20–30. https://doi.org/10.11646/zootaxa.2197.1.2

Gil-Santana HR, Ferreira RL (2017) A new species of *Dohrnemesa* and a new species of *Polauchenia* from Brazil (Hemiptera: Heteroptera: Reduviidae: Emesinae). Zootaxa 4338: 201–240. https://doi.org/10.11646/zootaxa.4338.2.1

Gil-Santana HR, Gouveia FBP, Zeraik SO (2010) *Tagalis evavilmae* sp. nov. (Hemiptera: Reduviidae: Saicinae), an inhabitant of birds' nests in Amazonas, Brazil, with taxonomical notes and a key to the species of *Tagalis* Stål. Zootaxa 2721: 1–14. https://doi.org/10.11646/zootaxa.2721.1.1

Gil-Santana HR, Forero D, Weirauch C (2015) Assassin bugs (Reduviidae excluding Triatominae). In: Panizzi AR, Grazia J (Eds) True bugs (Heteroptera) of the Neotropics, Entomology in Focus 2. Springer Science+Business Media, Dordrecht, 307–351. https://doi.org/10.1007/978-94-017-9861-7_12

Karmann I, Sánchez LE (1979) Distribuição das rochas carbonáticas e províncias espeleológicas do Brasil. Espeleo-Tema 13: 105–167.

Lent H, Wygodzinsky P (1979) Revision of the Triatominae (Hemiptera: Reduviidae) and their significance as vectors of Chagas' disease. Bulletin of the American Museum of Natural History 163: 123–520.

McAtee WL, Malloch JR (1923) Notes on American Bactrodinae and Saicinae (Heteroptera: Reduviidae). Annals of the Entomological Society of America 15: 247–254. https://doi.org/10.1093/aesa/16.3.247

Melo MC (2008) New records of Peruvian Reduviidae (Heteroptera), with the description of a new species of *Tagalis* Stål 1860 (Saicinae). Zootaxa 1763: 55–62. https://doi.org/10.11646/zootaxa.1763.1.4

Mittermeier RA, Turner WR, Larsen FW, Brooks TM, Gascon C (2011) Global biodiversity conservation: the critical role of hotspots. In: Zachos FE, Habe JC (Eds) Biodiversity Hotspots. Springer Publishers, London, 3–22. https://doi.org/10.1007/978-3-642-20992-5_1

Myers N, Mittermeier RA, Mittermeier CG, Fonseca, GAB, Kent, J (2000) Biodiversity hotspots for conservation priorities. Nature 403: 853–858. https://doi.org/10.1038/35002501

Pape RB (2013) Description and ecology of a new cavernicolous, arachnophilous thread-legged bug (Hemiptera: Reduviidae: Emesini) from Kartchner Caverns, Cochise County, Arizona. Zootaxa 3670: 137–156. https://doi.org/10.11646/zootaxa.3670.2.2

Rédei D (2004) The last instar larva of *Exaeretosoma cheesmanae* Elkins, 1962 (Heteroptera: Reduviidae: Saicinae). Journal of the Asia-Pacific Entomology 7: 253–255. https://doi.org/10.1016/S1226-8615(08)60224-1

Rosa JA, Mendonça VJ, Rocha CS, Gardim S, Cilense M (2010) Characterization of the external female genitalia of six species of Triatominae (Hemiptera, Reduviidae) by scanning electron microscopy. Memórias do Instituto Oswaldo Cruz 105: 286–292. https://doi.org/10.1590/S0074-02762010000300007

Rosa JA, Mendonça VJ, Gardim S, Carvalho DB, Oliveira J, Nascimento JD, Pinotti H, Pinto MC, Cilense, M, Galvão C, Barata JMS (2014) Study of the external female genitalia of 14 *Rhodnius* species (Hemiptera, Reduviidae, Triatominae) using scanning electron microscopy. Parasites & Vectors 7: 17. https://doi.org/10.1186/1756-3305-7-17

SEPLAN (2008) Atlas do Tocantins: subsídios ao planejamento da gestão territorial. 4th Edition. Diretoria de Zoneamento Ecológico-Econômico–DEZ, Palmas, 49 pp.

Schuh RT, Weirauch C (2020) True bugs of the world (Hemiptera: Heteroptera). Classification and natural history. (2nd edn.). Siri Scientific Press, Manchester, UK, 767 pp. [32 pls]

Schuh RT, Weirauch C, Wheeler WC (2009) Phylogenetic relationships within the Cimicomorpha (Hemiptera: Heteroptera): a total-evidence analysis. Systematic Entomology 34: 15–48. https://doi.org/10.1111/j.1365-3113.2008.00436.x

Varela PS, Melo MC (2017) New species of *Tagalis* Stål, 1860 (Hemiptera, Reduviidae, Saicinae) from Argentina.Proceedings of the Entomological Society of Washington 119: 122–129. https://doi.org/10.4289/0013-8797.119.1.122

Weirauch C (2007) Hairy attachment structures in Reduviidae (Cimicomorpha, Heteroptera), with observations on the fossula spongiosa in some other Cimicomorpha. Zoologischer Anzeiger 246: 155–175. https://doi.org/10.1016/j.jcz.2007.03.003

Weirauch C (2008a) Cladistic analysis of Reduviidae (Heteroptera: Cimicomorpha) based on morphological characters. Systematic Entomology 33: 229–274. https://doi.org/10.1111/j.1365-3113.2007.00417.x

Weirauch C (2008b) From four- to three- segmented labium in Reduviidae (Hemiptera: Heteroptera). Acta Entomologica Musei Nationalis Pragae 48: 331–344.

Weirauch C, Forero D (2007a) *Kiskeya palassaina*, new genus and species of Saicinae (Heteroptera: Reduviidae) from the Dominican Republic. Zootaxa 1468: 57–68. https://doi.org/10.11646/zootaxa.1468.1.2

Weirauch C, Forero D (2007b) *Kiskeyana* new replacement name for the assassin bug *Kiskeya* (Hemiptera: Heteroptera: Reduviidae) from the Dominican Republic. Zootaxa 1530: 68. https://doi.org/10.11646/zootaxa.1530.1.7

Williams KJ, Ford A, Rosauer DF, De Silva N, Mittermeier R, Bruce C, Larsen FW, Margules C (2011) Forests of east Australia: the 35th biodiversity hotspot. In: Zachos FE, Habel JC (Eds) Biodiversity Hotspots. Springer Publishers, London, 295–310. https://doi.org/10.1007/978-3-642-20992-5_16

Wygodzinsky P (1966) A monograph of the Emesinae (Reduviidae, Hemiptera). Bulletin of the American Museum of Natural History 133: 1–614.

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RESEARCH ARTICLE

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A new species of *Elephantomyia* crane fly (Diptera, Limoniidae) from Jeju Island, South Korea

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Abstract

A new species of crane fly (Diptera, Limoniidae), *Elephantomyia* (*Elephantomyia*) *hallasana* Podenas & Podeniene, **sp. nov.**, from Jeju Island, South Korea is described. Adult and larval characters are illustrated. *Elephantomyia* (*E.*) *hallasana* **sp. nov.** is the only species of the genus *Elephantomyia* Osten Sacken, 1860 recorded from Jeju Island, South Korea. Habitat, elevation range, and seasonality data are presented. Distributional notes on *E. subterminalis* Alexander, 1954 in the Far East of Russia (Khabarovskiy and Primorskiy regions) are discussed. An identification key for all Eastern Palaearctic species of subgenus *E.* (*Elephantomyia*) is presented.

Keywords

Eastern Palaearctic, habitat, key, larva, Limoniinae, taxonomy

Introduction

Crane flies belonging to the genus *Elephantomyia* Osten Sacken, 1860 are easily recognized by their long proboscis, which often exceeds body length (head + thorax + abdomen). The extended rostrum, with relatively small mouth parts and reduced palpi, is used for sucking nectar from tubular flowers (Savchenko 1986). Previously, only one

species of the genus *Elephantomyia* was recorded from the Korean peninsula (Podenas et al. 2015). Crane fly specimens collected during field trips to South Korea in 2017 and 2019 included one new species of *Elephantomyia*. It is the only species of the genus *Elephantomyia* recorded from Jeju Island.

Materials and methods

All specimens of Korean crane flies of the genus *Elephantomyia* presented in this study are preserved at the National Institute of Biological Resources (**NIBR**), Incheon, South Korea; all other specimens mentioned are preserved at the National Museum of Natural History, Smithsonian Institution, Washington, DC, USA (**USNM**). Adults were collected by insect net and with collecting lights. Collected specimens were dry mounted laterally on paper points. Wet specimens are preserved in 96% ethanol (EtOH). Male wings were slide mounted in Euparal. Dissected male genitalia were cleared in 10% KOH and preserved in microvials with glycerol beneath the pinned specimen. Larvae were collected by hand digging in dead wood and preserved in 70% ethanol. Larval head capsules and spiracular fields were slide mounted in glycerol.

Specimens were examined with an Olympus SZX10 dissecting microscope and Nikon Eclipse T*i* microscope. Photographs of adults and larvae of Korean crane flies were taken with a Canon EOS 80D digital camera through a Canon MP-E 65 mm macro lens at the Nature Research Centre, Vilnius, Lithuania. Photographs of larval head capsules were taken with a Nikon DS-Fi1 digital camera at Vilnius University, Lithuania. Photographs for Figures 21–26 were taken with a Canon EOS 6D digital camera through a Canon MP-E 65 mm macro lens at the Academy of Natural Sciences of Drexel University, Philadelphia, PA, USA.

Terminology for adult morphological features follows McAlpine (1981). Larva morphological features follows Oosterbroek and Theowald (1991) and Teskey (1981). Definitions of biogeographical units follows Oosterbroek (2020).

Taxonomy

Elephantomyia Osten Sacken, 1860

Elephantomyia Osten Sacken, 1860: 220; Alexander 1948: 522; Ito 1948: 89; Ishida 1959: 2; Savchenko and Krivolutskaya 1976: 74; Savchenko 1983: 62, 1986: 202, 1989: 49; Podenas et al. 2015: 70.

Type species. *Limnobiorhynchus canadensis* Westwood, 1836 (= *westwoodi* Osten Sacken, 1869).

A total of 16 species of *Elephantomyia* are known from the East Palaearctic (Oosterbroek 2020). They belong to two subgenera: *E.* (*Elephantomyia*) Osten Sacken, 1860

and *E.* (*Elephantomyodes*) Alexander, 1923. The nominate subgenus includes 14 species, and the subgenus *Elephantomyodes* includes two species (*E. sophiarum* Ito, 1948 from Honshu and Kyushu, Japan, and *E. tianmushana* Zhang et al., 2015 from Zhejiang, China). Eastern Palaearctic species of the subgenus *E.* (*Elephantomyodes*) can be easily distinguished from species belonging to the subgenus *E.* (*Elephantomyia*), as they have snowy white tarsal segments and a very narrow anal angle of the wing. Only one species of the genus *Elephantomyia*, *E. edwardsi* Lackschewitz, 1932 was previously recorded from the Korean Peninsula (Podenas et al. 2015).

Key to the Eastern Palaearctic species of the subgenus *Elephantomyia* (*Elephantomyia*)

1 General body color black **2**
– General body color yellow, brown (Fig. 1), or gray; but if thorax black, abdomen yellow **4**
2 Wing clear, except stigma **3**
– Wing with distinct darkening surrounding cross-veins, along frontal margin, and along vein *Cu* (Fig. 21) ..... ***Elephantomyia* (*Elephantomyia*) *carbo carbo* Alexander, 1938a (China: Sichuan)**
3 Abdomen black ..... ***Elephantomyia* (*Elephantomyia*) *insolita* Alexander, 1940 (China: Sichuan)**
– Abdomen bicolored: basal half of each segment yellow, distal dark brown ..... ***Elephantomyia* (*Elephantomyia*) *palmata* Alexander, 1947 (Japan: Honshu)**
4 Thorax dark (black, gray, or brown) (Fig. 1) **5**
– Thorax light (yellow or brownish yellow) **10**
5 Rostrum as long as the remainder (head + thorax + abdomen) of the body **6**
– Rostrum shorter, approximately as long as abdomen (Fig. 1) **8**
6 Antenna black ..... ***Elephantomyia* (*Elephantomyia*) *inulta* Alexander, 1938b (China: Xizang, Yunnan; India: Assam)**
– Antenna yellow to brownish yellow (Fig. 1) **7**
7 Tarsal segments yellow. Outer gonostylus of male terminalia with hooked apex, anterior apodeme of aedeagus large, fan-shaped ..... ***Elephantomyia (Elephantomyia) laohegouensis* Zhang, Li & Yang, 2015 (China: Sichuan)**
– Tarsal segments brown. Outer gonostylus of male terminalia with bifid apex, anterior apodeme of aedeagus very small, tripartite ..... ***Elephantomyia* (*Elephantomyia*) *zonata* Savchenko, 1976 (Russia: Sakhalin, Kuril Island)**
8 Thorax gray. Aedeagus of male terminalia shaped as a long, coiled tube, gonostyli terminal ..... ***Elephantomyia* (*Elephantomyia*) *plumbea* Alexander, 1954 (Japan: Shikoku)**
– Thorax brown (Fig. 1). Aedeagus of male terminalia short and nearly straight, if it is shaped as a long, coiled tube, then gonostyli situated medially on gonocoxite (Fig. 2) **9**

9 Male gonostyli at the apex of gonocoxite, aedeagus short, not coiled (Fig. 23)....***Elephantomyia* (*Elephantomyia*) *tetracantha* Alexander, 1954 (Russia: Primoskyi Kray; Japan: Shikoku)**

– Male gonostyli situated medially on gonocoxite (Fig. 2), aedeagus long, coiled ..... ***Elephantomyia* (*Elephantomyia*) *hallasana* Podenas & Podeniene, sp. nov. (Korea: Jeju Island)**

10 Wing with costal area distinctly darkened (Fig. 24).....***Elephantomyia* (*Elephantomyia*) *hokkaidensis* Alexander, 1924 (Russia: Amur Oblast, Primorskiy Kray, Sakhalin, Kuril Island; Japan: Hokkaido, Honshu, Shikoku)**

– Wing with costal area not darker than entire wing (Fig. 7).....**11**

11 Antennal flagellum brown (Japanese species only).....**12**

– Antennal flagellum yellow.....**13**

12 Mesonotal prescutum with median anterior darkening, rostrum as long as abdomen, knob of halter pale yellow, paramere of male terminalia with few spines, mesal surface of gonocoxite covered with long sparse setae (Fig. 26) ....***Elephantomyia* (*Elephantomyia*) *dietziana* Alexander, 1930 (Japan: Honshu, Shikoku, Kyushu)**

– Mesonotal prescutum without markings, rostrum as long as the remainder (head + thorax + abdomen) of the body, knob of halter darkened, paramere of male terminalia spineless, mesal surface of gonocoxite covered with short dense setae.....
...***Elephantomyia* (*Elephantomyia*) *takachihoi* Ito, 1948 (Japan: Kyushu)**

13 Apex of male gonocoxite with triangle shaped lobe beyond base of outer gonostylus, aedeagus long, coiled, paramere widened distally, distal part with straight spines (Figs 3, 4) **14**

– Apex of male gonocoxite widely rounded, not extended into lobe, aedeagus short and straight, not coiled, paramere long and narrow, without spines at apex .....***Elephantomyia* (*Elephantomyia*) *krivosheinae* Savchenko, 1976 (Russia: Altay, Tuva, Khabarovskiy kray, Primorskiy kray, European part; Europe)**

14 Paramere of male terminalia with 4 or 5 spines distally (Fig. 4) .....
.....***Elephantomyia* (*Elephantomyia*) *subterminalis* Alexander, 1954 (Russia: Khabarovskiy kray, Primorskiy kray; Japan: Shikoku)**

– Paramere of male terminalia with 12–16 spines distally (Fig. 3).....
.....***Elephantomyia* (*Elephantomyia*) *edwardsi* Lackschewitz, 1932 (Korea; Russia: Altay, European part; Europe)**

***Elephantomyia* (*Elephantomyia*) *hallasana* Podenas & Podeniene, sp. nov.**
http://zoobank.org/F9D288A8-FFD6-4504-AC1C-8A7A37A47C3A
Figs 1, 2, 6, 8–19

Type species. *Holotype*: Male (pinned), South Korea, Jeju-do, Seogwipo-si, Saekdal-dong, 33°21.46'N, 126°27.85'E, alt. 1100 m, 2019.06.17, S. Podenas leg., (NIBR).

Paratypes: 1 male (in EtOH), 1 female (pinned), 2 larvae (one dissected and slide-mounted), South Korea, Jeju Island, Hallasan National Forest, 33°25.93'N, 126°35.87'E, alt. 580 m, 2017.05.24, S. Podenas, V. Podeniene leg. (NIBR); 1 female (pinned), South Korea, Jeju-do (do = Island), Jeju-si, Yonggang-dong, 33°25.83'N, 126°35.84'E, alt. 590 m, [at margin of Hallasan National Forest], 2017.05.24, S. Podenas, V. Podeniene leg., at light (NIBR); 3 females (pinned), 2 females (in EtOH), topotypic (NIBR).

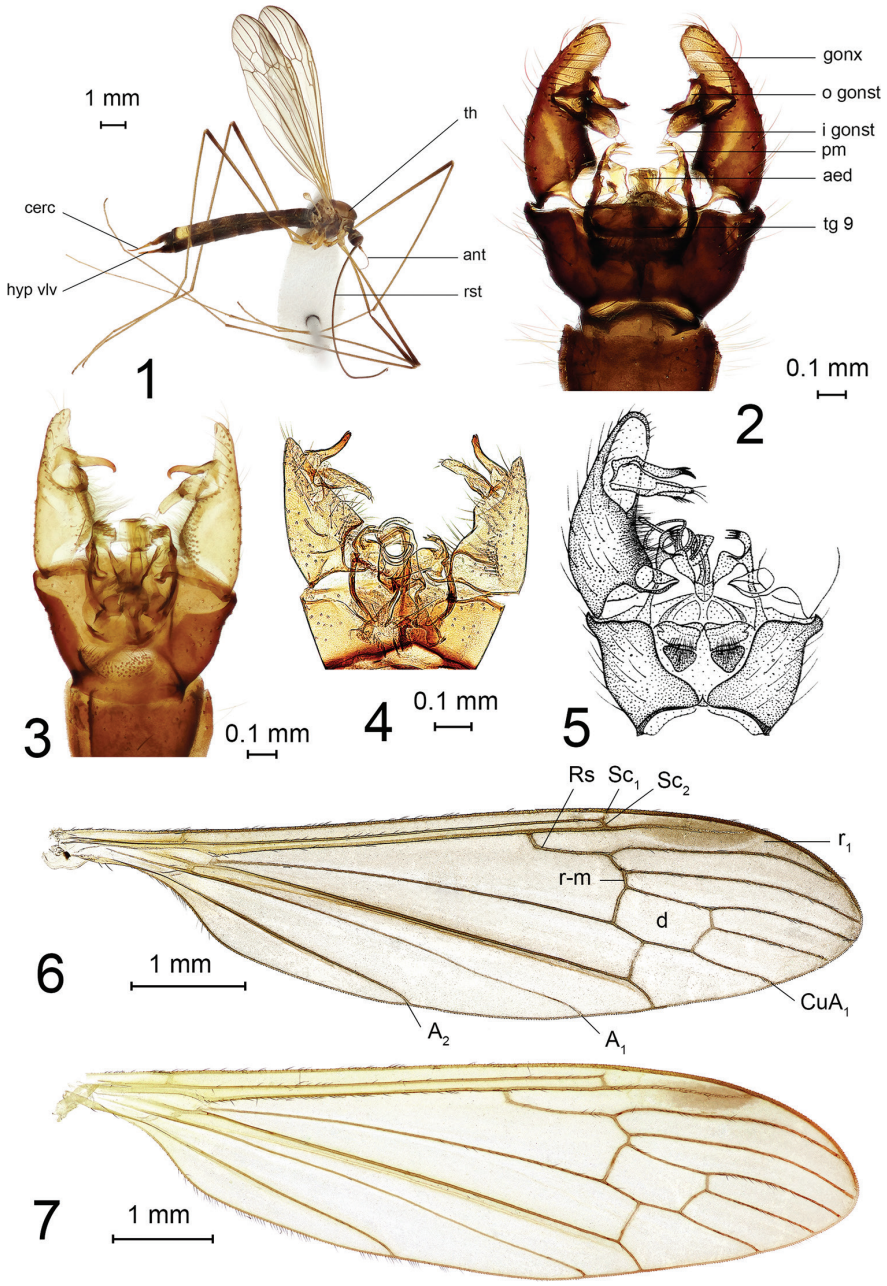
Comparative material examined. *E. carbo carbo*: holotype, male (slide-mounted) (Fig. 21), China, Czechwan, Mount Omei, White Cloud Temple, alt. 2743 m, 1937.06.12, Tsen leg. (USNM); *E. dietziana*: paratype, male (slide-mounted) (Fig. 26), Japan, Kiushiu, Kirishima, alt. 762 m, 3 May 1929, S. Issiki leg. (USNM); *E. hokkaidensis*: metatype, male (slide-mounted) (Figs 24, 25), Japan, Kiushiu, Iwate, Funakosi, 20 September 1947, H. Yamamoto leg. (USNM); *E. insolita*: holotype, female (slide-mounted), China, Czechwan, Mount Omei, Chu Lao Tong Temple, alt. 1981 m, 6 June 1938, Tsen leg. (USNM); *E. palmata*: holotype, male (slide-mounted) (Fig. 22), Japan, Honshiu, Ontake, Hida, 6–10 July 1934, H. Ise leg. (USNM), paratypes: male (pinned, parts slide-mounted), Japan, Honshiu, Ontake, Hida, Southern Alps, alt. 1800 m, 10 July 1934, H. Ise leg. (USNM), male (pinned), Ontake, Hida, 6–10 July 1934, H. Ise leg. (USNM); *E. plumbea* (as *E. dietziana plumbea*): allotype, male (slide-mounted), Japan, Shikoku, Imanoyama, alt. 865 m, 12 May 1951, Issiki-Ito leg. (USNM); *E. tetracantha*: holotype, male (slide-mounted) (Fig. 23), Japan, Shikoku, Mt. Tsurugi, 31 May 1950, Issiki-Ito leg. (USNM); *E. edwardsi* (Figs 3, 7) and *E. subterminalis* (Fig. 4) listed in Podenas et al. (2015).

Diagnosis. ***Adult.*** It is a brown to light-brown species with banded abdomen. Body length 6.7–10.5 mm. Head gray and bearing rostrum that is approximately as long as abdomen. Mesonotal prescutum has distinct median and indistinct lateral stripes. Pleuron dark brown. Wing unpatterned except elongate light brown stigma. Abdominal tergites yellow to yellowish brown frontally, dark brown posteriorly, pattern more distinct in male. Abdomen of female darker than that of male with a very distinct light-yellow spot on the seventh tergite. Male genitalia with elongate gonocoxite, distal portion of which extends distinctly beyond bases of gonostyli. Outer gonostylus slightly angulate medially, with apex turned outwards and bearing small subapical tooth, inner gonostylus wide and non-sclerotized. The paramere armed with 4 or 5 teeth.

Larva. Medium-sized, 9–17 mm long. Body covered with long, golden hairs. Head capsule reduced, weakly sclerotized, elongated, posterior part consists of two pairs of rods. Mandible small, with two prominent apical teeth; antenna long, apical segment much longer than basal. Esophageal region strengthened with oblique parallel ctenoid sclerotized structures. Spiracular disc with lateral and ventral lobes, entirely covered with pale sclerites. Ventral lobe bears long apical seta.

Description. ***Adult*** (Fig. 1). General body color brown to light brown. Body length of male 6.7–8.8 mm, female 7.0–10.5 mm. Male wing: 6.5–7.4 mm, female wing: 6.7–9.2 mm.

Head. Gray, posterior yellowish. Vertex narrow, covered with sparse golden setae. Length of male antenna 1.2–1.3 mm, female 1.1–1.5 mm. Scape dark brown dusted



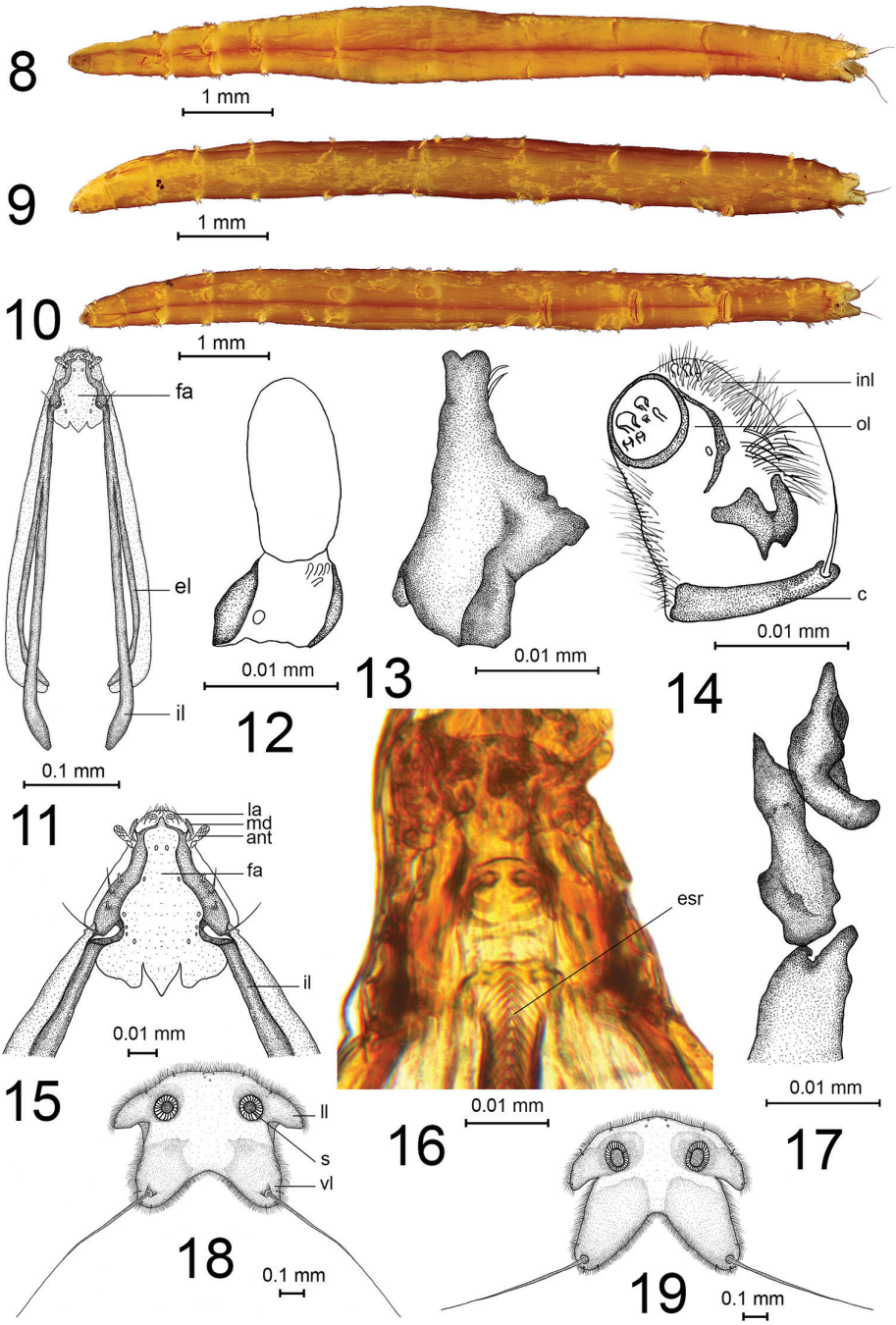
Figures 1–7. *Elephantomyia* (*Elephantomyia*). **1** *E.* (*E.*) *hallasana* Podenas, Podeniene, sp. nov., paratype, female, habitus view **2** *E.* (*E.*) *hallasana* sp. nov., paratype, male genitalia, dorsal view **3** *E.* (*E.*) *edwardsi*, male genitalia, dorsal view **4** *E.* (*E.*) *subterminalis*, holotype, male genitalia, dorsal view **5** *E.* (*E.*) sp., male genitalia, dorsal view (identified as *E. subterminalis* in Savchenko, 1986: fig. 101) **6** *E.* (*E.*) *hallasana* sp. nov., paratype, wing **7** *E.* (*E.*) *edwardsi*, wing. Abbreviations: A_1 – first anal vein, A_2 – second anal vein, aed – aedeagus, ant – antenna, cerc – cercus, CuA_1 – branch of cubital anal vein, d – discal cell, gonx – gonocoxite, hyp vlv – hypogynial valva, i gonst – inner gonostylus, o gonst – outer gonostylus, pm – paramere, r_1 – first radial cell, r-m – radio-medial cross vein, rst – rostrum, tg 9 – ninth tergite, th – thorax.

with gray, approximately as long as wide. Pedicel nearly rounded, light brown. Flagellum with two basal segments brownish, remainder pale yellow. Flagellum 14-segmented. Basal flagellomere large, rounded. Segments decreasing in width towards apex, apical flagellomere very small. Longest flagellomeres at the middle of antennae. Verticils up to three times as long as respective segments. Short erect pubescence, covering segments, pale. Rostrum brown, as long as abdomen, covered with short brown pubescence. Male rostrum approximately 5.0 mm, female 6.1–8.6 mm long. Palpus very short, three-segmented, basal segment longer than two succeeding segments combined. Labella pale yellow.

Thorax. Brown to light brown, covered with sparse brownish gray-pruinosity. Cervical sclerites dark brown. Pronotum dark brown dorsally, yellow laterally, dusted with brownish pruinosity. Mesonotal prescutum with wide brown median line, darker anteriorly and less distinct posteriorly. Lateral stripe short, indistinct. Wing (Fig. 6) translucent, with weak brownish tint, slightly yellowish at base and along entire costal field. Stigma light brown, elongate. Veins brown. Wing venation: vein Sc long, tip of Sc_1 at branching point of radial sector, Sc_2 close to Sc_1 tip, Rs comparatively short, angulate and short spurred at base, R_2 (r-r) missing, cell r_1 widened distally; both branches of Rs slightly arched, tips bent posteriorly; cross-vein r-m short; discal cell large, nearly rectangular, twice as long as wide, basal deflection of CuA_1 at the middle of discal cell, both anal veins nearly straight, diverging, anal lobe long, slightly widened at middle. Halter brownish yellow, pale at base. Male halter 0.9–1.1 mm long; female 1.0–1.4 mm. Femur brown with yellow base, dark brown distally, tibiae brown, indistinctly darkened at apex, tarsomeres light brown, distal segment darker. Legs covered with short, semi-adherent, brownish setae. Male femur II: 4.9 mm, tibia II: 4.2 mm, tarsus II: 3.6 mm, female femur I: 4.2–5.6 mm long, II: 5.9 mm, III: 4.4–5.8 mm, tibia I: 6.0–7.3 mm, II: 6.6 mm, III: 5.3–6.8 mm, tarsus I: 6.2–7.3 mm, II: 5.2 mm, III: 4.6–5.0 mm long. Claw simple without subbasal spines or teeth in both sexes.

Male abdomen. Distinctly bicolored, tergites and sternites yellow at base and distinctly dark brown along posterior margin. First tergite darkened at base and along distal margin, with yellow spot medially. Male terminalia (Fig. 2) dark brown. Sclerites of ninth segment fused and forming complete ring, posterior margin dorsally with wide and deep invagination. Dorsal surface of ninth tergite with two densely setose emarginations. Gonocoxite long and slightly arched with two pairs of gonostyli attached slightly beyond midpoint of gonocoxite. Distal part of gonocoxite, beyond bases of gonostyli, large, with rounded apex. Outer gonostylus slightly angulate medially with apex turned outwards, distal apex darkened and distinctly bidentate. Inner gonostylus longer than outer gonostylus, wide, fleshy, and setose. Paramere with four or five long spines distally forming a comb-like structure. Aedeagus shaped as a long, coiled tube.

Female abdomen. Generally darker than in male, somewhat glossy. Transverse yellow sutures on tergites vary depending on specimen, but narrower than in male, less distinct on basal segments and well developed on posterior segments. Sutures on tergites more distinct laterally, but narrower and less distinct along middle of sclerite.



Figures 8–19. Larva of *Elephantomyia* (*Elephantomyia*). **8–18** *E.* (*E.*) *hallasana* Podenas, Podeniene, sp. nov., paratype **8** general view, dorsal aspect **9** general view, lateral aspect **10** general view, ventral aspect **11** head, dorsal view **12** antenna **13** mandible **14** maxilla **15** frontoclypeus **16** esophageal region **17** hypopharynx **18** spiracular field **19** spiracular field of *E.* (*E.*) *edwardsi*. Abbreviations: ant – antenna, c – cardo, el – externolateralia, esr – esophageal region, fa – frontoclypeal apotome, il – internolateralia, inl – inner lobe, la – labrum, ll – lateral lobe, ol – outer lobe, s – spiracle, vl – ventral lobe.

Distinct yellow lateral spots present on 3–7, 5–7, or only on seventh tergite (Fig. 1). Tergites and sternites brown basally, dark brown distally. Seventh tergite distinctly yellow with narrowly darkened posterior margin, covered with sparse, dark brown, erect setae. Seventh sternite dark brown with narrow yellow transverse suture at base. Tenth tergite dark brown basally, rusty brown distally, covered with sparse brownish pruinosity. Cercus brown, paler at base, long and narrow, distal part raised. Eighth sternite glossy dark brown, hypovalva brown, pale apex, long and narrow, reaching to about two-thirds of cercus.

Larva. Body brownish yellow (Figs 8–10). Length 7.8–8.6 mm, width 0.9 mm.

Head. Head capsule 0.6 mm long, 0.15 mm wide, hemicephalic, elongated, weakly sclerotized and depressed dorsoventrally (Fig. 11). Genae reduced, posterior part of head capsule consists of one pair of rod-shaped internolateralia and one pair of rod-shaped externolateralia, all bent medially, internolateralia and externolateralia joined by membrane. Labrum narrow, transversal, with numerous long hairs on epipharynx and a pair of sclerotized, comb-shaped premandibles, pair of sensory rings with two sensory papillae situated on anterior part of labrum (Fig. 15). Frontoclypeal apotome membranous with a pair of sensory pits on anterior portion, a pair of similar structures anterolaterally and four pairs of pits on lateral part. Mandible slender (Fig. 13), ventral and dorsal edges without prominent teeth, two prominent apical teeth, medially with two long acute spines. Maxilla (Fig. 14) short and weakly sclerotized bearing inner (fused galea and lacinia) and outer lobes, cardo long and narrow, with a single long apical seta. Inner lobe elongate-oval, with numerous apical hairs, with large area bearing small sensory structures distally, and with elongated narrow sclerite on inner margin. Outer lobe cylindrical with apical sensory structures, with numerous hairs on apical and lateral parts and with large irregularly shaped sclerite at the base. Antenna long, reaching apex of mandible, one-segmented with four short sensory papillae and one large apical papilla. Basal segment subcylindrical, short and sclerotized, apical papilla sculptured, elongate-oval and nearly twice as long as basal segment (Fig. 12). Both antennae close to each other. Ventral side of head with numerous long hairs in the maxillary area. Hypopharynx consists of two pairs of rods (Fig. 17). Labium membranous with three pairs of sensory papillae apically. Esophageal region strengthened with oblique parallel ctenoid sclerotized structures (Fig. 16).

Thorax. All thoracic segments wider than long, covered with long, golden, silky hairs.

Abdomen. First abdominal segment wider than long. Second abdominal segment 1.5 times as long as wide. Abdominal segments II–VII almost twice as long as wide. Abdominal segments V–VII with ventral creeping welt each (Figs 9, 10). Creeping welt with brown spines, arranged into longitudinal rows. All abdominal segments covered with long, golden, silky hairs.

Anal division. Spiracular field surrounded by four (two lateral and two ventral) lobes (Fig. 18). Lateral lobe 1.5 times as wide as long, covered with pale sclerite surrounding spiracle, three short setae located at the outer margin of lobe. Ventral lobe as long as width at the base and entirely covered by pale sclerite. Very long seta, 2.5 times as long as lobe itself, located close to apex of lobe. One short bifurcated and two short single setae located at the apical part of each lobe. Two pairs of short setae located on

the dorsal margin of spiracular field. Spiracular field fringed with short tiny setae except inner margin of lateral lobes (Fig. 18). Spiracle small, rounded, distance between spiracles more than two diameters of spiracle itself. Anal field consists of two pairs of blunt, white, fleshy anal papillae, which are retracted and hardly visible in studied specimens. Tuft of very long dense hairs located in front of anal field.

Etymology. The new species is named after the locality where it was collected, Hallasan National Park, which surrounds the highest mountain in South Korea, the shield volcano Hallasan.

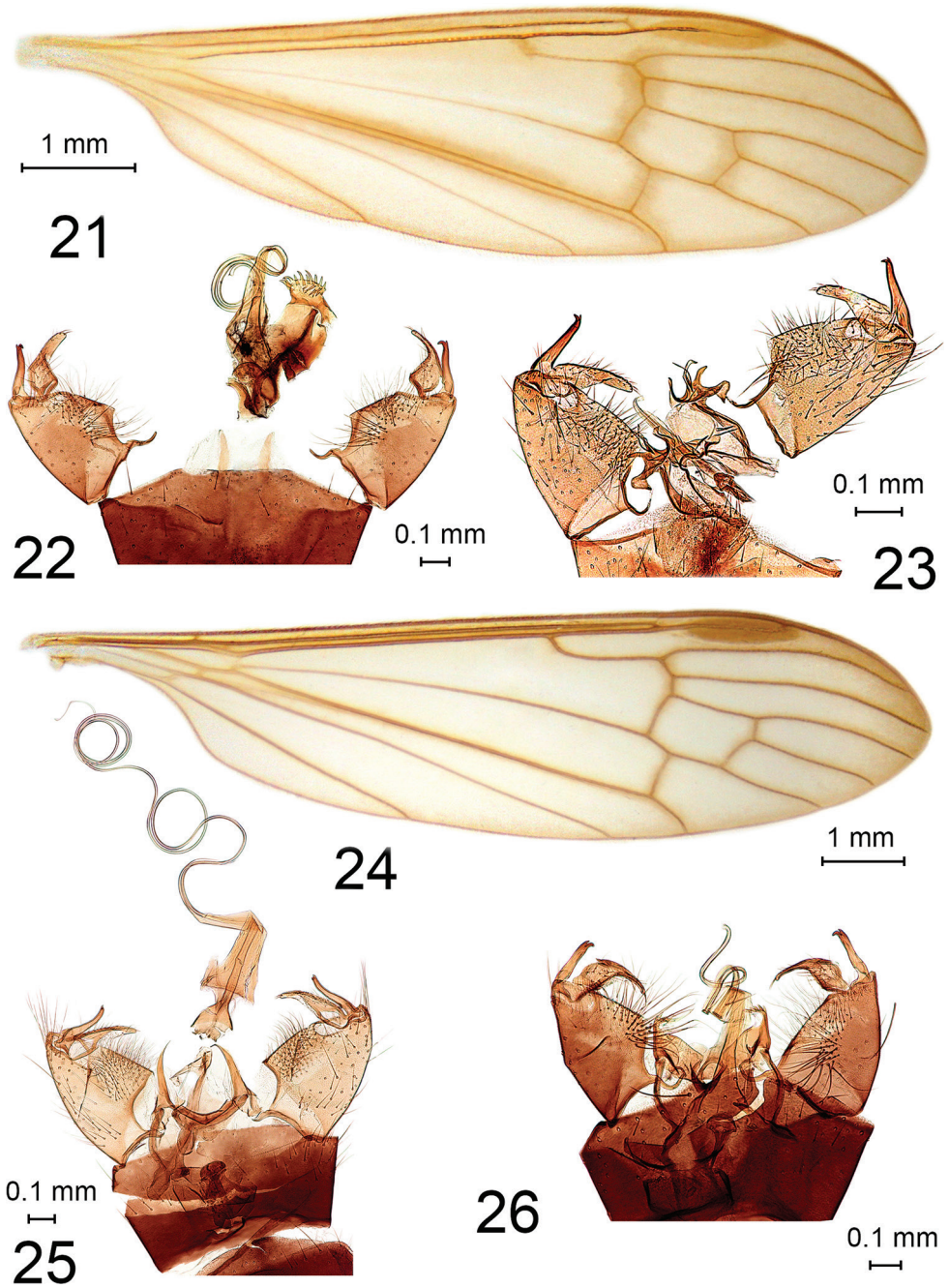
Distribution. Currently known only from Hallasan National Park, Jeju Island, South Korea.

Habitats. Valley floor covered with deciduous trees and shrubs, and moss covered rocks (Fig. 20); deciduous forest with dense cover of bamboo-grass (*Sasa quelpaertensis*); park meadow with sparsely planted deciduous trees mixed with pines. Adults are attracted to light. Larvae were found under the bark of truncated deciduous tree trunks, in sap, with fungi together with *Atypophtalmus* (*Microlimonia*) sp. and *Libnotes* sp.

Elevation. Less than 600 m to 1100 m.

Period of activity. Adults on wing from late May through middle of June.

Figure 20. Habitat (type locality) of *Elephantomyia* (*Elephantomyia*) *hallasana* Podenas, Podeniene, sp. nov.



Figures 21–26. *Elephantomyia* (*Elephantomyia*). **21** *E.* (*E.*) *carbo*, holotype, wing **22** *E.* (*E.*) *palmata*, holotype, male genitalia, dorsal view **23** *E.* (*E.*) *tetracantha*, holotype, male genitalia, dorsal view **24** *E.* (*E.*) *hokkaidensis*, wing **25** *E.* (*E.*) *hokkaidensis*, male genitalia, dorsal view **26** *E.* (*E.*) *dietziana*, paratype, male genitalia, dorsal view.

Discussion

Elephantomyia hallasana sp. nov. is the only *Elephantomyia* species recorded from the Jeju Island. It is closely related to *E. edwardsi* (Figs 3, 7), which is recorded from the Korean Peninsula, and *E. subterminalis* (Fig. 4), which was described from Shikoku Island, Japan. The most striking difference of *E. hallasana* sp. nov. is the huge distal portion of the gonocoxite extending beyond the base of the gonostyli (Fig. 2) and the comparatively stout gonostyli. The outer gonostylus is slightly angulate medially with its apex turned outwards, not inwards as in most other species of the genus *Elephantomyia*. The distal portion of the gonocoxite is small in *E. subterminalis*, comparatively big in *E. edwardsi*, but much larger in *E. hallasana* sp. nov. The outer gonostylus bears a small subapical tooth, which usually is hidden in dorsal view in *E. edwardsi* but distinctly visible in *E. hallasana* sp. nov. The inner gonostylus in *E. edwardsi* and *E. subterminalis* has a narrow apex but fleshy and broad in *E. hallasana* sp. nov. The paramere of *E. hallasana* sp. nov. has 4 or 5 teeth, like that in *E. subterminalis*, but bears many spines, as in *E. edwardsi*. The wing venation is similar in all three species, and only the radial sector is somewhat longer in *E. edwardsi*. The female of *E. edwardsi* has a banded pattern on the abdomen, similar to that of the male; the female of *E. subterminalis* is still undescribed. The female of *E. hallasana* sp. nov. has darker abdomen than that of male and that of both sexes of *E. edwardsi*, with a very distinct, light-yellow spot on the seventh tergite. Despite *E. hallasana* sp. nov. being currently known only from Jeju Island, we expect that related species occur in the Far East of Russia. It is likely that species identified by E. N. Savchenko as *E. subterminalis* (Savchenko 1976, 1983) from the Russian Far East (Fig. 5) represents a new species, related to *E. hallasana* sp. nov. E. N. Savchenko's illustration of male terminalia shows structures more similar to *E. hallasana* sp. nov. than to *E. subterminalis*.

Larvae of seven species of subgenus *E.* (*Elephantomyia*) are known: *E.* (*E.*) *aurantiaca* Alexander, 1917, *E.* (*E.*) *edwardsi*, *E.* (*E.*) *hokkaidensis*, *E.* (*E.*) *krivosheinae*, *E.* (*E.*) *montana* Alexander, 1934, *E.* (*E.*) *subterminalis*, and *E.* (*E.*) *westwoodi westwoodi* Osten Sacken, 1869, were described to date (Alexander 1920; Bangerter 1934; Wood 1952; Krivosheina 2010; Krivosheina and Krivosheina 2011). Immature stages of other three subgenera are still unknown. Based on this material, two different larval types could be distinguished: a moss-dwelling group with a massive, almost complete head capsule and reduced spiracular lobes (Afrotropical species: *E.* (*E.*) *aurantiaca*), and a dead-wood-inhabiting type with a strongly reduced head capsule and four-lobed spiracular field (Afrotropical, Palaearctic, and Nearctic species: *E.* (*E.*) *krivosheinae*, *E.* (*E.*) *edwardsi*, *E.* (*E.*) *subterminalis*, *E.* (*E.*) *hokkaidensis*, *E.* (*E.*) *westwoodi*, *E.* (*E.*) *montana*). These two similar morphological groups have only the ventral creeping welts on abdominal segments V–VII and the golden yellow body coloration in common; other characters are different. *Elephantomyia* (*E.*) *hallasana* sp. nov. shares the characters of the second, dead-wood inhabiting type.

According to Krivosheina (2010), species-specific differences of *Elephantomyia* larvae were noticed in the sclerotization pattern of spiracular fields and in spines of creeping welts. We found that species differ also in the ratio between the length of the ventral apical hair and the base width of the ventral spiracular lobe. Head capsules of different species are similar.

The larva of *E.* (*E.*) *subterminalis* from the Far East of Russia, Kedrovaya Pad and Ussuri Nature Reserves was described by Krivosheina (2010), but we have doubts about the determination of that species. The larva of *E.* (*E.*) *hallasana* sp. nov. is similar to the larva described by Krivosheina; the only difference is the length of the ventral apical seta, which is more than 2.5 times as long as the ventral spiracular lobe in *E.* (*E.*) *hallasana* sp. nov. and less than twice as long as lobe in the species from the Kedrovaya Pad and Ussuri Nature Reserves.

Two species of *Elephantomyia*, *E.* (*E.*) *edwardsi* and *E.* (*E.*) *hallasana* sp. nov., occur on the Korean Peninsula. Larvae of these two species differ in characters of spiracular field, such as the sclerotization of ventral lobes, ratio of length and width of the ventral lobe, and length of ventral setae. Ventral sclerites of *E.* (*E.*) *edwardsi* (Fig. 19) cover a larger part of the ventral lobe than in *E.* (*E.*) *hallasana* sp. nov. (Fig. 18), the ventral lobe in *E.* (*E.*) *hallasana* sp. nov. is just slightly longer than wider at base, whereas in *E.* (*E.*) *edwardsi* the ventral lobe is more than 1.5 times longer than wider at base, the length of ventral apical seta is more than 2.5 times as long as the ventral spiracular lobe in *E.* (*E.*) *hallasana* sp. nov. and less than twice as long as the lobe itself in *E.* (*E.*) *edwardsi*.

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References

Alexander CP (1917) The crane-flies of South Africa in the South African museum (Diptera, Tipulidae). Part I. Annals of the South African Museum 17: 139–184. https://doi.org/10.5962/bhl.part.22314

Alexander CP (1920) The crane-flies of New York. Part II. Biology and phylogeny. Memoirs, Cornell University Agricultural Experiment Station 38: 691–1133. https://doi.org/10.5962/bhl.title.33641

Alexander CP (1923) Undescribed species of Japanese crane-flies (Tipulidae, Diptera). Part III. Annals of the Entomological Society of America 16: 57–76. https://doi.org/10.1093/aesa/16.1.57

Alexander CP (1924) New or little-known crane flies from northern Japan (Tipulidae, Diptera). Philippine Journal of Science 24: 531–611.

Alexander CP (1930) New or little-known Tipulidae from eastern Asia (Diptera). VII. Philippine Journal of Science 42: 507–535.

Alexander CP (1934) Undescribed Tipulidae from the Ethiopian region. Encyclopedie Entomologique, (B II), Diptera 7: 49–62.

Alexander CP (1938a) New or little-known Tipulidae from eastern Asia (Diptera). XXXVIII. Philippine Journal of Science 66: 309–342.

Alexander CP (1938b) New or little-known Tipulidae from eastern Asia (Diptera). XXXVII. Philippine Journal of Science 66: 221–259.

Alexander CP (1940) New or little-known Tipulidae from eastern Asia (Diptera). XLII. Philippine Journal of Science 71: 169–204.

Alexander CP (1947) Undescribed species of Japanese crane-flies (Diptera: Tipulidae). Part VI. Annals of the Entomological Society of America 40: 350–371. https://doi.org/10.1093/aesa/40.2.350

Alexander CP (1948) Notes on the tropical American species of Tipulidae (Diptera). V. The specialized Hexatomini: *Limnophila*, *Shannonomyia*, *Gynoplistia*, *Hexatoma*, *Atarba*, *Elephantomyia*, and allies. Revista de Entomologia 19: 509–556.

Alexander CP (1954) Records and descriptions of Japanese Tipulidae (Diptera). Part III. The crane-flies of Shikoku. III. Philippine Journal of Science 82: 263–308.

Bangerter H (1934) Mücken-Metamorphosen VI. Konowia 13: 264–272.

Ishida H (1959) The catalogue of the Japanese Tipulidae, with the keys to the genera and subgenera (Diptera). V. Limoniinae, tribe Hexatomini. Science Report of the Hyogo University of Agriculture, Serie Natural Sciences 4(1): 3–11.

Ito S (1948) Two undescribed species of the tipulid genus *Elephantomyia* from Japan. Mushi 18: 89–92.

Krivosheina NP (2010) New data on the ecology and morphology of xylobiont larvae of the genus *Elephantomyia* Ost.-Sack. (Diptera, Limoniidae). Entomological Review 90: 603–614. https://doi.org/10.1134/S0013873810050076

Krivosheina NP, Krivosheina MG (2011) Key to Terrestrial Crane-fly Larvae (Diptera, Limoniidae, Pediciidae) of Russia. KMK Scientific Press, Moscow, 294 pp.

Lackschewitz P (1932) Eine neue *Elephantomyia* O. S. (Dipt., Nematoc. polyn.) aus dem Ostbaltikum. Konowia 11: 218–222.

McAlpine JF (1981) Morphology and terminology – adults. In: McAlpine JF, Peterson BV, Shewell GE, Teskey HI, Vockeroth IR, Wood DM (Eds) Manual of Nearctic Diptera. Monograph 27(1). Research Branch, Agriculture Canada, Ottawa, 9–63.

Oosterbroek P (2020) Catalogue of the Craneflies of the World (CCW). https://ccw.naturalis.nl/index.php [Accessed on: 2020-6-16]

Oosterbroek P, Theowald Br (1991) Phylogeny of the Tipuloidea based on characters of larvae and pupae (Diptera, Nematocera) with an index to the literature except Tipulidae. Tijdschrift voor Entomologie 134: 211–267.

Osten Sacken CR (1860) New genera and species of North American Tipulidae with short palpi, with an attempt at a new classification of the tribe. Proceedings of the Academy of Natural Sciences of Philadelphia 1859: 197–254.

Osten Sacken CR (1869) Monographs of the Diptera of North America. Part IV. Smithsonian Miscellaneous Collections 8(219): [i–xii] 1–345.

Podenas S, Byun HW, Kim SK (2015) Limoniinae crane flies (Diptera: Limoniidae) new to Korea. Journal of Species Research 4: 61–96. https://doi.org/10.12651/JSR.2015.4.2.061

Savchenko EN (1976) On the fauna of limoniid-flies (Diptera, Limoniidae) of the USSR, 1. Genus *Elephantomyia* O.-S. Dopovidi Akademii Nauk Ukrayinskoyi RSR (B)5: 466–470 [in Ukrainian], 470–472. [in Russian]

Savchenko EN, Krivolutskaya GO (1976) Limoniidae of the South Kuril Islands and South Sakhalin. Akademiya Nauk Ukrainskoy SSR, Kiev, 160 pp. [in Russian]

Savchenko EN (1983) Limoniidae of South Primorye. Akademiy Nauk Ukrainskoy SSR, I.I. Schmalhausen Institute of Zoology of Academy of Sciences of Ukraine, Naukova Dumka, Kiev, 156 pp. [in Russian]

Savchenko EN (1986) Komary-limoniidy [limoniid-flies]. (General description, subfamilies Pediciinae and Hexatominae). Fauna Ukrainy 14(2): 1–380. [in Russian]

Savchenko EN (1989) Komary-limoniidy fauny SSSR [Limoniidae fauna of the USSR]. Determination tables of superspecies taxa with catalogue survey of species. Akadimiya Nauk Ukrainian SSR, I.I. Schmalhausen Institute of Zoology of Academy of Sciences of Ukraine, Naukova Dumka, Kiev, 377 pp. [in Russian]

Teskey HI (1981) Morphology and terminology – larvae. In: McAlpine JF, Peterson BV, Shewell GE, Teskey HI, Vockeroth IR, Wood DM (Eds) Manual of Nearctic Diptera. Monograph 27(1). Research Branch, Agriculture Canada, Ottawa, 65–68.

Westwood JO (1836) Insectorum nonnullorum novorum (ex ordine Dipterorum) descriptiones. Annales de la Société Entomologique de France (1)4: 681–685.

Wood HG (1952) The crane-flies of the South-West Cape (Diptera, Tipuloidea). Annals of the South African Museum 39: 1–327.

Zhang X, Li Y, Yang D (2015) A review of the genus *Elephantomyia* Osten Sacken from China, with descriptions of two new species (Diptera, Limoniidae). Zootaxa 3919: 553–572. https://doi.org/10.11646/zootaxa.3919.3.6

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RESEARCH ARTICLE

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The Dolichopodidae (Diptera) of Montserrat, West Indies

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Abstract

The long-legged flies (Dolichopodidae) of the island of Montserrat in the Lesser Antilles have been surveyed and include 63 species in 27 genera. The following eleven new species are described and illustrated: *Amblypsilopus marskeae* **sp. nov.**, *Medetera iviei* **sp. nov.**, *Medetera montserratensis* **sp. nov.**, *Systenus ladonnae* **sp. nov.**, *Thrypticus mediofuscus* **sp. nov.**, *Chrysotus antillensis* **sp. nov.**, *Chrysotus callichromoides* **sp. nov.**, *Chrysotus interfrons* **sp. nov.**, *Chrysotus montserratensis* **sp. nov.**, *Diaphorus robinsoni* **sp. nov.**, and *Sympycnus montserratensis* **sp. nov.** Six species have only been found on Montserrat (ca. 10% endemicity). Keys are provided to the genera and species on Montserrat, their known distribution summarized, and additional new island records provided for many species. *Asyndetus wirthi* Robinson is synonymized with *A. interruptus* (Loew) and *Achradocera apicalis* (Aldrich) is removed from synonymy with *A. barbata* (Loew). *Diaphorus flavipes* Aldrich is transferred to *Chrysotus* as a new combination. A new replacement name, *Chrysotus milvadu* **nom. nov.**, is provided for the Nearctic *Chrysotus parvulus* Van Duzee. Lectotypes are designated for *Achradocera apicalis* (Aldrich) and *Asyndetus fratellus* Aldrich. The fauna of Montserrat is summarized and compared with that of Dominica. Collecting methods are compared and threats to the dolichopodid fauna of Montserrat discussed.

Keywords

Biodiversity, Caribbean, checklist, inventory, Lesser Antilles, new species, West Indies

Table of contents

Introduction

Dolichopodidae, or long-legged flies, are one of the largest dipteran families with more than 7,500 described species worldwide (Bickel 2009). Adults are usually less than 6 mm in size and metallic green-blue to bronze in color, but fewer species are nonmetallic yellow to brown or black. Most dolichopodids can be easily recognized by their general habitus, slender build, long legs, metallic coloration, reduced wing venation, and hair-like arista. Long-legged flies can be found in all terrestrial habitats, but adults are most abundant in moist habitats and can be commonly found on coastal rocks, sand, moist ground, foliage, tree trunks, and rocks in or near running water. Larvae occur in mud, moist soil, leaf litter, moss, algal mats, decaying seaweed, under bark (usually associated with bark beetle galleries), in tree holes, and within plant tissues (Dyte 1959; Bickel 2009). Adults and larvae of most dolichopodid species are predators that feed on other small invertebrates (Ulrich 2004) and may play important roles controlling mosquitoes, bark beetles, and agricultural pests (e.g., Laing and Welch 1963; Nicolai 1995; Kautz and Gardiner 2019). An exception to this predatory lifestyle is *Thrypticus*, whose larvae are phytophagous and feed within stems of plants (Bickel and Hernandez 2004). Because of species' high habitat specificity and putative sensitivity to disturbance (e.g., pesticides; Regan et al. 2017; Kautz and Gardiner 2019), Dolichopodidae show promise in serving as bioindicators of habitat quality and environmental change (Pollet 2009).

Like many fly families, the number of species of Dolichopodidae reaches its maximum in the New World tropics (Brown 2009; Borkent et al. 2018; Brown et al. 2018). However, dolichopodids in the New World tropics remain undersampled and understudied, with described faunas available for just a few areas (e.g., Robinson 1975; Pollet et al. 2018) and many regions having few or no recorded species at all. One region in which dolichopodids have received limited attention is the Lesser Antilles, part of the Caribbean Island Hotspot for biodiversity due to the high numbers of species and level of endemism for the available land area (Smith et al. 2005). The first report of Dolichopodidae in the Lesser Antilles came near the turn of the twentieth century, when J.M. Aldrich reported 46 species from St. Vincent (Aldrich 1896) and 55 species from Grenada (Aldrich 1902) based on material collected by H. H. Smith from 1889–1895 as part of a Royal Society project coordinated by the West India Exploration Committee. The dolichopodid fauna of Dominica is the most completely known in the Lesser Antilles due to the Bredin-Archbold-Smithsonian Biological Survey of Dominica (1960–1966). Several dipterists participated in this survey (e.g., R.J. Gagné, H. Robinson, G.C. Steyskal W.W. Wirth) and the Dolichopodidae were treated by Robinson (1975) and included 113 species in 30 genera. Since Robinson (1975), two genera and two species of Dolichopodidae have been added to the fauna of Dominica (Runyon 2015; Brooks and Cumming 2018), combined with the one genus and four species added herein brings Dominica's count to 119 species in 33 genera. Aside from Grenada, St. Vincent, and Dominica, very few published records exist of dolichopodids on other Lesser Antillean islands (Van Duzee 1933a; Robinson 1975; Capellari

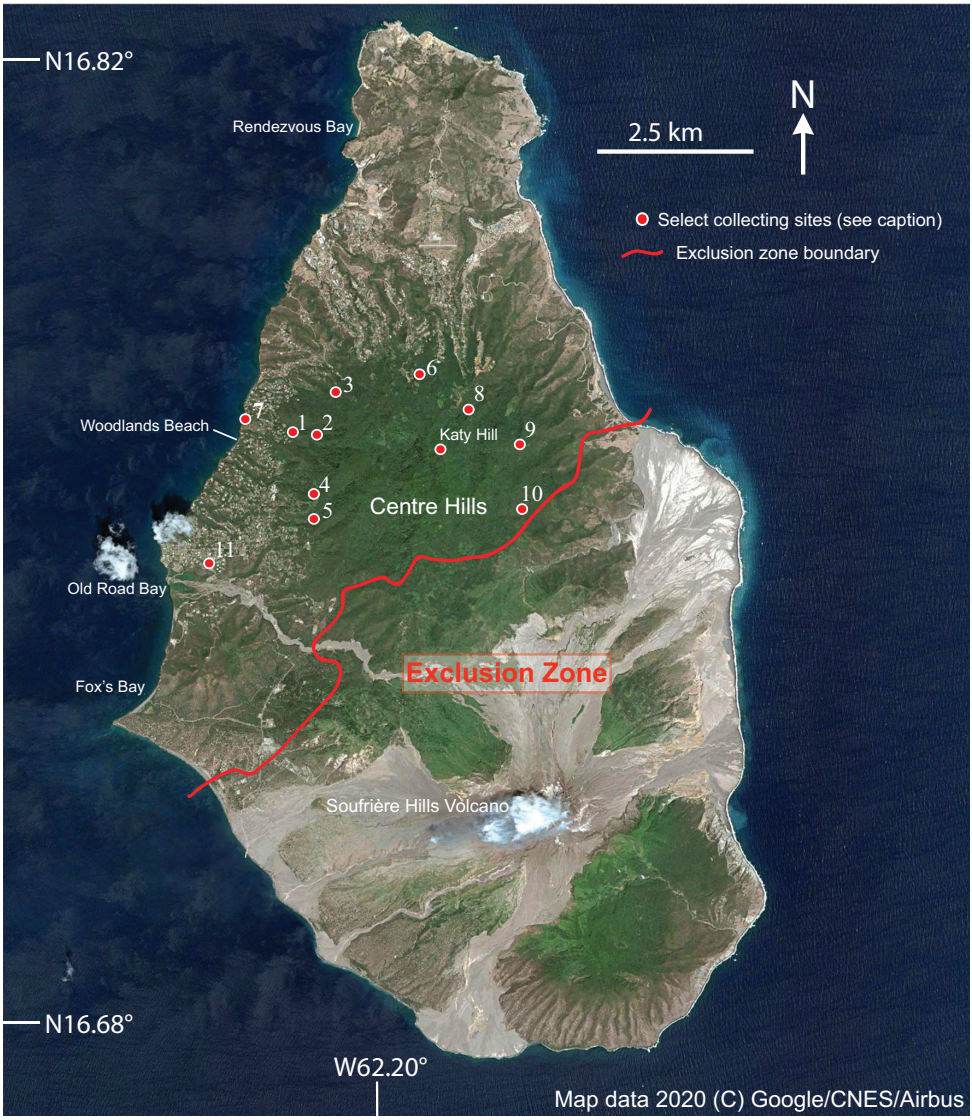

Figure 1. Map of Montserrat showing exclusion zone and primary collecting sites: 1–Cassava Ghaut, Beattie House; 2–Cassava Ghaut, canopy fogging site; 3–Fogarty Ghaut; 4–Gun Hill; 5–Hope Ghaut; 6–Underwood Ghaut; 7–Woodlands, Riverside House; 8– Bottomless Ghaut; 9–Jack Boy Hill; 10–Fairy Walk River; 11– Old Towne.

2015; Runyon and Capellari 2018). In fact, the islands with the next highest numbers of recorded dolichopodid species are Antigua (Robinson 1975) and St. Lucia (Van Duzee 1933a; Bickel 2002; Capellari 2015), each with just three documented species.

Montserrat (Figs 1, 2) is a small volcanic island near the northern end of the Lesser Antilles in the eastern Caribbean. It lies between 16°40' to 16°49'N latitude and 62°08' to 62°14'W longitude, with the closest large islands being Antigua (39 km to the northeast), Nevis (50 km to the northwest) and Basse-Terre (in the Guadeloupe archipelago,

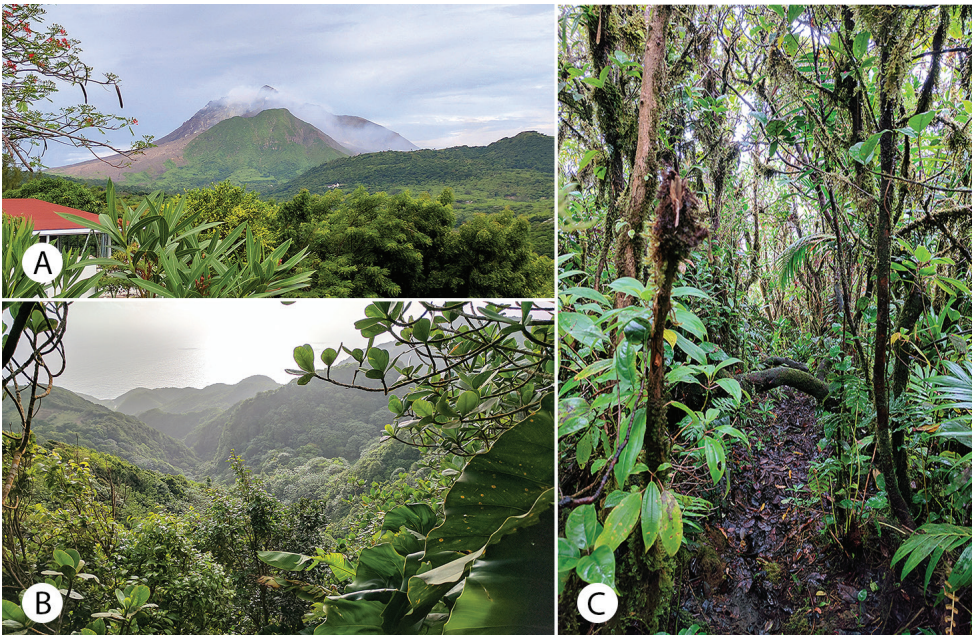

Figure 2. Some Montserrat landscapes and habitats **A** Soufrière Hills Volcano, view from Old Towne, June 2017 **B** northeast view from Katy Hill into Bottomless Ghaut **C** elfin woodland on top of Katy Hill, at the highest elevations of the Centre Hills. Photographs by Justin Runyon.

55 km to the southeast). Montserrat is ca. 100 km^2 in area and composed of three volcanic regions. These are (from North to South, with maximum elevation): the more arid Silver Hills (ca. 380 m), the Centre Hills (741 m) containing most of Montserrat's high-quality and mature forests, and the Soufrière Hills Volcano (SHV)–South Soufrière Hills complex (ca. 1,050 m) (Harford et al. 2002). It is unclear when Montserrat emerged as an aerial land mass available for colonization, but estimates suggest between 4.3–2.6 Ma (Rea 1974; Harford et al. 2002). Montserrat has a moist tropical maritime climate with total annual rainfall varying from 1,100 mm at the coast to 2,100 mm at higher elevations (Young 2008; Hemmings et al. 2015). Geography is mostly steep with deeply incised radial valleys (locally called *ghauts*) that drain the higher elevations. However, despite high rainfall, there are no permanent rivers and streams and springs are predominantly ephemeral, due to the small size of the island and porous nature of the bedrock (Hemmings et al. 2015). Vegetation types transition from dry forest, mesic forest, wet forest, to elfin woodland as elevation increases (Young 2008). In 1995, the long-dormant Soufrière Hills volcano erupted, and activity has continued episodically since (Druitt and Kokelaar 2002). This volcanic activity destroyed a large proportion of vegetation on the southern half of the island including the highest elevations, resulting in establishment of an exclusion zone that rendered greater than half of Montserrat inaccessible (Fig. 1).

This study is based on material collected during the Centre Hills Biodiversity Assessment conducted from 2001–2005 (Young 2008) and material collected by the author in June 2017. Prior to this survey there were no published records of Dolichopodidae from Montserrat. A very preliminary list of dolichopodids from early work of

this project was provided in the report by Ivie et al. (2008). Two dolichopodid species were recently reported from Montserrat, using material collected for this project: *Chimerothalassius runyoni* Brooks and Cumming (Brooks and Cumming 2018) and *Chrysotus xiphostoma* Robinson (Runyon and Capellari 2018). The purpose of this paper is to treat the dolichopodid fauna of Montserrat. Montserrat's fauna is contrasted with Dominica's, the only other island in the Lesser Antilles in which the dolichopodids have been intensively sampled and described. Lastly, collecting methods are compared and threats to the dolichopodid fauna of Montserrat discussed.

Materials and methods

Specimens were collected during the Centre Hills Biodiversity Assessment (2001–2005) using Malaise traps, ultraviolet light traps, canopy fogging, and pan traps. Details of canopy fogging are given in Marske (2004). Several sites, mostly in mid-elevation forests of the Centre Hills, were intensively and repeatedly sampled, especially in 2002–2003 (Table 1; see Marske 2004; Ivie et al. 2008). In 2005, sampling focused on wetter (e.g., ghauts) and drier (e.g., coastal) habitats using Malaise traps, ultraviolet light traps, and pan traps. In June 2017, targeted sampling was done mostly with a net, but also using Malaise traps and pan traps.

Holotypes are deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D.C. (**USNM**). Representatives of as many species as possible are also deposited in the USNM. All other specimens are deposited in the Montana Entomology Collection, Montana State University, Bozeman (**MTEC**), unless noted otherwise. Label data for primary types of new species are cited verbatim in quotation marks with lines separated by a slash ("/"), labels separated by a semicolon (";"), and annotations in square brackets ("[]"). Label data for other material is presented in a standardized format, utilizing locality names for major sites presented in Table 1. Nearly all material derived from the Centre Hills Biodiversity Assessment from 2001–2005 (Young 2008) and material collected by the author in June 2017. In addition, several large collections (California Academy of Sciences, San Francisco; Canadian National Collection of Insects, Ottawa; Natural History Museum, London; National Museum of Natural History, Smithsonian Institution, Washington, D.C.) were searched for dolichopodid specimens from Montserrat. The only ones found were one specimen each of *Condylostylus longicornis* (Fabricius) and *Thrypticus violaceus* Van Duzee, both collected in 1910, in the USNM.

To examine male terminalia using a compound microscope, for larger species the tip of the abdomen was cut off or for small species the entire specimen was removed from their pins by soaking in an approximately 50:50 mixture of 95% ethanol and ethyl acetate to dissolve shellac gel. These specimens were subsequently macerated in 85% lactic acid by heating in a microwave oven for one to three 15-second intervals, prior to being transferred to glycerin. Potassium hydroxide (20%) was additionally used to clear tergites of species in which terminalia are enclosed in tip of abdomen (e.g., most Diaphorinae). These specimens/genitalia were then transferred to plastic micro-tubes and placed on a pin or attached to the corresponding specimens.

Table 1. Information on major Montserrat sampling localities during the Centre Hills Biodiversity Assessment (2001–2005). Locality names are used in Material examined sections.

Locality name	Latitude (N) / Longitude (W)	Elevation (m)	Habitat type
Cassava Ghaut, Beattie House	16°45.91'N, 62°12.95'W	193	dry forest
Cassava Ghaut, canopy fogging site	16°45.75'N, 62°12.47'W	263	mesic forest
Fogarty	16°46.235'N, 62°12.529'W	367	mesic forest
Gun Hill	16°45.4'N, 62°12.7'W	260	mesic forest
Hope Ghaut	16°45.169'N, 62°12.736'W	315	mesic forest
Underwood Ghaut	16°46.327'N, 62°11.734'W	369	mesic forest
Woodlands, Riverside House	16°45.985'N, 62°13.341'W	43	dry forest

Terminology used for adult structures follows McAlpine (1981) and Cumming and Wood (2009). In descriptions, the position of features on elongate structures, such as leg segments, is given as numerical fractions of the total length, starting from the base (e.g., seta at 1/3), but spelled out as words for proportions (e.g., "brown on apical two-thirds"). The male postabdomen on intact specimens is rotated approximately 180° and lateroflexed to the right, but in descriptions "dorsal" and "ventral" refer to the true morphological positions prior to genitalic rotation and flexion (e.g., in lateral view, top of the page is ventral while the bottom is dorsal). The relative lengths of the podomeres are representative ratios and not measurements. The following abbreviations and terms are used:

ad anterodorsal(ly);
av anteroventral(ly);
pd posterodorsal(ly);
pv posteroventral(ly).

Body segments are denoted using Roman numerals (e.g., tergite VI). Legs are designated by Roman numerals, tarsomeres by bracketed Arabic numerals (e.g., tarsus III(4) = 4th tarsomere of hindleg).

Identification of species was accomplished using published keys and descriptions, especially Aldrich (1896), Aldrich (1902), and Robinson (1975), followed by: (1) examination of primary types; (2) comparison with material from Dominica and other islands; and (3) sending specimens to experts of particular groups: Achalcinae verified by Marc Pollet; Neurigoninae by Stefan Naglis; some *Chrysotus* by Renato Capellari; and *Chimerothalassius* by Scott Brooks and Jeff Cumming. Subfamilies are presented in order following Robinson (1975). Rarefaction was performed using iNext Online (Chao et al. 2016) a procedure that equalizes the sampling effort based on the number of specimens.

Results

Approximately 1,500 dolichopodid specimens were collected during this study, representing 63 species in 27 genera. A list of Dolichopodidae species from Montserrat and current understanding of their distributions are presented in Table 2. A sampling curve illustrating the accumulation of unique species with the number of specimens collected approaches but does not reach an asymptote (Fig. 3), indicating that most of Montserrat's dolichopodid species were discovered during this project.

Table 2. Species list of Dolichopodidae (Diptera) known from Montserrat, current understanding of distributional status, and occurrence on Dominica. Distribution status codes: IE – Island Endemic, Montserrat only; LAE – Lesser Antilles Endemic, Sombrero to Grenada including local endemics recorded from just a few islands; WIE – West Indian Endemic, not on mainland or only south Florida; WN – Widespread Native, West Indies and mainland (rankings follow Ivie et al. 2008).

Species	Distributional status	Dominica
Parathalassiinae		
Chimerothalassius runyoni Brooks & Cumming	LAE	x
Sciapodinae		
Amblypsilopus luteus (Robinson)	LAE	x
Amblypsilopus marskeae sp. nov.	IE	
Condylostylus albiciliatus (Van Duzee)	WIE	x
Condylostylus longicornis (Fabricius)	WN	x
Condylostylus nigripilosus Robinson	LAE	x
Condylostylus quadricolor (Walker)	WN	x
Neurigoninae		
Coeloglutus concavus Aldrich	WN	x
Dactylomyia decora (Aldrich)	LAE	
Neurigona fuscicosta Robinson	LAE	x
Viridigona thoracica (Van Duzee)	WN	x
Medeterinae		
Cryptopygiella musaphila Robinson	LAE	x
Medetera crassicauda Robinson	WIE	x
Medetera dominicensis Robinson	LAE	x
Medetera iviei sp. nov.	IE	
Medetera montserratensis sp. nov.	IE	
Medetera pseudonigripes Robinson	LAE	x
Systenus ladonnae sp. nov.	LAE	x
Thrypticus abdominalis (Say)	WN	x
Thrypticus aequalis Robinson	LAE	x
Thrypticus mediofuscus sp. nov.	LAE	x
Thrypticus parvulus Van Duzee	LAE	x
Thrypticus violaceus Van Duzee	WN	x
Achalcinae		
Xanthina rubromarginata Robinson	LAE	x
Enliniinae		
Enlinia patellitarsis Robinson	LAE	x
Harmstonia simplex Robinson	LAE	x
Peloropeodinae		
Micromorphus albipes (Zetterstedt)	WN, Oriental, Palearctic	x
Peloropeodes frater (Aldrich)	LAE	x
Diaphorinae		
Achradocera apicalis (Aldrich)	WN	x
Asyndetus interruptus (Loew)	WN	x
Asyndetus fratellus Aldrich	WIE	
Chrysotus acutus Aldrich	LAE	x
Chrysotus albihirtipes Robinson	LAE	x
Chrysotus angustifrons (Robinson)	LAE	x
Chrysotus antillensis sp. nov.	WIE	x
Chrysotus brevicornis Van Duzee	WN	x
Chrysotus callichromoides sp. nov.	LAE	x
Chrysotus callichromus Robinson	LAE	x
Chrysotus hirsutus Aldrich	WN	x

Species	Distributional status	Dominica
Chrysotus interfrons sp. nov.	IE	
Chrysotus integer Robinson	LAE	x
Chrysotus lamellicaudatus Robinson	LAE	x
Chrysotus mediocaudatus Robinson	LAE	x
Chrysotus microtatus Meuffels & Grootaert	LAE	x
Chrysotus montserratensis sp. nov.	IE	
Chrysotus orichalceus Gosseries	LAE	x
Chrysotus parvulus (Aldrich)	WIE	x
Chrysotus proximus Aldrich	LAE	x
Chrysotus pseudoniger Robinson	LAE	x
Chrysotus spectabilis (Loew)	WN	x
Chrysotus spinipes Van Duzee	WIE	x
Chrysotus xiphostoma Robinson	LAE	x
Diaphorus contiguus Aldrich	WN	x
Diaphorus robinsoni sp. nov.	LAE	x
Symbolia linearis (Aldrich)	LAE	x
Plagioneurinae		
Plagioneurus univittatus Loew	WN	x
Sympycninae		
Sympycnus montserratensis sp. nov.	IE	
Sympycnus pentachaetus Robinson	LAE	x
Dolichopodinae		
Paraclius megalocerus Robinson	LAE	x
Paraclius sp. (female)	?	
Tachytrechus perornatus Robinson	LAE	x
Hydrophorinae		
Cymatopus bredini Robinson	LAE	x
Thinophilus ochrifacies Van Duzee	WN	x

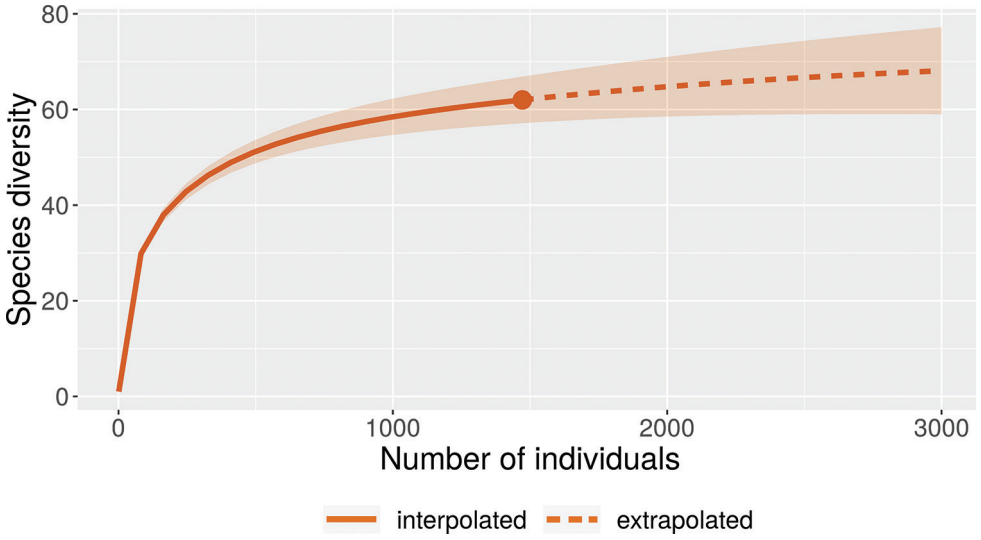

Figure 3. Rarefaction of species accumulation curve for Montserrat Dolichopodidae with 95% confidence interval and extrapolation to 2 × the numbers of individuals sampled in this study.

Key to the genera of Dolichopodidae of Montserrat*

1 Antenna with single articled arista-like stylus (Brooks and Cumming 2018: figs 3, 4); wing with crossvein dm-cu absent (Brooks and Cumming 2018: figs 8, 9); body size ca. 1.0 mm; rocky coastlines; PARATHALASSIINAE.... ..... ***Chimerothalassius*** **Shamshev & Grootaert**

– Antenna with two articled arista-like stylus; wing with crossvein dm-cu present; body size and habitat various **2**

2 Vertex strongly excavated on either side of ocellar tubercle; vein M distinctly branched, with M_2 present at least as a fold on membrane (as in Fig. 4D); SCIAPODINAE **3**

– Vertex not or scarcely excavated; vein M not branched, M_2 absent **4**

3 Frons with raised mound bearing strong vertical seta subtended by numerous shorter hairs; both pairs of scutellar setae long; antenna black..... ..... ***Condylostylus*** **Bigot**

– Vertical seta not arising on setose mound; lateral scutellar setae reduced and hair-like; antenna with some segments yellow..... ***Amblypsilopus*** **Bigot**

4 Veins R_{4+5} and M diverging from base to tip, with vein M ending distinctly behind wing tip (in some males vein M arches greatly backwards in apical third of wing); body size ca. 1.0 mm; ENLINIINAE..... **5**

– Veins R_{4+5} and M subparallel or converging beyond crossvein dm-cu (but diverging in males of *Systenus ladonnae*, Fig. 14B); body size usually greater than 2.0 mm..... **6**

5 Acrostichal setae absent; male wing and legs unmodified; females with small setae present on face above mouth ..... ***Harmstonia*** **Robinson**

– Acrostichal setae biseriate; males with tarsus I modified; female face without setae..... ***Enlinia*** **Aldrich**

6 Scape with setae on dorsal surface; male hypopygium enlarged and pedunculated, and projecting forward beneath abdomen; femur II and III with strong anterior preapical setae; all tibia with strong setae; posterior mesonotum not flattened; DOLICHOPODINAE..... **7**

– Without the above combination of characters..... **9**

7 Dorsal and ventral hairs of arista-like stylus much longer than lateral hairs; vein M distinctly bent midway beyond dm-cu crossvein and joining margin near R_{4+5} ..... ***Pelastoneurus*** **Loew [not yet recorded from Montserrat]**

– Arista-like stylus with all hairs subequal, or bare; venation various..... **8**

8 Lower margin of face rounded, projecting medially and extending below eye level; vein M beyond dm-cu crossvein gradually approaching R_{4+5} .... ***Tachytrechus*** **Haliday**

– Lower margin of face more or less straight and not reaching lower eye margin; vein M abruptly approaching R_{4+5} beyond dm-cu crossvein.... ***Paraclius*** **Loew**

* Modified from Robinson 1975 and Bickel 2009.

9 Posterior mesonotum distinctly flattened and slight depressed, from one-third to one-half of surface between dorsocentral setae, and distinct from concave anterior mesonotum **10**

– Posterior mesonotum not flattened, or at most only slightly or apparently flattened immediately anteriad of scutellum **21**

10 Femur II and III without major anterior preapical seta; dorsal postcranium usually distinctly concave **11**

– Femur II and III with distinct anterior or anterodorsal preapical seta; dorsal postcranium various **19**

11 Body and legs covered with dense gray tomentum, usually obscuring cuticle; mesonotum strongly arched with posterior slope flattened but not concave and with weak margin; acrostichal setae absent; scutellum with 2 (rarely 3) slender setae per side lateral to pair of larger setae; male forefemur with row of stout anteroventral setae on basal half; rocky coastlines; HYDROPHORINAE, in part ..... ***Cymatopus*** **Kertész**

– Body tomentum usually not dense, and underlying cuticle visible; mesonotum usually strongly flattened to slightly concave with distinct margin; scutellum with 0 or 1 hair or seta per side lateral to pair of larger setae; not restricted to intertidal areas; other features various **12**

12 First flagellomere globular, nearly round in anterior view; hypopygium completely enclosed by abdomen (Fig. 6B) ..... ***Cryptopygiella*** **Robinson**

– First flagellomere compressed laterally, subrectangular or flattened in anterior view; hypopygium external and usually distinctly pedunculated, at most partially hidden **13**

13 Arista-like stylus apical; male genitalic capsule ovate to pyriform on a peduncle formed by exserted haired segment VII, and not encapsulated or enfolded by preceding abdominal segments; male abdominal segments IV and V unmodified; vein M various; face often metallic; MEDETERINAE **14**

– Arista-like stylus dorsal or subapical; male genitalic usually globular, on a peduncle formed by short bare segment VII, and sometimes enfolded by preceding abdominal segments; male abdominal segments IV and/or V sometimes with ventral modifications; vein M beyond dm-cu crossvein with flexion or depression (*bosse alaire*) in membrane; face with dense pruinosity; NEURIGONINAE **16**

14 Male antenna with first flagellomere abruptly narrowed to elongate tapering point in distal half (Fig. 14C); female first flagellomere subovate (Fig. 14D); proepisternum with single pale seta; M beyond dm-cu crossvein with flexion; 6 strong dorsocentral setae ..... ***Systenus*** **Loew**

– Postpedicel of male and female similar, not elongate; proepisternum bare; M beyond dm-cu crossvein without flexion; dorsocentral setae usually 5 or fewer **15**

15 Wing vein M distinctly curving towards R_{4+5} beyond dm-cu crossvein; vein A_1 weak but distinct; hind coxa with 1 lateral seta; 2 supra-alar setae present, posterior seta stronger than anterior; femur II without strong posterior subapical seta; female oviscapt not forming a sclerotized, bladelike piercing structure ..... ***Medetera*** **Fischer von Waldheim**

– Wing with veins M and R_{4+5} subparallel to apex; vein A_1 absent; hind coxa with 2 lateral setae; only 1 supra-alar seta present; femur II with strong posterior subapical seta; female oviscapt sclerotized, bladelike and laterally compressed ..... ***Thrypticus*** **Gerstäcker**

16 Thorax strongly elongated; abdomen approximately as long as thorax, dorsoventrally flattened; vertex excavated dorsally laterad of ocellar tubercle; tarsus I(5) with ventral comb of short spines; arista-like stylus subapical; hypopygium small, partially enclosed by segment V or VI ..... ***Coeloglutus*** **Aldrich**

– Thorax not elongated; abdomen usually longer than thorax, cylindrical; vertex not excavated; tarsus I(5) unmodified; arista-like stylus dorsal; hypopygium large, external **17**

17 Vein M S-shaped, joining costa before wing apex and close to R_{4+5}, with costal difference between veins less than half length of crossvein dm-cu; tibiae II and III bare of major setae; hypopygium yellow; female oviscapt with cercus rounded and free from tergites IX+X ..... ***Dactylomyia*** **Loew**

– Vein M straight or slightly bent, joining costa near or behind wing apex, with costal difference between vein M and R_{4+5} greater than half length of crossvein dm-cu; tibia II and/or III with major setae; hypopygium black; female oviscapt with cercus digitiform and fused to tergites IX+X..... **18**

18 Thorax metallic green-blue; tarsus I(4) slightly compressed; wing hyaline ..... ***Viridigona*** **Naglis**

– Thorax mostly yellowish, metallic blue-green on only mesonotal depression and scutellum; tarsus I(4) not compressed; wing brownish anteriorly, especially in males ..... ***Neurigona*** **Rondani**

19 Acrostichal setae biseriate; body mostly yellow; pedicel overlapping first flagellomere medially; male palpi modified with reddish apical margin; hypopygium not enlarged; ACHALCINAE ..... ***Xanthina*** **Aldrich**

– Acrostichal setae uniseriate or totally absent; body usually dark colored; pedicel truncate, not overlapping first flagellomere; male palpus unmodified; hypopygium various but often enlarged; PELOROPEODINAE **20**

20 Acrostichal setae totally absent; hypopygium subrectangular, free from abdomen; body size 1.0–1.5 mm..... ***Micromorphus*** **Mik**

– Acrostichal setae uniseriate; hypopygium swollen and globular, encapsulated at abdominal apex; tarsus I(5) with one slightly enlarged, appressed claw; body size 2.0–2.5 mm..... ***Peloropeodes*** **Wheeler**

21 Pair of large postvertical setae present on dorsal postcranium, out of line with postorbital series; abdomen dorsoventrally flattened; face and enlarged subquadrate palpi golden; coastal areas; HYDROPHORINAE, in part..... ..... ***Thinophilus*** **Wahlberg**

– Postvertical setae, if present, near vertex; abdomen usually ovate, and rarely dorsoventrally flattened; palpus usually small, but sometimes enlarged in male only; male face often narrowed **22**

22 Face with vertical median furrow; crossvein dm-cu oblique, parallel to last part of M; male abdominal sternites III and IV with strong submarginal setae; acrostichal setae absent; thorax metallic green with coppery band; arista-like stylus dorsal and first flagellomere pointed triangular; PLAGIONEURINAE ..... ***Plagioneurus*** **Loew**

– Face without median furrow; crossvein dm-cu not parallel to last part of M; abdominal sternites III and IV without obvious large setae; other characters various **23**

23 Femur II and/or III with distinct anterior or anterodorsal preapical seta; SYMPYCNINAE ..... ***Sympycnus*** **Loew**

– Femur II and/or III without distinct anterior preapical seta (but sometimes with larger av setae near apex), or such apparent preapicals indistinct from background setal field; DIAPHORINAE..... **24**

24 Scape with dorsal setae..... ***Symbolia*** **Becker**

– Scape without dorsal setae..... **25**

25 Upper part of proepisternum with 1 or more small setae; male face parallel-sided; female with narrowest part of face subequal in width to widest part of frons; males often with enlarged pulvilli that are fused with claws on foreleg; male tergite VI bare, mostly or completely hidden; male sternite VIII with 4 strong projecting setae **26**

– Upper part of proepisternum bare; male face narrowed below or parallel-sided; female with narrowest part of face narrower than widest part of frons; males rarely with enlarged pulvilli fused with claws; male tergite VI setose or at least with 1 distolateral seta at lower margin, mostly exposed; setae on male sternite VIII not or scarcely stronger than those on tergite VI **27**

26 Costa not extending beyond tip of R_{4+5}; distal vein M weakened or broken, usually with distal section displaced; calypter with pale setae; male frons wide, eyes not dorsally holoptic..... ***Asyndetus*** **Loew**

– Costa ending at apex of vein M; vein M unbroken; calypter with black setae; male eyes dorsally holoptic..... ***Diaphorus*** **Meigen**

27 Male first flagellomere with slender apical projection bearing essentially apical arista-like stylus; lower postocular surface with many flattened pale setae; femur III wholly brown, femora I and II mostly yellow and usually narrowly brownish along dorsal edge ..... ***Achradocera*** **Becker**

– Male first flagellomere with arista-like stylus subapical in notch or to side of tip; lower postocular surface with fine pale setae, not flattened; color of femora various ..... ***Chrysotus*** **Meigen**

Systematic List

Subfamily Parathalassiinae
Genus *Chimerothalassius* Shamshev & Grootaert

***Chimerothalassius runyoni* Brooks & Cumming**

Chimerothalassius runyoni Brooks & Cumming, 2018: 513.

Material examined. Montserrat: 4 ♂, 13 ♀, Woodlands Beach, rocks in intertidal zone, 16°45.817'N, 62°13.384'W, 20–22 June 2017, JB Runyon. Specimens deposited in the Canadian National Collection of Insects, Ottawa.

Distribution. Dominica, Montserrat.

Remarks. *Chimerothalassius* belongs to the subfamily Parathalassiinae which is considered the sister group to the Dolichopodidae *sensu stricto* (Sinclair and Cumming 2006; Brooks and Cumming 2011). *Chimerothalassius runyoni* was known from one female specimen and a slide-mounted wing collected in Dominica during the Bredin-Archbold-Smithsonian Biological Survey and was formally described after males were collected on Montserrat in 2017 (Brooks and Cumming 2018). This species occurs on rocky or stony intertidal zones.

Subfamily Sciapodinae
Genus *Amblypsilopus* Bigot

Key to the species of *Amblypsilopus* in Montserrat

1 Thorax mostly yellow with mid-dorsal metallic blue-green stripe; male costa with long S-shaped cilia ..... ***A. luteus* (Robinson)**
– Thorax entirely metallic blue-green; male costa without long cilia..... .....***A. marskeae* sp. nov.**

***Amblypsilopus luteus* (Robinson)**

Sciapus luteus Robinson, 1975: 16.

Material examined. Dominica: ***Holotype*** ♂, Clarke Hall, 17 February 1964, H. Robinson (USNM). **Montserrat:** 5 ♂, 5 ♀, Woodlands, Riverside House, 10–12 January 2002, Malaise trap, Ivie, Marske & Puliafico; 1 ♀, same as previous, 5–7 January 2002; 15 ♂, 2 ♀, Cassava Ghaut, Beattie House, 14–21 January 2002, Malaise trap, A. Krakower; 2 ♂, 1 ♀, same as previous, 21 January–5 February 2002; 2 ♂, 1 ♀, same as previous, 5–15 February 2002; 1 ♂, same as previous, 18 March–4 April 2002; 4 ♂, 5 ♀, same as previous, 14–30 June 2002, M.A. Ivie; 1 ♂, same as previous, 30 June–4

July 2002; 3 ♂, Cassava Ghaut, canopy fogging at dawn, 4 February 2003, L. Martin & J. Boatswain; 1 ♂, Gun Hill, 18–30 May 2002, Malaise trap, K.A. Marske; 1 ♂, 2 ♀, same as previous, 30 May–7 June 2002; 2 ♂, 2 ♀, same as previous, 2–19 June 2002; 2 ♂, 1 ♀, Cassava St., Burty House, 13–14 January 2002, UV light trap, M.A. Ivie & K. Marske; 2 ♂, Fogarty, 20–22 June 2002, Malaise trap, K.A. Marske; 3 ♂, Hope Ghaut, canopy fogging at dawn, 4 December 2002, J. Boatswain & J. Martin; 1 ♀, Hope Ghaut, 8–10 January 2002, yellow pan trap, K.A. Markse; 1 ♂, Underwood Ghaut, canopy fogging at dawn, 23 May 2002, K. Marske & J. Boatswain; 1 ♂, trail to Fairy Walk, 15 August 2005, yellow pan, V.G. Martinson; 1 ♂, on roadside vegetation, 16°46.06'N, 62°13.10'W, 19 June 2017, J.B. Runyon; 1 ♀, Woodlands Beach, 16°45.75'N, 62°13.42'W, 20 June 2017, J.B. Runyon; 5 ♂, Hope Ghaut, 300 m, 16°45.108'N, 62°12.695'W, 20 June 2017, J.B. Runyon; 2 ♂, 1 ♀, Fogarty Ghaut (Soldiers), 16°46.41'N, 62°12.44'W, 21 June 2017, J.B. Runyon; 1 ♀, Jack Boy Hill (top), 480 m, 16°45.797'N, 62°10.886'W, 25 June 2017, J.B. Runyon; 2 ♂, Fairy Walk River, 260 m, 16°45.162'N, 62°10.854'W, 26 June 2017, J.B. Runyon (MTEC, USNM).

Distribution. Dominica, Montserrat.

Remarks. Adults occur on vegetation but were also commonly found hopping around on dead leaves and rocks on the forest floor.

***Amblypsilopus marskeae* sp. nov.**

http://zoobank.org/92E7384D-FB10-4479-AE9C-0AC3737E9E6B

Figs 4, 5

Type material. ***Holotype***, ♂ labelled: "WEST INDIES: MONTSERRAT/ rental house in Old Town/ 16°44.795'N, 62°13.711'W/ 19 JUNE 2017, JB Runyon"; "HOLOTYPE/ ♂ *Amblypsilopus*/ *marskeae*/ Runyon [red label]" (USNM, type number USNMENT01350607). ***Paratypes*: Montserrat:** 4 ♂, 5 ♀, same data as holotype; 1 ♂, Woodlands, Riverside House, 5–7 January 2002, Malaise trap, Ivie, Marske & Puliafico; 1 ♂, same as previous, 10–12 January 2002 (MTEC).

Description. Male (Fig. 4). Body length 4.5–5.0 mm, wing length 4.0–4.5 × width 1.1–1.3 mm. ***Head*:** Face somewhat narrowed below, three-fifths as wide at frontoclypeal suture as at antenna; face and frons metallic blue-green with violet reflections, with white pruinosity that is coarser and denser on lower face. Palpus yellow, rather narrow and pointed apically, with short yellow setae and two black setae (near 1/2 and at apex). Proboscis yellow, projecting anteriorly, with a few yellow hairs. Antenna with scape and pedicel yellow; first flagellomere brown, ovate-triangular, a little longer than wide, with arista-like stylus inserted near middle of dorsal edge. Lower postocular setae white. ***Thorax*:** Scutum and scutellum metallic green with some violet reflections, covered with slight white pruinosity; five pairs of biseriate acrostichal setae, the posterior-most pair much larger (subequal in size to largest dorsocentral setae); five or six pairs of dorsocentral setae, posterior two pairs largest; scutellum with one pair of large marginal setae and one pair of very small lateral setae. Pleuron metallic green with

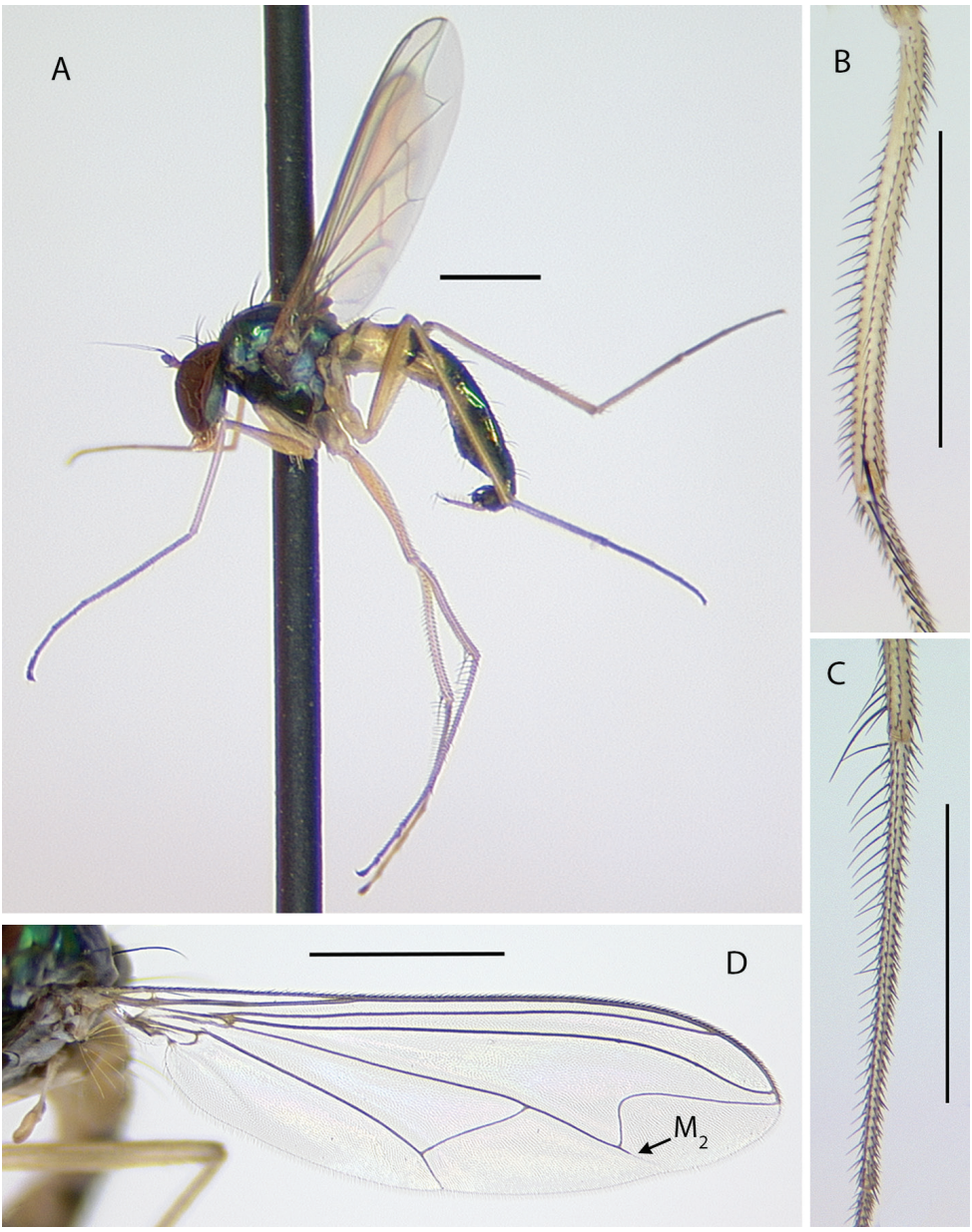

Figure 4. *Amblypsilopus marskeae* sp. nov. males **A** habitus of holotype, left lateral **B** tibia II and base of tarsus II(1), anterodorsal view **C** tip of tibia II and tarsus II(1), dorsal **D** wing, dorsal. Scale bars: 1 mm.

dense white pruinosity. ***Legs*:** Coxa I entirely yellow with yellow hairs and three strong yellow distolateral setae; coxa II brown on outer surface with yellow anterior hairs and yellow apical setae, without lateral seta; coxa III entirely yellow with large yellow dorsal seta near 1/2 and a few yellow hairs. Remainder of legs yellow, except distal tarsomeres

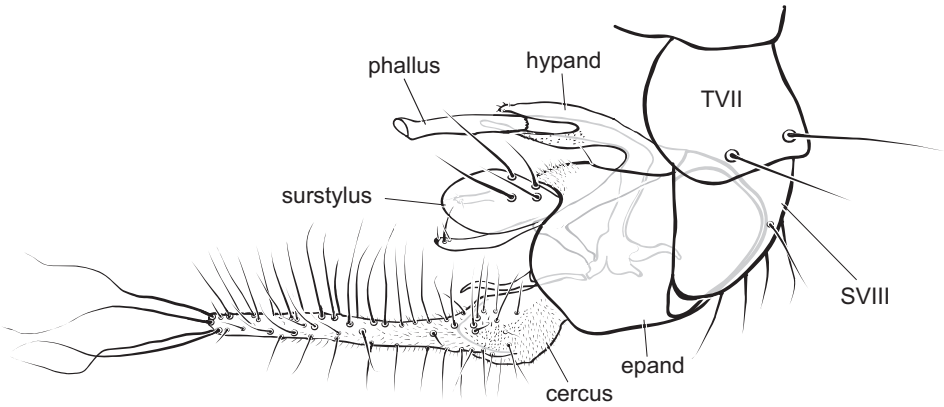

Figure 5. *Amblypsilopus marskeae* sp. nov. male terminalia, left lateral. Abbreviations: epand-epandrium; hypand-hypandrium; TVII-tergite 7; SVIII-sternite 8. Scale bar: 0.5 mm.

brownish. Femora unmodified, except femur II has slightly longer rows of black setae pd and posteriorly on apical half; femora lacking anterior preapical setae. Tibia I with small ad seta at 1/5; tibia II (Fig. 4B, C) slightly sinuous, with row of 4–5 ad setae near apex rapidly increasing in size distally (longest 3 × width of tibia), with row of erect av setae on distal 2/3, longest setae in this row near middle and slightly longer than width of tibia, with pv row of very short erect setae, with 3–4 outstanding ventral setae on basal one-fourth (longest subequal to width of tibia); tibia III with ad seta near 1/5. Tarsus II(1–3) with ad row of erect setae, those at base of tarsus II(1) longest (length ca. 3 × width of tibia) and gradually decreasing in size distally (Fig. 4C), tarsus II(2–3) with 2–3 slightly longer setae in this row near apex and with rather long black distally directed posterior seta at apex; tarsus II (3–4) very slightly swollen at base bearing small tuft of short black posterior setae; tarsus III(1) with 2–3 black setae ventrally at base. Ratios of tibia:tarsomeres: leg I: 14–18–5–4–2–1; leg II: 20–22–6–5–3–2; leg III: 26–14–6–4–2–1. ***Wing*** (Fig. 4D): Hyaline, narrowly oblong-elliptical; costa without obvious special cilia or setae, but with very short (length subequal to width of costa), erect, fine cilia scattered along costa from just before apex of R_1 to near apex of R_{2+3}, the position of these minute cilia seems to correspond to the longer, curved costal cilia found in other *Amblypsilopus* species (e.g., *A. bredini* Robinson); vein M branched, M_1 strongly arched anteriorly just beyond branch and ending in wing apex; M_2 fading and not reaching wing margin; crossvein dm-cu nearly 3 × as long as last part of CuA_1. Calypter yellow with edge narrowly black, with fan of long yellow setae. Halter yellow. ***Abdomen*****:** Narrow, cylindrical. Tergite I yellow with posterolateral edge narrowly brown, with yellow hairs and longer black setae on posterior margin; remainder of tergites with black hairs and setae, those near posterior margins larger; tergite II entirely yellow on basal one-fourth and on most of lateral surface, brown with metallic green reflections dorsally and along posterior margin; tergites III and IV mostly yellow

laterally and brown with metallic green reflections dorsally and along posterior margins; tergites V–VII entirely metallic green; tergite VII mostly bare except four large setae along posterior margin. Sternites I–IV yellow with sparse yellow hairs; sternites V and VI brown with mostly dark hairs and setae; sternite VII reduced to a sclerotized band attached to ovate setose sternite VIII which covers the hypopygial foramen. Hypopygium (Fig. 5) rather small, on a short, broad peduncle formed by tergite VII. Hypopygial foramen at base on left side. Epandrium brown, a little longer than wide, rather square apically, covered with white microtrichia that is densest at ventroapical corner. Surstylus shining dark brown, bilobed, with large oval ventral lobe bearing four large setae and small digitiform medial lobe with three small setae near apex; dorsal lobe of surstylus slender, finger-like with three ventral setae near apex. Cercus yellow, elongate cylindrical but broader basally, covered with abundant setae (color of setae varies from yellow to dark brown) especially along ventral surface, and with four long black wavy setae at apex. Phallus broad, slightly flared at apex with large opening, with sclerotized articulation near 2/3, near where phallus emerges from hypandrium. Hypandrium sclerotized dark brown, asymmetrical, with broad ventral hood bearing hairs at pointed apex and left lateral lobe arising near base that crosses dorsally to right side of phallus, this lobe has minute scale-like setae on apical half. Subepandrial sclerite with sharply pointed, slightly hooked process emerging just ventral to base of cercus.

Female. Body length 4.5–5.0 mm, wing length 4.0–4.5 × width 1.3–1.5 mm. Similar to male, but clypeus more distinct and bulging; three yellow distolateral setae on coxa I stronger than in male; leg II unmodified, tibia II with small ad and pv seta near 1/5 and smaller pv seta near 1/2; wing noticeably broader.

Etymology. This species is named to honor Dr. Katharine A. Marske (University of Oklahoma). Many specimens used in this study were collected as part of Katie's Master's thesis at Montana State University examining the effects of volcanic ash on Montserrat forest insects (Marske 2004), a component of the Centre Hills Biodiversity Assessment.

Distribution. Montserrat.

Remarks. *Amblypsilopus marskeae* belongs to the New World group of *Amblypsilopus* species that possess costal cilia (which are poorly developed in *A. marskeae*) and three strong distolateral setae on coxa I that are more strongly developed in females. *Amblypsilopus marskeae* is closely related to *A. bredini* (Robinson) from Dominica which has a similarly sinuous tibia II but differs most notably in color of the thorax and males lacking long, hooked cilia on the costa. Specimens were collected at the type locality from a shaded, vertical surface of a roadside concrete wall and on low vegetation in an adjacent small ghaut.

Genus *Condylostylus* Bigot

Key to the species of *Condylostylus* in Montserrat

1 Wing clear or slightly clouded along anterior margin **2**
– Wing with 2 transverse brown bands that are joined anteriorly **3**

2 Tibia III with only distal one-third brown; tibiae I and II with long setae; femur III with long dense wavy-tipped white hairs posteriorly; tibia II and tarsus II(1) without row of distinctive setae..... ***C. albiciliatus*** **(Van Duzee)**

– Tibia III wholly brown; tibiae I and II with longest setae only twice as long as tibial width; femur III with straight white hairs posteriorly only a little longer than femoral width; tibia II with ca. 12 short setae in av row; tarsus II(1) with series of slender erect cilia along anterior surface .... ***C. longicornis*** **(Fabricius)**

3 Clypeus as wide or wider than long; male with numerous black hairs along middle of scutum; hypopygium and cerci large; female femora black; knob of halter dark brown in both sexes..... ***C. nigripilosus*** **Robinson**

– Clypeus width less than length; male without black hairs on scutum; hypopygium and cerci small; female femora yellow; knob of halter yellow brown in both sexes ..... ***C. quadricolor*** **(Walker)**

Condylostylus albiciliatus (Van Duzee)

Psilopus albiciliatus Van Duzee, 1927: 9.
Condylostylus perpilosus Robinson, 1975: 8.

Material examined. Dominica: ***Holotype*** ♂ of *Condylostylus perpilosus*, Clarke Hall, 11–20 January 1965, W.W. Wirth (USNM). **Montserrat:** 3 ♂, 3 ♀, Woodlands, Riverside House, 5–7 January 2002, Malaise trap, Ivie, Marske & Puliafico; 2 ♂, 7 ♀, same as previous, 10–12 January 2002; 3 ♂, same as previous, yellow pan, 8–10 January 2002, K. Marske & K. Puliafico; 8 ♂, 1 ♀, Cassava Ghaut, Beattie House, 15–18 February 2002, light trap, A. Krakower; 1 ♂, same as previous, 11–23 March 2002, UV light; 2 ♂, same as previous, 6–12 June 2002; 3 ♂, 1 ♀, same as previous, 21–30 June 2002, M.A. Ivie; 4 ♂, 3 ♀, Cassava Ghaut, Beattie House, 14–21 January 2002, Malaise trap, A. Krakower; 5 ♂, 1 ♀, same as previous, 21 January–5 February 2002; 1 ♂, 2 ♀, same as previous, 5–15 February 2002; 2 ♂, same as previous, 4–23 March 2002; 2 ♂, same as previous, 18 March–4 April 2002; 1 ♂, 1 ♀, same as previous, 8–17 April 2002; 1 ♂, 1 ♀, same as previous, 17–30 May 2002; 1 ♂, 4 ♀, same as previous, 14–30 June 2002, M.A. Ivie; 1 ♂, Cassava Ghaut, canopy fogging at dawn, 21 May 2002, K. Marske & J. Boatswain; 4 ♂, trail to Fairy Walk, 15 August 2005, yellow pan trap, V.G. Martinson; 1 ♂, Hope Ghaut, canopy fogging at dawn, 4 December 2002, J. Boatswain & J. Martin; 1 ♂, Fogarty, canopy fogging at dawn, 10 October 2002, J. Daley & J. Martin; 1 ♂, Sweetwater Ghaut, 1 August 2005, yellow pans, V.G. Martinson; 1 ♂, Cassava St., Burty House, 13–14 January 2002, UV light trap, M.A. Ivie & K. Marske; 1 ♂, Killiekranke, 3 August 2005, yellow pan trap, V.G. Martinson; 2 ♂, on roadside vegetation, 16°46.06'N, 62°13.10'W, 19 June 2017, J.B. Runyon; 1 ♂, Hope Ghaut, 280 m, 16°45.101'N, 62°12.760'W, 20 June 2017, J.B. Runyon (MTEC, USNM).

Distribution. West Indies (Dominica, Jamaica, Montserrat, Puerto Rico, St. Lucia, Virgin Islands).

Remarks. This species is widespread in the West Indies, being described using material from Jamaica, Puerto Rico, and the Virgin Islands (Van Duzee 1927) and later reported from Dominica (Robinson 1975) and St. Lucia (Bickel 2002). Robinson (1975) described this species as *Condylostylus perpilosus* which was synonymized with *C. albiciliatus* by Bickel (2002). Adults of *C. albiciliatus* appear to be active year-round on Montserrat.

Condylostylus longicornis (Fabricius)

Musca longicornis Fabricius, 1775: 783.
Psilopus radians Macquart, 1834: 450.
Psilopus nigripes Macquart, 1842: 181.
Psilopus flavimanus Macquart, 1842: 182.
Psilopus chrysoprasi Walker, 1848–1849: 646.
Psilopus metallifer Walker, 1848–1849: 647.
Psilopus zonatulus Thomson, 1869: 509.
Psilopus trichosoma Bigot, 1890: 285.
Psilopus ciliipes Aldrich, 1901: 355.
Condylostylus dentaticauda Van Duzee, 1933b: 66.

Material examined. Dominica: 3 ♂, 2 ♀, near Layou, 27 January–12 February 1964, H. Robinson (USNM); 2 ♂, 1 ♀, Springfield Estate, yellow pans, 1–3 June 2011, M.A. & L.L. Ivie. **Montserrat:** 13 ♂, 9 ♀, Woodlands, Riverside House, 10–12 January 2002, Malaise trap, Ivie, Marske & Puliafico; 4 ♂, 5 ♀, same as previous, 5–7 January 2002; 5 ♂, 4 ♀, trail to Fairy Walk, 15 August 2005, yellow pan trap, V.G. Martinson; 1 ♂, Sweetwater Ghaut, 1 August 2005, yellow pans, V.G. Martinson; 1 ♂, 1910, HAB [remainder of label illegible] (MTEC, USNM).

Distribution. *Condylostylus longicornis* is widespread in the New World tropics and subtropics and has been readily transported by humans to other biogeographic realms. Recorded from the southeastern USA, Caribbean, Central America, tropical South America (including Galápagos Islands), and introduced to French Polynesia and Hawaii (Bickel 2002), Australia, China, India, Indonesia, Papua New Guinea, Philippines, and Sri Lanka (Yang et al. 2006), and United Arab Emirates (Naglis and Bickel 2017).

Remarks. Robinson (1975) treated this species as *Condylostylus chrysoprasi* (Walker). The synonymy is from Bickel (2002).

Condylostylus nigripilosus Robinson

Condylostylus nigripilosus Robinson, 1975: 11.

Material examined. Dominica: ***Holotype*** ♂, Clarke Hall, 15–19 April 1966, R.J. Gagné (USNM). **Montserrat:** 1 ♂, ♀, Cassava Ghaut, yellow pan trap, 24 July 2005,

V.G. Martinson; 1 ♀, Cedar Ghaut, yellow pan trap, 4 August 2005, V.G. Martinson & D. Hughley (MTEC, USNM).

Distribution. Dominica, Montserrat.

Remarks. The male specimen from Montserrat has more of the hairs on the frons and femora white (which are mostly black in Dominica specimens), but otherwise it matches the holotype of *C. nigripilosus*.

***Condylostylus quadricolor* (Walker)**

Psilopus quadricolor Walker, 1848–1849: 649.
Psilopus jucundus Loew, 1861: 87, 88; 1864: 258–260.
Psilopodinus astequinus Bigot, 1888: xxx.
Psilopus similis Aldrich, 1901: 359.
Sciapus digitatus Van Duzee, 1914: 391.
Condylostylus nigritibia Van Duzee, 1932: 183.

Material examined. Dominica: 2 ♂, Springfield Estate, yellow pans, 1–3 June 2011, M.A. & L.L. Ivie. **Montserrat:** 2 ♂, Cassava Ghaut, 25 July 2005, yellow pan trap, V.G. Martinson; 1 ♂, trail to Fairy Walk, 15 August 2005, yellow pan trap, V.G. Martinson; 1 ♀, Cassava Ghaut, Beattie House, Malaise, 21 January–5 February 2002, A. Krakower; 1 ♀, same as previous, 17–30 May 2002; 1 ♂, 3 ♀, Woodlands, Riverside House, 10–12 January 2002, Malaise trap, Ivie, Marske & Puliafico (MTEC, USNM).

Distribution. Widespread in the Neotropics.

Remarks. Robinson (1975) treated this species as *Condylostylus similis* (Aldrich), synonymized by Bickel (2002).

Subfamily Neurigoninae
Genus *Coeloglutus* Aldrich

***Coeloglutus concavus* Aldrich**

Coeloglutus concavus Aldrich, 1896: 338.
Medetera sinuata Parent, 1928: 159.
Coeloglutus bicoloripes Van Duzee, 1933a: 15.

Material examined. Montserrat: 2 ♂, 1 ♀, Cassava Ghaut, canopy fogging at dawn, 21 May 2002, K. Marske & J. Boatswain; 1 ♀, Cassava Ghaut, Malaise trap, 4–23 March 2002, A. Krakower; 1 ♂, 2 ♀, Fogarty Ghaut, canopy fogging, 6 December 2002, J. Daley & L. Aymer (MTEC, USNM).

Distribution. West Indies (Puerto Rico, Dominica, Montserrat, St. Vincent) and from Guatemala south to Bolivia (Naglis 2001).

Remarks. Naglis (2001) provided a re-description and illustration of *C. concavus*.

Genus *Dactylomyia* Loew

***Dactylomyia decora* (Aldrich)**

Neurigona decora Aldrich, 1902: 83.

Material examined. Montserrat: 1 ♂, Cassava Ghaut, Beattie House, 11–23 March 2002, UV light, A. Krakower; 1 ♂, same as previous, 21–30 June 2002, M.A. Ivie; 1 ♂, same as previous, Malaise trap, 8–17 April 2002, A. Krakower; 1 ♂, same as previous, 4–11 March 2002, M.A. Ivie & K.A. Marske; 2 ♀, rental house in Old Town, 16°44.795'N, 62°13.711'W, 19 June 2017, J.B. Runyon (MTEC, USNM).

Distribution. Lesser Antilles (Barbados, Grenada, Montserrat, St. Vincent).

Remarks. *Dactylomyia decora* was re-described and illustrated by Naglis (2002). The 2017 specimens were collected from the trunk of an ornamental flame tree, *Delonix regia*, in a residential yard.

Genus *Neurigona* Rondani

***Neurigona fuscicosta* Robinson**

Neurigona fuscicosta Robinson, 1975: 23.

Material examined. Montserrat: 1 ♂, Cassava Ghaut, Beattie House, 18 March–4 April 2002, Malaise trap, A. Krakower; 1 ♂, same as previous, 8–17 April 2002; 2 ♂, same as previous, 17–30 May 2002; 2 ♂, same as previous, 14–30 June 2002, M.A. Ivie; 1 ♂, Gun Hill, 30 May–7 June 2002, Malaise trap, K.A. Marske (MTEC, USNM).

Distribution. Dominica, Montserrat.

Remarks. *Neurigona fuscicosta* was re-described and illustrated by Naglis (2003).

Genus *Viridigona* Naglis

***Viridigona thoracica* (Van Duzee)**

Neurigona thoracica Van Duzee, 1931a: 178.

Material examined. Dominica: 1 ♂, St. David Parish, ca. 1 km NE Ponte Casse, Waitukubuli National Trail, 15.381490N, 61.340138W, Malaise trap, 31 May–5 June 2011. **Montserrat:** 1 ♂, Gun Hill, 18–30 May 2002, Malaise trap, K.A. Marske; 1 ♂, same as previous, 30 May–7 June 2002; 1 ♀, Cassava Ghaut, Beattie House, 4–23 March 2002, Malaise trap, A. Krakower; 1 ♂, same as previous, 17–30 May 2002; 1 ♂, same as previous, 14–30 June 2002, M.A. Ivie; 1 ♀, ghaut above Montserrat Volcano Observatory, 330 m, 16°45.130'N, 62°12.487'W, 27 June 2017, J.B. Runyon (MTEC, USNM).

Distribution. Widely distributed in the American tropics (Dominica, Ecuador, Montserrat, Panama, Peru, and Venezuela).

Remarks. See Naglis (2003) for a revision of the genus *Viridigona* and re-description of *V. thoracica*.

Subfamily Medeterinae
Genus *Cryptopygiella* Robinson

***Cryptopygiella musaphila* Robinson**
Fig. 6

Cryptopygiella musaphila Robinson, 1975: 41.

Material examined. Dominica: *Holotype* ♂, La Ronde River, 15 February 1964, H. Robinson (USNM). **Montserrat:** 1 ♀, Bottomless Ghaut, 5 August 2005, yellow pan trap, V.G. Martinson; 1 ♀, Big River, 450 m, 16°45.690'N, 62°11.174'W, 28 June 2017, J.B. Runyon; 1 ♂, small ghaut, on *Heliconia*, 16°45.844'N, 62°11.402'W, 28 June 2017, J.B. Runyon (MTEC, USNM).

Distribution. Dominica, Montserrat.

Remarks. This is the first report of the monotypic genus *Cryptopygiella* outside of Dominica. Specimens seem to be restricted to the deepest ghauts on Montserrat. The male antenna and genitalia were illustrated by Bickel (2009). The male postabdomen is unique in being completely enclosed within an opening at apex of the preabdomen

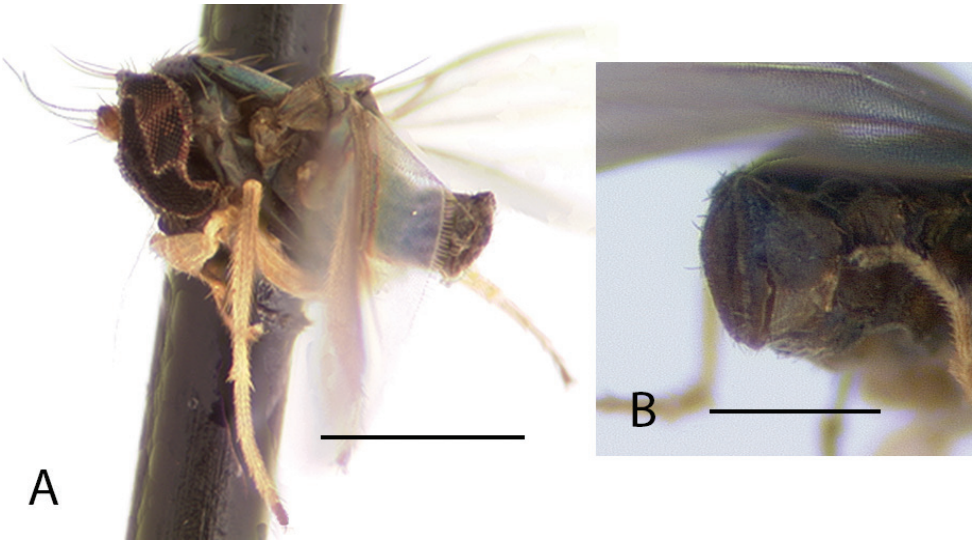

Figure 6. *Cryptopygiella musaphila* Robinson, male **A** habitus, left lateral **B** tip of abdomen showing opening that encloses postabdomen, right lateral. Scale bars: 0.5 mm (**A**), 0.25 mm (**B**).

(Fig. 6B). Adults collected in 2017 were found on large *Heliconia* leaves, a similar habitat to where they were found on Dominica "running over the surface of banana leaves" (Robinson 1975).

Genus *Medetera* Fischer von Waldheim

Key to the species of *Medetera* in Montserrat

1 Body length ca. 3.0 mm; thorax with 3 pairs of large dorsocentral setae and 4 large scutellar setae; femur III with 2–3 large setae on anterior surface; crossvein dm-cu slightly longer than last part of CuA_1; male tarsus I with some segments flattened (Fig. 11) ..... ***M. montserratensis* sp. nov.**

– Body length ca. 2.2 mm or less; thorax with 2 pairs of large dorsocentral setae and 2 large scutellar setae (lateral pair small of lacking); femur III without large setae on anterior surface that are distinct from background setal field; crossvein dm-cu shorter than last part of CuA_1; male tarsus I plain **2**

2 Antenna with scape and pedicel yellow; femora yellow..... ..... ***M. dominicensis* Robinson**

– Antenna dark brown to black; femora mostly to wholly dark brown **3**

3 Hypopygium of male not extending posteriorly beyond preabdomen; crossvein dm-cu ca. half as long as last part of CuA_1; calypter with brown setae; body length ca. 1.5 mm ..... ***M. pseudonigripes* Robinson**

– Hypopygium of male extending posteriorly beyond preabdomen (most obvious in right lateral view); crossvein dm-cu two-thirds as long as last part of CuA_1; calypter with yellow setae; body length ca. 2.0 mm **4**

4 Face metallic dark blue, with little to no pruinosity (Fig. 8B); male cercus approximately as long as wide, square apically; male surstylus without thin translucent ventral lobe..... ***M. crassicauda* Robinson**

– Face covered with dense golden-brown pruinosity (Fig. 8A); male cercus 2.5 × as long as wide, pointed apically; male surstylus with wide, thin translucent ventral lobe (Fig. 9)..... ***M. iviei* sp. nov.**

Medetera crassicauda Robinson

Medetera crassicauda Robinson, 1975: 27.

Material examined. Dominica: ***Holotype*** ♂, South Chiltern, 26 March 1964, H. Robinson (USNM). **Montserrat:** 2 ♂, Cassava Ghaut, Beattie House, 8–17 April 2002, Malaise trap, A. Krakower (MTEC, USNM).

Distribution. Dominica, Montserrat, Puerto Rico.

Medetera dominicensis Robinson

Medetera dominicensis Robinson, 1975: 26.

Material examined. Dominica: ***Holotype*** ♂, Springfield Estate, 9 March 1964, H. Robinson (USNM). **Montserrat:** 9 ♂, 4 ♀, Cassava Ghaut, Beattie House, 14–21 January 2002, Malaise trap, A. Krakower; 5 ♂, 3 ♀, same as previous, 21 January–05 February 2002; 3 ♂, same as previous 5–15 February 2002; 8 ♂, same as previous, 4–23 March 2002; 4 ♂, 5 ♀, same as previous, 23 March–8 April 2002; 8 ♂, 1 ♀, same as previous, 18 March–4 April 2002; 12 ♂, 1 ♀, same as previous, 8–17 April 2002; 5 ♂, 1 ♀, same as previous, 17 April–1 May 2002; 4 ♂, same as previous, 17–30 May 2002; 4 ♂, 9 ♀, same as previous, 14–30 June 2002, M.A. Ivie; 1 ♂, same as previous, 30 June–4 July 2002; 5 ♂, Cassava Ghaut, 16°45.749'N, 62°12.473'W, canopy fogging at dawn, 5 December 2002, J. Boatswain & L. Martin; 1 ♂, same as previous, 4 February 2003, L. Martin & J. Boatswain; 19 ♂, 7 ♀, Underwood Ghaut, canopy fogging at dawn, 23 May 2002, K. Marske & J. Boatswain; 3 ♂, 2 ♀, Gun Hill, 18–30 May 2002, Malaise trap, K.A. Marske; 4 ♂, 1 ♀, same as previous, 2–19 June 2002; 2 ♂, 1 ♀, Woodlands, Riverside House, 5–7 January 2002, Malaise trap, Ivie, Marske & Puliafico; 1 ♂, same as previous, Malaise trap in lawn, 17–28 July 2005; 1 ♂, 2 ♀, Fogarty, 21 June 2002, canopy fogging at dawn, K.A. Marske & Forestry staff; 1 ♂, same as previous, 6 December 2002, J. Daley & L. Aymer; 1 ♂, 2 ♀, rental house in Old Town, 16°44.795'N, 62°13.711'W, 19 June 2017, J.B. Runyon; 1 ♂, 1 ♀, Hope Ghaut, 280 m, 16°45.101'N, 62°12.760'W, 20 June 2017, J.B. Runyon; 3 ♂, 1 ♀, Hope Ghaut, 300 m, 16°45.108'N, 62°12.695'W, 20 June 2017, J.B. Runyon; 5 ♂, Fogarty Ghaut, 16°46.41'N, 62°12.44'W, 21 June 2017, J.B. Runyon; 1 ♂, Woodlands Beach, 16°45.75'N, 62°13.42'W, 22 June 2017, J.B. Runyon; 2 ♂, 1 ♀, Runaway Ghaut, 175 m, 16°45.43'N, 62°12.89'W, 23 June 2017, J.B. Runyon; 2 ♂, Jack Boy Hill (top), 480 m, 16°45.797'N, 62°10.886'W, 25 June 2017, J.B. Runyon; 2 ♂, Fairy Walk River, 260 m, 16°45.162'N, 62°10.854'W, 26 June 2017, J.B. Runyon; 1 ♂, 2 ♀, ghaut above Montserrat Volcano Observatory, 330 m, 16°45.130'N, 62°12.487'W, 27 June 2017, J.B. Runyon (MTEC, USNM).

Distribution. Dominica, Montserrat.

Remarks. Adults of *M. dominicensis* were common in fogging samples and Malaise traps, and in 2017 were commonly seen on and collected from trunks of a wide variety tree species. Numerous males taken by fogging and in Malaise traps, presumably teneral, have the hypopygium yellowish rather than brown. Bickel (1985) indicated that *M. dominicensis* is closely related and could be conspecific with *M. nova* Van Duzee from eastern North America. Comparison of male specimens of *M. nova* (Pennsylvania, Virginia) with specimens of *M. dominicensis* reveals substantial and consistent differences in the form of the cercus and surstylus, notably the presence of branched hairs on the surstylus of *M. dominicensis*.

***Medetera iviei* sp. nov.**
http://zoobank.org/BB00592E-B1DA-4183-9313-1977BDAE94EC
Figs 7–9

Type material. ***Holotype***, ♂ labelled: "MONTSERRAT: Woodlands/ Riverside House, 140 ft/ 16°45.985'N, 62°13.341'W/ 10–12JAN2002, Malaise/ Ivie, Marske, Puliafico" "HOLOTYPE/ ♂ *Medetera*/ *iviei*/ Runyon [red label]" (USNM, type number USNMENT01350608).

Description. Male (Fig. 7). Body length 2.2 mm, wing length 1.8 × width 0.6 mm. ***Head*:** Face (Fig. 8A) slightly narrowed near middle, covered with dense golden-brown pruinosity; clypeus with less dense golden-brown pruinosity revealing dark metallic blue-green cuticle. Frons with dense golden-brown pruinosity. Palpus ovate, shining black with a few small pale setae. Proboscis shining black. Antenna black; first flagellomere small, oval; arista-like stylus inserted just dorsal of apex. Lower postocular setae pale yellow to white. ***Thorax*:** Scutum dorsally dark metallic green with brown pruinosity that is densest between acrostichal and dorsocentral rows of setae creating two indistinct brown stripes, scutum laterally metallic blue-green with gray pruinosity; setae on thorax light yellow; 8–10 pairs of small biseriate acrostichal setae; only pos-

Figure 7. *Medetera iviei* sp. nov. habitus of male holotype, left lateral. Scale bar: 1.0 mm.

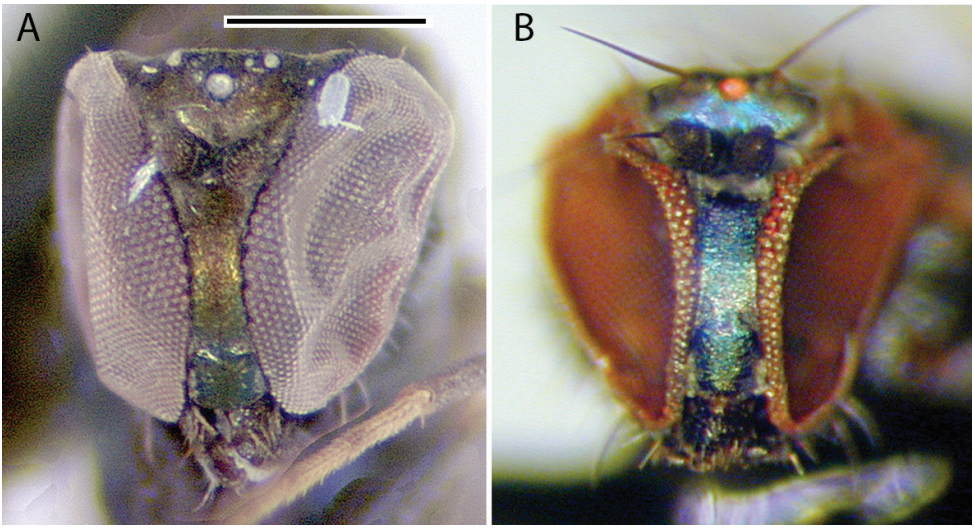

Figure 8. Heads of males, showing color differences of face and frons, anterior views **A** *Medetera iviei* sp. nov. **B** *M. crassicauda* Robinson (Dominica, holotype). Scale bar: 0.5 mm.

terior two pairs of dorsocentral setae noticeably enlarged; scutellum with one pair of large marginal setae and one pair of very small lateral setae. Pleuron dark metallic bluish green with gray pruinosity; with three small whitish setae on lower proepisternum. ***Legs*:** Setae and setulae pale yellow to white except setae on coxa I and lateral setae on coxae II and III light brown. Coxae wholly dark brown. Femora dark brown with tips yellow, legs otherwise yellow. Femora and tibiae I and III without distinct setae. Tibia II with paired dorsal setae near 1/3 (ad seta slightly larger than pd seta), a ventral seta at apex; tibia III with two small black hooked pd spurs at apex subtended by small yellow concavity. Tarsi plain, tarsus II with some black spicules ventrally. Ratios of tibia:tarsomeres: leg I: 24–8–8–6–4–3; leg II: 26–14–12–7–3–2; leg III: 34–7–16–9–5–4. ***Wing*:** Hyaline with brown veins, narrowly oval. R_{2+3} arching slightly backward; R_{4+5} curving more strongly backward than R_{2+3}, approaching and becoming parallel with M near wing tip; crossvein dm-cu ca. two-thirds as long as last part of CuA_1. Calypter white with white setae. Halter stem yellow-brown, knob white. ***Abdomen*:** Dark brown with dark metallic green-blue reflections and slight gray pruinosity, with small yellowish setae. Hypopygium (Figs 7, 9) very large (slightly smaller than remainder of abdomen in right lateral view), fusiform, dark brown to almost black, projecting posteriorly beyond attachment to preabdomen and on a short peduncle formed by tergite VI. Hypopygial foramen left lateral near base. Epandrium dark brown to black, blunt apically, ventrally with large yellow erect seta basal to surstylus and smaller yellow seta basal to larger seta. Ventral lobe of surstylus bilobed, light brown, overlapping corner of epandrium at base, basoventral lobe large, thin, translucent, broadly rounded, and apicodorsal lobe smaller with a couple small lobes at tip and one or two small yellow

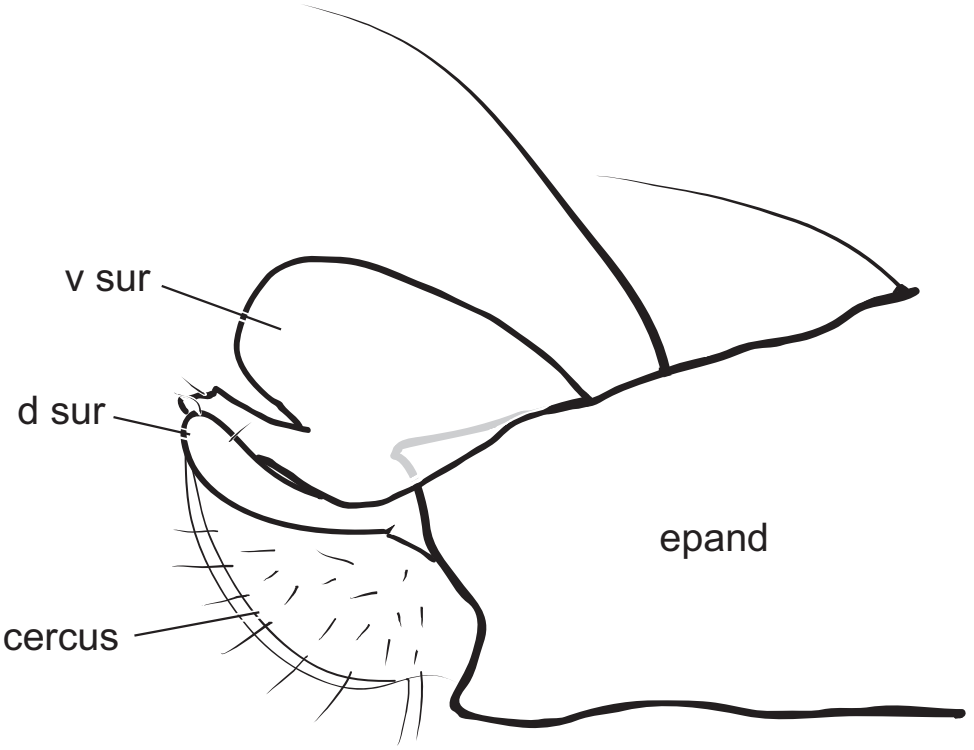

Figure 9. *Medetera iviei* sp. nov. apex of male hypopygium, left lateral. Abbreviations: epand-epandrium; d sur-dorsal lobe of surstylus; v sur-ventral lobe of surstylus. Scale bar: 0.25 mm.

apical hairs. Dorsal lobe of surstylus yellow, spatulate, with a couple small yellow hairs. Cercus brown, evenly rounded dorsally, pointed apically, with thin translucent membrane along dorsal edge, sparsely covered with short pale setae.

Female. Unknown.

Etymology. This species is named for the coleopterist Michael A. Ivie (Montana State University) who led the invertebrate component of the Centre Hills Biodiversity Assessment project (2000–2005) and made this material available for study.

Distribution. Montserrat.

Remarks. *Medetera iviei* is most similar to *M. crassicauda* Robinson to which it keys in Robinson (1975), most notably in males of both possessing an extremely large hypopygial capsule that extends backwards beyond the end of the preabdomen. Males of *M. iviei* differ from those of *M. crassicauda* in the color of the face (Fig. 8) and in the form of the cercus (in *M. iviei* the cercus is pointed apically with length 2.5 × width, in *M. crassicauda* the cercus is blunt apically and nearly square) and the surstylus (in *M. iviei* the surstylus has a wide, thin translucent ventral lobe that is absent in *M. crassicauda*).

***Medetera montserratensis* sp. nov.**
http://zoobank.org/46F07ADF-90AB-46F4-859C-F4A9D1CC6CD2
Figs 10–13

Type material. ***Holotype***, ♂ labelled: "WEST INDIES: MONTSERRAT/ Fogarty Ghaut (Soldiers)/ 16°46.41'N, 62°12.44'W/ 21 June 2017, JB Runyon"; "HOLOTYPE/ ♂ *Medetera*/ *montserratensis*/ Runyon [red label]" (USNM, type number USNMENT01350609). ***Paratypes*: Montserrat:** 1 ♂, 1 ♀, same data as holotype; 10 ♂, Runaway Ghaut, 175 m, 16°45.43'N, 62°12.89'W, 23 June 2017, J.B. Runyon; 1 ♀, Jack Boy Hill (top), 480 m, 16°45.797'N, 62°10.886'W, 25 June 2017, J.B. Runyon (MTEC, USNM).

Description. Male (Fig. 10). Body length 2.7–3.0 mm, wing length 2.5–2.8 × width 1.0–1.1 mm. ***Head*:** Face and frons metallic dark blue-violet to green with little to no pruinosity, clypeus with brown pruinosity. Palpus black, rounded, covered with short brown setae and one larger brown to black seta near apex. Proboscis black with relatively large yellowish setae along margin. Antenna black, scape and pedicel sometimes somewhat yellow-orange ventrally; first flagellomere short, blunt, somewhat compressed laterally; arista-like stylus apical, inserted in slight sinus. Lower postocular setae white to yellow-white. ***Thorax*:** Scutum dark metallic green with distinct violet reflections and slight grayish pruinosity, flattened area of posterior mesonotum reddish-copper; small setae yellow, large setae black; ca. 12 pairs of small yellow biseriate acrostichal setae that are not very distinct from numerous small setae covering anterior half of scutum, posterior-most pair of acrostichal setae diverging slightly; three pairs of large black dorsocentral setae; scutellum with two pairs of large black marginal setae, outer pair 3/4 as long as inner pair. Pleuron dark metallic bluish green with more grayish pruinosity than scutum; with 2–3 small yellow-brown to black setae on lower proepisternum. ***Legs*:** Coxae dark brown with extreme tips becoming yellowish, coxa II often somewhat yellowish laterally; with yellow-brown setae. Legs otherwise yellow. Femora I and II with row of longer yellow-brown pv setae apically; femur II with short yellow ventral setae on basal half; femur III with setae on dorsal half brown, those on ventral half yellow, 2–3 distinct erect yellow-brown setae along middle of anterior surface and many longer erect brown ad setae at base. Tibia I without distinct setae, dorsal setulae brown, ventral setulae yellow; tibia II with setulae yellow to brown, with paired black dorsal setae near 1/3, five small brown apical setae; tibia III with setulae and most larger setae usually yellow, rather small brown ad seta near 1/5 and at apex, 4–5 large usually yellow pd setae. Tarsus I (Fig. 11A) with tarsomere I(2) flattened and broadened apically; tarsomere I(3) slightly longer than wide, rounded apically, concave on anterior surface; tarsomere I(4, 5) very small, combined length less than length of tarsomere I(3); tarsomere III(1) with minute black posterior spicule at base and several distinct small black apical setae. Ratios of tibia:tarsomeres: leg I: 36–20–10–11–2–4; leg II: 48–22–9–8–4–4; leg III: 64–12–24–16–6–5. ***Wing*:** Hyaline, oval, with brown veins. Vein R_{2+3} nearly straight; R_{4+5} curving slightly backwards on apical half of wing, approaching and nearly parallel near apex with M_1 which curves distinctly forward beyond crossvein dm-cu; crossvein dm-cu slightly longer than last part of CuA_1. Calypter

Figure 10. *Medetera montserratensis* sp. nov. habitus of male holotype, left lateral. Scale bar: 1.0 mm.

white with yellow-white setae. Halter knob and stem white. ***Abdomen*:** Stout basally, rather abruptly tapered distally, with yellow setae, metallic green with copper reflections, obscured by little or no pruinosity. Sternites brown with many short pale yellow setae. Hypopygium (Fig. 12) on a peduncle created by segments VI and VII; tergite VI setose; segment VII dark brown with tergite setose, sternite bare and rather flattened ventrally and strongly sclerotized. Hypopygial foramen left basolateral. Sternite VIII relatively large, dark brown, forming a setose cap-like cover over hypopygial foramen. Epandrium elongate oval, 3 × as long as wide, brown dorsally and at base, becoming yellow ventrally, with two small ventral setae near apex. Surstylus yellow, with two large lobes; dorsal lobe with patch of sensilla and three or four small setae at apex; ventral lobe shallowly cordate apically, with large branched seta near 1/2 and finger-like medial lobe near base. Cercus yellow with yellow setae and hairs, rounded dorsally, rather flat ventrally, with small finger-like apical lobe. Phallus simple, narrow with round apex, slightly longer than hypandrium. Hypandrium arising near mid-length of epandrium, and forming hood over phallus, more sclerotized along ventral margin.

Figure 11. Tarsus I of males, posterior view **A** *Medetera montserratensis* sp. nov. **B** *Medetera steyskali* Robinson (Dominica). Scale bar: 0.25 mm.

Female. Body length 3.1–3.2 mm, wing length 2.7–2.8 × width 1.1–1.2 mm. Similar to male, but tarsus I plain with ratios of tarsomeres: 18-10-7-3-4.

Etymology. This species is named for the island of Montserrat.

Distribution. Montserrat.

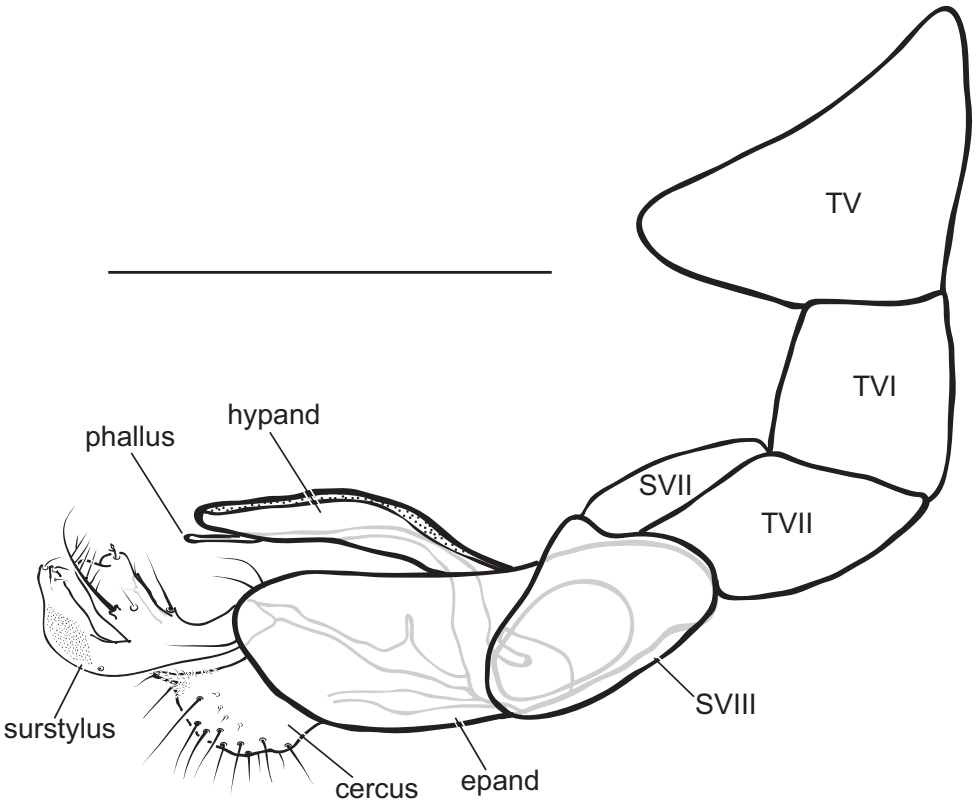

Figure 12. *Medetera montserratensis* sp. nov. male terminalia, left lateral view. Abbreviations: epand-epandrium; hypand-hypandrium; T-tergite; S-sernite. Scale bar: 0.5 mm.

Remarks. *Medetera montserratensis* belongs to the *M. aberrans* species group that is characterized in part by having tarsomeres I (2, 3) flattened and modified (for other group characters see Bickel and Arnaud 2011). The *aberrans* group contains 27 species in the Neotropics (Yang et al. 2006, as *Saccopheronta* Becker), but only *M. montserratensis*, *M. steyskali* Robinson (Dominica), *M. excavata* (Becker) (Bolivia, Peru), and *M. metallina* (Becker) (Peru) have wholly yellow femora (the latter two species have "red-yellow" legs in contrast to the bright yellow legs of *M. montserratensis* and *M. steyskali*). *Medetera montserratensis* and *M. steyskali* both are distinct from *M. excavata* which has an excavated tarsus I(3) (Becker 1922: fig. 55) and *M. metallina* which has black postorbital setae. *Medetera montserratensis* is very similar to *M. steyskali*, and the two are likely sister taxa, but differs in having tarsomeres I (2, 3) broader (Fig. 11) and in small details in the shape of surstylar lobes (e.g., shape of the finger-like medial lobe).

Adults of *Medetera montserratensis* were found on trunks of large palm trees, several times seen occurring in small aggregations of 4–6 individuals that were mostly males (Fig. 13).

Figure 13. *Medetera montserratensis* sp. nov., group of four males on palm trunk in Runaway Ghaut, Montserrat, 23 June 2017. Photograph by Justin Runyon.

Medetera pseudonigripes Robinson

Medetera pseudonigripes Robinson, 1975: 28.

Material examined. Dominica: ***Holotype*** ♂, Clarke Hall, 7 March 1964, H. Robinson (USNM). **Montserrat:** 2 ♂, Cassava Ghaut, Beattie House, 21–30 June 2002, uv light, M.A. Ivie; 1 ♂, same as previous, 6–30 June 2002, A. Krakower; 1 ♂, rental house in Old Town, 16°44.795'N, 62°13.711'W, 19 June 2017, J.B. Runyon. **St. Lucia**: Micoud District, Mamiku Gardens, 10–15 m, 13°52.11'N, 60°54.07'W, 9 May 2009, J.B. Runyon; 5 ♂, 1 ♀, nr. Micoud, trail to Fond Bay, 15 m, 13°49'48"N, 60°53'42"W, 16–22 May 2009, Malaise, S.D. Gaimari & A.R. Cline; 1 ♂, Barre de L'Isle trail, 285 m, 13.93268N, 60.95775W, 18–30 May 2009, Malaise, R.C. Winton & L.L. Ivie (MTEC, USNM).

Distribution. Dominica, Montserrat, St. Lucia.

Remarks. The tibiae in specimens from Montserrat are mostly yellow whereas those from Dominica and St. Lucia are mostly brown, but otherwise appear conspecific. The drawing of male genitalia of *M. pseudonigripes* in Robinson (1975: fig. 25) shows the surstylus pointed, but it is actually narrowly spatulate with tip shallowly concave or notched. This species belongs to the *M. isobellae* species group most notably in having the surstyli fused into expanded apical lobe with modified setae medially (Bickel 1985). *M. pseudonigripes* is very similar to the Nearctic *M. isobellae* Bickel, but the latter species has the surstylus much broader apically with the tip not concave or notched.

Genus *Systenus* Loew

Systenus ladonnae sp. nov.

http://zoobank.org/20575311-14CB-4EC6-A3E8-7F1BE369715F
Figs 14, 15

Type material. ***Holotype***, ♂ labelled: "MONTSERRAT: Cassava/ Ghaut, Beattie House/ 16°45.91'N, 62°12.95W/ 04–23MAR2002, 632 ft./ A. Krakower, Malaise" "HOLOTYPE/ ♂ *Systenus*/ *ladonnae*/ Runyon [red label]" (USNM, type number USNMENT01350610). ***Paratypes***: **Dominica**: 1 ♀, Cabrits National Park, East Cabrits Trail, 15.58564N, 61.47210W, Malaise, 30 May–7 June 2011, M.A. & L.L. Ivie. **Montserrat:** 1 ♂, same data as holotype, 23 March–3 April 2002, uv light, K.A. Marske; 1 ♂, Hill above Hope Ghaut, 16°45.17'N, 62°12.74'W, canopy fogging at dawn, 4 December 2002, 1,051 ft, J. Boatswain & J. Martin. **Nevis:** 1 ♂, Lover's Beach, 17.20451N, 62.60577W, 21 March 2017, Malaise, W. Smithen; 1 ♀, same as previous, 26 April 2017. **St. Kitts:** 1 ♀, Dos d'Ane Pond Trail, 17°20.049'N, 62°48.012'W, Malaise, 31 July–12 August 2017 (MTEC, USNM).

Description. Male (Fig. 14A–C). Body length 2.9 mm, wing length 2.6 × width 0.9 mm. ***Head*:** Face narrowed below but eyes distinctly separated (ca. five ommatidia wide at narrowest point); face and frons dark metallic green with some violet reflec-

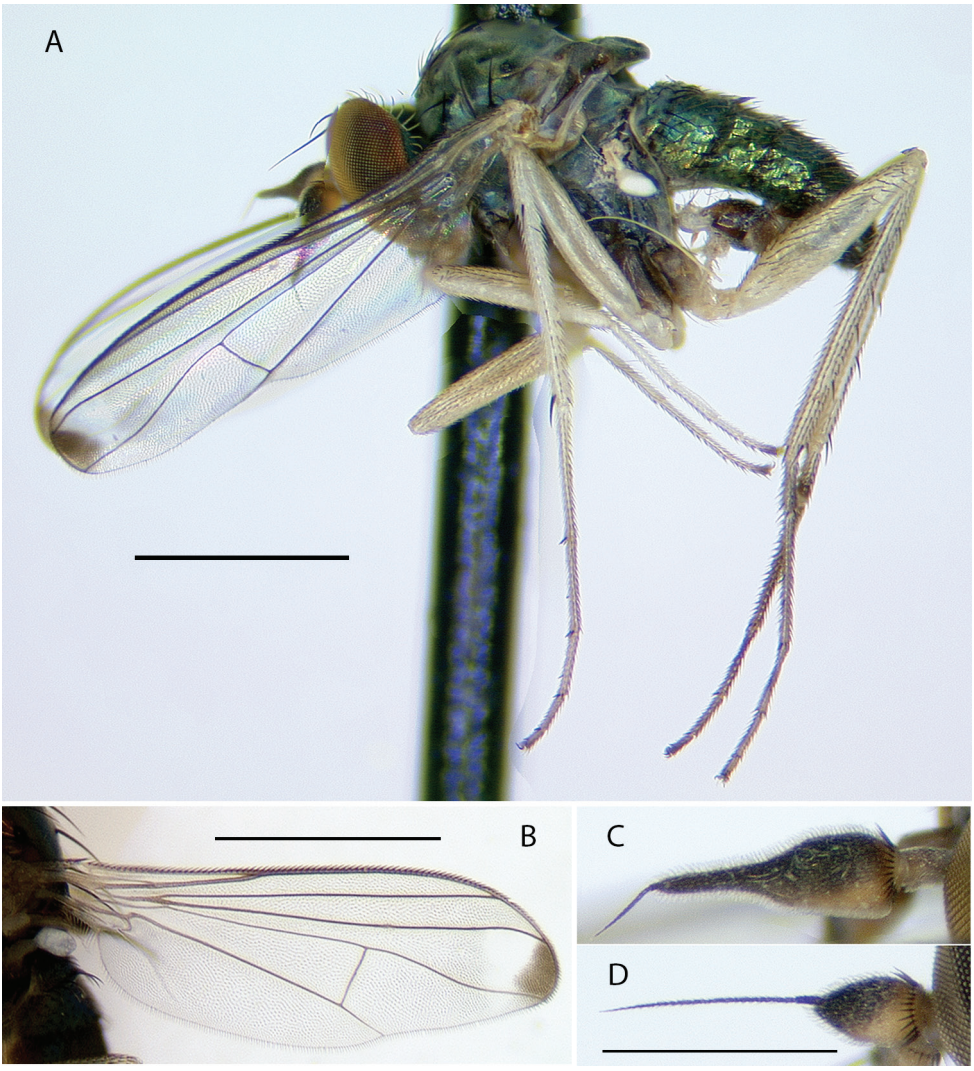

Figure 14. *Systenus ladonnae* sp. nov. **A** habitus of male holotype, left lateral **B** male wing, dorsal **C** male antenna, left lateral **D** female antenna, left lateral. Scale bars: 1.0 mm (**A, B**), 0.5 mm (**C, D**).

tions, covered with thick grayish pruinosity. Palpus yellow with short black setae and one larger seta near apex. Proboscis yellow, keel-like, projecting anteriorly. Antenna (Fig. 14C) with scape and pedicel yellowish, scape without dorsal setae; first flagellomere yellow on approximately basal third below, otherwise brown, subrectangular basally and abruptly narrowed to elongate tapering point in distal half, covered with short thick pubescence; arista-like stylus apical, short, length subequal to basal width of first flagellomere. Postcranium dorsally concave. Postocular setae in a single row, wholly white. ***Thorax*:** Scutum dark metallic green with a bronze stripe between acrostichal setae, covered with rather dense light gray pruinosity; posterior mesonotum distinctly flattened; ca. 12 pairs of biseriate acrostichal setae; six strong dorsocentral setae;

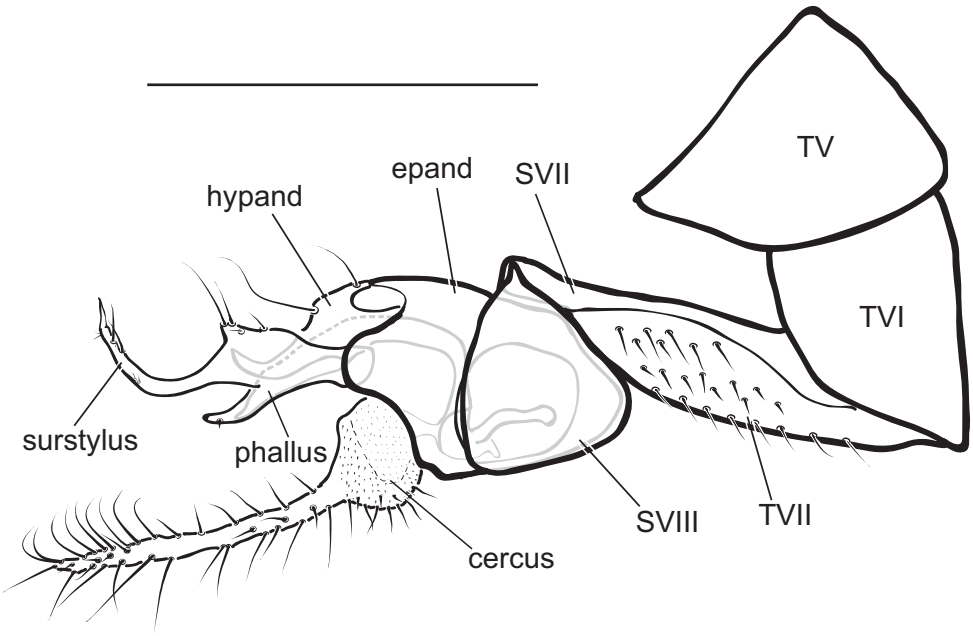

Figure 15. *Systenus ladonnae* sp. nov. male terminalia, left lateral. Abbreviations: epand-epandrium; hypand-hypandrium; T-tergite; S-sernite. Scale bar: 0.5 mm.

scutellum with two pairs of large marginal setae, lateral pair smaller. Pleuron wholly green with dense light grey pruinosity; proepisternum with one strong ventrally projecting white seta above base of coxa I. ***Legs*****:** Coxa I yellow with approximately basal half brown, with yellow setae on anterior surface, those near apex large; coxa II dark brown with yellow anterior setae, without lateral seta; coxa III dark brown with apex becoming yellow, with large yellow ad seta near 1/2. Remainder of legs yellow, except distal tarsomeres brownish. Femora lacking anterior preapical setae; femora II and III with ventral surface appearing fuzzy due to very short yellow microsetulae. Tibiae I and II covered with short ivory-colored vestiture; tibia I bare of major setae; tibia II with black dorsal and ad seta near 1/5, with two black apical setae anteriorly, remainder of apical setae very short; tibia III with 4–5 pd setae scattered along length. Tarsus III covered in short, stiff setulae which are longest ventrally (length subequal to width of tarsomeres). Ratios of tibia:tarsomeres: leg I: 18–8–5–3–2–2; leg II: 22–12–8–5–3–2; leg III: 26–5–12–6–4–3. ***Wing*** (Fig. 14B): Hyaline, but with apical brown maculation between R_{4+5} and M_1 that is immediately preceded by a similar-sized white spot with white microtrichia; vein R_{4+5} nearly straight then bent posteriorly near apex; vein M_1 bowed beyond crossvein dm-cu so that veins R_{4+5} and M_1 diverge and then converge near apex. Calypter yellow with fan of yellow-brown setae. Halter pale yellow. ***Abdomen*****:** Metallic green with bronze reflections and dusting of gray pruinosity; posterior margin of tergite I with row of long brown to black setae, tergites otherwise covered with short brown to black setae. Sternites II–VI membranous or only weakly scle-

rotized, somewhat recessed; sternite VIII forming a setose cap-like cover over hypopygial foramen. Hypopygium (Fig. 15) on an elongate narrow peduncle formed by tergite and sternite VII that are separated by partially sclerotized pleural membrane, sternite VII glabrous, tergite VII setose. Hypopygial foramen left lateral near base. Epandrium dark brown, a little longer than wide. Surstylus yellow, antler-shaped, with rather large dorsal lobe before 1/2, small setae-bearing ventral lobe near 1/2, and long, slender finger-like apical lobe. Cercus yellow, with rounded swollen base, elongate and digitiform distally with many yellow setae. Phallus simple, rather broad throughout and narrowed near apex, arching dorsally on apical half. Hypandrium somewhat wishbone-shaped in ventral view, up curved distally in lateral view, attached to epandrium by a membrane.

Female. Body length 2.7–3.0 mm, wing length 2.5–2.6 × width 0.9–1.0 mm. Similar to male, but face wider (width slightly less than width of first flagellomere); antenna (Fig. 14D) shorter, ovoid with pointed apex; arista-like stylus longer than first flagellomere; wing without maculation, but some specimens with hint of brown clouding at and just behind apex of R_{4+5}.

Etymology. This species is named in honor of LaDonna Ivie (Bozeman, MT) whose hard work and expertise made the Montserrat biodiversity project possible. She ran many traps on Montserrat and the Malaise trap on Dominica that collected the only known specimen of this genus/species from that island.

Distribution. Dominica, Montserrat, Nevis, St. Kitts.

Remarks. This is the first report of the genus *Systenus* in the Lesser Antilles and is the 23rd species described from the New World. *Systenus ladonnae* is similar to *S. maculipennis* Bickel from Costa Rica (Bickel, 2015), but *S. maculipennis* differs most notably in the shape of the wing apex (wing membrane is reduced posteriad of distal vein M in *S. maculipennis*) and in lacking a white spot on wing. *Systenus ladonnae* also resembles the Nearctic *S. apicalis* Wirth which also has a white and black spot near wing apex, but in *S. apicalis* the white spot is apical to the brown spot.

Specimens were collected in dry forests near the coast and low elevation mesic forests.

Genus *Thrypticus* Gerstäcker

Key to the species of *Thrypticus* in Montserrat

1 Abdominal tergite I and often tergite II yellow ..... ***T. abdominalis* (Say)**
– Abdominal tergites wholly metallic green **2**
2 Basal abdominal sternites yellow; male surstylus with 2 very long setae at apex ..... ***T. violaceus* Van Duzee**
– Abdominal sternites dark; male surstylus without 2 exceptionally long apical setae **3**
3 Thorax with 8 or more pairs of acrostichal setae with hindmost offset laterally; male surstylus as long as epandrium ..... ***T. parvulus* Van Duzee**
– Thorax with 5 or 6 (rarely 7) pairs of acrostichal setae in nearly straight rows; hypopygial appendages shorter than epandrium **4**

4 Antenna with scape and pedicel yellow; tarsomeres III(1, 2) of ca. equal length; epandrium tapered from base to appendages, rather pointed apically; hypopygial appendages yellow..... ***T. aequalis* Robinson**

– Antenna wholly brown; tarsus III(1) distinctly shorter than tarsus III(2); epandrium scarcely tapered from base to tip, blunt apically (Fig. 17); hypopygium with median appendage (dorsal lobe of surstylus) brown (Fig. 16B) ..... ***T. mediofuscus* sp. nov.**

Thrypticus abdominalis (Say)

Chrysotus abdominalis Say, 1829–1830: 169.
Xanthotricha cupulifer Aldrich, 1896: 339.

Material examined. Dominica: 1 ♂, Grande Savane, 1 February 1965, W.W. Wirth (USNM); 1 ♂, Springfield Estate, yellow pan, 1–3 June 2011. **Montserrat:** 1 ♂, 1 ♀, Cassava Ghaut, Beattie House, 8–17 April 2002, Malaise trap, A. Krakower; 1 ♀, same as previous, 14–30 June 2002; 1 ♂, 2 ♀, Gun Hill, 2–19 June 2002, Malaise trap, K.A. Marske (MTEC, USNM).

Distribution. *Thrypticus abdominalis* is a widespread species, occurring in central and eastern North America, Central America, and throughout the West Indies.

Thrypticus aequalis Robinson

Thrypticus aequalis Robinson, 1975: 36.

Material examined. Dominica: 2 ♀, Clarke Hall, Malaise trap, 8–10 January 1965, W.W. Wirth (USNM); 1 ♂, 2 ♀, Springfield Estate, yellow pan trap, 1–3 June 2011, M.A. & L.L. Ivie. **Montserrat:** 1 ♀, Bottomless Ghaut, 5 August 2005, yellow pan trap, V.G. Martinson (MTEC).

Distribution. Dominica, Montserrat.

Remarks. The female specimen from Montserrat matches female paratypes (the holotype is a male) and other specimens from Dominica notably by the distinctive structure of the ovipositor (Robinson 1975, fig. 59).

Thrypticus mediofuscus sp. nov.

http://zoobank.org/0E5CEF17-C104-4AC2-A845-D9DE6D680E06
Figs 16, 17

Type material. ***Holotype***, ♂ labelled: "MONTSERRAT:/ Sweetwater Ghaut/ 01 Aug 2005/ Yellow Pan Trap/ V.G. Martinson"; "HOLOTYPE/ ♂ *Thrypticus*/ *mediofuscus*/ Runyon [red label]" (USNM, type number USNMENT01350611). ***Paratypes*:**

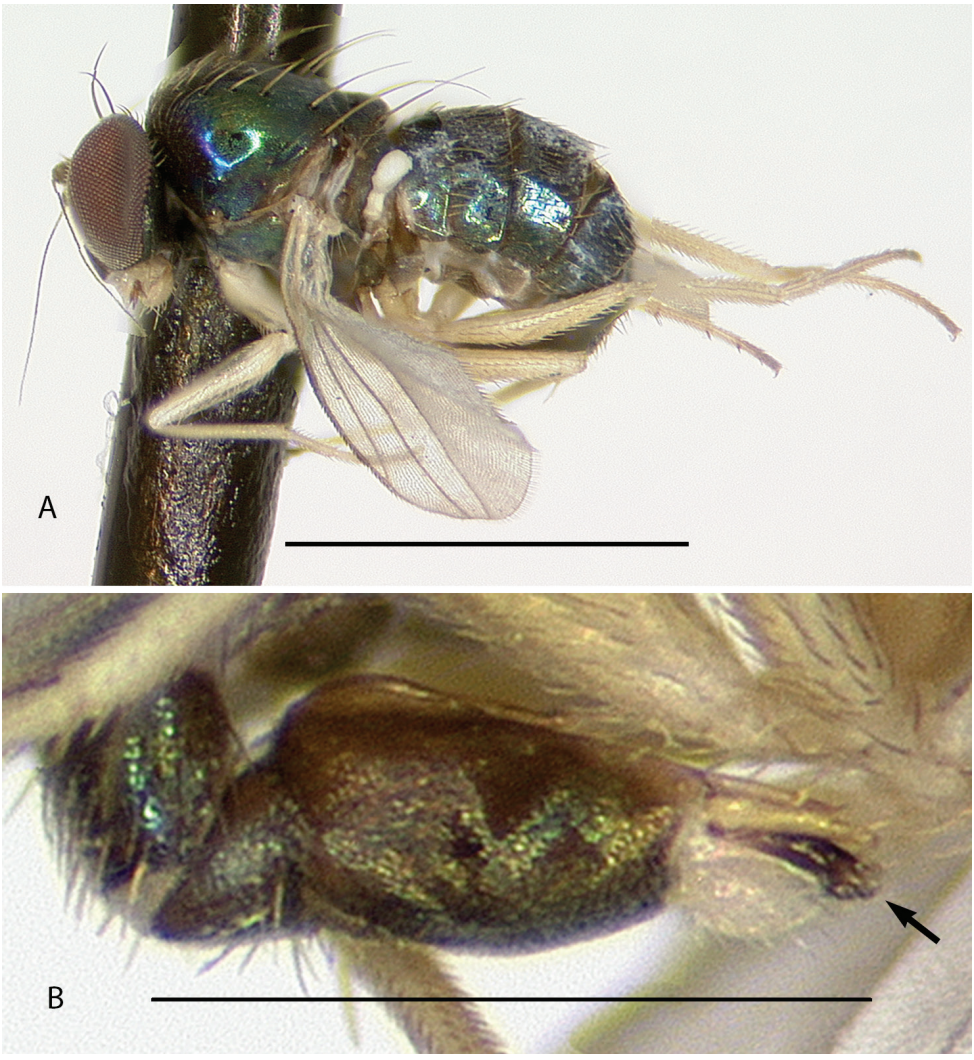

Figure 16. *Thrypticus mediofuscus* sp. nov. **A** habitus of holotype male, left lateral **B** male terminalia, right lateral, arrow indicates darker middle hypopygial appendage (dorsal lobe of surstylus). Scale bars: 1.0 mm (**A**), 0.5 mm (**B**).

Dominica: 3 ♂, Springfield Estate, 1–3 June 2011, yellow pan trap, M.A. & L.L. Ivie; 1 ♂, St. Paul Parish, Springfield Estate, 29 May 2011, FIT with yellow pan, M.A. & L.L. Ivie. **Montserrat:** 1 ♂, rental house in Old Town, 16°44.79'N, 62°13.711'W, 80 m, yellow pan traps, 19 June 2017, J.B. Runyon (MTEC, USNM).

Description. Male (Fig. 16). Body length 1.7 mm, wing length 1.4 × width 0.5 mm. ***Head*:** Face wider than first flagellomere, dark brown with little to no violet reflections and very sparse light brown pruinosity, lower face with denser light brown pruinosity. Frons dark brown with strong violet reflections. Palpus yellow, slender, ovate with larger subapical yellow seta. Proboscis yellow with yellow marginal hairs.

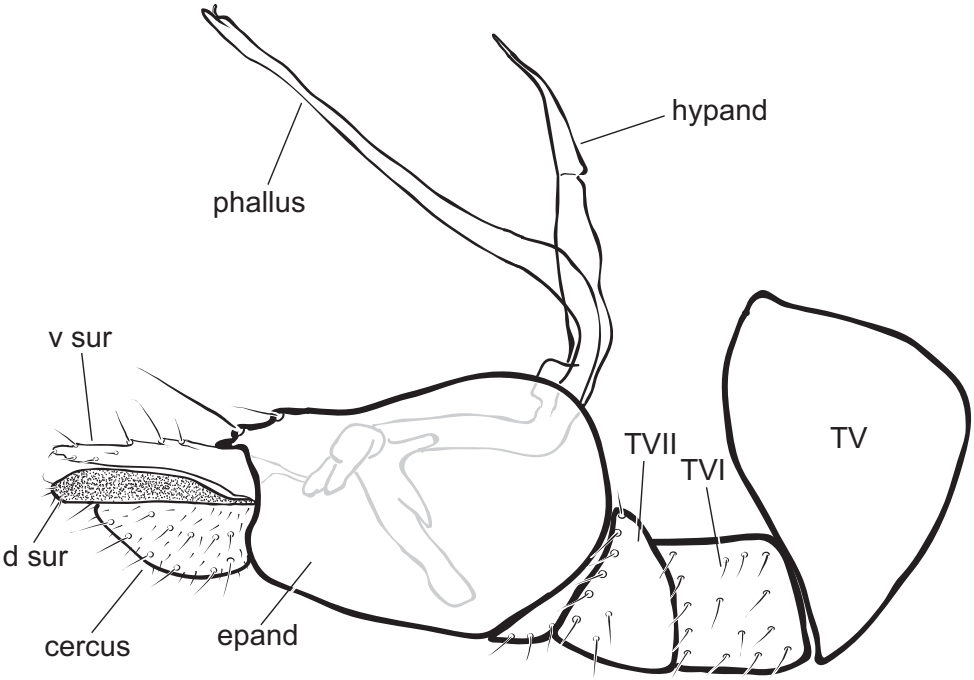

Figure 17. *Thrypticus mediofuscus* sp. nov. male terminalia, left lateral. Abbreviations: epand-epandrium; d sur-dorsal lobe of surstylus; hypand-hypandrium; T-tergite; v sur-ventral lobe of surstylus. Scale bar: 0.25 mm.

Antenna brown, often slightly dark reddish; first flagellomere rounded, very short, only slightly larger than scape; arista-like stylus apical. Lower postocular setae pale yellow to white, ventral-most seta distinctly larger. ***Thorax*:** Scutum dark metallic green with slight grayish pruinosity and strong violet reflections on anterior half; setae yellow to yellow-brown; ca. six pairs of small biseriate acrostichal setae, posterior-most acrostichal setae not distinctly diverging; five or six pairs of dorsocentral setae, posterior four pairs large, increasing in size posteriorly; scutellum with a pair of large marginal setae and minute seta on outer margin. Pleuron concolorous with scutum but more brownish above coxae II and III, without violet reflections; with a yellow seta on lower proepisternum. ***Legs*:** Wholly yellow with yellow to yellow-brown setae. Femur and tibia I without distinctive setae. Tibia II with large distally directed ad seta at 1/3 and ventral seta at apex; tibia III with row of very short erect comb-like setae (length ca. half width of tibia) on apical half dorsally and similar smaller row of such setae ventrally. Tarsomere I(1) with ventral row of very short erect comb-like setae (length < width of tarsomere). Ratios of tibia:tarsomeres: leg I: 18–8–4–3–2–3; leg II: 24–10–6–4–3–2; leg III: 28–6–8–5–3–3. ***Wing*:** Hyaline, oval, with light brown veins. Vein R_{2+3} essentially straight and diverging from R_{4+5} throughout, ending in costa near 4/5 of wing length; R_{4+5} curving slightly backwards on apical half of wing, approaching and subparallel to M_1 near apex, half as far from M_1 at apex than opposite crossvein dm-cu; M_1 essentially straight beyond crossvein dm-cu, ending in wing apex; last part of CuA_1

ca. 3.5 × longer than crossvein dm-cu. Calypter white with yellow-white setae. Halter knob and stem white. ***Abdomen*:** Tergites metallic dark green with slight bluish reflections, obscured by little or no pruinosity, setae yellow. Sternites brown with short pale brown setae. Hypopygium (Figs 16B, 17) on a short peduncle created by segments VI and VII. Epandrium dark brown with some metallic green reflections and sparse grayish pruinosity and two very small ventral lobes near apex each bearing a seta; hypopygial foramen left basolateral. Surstylus and cercus not spreading, forming a compact structure that in ventral view is oval with pointed apex; ventral lobe of surstylus pale yellow, shining, with four rather erect yellow ventral setae spaced along length; dorsal lobe of surstylus shining brown, with small hairs at apex. Cercus pale yellow, evenly rounded dorsally and covered with yellow hairs and two rows of slightly larger yellow setae. Phallus bifurcate at apex, with subquadrate membranous ventral lobe near base. Hypandrium with flexion and indentation near 2/3, caudate and membranous apically.

Female. Unknown.

Etymology. This species is named for the dark middle appendage of the hypopygium (dorsal lobe of surstylus) of the male in lateral view (Fig. 16B).

Distribution. Dominica, Montserrat.

Remarks. In Robinson (1975), *Thrypticus mediofuscus* keys to *T. delicatus* Robinson (holotype examined), but is distinguished by larger body size (1.2 mm in *T. delicatus*), having coxa II wholly yellow (brownish in *T. delicatus*), relative length of tarsomeres I(1, 2) as 2:1 (5:4 in *T. delicatus*) and having dorsal lobe of surstylus dark brown (Figs 16B, 17; hypopygial appendages wholly yellow in *T. delicatus*). *Thrypticus mediofuscus* is the only *Thrypticus* species in the Lesser Antilles with a bicolored surstylus, however, I have seen a related undescribed species from St. Lucia.

All specimens from both Montserrat and Dominica were collected in yellow pan traps.

Thrypticus parvulus Van Duzee

Thrypticus parvulus Van Duzee, 1930a: 86.

Material examined. Montserrat: 1 ♂, 1 ♀, Cassava Ghaut, Beattie House, 14–30 June 2002, Malaise trap, M.A. Ivie; 1 ♀, same as previous, 10–12 January 2002, Ivie, Marske & Puliafico. 1 ♀, Fogarty, 20–22 June 2002, Malaise trap, K.A. Marske (MTEC).

Distribution. Dominica, Montserrat, St. Vincent.

Thrypticus violaceus Van Duzee

Thrypticus violaceus Van Duzee, 1927: 5.
Thrypticus setosus Robinson, 1964: 118.

Material examined. Dominica: 1 ♂, Fond Colet, 5–9 October 1964, P.J. Spangler (USNM) **Montserrat:** 12 ♂, 12 ♀, Woodlands, Riverside House, 10–12 January

2002, Malaise trap, Ivie, Marske & Puliafico; 9 ♂, 4 ♀, same as previous, 5–7 January 2002; 4 ♂, 2 ♀, same as previous, 17–28 July 2005, WIBF group; 2 ♂, 3 ♀, Hope Ghaut, 8–10 January 2002, yellow pan traps, K.A. Marske; 1 ♂, Cassava Ghaut, Beattie House, 14–30 June 2002, Malaise trap, M.A. Ivie; 1 ♀, Gun Hill, 2–19 June 2002, Malaise trap, K.A. Marske (MTEC, USNM); 1 ♀, March 1910 (USNM).

Distribution. North America (Florida, North Carolina, and Texas) and the West Indies (Haiti, Puerto Rico, Dominica, and Montserrat).

Subfamily Achalcinae
Genus *Xanthina* Aldrich

***Xanthina rubromarginata* Robinson**

Xanthina rubromarginata Robinson, 1975: 44.

Material examined. Dominica: 1 ♂, Trafalgar Falls, 15 March 1964, H. Robinson (USNM). **Montserrat:** 3 ♂, 3 ♀, Woodlands, Riverside House, 8–10 January 2002, yellow pan traps, K. Marske & K. Puliafico; 1 ♀, same as previous, 22 July 2005, V.G. Martinson; 1 ♀, Bottomless Ghaut to Big River trail, 14 August 2005, yellow pan traps, V.G. Martinson; 1 ♂, 4 ♀, Cassava Ghaut, 24 July 2005, yellow pan traps, V.G. Martinson; 1 ♂, 1 ♀, Big River, 5 August 2005, yellow pan traps, V.G. Martinson; 1 ♂, Hope Ghaut, 300 m, 16°45.108'N, 62°12.695'W, 20 June 2017, J.B. Runyon; 1 ♂, 2 ♀, Jack Boy Hill (top), 480 m, 16°45.797'N, 62°10.886'W, 25 June 2017, J.B. Runyon; 1 ♂, 2 ♀, ghaut above Montserrat Volcano Observatory, 330 m, 16°45.130'N, 62°12.487'W, 27 June 2017, J.B. Runyon; 1 ♂, Big River, 450 m, 16°45.690'N, 62°11.174'W, 28 June 2017, J.B. Runyon (MTEC, USNM).

Distribution. Dominica, Montserrat.

Remarks. Adults were collected in yellow pan traps and by sweeping moist, deeply shaded ground in mesic forests.

Subfamily Enliniinae
Genus *Enlinia* Aldrich

***Enlinia patellitarsis* Robinson**

Enlinia patellitarsis Robinson, 1975: 48.

Material examined. Dominica: ***Holotype*** ♂, Freshwater Lake, 23 February 1964, H. Robinson (USNM). **Montserrat:** 8 ♂, 4 ♀, Runaway Ghaut, roadside springs, 150 m, 16°45.449'N, 62°13.011'W, 22 June 2017, J.B. Runyon; 14 ♂, 3 ♀, Hope Ghaut, 300 m, 16°45.108'N, 62°12.695'W, 20 June 2017, J.B. Runyon; 4 ♂, 1 ♀, same as previous, 280 m, 16°45.101'N, 62°12.760'W (MTEC, USNM).

Distribution. Dominica, Montserrat.

Remarks. Adults were found hovering closely to nearly vertical rocky surfaces of dripping springs and in a small creek on wet rock surfaces being occasionally splashed by water. Adults were found in similar habitats on Dominica (Robinson 1975: 49).

Genus *Harmstonia* Robinson

Harmstonia simplex Robinson

Harmstonia simplex Robinson, 1967a: 5.

Material examined. Dominica: ***Holotype*** ♂, Clarke Hall, 11–20 February 1965, W.W. Wirth (USNM). **Montserrat:** 2 ♂, 1 ♀, Big River, 5 August 2005, yellow pan traps, V.G. Martinson; 1 ♀, Bottomless Ghaut, 5 August 2005, yellow pan traps, V.G. Martinson; 3 ♂, 3 ♀, Hope Ghaut, 300 m, 16°45.108'N, 62°12.695'W, 20 June 2017, J.B. Runyon; 5 ♂, 5 ♀, same as previous, 280 m, 16°45.101'N, 62°12.760'W; 5 ♀, Runaway Ghaut, roadside springs, 150 m, 16°45.449'N, 62°13.011'W, 22 June 2017, J.B. Runyon; 1 ♂, Runaway Ghaut, 175 m, 16°45.43'N, 62°12.89'W, 23 June 2017, J.B. Runyon; 1 ♂, 1 ♀, Corbett Spring, 300 m, 16°45.012'N, 62°11.184'W, 26 June 2017, J.B. Runyon; 2 ♂, 1 ♀, Fairy Walk River, 260 m, 16°45.162'N, 62°10.854'W, 26 June 2017, J.B. Runyon; 2 ♂, 2 ♀, ghaut above Montserrat Volcano Observatory, 330 m, 16°45.130'N, 62°12.487'W, 27 June 2017, J.B. Runyon; 2 ♂, 1 ♀, Bottomless Ghaut, 400 m, 16°45.994'N, 62°11.497'W, 28 June 2017, J.B. Runyon; 5 ♂, 5 ♀, Big River, 450 m, 16°45.690'N, 62°11.174'W, 28 June 2017, J.B. Runyon (MTEC, USNM).

Distribution. Dominica, Montserrat.

Remarks. This is the only species of *Harmstonia* known from the Lesser Antilles. Adults were found on moist rocks in ghauts, but unlike *Enlinia patellitarsis*, do not require running or splashing water.

Subfamily Peloropeodinae
Genus *Micromorphus* Mik

Micromorphus albipes (Zetterstedt)

Hydrophorus albipes Zetterstedt, 1843: 454.
Achalcus caudatus Aldrich, 1902: 93.
Micromorphus panamensis Van Duzee, 1931a: 180.

Material examined. Dominica: 2 ♂, 29 January 1964, H. Robinson (USNM); 1 ♂, St. Paul Parish, near Pont Casse (trail), Morne Trois Pitons, humid forest, Malaise, 750 m, 16–17 April 2004, M.E. Irwin & B.M. Shepard. **Montserrat:** 1 ♀, Bottomless Ghaut, 5 August 2005, yellow pan traps, V.G. Martinson; 2 ♀, Hope Ghaut, 300 m, 16°45.108'N, 62°12.695'W, 20 June 2017, J.B. Runyon; 1 ♂, 8 ♀, Jack Boy Hill (top), 480 m, 16°45.797'N, 62°10.886'W, 25 June 2017, J.B. Runyon; 1 ♂, 2 ♀,

ghaut above Montserrat Volcano Observatory, 330 m, 16°45.130'N, 62°12.487'W, 27 June 2017, J.B. Runyon; 4 ♂, 2 ♀, Big River, 450 m, 16°45.690'N, 62°11.174'W, 28 June 2017, J.B. Runyon; 1 ♂, Katy Hill (top), 730 m, 16°45.731'N, 62°11.646'W, 28 June 2017, J.B. Runyon (MTEC, USNM).

Distribution. *Micromorphus albipes* is exceptionally widespread being reported from the Nearctic, Neotropics, Oriental, and Palearctic realms (Pollet et al. 2004).

Remarks. Robinson (1975) identified this species in Dominica, and specimens from Montserrat match those from Dominica. However, as noted by Pollet et al. (2004), there is some question about whether Zetterstedt's species is truly so ubiquitous and careful comparison of specimens from each realm is needed. In 2017, adults were obtained by sweeping moist, shaded ground in mesic forests.

Genus *Peloropeodes* Wheeler

Peloropeodes frater (Aldrich)

Sympycnus frater Aldrich, 1902: 83.

Material examined. Dominica: 1 ♂, St. John Parish, Cabrits National Park, East Cabrits Trail, 15.58564N, 61.47210W, 30 May–7 June 2011, Malaise, M.A. & L.L. Ivie. **Montserrat:** 3 ♂, 4 ♀, Hope Ghaut, 300 m, 16°45.108'N, 62°12.695'W, 20 June 2017, J.B. Runyon; 5 ♂, 3 ♀, same as previous, 280 m, 16°45.101'N, 62°12.760'W; 6 ♂, 6 ♀, Runaway Ghaut, roadside springs, 150 m, 16°45.449'N, 62°13.011'W, 22 June 2017, J.B. Runyon; 1 ♂, Runaway Ghaut, 175 m, 16°45.43'N, 62°12.89'W, 23 June 2017, J.B. Runyon; 1 ♂, Bottomless Ghaut, 400 m, 16°45.994'N, 62°11.497'W, 28 June 2017, J.B. Runyon. **St. Lucia:** 2 ♂, 1 ♀, Micoud District, Latille Falls, 50 m, 13°49.94'N, 60°55.14'W, 9 May 2009, J.B. Runyon (MTEC, USNM).

Distribution. Dominica, Grenada, Montserrat, St. Lucia.

Remarks. Males of this species have a distinctive long, usually wavy-tipped ventral seta near base of femur II. There is considerable variation in several characters in male specimens among islands, most notably in the modifications at posterior edge of male abdominal sternite III. Specimens from Dominica have the sclerotized lateral lobes of sternite III narrow, but those from Montserrat are broadly rounded. It seems likely that a *P. frater* species complex exists in the Lesser Antilles, but examination of more specimens from more islands is needed to assess limits of variation.

Subfamily Diaphorinae

Genus *Achradocera* Becker

Achradocera apicalis (Aldrich)

Fig. 18A, C

Chrysotus apicalis Aldrich, 1896: 330.
Achradocera angustifacies Becker, 1922: 207.

Material examined. ***Lectotype*** (designated here to fix identity of the species) ♂, labelled: "St. Vincent/ W. Indies."; "Collection/ JM Aldrich"; "Cotype/ No.50426/ U.S.N.M."; "*Chrysotus*/ *apicalis*/ Type Ald. [hand written]"; "LECTOTYPE/ ♂ *Achradocera*/ *apicalis* (Aldrich)/ des. JB Runyon" [red label] (USNM). **Dominica:** 5 ♂, 2 ♀, Springfield Estate, FIT trap, 29 May 2011, M.A. & L.L. Ivie; 1 ♂, same as previous, Malaise trap, 29 May–1 June 2011; 3 ♂, same as previous, yellow pan traps, 1–3 June 2011. **Montserrat:** 6 ♂, 2 ♀, Woodlands, Riverside House, 10–12 January 2002, Malaise trap, Ivie, Marske & Puliafico; 6 ♂, 1 ♀, same as previous, 5–7 January 2002; 3 ♂, same as previous, 17–28 July 2005, WIBF group; 3 ♂, Hope Ghaut, 8–10 January 2002, yellow pan traps, K.A. Marske; 1 ♂, Cassava Ghaut, Beattie House, 21 January–5 February 2002, Malaise trap, A. Krakower; 2 ♂, same as previous, 24 June 2005, yellow pan traps, V.G. Martinson; 3 ♂, Sweetwater Ghaut, 1 August 2005, yellow pan traps, V.G. Martinson; 3 ♂, Bottomless Ghaut, 5 August 2005, yellow pan traps, V.G. Martinson; 1 ♂, trail to Fairy Walk, 15 August 2005, yellow pan traps, V.G. Martinson; 2 ♂, Cedar Ghaut, 4 August 2005, yellow pan traps, V.G. Martinson; 1 ♂, Big River, 5 August 2005, yellow pan traps, V.G. Martinson. **Nevis:** 5 ♂, Camps River Ghaut, 17°11.36'N, 62°34.66'W, 25 May 2017, J.B. Runyon; 3 ♂, small pond, 200 m, 17°07.460'N, 62°35.584'W, 26 May 2017, J.B. Runyon; 1 ♂, The Source trail, 400–550 m, 17°08.76'N, 62°34.31'W, 26 May 2017, J.B. Runyon. **St. Lucia:** 6 ♂, 2 ♀, Escap Community, small stream in dry forest, 45 m, 13°49.92'N, 60°53.91'W, 2–3 May 2009, J.B. Runyon; 5 ♂, Savannes, Mangrove Reserve, 0–5 m, 13°45.97'N, 60°54.88'W, 3 May 2009, J.B. Runyon; 1 ♂, 1 ♀, trail, dry forest, 45 m, 13°49.9'N, 60°53.9'W, 6 May 2009, J.B. Runyon; 2 ♂, 1 ♀, Doree River ravine, 220 m, 13°47.962'N, 61°01.100'W, 7 May 2009, J.B. Runyon; 1 ♂, Fond Bay near beach, 13°49.89'N, 60°53.65'W, 8 May 2009, J.B. Runyon (MTEC, USNM).

Distribution. Widespread in the West Indies, also reported from Mexico, Ecuador, Chile, and has recently dispersed (probably via accidental human introduction) to French Polynesia and Tonga (Bickel 2000).

Remarks. Aldrich (1902) synonymized *Achradocera apicalis* (Aldrich) with *A. barbata* (Loew), primarily due to the distinctive femoral coloration of both species. Robinson (1975) considered *A. apicalis* distinct by the much shorter antenna of the male. Bickel (2000) followed Aldrich (1902) and treated *A. apicalis* and *A. barbata* as synonyms, based again in part on femoral coloration and variation in male antennal length. However, comparison of photos of the holotype of *A. barbata* (MCZ) and specimens from North America (Alabama, Florida, Georgia, Indiana, Kentucky, Missouri, New York, Pennsylvania, Texas, South Carolina, Virginia) with *A. apicalis* from the West Indies (Dominica, Montserrat, Nevis, St. Lucia, St. Vincent) reveals that these species are distinct, most notably in the form of the male front tarsus and genitalia (Fig. 18). The *A. barbata* type and male specimens from North America all have a distinct series of ventral setae on tarsus I (Fig. 18B) whereas specimens from the West Indies (including syntypes from St. Vincent) lack these setae (Fig. 18A). The surstylus and phallus are also very different, with *A. barbata* having the surstylus enlarged and rounded apically and phallus dorsally serrate (Fig. 18D; Bickel 2000: fig. 1a) but in *A. apicalis* the surtylus is smaller and pointed apically and the phallus is not serrate (Fig. 18C; Bickel

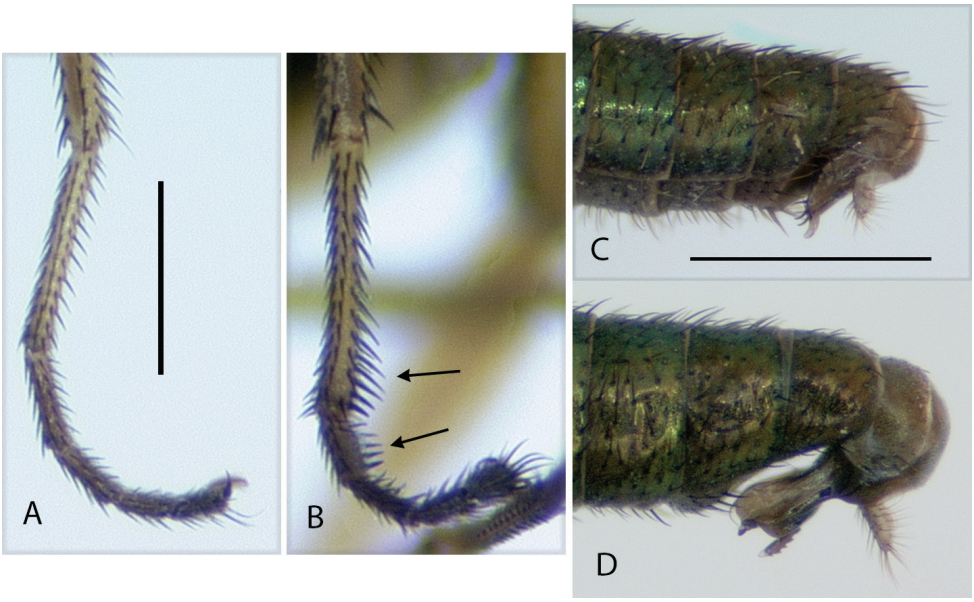

Figure 18. Tarsus I and terminalia of males **A** *Achradocera apicalis* (Aldrich), tarsus I, posterior view (Montserrat) **B** *Achradocera barbata* (Loew), tarsus I, posterior view (Kentucky, USA), arrows indicate ventral setae **C** *Achradocera apicalis*, tip of abdomen, left lateral (Montserrat) **D** *Achradocera barbata*, tip of abdomen, left lateral (Florida, USA). Scale bars: 0.25 mm (**A, B**), 0.5 mm (**C, D**).

2000: fig. 1e as *A. barbata*). The antennal length in males of *A. apicalis* is highly variable, as noted by Bickel (2000), but in all available specimens is distinctly shorter than the antenna in males of *A. barbata.* Therefore, *A. apicalis* (Aldrich) is here removed from synonymy with *A. barbata* (Loew). The species described in Bickel (2000) as *A. barbata* is *A. apicalis*.

Genus *Asyndetus* Loew

Key to the species of *Asyndetus* in Montserrat

1 Tibiae I and II dark brown to black usually with distinct metallic green reflections; tibia III with ≥12 large setae (excluding apicals); vein R_1 reaching over half distance to tip of R_{2+3}; body size > 3.5 mm (usually 4.0–6.0 mm); usually associated with crab holes ..... ***A. interruptus* (Loew)**

– Tibiae I and II usually yellow (sometimes brownish), with little or no distinct metallic green coloration; tibia III with <8 distinct relatively small setae (excluding apicals); vein R_1 not reaching quite half distance to tip of R_{2+3}; body size usually < 3.0 mm..... ***A. fratellus* Aldrich**

***Asyndetus interruptus* (Loew)**

Diaphorus interruptus Loew, 1861: 37.
Asyndetus interruptus Loew, 1869: 37.
Asyndetus bredini Robinson, 1975: 68.
Asyndetus wirthi Robinson, 1997: 479, syn. nov.

Material examined. Belize: 2 ♂, 5 ♀, Stann Creek District, beach at Hopkins, 0–2 m, 16°51.16'N, 88°16.73'W, 23 April 2015, JB Runyon; 10 ♂, 3 ♀, same as previous, 18 March 2019. **British Virgin Islands:** 1 ♂, Prickly Pear Island, 18°30.18'N, 64°22.00'W, 3 November 2016, JB Runyon. **Montserrat:** 20 ♂, 8 ♀, Woodlands Beach, 16°45.75'N, 62°13.42'W, 20 June 2017, J.B. Runyon; 1 ♂, 2 ♀, Old Road Bay (beach), 16°44.623'N, 62°14.035'W, 22 June 2017, J.B. Runyon; 2 ♂, Fox's Bay Beach, 16°43.59'N, 62°14.17'W, 24 June 2017, J.B. Runyon; 1 ♀, Rendezvous Bay Beach, 16°48.489'N, 62°12.296'W, 23 June 2017, J.B. Runyon; 2 ♀, Rendezvous Bay, 26 July 2005, yellow pan trap, V.G. Martinson. **Nevis:** 7 ♂, Winward Beach, 17°06.96'N, 62°32.91'W, 28 May 2017, J.B. Runyon. **St. Kitts:** 3 ♂, Majors Bay, 17°13.62'N, 62°38.91'W, 2 June 2017, J.B. Runyon; 9 ♂, 4 ♀, North Friar's Bay, 17°16.59'N, 62°40.33'W, 24 May 2017, J.B. Runyon. **St. Lucia:** 5 ♂, 3 ♀, Savannes, Mangrove Reserve, 0–5 m, 13°45.97'N, 60°54.88'W, 3 May 2009, J.B. Runyon; 3 ♂, Micoud District, Fond Bay at beach, 0–5 m, 13°49.89'N, 60°53.65'W, 8 May 2009, J.B. Runyon (MTEC, USNM).

Distribution. Widespread, can be found on beaches in the southeastern United States (Florida), Central America (Belize), Ecuador (Galápagos Islands), and the West Indies (Antigua, British Virgin Islands, Cuba, Dominica, Jamaica, Montserrat, Nevis, St. Kitts, St. Lucia).

Remarks. Initially, I thought both *A. interruptus* and *A. wirthi* Robinson, very similar species (Robinson and Deyrup 1997), were represented in material from Montserrat. Specimens of *A. interruptus* show a wide range of intraspecific variability as discussed by Bickel and Sinclair (1997). The large series from Woodlands Beach shows a gradation in characters used by Robinson and Deyrup (1997) to distinguish *A. interruptus* and *A. wirthi* (e.g., relative length to width of face, shape of antenna, presence of coppery median band between rows of dorsocentral setae). Dissection and examination of male genitalia of *interruptus*-morphotype and *wirthi*-morphotype specimens from Woodlands Beach reveal no obvious differences and both match the illustration in Bickel and Sinclair (1997). Thus, *A. wirthi* is considered a synonym of *A. interruptus*.

Asyndetus interruptus adults were seen mostly on open sand almost always near crab holes and most specimens were obtained by quickly placing a net over crab holes to catch adults as they promptly flew out. This species was re-described and illustrated by Bickel and Sinclair (1997).

***Asyndetus fratellus* Aldrich**
Fig. 19

Asyndetus fratellus Aldrich, 1896: 332.

Material examined. ***Lectotype*** (designated here to fix identity of the species) ♂, St. Vincent, W. Indies, Collection J.M. Aldrich, *Asyndetus fratellus* Type Ald., "LECTOTYPE/ ♂ *Asyndetus*/ *fratellus* Aldrich/ des. JB Runyon" [red label] (USNM, specimen number USNMENT01519227). **British Virgin Islands:** 1 ♂, 1 ♀, Guana Island, sand pit Malaise, 15–21 October 2001, B. & B. Valentine; 3 ♀, same as previous, Malaise, 23–25 October 2000; 1 ♂, same as previous, East end, white beach, 2–10 October 2002, R.R. Snelling; 4 ♂, 2 ♀, Eustatia Island, Main Beach, pan traps, 18°30.59'N, 64°21.41'W, 31 October 2016, J.B. Runyon; 2 ♂, 2 ♀, same as previous, Baby Beach, 18°30.63'N, 64°21.57'W, 28–30 October 2016; Prickly Pear Island, salt pond edge, pan traps, 18°30.18'N, 64°21.99'W, 3 November 2016, J.B. Runyon; 7 ♂, 2 ♀, Virgin Gorda, Bitter End Yacht Club, sandy ground near beach, 18°30.13'N, 64°21.30'W, 8–10 November 2016, J.B. Runyon. **Montserrat:** 1 ♂, Woodlands Beach, 16°45.75'N, 62°13.42'W, 21 June 2017, J.B. Runyon; 4 ♂, 6 ♀, Old Road Bay (beach), 16°44.623'N, 62°14.035'W, 22 June 2017, J.B. Runyon; 2 ♂, 2 ♀, Fox's Bay Beach, 16°43.59'N, 62°14.17'W, 24 June 2017, J.B. Runyon; 1 ♀, Rendezvous Bay Beach, 16°48.489'N, 62°12.296'W, 23 June 2017, J.B. Runyon; 1 ♀, Rendezvous Bay, 26 July 2005, yellow pan trap, V.G. Martinson. **Nevis:** 14 ♂, 17 ♀, Winward Beach, 17°06.96'N, 62°32.91'W, 28 May 2017, J.B. Runyon. **Puerto Rico:** 2 ♂, 5 ♀, Culebra, Flamenco Beach, 27 December 2001, M. Huben. **St. Kitts:** 4 ♂, 3♀, Majors Bay, on *Ipomoea*, 17°13.624'N, 62°38.908'W, 21 May 2017, J.B. Runyon; 1 ♂, 2 ♀, North Friar's Bay, 17°16.59'N, 62°40.33'W, 24 May 2017, J.B. Runyon; 1 ♂, South Frigate Bay, 17°16.869'N, 62°41.201'W, 24 May 2017, J.B. Runyon. **St. Lucia:** 18 ♂, 26 ♀, Savannes, Mangrove Reserve, 0–5 m, 13°45.97'N, 60°54.88'W, 3 May 2009, J.B. Runyon; 5 ♂, 5 ♀, Micoud District, Fond Bay at beach, 0–5 m, 13°49.89'N, 60°53.65'W, 8 May 2009, J.B. Runyon (MTEC, USNM).

Re-description, based on material from Montserrat. Male. Body length 2.2–2.7 mm (body size of some specimens from St. Kitts and Nevis approach 3.5 mm), wing length 1.7–2.1 × width 0.7–1.0 mm. ***Head*:** Face as wide as frons, parallel-sided, slightly higher than wide, covered with dense white pruinosity that obscures ground color. Frons with dense grayish white pruinosity, obscuring ground color; vertical setae proclinate. Palpus black with sparse white pruinosity, with black setae, a couple larger setae near apex. Proboscis black. Antenna black; pedicel somewhat produced above and on sides; first flagellomere short, wider than long, rounded apically; arista-like stylus inserted near middle of dorsal edge. Lower postocular setae white. ***Thorax*:** Scutum dark metallic green-blue with dense white pruinosity, with distinct band of coppery brown pruinosity between dorsocentral rows becoming slightly broader posteriorly and ending at scutellum and coppery brown pruinose area above wing bases; 1–6 pairs of irregularly biseriate acrostichal setae, often missing on anterior half of scutum; five pairs of dorsocentral setae; scutellum with one pair of large marginal setae and one pair of small lateral setae. Pleuron dark metallic bluish green with dense grayish white pruinosity; with two small black

Figure 19. Lectotype male of *Asyndetus fratellus* (St. Vincent), left lateral (specimen number USNMENT01519227). Scale bar: 1.0 mm. Photo taken by Alyssa Seemann (USNM).

setae on lower proepisternum and one or two small black setae on upper proepisternum. ***Legs*:** Hairs and setae mostly black. Coxae concolorous with pleuron; coxae I and II with black setae anteriorly; coxa III with black lateral seta near base and small brown lateral seta near 2/3. Femora dark brown to black with extreme tips yellow, with av and pv rows of longer rather slender dark setae ventrally (longest ca. half width of femur) that can ap-

pear yellowish in certain lights, and with a few stouter av and pv setae near apex; femora II and III also with slightly larger anterior setae near apex. Tibiae I and II yellow (some specimens from British Virgin Islands, Puerto Rico, St. Lucia, and St. Vincent have tibia I and/or II varying degrees of brown), tibia II usually brownish at very base, tibia III brown but sometimes yellowish basally; tibia I with small area of close-set pale setulae av on apical half, with small setae, an ad seta near 1/3, pd seta near 1/3, 1/2, near apex and apical ad, posterior, and pv seta; tibia II with large ad seta near 1/5 and 3/5, large pd seta just before 1/5, 1/2, near 3/5, smaller ventral seta near 3/5, and 3–4 large apical setae, the ventral one largest; tibia III with large setae, ad seta at 1/5, just beyond 1/2 and sometimes smaller seta near 2/5, with five or six pv small setae of varying lengths rather evenly spaced along length of tibia, no ventral setae, four apical setae the dorsal seta largest. Tarsomeres I(1) and II(1) with apex brown, tarsi otherwise dark brown; tarsomere 5 of each leg with apical fan of small black dorsal setae. Tarsomere I(5) slightly broadened. Tarsal claws absent, pulvilli white and enlarged on all legs. Ratios of tibia:tarsomeres: leg I: 32–14–8–6–4–5; leg II: 40–18–10–7–4–5; leg III: 45–13–12–9–6–5. ***Wing*:** Hyaline but with slight whitish sheen and brown veins, oblong-elliptical with prominent anal lobe. Veins R_{2+3} and R_{4+5} rather close together, subparallel but slightly diverging apically, both joining costa before wing apex; R_{4+5} nearly straight to scarcely bent backwards at apex. Distal section of M free and offset from basal section (rarely these sections are indistinctly connected via a thin trace of vein M; basal and distal sections of M overlap in a few female specimens from St. Kitts and Nevis). Crossvein dm-cu placed near basal 1/3 of wing length, ca. one-seventh as long as last part of CuA_1. Calypter white with white setae. Halter stem yellow-brown and knob white. ***Abdomen*:** Cylindrical, dark metallic green (some specimens with distinct copper reflections) obscured by grayish white pruinosity that is thickest laterally. Tergites covered with numerous small black setae that are longer laterally and along distal margins; tergite VI mostly to completely hidden, bare. Sternites with sparse but rather long setae that can appear brownish. Sternite VIII with four short but stout setae projecting posteriorly from apex of preabdomen. Hypopygium small, dark brown, enclosed in tip of abdomen. Epandrium dark brown, nearly round. Surstylus bilobed; dorsal lobe shining dark brown, as long as epandrium, narrow, broadest basally with slightly expanded apex, with distinct dorsal seta near 2/3 (and sometimes a second smaller neighboring seta) and minute hairs apically; ventral lobe of surstylus half as long as dorsal lobe, subtriangular, with distinct seta at apex subtended by one or two smaller setae and medially near base with a papilla bearing a seta. Cercus dark brown, small, nearly round, covered with small black setae of nearly uniform length.

Female. Body length 2.6–2.9 mm, wing length 2.1–2.4 × width 0.8–1.1 mm. Similar to male, but face slightly wider; clypeus distinct, bulging slightly; femora II and III without longer ventral setae but av row on femur I distinct; tibia III often yellowish on basal half; each tarsomere 5 without fan of black dorsal setae; pulvilli small; short distinct claws present.

Distribution. British Virgin Islands, Grenada, Jamaica, Montserrat, Nevis, Puerto Rico, St. Kitts, St. Lucia, St. Vincent.

Remarks. All specimens from Montserrat have yellow tibiae I and II, and because of this I at first suspected these represented an undescribed species. The only other spe-

cies of *Asyndetus* known from the West Indies reported to have tibiae I and II yellow is *A. syntormoides* Wheeler which has an enlarged first flagellomere and vein M delicate but complete throughout (Wheeler 1899: figs 50–52). However, examination of material from Puerto Rico to St. Lucia (see Material examined) reveals the color of tibiae I and II varies from yellow to dark brown. Specimens from islands north of Montserrat generally have tibia I yellow with tibia II often yellow but frequently brown (a few specimens also have tibia I brown), but specimens southward usually have all tibia brownish, including the lectotype from St. Vincent (Fig. 19; a few specimens from St. Lucia have tibia I yellow). Other characters are variable including body size (2.0–3.5 mm), number/extent of acrostichal setae, and size of ventral setae on femora II and III. I can find no characters to reliably distinguish these specimens, and thus consider them conspecific, and interpret *A. fratellus* as a littoral species widespread in the West Indies. However, a revision of this genus in the Neotropics is needed. Two species similar to *A. fratellus* were described from Dominica (*A. dominicensis* Robinson) and Puerto Rico (*A. deficiens* Robinson) that might prove conspecific. Outside the West Indies, *A. currani* Van Duzee (Panama, photos of holotype examined) is very similar and might also prove conspecific, but the holotype has ventral hairs on femora more yellowish and wing with R_{4+5} slightly more bent backwards at apex.

Many adults of *A. fratellus* were collected from leaves of beach morning glory (*Ipomoea pes-caprae*).

Genus *Chrysotus* Meigen

Key to the species of *Chrysotus* in Montserrat (males)

1 First flagellomere broad, 2–3 × as wide as pedicel, with base projecting above base of pedicel (as in Fig. 27), which is distinctly produced on inner side ... **2**

– First flagellomere scarcely broader than pedicel, which is not distinctly longer on inner side ... **5**

2 Tarsus III(1) with conspicuous ventral seta near 1/2 .... ***C. spinipes* Van Duzee**

– Tarsus III(1) without conspicuous ventral seta ... **3**

3 Tarsus III(2) prolonged posteriorly in spur overlapping tarsus III(3) (Fig. 28B) ... ***C. montserratensis* sp. nov.**

– Tarsus III(2) without spur-like projection ... **4**

4 First flagellomere with deep rectangular apical notch where arista-like stylus is inserted; tibiae wholly yellow; halter knob yellow ..... ***C. proximus* Aldrich**

– First flagellomere only slightly depressed where arista-like stylus is inserted; tibiae II and III brownish; halter knob brown ..... ***C. integer* Robinson**

5 Male face broad, eyes not contiguous below antennae ... **6**

– Male face obliterated or nearly so by contiguous eyes ... **11**

6 Tergite VI bare except 1 distolateral seta at lower margin; males with tarsal claws absent on all legs ... **7**

– Tergite VI covered with numerous setae; males with all legs with at least 1 claw ... **8**

7 Male frons as wide as face, dorsal ommatidia not enlarged (Fig. 25C); ad seta near base of tibia II large (length > width of tibia)..... ***C. parvulus*** **(Aldrich)**

– Male frons narrower than face, dorsal ommatidia noticeably enlarged (Fig. 25B); ad seta near base of tibia II small (length < width of tibia)..... ***C. interfrons*** **sp. nov.**

8 Abdomen deep bluish violet; males with all legs with only 1 claw; epandrium with bulbous basodorsal protuberance (Fig. 23) **9**

– Abdomen metallic green to bronze or brown; males with 2 claws on leg III; epandrium evenly rounded basally and dorsally **10**

9 Halter knob brown; setae on the thorax, legs, abdomen, and calypter dark brown to black; sheath of phallus with 1 large apical spine..... ***C. callichromus*** **Robinson**

– Halter knob white; setae on the thorax, legs, abdomen, and calypter mostly white to pale brown; sheath of phallus with 3 large apical spines (Fig. 23) .... ***C. callichromoides*** **sp. nov.**

10 Eyes broadly separated above antennae; palpus yellow..... ***C. angustifrons*** **(Robinson)**

– Eyes contiguous above antennae; palpus mostly brown.... ***C. spectabilis*** **(Loew)**

11 Coxa I half or more yellow..... **12**

– Coxa I mostly to wholly brown to black **16**

12 Palpus yellow, narrow, very long (length subequal to head height); first flagellomere yellow..... ***C. xiphostoma*** **Robinson**

– Palpus short; first flagellomere brown..... **13**

13 First flagellomere prolonged into slender tip bearing numerous long hairs; pleuron yellow ..... ***C. microtatus*** **Meuffels & Grootaert**

– First flagellomere short, not or scarcely longer than wide; pleuron dark **14**

14 Scape and pedicel yellow; coxa I with rather long yellow setae; femur III yellow and with 2 erect ventral setae at base ..... ***C. brevicornis*** **Van Duzee**

– Antenna wholly brown; coxa I with brown to black setae; femur III with apical half partly to wholly brown and without distinct ventral setae at base **15**

15 Palpus yellow, exserted, elongate oval, bare except for a strong seta at apex; tibia and tarsus III with many long, erect setae covering anterior surface; hypopygium enlarged, abdomen not tapering..... ***C. hirsutus*** **Aldrich**

– Palpus yellow, small and partly hidden, covered with several small setae; tibia and tarsus III without unusual setae; hypopygium small, abdomen noticeably tapering ..... ***C. antillensis*** **sp. nov.**

16 First flagellomere triangular and prolonged (length ca. 2.5 × basal width) with apex deeply cleft and arista-like stylus inserted between 2 narrow projections, the ventral longer; tibia I whitish-yellow with white setae posteriorly; halter knob brown ..... ***C. acutus*** **Aldrich**

– First flagellomere not prolonged or cleft apically; tibia I without white setae posteriorly; halter knob yellow or brown..... **17**

17 Palpus rounded, white; wing veins R_{4+5} and M_1 slightly diverging distally; male abdomen stout, broadened to tip; cercus prominent **18**

– Palpus black; wing veins R_{4+5} and M_1 parallel to slightly convergent distally; male abdomen gradually tapered; cercus small **19**

18 Wing vein M_1 straight distally; cercus narrowly oval bearing only slender setae..... ***C. mediocaudatus* Robinson**

– Wing vein M_1 curving backward near tip; cercus broad, rather appressed, sclerotized and bearing 2 or 3 stout apical setae.... ***C. lamellicaudatus* Robinson**

19 Legs wholly brown to black; tibia II with small ad seta, without pd setae; wing with crossvein dm-cu two-thirds as long as last part of CuA_1; mesoscutum with dense black pruinosity; female face slightly narrowed below..... ..... ***C. orichalceus* Gosseries**

– Legs partly yellow or white; tibia II with large ad seta, and usually with 2 small pd setae; wing with crossvein dm-cu half as long as last part of CuA_1; mesoscutum without black pruinosity; female face parallel-sided **20**

20 Femora mostly dark brown with dark setae; female with lower postocular setae pale..... ***C. pseudoniger* Robinson**

– Femora yellow with femur III partly brown, with many white setae; female with lower postocular setae mostly dark ..... ***C. albihirtipes* Robinson**

Chrysotus acutus Aldrich

Chrysotus acutus Aldrich, 1896: 329.

Material examined. Montserrat: 3 ♂, Bottomless Ghaut to Big River trail, 14 August 2005, yellow pan traps, V.G. Martinson; 1 ♂, Big River, 5 August 2005, yellow pan traps, V.G. Martinson; 2 ♂, ghaut above Montserrat Volcano Observatory, 330 m, 16°45.130'N, 62°12.487'W, 27 June 2017, J.B. Runyon (MTEC, USNM). **St. Vincent:** Syntype ♂ (USNM).

Distribution. Lesser Antilles (Dominica, Montserrat, St. Vincent). Reports of this species in Central America are probably incorrect (Robinson 1975).

Chrysotus albihirtipes Robinson

Chrysotus albihirtipes Robinson, 1975: 90.

Material examined. Dominica: ***Holotype*** ♂, Boeri Lake trail, 22 February 1964, H. Robinson (USNM). **Montserrat:** 1 ♂, Runaway Ghaut, 175 m, 16°45.43'N, 62°12.89'W, 23 June 2017, J.B. Runyon (MTEC).

Distribution. Dominica, Montserrat.

***Chrysotus angustifrons* (Robinson)**

Diaphorus angustifrons Robinson, 1975: 93.
Dubious angustifrons (Robinson) [unwarranted combination by Wei 2012: 611].

Material examined. Dominica: 1 ♂, Springfield Estate, yellow pans, 1–3 June 2011, M.A. & L.L. Ivie. **Montserrat:** 2 ♂, 2 ♀, Fox's Bay Beach, 16°43.59'N, 62°14.17'W, 23 June 2017, J.B. Runyon (MTEC, USNM).

Distribution. Dominica, Montserrat.

Remarks. This species was transferred to *Chrysotus* and re-described and illustrated by Capellari and Amorim (2010). Wei (2012) proposed placement of this species in a new genus, *Dubius* Wei, but this appears to be unwarranted as discussed by Capellari and Amorim (2014).

***Chrysotus antillensis* sp. nov.**
http://zoobank.org/5B0B8171-7B2F-4BC0-9F16-04047BFDB5F0
Figs 20, 21

Type material. ***Holotype***, ♂ labelled: "DOMINCA: St. John Par./ Cabrits N.P. (Malaise)/ East Cabrits Trail/ 15.58564N, 61.47210W/ 30MAY–07JUNE 2011/ M.A. & L.L. Ivie"; "HOLOTYPE/ ♂ *Chrysotus*/ *antillensis*/ Runyon [red label]" (USNM, type number USNMENT01350612). ***Paratypes*:** 41 ♂, 1 ♀, same data as holotype. **Montserrat:** 1 ♂, Woodlands, Riverside House, 10–12 January 2002, Malaise trap, Ivie, Marske, Puliafico**. Nevis**: 6 ♂, 2 ♀, Recreation ground, 134 m, 17°07.507'N, 62°34.446'W, 31 August 2017, fogging; 1 ♂, St. John Parish, small pond, 200 m, 17°07.460'N, 62°35.584'W, 26 May 2017, J.B. Runyon. **St. Lucia:** 5 ♂, 2 ♀, near Micoud, trail to Fond Bay, 15 m, 13°49'48"N, 60°53'42"W, 16–22 May 2009, Malaise trap, S.D. Gaimari & A.R. Cline; 1 ♂, Grande Anse, 38 m, 14.00519N, 60.89737W, Malaise trap, 13–23 May 2009, R. Winton & E. Ivie; 1 ♂, Grande Anse, 14.00529N, 60.89737W, FIT, 23–26 May 2009, C.A. Maier & R.C. Winton (MTEC, USNM).

Other material examined. British Virgin Islands: 1 ♂, 9 ♀, Tortola, 425 m, 18°25.35'N, 64°38.67'W, 6 November 2016, J.B. Runyon; 1 ♀, Eustatia Island, Baby Beach, 18°30.64'N, 64°21.57'W, 28 October 2016, J.B. Runyon; 1 ♂, 1 ♀, Guana Island, sand pit Malaise, 15–21 October 2001, B. & B. Valentine.

Description. Male (Fig. 20A). Body length 1.9–2.1 mm, wing length 1.6–1.7 × width 0.6–0.7 mm. ***Head*:** Eyes contiguous below, with anterior ommatidia enlarged; upper face narrowly triangular, metallic green with dense light brown pruinosity. Frons metallic green-blue with sparse light brown pruinosity and minor bronze reflections. Postcranium with dense light brown pruinosity. Palpus small, oval, yellow, covered with minute yellow hairs and a pale brown to black dorsal subapical seta. Proboscis dark yellow to brown with fine pale to brown hairs along margin. Antenna (Fig. 20B) black; scape rather long, cylindrical; pedicel shorter than scape, with apical ring of small setae, and a larger apical seta dorsally; first flagellomere subtriangular, rounded

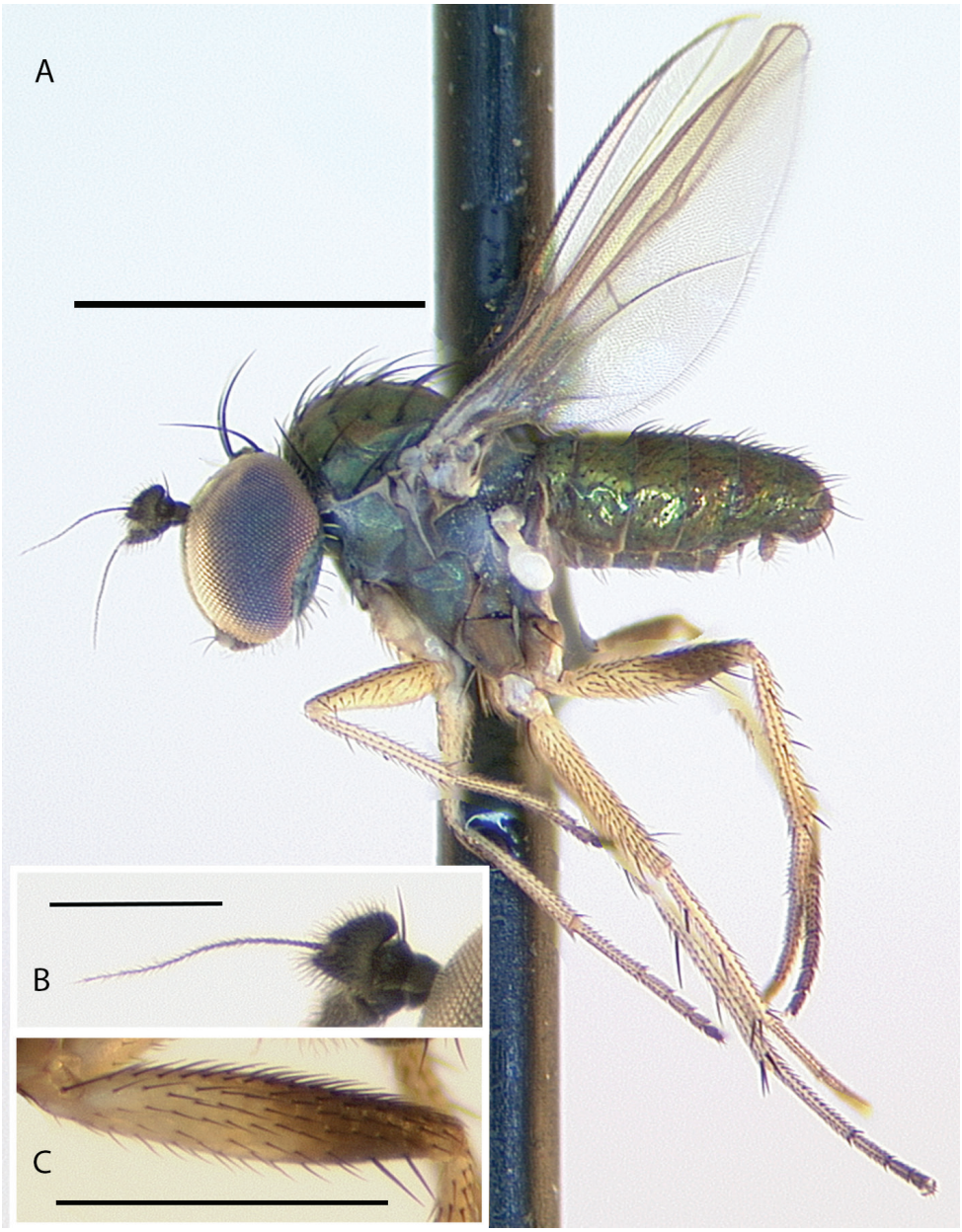

Figure 20. *Chrysotus antillensis* sp. nov., male **A** habitus of male holotype, left lateral **B** antenna, left lateral **C** femur III, anterior. Scale bars: 1.0 mm (**A**), 0.25 mm (**B**), 0.5 mm (**C**).

dorsally at base and overlapping pedicel, width subequal to length; arista-like stylus subapical, inserted just lateral and dorsal to apex in a small notch. Postocular setae white. ***Thorax*:** Scutum and scutellum metallic green with strong bronze reflections and sparse light brown pruinosity; postpronotal lobe with a small yellow spot at lateral corner; eight pairs of small biseriate acrostichal setae; six pairs of dorsocentral setae, an-

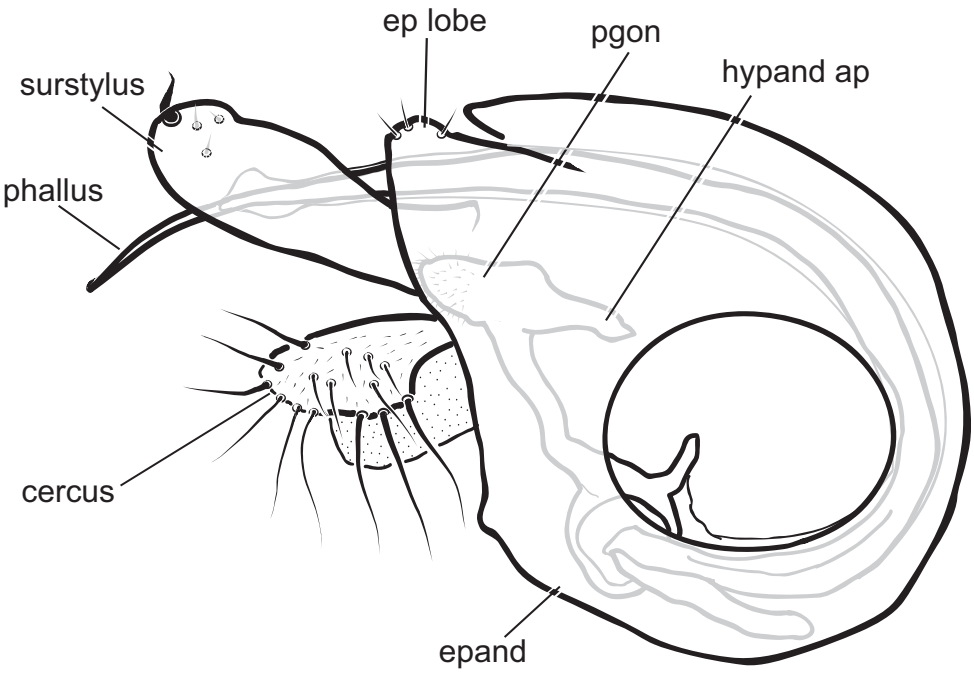

Figure 21. *Chrysotus antillensis* sp. nov. male terminalia, left lateral. Abbreviations: epand-epandrium; ep lobe-epandrial lobe; hypand ap-hypandrial apodeme; pgon-postgonite. Scale bar: 0.1 mm.

terior-most pair small; scutellum with one pair of large marginal setae and one pair of small lateral setae. Pleuron metallic bluish green with dense gray pruinosity; one or two pale brown setae on lower proepisternum. ***Legs*:** Coxa I yellow but usually brownish at very base, with yellow-brown to black setae; coxae II and III nearly concolorous with pleuron but with brown tinge and yellow tips, with pale brown to brown setae. Femora yellow except femur III (Fig. 20C) brown on approximately apical one-third with tip narrowly yellow and with 2–3 distinct av setae near tip; femur II with preapical av and pv seta. Tibia I yellow with small ad seta at 1/4; tibia II yellow with large ad seta near 1/5 and usually a smaller ad seta at 1/2, small pv seta just before 1/5 and 1/2, and with apical ring of four or five setae; tibia III yellow with ad seta at 1/5 and 1/2, a subapical dorsal seta, with pv seta near 1/5, 2/5, 1/2, and 4/5. Tarsi yellow, distal tarsomeres becoming brown, with small claws and very small pulvilli. Ratios of tibia:tarsomeres: leg I: 22–12–5–4–3–4; leg II: 28–13–6–5–3–3; leg III: 34–10–8–5–3–3. ***Wing*:** Hyaline, oblong-elliptical, relatively narrow with poorly developed anal lobe. Vein R_{4+5} and M_1 nearly straight but very slightly diverging near apex. Crossvein dm-cu placed near 2/5 of wing length, ca. one-fourth as long as last part of CuA_1. Calypter white with white to pale-brown setae. Halter stem and knob yellow. ***Abdomen*:** Cylindrical, gradually tapering, with hairs and setae black. Tergites dark metallic green with bronze reflections and little to no pruinosity; tergite VI with numerous small setae. Sternite

VIII covering hypopygial foramen, with small setae. Hypopygium (Fig. 21) small, partially embedded in tip of abdomen. Hypopygial foramen left lateral. Epandrium dark brown, rounded with distal margin rather flattened, with broad ventroapical lobe bearing three small setae. Surstylus paddle-shaped, shining brown, with three small medial setae near apex and a larger medial black spine-like seta at apex. Cercus brown, triangular with ventral margin rather straight, with brown hairs and setae. Phallus narrow with rounded, very slightly broadened apex; encircled by external membranous sheath that has small wing-like inflations before apex of phallus. Postgonites covered with microtrichia apically. Hypandrial apodemes short, rather pointed apically in lateral view.

Female. Body length 2.1–2.3 mm, wing length 1.9–2.0 × width 0.8–0.9 mm. Similar to male, but face wide (>half width of frons at ocellus) and nearly parallel-sided, covered with dense light gray-brown pruinosity; clypeus distinct, bulging at suture; frons metallic blue-green to violet with very sparse light brown pruinosity; palpi larger, yellow with base brown, covered with yellow microtrichia and a few small brown to black setae; scape short, subequal in length to pedicel; first flagellomere shorter, reniform; abdomen broader, slightly flattened dorsoventrally; wing noticeably broader.

Etymology. This species is named for the Greater and Lesser Antilles.

Distribution. British Virgin Islands, Dominica, Montserrat, Nevis, St. Lucia.

Remarks. The combination of hind femur color and shape of the male first flagellomere of *C. antillensis* is distinctive (Fig. 20). Females are very similar to those of *C. hirsutus* Aldrich, but females of *C. antillensis* have two or three small but distinct ventral setae on tibia III (no outstanding ventral setae in *C. hirsutus*). Given the number of specimens collected in Dominica in 2011, it is perhaps surprising that *C. antillensis* was not discovered during the Bredin-Archbold-Smihsonian survey of Dominica (Robinson 1975). However, four species found on Montserrat that were not included in Robinson (1975) are herein reported from Dominica (*Chrysotus antillensis*, *C. callichromoides*, *Systenus ladonnae*, and *Thrypticus mediofuscus*). These four species appear largely restricted to dry forests at lower elevations, suggesting that this habitat type may not have received adequate attention during the Dominica survey.

Chrysotus brevicornis Van Duzee

Chrysotus brevicornis Van Duzee, 1933b: 68.
Chrysotus brevispina Van Duzee, 1933b: 68.
Chrysotus latifacies Van Duzee, 1933b: 69.
Chrysotus mexicanus Robinson, 1967b: 120.

Material examined. Dominica: 3 ♂, Springfield Estate, FIT, 29 May 2011, M.A. & L.L. Ivie. **Mexico:** ***Holotype*** ♂ of *Chysotus mexicanus*, Veracruz, km 375, rt. 180, 7 August 1962, H. Robinson (USNM). **Montserrat:** 29 ♂, 24 ♀, Woodlands, Riverside House, 10–12 January 2002, Malaise trap, Ivie, Marske, Puliafico; 8 ♂, 4 ♀, same as previous, 5–7 January 2002; 3 ♂, Hope Ghaut, 8–10 January 2002, yellow pan traps, K.A. Marske; 1 ♂, Bottomless Ghaut, 5 August 2005, yellow pan traps, V.G. Martin-

son; 1 ♂, Underwood Ghaut, canopy fogging at dawn, 23 May 2002, K. Marske & J. Boatswain; 8 ♂, 3 ♀, Fox's Bay Beach, 16°43.59'N, 62°14.17'W, 23 June 2017, J.B. Runyon; 4 ♂, 1 ♀, rental house in Old Town, 16°44.795'N, 62°13.711'W, 19 June 2017, J.B. Runyon (MTEC, USNM).

Distribution. Widespread in the Neotropics, from Mexico to Brazil and throughout the West Indies, and the Galápagos Islands.

Remarks. This species was re-described and illustrated by Bickel and Sinclair (1997). Robinson (1975) treated this species as *C. mexicanus*.

***Chrysotus callichromoides* sp. nov.**
http://zoobank.org/406317D4-9363-4C91-BABB-68D1D6518D18
Figs 22, 23

Type material. ***Holotype***, ♂ labelled: "MONTSERRAT: Woodlands/ Riverside House, 140 ft/ 16°45.985'N, 62°13.341'W/ 10–12JAN2002, Malaise/ Ivie, Marske, Puliafico"; "HOLOTYPE/ ♂ *Chrysotus*/ *callichromoides*/ Runyon [red label]" (USNM, type number USNMENT01350613). ***Paratypes*: Montserrat:** 2 ♂, 2 ♀, same data as holotype; 1 ♂, same as previous, 5–7 January 2002; 2 ♂, same as previous, 10–13 January 2002, at light; 8 ♂, Cassava Ghaut, Beattie House, 632 ft, 16°45.91'N, 62°12.95'W, 8–17 April 2002, Malaise, A. Krakower; 2 ♂, 1 ♀, same as previous, 17 April–1 May 2002; 1 ♂, same as previous, 17–30 May 2002; 4 ♂, same as previous, 6–12 June 2002; uv light; 10 ♂, 10 ♀, same as previous, 21–30 June 2002, M.A. Ivie; 5 ♂, 7 ♀, same as previous, 14–30 June 2002, Malaise; 5 ♂, same as previous, 24 June 2005, yellow pans, V.G. Martinson; 1 ♂, Rendezvous Bay, 26–31 July 2005, uv light, WIBF group; 1 ♂, Cedar Ghaut, 26–31 July 2005, yellow pans, V.G. Martinson; 1 ♂, Bottomless Ghaut, 5 August 2005, yellow pans, V.G. Martinson; 1 ♂, Old Town, 16°44.795'N, 62°13.711'W, 19 June 2017, J.B. Runyon.

Other material examined. Dominica: 4 ♂, 1 ♀, St. John Parish, Cabrits National Park, East Cabrits Trail, 15.58564°N, 61.47210°W, 30 May–7 June 2011, Malaise, M.A. & L.L. Ivie. **Nevis**: 1 ♂, Camps watershed, 17.18972N. 62.57740W, 70 m, Malaise; 1 ♂, same as previous, yellow pans, 25 May 2017, J.B. Runyon; 4 ♂, Recreation ground, 134 m, 17°07.507'N, 62°34.446'W, 31 August 2017, fogging; 2 ♂, Pinney's Estate, 22 m, 17°08'54.7"N, 62°37'15.8"W, 20 June 2017, fogging. **St. Kitts**: 2 ♂, Majors Bay, 15 m, 17.22713N, 62.65183W, 20 February–3 March 2017, Malaise. **St. Lucia**: 5 ♂, 1 ♀, Micoud District, Escap community, 13°49.92'N, 60°53.91'W, 2–7 May 2009, yellow pans, J. Runyon & C. Delphia; 2 ♂, 1 ♀, Micoud District, trail in dry forest, 45 m, 13°49.9'N, 60°53.9'W, 6 May 2009, J.B. Runyon; 7 ♂, 7 ♀, near Micoud, trail to Fond Bay, 15 m, 13°49'48"N, 60°53'42"W, 16–22 May 2009, Malaise and blacklight trap, S.D. Gaimari & A.R. Cline (MTEC, USNM).

Description. Male (Fig. 22). Body length 2.2–2.6 mm, wing length 2.0–2.5 × width 0.8–1.1 mm. ***Head*:** Eyes not contiguous below; face only slightly narrowed, at narrowest one-third width of frons at ocelli; face and frons metallic green-blue with yel-

Figure 22. *Chrysotus callichromoides* sp. nov. habitus of male holotype, left lateral. Scale bar: 1.0 mm.

low-brown pruinosity that is denser along eyes. Palpus black, oval and broadly pointed apically, with sparse silver pruinosity and ca. six yellow-brown to black setae. Proboscis dark brown with fine hairs along margin. Antenna black; first flagellomere short, width ca. 1.5 × length, lower posterior margin rather flat and dorsal margin rounded, slightly receding; arista-like stylus nearly apical, with small pointed projection below insertion. Lower postocular setae white. ***Thorax*:** Scutum and scutellum metallic green with distinct violet reflections and sparse light brown pruinosity; setae on scutum pale brown; six pairs of small biseriate acrostichal setae; six pairs of dorsocentral setae, anterior-most pair small; scutellum with one pair of large marginal setae and one pair of small lateral setae. Pleuron metallic bluish green with sparse gray pruinosity; one or two white setae on lower proepisternum. ***Legs*:** Coxae dark brown with metallic blue-green reflections and white setae. Femora dark brown with metallic blue-green reflections with yellow apex and yellow to pale brown hairs and setae, with a few small av and pv setae near

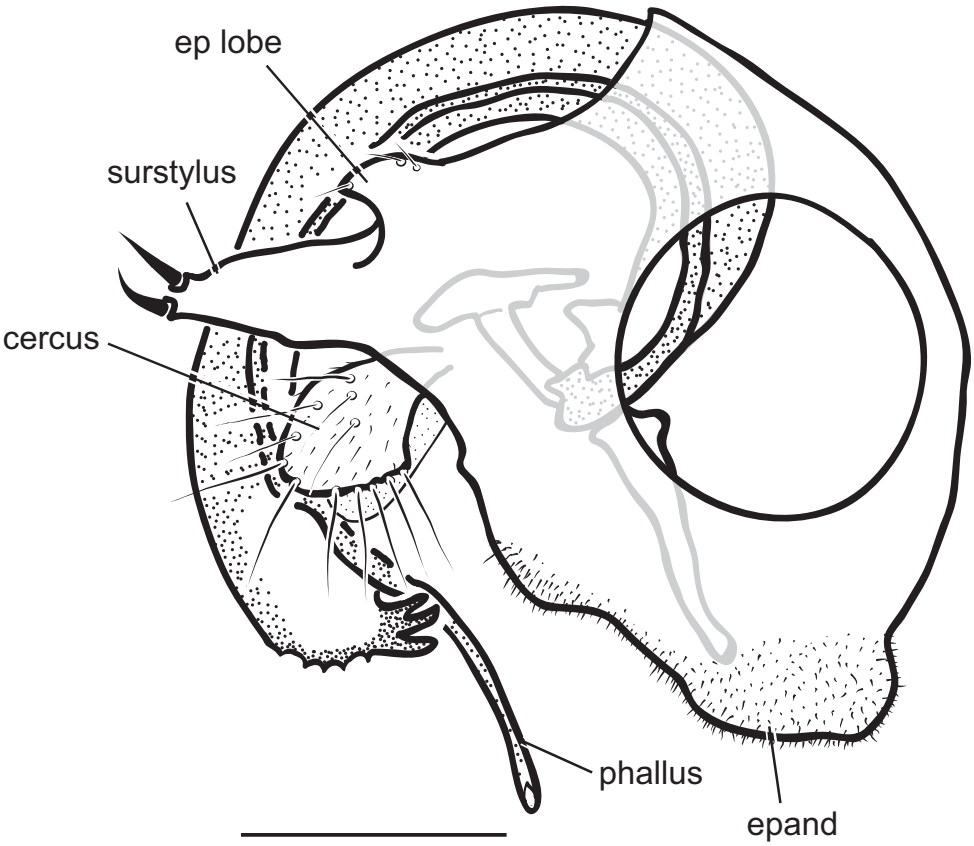

Figure 23. *Chrysotus callichromoides* sp. nov. male terminalia, left lateral. Abbreviations: epand-epandrium; ep lobe-epandrial lobe. Scale bar: 0.1 mm.

tips; femur II with four or five small posterior setae on apical one-third. Tibiae yellow with most setae and hairs pale brown; tibia I without distinctive setae; tibia II without distinctive setae except two large ventral setae at apex; tibia III with ad seta near 1/4, smaller pd seta near 1/4, 1/2, and near apex (specimens from St. Lucia usually have another pd seta near 2/5). Tarsi yellow, distal tarsomeres becoming brown, with tarsomere 5 slightly broadened; pulvilli white and slightly enlarged (subequal in size to tarsomere 5), and each leg with just one tarsal claw; tarsomeres I (2–4) ventrally with white pile. Ratios of tibia:tarsomeres: leg I: 25–18–8–6–3–4; leg II: 36–20–9–6–3–4; leg III: 44–16–9–6–4–4. ***Wing*:** Hyaline, oblong-elliptical. Costa slightly more thickened than usual between R_1 and R_{4+5}. Vein R_{4+5} nearly straight. Vein M_1 curving slightly backwards near apex. Crossvein dm-cu ca. two-thirds as long as last part of CuA_1. Calypter yellow with white to pale-brown setae. Halter knob white, stem brownish at base. ***Abdomen*:** Broadly cylindrical, gradually tapering, with hairs and setae pale brown to brown. Tergites dark metallic violet (especially in dorsal view), lateral margins and sternites bluish

green; marginal setae only slightly larger; tergite VI with numerous small setae. Sternite VIII with small setae, covering hypopygial foramen. Hypopygium (Fig. 23) small, dark brown to black, positioned in ventral notch at tip of abdomen. Hypopygial foramen left lateral. Epandrium dark brown, rather deeply emarginated apicoventrally, with triangular ventroapical lobe bearing three small setae; basodorsally with bulbous protuberance that is densely covered with minute hairs. Surstylus elongate, shining brown, with two strong spines at apex. Cercus brown, ovoid with apex somewhat pointed and narrowed at base, with rather dense whitish to pale brown hairs and setae. Phallus simple, narrow, strongly arched, strongly sclerotized but less so near rounded apex; with sheath rather broad throughout, broadened near apex with 4–5 small dorsal teeth along dorsal margin and three black apical spines arching ventrally to overlap phallus, strongly sclerotized except membranous subapically in middle of expanded area.

Female. Body length 2.2–2.6 mm, wing length 2.0–2.4 × width 0.8–1.0 mm. Similar to male, but face less narrowed below with narrowest width two-thirds width of frons at ocelli; clypeus distinct, bulging at suture; first flagellomere with less prominent point below insertion of arista-like stylus; thorax and abdomen dark green with bronze reflections, not violet; femur I usually more yellow at tip; tibia II with large ad seta near 1/5; tarsi with tarsomere 5 not broadened, pulvilli not enlarged, with two tarsal claws; wing with thickening of costa less pronounced.

Etymology. This species is named for its similarity and presumed relatedness to *C. callichromus* Robinson.

Distribution. Dominica, Montserrat, Nevis, St. Kitts, St. Lucia.

Remarks. *Chrysotus callichromoides* differs most noticeably from *C. callichromus* in having a white halter knob and white to pale brown setae on the thorax, legs, abdomen, and calypter (each of these has dark brown to black setae in *C. callichromus*). The male genitalia of these two species are very similar, but the phallus sheath in *C. callichromus* has only one apical black spine (three in *C. callichromoides*). The habitat also seems to differ, with *C. callichromoides* mostly found in low elevation dry forests and *C. callichromus* in moist ghauts in mesic forests. *Chrysotus morrisoni* Van Duzee (Virgin Islands) (holotype examined) is also related but differs in the scutum having dense brownish pruinosity (mostly obscuring cuticle) with only very slight violet reflections.

Chrysotus callichromus Robinson

Chrysotus callichromus Robinson, 1975: 79.

Material examined. Dominica: ***Holotype*** ♂, Clarke Hall, light trap, 21–28 February 1965, W.W. Wirth (USNM). **Montserrat:** 3 ♂, ghaut above Montserrat Volcano Observatory, 330 m, 16°45.130'N, 62°12.487'W, 27 June 2017, J.B. Runyon (MTEC, USNM).

Distribution. Dominica, Montserrat.

Chrysotus hirsutus Aldrich

Chrysotus hirsutus Aldrich, 1896: 328.

Material examined. Dominica: 4 ♂, 4 ♀, Cabrits National Park, East Cabrits Trail, 15.58564N, 61.47210W, Malaise, 30 May–7 June 2011, M.A. & L.L. Ivie. **Montserrat:** 19 ♂, 12 ♀, Woodlands, Riverside House, 10–12 January 2002, Malaise trap, Ivie, Marske, Puliafico; 3 ♂, 2 ♀, same as previous, 5–7 January 2002; 2 ♂, Cassava Ghaut, Beattie House, 14–21 January 2002, Malaise trap, A. Krakower; 1 ♂, same as previous, 18 March–4 April 2002; 1 ♀, same as previous, 21–30 June 2002, UV light, M.A. Ivie; 1 ♂, Hope Ghaut, 8–10 January 2002, yellow pan traps, K.A. Marske; 1 ♂, Bottomless Ghaut, 5 August 2005, yellow pan traps, V.G. Martinson; 2 ♂, trail to Fairy Walk, 15 August 2005, yellow pan traps, V.G. Martinson (MTEC, USNM). **St. Vincent:** Syntype ♂ (USNM).

Distribution. Widespread in the New World tropics.

Chrysotus interfrons sp. nov.

http://zoobank.org/BA1E88D1-F0B5-4F72-B2DA-462C39498D26
Figs 24–26

Type material. ***Holotype***, ♂ labelled: "MONTSERRAT:/ Cedar Ghaut/ 04AUG2005, V. G./ Martinson, D. Hughley/ Yellow Pan Trap"; "HOLOTYPE/ ♂ *Chrysotus*/ *interfrons*/ Runyon [red label]" (USNM, type number USNMENT01350615). ***Paratypes*: Montserrat:** 1 ♂, Woodlands, Riverside House, 5–7 January 2002, Malaise trap, Ivie, Marske & Puliafico; 2 ♂, 1 ♀, Hope Ghaut, 8–10 January 2002, yellow pan trap, K.A. Marske; 1 ♂, Cassava Ghaut, 877 ft, 16°45.75'N, 62°12.47'W, fogging at dawn, K. Marske & J. Boatswain; 1 ♂, Beattie House, 21–30 June 2002, uv light, M.A. Ivie; 2 ♂, Fogarty Ghaut (Soldiers), 16°46.41'N, 62°12.44'W, 21 June 2017, J.B. Runyon; 1 ♂, Runaway Ghaut, 175 m, 16°45.43'N, 62°12.89'W, 23 June 2017, J.B. Runyon; 1 ♂, Fairy Walk River, 260 m, 16°45.162'N, 62°10.854'W, 26 June 2017, J.B. Runyon (MTEC, USNM).

Description. Male (Fig. 24). Body length 2.7–2.8 mm, wing length 2.2–2.3 × width 0.9–1.1 mm. ***Head*:** Face recessed, ca. 1.5 × as high as wide, nearly rectangular but very slightly narrowed below middle, ca. 3 × as wide as frons, metallic green cuticle almost completely obscured by yellowish white pruinosity. Frons (Fig. 25B) narrowed above with narrowest width subequal to width of anterior ocellus, dark metallic green mostly obscured by white to yellowish white pruinosity. Palpus narrowly oval, pale yellow with a few small black setae. Proboscis dark yellow, with very fine brown hairs along margin. Antenna brown-yellow; first flagellomere small, truncated-triangular, two-thirds as long as high; arista-like stylus arising from median-apical sinus. Postocular setae pale yellow, uppermost four or five becoming brown; ventral postcranium with ca. four pale yellow setae per side that are longer than postocular setae. ***Thorax*:** Scutum and scutellum dark metallic green with weak copper and blue reflections

Figure 24. *Chrysotus interfrons* sp. nov. habitus of holotype male, left lateral. Scale bar: 1.0 mm.

and sparse light brown pruinosity that is denser on anterior and lateral slopes; setae on scutum light brown to black; seven pairs of biseriate acrostichal setae; six pairs of dorsocentral setae, anterior-most pair small; scutellum with one pair of large marginal setae and one pair of very small setae just lateral to larger setae. Pleuron dark brown with metallic blue reflections and moderately dense gray pruinosity; 1–3 yellow setae on lower proepisternum; upper proepisternum bare. ***Legs*:** Yellow, except most of coxa II, basal half or more of coxa III and 5th segment of tarsi brown. Anterior surface of coxa I with scattered, rather long yellow to brown setae; coxa II with scattered yellow to brown setae on anterior surface and large ad yellowish seta near 1/2; coxa III with large yellowish lateral seta near base. Femora I and II with pv row of brown setae (length < width of femur), those distally longest; femur III anteriorly and posteriorly with one or two erect yellow setae near base. Tibia I without distinctive setae but setae along ventral surface slightly longer (length subequal to width of tibia), finer, and usually paler than those on dorsal surface; tibia II with very small brown to black ad seta near 1/5 (length < width of tibia), sometimes a trace of a pd seta near 1/2, and 2 larger brown ventral setae at apex; tibia III with small ad seta near 1/5, usually larger pd seta near 2/5,

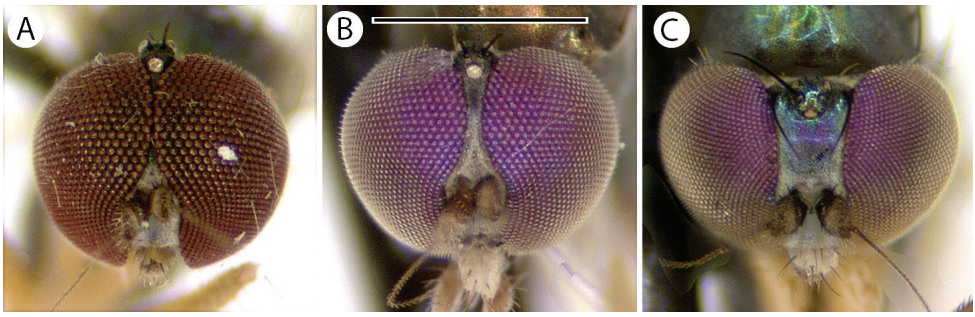

Figure 25. Heads of males, anterodorsal views **A** *Chrysotus flavipes* (Aldrich) (Dominica) **B** *Chrysotus interfrons* sp. nov. (Montserrat) **C** *Chrysotus parvulus* (Aldrich) (Montserrat). Note differences in width of frons and enlargement of ommatidia. Scale bar: 0.5 mm.

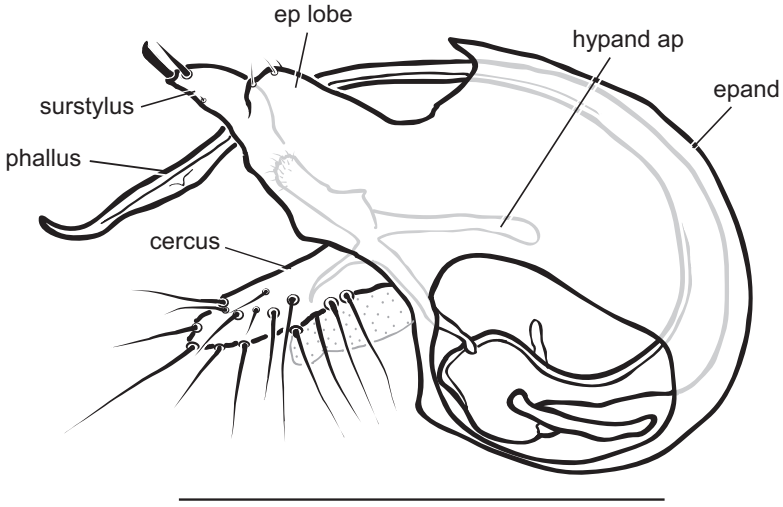

Figure 26. *Chrysotus interfrons* sp. nov. male terminalia, left lateral. Abbreviations: epand-epandrium; ep lobe-epandrial lobe; hypand ap-hypandrial apodeme. Scale bar: 0.25 mm.

3/5, near tip, and very small pd seta near 1/6. Tarsi with pulvilli enlarged, on tarsus I slightly larger than tarsomere 5, less enlarged on tarsi II and III; tarsal claws absent on all legs. Ratios of tibia:tarsomeres: leg I: 36–22–10–5–4–4; leg II: 42–24–11–7–3–4; leg III: 50–16–13–8–5–4. ***Wing*:** Hyaline, broadly elliptical with well-developed anal lobe, veins brown. R_{2+3} straight, slightly and evenly diverging from R_{4+5}. R_{4+5} and M_1 nearly parallel beyond crossvein dm-cu. Crossvein dm-cu slightly less than half as long as last part of CuA_1. Calypter yellow with yellow to light brown setae. Halter knob and stem light yellow. ***Abdomen*:** Cylindrical, metallic green with bronze reflections, sides of tergite II and basal sternites yellow. Setae of tergites brown to black, sternites with longer usually yellow setae. Tergite VI bare except one distolateral seta at lower margin. Sternite VIII with ca. eight brownish setae of various sizes, the largest two or three

only slightly larger than setae along margins of tergites. Hypopygium (Fig. 26) small, brown, positioned in ventral notch at tip of abdomen. Hypopygial foramen lateral but positioned relatively far posteriorly and near dorsal edge. Epandrium brown, ventrally with small spine-like projection where phallus emerges; with broad ventroapical lobe that is subquadrate apically with ca. three small setae. Surstylus elongate, rounded ventrally, shining brown, with strong apical cylindrical seta with rounded tip that is subtended by a smaller seta. Cercus digitiform with slightly pointed apex, brownish yellow, with numerous stiff yellow to brown setae especially along basal half of dorsal margin. Phallus narrow with apex round; sheath of phallus membranous, slightly expanded subapically with a small tooth in membrane. Postgonites rounded apically with some microtrichia. Hypandrial apodemes rather long and narrow.

Female. Body length 2.8 mm, wing length 2.0 × width 0.9 mm. Similar to male, but face and frons with blue-violet reflections and yellow-brown pruinosity that is denser along eyes; frons as wide as face; clypeus distinct and forming lower one-third of face; palpus broader with a few more setae; antenna slightly shorter and more rounded distally; femora I and II with pv row of setae smaller and indistinct basally; femur III without erect setae near base; pulvilli not enlarged; wing tinged with brown; tarsal claws present on all legs.

Etymology. This species is named for the relative width of the frons in males which is intermediate to males of the closely related species *Chrysotus flavipes* (Aldrich) and *Chrysotus parvulus* (Aldrich) (Fig. 25).

Distribution. Montserrat.

Remarks. *Chrysotus interfrons* forms a closely related group with two other West Indian species that have to date been treated in the genus *Diaphorus.* However, these species do not fit in the current definition of *Diaphorus* proposed by Robinson and Vockeroth (1981) since they lack setae on the upper proepisternum, black calypteral setae, a completely bare tergite VI, and four to eight long strong setae on sternite VIII (see discussion in Capellari and Amorim 2010). *Diaphorus parvulus* Aldrich was transferred to *Chrysotus* by Becker (1922, page 170), an act that has been largely overlooked. *Diaphorus flavipes* Aldrich is herein moved to *Chrysotus*: *Chrysotus flavipes* (Aldrich) comb. nov. *Chrysotus mundus* (Loew) is very similar to *Chrysotus flavipes* and the two are possibly conspecific.

Chrysotus interfrons is most easily separated from West Indian members of this group by the narrow frons (Fig. 25); additional characters distinguishing these related species are given in Table 3. *Chrysotus flavipes* and *C. parvulus* are widespread in the Lesser Antilles, and both occur on Dominica (Robinson 1975), Grenada (Aldrich 1902), and St. Vincent (Aldrich 1896) but *C. flavipes* is absent on Monserrat.

Table 3. Characters distinguishing males of the closely related *Chrysotus flavipes* (Aldrich), *C. interfrons* sp. nov., and *C. parvulus* (Aldrich).

Character	*Chrysotus flavipes*	*C. interfrons*	*C. parvulus*
Frons (Fig. 25)	obliterated by contiguous eyes	narrow	as wide as face
Face shape	height subequal to width	height ca. 1.5 × width	height ca. 1.5 × width
Ommatidia	dorsal facets greatly enlarged	dorsal facets slightly enlarged	dorsal facets not enlarged
Size *ad* seta on tibia II	small (length < width of tibia)	small (length < width of tibia)	large (length > width of tibia)

Chrysotus integer Robinson

Chrysotus integer Robinson, 1975: 75.

Material examined. Dominica: ***Holotype*** ♂, Clarke Hall, 11–20 January 1965, Malaise trap, W.W. Wirth (USNM). **Montserrat:** 3 ♂, Woodlands, Riverside House, 10–12 January 2002, Malaise trap, Ivie, Marske, Puliafico; 2 ♂, same as previous, 5–7 January 2002; 1 ♂, Cassava Ghaut, Beattie House, 21 January–5 February 2002, Malaise trap, A. Krakower; 1 ♂, same as previous, 6–12 June 2002, UV light; 1 ♂, 1 ♀, Bottomless Ghaut, 5 August 2005, yellow pan traps, V.G. Martinson (MTEC, USNM).

Distribution. Dominica, Grenada, and Montserrat.

Chrysotus lamellicaudatus Robinson

Chrysotus lamellicaudatus Robinson, 1975: 87.

Material examined. Dominica: ***Holotype*** ♂, South Chiltern Estate, 2 February 1965, W.W. Wirth (USNM). **Montserrat:** 1 ♂, Woodlands, Riverside House, 5–7 January 2002, Malaise trap, Ivie, Marske, Puliafico; 1 ♂, same as previous, 22 July 2005; yellow pan traps, V.G. Martinson; 3 ♂, 4 ♀, Cassava Ghaut, 24 July 2005, yellow pan traps, V.G. Martinson; 2 ♂, Bottomless Ghaut, 5 August 2005, yellow pan traps, V.G. Martinson; 2 ♂, Bottomless Ghaut trail to Big River, 14 August 2005, yellow pan traps, V.G. Martinson; 3 ♂, Hope Ghaut, 8–10 January 2002, yellow pan traps, K.A. Marske; 1 ♂, Sweetwater Ghaut, 1 August 2005, yellow pan traps, V.G. Martinson; 1 ♂, Killiekranke, 3 August 2005, yellow pan traps, V.G. Martinson; 5 ♂, Hope Ghaut, 300 m, 16°45.108'N, 62°12.695'W, 20 June 2017, J.B. Runyon; 3 ♂, Fogarty Ghaut (Soldiers), 16°46.41'N, 62°12.44'W, 21 June 2017, J.B. Runyon; 1 ♂, Runaway Ghaut, 175 m, 16°45.43'N, 62°12.89'W, 23 June 2017, J.B. Runyon; 1 ♂, Corbett Spring, 300 m, 16°45.012'N, 62°11.184'W, 26 June 2017, J.B. Runyon; 1 ♂, Fairy Walk River, 260 m, 16°45.162'N, 62°10.854'W, 26 June 2017, J.B. Runyon; 1 ♂, ghaut above Montserrat Volcano Observatory, 330 m, 16°45.130'N, 62°12.487'W, 27 June 2017, J.B. Runyon; 3 ♂, 2 ♀, Big River, 450 m, 16°45.690'N, 62°11.174'W, 28 June 2017, J.B. Runyon; 1 ♂, Bottomless Ghaut, 400 m, 16°45.994'N, 62°11.497'W, 28 June 2017, J.B. Runyon (MTEC, USNM).

Distribution. Dominica, Montserrat.

Chrysotus mediocaudatus Robinson

Chrysotus mediocaudatus Robinson, 1975: 87.

Material examined. Dominica: ***Holotype*** ♂, Fond Figues River, 9 February 1965, W.W. Wirth (USNM). **Montserrat:** 3 ♂, ghaut above Montserrat Volcano Observatory, 330 m, 16°45.130'N, 62°12.487'W, 27 June 2017, J.B. Runyon (MTEC, USNM).

Distribution. Dominica, Montserrat.

Chrysotus microtatus Meuffels & Grootaert

Chrysotus minimus Robinson, 1975: 82; preoccupied by *Chrysotus minimus* (Meigen, 1830).
Chrysotus microtatus Meuffels & Grootaert, 1999: 291; new name for *Chrysotus minimus* Robinson.

Material examined. Dominica: ***Holotype*** ♂, Fond Figues River, rain forest, 3 February 1965, W.W. Wirth (USNM). **Montserrat:** 10 ♂, 7 ♀, Bottomless Ghaut, 5 August 2005, yellow pan traps, V.G. Martinson; 3 ♂, same as previous, 14 August 2005; 19 ♂, 21 ♀, Bottomless Ghaut trail to Big River, 14 August 2005, yellow pan traps, V.G. Martinson; 16 ♂, 4 ♀, Big River, 5 August 2005, yellow pan traps, V.G. Martinson; 2 ♂, 4 ♀, Big River, 450 m, 16°45.690'N, 62°11.174'W, 28 June 2017, J.B. Runyon; 1 ♂, Bottomless Ghaut, 400 m, 16°45.994'N, 62°11.497'W, 28 June 2017, J.B. Runyon (MTEC, USNM).

Distribution. Dominica, Montserrat.

Remarks. Adults of *Chrysotus microtatus* were found on Montserrat only in the deepest ghauts.

Chrysotus montserratensis sp. nov.

http://zoobank.org/BF0C4941-5632-43FB-A438-2C1599991A6E
Figs 27–29

Type material. ***Holotype***, ♂ labelled: "WEST INDIES: MONTSERRAT/ Big River 450 m/ 16°45.690'N, 62°11.174'W/ 28 JUNE 2017, JB Runyon"; "HOLOTYPE/ ♂ *Chrysotus* / *montserratensis* / Runyon [red label]" (USNM, type number USNMENT01350614). ***Paratypes*****: Montserrat:** 3 ♀, same data as holotype; 2 ♀, Big River, 5 August 2005, yellow pans, V.G. Martinson; 2 ♀, Jack Boy Hill (top), 480 m, 16°45.797'N, 62°10.886'W, 25 June 2017, J.B. Runyon; 1 ♀, ghaut above Montserrat Volcano Observatory, 330 m, 16°45.130'N, 62°12.487'W, 27 June 2017, J.B. Runyon; 1 ♂, Bottomless Ghaut, 400 m, 16°45.994'N, 62°11.497'W, 28 June 2017, J.B. Runyon; 1 ♀, Katy Hill (top), 730 m, 16°45.731'N, 62°11.646'W, 28 June 2017, J.B. Runyon (MTEC, USNM).

Description. Male (Fig. 27A). Body length 2.9–3.0 mm, wing length 2.4–2.5 × width 0.9–1.0 mm. ***Head*****:** Eyes essentially contiguous below; face dark metallic green-blue obscured by light brown pruinosity, lower half of face very narrow (subequal in width to one ommatidium) and nearly parallel-sided, upper face narrow triangular. Frons metallic green-blue with brown pruinosity. Palpus brown, subquadrate with rounded corners, with ca. four rather large black setae (longest subequal to width of palpus). Proboscis dark brown, somewhat enlarged and projecting anteriorly, with brown hairs along margin. Antenna (Fig. 27A) black; first flagellomere large, triangular-ovate to crescent-shaped, base extending above and overlapping pedicel; arista-like

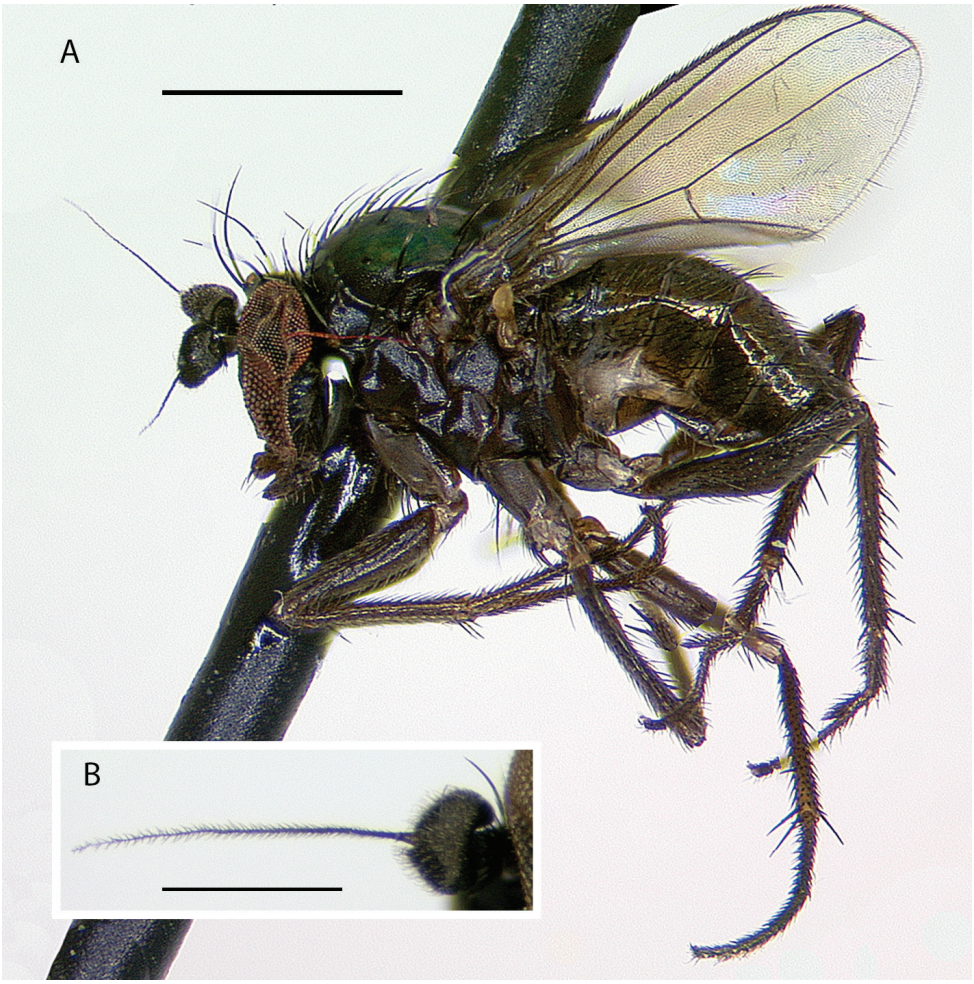

Figure 27. *Chrysotus montserratensis* sp. nov. **A** habitus of holotype male, left lateral **B** female antenna, left lateral. Scale bars: 1.0 mm (**A**), 0.5 mm (**B**).

stylus subapical, inserted in shallow notch. Postocular setae brown to black. ***Thorax*:** Scutum and scutellum dark metallic green with slight blue reflections and sparse light brown pruinosity; setae on scutum black; six pairs of rather large irregularly biseriate acrostichal setae; six pairs of dorsocentral setae; scutellum with one pair of large marginal setae and one pair of smaller lateral setae (ca. half length of larger setae). Pleuron dark brown to almost black with slight green-blue reflections, obscured by gray pruinosity; with two brown to black setae on lower proepisternum. ***Legs*:** Dark brown to black with black setae and hairs. Coxa I with rather long coarse anterior setae becoming larger distally; coxa II apically with two small brown spines composed of fused setae. Trochanter II with large av seta. Femur I with slightly longer pv setae full-length, those at very base erect, those near tip larger. Femur II with slightly longer setae av and pv, with subapical row of four to five posterior setae; femur III with a few larger preapi-

Figure 28. Tarsus III of males, posterior views **A** *Chrysotus excisus* Aldrich (Dominica) **B** *Chrysotus montserratensis* sp. nov. Arrows indicate spur-like projection on tarsus III(2). Scale bar: 0.5 mm.

cal av, pv, and anterior setae. Tibia I with very small ad seta near 1/4 and larger pd seta at apex, with ventral setae slightly longer; tibia II with large ad seta near 1/4 preceded by very small seta, a smaller ad seta near 1/2, ventrally with a seta near 1/3, 1/2, and 3/5 which increase in size distally, and four large apical setae; tibia III with 3–5 ad setae the largest near 1/5, 2/5, and just beyond 1/2, four or five pd setae with largest near 1/3, 2/5, 3/5, four apical or subapical setae, ventral surface with slightly longer setae. Ventral surface of tarsomeres I(1, 2) with longer setae (longest slightly wider than tarsomere); tarsus III (Fig. 28B) with dense short brushy setae; tarsomere III(1) a little broadened with longest setae anteriorly; tarsomere III(2) prolonged posteriorly into a spur overlapping ca. half of tarsomere III(3), this spur covered ventrally with

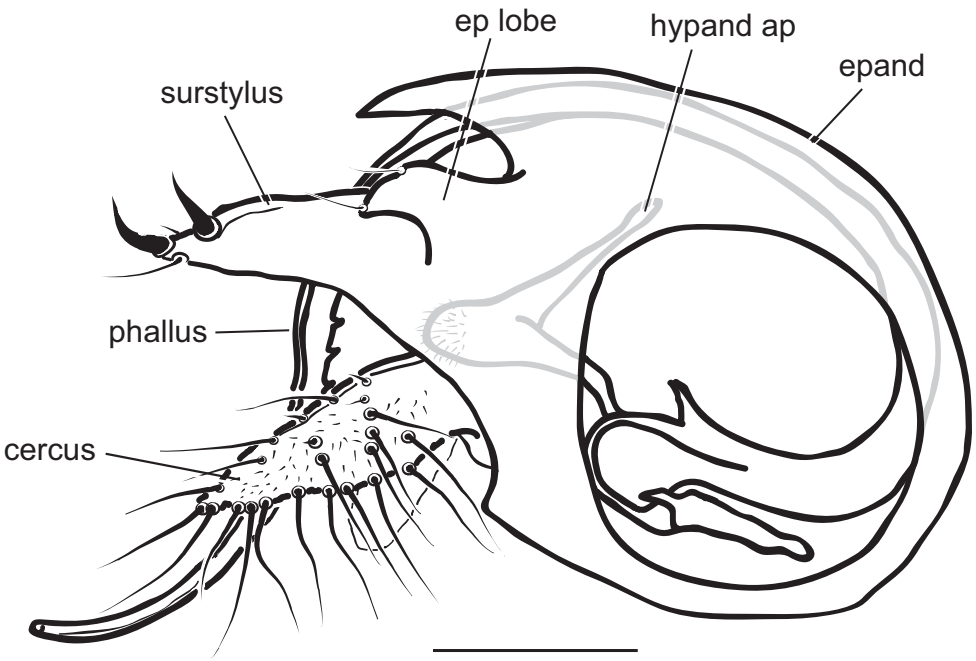

Figure 29. *Chrysotus montserratensis* sp. nov. male terminalia, left lateral. Abbreviations: epand-epandrium; ep lobe-epandrial lobe; hypand ap-hypandrial apodeme. Scale bar: 0.1 mm.

short dense setae; tarsomeres III(3, 4) with slightly longer setae anteriorly and dorsally. Pulvilli not enlarged, all legs with two claws. Ratios of tibia:tarsomeres: leg I: 38–22–9–8–6–4; leg II: 40–20–8–7–4–3; leg III: 50–14–6 (12 including spur)–11–8–4. ***Wing*:** Hyaline, elliptical, with brown veins. R_{2+3} straight. R_{4+5} and M_1 nearly parallel in apical half of wing, both curving slightly backward apically. Last part of CuA_1 ca. 2.5 × as long as crossvein dm-cu. Calypter dark brown with black setae. Halter knob and stem yellow. ***Abdomen*:** Cylindrical, rather broad, gradually tapering, with hairs and setae black. Tergites and sternites dark metallic greenish, nearly black; tergite VI with numerous small setae and larger marginal setae. Sternite VIII with small setae, covering hypopygial foramen. Hypopygium (Fig. 29) small, blackish, positioned in ventral notch at tip of abdomen. Epandrium black, with small ventroapical lobe bearing two small setae. Surstylus elongate, shining dark brown, with strong subapical spine and spine at apex, and two small hairs near apex. Cercus elongate triangular, brown, with numerous stiff brown setae especially along dorsal margin; more sclerotized narrowly along ventral edge. Phallus simple, narrow, with apex round; sheath of phallus broadened dorsally near and beyond emergence from epandrium, with three or four small teeth along dorsal margin ca. midway between epandrium and tip of phallus. Postgonites rounded apically with some microtrichia. Hypandrial apodemes long and narrow.

Female. Body length 3.1–3.5 mm, wing length 2.6–3.1 × width 0.9–1.4 mm. Similar to male, but face wide, narrowest part ca. two-thirds width of frons at ocellus; dark metallic green-blue obscured by very sparse light brown pruinosity; clypeus

distinct, bulging at suture, slightly widened; palpus broader, more rounded apically, with more setae; first flagellomere (Fig. 27B) smaller, length two-thirds height, distinctly crescent-shaped in medial view, apical notch smaller; scutum with strong metallic green-blue-violet reflections; coxa II without apical spines; tarsomere II(1) with less distinct ventral setae; tarsus III without dense brushy setae; tarsus III(2) without spur.

Etymology. This species is named for the island of Montserrat.

Distribution. Montserrat.

Remarks. *Chrysotus montserratensis* is related to *C. excisus* Aldrich (Dominica, Mexico, St. Vincent) and *C. pseudexcisus* (Dominica) being most closely related to *C. excisus* which shares tarsomere III(2) prolonged posteriorly in a spur overlapping base of tarsomere III(3). *Chrysotus montserratensis* differs in having a larger spur on tarsomere III(2) (Fig. 28), larger body size, and a yellow halter knob.

Chrysotus orichalceus Gosseries

Chrysotus niger Aldrich, 1896: 327; preoccupied by *Chrysotus niger* Loew, 1869.
Chrysotus orichalceus Gosseries, 1988: 305; new name for *Chrysotus niger* Aldrich.

Material examined. Dominica: ♂, Clarke Hall, 11–20 January 1965, Malaise trap, W.W. Wirth (USNM). **Montserrat:** 22 ♂, 6 ♀, Woodlands, Riverside House, 10–12 January 2002, Malaise trap, Ivie, Marske, Puliafico; 15 ♂, 6 ♀, same as previous, 5–7 January 2002; 2 ♂, 2 ♀, Cassava Ghaut, Beattie House, 4–23 March 2002, Malaise trap, A. Krakower; 1 ♂, same as previous, 18 March–4 April 2002; 2 ♂, Hope Ghaut, 8–10 January 2002, yellow pan traps, K.A. Marske; 1 ♂, 2 ♀, Jack Boy Hill, 28 July 2005, yellow pan traps, V.G. Martinson; 1 ♂, Hope Ghaut, 23 July 2005, yellow pan traps, V.G. Martinson; 1 ♂, Sweetwater Ghaut, 1 August 2005, yellow pan traps, V.G. Martinson; 1 ♂, Runaway Ghaut, roadside springs, 150 m, 16°45.449'N, 62°13.011'W, 22 June 2017, J.B. Runyon (MTEC, USNM). **St. Vincent:** Syntypes 2 ♂, 2 ♀, May (USNM).

Distribution. Dominica, Montserrat, and St. Vincent.

Chrysotus parvulus (Aldrich)

Diaphorus parvulus Aldrich, 1896: 321.
Chrysotus longipes Van Duzee, 1927: 1.

Material examined. Dominica: 3 ♂, 23 January–17 February 1964, H. Robinson; 1 ♂, 1 ♀, St. Mark Parish, 4 km N Soufriere, 75 m, 17–19 March 2003, E. Bentson, G. Carner; 13 ♂, Cabrits National Park, East Cabrits Trail, 15.58564N, 61.47210W, Malaise, 30 May–7 June 2011, M.A. & L.L. Ivie. **Montserrat:** 1 ♂, 3 ♀, Underwood Ghaut, canopy fogging at dawn, 23 May 2002, K. Marske & J. Boatswain; 1 ♂, 1 ♀, Woodlands, Riverside House, 22 July 2005, yellow pan traps, V.G. Martinson;

1 ♂, 4 ♀, Bottomless Ghaut, 5 August 2005, yellow pan trap, V.G. Martinson; 6 ♂, 4 ♀, same as previous, 14 August 2005; 2 ♂, 4 ♀, Killiekranke, 3 August 2005, yellow pan trap, V.G. Martinson; 9 ♂, 1 ♀, Big River, 5 August 2005, yellow pan traps, V.G. Martinson; 4 ♂, 6 ♀, Bottomless Ghaut trail to Big River, 14 August 2005, yellow pan traps, V.G. Martinson; 1 ♂, Cassava Ghaut, 24 June 2005, yellow pan traps, V.G. Martinson; 2 ♂, 3 ♀, Fogarty Ghaut (Soldiers), 16°46.41'N, 62°12.44'W, 21 June 2017, J.B. Runyon; 2 ♂, 3 ♀, Jack Boy Hill (top), 480 m, 16°45.797'N, 62°10.886'W, 25 June 2017, J.B. Runyon; 1 ♀, Big River, 450 m, 16°45.690'N, 62°11.174'W, 28 June 2017, J.B. Runyon; 1 ♀, Bottomless Ghaut, 400 m, 16°45.994'N, 62°11.497'W, 28 June 2017, J.B. Runyon; 1 ♂, 1 ♀, Katy Hill (top), 730 m, 16°45.731'N, 62°11.646'W, 28 June 2017, J.B. Runyon; 1 ♂, ghaut above Montserrat Volcano Observatory, 330 m, 16°45.130'N, 62°12.487'W, 27 June 2017, J.B. Runyon (MTEC, USNM).

Distribution. Lesser Antilles and Puerto Rico.

Remarks. This species was moved from *Diaphorus* to *Chrysotus* by Becker (1922, page 170), an act that has gone largely unnoticed. Becker's move was correct because this species does not fit in the current definition of the genus *Diaphorus* (see Remarks for *C. interfrons* sp. nov.). In particular it lacks setae on the upper proepisternum, black calypteral setae, a completely bare tergite 6, and four to eight long strong setae on sternite 8. The species fits in the broadly defined *Chrysotus* following Pollet et al. (2004), which is likely paraphyletic and might need subdivision as diaphorine phylogeny is elucidated (Capellari and Amorim 2010). This necessitates a new replacement name for the Nearctic *Chysotus parvulus* Van Duzee, 1924, as:

Chrysotus milvadu nom. nov.

Chysotus parvulus Van Duzee, 1924b: 25; preoccupied by *Chrysotus parvulus* (Aldrich, 1896).

Note. This honorary new name is derived from combining the first two or three letters each of Millard Van Duzee and is treated here as a noun in apposition.

Chrysotus proximus Aldrich

Chrysotus proximus Aldrich, 1896: 326.

Material examined. Montserrat: 2 ♂, Cassava Ghaut, Beattie House, 14–21 January 2002, Malaise trap, A. Krakower; 1 ♂, Hope Ghaut, 8–10 January 2002, yellow pan traps, K.A. Marske; 1 ♂, Hope Ghaut, 300 m, 16°45.108'N, 62°12.695'W, 20 June 2017, J.B. Runyon; 1 ♀, Runaway Ghaut, 175 m, 16°45.43'N, 62°12.89'W, 23 June 2017, J.B. Runyon; 3 ♂, 9 ♀, Jack Boy Hill (top), 480 m, 16°45.797'N, 62°10.886'W,

25 June 2017, J.B. Runyon; 7 ♂, 2 ♀, ghaut above Montserrat Volcano Observatory, 330 m, 16°45.130'N, 62°12.487'W, 27 June 2017, J.B. Runyon (MTEC, USNM). **St. Vincent:** Syntypes 1 ♂, 1 ♀ (USNM).

Distribution. Lesser Antilles (Dominica, Grenada, Montserrat, and St. Vincent).

Chrysotus pseudoniger Robinson

Chrysotus pseudoniger Robinson, 1975: 89.

Material examined. Dominica: ***Holotype*** ♂, Clarke Hall, cocoa trail, 18 January 1965, W.W. Wirth (USNM). **Montserrat:** 1 ♂, Hope Ghaut, 23 July 2005, yellow pan traps, V.G. Martinson; 4 ♂, Big River, 5 August 2005, yellow pan traps, V.G. Martinson; 2 ♂, 1 ♀, Bottomless Ghaut, 5 August 2005, yellow pan traps, V.G. Martinson; 4 ♂, 1 ♀, Fairy Walk, 9 August 2005, yellow pan traps, V.G. Martinson; 1 ♂, Bottomless Ghaut trail to Big River, 14 August 2005, yellow pan traps, V.G. Martinson; 2 ♂, Hope Ghaut, 300 m, 16°45.108'N, 62°12.695'W, 20 June 2017, J.B. Runyon (MTEC, USNM).

Distribution. Dominica, Montserrat.

Chrysotus spectabilis (Loew)

Diaphorus spectabilis Loew, 1861: 57.
Diaphorus exunguis Thomson, 1869: 506.
Diaphorus approximatus Aldrich, 1896: 321.
Dubious spectabilis (Loew) [unwarranted combination by Wei 2012: 611].

Material examined. Dominica: 10 ♂, 1 ♀, Springfield Estate, yellow pans, 1–3 June 2011, M.A. & L.L. Ivie. **Montserrat:** 22 ♂, 24 ♀, Woodlands, Riverside House, 10–12 January 2002, Malaise trap, Ivie, Marske & Puliafico; 1 ♂, same as previous, 5–7 January 2002; 3 ♂, Hope Ghaut, 8–10 January 2002, yellow pan traps, K.A. Marske; 5 ♂, Cassava Ghaut, Beattie House, 14–21 January 2002, Malaise trap, A. Krakower; 1 ♂, same as previous, 5–15 February 2002; 1 ♂, same as previous, 23 March–8 April 2002; 1 ♂, same as previous, 8–17 April 2002; 1 ♂, same as previous, 17 April–01 May 2002; 3 ♂, 1 ♀, same as previous, 13–14 January 2002, blacklight, M.A. Ivie & K.A. Marske; 1 ♂, same as previous, canopy fogging at dawn, 21 May 2002, K. Marske & J. Boatswain; 3 ♂, same as previous, 24 June 2005, yellow pan traps, V.G. Martinson; 1 ♂, Big River, 5 August 2005, yellow pan traps, V.G. Martinson; 2 ♂, Bottomless Ghaut, 5 August 2005, yellow pan traps, V.G. Martinson; 3 ♂, 1 ♀, Jack Boy Hill, 28 July 2005, yellow pan traps, V.G. Martinson; 2 ♂, Cedar Ghaut, 4 August 2005, yellow pan traps, V.G. Martinson (MTEC, USNM).

Distribution. Eastern North America south to Argentina.

Remarks. Capellari and Amorim (2010) re-described and illustrated this species. Wei (2012) proposed placement of *C. spectabilis* in the new genus *Dubius* Wei, but I concur with Capellari and Amorim (2014) that this is unjustified.

Chrysotus spinipes Van Duzee

Chrysotus spinipes Van Duzee, 1924b: 19.

Material examined. Cuba: ***Holotype*** ♂, Havana, Baker (CAS). **Dominica:** 1 ♂, Clarke Hall, 21–28 February 1965, light trap, W.W. Wirth (USNM). **Montserrat:** 3 ♂, Woodlands, Riverside House, 10–12 January 2002, Malaise trap, Ivie, Marske & Puliafico (MTEC, USNM).

Distribution. Cuba, Dominica, Montserrat.

Chrysotus xiphostoma Robinson

Chrysotus xiphostoma Robinson, 1975: 84.

Material examined. Dominica: ***Holotype*** ♂, Clarke Hall, 21–23 January 1965, light trap, W.W. Wirth (USNM). **Montserrat:** 37 ♂, 18 ♀, Woodlands, Riverside House, 10–12 January 2002, Malaise trap, Ivie, Marske & Puliafico; 10 ♂, 6 ♀, same as previous, 5–7 January 2002; 2 ♂, Hope Ghaut, 8–10 January 2002, yellow pan traps, K.A. Marske; 2 ♂, Bottomless Ghaut, 5 August 2005, yellow pan traps, V.G. Martinson; 4 ♂, Bottomless Ghaut trail to Big River, 14 August 2005, yellow pan traps, V.G. Martinson; 1 ♂, Big River, 5 August 2005, yellow pan traps, V.G. Martinson; 2 ♂, Sweetwater Ghaut, 1 August 2005, yellow pan traps, V.G. Martinson; 1 ♂, Cedar Ghaut, 4 August 2005, yellow pan traps, V.G. Martinson; 1 ♂, Hope Ghaut, 300 m, 16°45.108'N, 62°12.695'W, 20 June 2017, J.B. Runyon; 1 ♀, Runaway Ghaut, roadside springs, 150 m, 16°45.449'N, 62°13.011'W, 22 June 2017, J.B. Runyon (MTEC, USNM).

Distribution. Lesser Antilles (Dominica, Montserrat, Nevis, Saint Kitts, Saint Lucia) (Runyon and Capellari 2018).

Remarks. *Chrysotus xiphostoma* belongs to the *Chysotus longipalpus* species group and was re-described and illustrated by Capellari (2015).

Genus *Diaphorus* Meigen

Key to the species of *Diaphorus* in Montserrat

1 Femora mostly brown with tips yellow; lower postocular setae black; knob of halter brownish ..... ***D. contiguus*** **Aldrich**

– Femora wholly yellow; lower postocular setae white; knob of halter yellow ... . ***D. robinsoni*** **sp. nov.**

***Diaphorus contiguus* Aldrich**

Diaphorus contiguus Aldrich, 1896: 323.

Material examined. Montserrat: 1 ♂, Woodlands, Riverside House, 10–12 January 2002, Malaise trap, Ivie, Marske & Puliafico (MTEC). **St. Vincent:** Syntype 1 ♂ (USNM).

Distribution. Southeastern USA, Bermuda, and the Lesser Antilles (Dominica, Montserrat, St. Vincent).

***Diaphorus robinsoni* sp. nov.**
http://zoobank.org/AFBA73D2-A8AE-4402-AD99-583A54E4A27D
Figs 30, 31

Type material. ***Holotype***, ♂ labelled: "DOMINICA: St. John Par./ Cabrits N.P. (malaise)/ East Cabrits Trail/ 15.58564N, 61.47210W/ 30MAY–07JUNE 2011/ M.A. & L.L. Ivie"; "HOLOTYPE/ ♂ *Diaphorus*/ *robinsoni*/ Runyon [red label]" (USNM, type number USNMENT01350616). ***Paratypes*: Dominica:** 3 ♂, 2 ♀, Clarke Hall, 2–21 March 1964, H. Robinson. **Montserrat:** 1 ♂, Cassava Ghaut, 877 ft, canopy fogging at dawn, 21 May 2002, K. Marske & J. Boatswain; 1 ♂, Hope Ghaut, 300 m, 16°45.108'N, 62°12.695'W, 20 June 2017, J.B. Runyon (MTEC).

Description (adapted from Robinson (1975), as *Diaphorus mundus*). **Male** (Fig. 30). Body length 2.8–3.3 mm, wing length 2.7–3.1 × width 1.2–1.5 mm. ***Head*:** Eyes broadly contiguous above antenna, with ommatidia distinctly enlarged on dorsal half. Face distinctly recessed, as high as wide, metallic bluish with slight whitish pruinosity that is densest and brownish along eyes. Frons reduced to a narrow triangle immediately above antennae, covered with dense brown pruinosity. Palpus yellow with black setae, with one distinct large black seta at apex. Proboscis brown. Antenna brown; first flagellomere slightly yellowish basally, rather truncate, ca. 1.5 × as high as long, with small whitish hairs. Arista-like stylus apical, inserted at dorsal corner. Lower postocular setae multiseriate, white. ***Thorax*:** Scutum and scutellum bright metallic green with some violet reflections and slight yellowish pruinosity; 5–7 pairs of black biseriate acrostichal setae; five pairs of black dorsocentral setae; scutellum with one pair of large marginal setae and one pair of small lateral setae. Pleuron slightly bluish with denser grayish yellow pruinosity; upper proepisternum with two small brownish setae, lower proepisternum with distinct black seta above coxa I. ***Legs*:** Yellow except base of coxa I and all of coxae II and III brown. Hairs and setae black. Coxa I with small black setae on anterior surface and three or four large black setae spaced along distal two-thirds of lateral edge; coxa II with rather long, rather dense setae anteriorly and three larger ad setae; coxa III with large ad seta near base. Femur I with row of pv setae, basal-most seta in this series larger and erect, others progressively longer on distal two-thirds, with row of shorter av setae on basal two-thirds; femur II with both av and pv rows of short setae, pv series more distinct; femur III with longer erect setae in four ventral rows, one av and one pv seta near base stronger. Tibia I with only very small ad seta near 1/5;

Figure 30. *Diaphorus robinsoni* sp. nov. habitus of holotype male, left lateral. Scale bar: 1.0 mm.

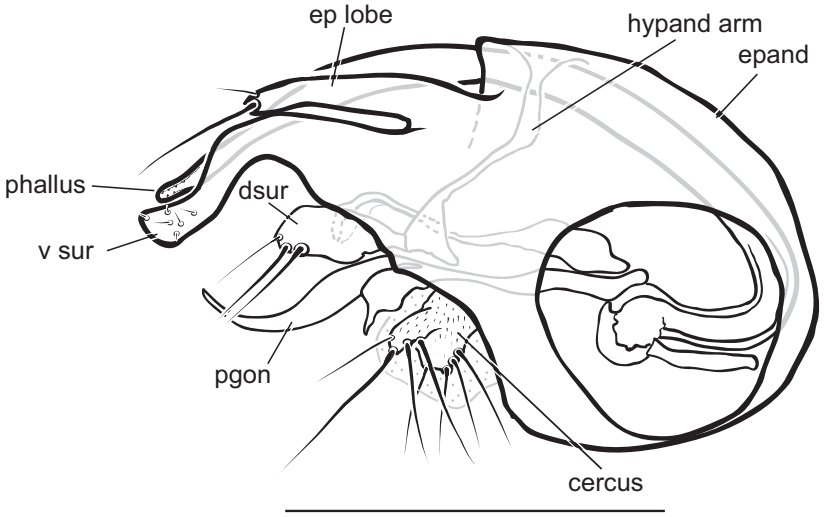

Figure 31. *Diaphorus robinsoni* sp. nov. male terminalia, left lateral. Abbreviations: d sur-dorsal lobe of surstylus; epand-epandrium; ep lobe-epandrial lobe; hypand arm-hypandrial arm; pgon-postgonite; v sur-ventral lobe of surstylus. Scale bar: 0.25 mm.

tibia II with rather large ad seta near 1/5 and smaller ad seta near 1/2, small pd seta near 1/5 and 1/2, distinct ventral seta near 3/4, four apical setae; tibia III with small ad seta near 1/5, larger pd seta near 1/5, 2/5, 3/5, and 4/5, four apical setae. Pulvilli much enlarged on leg I, moderately enlarged on leg II, and scarcely enlarged on leg III. Tarsal

claws absent on legs I and II. Ratios of tibia:tarsomeres: leg I: 40–24–8–6–4–6; leg II: 48–28–12–8–4–3; leg III: 64–18–16–12–8–5. ***Wing*:** Hyaline, oval, broad at base with well-developed anal lobe. Veins yellow-brown. R_1 reaching 2/5 of wing length. R_{2+3} very slightly flexed, very slightly diverging from R_{4+5}. M_1 nearly straight and nearly parallel with R_{4+5} beyond crossvein. Crossvein dm-cu ca. two-thirds as long as last part of CuA_1. Calypter yellow-brown with black setae. Halter knob yellow. ***Abdomen*:** Wholly metallic green with strong coppery reflections. Hairs and setae black with some pale hairs on sternites; marginal setae of tergites and those laterally on tergite II 2–3 × as long as background setae. Tergite VI bare. Sternite VIII with four large, stout black setae projecting posteriorly from tip of preabdomen. Hypopygium (Fig. 31) small, dark brown, mostly concealed in ventral notch at tip of abdomen. Hypopygial foramen left basolateral, placed near dorsal edge of epandrium. Epandrium dark brown, with rather large finger-like ventroapical lobe bearing one large and one small seta at apex. Ventral lobe of surstylus elongate, rather sigmoid, with ca. six very small socketed setae near apex. Doral lobe of surstylus rather broadly rounded and with three setae. Cercus brown, small, bilobed with each lobe covered in minute hairs and bearing three or four brown setae. Phallus strongly arched, apex round and very slightly flared with several minute inward-facing teeth along lateral margin near apex. Hypandrial arms present, symmetrical, but not external to epandrium. Postgonites bilobed apically, ventral lobe large and hook-shaped, dorsal lobe smaller with pointed lobe immediately ventral to cercus.

Female. Body length 3.1 mm, wing length 3.1 × width 1.4 mm. Similar to male, but face 1.5 × as wide as high; clypeus distinct, forming lower two-fifths of face; front as wide as face with straight sides; face and front bluish with violet reflections; palpus broader, brownish, with apical setae distinct; femora without longer ventral setae; tibia II with small additional ad seta near base, second small ventral seta near 1/3, sometimes with an additional av or pd seta.

Etymology. This species is named for Harold Robinson who collected and treated this species (as *D. mundus* Loew) on Dominica.

Distribution. Dominica, Montserrat.

Remarks. Robinson (1975) interpreted this species as *Diaphorus mundus* Loew which was transferred to the genus *Chrysotus* by Pollet et al. (2004) because it does not fit the definition of *Diaphorus* proposed by Robinson and Vockeroth (1981). *Chrysotus mundus* actually belongs to the group containing *C. interfrons* sp. nov. and *C. parvulus*. *Diaphorus robinsoni* sp. nov. is a true *Diaphorus* and is most similar to *D. amazonicus* Parent (Brazil) but this species has tergites 2–3 yellow laterally (wholly green in *D. robinsoni*) and *Diaphorus subsejunctus* Loew (Cuba) which has the eyes not meeting above antenna and pale calypteral setae (and thus might not be a true *Diaphorus*).

Genus *Symbolia* Becker

Symbolia linearis (Aldrich)

Anepsius linearis Aldrich, 1896: 317.
Sympycnus thoracicus Van Duzee, 1930b: 51.

Material examined. Dominica: 1 ♀, Dleau Morne Laurent, 1 March 1964, H. Robinson (USNM). **Montserrat:** 1 ♀, Katy Hill (top), 730 m, 16°45.731'N, 62°11.646'W, 28 June 2017, J.B. Runyon (MTEC).

Distribution. Lesser Antilles (Dominica, Grenada, Montserrat, and St. Vincent).

Remarks. The single female collected on Montserrat was taken from a large leaf at the top of Katy Hill, the highest point sampled on the island.

Subfamily Plagioneurinae
Genus *Plagioneurus* Loew

Plagioneurus univittatus Loew

Plagioneurus univittatus Loew, 1857: 43.

Material examined. Dominica: 1 ♂, Springfield Estate, yellow pans, 1–3 June 2011, M.A. & L.L. Ivie; 1 ♀, same as previous, Malaise trap, 29 May–11 June 2011. **Montserrat:** 1 ♂, Woodlands, Riverside House, 8–10 January 2002, yellow pan traps, K. Marske & K. Puliafico; 1 ♀, Sweetwater Ghaut, 1 August 2005, yellow pan traps, V.G. Martinson (MTEC, USNM).

Distribution. Widely distributed in the New World and reported from the eastern Nearctic, Central America, South America, and the West Indies (Robinson 1964; Pollet et al. 2004).

Subfamily Sympycninae
Genus *Sympycnus* Loew

Key to the species of *Sympycnus* in Montserrat

1 Thorax with 5 pairs of dorsocentral setae; body size ca. 1.5 mm..... ..... ***S. pentachaetus* Robinson**

– Thorax with 6 pairs of dorsocentral setae; body size ca. 2.2 mm..... ..... ***S. montserratensis* sp. nov.**

Sympycnus montserratensis sp. nov.

http://zoobank.org/9A4E8EE3-CA47-4C80-A185-55AB26BD2A9C
Fig. 32

Type material. ***Holotype***, ♂ labelled: "WEST INDIES: MONTSERRAT/ Katy Hill (top), 730 m/ 16°45.731'N, 62°11.646'W/ 28 JUNE 2017, J.B. Runyon"; "HOLOTYPE/ ♂ *Sympycnus*/ *montserratensis*/ Runyon [red label]" (USNM, type number USNMENT01350617). ***Paratypes*: Montserrat:** 1 ♂, 6 ♀, same data as holotype (MTEC, USNM).

Figure 32. *Sympycnus montserratensis* sp. nov. male **A** habitus of holotype, left lateral **B** tarsus I, posterior view, arrows indicate slender distally-curved ventral setae **C** male antenna, medial view. Scale bars: 0.5 mm (**A**), 0.25 mm (**B, C**).

Description. Male (Fig. 32A). Body length 2.2 mm, wing length 2.2 × width 0.8 mm. ***Head*:** Eyes essentially contiguous below, face very narrow throughout (most of face ≤ width of one ommatidium), very slightly widened near mouth and narrowly triangular immediately below antennae, dark brown with thick brown-gray pruinosity. Frons and occiput dark brown with dense brown-gray pruinosity. Palpus very small, narrowly oval, dark yellow with two small black setae near apex. Proboscis brown, with fine brown hairs along margin. Antenna (Fig. 32C) with scape and very base of first flagellomere yellow, remainder brown; first flagellomere broadly triangular with rounded apex, as long as high; arista-like stylus arising from middle of dorsal

edge. Lower postocular setae longer, whitish, upper postocular setae black. ***Thorax*****:** Scutum and scutellum yellow-brown with black setae; acrostichal setae absent; six pairs of dorsocentral setae, 5th and 6th pairs smaller, 5th pair slightly out of line; scutellum with one pair of large marginal setae and one pair of minute lateral hairs. Pleuron and metepimeron yellow, anepimeron with small black triangular area below wing insertion; proepisternum with two small, fine pale setae. ***Legs*****:** Yellow, except coxa II with small brown streak at insertion of ad seta and small black posterobasal spot; tarsi becoming faintly brown distally. Anterior surface of coxa I with short yellow to brown setae becoming larger distally and ca. five black setae across apex. Femur I with small subapical pv seta; femur II with subapical anterior and pv seta; femur III with subapical anterior seta. Tibia I without distinctive setae; tibia II with ad seta near 1/3 and 2/3, pd near 1/5, pv near 2/3, and 4 apical setae; tibia III with ad seta near 1/5, and small rather indistinct pd seta just before 1/5, 2/5, just beyond 1/2, near 2/3, and 4 apical setae. Tarsus I (Fig. 32B) with tarsomere I(1) bearing two longer slender distally-curved ventral setae in basal half and a slightly shorter such seta at apex, and series of ca. 4–6 very short slender more erect ventral setae scattered along length (two near base most distinct). Ratios of tibia:tarsomeres: leg I: 32-18-9-4-2-3; leg II: 45-22-10-8-5-4; leg III: 58-12-16-10-6-5. ***Wing*****:** Surface brownish tinged, slightly darker brown anteriorly, with dark brown veins; narrowly elliptical without anal lobe. R_{2+3} essentially straight. R_{4+5} distinctly arching backward and slightly convergent with M_1 near apex. M_1 arching backwards slightly near apex, ending in wing tip. Crossvein dm-cu two-thirds as long as last part of CuA_1. Calypter brown with fan of rather long yellow to light brown setae. Halter knob brownish yellow and stem yellow. ***Abdomen*****:** Cylindrical, slender, longer than thorax, with black setae. Tergites dark brown dorsally, except tergite I (and sometimes part of tergite II) yellow-brown dorsally; tergites I–V broadly yellow laterally; tergite 6 wholly dark brown. Sternites yellow. Abdomen without metallic reflections. Hypopygium very small, dark brown, mostly concealed in tip of preabdomen, not dissected. Cerci brown, narrowly triangular (twice as long as wide), covered with short brown hairs with longer nearly white hairs at apex.

Female. Body length 2.2–2.3 mm, wing length 2.2–2.3 × width 0.8–0.9 mm. Similar to male, but face broader (one-third width of frons), parallel-sided, upper face with gray pruinosity, clypeus with gray-brown pruinosity; palpus larger, dark yellow to nearly brown with white tip; dorsum of thorax more yellow with scutellum brown; tarsus I unmodified, but tarsus I(1) usually with one very short slender curved ventral seta evident at base; abdomen generally more yellow, curved downward when dry.

Etymology. This species is named for the island of Montserrat.

Distribution. Montserrat.

Remarks. *Sympycnus montserratensis* is related to *S. dominicensis* Robinson (Dominica) but differs most notably in color of the thorax (yellow-brown in *S. montserratensis*, brown in *S. dominicensis*) and form of front tarsus in males (e.g., position of slender curved ventral setae and relative length of tarsomeres; cf. Robinson 1975: fig. 194). Specimens were taken by sweeping shaded moist leaf-covered ground in elfin woodland on the top Katy Hill (Fig. 2C).

The hypopygium was not dissected to preserve intact the two male specimens and because male terminalia in Sympycninae frequently offer no reliable characters to separate species within a genus (e.g., Hurley and Runyon 2009; Evenhuis 2012; Runyon 2012).

Sympycnus pentachaetus Robinson

Sympycnus pentachaetus Robinson, 1975: 106.

Material examined. Dominica: 1 ♂, 3 ♀, St. David Parish, ca. 1 km NE Ponte Casse, Waitukubuli National Trail, 15.381490N, 61.340138W, Malaise trap, 31 May–5 June 2011. **Montserrat:** 1 ♀, Jack Boy Hill (top), 480 m, 16°45.797'N, 62°10.886'W, 25 June 2017, J.B. Runyon; 3 ♂, 3 ♀, Big River, 450 m, 16°45.690'N, 62°11.174'W, 28 June 2017, J.B. Runyon; 1 ♂, Bottomless Ghaut, 400 m, 16°45.994'N, 62°11.497'W, 28 June 2017, J.B. Runyon (MTEC, USNM).

Distribution. Dominica, Montserrat.

Remarks. *Sympycnus pentachaetus* adults were collected by sweeping shaded moist ground and streamside rocks in higher elevation mesic forests but at lower elevations than *S. montserratensis*.

Subfamily Dolichopodinae
Genus *Paraclius* Loew

Key to the species of *Paraclius* in Montserrat

1 Pleuron and much of abdomen yellow.....***P. megalocerus* Robinson**
– Most of pleuron and all of abdomen metallic green to blue.....
.....***P.* unidentified species (female)**

Paraclius megalocerus Robinson

Paraclius megalocerus Robinson, 1975: 111.

Material examined. Dominica: ***Holotype*** ♂, Clarke Hall, 28 February 1964, H. Robinson (USNM). **Montserrat:** 1 ♂, Woodlands, Riverside House, 8–10 January 2002, yellow pan traps, K. Marske & K. Puliafico (MTEC).

Distribution. Dominica, Montserrat.

Paraclius unidentified species

Material examined. Montserrat: 1 ♀, Woodlands, Riverside House, 8–10 January 2002, yellow pan traps, K. Marske & K. Puliafico (MTEC).

Remarks. The female specimen differs from those of *P. megalocerus* in having the pleuron and abdominal tergites metallic green or blue. This species seems most similar to males of *P. pavo* (Aldrich) from St. Vincent (the female is unknown) but cannot be confidently assigned to species.

Genus *Tachytrechus* Haliday

Tachytrechus perornatus Robinson

Tachytrechus perornatus Robinson, 1975: 122.

Material examined. Dominica: ***Holotype*** ♂, La Ronde River, 15 February 1964, H. Robinson (USNM). **Montserrat:** 2 ♂, 3 ♀, Hope Ghaut, 280 m, 16°45.101'N, 62°12.760'W, 20 June 2017, J.B. Runyon; 1 ♀, same as previous, 300 m, 16°45.108'N, 62°12.695'W (MTEC, USNM).

Distribution. Dominica, Montserrat.

Remarks. Adults were collected from rocks in a small stream with flowing water.

Subfamily Hydrophorinae

Genus *Cymatopus* Kertész

Cymatopus bredini Robinson

Cymatopus bredini Robinson, 1975: 125.

Material examined. Dominica: ***Holotype*** ♂, Calibishie seashore, 27 February 1965, W.W. Wirth (USNM). **Montserrat:** 11 ♂, 5 ♀, Rendezvous Bay Beach, rocks in intertidal zone, 16°48.489'N, 62°12.296'W, 23 June 2017, J.B. Runyon. **St. Kitts:** 1 ♂, North Friars Bay, 17°16.59'N, 62°40.33'W, 24 May 2017, J.B. Runyon (MTEC, USNM).

Distribution. Lesser Antilles (Antigua, Dominica, Montserrat, St. Kitts).

Remarks. Montserrat specimens were obtained by sweeping partially shaded nearly vertical walls in the splash zone of large rock outcrops at the south end of Rendezvous Bay Beach.

Genus *Thinophilus* Wahlberg

Thinophilus ochrifacies Van Duzee

Thinophilus ochrifacies Van Duzee, 1924a: 101.

Material examined. Anguilla: 2 ♀, Sombrero, 18°35.17'N, 63°25.63'W, small freshwater pool, 12–13 November 1999, M.A. Ivie & J.B. Runyon. **Montserrat:** 4 ♂, 1 ♀, Fox's Bay Beach, 16°43.59'N, 62°14.17'W, 23 June 2017, J.B. Runyon. **St. Kitts:** 1 ♂, South Frigate Bay, 17°16.869'N, 62°41.201'W, 24 May 2017, J.B. Runyon. **St. Lu-**

cia: 7 ♂, 6 ♀, Savannes, Mangrove Reserve, 0–5 m, 13°45.97'N, 60°54.88'W, 3 May 2009, J.B. Runyon; 4 ♂, 3 ♀, Fond Bay at beach, 0–5 m, 13°49.89'N, 60°53.65'W, 8 May 2009, J.B. Runyon (MTEC, USNM).

Distribution. Nova Scotia, Canada south to Mexico and the West Indies (Robinson 1975).

Remarks. This species is restricted to coastal areas. Adults were found in Montserrat on open mud at edges of a drying freshwater pool at the back of Fox's Bay Beach.

Discussion

Summary of Montserrat fauna

The list of Montserrat Dolichopodidae includes 63 species in 27 genera (Table 2). Two-thirds of Montserrat's species (41 spp. or 65%) are endemic to the Lesser Antilles, 10% (6 spp.) are restricted to the wider West Indies, and ca. 25% (15 spp.) are widespread natives that also occur on the mainland. Six species are known only from Montserrat and could be single island endemics (*Amblypsilopus marskeae*, *Chrysotus montserratensis*, *C. interfrons*, *Medetera iviei*, *M. montserratensis*, and *Sympycnus montserratensis*). There is no evidence that any dolichopodid species was introduced by human activities, and all appear to naturally occur on Montserrat.

How many dolichopodid species occur on Montserrat? The species list provided here is undoubtedly incomplete. Based on the Chao 1 estimator (Chao 1984), which takes into account the number of species represented by precisely one (eight species), and the number represented by precisely two (four species) individuals, it is estimated there are an additional eight species to be discovered, and when fully known Montserrat's fauna will contain approximately 71 species of Dolichopodidae. The rarefaction curve showing accumulation of unique species levels off but does not reach an asymptote (Fig. 3), suggesting more species will be discovered if sampling effort is further increased. Extrapolation of this curve estimates that doubling the original effort (i.e., collecting another 1500 specimens) would yield ca. six additional species. However, focused collecting in habitats inadequately sampled to date (e.g., high elevations) or likely to support the most diverse dolichopodid communities (e.g., deep ghauts, permanent streams) will more efficiently allow collection of undiscovered species. An important caveat is that less than half the island was sampled due to the volcano exclusion zone and surveying intact habitats on the southern half of Montserrat, e.g., the sizeable remaining higher-elevation forests in the Roaches area, could add even more species.

Comparison of Dominica and Montserrat faunas

Dominica and Montserrat are the only two islands in the Lesser Antilles with reasonably well-sampled and described dolichopodid faunas. The 63 species on Montserrat (ca. 100 km^2) is greater than half of the 119 species known from Dominica (ca. 750 km^2). For species-area relationship (Preston 1962) this gives a preliminary value

of 15.1 for c and 0.311 for z for Dolichopodidae in the volcanic islands of the Lesser Antilles. Clearly, a better understanding of the dolichopodid faunas of other islands in the Lesser Antilles is needed to accurately assess the species-area relationship of the region. Using Darlington's rule of thumb (MacArthur and Wilson 1967) that a ten-fold increase in area results in a doubling of species richness, Montserrat has more species than predicted relative to Dominica, and this is further supported by the fact that less than half of Montserrat's area was sampled (due to the exclusion zone). However, the respective faunas are not completely known, and it seems likely that Dominica has more species remaining to be discovered than Montserrat.

The vast majority of species on Montserrat also occur on Dominica (ca. 87%), indicating that Dolichopodidae, in general, are effective at dispersing. Montserrat has 27 of the 33 genera occurring on Dominica (missing *Discopygiella* Robinson, *Dominicomyia* Robinson, *Haromyia* Runyon, *Micromedetera* Robinson, *Pelastoneurus* Loew, and *Pseudosympycnus* Robinson). Twenty-two species are currently known to occur only on Dominica and Montserrat. These latter species also likely occur in Guadeloupe (which has no published records of dolichopodids) and possibly other neighboring islands.

Among the dolichopodid species or genera that are present on Dominica but missing from Montserrat, some can be explained by habitat diversity, especially wet habitats. For example, the general lack of standing fresh water (e.g., lakes or swamps) on Montserrat could explain the absence of *Pelastoneurus* (three species on Dominica) and some species of *Thrypticus* (possibly due to absence of their aquatic host plants). Moreover, several species on Dominica appear restricted to larger permanent rivers (e.g., *Micromedetera*), a habitat absent on Montserrat. Elevation also plays a role since Dominica's maximum elevation (ca. 1,450 m) and amount of high elevation habitat is greater than Montserrat's (maximum elevation ca. 1,050 m) and some Dominica species not on Montserrat seem restricted to these higher habitats (e.g., *Pseudosympycnus*). Montserrat's highest intact habitat is Katy Hill (741 m) with the highest elevations on the island, the peaks of the Soufrière Hills, destroyed by volcanic activity – if higher elevation species occurred there, they are now almost certainly gone. The volcanic nature and small size of Montserrat could also result in periodic extinction events, perhaps for the whole island, requiring recolonization and leading to lower island endemicity. A component underrepresented on Montserrat is the so-called 'micro-dolichopodids', species in several genera with body size ca. 1.0 mm (Runyon and Robinson 2010). These species can be difficult to collect due to their small size, elusive habits, and microhabitat specialization (Robinson 1969, 1975, Runyon and Pollet 2018). For example, it seems very likely that additional species of the micro-dolichopidid genus *Enlinia* occur on Montserrat as two or more species occur on West Indian islands of similar or smaller size (Runyon, unpublished data). Targeted net collecting focusing on areas with permanent or semi-permanent water will likely lead to discovery of more micro-dolichopodid species on Montserrat.

Comparison of collecting methods

Five collecting methods were used in this survey: Malaise traps, pan traps, ultraviolet light traps, canopy fogging, and targeted net collecting. All methods collected doli-

chopodid specimens, but most productive were net collecting (40 spp.), pan traps (33 spp.), and Malaise traps (29 spp.). Canopy fogging and ultraviolet light traps each collected ten species. Twenty-eight species were caught by only one collecting method, 20 species by two methods, nine by three methods, three by four methods, and three species were caught by all five collecting methods. Of the species unique to one method, net collecting (14 unique spp.), Malaise traps (8 unique spp.), and pan traps (6 unique spp.) caught the most. Canopy fogging and ultraviolet light traps caught no unique species, suggesting that inventorying dolichopodids with net collecting, pan and Malaise traps is sufficient. However, trap types were not deployed equally across time and habitats which likely influenced their relative effectiveness.

The relatively large number of species unique to net collecting can be largely explained by the habitat preferences of these species and the difficulty in using passive traps in such habitats. For example, four coastal/littoral species (*Chimerothalassius runyoni*, *Chrysotus angustifrons*, *Cymatopus bredini*, and *Thinophilus ochrifacies*) were only obtained by net collecting in areas where trapping was not possible or attempted. Moreover, passive trapping caught just three specimens (all female) of the two beach-inhabiting species of *Asyndetus*, whereas dozens of specimens (including males) of both species were readily obtained with a net. Other examples of species caught only by net include those restricted to rocks in streams (*Enlinia patellitarsis*, *Peloropeodes frater*, *Sympycnus pentachaetus*, and *Tachytrechus perornatus*) or the highest elevations (e.g., *Symbolia linearis* and *Sympycnus montserratensis*), habitats in which it is difficult to place and maintain traps. Another contributing factor is the 2001–2005 survey focused primarily on Coleoptera and traps were not specifically placed in areas to target dolichopodids. This underscores the importance of targeted net collecting or careful trap placement during inventories, e.g., to avoid missing habitat-specific species of Diptera.

Threats to the Montserrat fauna

Although the Soufrière Hills volcano has been quiet in recent years, additional volcanic activity remains the primary threat to Montserrat dolichopodids. Since volcanic activity began in 1995, approximately 60% of the forest cover on Montserrat has been lost (Young 2008). Additional volcanic activity could destroy remaining intact habitats and ash fall events can have significant negative effects on arthropods (Marske et al. 2007). Ash fall can severely negatively affect water quality and associated riparian areas – habitats that many species of dolichopodids depend on – and smaller waterways, like those on Montserrat, are most affected (Miserendino et al. 2012).

The Centre Hills contains the largest remaining tract of forest in Montserrat (Fig. 1), and most species of Dolichopodidae were found there. Most of the mid to upper elevations of the Centre Hills were protected in 2000 under the Protected Forest Order and Forest Reserve Order of the Forestry, Wildlife, National Parks and Protected Areas Act (Young 2008). However, most of the lower elevations of the Centre Hills and dry/littoral forests remain unprotected. Three of the six species of dolichopodids endemic to Montserrat appear restricted to these lower elevation habitats (*Amblypsilopus marskeae*, *Chrysotus interfrons*, and *Medetera iviei*), and protecting areas representative

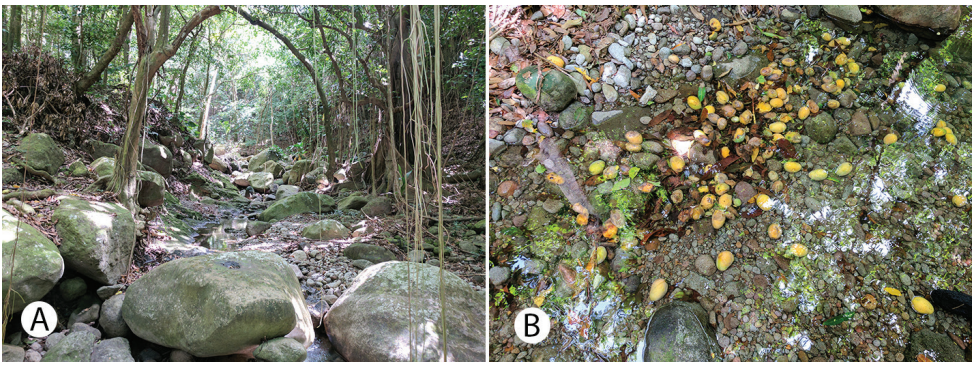

Figure 33. The presence of large numbers of mango trees seemed to negatively affect the abundance and diversity of dolichopodids along some Montserrat streams **A** Fogarty Ghaut seems an ideal place for Dolichopodidae, but few were found **B** large numbers of mango fruit and leaves filled the stream and stream sides in Fogarty Ghaut, suggesting that chemicals from this material could be killing aquatic or semi-aquatic insects. Photographs by Justin Runyon.

of these habitats could ensure conservation of these unique species. Protection of these drier habitats was among the highest priority conservation recommendations resulting from the Centre Hills Biodiversity Assessment (Young 2008).

Of final note is nonnative mango (*Mangifera indica* L.) and its possible negative effects on dolichopodids and other aquatic or semi-aquatic insects. Mango is native to South Asia and cultivated widely in the tropics, including Montserrat. The skin of the fruit, leaves, and bark contain chemical compounds that can cause contact dermatitis in humans (Oka et al. 2004) and be toxic to insects. For example, aqueous extracts of *M. indica* are known to kill Diptera larvae (e.g., mosquitoes; Rahuman et al. 2009; Zuharah et al. 2014) and have been used to control aphid, beetle, and moth pests in cowpea crops in Africa (Kossou et al. 2001). Mango trees are very abundant along some lower elevation waterways and fruits and leaves fall in large numbers into these streams and streamside habitats (Fig. 33B). Dolichopodids and other aquatic insects were largely absent at several sites on Montserrat invaded by large numbers of mango trees (e.g., very few individuals of just two or three species found at Fairy Walk River and Fogarty Ghaut) that are seemingly ideal habitats that should support a diverse and abundant dolichopodid community (Fig. 33A). Species that were abundant along streams with lots of mangos were those that are not strictly aquatic or semi-aquatic (e.g., *Medetera* spp., whose larvae live under tree bark). This phenomenon was also observed on St. Kitts (Runyon, personal observation). More research is needed to determine if mangoes are responsible. If so, limiting spread or reducing the numbers of large mango trees might be an effective way to improve habitat for insects (upon which other organisms depend, including the endemic and critically endangered Montserrat oriole). However, control of mangos would need to be balanced with the important habitat large trees can provide for the endemic orchid *Epidendrum montserratense* Nir (Young 2008), agriculture, and the livelihoods of those that collect fruits to eat or sale.

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References

Aldrich JM (1896) Dolichopodidae; Phoridae. In: Williston SW (Ed.) On the Diptera of St. Vincent (West Indies). Transactions of the Entomological Society of London 1896: 309–345. [435–438.]

Aldrich JM (1901) Supplement. Dolichopodidae. In: Godman FD, Salvin O (Eds) Biologia Centrali Americana. Zoologia Insecta Diptera (Vol. 1). 333–366.

Aldrich JM (1902) Dolichopodidae of Grenada, W.I. Kansas University Science Bulletin 1: 75–94.

Becker T (1922) Dipterologische Studien, Dolichopodidae. B. Nearktische und Neotropische Region. Abhandlungen der Zoologisch-Botanischen Gesellschaft in Wein (1921) 13(1): 1–394. https://doi.org/10.5962/bhl.title.9607

Bickel DJ (1985) A revision of the Nearctic *Medetera* (Diptera: Dolichopodidae). U.S. Department of Agriculture, Technical Bulletin 1692: 1–109.

Bickel DJ (2000) New World *Achradocera* in Hawai'i, Tonga, and French Polynesia, with discussion of the genus (Diptera: Dolichopodidae). Bishop Museum Occasional Papers 64: 14–20.

Bickel DJ (2002) New synonyms in the Nearctic and Neotropical Sciapodinae (Diptera: Dolichopodidae). Studia dipterologica 9: 545–560.

Bickel DJ (2009) Family Dolichopodidae. In: Brown BV, Borkent A, Cumming JM, Wood DM, Woodley NE, Zumbado M (Eds) Manual of Central American Diptera (Vol. 1). NRC Press, Ottawa, 671–694.

Bickel DJ (2015) The Costa Rican *Systenus* Loew (Diptera: Dolichopodidae): rich local sympatry in an otherwise rare genus. Zootaxa 4020: 169–182. https://doi.org/10.11646/zootaxa.4020.1.7

Bickel DJ, Arnaud Jr PH (2011) *Medetera johnthomasi* (Diptera: Dolichopodidae), a new species from California with notes on the *aberrans* species group. The Pan-Pacific Entomologist 87: 124–129. https://doi.org/10.3956/2011-09.1

Bickel DJ, Sinclair BJ (1997) The Dolichopodidae (Diptera) of the Galápagos Islands, with notes on the New World fauna. Entomologica scandinavica 28: 241–270. https://doi.org/10.1163/187631297X00079

Bickel DJ, Hernandez MC (2004) Neotropical *Thrypticus* (Diptera: Dolichopodidae) reared from water hyacinth, *Eichhornia crassipes*, and other Pontederiaceae. Annals of the Entomological Society of America 97: 437–449. https://doi.org/10.1603/0013-8746(2004)097[0437:NTDDRF]2.0.CO;2

Bigot MF (1888) [Diagnoses d'espèces nouvelles de Dolichopodi]. Annales de la Société entomologique de France 8: xix–xxx.

Bigot MF (1890) Diptères nouveaux ou peu connus. 36^{e} partie. XLV Dolichopodi. Annales de la Société entomologique de France 10: 261–296.

Borkent A, Brown BV, Adler PH, Amorim DS, Barber K, Bickel D, Boucher S, Brooks SE, Burger J, Burington ZL, Capellari RS, Costa DNR, Cumming JM, Curler G, Dick CW, Epler JH, Fisher E, Gaimari SD, Gelhaus J, Grimaldi DA, Hash J, Hauser M, Hippa H, Ibáñez-Bernal A, Jaschhof M, Kameneva EP, Kerr PH, Korneyev V, Korytkowski CA, Kung G-A, Kvifte GM, Lonsdale O, Marshall SA, Mathis W, Michelsen V, Naglis S, Norrbom AL, Paiero S, Pape T, Pereira-Colavite A, Pollet M, Rochefort S, Rung A, Runyon JB, Savage J, Silva VC, Sinclair BJ, Skevington JH, Stireman III JO, Swann J, Vilkamaa P, Wheeler T, Whitworth T, Wong M, Wood DM, Woodley N, Yau T, Zavortink TJ, Zumbado MA (2018) Remarkable fly (Diptera) diversity in a patch of Costa Rican cloud forest: Why inventory is a vital science. Zootaxa 4402: 53–90. https://doi.org/10.11646/zootaxa.4402.1.3

Brooks SE, Cumming JM (2011) The New World genera of *Parathalassiinae* (Diptera: Empidoidea: Dolichopodidae s.lat.), with new species of *Thalassophorus* and *Eothalassius*. The Canadian Entomologist 143: 423–446. https://doi.org/10.4039/n11-027

Brooks SE, Cumming JM (2018) New species of *Chimerothalassius* Shamshev & Grootaert (Diptera: Dolichopodidae: Parathalassiinae) from the West Indies and Costa Rica. Zootaxa 4387: 511–523. https://doi.org/10.11646/zootaxa.4387.3.6

Brown BV (2009) Introduction. In: Brown BV, Borkent A, Cumming JM, Wood DM, Woodley NE, Zumbado M (Eds) Manual of Central American Diptera (Vol. 1). NRC Press, Ottawa, 7 pp.

Brown BV, Borkent AH, Adler P, Amorim DdS, Barber K, Bickel D, Boucher S, Brooks SE, Burger J, Burington ZL, Capelari RS, Costa DNR, Cumming JM, Curler G, Dick CW, Epler JH, Fisher E, Gaimari SD, Gelhaus J, Grimaldi DA, Hash J, Hauser M, Hippa H, Ibáñez-Bernal S, Jaschhof M, Kameneva EP, Kerr PH, Korneyev V, Korytkowski CA, Kung G-A, Kvifte GM, Lonsdale O, Marshall SA, Mathis W, Michelsen V, Naglis S, Norrbom AL, Paiero S, Pape T, Pereira-Colavite A, Pollet M, Rochefort S, Rung A, Runyon JB, Savage J, Silva VC, Sinclair BJ, Skevington JH, Stireman III JO, Swann J, Thompson FC, Vilkamaa P, Wheeler T, Whitworth T, Wong M, Wood DM, Woodley N, Yau T, Zavortink TJ, Zumbado MA (2018) Comprehensive inventory of true flies (Diptera) at a tropical site. Communications Biology 1: 1–8. https://doi.org/10.1038/s42003-018-0022-x

Capellari RS, Amorim DS (2010) Re-description and new combination of five New World species of *Chrysotus* Meigen, with comments on the Neotropical genus *Lyroneurus* Loew (Diptera: Dolichopodidae). Zootaxa 2520: 49–65. https://doi.org/10.11646/zootaxa.2520.1.2

Capellari RS, de Souza Amorim D (2014) New combinations and synonymies for Neotropical species of Diaphorinae (Diptera: Dolichopodidae). Contributions to Entomology 64: 375–381. https://doi.org/10.21248/contrib.entomol.64.2.375-381

Capellari RS (2015) Review of the *longipalpus*-group of *Chrysotus* Meigen (Diptera: Dolichopodidae), with description of four new species. Neotropical Entomology 44: 47–58. https://doi.org/10.1007/s13744-014-0254-5

Chao A (1984) Non-parametric estimation of the number of classes in a population. Scandinavian Journal of Statistics 11: 265–270.

Chao A, Ma KH, Hsieh TC (2016) iNEXT (iNterpolation and EXTrapolation) Online. Program and User's Guide. http://chao.stat.nthu.edu.tw/wordpress/software_download/

Cumming JM, Wood DM (2009) Adult morphology and terminology. In: Brown BV, Borkent A, Cumming JM, Wood DM, Woodley NE, Zumbado M (Eds) Manual of Central American Diptera (Vol. 1). NRC Press, Ottawa, 9–50.

Druitt TH, Kokelaar BP (2002) The eruption of Soufrière Hills Volcano, Montserrat, from 1995 to 1999. Geological Society, London, Memoirs 21: 1–645. https://doi.org/10.1144/GSL.MEM.2002.021.01.03

Dyte CE (1959) Some interesting habitats of larval Dolichopodidae (Diptera). Entomologist's Monthly Magazine 95: 139–143.

Evenhuis NL (2012) Review of the *Campsicnemus fumipennis* group (Diptera: Dolichopodidae) in the Hawaiian Islands, with descriptions of new species and corrections of misidentifications. Zootaxa 3497: 1–16. https://doi.org/10.11646/zootaxa.3497.1.1

Fabricius JC (1775) Systema Entomologiae. Flensburgi et Lipsiae, 832 pp.

Gosseries J (1988) Some new names in the Dolichopodidae (Diptera). Bulletin et Annales de la Société royale belge d'Entomologie 124: 304–307.

Harford CL, Pringle MS, Sparks RSJ, Young SR (2002) The volcanic evolution of Montserrat using 40Ar/39Ar geochronology. Geological Society, London, Memoirs 21: 93–113. https://doi.org/10.1144/GSL.MEM.2002.021.01.05

Hemmings B, Whitaker F, Gottsmann J, Hughes A (2015) Hydrogeology of Montserrat review and new insights. Journal of Hydrology: Regional Studies 3: 1–30. https://doi.org/10.1016/j.ejrh.2014.08.008

Hurley RL, Runyon JB (2009) A review of *Erebomyia* (Diptera: Dolichopodidae), with descriptions of three new species. Zootaxa 2054: 38–48. https://doi.org/10.11646/zootaxa.2054.1.2

Ivie MA, Marske KA, Foley IA, Guerrero KA, Ivie LL (2008) Invertebrates of the Centre Hills and Montserrat, with an emphasis on beetles. In: Young RP (Ed.) A Biodiversity Assessment of the Centre Hills, Montserrat. Durrell Conservation Monograph No. 1. Durrell Wildlife Conservation Trust, Jersey, Channel Islands, 56–89.

Kautz AR, Gardiner MM (2019) Agricultural intensification may create an attractive sink for Dolichopodidae, a ubiquitous but understudied predatory fly family. Journal of Insect Conservation 23: 453–465. https://doi.org/10.1007/s10841-018-0116-2

Kossou DK, Gbèhounou G, Ahanchédé A, Ahohuendo B, Bouraïma Y, Huis AV (2001) Indigenous cowpea production and protection practices in Benin. International Journal of Tropical Insect Science 21: 123–132. https://doi.org/10.1017/S1742758400020178

Laing J, Welch HE (1963) A dolichopodid predacious on larvae of *Culex restuans* Theob. Proceedings of the Entomological Society of Ontario 93: 89–90.

Loew H (1857) Dipterologische Mitteilungen. Wiener Entomologische Monatschrift 1: 33–56. https://doi.org/10.1002/mmnd.48018570122

Loew H (1861) Neue Beiträge zur Kenntniss der Dipteren. Achter Beitrag. Programme der Königlichen Realschule zu Meseritz 1861: 1–100.

Loew H (1869) Diptera Americae septentrionalis indigena. Centuria otava. Berliner Entomologische Zeitschrift 13: 1–52.

MacArthur RH, Wilson EO (1967) The Theory of Island Biogeography. Princeton University Press, Princeton, 203 pp.

Macquart J (1834) Histoire naturelle des insectes. Diptères. Tome premier. N.E. Roret, Paris, 578 pp. https://doi.org/10.5962/bhl.title.14274

Macquart J (1842) Diptères exotiques nouveaux ou peu connus. Tome deuxième.–2^{e} partie. N.E. Roret, Paris, 136 pp. [pp. 65–200]

Marske KA (2004) Effects of Volcanic ash on the Insect Food of the Montserrat Oriole *Icterus oberi* Lawrence 1880. Master's thesis, Montana State University, Bozeman, US, 178 pp.

Marske KA, Ivie MA, Hilton GM (2007) Effects of volcanic ash on the forest canopy insects of Montserrat, West Indies. Environmental Entomology 36: 817–825. https://doi.org/10.1093/ee/36.4.817

McAlpine JF (1981) Morphology and terminology – adults. In: McAlpine JF, Peterson BV, Shewell GE, Teskey HJ, Vockeroth JR, Wood DM (Coordinators) Manual of Nearctic Diptera (Vol. 1). Agriculture Canada Monograph 27, 9–63.

Meuffels HJG, Grootaert P (1999) New names in the family Dolichopodidae (Diptera). Bulletin de l'Institut Royal des Sciences Naturelles de Belgique, Entomologie 69: 289–292.

Miserendino ML, Archangelsky M, Brand C, Epele LB (2012) Environmental changes and macroinvertebrate responses in Patagonian streams (Argentina) to ashfall from the Chaitén Volcano (May 2008). Science of the Total Environment 424: 202–212. https://doi.org/10.1016/j.scitotenv.2012.02.054

Naglis SM (2001) Revision of the Neotropical Neurigoninae (Diptera: Dolichopodidae) I: *Coeloglutus* Aldrich, *Neotonnoiria* Robinson, and *Paracoeloglutus* gen. nov., with the definition of the tribe Coeloglutini stat. nov. Studia dipterologica 8: 189–206.

Naglis SM (2002) Revision of the Neotropical Neurigoninae (Diptera: Dolichopodidae) II: *Argentinia* Parent, *Dactylomyia* Aldrich, *Macrodactylomyia* gen. nov., and *Systenoides* gen. nov., with the definition of a new tribe Dactylomyiini. Studia dipterologica 8 (2001): 475–504.

Naglis SM (2003) Revision of the Neotropical Neurigoninae (Diptera: Dolichopodidae) IV: *Viridigona* gen. nov. Studia dipterologica 9 (2002): 561–604.

Naglis S, Bickel DJ (2017) Order Diptera, Family Dolichopodidae, Subfamily Sciapodinae. Arthropod fauna of the UAE 6: 565–571.

Nicolai V (1995) The impact of *Medetera dendrobaena* Kowarz (Dipt., Dolichopodidae) on bark beetles. Journal of Applied Entomology 119: 161–166. https://doi.org/10.1111/j.1439-0418.1995.tb01264.x

Oka K, Saito F, Yasuhara T, Sugimoto A (2004) A study of cross-reactions between mango contact allergens and urushiol. Contact Dermatitis 51: 292–296. https://doi.org/10.1111/j.0105-1873.2004.00451.x

Parent O (1928) Etude sur les Diptères Dolichopodides exotiques conservés au Zoologisches Staatsinstitut und Zoologisches Museum de Hambourg. Mitteilungen aus dem Zoologischen Staatsinstitut und Zoologischen Museum in Hamburg 43: 155–198.

Pollet M (2009) Diptera as ecological indicators of habitat and habitat change. In: Pape T, Bickel D, Meier R (Eds) Diptera Diversity: Status, Challenges and Tools. Koninklijke Brill NV, Leiden, 302–322. https://doi.org/10.1163/ej.9789004148970.I-459.50

Pollet MA, Brooks SE, Cumming JM (2004) Catalog of the Dolichopodidae (Diptera) of America north of Mexico. Bulletin of the American Museum of Natural History 283: 1–114. https://doi.org/10.1206/0003-0090(2004)283<0001:COTDDO>2.0.CO;2

Pollet M, Leponce M, Pascal O, Touroult J, Van Calster H (2018) Dipterological survey in Mitaraka Massif (French Guiana) reveals megadiverse dolichopodid fauna with an unprecedented species richness in *Paraclius* Loew, 1864 (Diptera: Dolichopodidae). Zoosystema 40: 471–491. https://doi.org/10.5252/zoosystema2018v40a21

Preston FW (1962) The canonical distribution of commonness and rarity. Ecology 43: 185–215. https://doi.org/10.2307/1931976

Rahuman AA, Bagavan A, Kamaraj C, Vadivelu M, Zahir AA, Elango G, Pandiyan G (2009) Evaluation of indigenous plant extracts against larvae of *Culex quinquefasciatus* Say (Diptera: Culicidae). Parasitology Research 104: 1–637. https://doi.org/10.1007/s00436-008-1240-9

Rea WJ (1974) The volcanic geology and petrology of Montserrat, West Indies. Journal of the Geological Society 130: 341–366. https://doi.org/10.1144/gsjgs.130.4.0341

Regan K, Ordosch D, Glover KD, Tilmon KJ, Szczepaniec A (2017) Effects of a pyrethroid and two neonicotinoid insecticides on population dynamics of key pests of soybean and abundance of their natural enemies. Crop Protection 98: 24–32. https://doi.org/10.1016/j.cropro.2017.03.004

Robinson H (1964) A synopsis of the Dolichopodidae (Diptera) of the southeastern United States and adjacent regions. Miscellaneous Publications of the Entomological Society of America 4: 105–192.

Robinson H (1967a) Revision of the genus *Harmstonia* (Diptera: Dolichopodidae). Proceedings of the United States National Museum 123: 1–16. https://doi.org/10.5479/si.00963801.123-3615.1

Robinson H (1967b) New species of Dolichopodidae from the United States and Mexico (Diptera). Proceedings of the Entomological Society of Washington 69: 114–127.

Robinson H (1969) A monographic study of the Mexican species of *Enlinia* (Diptera: Dolichopodidae). Smithsonian Contributions to Zoology 25: 1–62. https://doi.org/10.5479/si.00810282.25

Robinson H (1975) Bredin-Archbold-Smithsonian Biological Survey of Dominica, the family Dolichopodidae with some related Antillean and Panamanian species (Diptera). Smithsonian Contributions to Zoology 185: 1–141. https://doi.org/10.5479/si.00810282.185

Robinson H, Vockeroth JR (1981) Dolichopodidae [Chapter 48]. In: McAlpine JF, Peterson BV, Shewell GE, Teskey HJ, Vockeroth JR, Wood DM (Eds) Manual of Nearctic Diptera (Vol. 1). Agriculture Canada Monograph 27: 625–639.

Robinson H, Deyrup M (1997) Two new species of *Asyndetus* Loew, and notes on the identity of *A. interruptus* Loew (Diptera: Dolichopodidae). Proceedings of the Entomological Society of Washington 99: 477–482.

Runyon JB (2012) The Nearctic species of *Telmaturgus* (Diptera: Dolichopodidae). The Canadian Entomologist 144: 337–347. https://doi.org/10.4039/tce.2012.30

Runyon JB (2015) *Haromyia*, a new genus of long-legged flies from Dominica (Diptera: Dolichopodidae). Zootaxa 3964: 589–595. https://doi.org/10.11646/zootaxa.3964.5.10

Runyon JB, Capellari RS (2018) Palpi aplenty: new species in the *Chrysotus longipalpus* species group (Diptera: Dolichopodidae). Zootaxa 4399: 579–585. https://doi.org/10.11646/zootaxa.4399.4.8

Runyon JB, Pollet M (2018) *Enlinia* of Mitaraka, French Guiana (Diptera: Dolichopodidae). Zoosystema 40: 453–468. https://doi.org/10.5252/zoosystema2018v40a19

Runyon JB, Robinson H (2010) *Hurleyella*, a new genus of Nearctic Dolichopodidae (Diptera). Zootaxa 2400: 57–65. https://doi.org/10.11646/zootaxa.2400.1.6

Say T (1829–1830) Description of North American dipterous insects. Journal of the Academy of Natural Sciences of Philadelphia 6: 149–178 (1829). [183–188 (1830)]

Sinclair BJ, Cumming JM (2006) The morphology, higher-level phylogeny and classification of the Empidoidea (Diptera). Zootaxa 1180: 1–172. https://doi.org/10.11646/zootaxa.1180.1.1

Smith ML, Hedges SB, Buck W, Hemphill A, Inchaustegui S, Ivie M, Martina D, Maunder M, Ortega JF (2005) Caribbean Islands. In: Mittermeier RA, Gil PR, Hoffmann M, Pilgrim J, Brooks T, Mittermeier CM, Lamoreux J, Da Fonseca GAB (Eds) Hotspots Revisited: Earth's Biologically Richest and Most Endangered Terrestrial Ecoregions. CEMEX, Mexico City, 112–118.

Thomson CG (1869) 6. Diptera. Species nova descripsit. Kongliga Svenska Vetenskaps-Akademien, Kongliga svenska fregatten Eugenies resa omkring jorden Pt. 2: Zoologie, Sec. 1: Insekter: 443–614, pl. 9. P.A. Nordstedt & Söner, Stockholm, 617 pp.

Ulrich H (2004) Predation by adult Dolichopodidae (Diptera): a review of literature with an annotated prey-predator list. Studia dipterologica 11: 369–403.

Van Duzee MC (1914) Notes on *Sciapus*, with descriptions of three new species. The Canadian Entomologist 46: 389–393.

Van Duzee MC (1924a) New species of the dipterous family Dolichopodidae. Occasional Papers of the Boston Society of Natural History 5: 101–106.

Van Duzee MC (1924b) A revision of the North American species of the dipterous genus *Chrysotus*. Bulletin of the Buffalo Society of Natural Sciences 13: 3–53.

Van Duzee MC (l927) New Dolichopodidae from the West Indies. American Museum Novitates 262: 1–10.

Van Duzee MC (1930a) New species of Dolichopodidae from North America and the West Indies. The Canadian Entomologist 62: 84–87. https://doi.org/10.4039/Ent6284-4

Van Duzee MC (1930b) The dipterous genus *Sympycnus* Loew in North America and the West Indies. Pan-Pacific Entomologist 7: 35–47. [49–63.]

Van Duzee MC (1931a) Dolichopodidae of the Canal Zone. Bulletin of the American Museum of Natural History 61: 161–205.

Van Duzee MC (1931b) New South and Central American Dolichopodidae. American Museum Novitates 484: 1–14.

Van Duzee MC (1932) Three new species of Dolichopodidae from North America and Cuba, with notes on *Diaphorus leucostola* Loew and its allies (Diptera). Entomological News 43: 183–187.

Van Duzee MC (1933a) New American Dolichopodidae. American Museum Novitates 655: 1–20.

Van Duzee MC (1933b) The Templeton Crocker Expedition of the California Academy of Sciences, 1932. No. 7. Dolichopodidae and Phoridae. Proceedings of the California Academy of Sciences 21: 65–73.

Walker F (1848–1849) List of the specimens of dipterous insects in the collection of the British Museum 1: 12–29 (1848). [2: 231–484 (1849); 3: 485–687 (1849); 4: 688–1172 (1849). British Museum, London.]

Wei L (2012) The evolutionary significance on fr/fa ratio of *Chrysotus* Meigen (Diptera, Dolichopodidae, Diaphorinae), with descriptions of one new genus and five new species. Acta Zootaxonomica Sinica 37: 611–622.

Wheeler WM (1899) New species of Dolichopodidae from the United States. Proceedings of the California Academy of Sciences ser. 3(2): 1–84.

Yang D, Zhu Y, Wang M, Zhang L (2006) World Catalog of Dolichopodidae (Insecta: Diptera). China Agricultural University Press, Beijing, 704 pp.

Young RP (2008) A Biodiversity Assessment of the Centre Hills, Montserrat. Durrell Conservation Monograph No. 1. Durrell Wildlife Conservation Trust, Jersey, Channel Islands, 319 pp. http://wildlife.durrell.org/library/document/durrell_cons_monograph_1_full_report.pdf

Zetterstedt JW (1843) Diptera Scandinaviae. Disposita et descripta 2: 441–894.

Zuharah WF, Fadzly N, Ali Y, Zakaria R, Juperi S, Asyraf M, Dieng H (2014) Larvicidal efficacy screening of Anacardaciae crude extracts on the dengue hemorrhagic vector, *Aedes aegypti*. Tropical Biomedicine 31: 297–304.

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RESEARCH ARTICLE

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The identity of Alfred Wallace's mysterious butterfly taxon *Lycaena nisa* solved: *Famegana nisa* comb. nov., a senior synonym of *F. alsulus* (Lepidoptera, Lycaenidae, Polyommatinae)

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Abstract

Lycaena nisa Wallace, 1866 was described from Formosa (Taiwan) and is here recognized as a senior subjective synonym of *Lycaena alsulus* Herrich-Schäffer, 1869. It is resurrected to serve as the valid name, *Famegana nisa* (Wallace, 1866), **comb nov.** of the species commonly known as *Famegana alsulus*. The name *Zizera taiwana* Sonan, 1938 (**syn. nov.**), also described from Formosa, is recognized as a junior subjective synonym of *L. nisa*. Another name, *Zizeeria alsulus eggletoni* Corbet, 1941 (**syn. nov.**), described from Hong Kong is also considered a junior subjective synonym of *L. nisa*. Moreover, all former synonyms of *alsulus* automatically become new junior synonyms for *nisa*. This species occurs in the Oriental and Australian regions and western Pacific.

Keywords

Famegana alsulus, Formosa, lectotype designation, *Lycaena alsulus*, new synonymy, Taiwan, *Zizera taiwana*

Introduction

Anyone interested in natural history knows the name Alfred Russel Wallace, considered the father of zoogeography, who developed the idea of nature selection independently of Charles Darwin (Limolino et al. 2010; Beccaloni 2013). His achievements cover a variety of biological disciplines, including systematics. He described many plants and animals, mostly based on collections made by himself and his assistants. Nevertheless, he also worked on collections from other sources. A good example is a work on lepidopterous insects collected by Robert Swinhoe, an English biologist who worked as consul in Formosa (Taiwan) from 1860–1866. In collaboration with Frederic Moore, Wallace studied a collection made in Takaw [today's Kaohsiung]. The butterfly portion of the collection was investigated by Wallace, the moth portion by Moore, and a joint paper was subsequently published as Wallace and Moore (1866). This paper has been regarded as the starting point of lepidopteran research of Taiwan (Shirôzu, 1986). In this landmark work of the Lepidoptera of Taiwan, 46 diurnal species and 93 nocturnal species are mentioned. Wallace noted that most of the species in the collection were widespread species with distributions shared with India and Malay, but he recognized five species he considered distinctive and described them as new. These species were *Pontia niobe* Wallace, 1866, *Pieris formosana* Wallace, 1866, *Terias vagans* Wallace, 1866, *Euploea swinhoei* Wallace, 1866, and *Lycaena nisa* Wallace, 1866. The taxonomic status of the first four taxa have been clarified by various authors since. *Pontia niobe* is recognized as a subspecies of *Leptosia nina* (Fabricius, 1793) (Pieridae) (Yata 1985; Hsu et al. 2018). *Pieris formosana* is generally considered as either a subspecies of *Appias lyncida* Cramer, 1777 (Pieridae) (e.g., Shirôzu 1960) or a junior synonym of *A. lyncida eleonora* Boisduval, 1836 (Pieridae) (e.g., Yata 1985; Hsu et al. 2018). *Terias vagans* is recognized as a junior synonym of *Eurema laeta* (Boisduval, 1836) (Pieridae) by Yata (1989). *Euploea swinhoei* is considered a subspecies of *Euploea sylvester* (Fabricius, 1793) (Nymphalidae) (Ackery and Vane-Wright 1984; Morishita 1985).

The status of *Lycaena nisa*, however, remains ambiguous and has not been re-examined (Shirôzu, 1986). Matsumura (1909) changed the generic assignment of *L. nisa* Wallace, 1866 to the genus *Zizera* but without giving any explanation. *Lycaena nisa* was excluded from a comprehensive checklist of Taiwan butterflies by Shirôzu (1960) and Shirôzu and Ueda (1992). During visits to the Natural History Museum, London (NHMUK) for a project on documenting information on the type specimens of Taiwan butterflies, the type material of *L. nisa* was retrieved from the Wallace collection. According to Wallace's (1866) original description, a pair of syntypes were available for *L. nisa*, but only a female specimen (Figs 1–3) was successfully located in the museum. The features of the specimen fully conform to the description given by Wallace (Wallace and Moore 1866: 360–361). Interestingly, it also agrees with a species commonly known as *Famegana alsulus* (Herrich-Schäffer, 1869) in all aspects, and these two taxa are shown to be conspecific.

As *Lycaena nisa* was published three years prior to Herrich-Schäffer's *Lycaena alsulus*, it takes the priority, and should be the valid name, invoking Article 23.1 of the

ICZN (1999: 24). Although the name *alsulus* has been used for this lycaenid butterfly in the literature more than 25 times in the last 50 years, it would be inappropriate and insensitive to make efforts to suppress or abandon a name established by Wallace himself. Moreover, *L. nisa* was used as a valid name by Matsumura (1909) after 1899, thus the condition for reversal of precedence ruled by Article 23.9.1 (ICZN 1999: 27) is not met. In the present article, *Lycaena nisa* Wallace is resurrected as the valid name for this lycaenid, with a list of its synonyms.

Materials and methods

Type specimens relevant to the study were examined in the Natural History Museum, London (**NHMUK**) and the Taiwan Agricultural Research Institute, Taichung (**TARI**). Additional specimens were collected for comparison from Australia, Hong Kong and Hainan, with vouchers deposited in the Department of Life Science, National Taiwan Normal University, Taipei (**NTNU**).

Taxonomic account

***Famegana nisa* (Wallace, 1866), comb. nov.**
Figures 1–3

Lycaena nisa Wallace, 1866: 360. Type locality: "Takaw, Formosa".
Lycaena alsulus Herrich-Schäffer, 1869: 75. Type locality: Rockhampton and Upolu [Australia]. syn. nov.
Lycaena exilis Lucas, 1889: 159, figs 13–15. Type locality: Cooktown to Bowen [Australia] (preoccupied by *Lycaena exilis* Boisduval, 1852). syn. nov.
Lycaena lulu Mathew, 1889: 312. Type locality: Tongatabu, [Tonga]. syn. nov.
Lycaena gracilis Miskin, 1890: 37. Type locality: Brisbane to Cooktown [Australia]. syn. nov.
Lycaena exiloides Lucas, 1891: 47. Replacement name for *Lycaena exilis* Lucas, 1889. syn. nov.
Zizera nisa: Matsumura 1909: 480.
Zizeeria alsulus: Waterhouse and Lyell 1914: 106.
Zizera lulu: Rothschild 1915: 390.
Zizera kalawarus Ribbe 1926: 91; Vane Wright and de Jong 2003: 155. Type locality: Celebes. syn. nov.
Zizera alsulus: Seitz 1927: 926.
Zizera taiwana Sonan, 1938: 254. Type locality: "Inrin, Formosa." syn. nov.
Zizeeria alsulus eggletoni Corbet 1941: 150; Ek-Amnuay 2012: 589. Type locality: Hong Kong, New territory. syn. nov.
Zizina alsulus taiwana: Shirôzu 1944: 37; Shirôzu 1960: 334; Hsu: 2013: 252.

Famegana alsulus: Eliot 1973: 453; D'Abrera 1977: 361; D'Abrera 1986: 651; Parsons 1999: 460; Braby 2000: 839; Braby 2016: 324.
Famegana alsulus alsulus: Common and Waterhouse 1981: 587.

Type material examined.

Wallace: The specimen of *Lycaena nisa* retrieved in NHMUK,

Lectotype (here designated) (Figs 1–3).

Taiwan • ♀; "♀. Formosa"; "*L. nisa* Wallace"; "Compare Otis Fab."; "Moore Coll. 1908-203. Formosa."; reg. no. 720422; NHMUK.

Sonan: Three specimens belonging to the type series of *Zizera taiwana* Sonan, 1938 retrieved in TARI, reg. nos. 37, 40, 45.

Holotype (Figs 4–6)

Taiwan • ♂; "Type [round paper, red characters in red circle]"; "Inrin, 30. X. 1932 Col. J. Sonan"; "*Zizera taiwana* Sonan DET. J. SONAN"; "No. 37".

Paratypes

Taiwan • 1♀ (Allotype); "Allo Type [round paper, orange characters in orange circle]"; "Inrin, 30. X. 1932 Col. J. Sonan"; "*Zizera taiwana* Sonan DET. J. SONAN"; "No. 45" • 1 ♀; "Para Type [round paper, green characters in green circle]"; "Inrin, 30. X. 1932 Col. J. Sonan"; "*Zizera taiwana* Sonan DET. J. SONAN"; "No. 40"

Corbet: Two specimens belonging to the type series of *Zizeeria alsulus eggletoni* Corbet, 1941 retrieved in NHMUK with the reg. no. 720438.

Holotype

Hong Kong • ♂ (Figs 7–9); "♂ Holotype *Zizeeria alsulus eggletoni* Cbt."; "Hong Kong District. + New Territory 5. IX. 1914. R. W. Barney", "Type H T [round label with red edge]", "Brit. Mus. 1921-312", "Zizeeria GENITALIA slide No. NSC. l."

Paratype

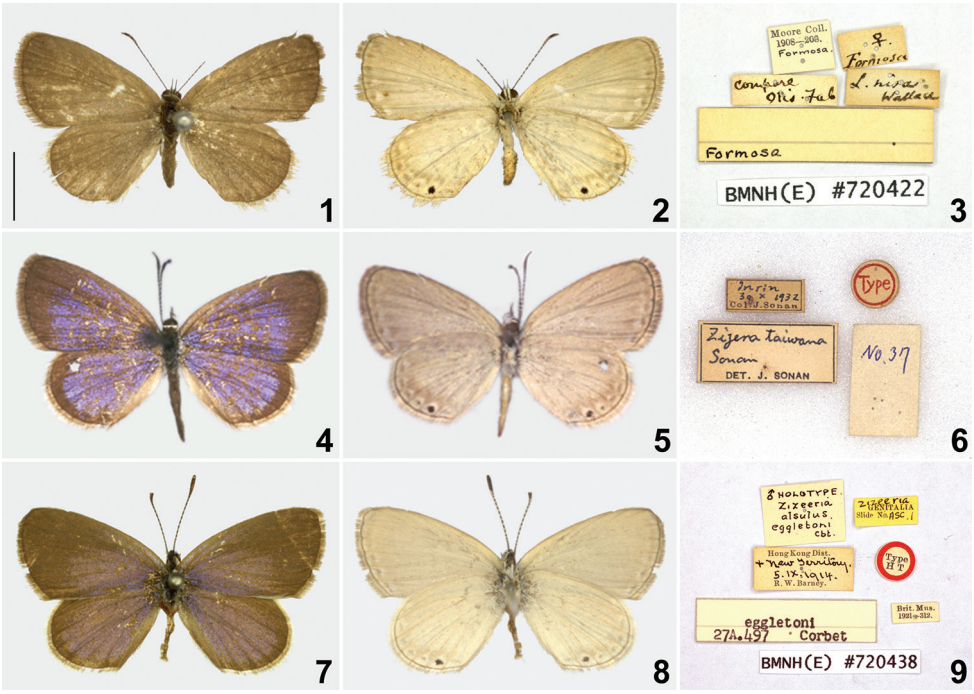
Hong Kong • ♂; "Hong Kong District. + New Territory 5. IX. 1914 R. W. Barney", "Type Holo-type [round label with red edge]", "Brit. Mus. 1921-312." Note: Although this specimen also bears a "holotype" label, the former bears a label with Corbet's hand-written characters indicating that it is the true holotype.

Additional material examined. Australia • 2 ♂ 2♀; Queensland, Mt. Stuart; 26 March 2017; Y. F. Hsu and M. Braby leg.; 1♂ 1♀; Queensland, Cairns, 30 March 2017; Y. F. Hsu and M. Braby leg. Hong Kong; 1♂; Yuen Long District, Shek Wu Wai; 14 October 2009; Y. F. Lo and W. L. Hui leg; 1♀; Ching Mun CP, Tai Mo Shan; 500m; 20. October. 2009; W. L. Hui leg; 1♀; New Territory, Ngau Tam Mei; 100m; 17 December 2018; Y. F. Hsu leg. Hainan• 3♂; Dongfang, Donghe, Nanran; 18 April 2010; Y. F. Lo leg.

Descriptions.

Lectotype of *Lycaena nisa*

Female (Figs 1, 2). Forewing length 10.9 mm. Head hairy, brown, with medial white band on frons. Antennae dark brown, segmented with white. Proboscis brown. Labial palpus hairy, porrect; third segment slender, pointed at distal end, white but brown dorsally. Compound eyes smooth. Thorax and abdomen dark brown dorsally,



Figures 1–9. Type specimens of *Famegana nisa* (Wallace, 1866) **1–3** lectotype of *Lycaena nisa* Wallace, 1866 **4–6** holotype of *Lycaena taiwana* Sonan, 1938 **7–9** holotype of *Zizeeria alsulus eggletoni* Corbet, 1941. Scale bar: 0.5 cm.

white ventrally. Forewing broad, somewhat elongate, termen slightly convex. Hindwing rounded. Wing uppersides uniformly brown. Wing undersides ground color white tinged with gray, spotless except for presence of submarginal bands consisted of faint narrow bands proximally and a series of faint brown spots distally along termen of both wings; dot in cell CuA_1 prominent, black. Fringe white.

Holotype of *Lycaena taiwana*

Male (Figs 4, 5). Forewing length 10.9 mm. Morphology conformed to those of *L. nisa*, except metallic purple patches present on uppersides of both wings proximally and those on hindwings.

Holotype of *Zizeeria alsulus eggletoni*

Male (Figs 7, 8). Forewing length 11.4 mm. Morphology conformed to those of *L. nisa*, except metallic purple patches present on uppersides of both wings proximally, and those on hindwings; submarginal bands on wing undersides slightly paler than those of *L. nisa* and *L. taiwana*.

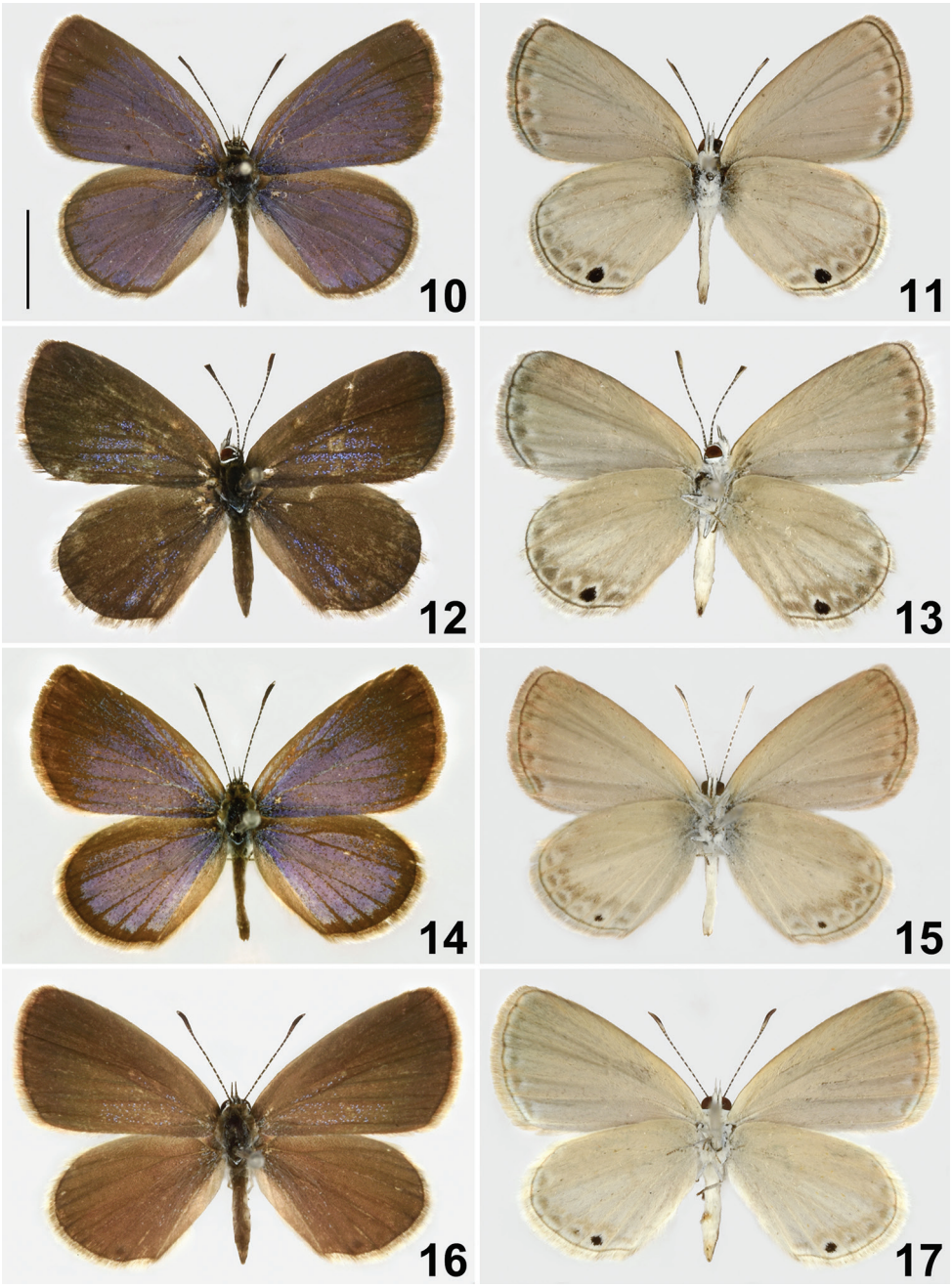
Distribution. This species occurs in the Oriental and Australian regions, and western Pacific, including southern China, Taiwan, the Philippines, Thailand, Sulawesi, Australia, the Torres Strait islands, Vanuatu, Fiji, Samoa, and Tonga (Eliot 1973; Braby 2000; Vane Wright and de Jong 2003; Ek-Amnuay 2012).

Biology. Larval hostplants of *Famegana nisa* have been reported to include various legume species, such as *Cajanus acutifolius* (F.Muell. ex Benth.) Maesen, *C. pubescens* (Ewart & Morrison) Maesen, *Desmodium elegans* Candolle, *Flemingia macrophylla* (Willd.) Merr., *Indigofera pratensis* F. Muell., *Galactia tenuiflora* (Klein ex Willdenow) Wight & Arnott, *Phyllodium pulchellum* (Linnaeus) Desvaux., *Tephrosia purpurea* (L.) Pers., *Vigna lanceolata* Benth., *V. radiata* (L.) Wilczek and *V. vexillata* (L.) A. Rich (all Fabaceae) (Bascombe et al. 1999; Braby 2000, 2016). Life histories are illustrated and described in Bascombe et al. (1999). Eggs are laid near flowers, upon which the larvae feed. Facultative mymecophily does occur.

Discussion

Famegana nisa dwells on open, grassy habitats, as suggested by its common names 'Grass Blue' (e.g., Kimura et al. 2014), 'Small Grass Blue' (e.g., Bascombe et al. 1999) or 'Black-spotted Grass Blue' (e.g., Braby 2000; Orr and Kitching 2010). This habitat is shared with members of several Polyommatinae, such as *Zizeeria*, *Zizula* or *Zizina*, but *Famegana* can easily be distinguished by its uniformly grayish white undersides of wings, with a single prominent black spot in the cell CuA_1 of hindwing, and obscure submarginal bands (Common and Waterhouse 1981; Bascombe et al. 1999; Braby 2000; Orr and Kitching 2010). Its male genitalia are also peculiar (Common and Waterhouse 1981), leading Eliot (1973) to establish a monospecific genus for it, stating "unlike those of any other species known to me, the principal peculiarity being the very stout brachia which are hinged wholly to the lateral processes of the tegumen and are capable of only limited movement". The male genitalia of the species have been illustrated in the literature, including Shirôzu (1960), Eliot (1973), and Bascombe et al. (1999) and are unique in the family Lycaenidae. Although up to four subspecies have been recognized, this species is poorly marked and seasonably variable in wing pattern, and subspecific delimitation is perhaps unnecessary for this species. Specimens in dry season have a reduced black spot, darker ground color on wing undersides, and more distinct submarginal bands on the hindwing undersides (Figs 14–17) when compared to those in wet season (Figs 10–13) according to Bascombe et al. (1999) and Braby (2000).

In addition to the name *Lycaena nisa* of Wallace, another name from Taiwan is available for the species, *Zizera taiwana* Sonan, 1938. Shirôzu (1944) pointed out that *Z. taiwana* is conspecific with *Z. alsulus* based on examination of the male genitalia, but retained *taiwana* as a subspecies of *Z. alsulus*. However, as mentioned above, there is no doubt that *Z. taiwana* represents a junior subjective synonym of *L. nisa*. Moreover, the population from southern China has been assigned to ssp. *eggletoni* Corbet, 1941, originally described from Hong Kong (Bascombe et al. 1999). As already pointed out by Shirôzu (1944), the specimens from Hong Kong (Figs 14–17), however, are indistinguishable from those from Taiwan (Figs 1–6). Consequently, *eggletoni* Corbet, 1941 should also be regarded as a junior subjective synonym of *L. nisa* Wallace, 1866.



Figures 10–17. Specimens of *Famegana nisa* (Wallace, 1866) **10, 11** male, Queensland, Cairns **12, 13** female, Queensland, Mt. Stuart **14, 15** male. Hong Kong, Yuen Long District, Shek Wu Wai **16, 17** female, Hong Kong, Ching Mun CP, Tai Mo Shan. Scale bar: 0.5 cm.

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References

Ackery PR, Vane-Wright RI (1984) Milkweed Butterflies, their cladistics and biology. Department of Entomology, British Museum (Natural History), London, 425 pp.

Bascombe MJ, Johnston G, Bascombe FS (1999) The Butterflies of Hong Kong. Academic Press, London, x + 422 pp.

Beccaloni G (2013) Alfred Russel Wallace and Natural Selection: the Real Story, 4 pp. http://downloads.bbc.co.uk/tv/junglehero/alfred-wallace-biography.pdf

Braby MF (2000) Butterflies of Australia. CSIRO, Collingwood, 976 pp. https://doi.org/10.1071/9780643100770

Braby MF (2016) The Complete Guide to Butterflies of Australia, 2nd edition. CSIRO, Collingwood, 384 pp. https://doi.org/10.1071/9781486301010

Common IFB, Waterhouse DF (1981) Butterflies of Australia, Revised edition. Angus & Robertson Publishers, Sydney, 682 pp.

Corbet (1941) A list of the butterflies of Hong Kong. Hong Kong Naturalist 10 (3/4): 148–165. https://hkjo.lib.hku.hk/exhibits/show/hkjo/browseArticle?book=b27722454&issue=270036

D'Abrera B (1977) Butterflies of the Australian Region. Hill House, Victoria, 415 pp.

D'Abrera B (1986) Butterflies of the Oriental Region, Part III. Hill House, Victoria, 536–672.

Ek-Amnuay P (2012) Butterflies of Thailand, 2nd edition. Baan Lae Suan Amarin Printing and Publishing, Bangkok, 943 pp.

Eliot JN (1973) The higher classification of the Lycaenidae (Lepidoptera): a tentative arrangement. Bulletin of the British Museum (Natural History) Entomology 28: 371–505. https://doi.org/10.5962/bhl.part.11171

Herrich-Schäffer GAW (1869) Neue Schmetterlinge aus dem "Museum Godeffroy" in Hamburg. Stettiner entomologische Zeitung 30(1–3): 65–80.

Hsu YF (2013) The Butterflies of Taiwan. Vol. 2. Lycaenidae. Morning Star Publishing Inc., Taichung, 333 pp. [In Chinese]

Hsu YF, Huang CL, Liang JY (2018) Butterfly Fauna of Taiwan, Vol. II, Pieridae. Forest Bureau, Council of Agricultural Executive Yuan, Taipei, 224 pp.

ICZN (1999) International Code of Zoological Nomenclature, 4th edition, The International Trust for Zoological Nomenclature 1999, London, 306 pp.

Kimura Y, Aoki T, Yamaguchi S, Uémura Y, Saito T (2014) The Butterflies of Tailand, Vol. 2, Lycaenidae. Mokuyosha, Tokyo, 245 pp.

Limolino MV, Riddle BR, Whittaker RJ, Brown JH (2010) Biogeography, 4th ed. Sinauer Association Inc., Sunderland, 878 pp.

Lucas TP (1889) Six new species of Rhopalocera. Proceedings of the Royal Society of Queensland 6(4): 151–161.

Lucas TP (1891) Correction. Six new species of Rhopalocera. Proceedings of the Royal Society of Queensland 7(1): 47.

Matsumura S (1909) A list of Formosan butterflies. Zoological Magazine, Tokyo 253: 479–481. [In Japanese]

Mathew GF (1889) Descriptions and life-histories of new species of Rhopalocera from the Western Pacific. Transactions of the Entomological Society of London 1889: 311–315. https://doi.org/10.1111/j.1365-2311.1889.tb02323.x

Miskin WH (1890) Descriptions of hitherto undescribed Australian Lepidoptera (Rhopalocera) principally Lycaenidae. Proceedings of the Linnean Society of New South Wales (2) 5(1): 29–43. https://doi.org/10.5962/bhl.part.18623

Morishita K (1985) Danaidae. In: Tsukada E (Ed.) Butterflies of the South East Asian Islands. Vol. II. Part I. Pieridae and Danaidae. Plapac Co. Ltd., Tokyo, 439–604.

Orr A, Kitching R (2010) The Butterflies of Australia. Jacana Books, Crows Nest, 296 + 31 pp.

Parsons M (1999) The Butterflies of Papua New Guinea, Their Systematics and Biology. Academic Press, London & San Diego, 736 pp. [+ 136 pls.]

Ribbe C (1926) Neue Lycaenenformen, hauptsächlich von Celebes (Lep. Lycaenidae). Entomologische Mitteilungen 15: 78–91.

Rothschild FRS (1915) On the Lepidoptera in the Tring Museum sent by Mr. A. S. Meek from the Admirality Islands, Dampier, and Vulcan Islands. Novitates Zoologicae 22(3): 387–402. https://doi.org/10.5962/bhl.part.1918

Seitz A (1927) Genus *Zizera*. In: Zeitz A (Ed.) The Macrolepidoptera of the World, Vol. IX. Fritz Lehmann Verlag, Stuttgart, 925–926.

Sonan J (1938) Notes on some butterflies from Formosa (5). Zephyrus 7: 250–256. [In Japanese]

Shirôzu T (1944) Notes on some Formosan Butterflies (1). The Transactions of the Kansai Entomological Society 14 (1): 30–42. [In Japanese]

Shirôzu T (1960) Butterflies of Formosa in Colour. Hoikusha, Osaka, 481 pp. [In Japanese]

Shirôzu T (1986) Bibliographical notes. In: Hamano E (Ed.) Ecological Encyclopedia of Taiwanese Butterflies. Kodansha Ltd., Tokyo, 352–474. [In Japanese]

Shirôzu T, Ueda K (1992) Lycaenidae. In: Heppner JB, Inoue H (Eds) Association for Tropical Lepidoptera, Gainesville, 136–139.

Waterhouse GA, Lyell G (1914) The Butterflies of Australia. Angus & Robertson Publishers, Sydney, 239 pp.

Vane Wright D, de Jong R (2003) The Butterflies of Sulawesi: Annotated Checklist for a Critical Island Fauna. Zoologische Verhandelingen Leiden 343: 1–267. https://www.researchgate.net/publication/254911978_The_butterflies_of_Sulawesi_Annotated_checklist_for_a_critical_island_fauna

Wallace AR, Moore F (1866) List of Lepidopterous insects collected at Takaw, Formosa, by Mr. Robert Swinhoe. Proceedings of the Zoological Society of London 1866: 355–365.

Yata O (1985) Pieridae. In: Tsukada E (Ed.) Butterflies of the South East Asian Islands. Vol. II. Part I. Pieridae and Danaidae. Plapac Co. Ltd., Tokyo, 5–438.

Yata O (1989) A revision of the Old World species of the genus *Eurema* Hubner (Lepidoptera, Pieridae), Part I. Phylogeny and zoogeography of the subgenus *Terias* Swainson and description of the subgenus *Eurema* Hübner. Bulletin of Kitakyushu Museum of Natural History 9: 1–103.