JHR 77: 151–165 (2020)
doi: 10.3897/jhr.77.50577
http://jhr.pensoft.net

RESEARCH ARTICLE

JOURNAL OF Hymenoptera RESEARCH
A peer-reviewed open-access journal
The International Society of Hymenopterists

Two new reared species of *Heteropteron* Brullé (Hymenoptera, Braconidae, Cardiochilinae) from northwest Costa Rica, with the first definitive host records for the genus

Elizabeth Zhu Dabek[1,2], James B. Whitfield[1], Winifred Hallwachs[3], Daniel H. Janzen[3]

1 *Department of Entomology, 320 Morrill Hall, 505 S. Goodwin Ave, University of Illinois, Urbana, IL 61801, USA* **2** *Department of Entomology, Plant Sciences Building, 4291 Fieldhouse Dr, University of Maryland, College Park, MD 20742, USA* **3** *Department of Biology, University of Pennsylvania, Philadelphia, PA 19104, USA*

Corresponding author: James B. Whitfield (jwhitfie@life.illinois.edu)

Academic editor: G. Broad | Received 28 January 2020 | Accepted 11 June 2020 | Published 29 June 2020

http://zoobank.org/CC501B40-0C38-419A-A620-D93A5F007CBD

Citation: Dabek EZ, Whitfield JB, Hallwachs W, Janzen DH (2020) Two new reared species of *Heteropteron* Brullé (Hymenoptera, Braconidae, Cardiochilinae) from northwest Costa Rica, with the first definitive host records for the genus. Journal of Hymenoptera Research 77: 151–165. https://doi.org/10.3897/jhr.77.50577

Abstract

Two new Costa Rican species of the braconid parasitoid wasp subfamily Cardiochilinae, *Heteropteron kidonoi* Dabek & Whitfield and *Heteropteron hasagawai* Dabek & Whitfield, are described and illustrated from dry forest in the Area de Conservacion Guanacastae, along with data on rearing from their hosts. *Heteropteron kidonoi* is a solitary endoparasitoid of *Stenoma cathosiota* (Lepidoptera: Depressariidae) on *Roupala montana* (Proteaceae), while *H. hasagawai* is a solitary endoparasitoid of *Carthara abrupta* (Lepidoptera: Pyralidae) on the same host plant, but typically at slightly higher elevation localities. Diagnostic characters are provided to distinguish these two new species from each other, and also from the three previously decsribed species of *Heteropteron*. *Heteropteron kidonoi* and *H. hasagawai* are the first species of *Heteropteron* to have any host data, and also are the first to be reported in Costa Rica.

Keywords

Carthara, Depressariidae, Parasitoid, Proteaceae, Pyralidae, *Roupala*, *Stenoma*

Introduction

We report here the description of two new reared species of the relatively rare yet large and colorful cardiochiline braconid wasp genus *Heteropteron*, from the Area de Conservacion Guanacaste (ACG) in northwest Costa Rica. The descriptions are notable for adding significantly to our understanding of the geographic distribution, habitat specialization and host natural history of this unusual genus. The specimens and data supporting the descriptions arise from the long -term rearing inventory of ACG (Janzen et al. 2009).

The definition of *Heteropteron* has had a somewhat confusing history, even in recent years. After first being erected by Brullé (1846) for the unusual slender and polished cardiochiline species *H. macula* Brullé, several other somewhat similar-looking Neotropical genera were later described: *Wesmaelella* Spinola, (1853) based on *W. rubricollis* Spinola, *Psilophthalmus* Szépligeti, (1902) based on *P. nigripennis* Szépligeti, and *Neocardiochiles* Szépligeti, (1908) based on *N. fasciipennis* Szépligeti. Schulz, (1911) synonymized *Psilophthalmus* under *Wesmaelella* and this synonymy has been maintained ever since. The remaining three genera were still considered as distinct as recently as Whitfield and Dangerfield (1997), but two years later Dangerfield et al. (1999) synonymized all three with *Heteropteron* as the senior synonym. Shortly afterward Mercado and Wharton (2003) pulled *Wesmaelella* (including *Psilophthalmus*) out of synonymy with *Heteropteron*, an arrangement agreed with by Papp (2014), with some reservations still due to confusion in the interpretation of some types. Due to museum loan limitations at the relevant museums, it has never been possible to compare all the types with one another simultaneously, but the situation has been clarified considerably in the last 20 years, and Papp's conclusions are adopted here. *Heteropteron* appears to be relatively early-diverging within Cardiochilinae based on both morphological and molecular evidence (Dangerfield et al. 1999; Murphy et al. 2008).

As a result of this history, *Heteropteron* currently has 3 described species: *H. fasciipennis* (Szépligeti), *H. macula* Brullé, and *H. whitfieldi* Mercado. All are known from the Neotropical Region, ranging from Mexico to Brazil, primarily in wet tropical forest. None of the three has any recorded hosts. The two new species described below most closely resemble *H. fasciipennis* in general appearance, probably belonging to the same color pattern mimicry complex but differing in mesosoma coloration (dark in *H. fasciipennis*, yellowish orange in the two new species) and other less obvious features such as hypopygium shape and slightly more complex spination of the pectinate tarsal claws). Little is known about this mimicry complex, but similar color patterns are found in the same region among some Heteroptera (Hemiptera) as well as among several other subfamilies of Braconidae, especially Braconinae and Agathidinae.

We do have new host data, however, for both species, constituting the first host records for the genus. *Heteropteron kidonoi* sp. nov. , described below, attacks caterpillars of *Stenoma cathosiota* (Depressariidae) (Fig. 1A) on the dry forest shrubby evergreen tree *Roupala montana* (Proteaceae); its very similar congener *H. hasagawai* sp. nov., also described below, specializes on the caterpillars of *Carthara abrupta* (Pyralidae)

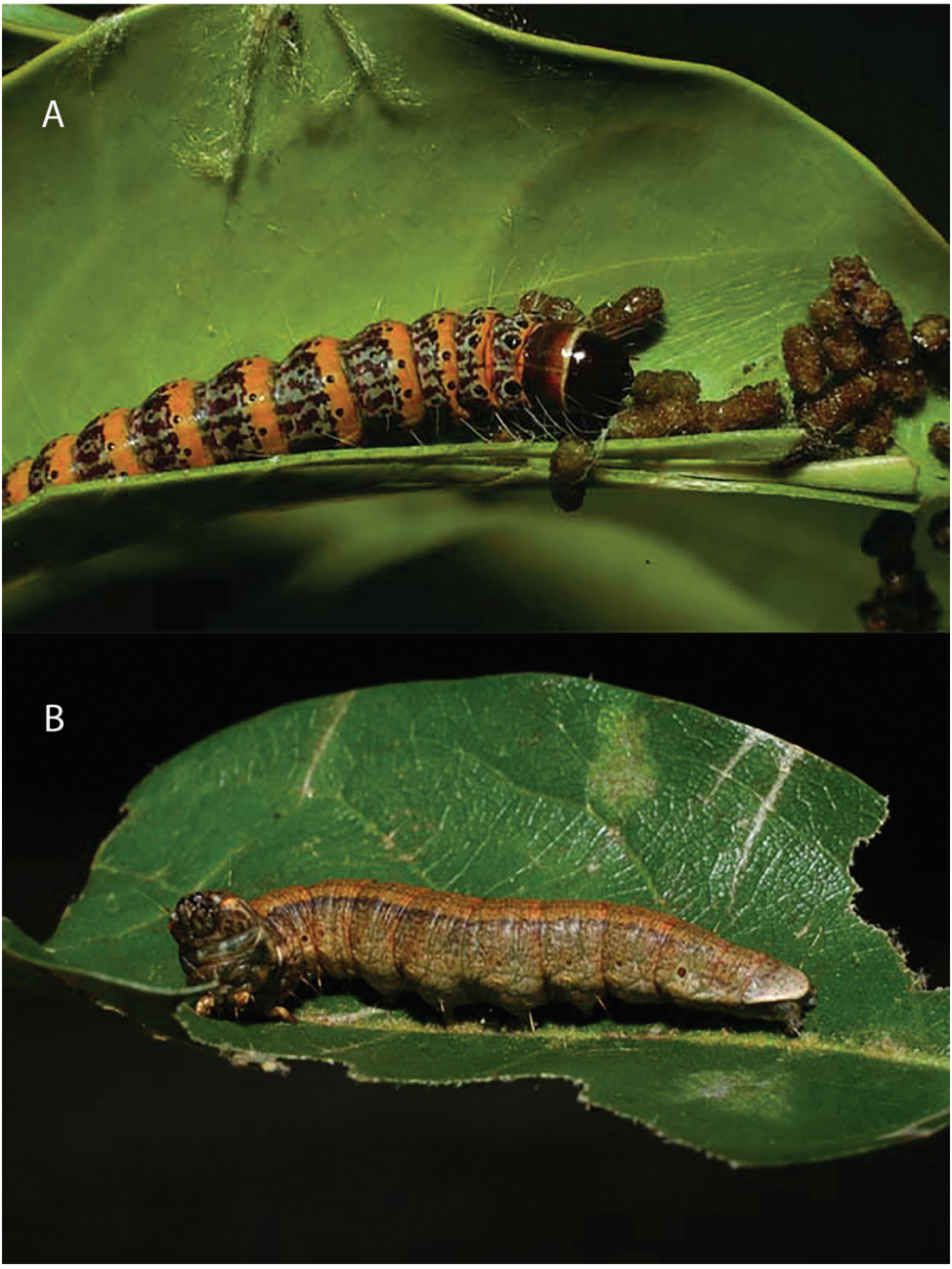

Figure 1. A live photo of *Stenoma cathosiota* caterpillar, host of *Heteropteron kidonoi* Dabek & Whitfield, sp. nov. **B** live photo of *Carthara abrupta*DHJ02 caterpillar, host of *H. hasegawai* Dabek & Whitfield, sp. nov.

(Fig. 1B) on the same host plant species, usually at slightly lower elevations. *Carthara abrupta*, as currently defined, feeds on a variety of plants; the form that hosts *H. hasagawai* is referred to informally as Carthara abruptaDHJ02. *H. kidonoi* spins its cocoon

within that of the host (Fig. 2); presumably *H. hasagawai* does as well, but we do not have direct documentation of that.

There were also no previously described species of *Heteropteron* recorded for Costa Rica.

Methods

Morphological terminology follows that used in Huber and Sharkey (1993) with usage specific to the microgastroid lineage Braconidae from Dangerfield et al. (1999) and Fernandez-Triana et al. 2014. Photographs were taken at the University of Illinois using a Leica M205 C stereo microscope (467 nm resolution) fitted with a five megapixel Leica DFC 425 digital microscope camera. Image stacking was achieved using a motor drive on the scope and the Leica z-stacking software.

Results

Descriptive Taxonomy

***Heteropteron kidonoi* Dabek & Whitfield, sp. nov.**
http://zoobank.org/034479D0-3812-4C7A-9303-C0102695C994
Figs 2–5

Material examined. *Holotype*: Female, Costa Rica: Guanacaste, Area de Conservación Guanacaste, Sector Orosí, Intersección Mata Redonda, el. 565 m, 10.99574, -85.4948, 29-V-2009; 09-SRNP-13270, DHJPAR0062136 (no sequence), host *Stenoma cathosiota* on *Roupala montana*. Deposited in USNM.

***Paratypes*:** 12 females (09-SRNP-13220, 09-SRNP-13321, 09-SRNP-13425, 09-SRNP-13337, 09-SRNP-13380, 09-SRNP-13290, 09-SRNP-13395, 09-SRNP-13322, 09-SRNP-13306, 09-SRNP-13446; 09-SRNP-13265, 09-SRNP-13421), 14 males (09-SRNP-13436, 09-SRNP-13341, 09-SRNP-13457, 09-SRNP-13399, 09-SRNP-13272, 09-SRNP-13267, 09-SRNP-13285, 09-SRNP-13307, 09-SRNP-13409, 09-SRNP-13359, 09-SRNP-13305, 09-SRNP-13391, 09-SRNP-13254, 09-SRNP-13451), all same data as holotype, no successful barcodes. 4 females (96-SRNP-1218, 96-SRNP-1208, 96-SRNP-1211, 96-SRNP-1214), 2 males (96-SRNP-1212, 96-SRNP-1215), same data as holotype except el. 445m, 10.94106, -85.50822, 01-V-1996, no successful barcodes. 1 female (05-SRNP-45258),1 male (05-SRNP-45272), Costa Rica: Guanacaste, Area de Conservación Guanacaste, Sector Orosí, Casona Orosi, el. 310 m, 10.95045, -85.54173, 24-V-2005, ex *Stenoma cathosiota* on *Roupala montana*. 2 females, Costa Rica: Guanacaste, Area de Conservación Guanacaste, Sector Orosí, Estacion Maritza, el. 570 m, 10.95922, -85.49514, 23-III-2005, ex *Stenoma cathosiota* on *Roupala montana*. Costa Rica: Guanacaste, Area de Conservación Gua-

Figure 2. Cocoon of *Stenoma cathosiota*, cut open to show (opened) cocoon of *H. kidonoi* spun within.

nacaste, Sector Orosí, Puente Sontoli, el. 245 m, 10.95119, -85.5975, 30-IV-2008, ex *Stenoma cathosiota* on *Roupala montana*. 7 females (02-SRNP-13449, 02-SRNP-13488, 02-SRNP-13521, 02-SRNP-13517, 02-SRNP-13470, 02-SRNP-13501, 02-SRNP-13477), 7 males (02-SRNP-13507, 02-SRNP-13461, 02-SRNP-13453, 02-SRNP-13502, 02-SRNP-13500, 02-SRNP-13320, 02-SRNP-13510), Costa Rica: Guanacaste, Area de Conservación Guanacaste, Sector Santa Elena, Quebrada Nance, el. 310 m, 10.86669, -85.64933, 22-VIII-2002, ex *Stenoma cathosiota* on *Roupala montana*. 1 female (02-SRNP-13036), Costa Rica: Guanacaste, Area de Conservación Guanacaste, Sector Santa Elena,Canyon Draga, el. 280 m, 10.87974, -85.65374, 4 -VIII-2002, ex *Stenoma cathosiota* on *Roupala montana*. 1 female (04-SRNP-24239), 1 male (04-SRNP-24740), COSTA RICA: Guanacaste, Area de Conservación Guanacaste, Sector El Hacha, Puedra Duende, el. 450 m, 11.011, -85.54459, 16-IX-2004, ex *Stenoma cathosiota* on *Roupala montana*; 2 females (11-SRNP-20911, 11-SRNP-20987), 1 male (11-SRNP-20988), same data but 31-V-2011. 1 female (98-SRNP-4871), 1 male (98-SRNP-4862) , Costa Rica: Guanacaste, Area de Conservación Guanacaste, Sector El Hacha, La Guitarra, el. 355 m, 10.99378, -85.52108, 7-VI-1998, ex *Stenoma cathosiota* on *Roupala montana*; 1 male (98-SRNP-4537), same data except 24-II-1998. 1 male, Costa Rica: Guanacaste, Area de Conservación Guanacaste, Sector El Hacha, Estacion Los Almendros, el. 290 m, 11.03226, -85.52776, 9-VII-2013 (host listed as incorrect in database). 1 female (09-SRNP-21074), Costa Rica: Guanacaste, Area de Conservación Guanacaste, Sector El Hacha, Genova, el. 210 m, 11.02335,

-85.60596, 9-IV-2009, ex *Stenoma cathosiota* on *Roupala montana*. 2 males, Costa Rica: Guanacaste, Area de Conservación Guanacaste, Sector El Hacha, Qurebrada Pitahaya, el. 320 m, 11.01182, -85.53168, 11-IX-2013, ex *Stenoma cathosiota* on *Roupala montana*. 1 male (06-SRNP-13274), Costa Rica: Guanacaste, Area de Conservación Guanacaste, Sector Santa Rosa, Aguacaliente, el. 250 m, 10.9303, -85.60297, 9-V-2006, ex *Stenoma cathosiota* on *Roupala montana*; 1 female (11-SRNP-13207), same data except 9-V-2011; 1 female, same data except 6-III-2005. 1 female (11-SRNP-55002), Costa Rica: Guanacaste, Area de Conservación Guanacaste, Sector Mundo Nuevo, Cerro Gongora Pelado, el. 740 m, 10.76307, -85.41332, 2-I-2011, ex *Stenoma cathosiota* on *Roupala montana.* Deposited in USNM, CNC, INHS, Museo Nacional de Costa Rica, Hymenoptera Institute (116 Franklin Ave, Redlands, CA 92373).

Body length excluding head. Average male, 7.5 mm; average female, 8.0 mm.

Body color (Fig. 3): Mesosoma pale except anterior propleuron dark, head black, metasoma variable with majority (31/42 specimens) with terga 6–8 dark, 1–5 pale. Antenna color: scape, pedicel, and flagellum dark. Coxa, trochanter, trochantellus dark. Forefemur variably pigmented, ventrally dark toward center. Tibia, tarsus, tibial spurs light. Pretarsus and tarsal claws dark, aroliar pad dark (Fig. 5D). Wings alternately banded light and dark (Figs 3A, B, 4C).

Head. Epistomal sulcus present, lightly impressed. Setose except vertex and occiput, sparsely so on clypeus. Setae light yellowish in color. Clypeus weakly and evenly convex. Clypeus 1.9 × broader than high, 2.1 × length of malar space. Clypeal margin truncate. Scape 2 × longer than broad, inner side deeply excised apically, base 2.2 × narrower than broadest point. First flagellomere 2.8 × as long as broad.

Face (Fig. 4A) 1.6 × broader than high. Galea dark, 1.5 × longer than wide. Glossae light, bilobed, similar in shape to galea: semicircular distally. Frons smooth, deeply excavated, excavation extending longitudinally from base of antennae to vertex and transversely from inner margin of left eye to inner margin of right eye. Frons dorsally with Y-shaped shallow ridge, with branches terminating immediately anteriorad median ocellus (Fig. 4B). Ocelli elevated within excavation with some setae. Small ridge evident at antennal base. Antenna with 36–37 flagellomeres.

Mesosoma. Pronotal collar unsculptured except for marginal ridges anteriorly and posteriorly with visible setal pits, lateral pronotum sculptured ventrally, reaching mesopleuron and dark in color, dorsally transitioning to light color with groove reaching subalar depression. Notauli smooth, incomplete, distinct anteriorly, evanescent posteriorly, extending about half length of mesoscutum; mesoscutum smooth, about as broad as long, flattened dorsally in lateral view, medial lobe bulging anteriorly, sparsely covered with brownish yellow setae.

Scutellum triangular, smooth, flat in lateral view, lateral areas bare and smooth. Posterior end of scutellum margined by ridge (Fig. 3A).

Metanotum smooth. Propodeum smooth, areola with complete longitudinal furrow, narrowing anteriorly, margined by weak carinae; pilosity moderate with high abundance in vicinity of spiracles. Setae near areola 10 × longer than distance between adjacent setae; spiracles 1.8 × longer than wide. Sternaulus indistinct, episternal scrobe present, sometimes weakly indented, not extended to sternaulus. Subalar depressions

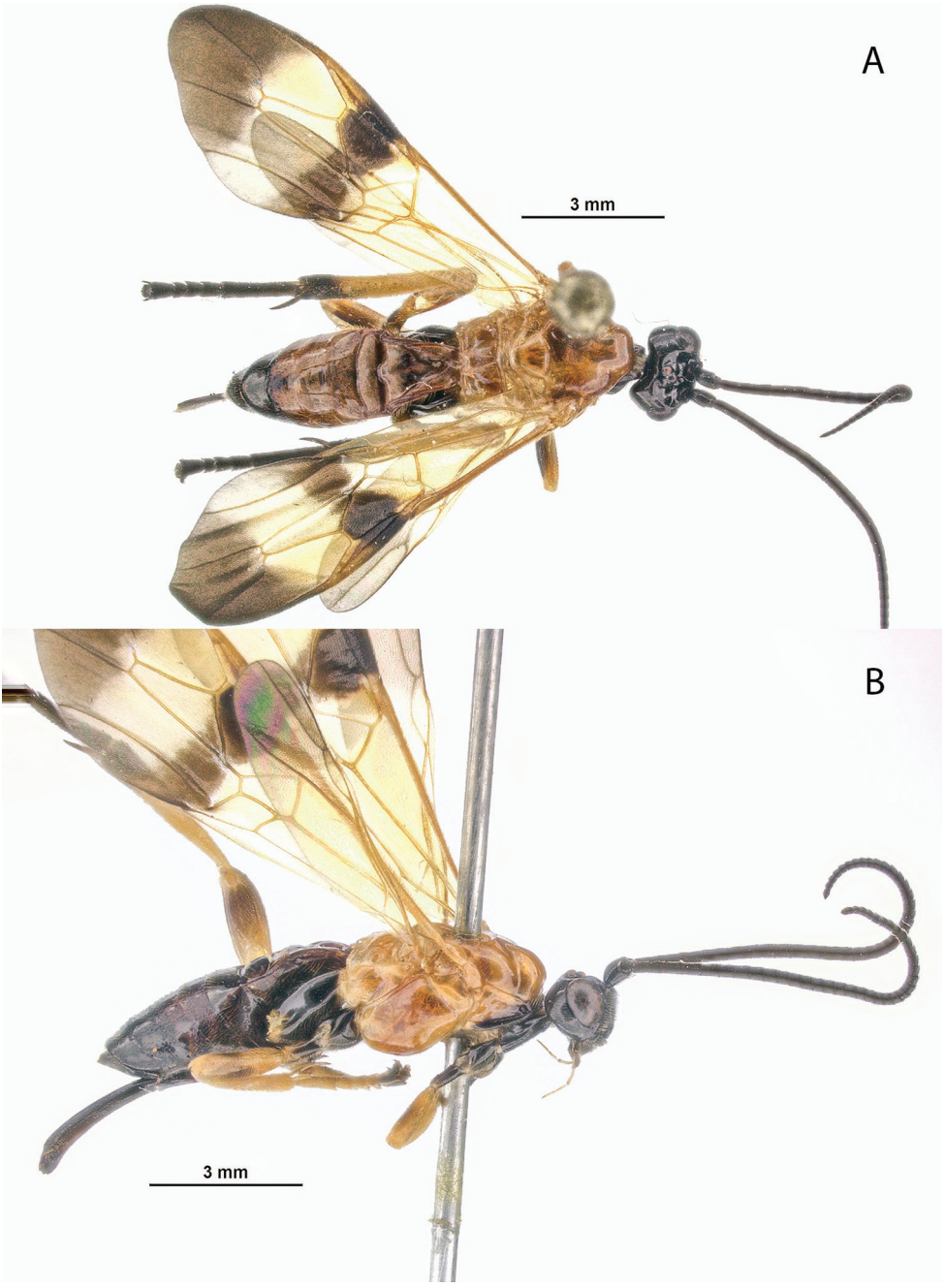

Figure 3. *Heteropteron kidonoi* Dabek & Whitfield **A** dorsal habitus **B** lateral habitus.

smooth with median carina forming obtuse angle. Subalar prominence tapering posteriorly to pleural sulcus, smooth, convex. Pleural sulcus with double grove. Posterior margin of mesopleuron smooth. Mesopleuron (Fig. 5A) smooth, lightly setose ven-

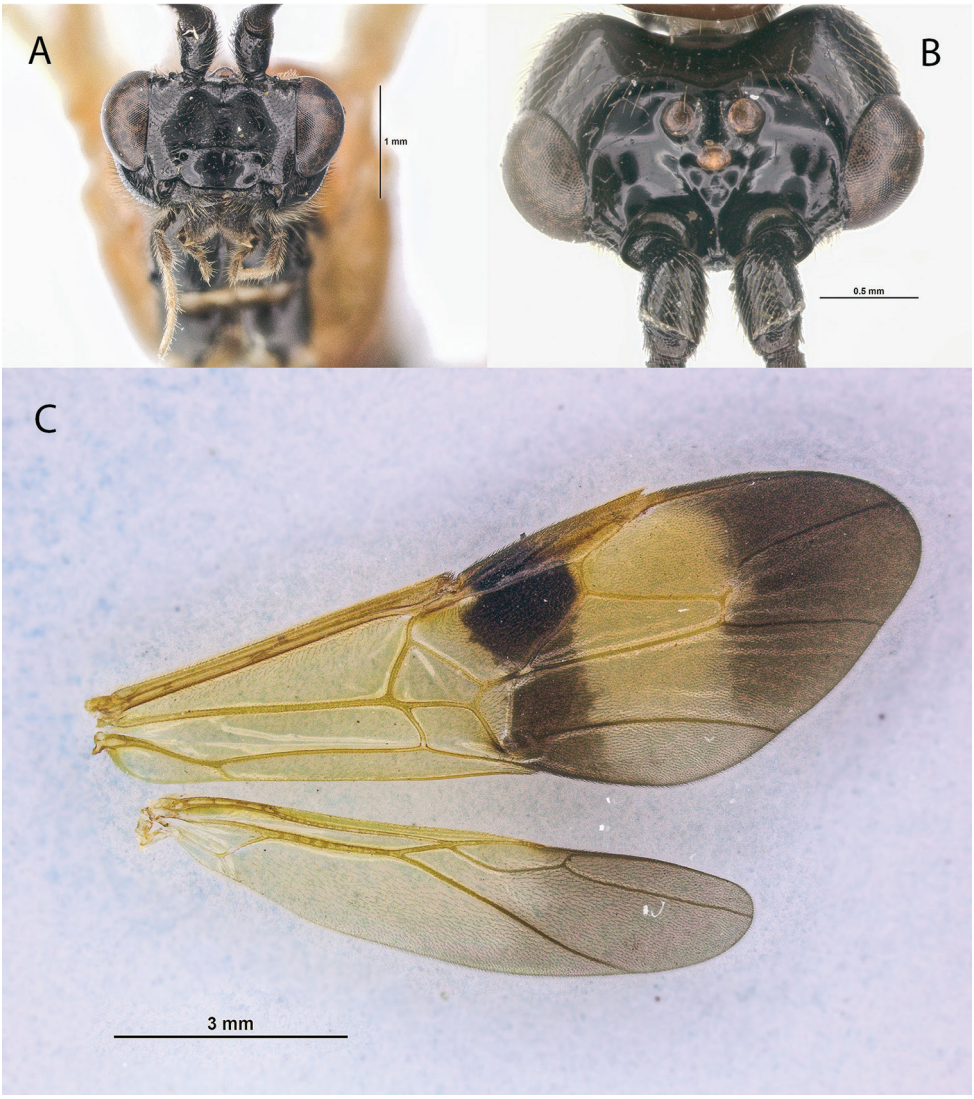

Figure 4. *Heteropteron kidonoi* Dabek & Whitfield **A** frontal view of face **B** dorsal view of frons and occiput, showing y-shaped ridge **C** wings, showing banding pattern.

trally. Metapleuron with distinct dorsal-ventral groove originating halfway down the dorsal edge of the metapleuron and ending at the posterior end of the ventral margin (forming distinct anterior and posterior separation), dorsoposterior of metapleuron setose, setae yellow.

Legs. Hind tibia gradually broadening distally, distal end 1.8 × as broad as proximal end. Hind femur 5 × as long as broad distally. Hind basitarsus same length as tarsomeres 2–5 combined, inner spur of hind tibia half the length of basitarsus. Second tarsus of fore leg 1.4 × longer than broad, fifth tarsus of foreleg 1.6 × longer than broad;

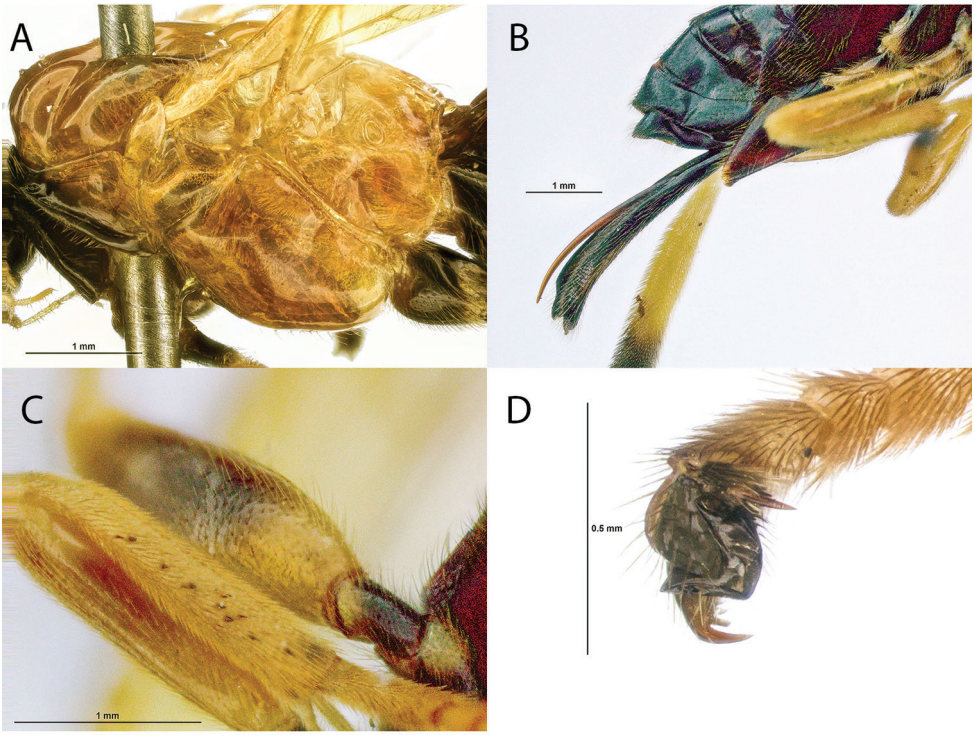

Figure 5. *Heteropteron kidonoi* Dabek & Whitfield **A** lateral view of mesosoma **B** lateral view of hypopygium tip and ovipositor with sheaths **C** tibial spines **D** last tarsal segment, showing pectinate claws and dark arolium.

second tarsus of mid leg 1.7 × longer than broad, fifth tarsus of mid leg 1.7 × longer than broad; second tarsus of hind leg 1.7 × longer than broad, fifth tarsus of hind leg 1.5 × longer than broad. Tibial spines, up to 12, generally > 6 in two alternating rows, variable in number and pattern. (Fig. 5C).

***Wings*.** Forewing 1.15 × longer than body. Pterostigma elongate, issuing *r* from its middle. Second submarginal cell long. Color pattern as in Fig. 4C.

***Metasoma*.** First tergite 1.25 × broader posteriorly than long. Third tergite 1.2 × as long as second tergite. Second latero-tergite well visible in dorsal view (Fig. 3A). All tergites polished. Hypopygium narrow laterally, tapering to rounded tip ventrally (Fig. 5B). Exserted ovipositor sheath as long as tarsomeres 1–5 combined, dark on posterior side.

Cocoon. Elongate, silk light tan externally and white internally, spun within the cocoon of its host (Fig. 2).

Host. Caterpillars of *Stenoma cathosiota* (Depressariidae) (Fig. 1A) on *Roupala montana* (Proteaceae).

Etymology. *Heteropteron kidonoi* is named in honor of Dr. Hiroshi Kidono (retired) of Japan International Collaboration Agency (JICA), who first came to ACG in 1992 and has since then, and hopefully many years more, been a major supporter of

all aspects of ACG, ranging from financing to Hesperiiidae taxonomy to female parataxonomists to international conservation biopolitics.

Diagnosis. This new species differs from *H. fasciipennis* most obviously in having a yellowish orange (in older specimens occasionally somewhat brownish) mesosoma rather than mostly blackish. From *H. hasegawai*, described below, it can be distinguished by its slightly to significantly darker yellowish portions of the metasoma (Figs 3, 5A), more acutely pointed hypopygium tip (Fig. 5B), more numerous and differently arranged small spines on the mid tibia (Fig. 5C), and the dark tarsal arolia (Fig. 5D).

Heteropteron hasagawai Dabek & Whitfield, sp. nov.

http://zoobank.org/8A5D9EB0-DED0-4042-8B08-F0AABFCB10D8

Figs 6–8

Material examined. ***Holotype*:** Female, Costa Rica: Guanacaste, Area de Conservación Guanacaste, Sector Santa Rosa, Finca Jenny, el. 205 m, 10.86333, -85.57443, 29-V-2009; 10-SRNP-15367, host *Carthara abrupta* on *Roupala montana*. Deposited in USNM.

***Paratypes*:** 3 females (10-SRNP-15373, 10-SRNP-15366, 10-SRNP-15356), 8 males (10-SRNP-15370, 10-SRNP-15354, 10-SRNP-15374, 10-SRNP-15351, 10-SRNP-15345, 10-SRNP-15361, 10-SRNP-15368, 10-SRNP-15369), all same data as holotype, no successful barcodes; 1 male, Costa Rica: Guanacaste, Area de Conservacion Guanacaste, Sector Orosí, Intersección Mata Redonda, el. 565 m, 10.99574, -85.4948, 29-V-2009, host *Carthara abrupta* on *Roupala montana* (09-SRNP-13448, no successful barcode). Deposited in USNM, CNC, INHS, Museo Nacional de Costa Rica, Hymenoptera Institute (116 Franklin Ave, Redlands, CA 92373).

Body length excluding head. Average male, 6.75 mm; average female, 6.5 mm.

Body color (Fig. 6): Mesosoma pale except propleuron dark. Head black, metasoma terga 1–5 pale, 6–8 dark with tergum 5 variable with dark patch medially distinctly triangular or with dusky patch, rarely absent. Antenna color: scape, pedicel, and flagellum dark. Coxa dark, trochanter mostly dark with posterior trochanter small light patch. Medial femur dark (8/13), lacking dark patch (5/13). Tarsus, aroliar pad ventrally white and dorsally black (Fig. 8D). Tarsal claw dark. Wings yellow and alternately banded light and dark (Figs 6, 7C)).

Head. Epistomal sulcus present, very light impression. Setose except vertex and occiput, sparse on clypeus. Setae light yellowish in color. Clypeus weakly and evenly convex. Margin truncate. Clypeus 2.2 × broader than high, 2.4 × length of malar space. Scape 2 × longer than broad, inner side deeply excised apically, base 1.7 × narrower than broadest point. First flagellomere 2.6 × as long as broad.

Face (Fig. 7A) 1.8 × broader than high. Galea dark, 1.2 × wider than long. Anterior tentorial pits very distinct, deep. Glossae light, bilobed. Frons smooth, deeply excavated, excavation extending longitudinally from base of antennae to vertex and transversely from inner margin of left eye to inner margin or right eye. Frons dor-

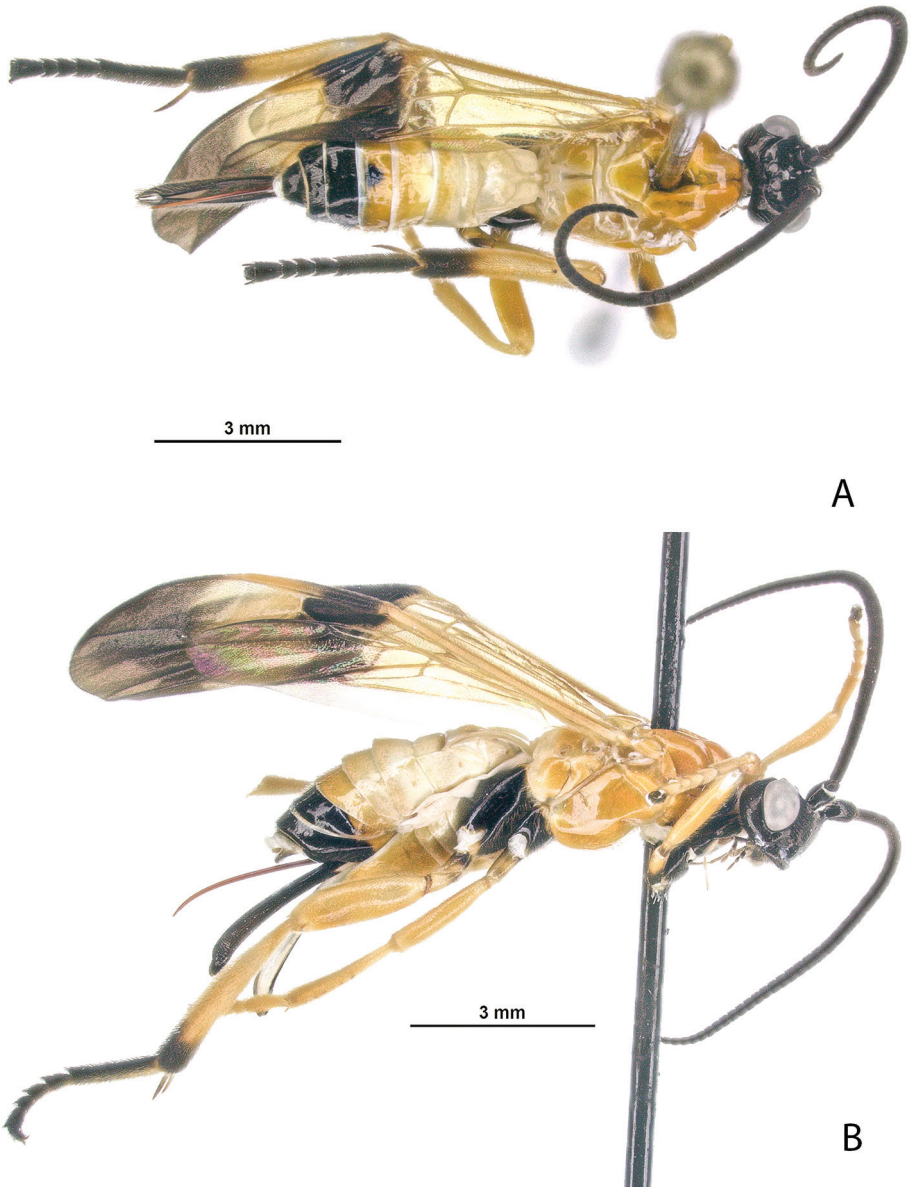

Figure 6. *Heteropteron hasegawai* Dabek & Whitfield **A** dorsal habitus **B** lateral habitus.

sally with distinct Y-shaped ridge with branches terminating immediately anterior to median ocellus (Fig. 7B). Ocelli elevated within excavation with some setae between. Visible ridge at antennal base. Antenna with 34–36 flagellomeres.

Mesosoma. Pronotum unsculptured except weakly on marginal ridges anteriorly and posteriorly, long light yellow setae anterodorsally. Pronotum light in color later-

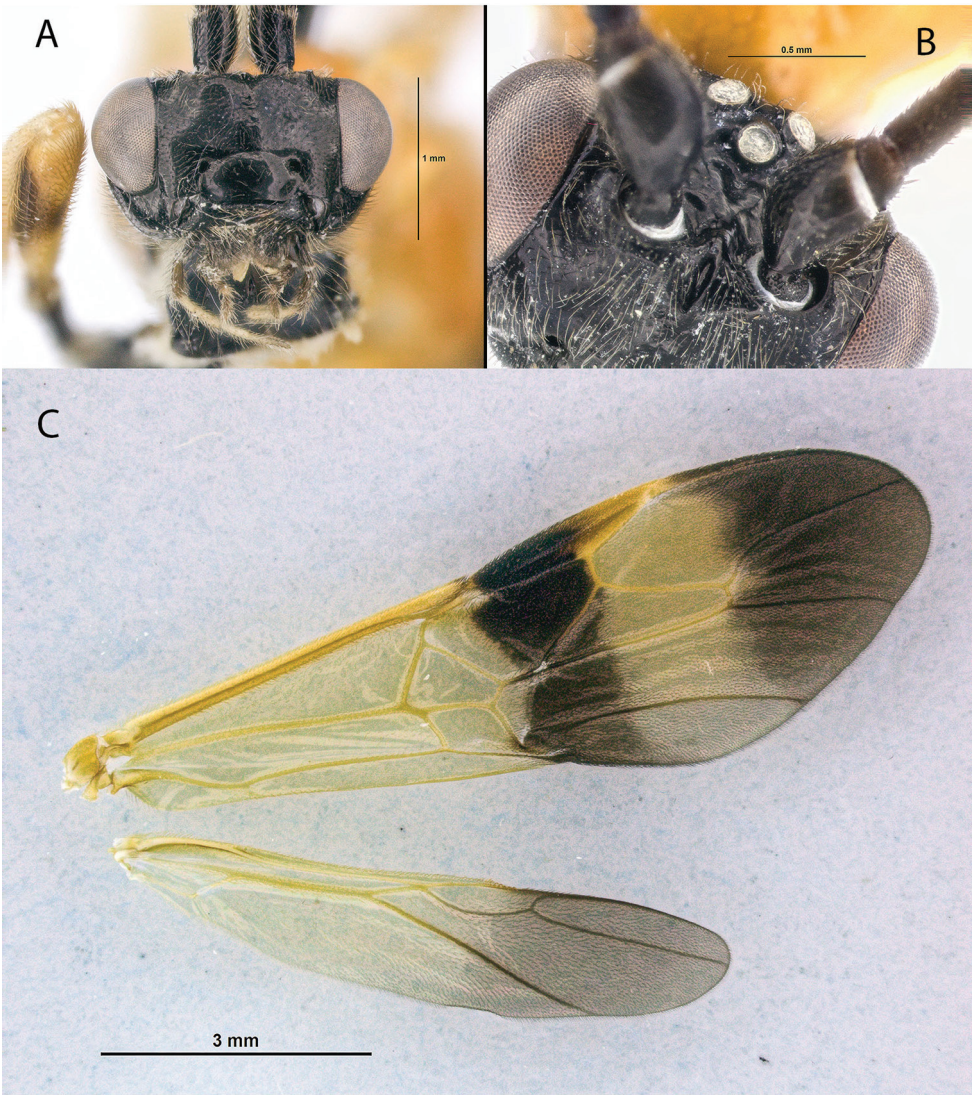

Figure 7. *Heteropteron hasegawai* Dabek & Whitfield **A** frontal view of face **B** dorsal view of frons and ocelli, showing y-shaped ridge **C** wings, showing banding pattern.

ally and posterodorsally, dark anteriorly and ventrally. Notauli smooth, incomplete, distinct anteriorly, evanescent posteriorly, extending about half length of mesoscutum; mesoscutum smooth, 1.1 × wider than long, flattened dorsally in lateral view, sparsely covered with yellow setae. Scutellum triangular, smooth, flat in lateral view, lateral areas of scutellum bare and smooth. Posterior end of scutellum lacking ridge at margin (Fig. 6A).

Propodeum smooth, virtually without areola but with complete longitudinal furrow; pilosity abundant in vicinity of spiracles. Setae 6 × longer then distance between each setae; spiracles 1.4 × longer than wide.

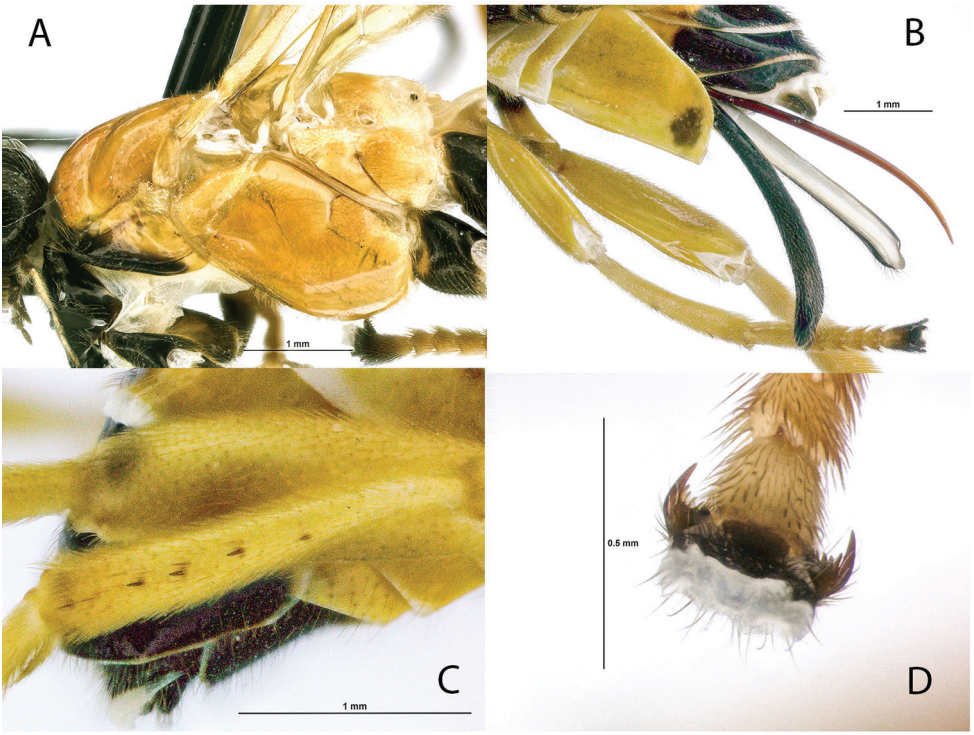

Figure 8. *Heteropteron hasegawai* Dabek & Whitfield **A** lateral view of mesosoma **B** lateral view of hypopygium tip and ovipositor with sheaths **C** tibial spines **D** last tarsal segment, showing pectinate claws and whitish arolium.

Subalar depression smooth with median carina forming obtuse angle. Subalar prominence tapering posteriorly to pleural sulcus, smooth, convex. Pleural sulcus with double groove. Posterior margin of mesopleuron smooth, moderately setose ventrally with visible setal pits. Mesopleuron smooth (Fig. 8A). Metapleuron with distinct dorsal-ventral groove starting halfway down the dorsal edge of the metapleuron and ending at the posterior end, moderately setose, setae light in color.

Legs. Hind tibia slightly broadening distally, distal end 1.8 × as long as proximal end. Hind femur 2.6 × as long as broad distally, distal end 2.1 × as long as proximal end. Hind basitarsus 1.2 × the length of tarsomeres 2–5 combined, inner spur of hind tibia half the length of basitarsus. Second tarsus of fore leg 1.4 × longer than broad, fifth tarsus of foreleg 1.7 × longer than broad; second tarsus of mid leg 1.3 × longer than broad, fifth tarsus of mid leg 1.3 × longer than broad; second tarsus of hind leg 1.7 × longer than broad, fifth tarsus of hind leg 1.3 × longer than broad. Tibial spines, generally < 7, variable in number and pattern (Fig. 8C).

Forewing. 1.15 × longer than body. Pterostigma elongate, issuing *r* from its middle. Second submarginal cell long. Banding pattern as in Fig. 7C.

Metasoma. First tergite 1.4 × broader posteriorly than long. Third tergite 1.4 × as long as second tergite. All tergites polished. Second latero-tergite visible in dorsal view

(Fig. 6A). Hypopygium broad, laterally truncate and rounded at tip (Fig. 8B), irregular blackened spot near tip. Ovipositor sheath as long as mesosoma with white streak at ventral base (Fig. 8B).

Cocoon. Not recorded.

Host. Caterpillars *of Carthara abrupta* (Pyralidae) on *Roupala montana* (Proteaceae). *Carthara abrupta*, as currently defined, feeds on a variety of plants; the form that hosts *H. hasagawai* is referred to informally as Carthara abruptaDHJ02.

Etymology. *Heteropteron hasegawai* is named in honor of Dr. Motohiro Hasegawa of Japan International Collaboration Agency (JICA), who first came to ACG in 2015 and has since then, and hopefully decades more, been a major supporter of all aspects of ACG, ranging from financing to biomonitoring of a geothermal electricity project with insect thermometers to biodevelopment to DNA barcoding to international conservaton biopolitics.

Diagnosis. This new species differs from *H. fasciipennis* most obviously in having a yellowish orange (in older specimens occasionally somewhat brownish) mesosoma rather than mostly blackish. From *H. kidonoi*, described above, it can be distinguished by its slightly to significantly lighter yellowish portions of the metasoma (Figs 6, 8A), more truncately pointed hypopygium tip (Fig. 8B), less numerous and more linearly arranged small spines on the mid tibia (Fig. 8C), and the whitish tarsal arolia (Fig. 8D).

Acknowledgements

EZD would like to thank Joshua Gibson (University of Illinois) for his help during the imaging process and the late Dr. Theresa Dabek for her support and encouragement throughout her ongoing education. We thank the ACG and GDFCF Parataxonomist Program for finding, rearing, preparing and databasing these and thousands of other parasitic Hymenoptera specimens, in the ongoing ACG biodiversity inventory, based on research and export permits PE-CUSBSE-VS-472-2019 and R-SINAC-ACG-PI009-2019, and their continuous decades of permits antecedents. We thank ACG itself for protecting and hopefully conserving indefinitely the parasite and host populations for these and thousands of other new species, and we thank the global taxasphere for their centuries of taxonomic discriminations that allow us to know that these are two new species and in their taxonomic hierarchy.

References

Brullé A (1846) Histoire Naturelles des Insects: Hymenopteres. Tome quatrieme. Librairie Encyclopedique de Roret, Paris, 689 pp.

Dangerfield PC, Austin AD, Whitfield JB (1999) Systematics of the world genera of Cardiochilinae (Hymenoptera: Braconidae). Invertebrate Taxonomy 13: 917–976. https://doi.org/10.1071/IT98020

Dangerfield, PC, Whitfield JB, Sharkey MJ, Janzen DH, Mercado I (1996) *Hansonia*, a new genus of cardiochiline Braconidae (Hymenoptera) from Costa Rica, with notes on its biology. Proceedings of the Entomological Society of Washington 98: 592–596.

Fernández-Triana JL, Whitfield JB, Rodriguez JJ, Smith MA, Janzen DH, Hallwachs WD, Hajibabaei M, Burns JM, Solis MA, Brown J, Cardinal S, Goulet H, Hebert PDN (2014) Review of *Apanteles sensu stricto* (Hymenoptera, Braconidae, Microgastrinae) from Area de Conservacion Guanacaste, northwest Costa Rica, with keys to all described species from Mesoamerica. ZooKeys 383: 1–565. https://doi.org/10.3897/zookeys.383.6418

Huber JT, Sharkey MJ (1993) Chapter 3, Structure. In: Goulet H, Huber JT (Eds) Hymenoptera of the World: An Identification Guide to Families. Centre for Land and Biological Resources Research, Ottawa, 13–59.

Janzen DH, Hallwachs W, Blandin P, Burns JM, Cadiou J-M, Chacon I, Dapkey T, Deans AR, Epstein ME, Espinoza B, Franclemont JW, Haber WA, Hajibabaei M, Hall JPW, Hebert PDN, Gauld ID, Harvey DJ, Hausmann A, Kitching IJ, LaFontaine D, Landry J-F, Lemaire C, Miller JY, Miller JS, Miller L, Miller S, Montero J, Munroe E, Green SR, Ratnasingham S, Rawlins JE, Robbins RK, Rodriguez JJ, Rougerie R, Sharkey MJ, Smith MA, Solis MA, Sullivan JB, Thiaucourt P, Wahl DB, Weller SJ, Whitfield JB, Willmott KR, Wood DM, Woodley NM, Wilson JJ (2009) Integration of DNA barcoding into an ongoing inventory of tropical complex biodiversity. Molecular Ecology Resources 9 (supplement 1): 1–26. https://doi.org/10.1111/j.1755-0998.2009.02628.x

Mercado I, Wharton RA (2003) Mexican cardiochiline genera (Hymenoptera: Braconidae), including a preliminary assessment of species-groups in *Toxoneuron* Say and *Retusigaster* Dangerfield, Austin and Whitfield. Journal of Natural History 37: 845–902. https://doi.org/10.1080/00222930110097167

Murphy N, Banks JC, Whitfield JB, Austin AD (2008) Phylogeny of the microgastroid complex of subfamilies of braconid parasitoid wasps (Hymenoptera) based on sequence data from seven genes, with an improved estimate of the time of origin of the lineage. Molecular Phylogenetics and Evolution 47: 378–395. https://doi.org/10.1016/j.ympev.2008.01.022

Papp J (2014) A revisional study on Szépligeti's cardiochiline type specimens deposited in the Hungarian Natural History Museum, Budapest (Hymenoptera, Braconidae, Cardiochilinae). Annales Historico-Naturales Musei Nationalis Hungarici 106: 169–214.

Smith MA, Rodriguez JJ, Whitfield JB, Janzen DH, Hallwachs W, Deans AR, Hebert PDN (2008) Extreme diversity of tropical parasitoid wasps exposed by iterative integration of natural history, DNA barcoding, morphology and collections. Proceedings of the National Academy of Sciences of the USA 105: 12359–12364. https://doi.org/10.1073/pnas.0805319105

Szépligeti V (1908) Braconiden aus der Sammlung des Ungarischen National-Museums. II Teil. Annales Historico-Naturales Musei Nationalis Hungarici 6: 397–427.

Whitfield JB, Dangerfield P (1997) Subfamily Cardiochilinae. Chapter 12. In: Wharton RA, Marsh PM, Sharkey MJ (Eds) Identification Manual to the New World Genera of the Family Braconidae (Hymenoptera). International Society of Hymenopterists Special Publication 1: 177–183.