Contributions to the systematics of New World macro-moths IV

Edited by

B. Christian Schmidt & J. Donald Lafontaine

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EDITORIAL

A peer-reviewed open-access journal
ZooKeys
Launched to accelerate biodiversity research

Contributions to the systematics of New World macro-moths IV

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This special issue of ZooKeys, "Contributions to the systematics of New World macro-moths IV" marks the fourth volume in this series, initiated in May 2009 (ZooKeys # 9), with the second volume published in March 2010 (ZooKeys # 39), and the third volume published in November 2011 (Schmidt and Lafontaine 2009, 2010, 2011). Twenty-two authors contributed 12 manuscripts for this volume, covering taxa in the Crambidae, Erebidae, Euteliidae, Geometridae, Noctuidae, and Notodontidae. New taxa are described from Argentina, Bahamas, Bolivia, Brazil, Canada, Cayman Islands, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, French Guiana, Guadeloupe, Guatemala, Guyana, Haiti, Honduras, Jamaica, Paraguay, Peru, Puerto Rico, British Virgin Islands, U.S. Virgin Islands, St. Lucia, Suriname, Trinidad, United States, and Venezuela. Taxonomic changes include the description of 27 new species and four new subspecies, eight new or revised synonyms, two revised statuses, and one new generic combination.

Since its inception in 2009, the "Contributions" series collectively includes 49 taxonomic publications by 38 authors. Geographic coverage has previously focused primarily on the North American fauna (Canada, United States and Mexico).

This issue marks a considerable increase in contributions concerning Neotropical taxa, and we look forward to continued emphasis of both realms in future volumes. Authors interesting in contribution to future editions of "Contributions …" are encouraged to contact us.

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Schmidt BC, Lafontaine JD (2009) Contributions to the systematics of New World macromoths. ZooKeys 9: 1–134.

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RESEARCH ARTICLE

A peer-reviewed open-access journal
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A new species of *Palpita* (Crambidae, Spilomelinae) from the coastal plains of southeastern United States

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Abstract

A new species of *Palpita* Hübner (Crambidae, Spilomelinae), *P. maritima*, **sp. n.,** is described from maritime forests of the coastal plains of southeastern United States.

Keywords

Taxonomy, *Palpita*, Spilomelinae, coastal plain, North Carolina, Florida, Alabama

Introduction

The genus *Palpita* Hübner is distributed worldwide. In the United States it consists of 11 recognized species (Munroe 1952, 1959, 1983). In North Carolina 6 species have been recorded, but only *P. magniferalis* (Walker) is found with some frequency. The other five species are very infrequently encountered. An exception, however, occurs in April along the coast in maritime forest habitats where numerous individuals of a *Palpita* species were collected by the first author. Genitalic morphology and molecular COI barcode analyses indicate these specimens represent a species new to science that is described below.

Material and methods

Specimens are deposited in the following collections: JBS (J. Bolling Sullivan, North Carolina, USA) and USNM (National Museum of Natural History, Washington, District of Columbia, USA).

Photographic methods used are described in Sullivan and Adams (2009). Procedures for dissecting and preparing genitalia follow Lafontaine (2004). DNA sequencing of the barcode fragment of the COI gene was conducted at the Canadian Center for DNA Barcoding in Guelph, Ontario. Barcode sequences (LNCC1234-11, LNCC1235-11) were compared by Nearest Neighbor Analyses as implemented on the Barcode of Life Data systems website (Ratnasingham and Hebert 2007).

Systematics

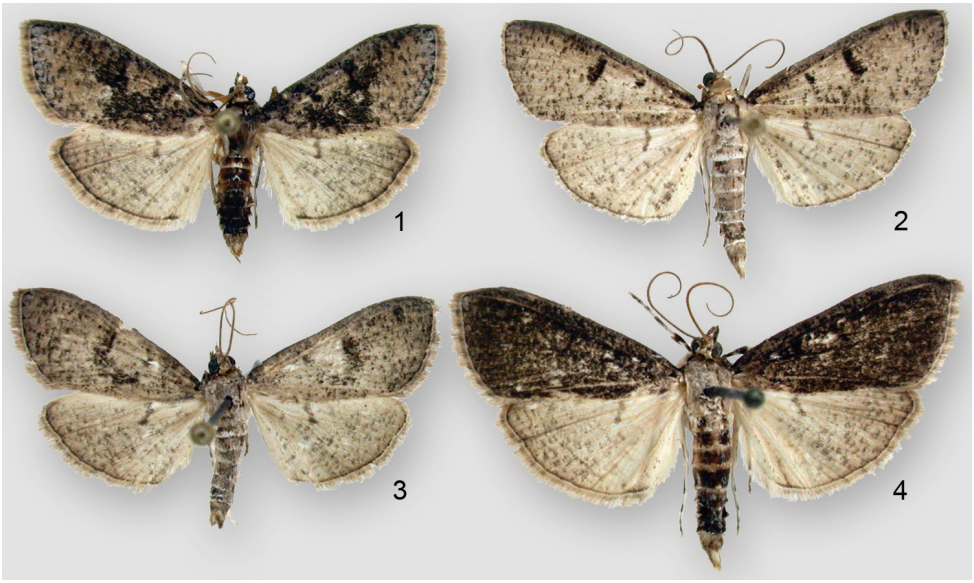
***Palpita maritima* Sullivan & Solis, sp. n.**
urn:lsid:zoobank.org:act:16C4A455-EB87-4BAD-913F-9358B54271FB
http://species-id.net/wiki/Palpita_maritima
Figs 1–3

Type material. Holotype male: **USA: North Carolina,** DCM Properties, Bald Head Island, Brunswick County (33.853; -79.975), 31 March 1994, J. Bolling Sullivan, Richard Broadwell, Brad Smith (USNM). **Paratypes:** 13 males, 2 females: same data as type. 10 m, 31 March 1994; 3 males, 2 females: 13 April 1994 (USNM).

Additional material examined. North Carolina, Carteret Co. Roosevelt Natural Area, Bogue Bank, 10-IV–2008. **Florida,** Putnam Co., Welaka For. Cons. Area, 17–21-III-1986, J.B. Heppner, Welaka Site 5, slashpine palmetto flatwoods. Liberty Co., Torreya State Park, 30-III-1988, H.D. Baggett. **Alabama,** Baldwin Co., Blakely State Park (30.749; -87.014), 25–29-VII-2011, J. Bolling Sullivan.

Diagnosis. The male genital characters, especially the shield-like juxta with two posterior pointed projections and the medial ribbon-like sclerotization across the valva, are diagnostic. External maculation, while fairly distinct within the genus, will not always distinguish this species readily from some forms of *P. arsaltealis* (Walker) and *P. freemanalis* Munroe that are also known from eastern U.S. coastal areas.

Description. Male. *Head* Labial palpi brown scaled above, white scaled below, scaling on inner surface lighter brown. Haustellum white scaled. Frons brown scaled with darker, chocolate-colored patches laterally. Vertex with central white scaling and lateral brown scaling. Maxillary palpi developed, forming mesially directed tufts at occipital angle. Eyes large with well-developed corona. Ocellus present. Antenna brown scaled dorsally to tip and tan ventrally with scape brown, pedicel brown with white shining scales at base; fasciculate with tiny ventral setae. *Thorax and abdomen* Thorax with fuscous scaling. First two abdominal segments with white scaling dorsally, fuscous and chocolate scaling laterally. Remaining segments chocolate colored



Figures 1–4. *Palpita maritima*, adult males from Bald Head Island, Brunswick County, North Carolina showing variation in maculation **1–3** paratypes **4** holotype.

dorsally with scattered fuscous scales covering most of segment and a row of white scales distally giving abdomen a ringed appearance. Terminal segment largely fuscous. Underside of abdomen white with scattered fuscous scales. Abdomen extends 1/3 length beyond wing margins. *Wings* (wing length=12 mm, n=20); span (wing tip to wing tip=29 mm). Forewing with apex slightly rounded. Ground color brown, a mixture of chocolate and fuscous scales. Orbicular and reniform spots well marked. Wing pattern varies depending on condition of wear. Some individuals with well-marked chocolate-colored areas. Hindwing fuscous, less patterned than forewing. Underside of wings white, less patterned, but orbicular and reniform spots visible. *Legs* Forelegs with alternating brown and white-scaled regions. Middle legs brown dorsally, white ventrally. Hind legs white. A single pair of spurs on mid tibia, two pair on hind tibia with smaller, distal spurs brown, proximal spurs white. Some individuals with all spurs white. Female similar to male, scaling on leg spurs usually white with scattered brown scales. *Male Genitalia* Tegumen posterodorsally square. Uncus elongate, narrow in middle, wider at both ends. Distal end smoothly rounded with a pad of dorsal setae. Valva broadly rounded with moderately-dense hair patch at apex. Costa sclerotized, slightly narrower than width of apex of uncus and widening slightly at 2/3 from base. Sacculus heavily sclerotized, half width of valva at base, narrowing distally, not extending to costal apex, with three dorsal (toward costa) projections. Most distal projection tapers at tip and extends thumb-like medially, extends toward costa more than ½ distance but shape variable among individuals and between left and right valves. Most basal projection about half distance along length of valva, broadly rounded, extends less than ½ way to costa. Between these two projections, a less-sclerotized thin,

ribbon-like projection extends across valva and bends toward costa without touching costa. Medial area of valva unsclerotized, with broadly-spaced setae. Vinculum 2–3× broader than tegumen, parategumen sclerites (=a pair of lateral sclerites located in basal region of tegumen, usually with long pencils or brushes of scales (=coremata) (Clavijo 1990)) present. Saccus pointed, curving dorsad. Juxta large, shield-like with distinct sub-basal invaginations. Posterior juxtal tip broad with two distinct pointed projections. Phallus weakly sclerotized; apex without projection or ornamentation on shaft. Ductus seminalis subbasal. Vesica sac-like, slightly wider than phallus with a dorsal basal sclerotization often looking like a fishing hook. A larger and more distal ventral patch of deciduous cornuti present (in some specimens only sockets remain on a sclerotized patch). *Female Genitalia* Eighth segment trapezoidal, 5× as wide as high with numerous setae arranged in 4 somewhat irregular rows. Anterior apophyses about 3× as long as posterior apophyses. Anterior and posterior apophyses narrow, rounded at tips. Seventh segment ovoid, lightly sclerotized. Ostium bursae broad, about 4/5 width of segment, flat, and extending dorsally with short sclerotized spines at lateral edges. Ductus bursae short, posteriorly highly sclerotized, anteriorly lightly sclerotized, slightly sclerotized at junction with corpus bursae. Corpus bursae lightly sclerotized anterior to ductus bursae. Two ventrally located, elongated, horn-shaped signa anterior to base of corpus bursae. Corpus bursae membranous, elongate, about half length of genital apparatus.

Biology and distribution. The species has been found frequently in North Carolina from Carteret County south to Brunswick County in late March and early April in coastal maritime forests. Additional captures have been made in the same habitat in June, July and August, but very few individuals represent later broods. This species has a much broader range along the southeastern coastline, but has been confused with other species and thus has remained unknown. For example, from Florida two specimens from Archbold Preserve, Highlands County, have barcodes that match *P. maritima* and two specimens from Liberty and Putnam counties morphologically match *P. maritima*. A male from Baldwin Co., Alabama, has been dissected and matches the North Carolina holotype. These habitats are dominated by live and laurel oaks, loblolly pines, yaupon holly and *Smilax* species. The larval foodplants of *P. maritima* have not been discovered, but other species of *Palpita,* including *P. gracilialis* (Hulst), *P. kimballi* Munroe, *P. magniferalis* and *P. quadristigmalis* (Guenée), use species of Oleaceae as foodplants (Robinson et al. 2002). *Osmanthus americana* (L.), Wild Olive, is distributed in the maritime forests of the outer Coastal Plain and is the likely food plant.

Remarks. Nearest neighbor joining barcode trees place *P. maritima* in a group that includes the *P. arsaltealis* (Walker) complex and *P. illibalis* (Hübner). *P. maritima* was compared to multiple genitalic preparations at the USNM of *P. arsaltealis* and *P. illibalis.* Males of *P. arsaltealis* (see fig. 3, Munroe 1952) and *P. illibalis* (see fig. 4, Munroe 1952) have a shield-like juxta, but lack pointed projections posteriorly that occur in *P. maritima* males (Fig. 5). The valvae of *P. arsaltealis* and *P. illibalis* are not as complex as *P. maritima. P. arsaltealis* and *P. illibalis* have two longer, pointed

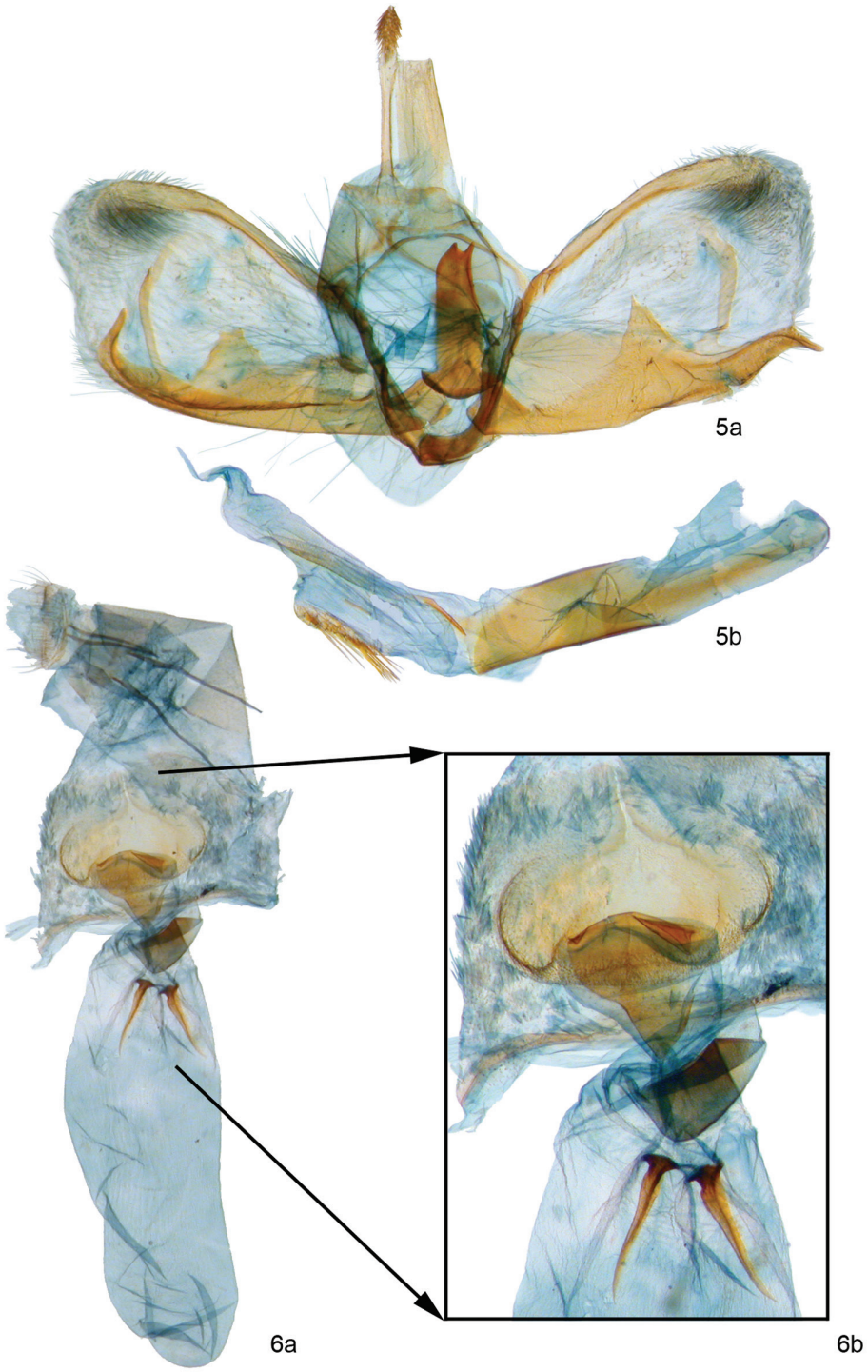


Figure 5–6. 5 *Palpita maritima*. **5a** male genitalia showing parategumen sclerites (= coremata) **5b** phallus with everted vesica **6** *Palpita maritima* **6a** female genitalia **6b** ostium bursae region.

saccular projections. *P. maritima* has three saccular projections, one distal, short, and pointed, and another proximal, short, and broad. *P. arsaltealis* and *P. illibalis* both lack the medially-located thin, ribbon-like sclerotization extending almost the width of the valva toward the costa that occurs in *P. maritima*. *Palpita maritima* females have lightly and incompletely sclerotized ductus bursae and the signa are ventrally located, unlike *P. arsaltealis* (see fig. 10, Munroe 1952) and *P. illibalis* (see fig. 11, Munroe 1952) females that have lightly but more completely sclerotized ductus bursae, and the signa are located almost laterally in the corpus bursae. *P. maritima* females (Fig. 6) have anterior apophyses three times as long as posterior apophyses, whereas *P. arsaltealis* and *P. illibalis* females have anterior apophyses that are two times as long as the posterior apophyses.

Etymology. The name refers to the habitat type, coastal maritime forest, where the species is most abundant in the spring.

Acknowledgments

Thanks to Mark Metz (SEL) who made genitalic dissections for MAS. James Hayden, Florida Department of Agriculture, provided additional specimens from Florida for morphological study. Richard Broadwell and Brad Smith helped collect material for this study that was partially funded by the U. S. Forest Service (Hall et al. 1999).

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RESEARCH ARTICLE

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Cryptic species within cryptic moths: new species of *Dunama* Schaus (Notodontidae, Nystaleinae) in Costa Rica

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Abstract

Based on almost 1,700 recently reared and wild-collected specimens, the genus *Dunama* Schaus (Notodontidae, Nystaelinae) in Costa Rica is reviewed. Eight species are recorded of which seven are newly described: *Dunama jessiehillae* Chacón, *Dunama jessiebarronae* Chacón, *D. janewaldronae* Chacón, *D. jessiebancroftae* Chacón, *D. janecoxae* Chacón, *D. biosise* Chacón, *D. indereci* Chacón. *Dunama angulinea* Schaus is redescribed and associated with its correct genitalia. *D. tuna* (Schaus), previously listed as ocurring in Costa Rica, is restricted to Colombia. Most species are described through their distinctive CO1 barcodes, genitalia and life histories. *Dunama* adults and caterpillars, their foodplants, and their parasites in Area de Conservación Guanacaste (ACG) in northwestern Costa Rica are described where known. Many life history stages are illustrated.

Keywords
Dunama, Heliconia, Musa, Arecaceae, caterpillars, moths, inventory, DNA barcodes, tropical forest, Area de Conservacion Guanacaste, INBio

Introduction

Schaus (1912) established the genus *Dunama* for a group of small, relatively drab, mottled and tree-bark patterned, brown notodontid moths with a black orbicular spot. Todd (1976) revised the genus whose distribution extends from Mexico to Amazonian Brazil. He described two new species and listed two species, *D. angulinea* Schaus and *D. tuna* (Schaus), from Costa Rica. One additional species was recently described by Miller and Thiaucourt (2011) from Ecuador. The genus traditionally has been placed in the Nystaleinae, but that placement remains provisional because species of *Dunama* lack the characteristic morphological traits of most nystaleines. Additionally, all known caterpillars of *Dunama* feed on monocots (Musaceae, Marantaceae, Heliconiaceae, Arecaceae), a trait rarely encountered in the Notodontidae. Review of the Costa Rican species is part of an ongoing documentation of over 700 notodontid species collected or reared by parataxonomists and others in Area de Conservación Guanacaste (Janzen 2004, Janzen et al. 2009, Janzen and Hallwachs 2011, 2012, and see http://janzen.bio.upenn.edu/caterpillars/database.lasso).

Material and methods

About 1,700 spread specimens of *Dunama* spp. were examined as follows: 1,545 rearing records from the project "Inventory of the caterpillars of Area de Conservación Guanacaste (ACG), and their parasitoids and food plants" (see Janzen 2004, Janzen et al. 2009, Janzen and Hallwachs 2011, 2012 and also search on *Dunama* spp. at http://janzen.bio.upenn.edu/caterpillars/database.lasso), where the species reside under their interim names until this paper is published. 73 light-caught specimens from the INBio Lepidoptera collection of the project "National Inventory of Biodiversity 1978–2011." 53 light-caught specimens from the collection of J. Bolling Sullivan, Beaufort, NC, USA.

Genital dissections and measurements were made using an Olympus SZ60 stereomicroscope with a calibrated ocular micrometer. The following protocol was used for the dissection of genitalia: abdomens were digested in 10% KOH, cleared, and stained with mercurochrome and Eosin Y (Montero-Ramírez et al. 2011). Genitalia and pelts were stored in glycerol for examination (in 70% ethanol solution, 3:1) and subsequently slide mounted using Euparal. Genital slides were photographed using a JVC 3-CCD color video camera attached to an Olympus SZ60 stereomicroscope, both mounted in an Olympus SZH-ILLD illumination base. Using Montage explorer software (version: 2.01.0075, Synoptics Ltd.) and Auto-Montage software (version: 4.02.0014, Synoptics Ltd.) photographs were enhanced for publication.

Morphological terminology follows Miller (1991). A subset of the total specimens was used for species descriptions.

All holotypes and representative paratypes are deposited in the collections at the Instituto Nacional de Biodiversidad (INBio), Santo Domingo de Heredia, Costa Rica, and the other paratypes are in the USNM.

Repository abbreviations

INBio	Instituto Nacional de Biodiversidad, Santo Domingo de Heredia, Costa Rica
JBS	J. Bolling Sullivan, Beaufort, North Carolina, USA
USNM	National Museum of Natural History, Smithsonian Institution, Washington, District of Columbia, USA

Key to morphological terminology

WL	Wing length
AD	Adterminal line
M	Medial line
PM	Postmedial line
ST 8	Sternum 8
T8	Tergum 8
CB	Corpus bursae
DB	Ductus bursae

Systematics

***Dunama* Schaus**
http://species-id.net/wiki/Dunama

Dunama Schaus, 1912: 52.

Type species. *Dunama angulinea* Schaus, 1912: 52; Draudt 1932: 981; Gaede 1934: 263; Todd 1976: 190–192.

Diagnosis. ***Adults*** – Small to medium-sized notodontid moths, forewing 10–22 mm, females larger than males; male antenna bipectinate for 4/5 of length with pectinations decreasing toward antennal tip, last 1/5 simple; female antenna simple; palpi upcurved to medial area of frons, second segment 2 x first segment in length, 3rd segment very small and slightly decumbent; scaling appressed; haustellum present, ocelli absent. Thoracic scaling not tightly appressed, without tufts, concolorous with forewing; abdominal scaling appressed, without tufts, concolorous with hindwing. Fore-

wing with M1 from proximal third of narrow accessory cell; hindwing with Sc from middle of cell diverging from Rs and straight; Rs and M1 connate from upper angle and M3 and Cu1 connate from lower angle of the cell. Male terminal tergites distinctive. ***Male genitalia*** – Uncus short, rounded, sometimes divided; socii sclerotized, upcurved; valves with costal margin sclerotized, sometimes with projections; anal margin often partially but narrowly sclerotized and usually diagnostic; juxta undifferentiated, transtilla membraneous; phallus well developed, sclerotized, usually extending to uncus and narrowing distally; often with distinct lateral and dorsolateral processes; eighth sternum diagnostic, quadrate basally but often with multiple distal projections. ***Female genitalia*** – Ovipositor lobes large, often sclerotized, ostia sclerotized, ductus and corpus bursae reduced, membranous and without signa. ***Larvae*** – Brightly colored, feeding on monocots.

Dunama angulinea Schaus, 1912

http://species-id.net/wiki/Dunama_angulinea
Figs 1–6

Type material. Holotype male: Guapiles, Costa Rica, 17505 USNM (examined).

Other material examined. ♂ Costa Rica, Limon Prov., Hitoy Cerere Reserve, 350 m, 9.404 N, -83.015 W, 1–4 July 2008, J. B. Sullivan (dissected); 3 ♂ Costa Rica, Limon Prov., Verugua Rainforest, 450 m, 9.653 N, -83.113 W, 12–16 March 2010, J. B. Sullivan (1 dissected, 3 barcoded).

Diagnosis. Sternum 8 (St8) wide, short, anterior margin simple, posterior margin bearing a pair of small, widely-separated processes. Phallus thin basally, wider medially, with a pair of short, serrate projections on each margin, distal part with a pair of opposite, marginal, non-serrate projections, longer than anterior ones. Vesica short, unsclerotized, without cornuti. The single pair of terminal, widely-separated processes of sternum 8 and the tripartite distal structure of the phallus distinguishes *D. angulinea* from its known congeners.

Redescription. Male (Figs 1–6). ***Head*** – Antenna pectinate in basal 4/5, rami moderately long, reddish brown, distal fifth of shaft simple, cream colored with an intermix of reddish-brown and gray-brown scales; scape with scale tuft reddish brown and cream colored; ocelli absent; labial palpus upcurved, reddish brown with a few scattered cream-colored scales; vertex reddish brown, cream colored laterally; patagium reddish brown near midline, reddish brown laterally, margins cream colored. ***Thorax and abdomen*** – Tegula cream colored at base, a mix of cream and reddish-brown scales distally; mesoscutum reddish brown anteriorly, cream and reddish brown posteriorly; mesoscutellum mostly creamy white; thoracic pleuron cream colored to reddish brown; legs mostly reddish brown on outer surfaces, cream colored on inner ones. Abdominal dorsum light gray, venter cream colored. ***Wings*** – Forewing dorsal ground color a mixture of gray-brown, reddish-brown, and beige-colored scales; veins lined with gray, especially distally; anal fold and cubitus reddish brown; orbicular spot diffuse reddish

Figures 1–6. *Dunama angulinea* **1, 2** Male Holotype dorsal and ventral Type # 17505 USNM **3** Male Holotype labels **4** Male genitalia **5** Male St8 **6** Phallus.

brown; reniform spot small, reddish brown; medial (M) line thin, reddish brown, a wide, vaguely-defined beige band beyond it; postmedial (PM) line thin, reddish brown, poorly defined; adterminal (AD) line reddish brown, fringe gray brown. Ventral surfaces of both wings gray brown (Figs 1, 2). Dorsal hindwing dirty gray brown, lighter near base. Wing length (WL) 11.20–12.2 mm). ***Male genitalia*** (Figs 4–6) – tergum 8 quadrate, posterior margin narrowly sclerotized; St8 wide, short, anterior margin simple, posterior margin extended and bearing a pair of long processes (Fig. 5). Uncus lobule-like, short and pubescent; socci thin, short and slightly curved. Valva broad and membranous, with saccular margin serrate, inner surface with spine-like process, near apex (Fig. 4). Phallus thin basally, wider medially, with a pair of short, serrate projections on each margin, distal part with a pair of opposite marginal non-serrate projections longer than anterior ones. Vesica short, unsclerotized (Fig. 6). **Female.** Unknown.

Natural history. Unknown

Distribution. Adults of *Dunama angulinea* have been collected from Limon Province (Hitoy Cerere, Verugua Rainforest, Guapiles). The distribution follows the Caribbean coast and we know of no records farther inland (Fig. 85). Two specimens identical in size and maculation from La Selva (Heredia) were found on dissection to represent another species described below.

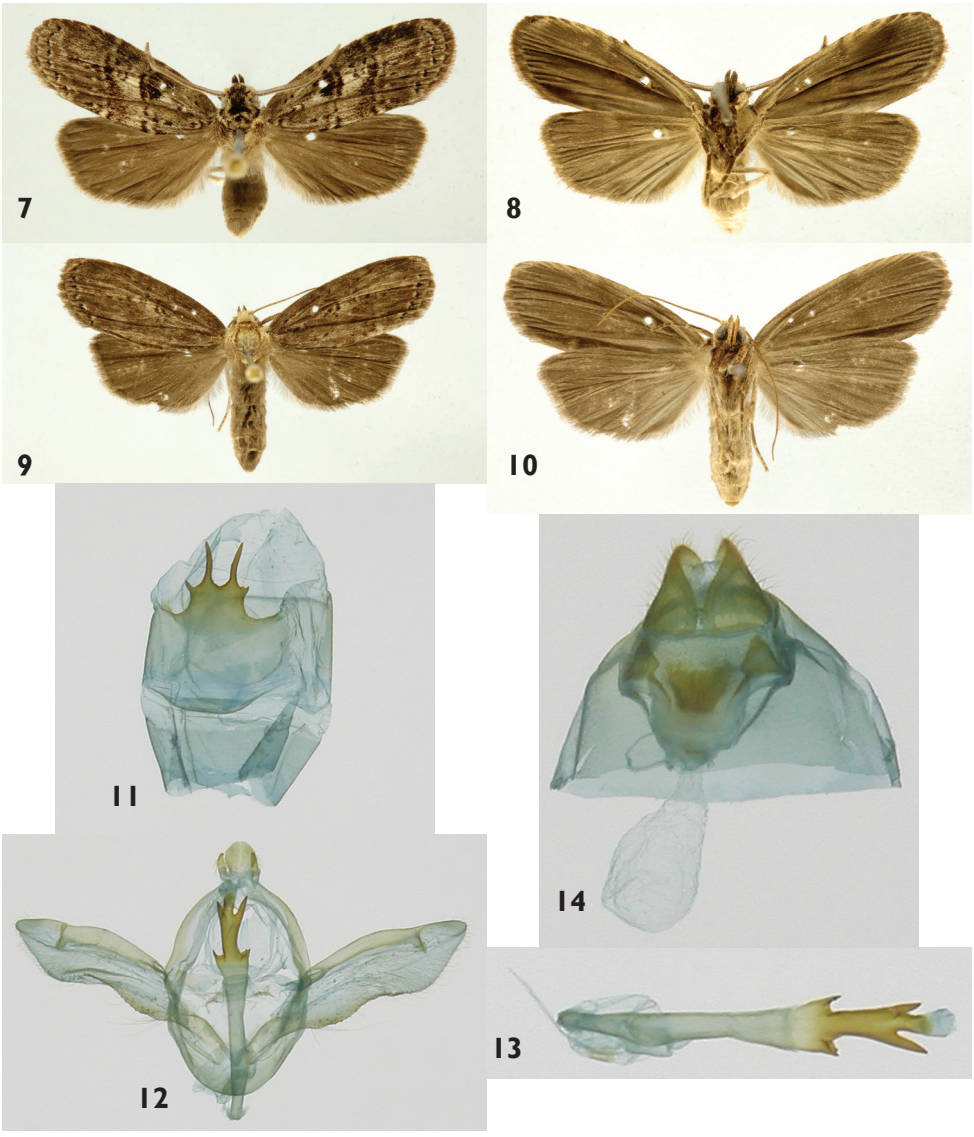
Remarks. Todd (1976, Fig. 10) illustrated the genitalia of what he supposed was *Dunama angulinea* from two paratypes from Guatemala (USNM slides ELT 822 ♂,

855 ♂). The holotype from Guapiles, Costa Rica was not dissected. When we dissected the type, it was obvious that the Guatemalan paratypes represent another species. We are not describing the Guatemalan species as new because its genitalia are very similar to those of *D. tuna* and because we have no specimens from the area between Guatemala and Costa Rica. We also have no barcode or life history data for the Guatemalan species. The barcode NJ tree (Fig. 86) associates *Dunama angulinea* with *D. jessiehillae*, described below, from western and inland Costa Rica and can be distinguished from it only by the shape of the sternum. One haplotype represents all three specimens of *Dunama angulinea* that are recent enough for molecular analysis.

Dunama jessiehillae **Chacón, sp. n.**
urn:lsid:zoobank.org:act:A2F983CB-4888-40BD-BE13-BFBD02302B4E
http://species-id.net/wiki/Dunama_jessiehillae
Figs 7–14, 74, 79–81

Type material. Holotype male: 99-SRNP-4120 (Dissected, COI Barcoded), Costa Rica, Prov. Alajuela, Sector San Cristobal, Sendero Vivero 10.86739 -85.38744, 730 m, 29 January 1999, Gloria Sihezar (INBio). **Paratypes**: Male: 07-SRNP-23691 (COI Barcoded), Costa Rica, Prov. Guanacaste, Sector del Oro, Rio Chon 11.04118 -85.44170, 320 m, 28 September 2007, Elieth Cantillano. Female: 04-SRNP-42836 (COI Barcoded), Costa Rica, Prov. Alajuela, Sector Rincon Rain Forest, Sendero Rincon 10.8962 -85.27769, 430 m, 16 December 2004, Jose Perez. Female: 99-SRNP-4126.. (COI Barcoded), Costa Rica, Prov. Alajuela, Sector San Cristobal, Sendero Vivero 10.86739 -85.38744, 730 m, 29 January 1999, Gloria Sihezar. Male: 99-SRNP-4116 (COI Barcoded), Costa Rica, Prov. Alajuela, Sector San Cristobal, Sendero Vivero 10.86739 -85.38744, 730 m, 1 February 1999, Gloria Sihezar. Female: 99-SRNP-4118 (COI Barcoded), Costa Rica, Prov. Alajuela, Sector San Cristobal, Sendero Vivero 10.86739 -85.38744, 730 m, 28 January 1999, Gloria Sihezar. Female: 07-SRNP-23698 (COI Barcoded), Costa Rica, Prov. Guanacaste, Sector del Oro, Rio Chon 11.04118 -85.44170, 320 m, 27 September 2007, Elieth Cantillano. Male: 08-SRNP-41651 (COI Barcoded), Costa Rica, Prov. Alajuela, Sector Rincon Rain Forest, Quebrada Escondida 10.89928 -85.27486, 420 m, 2 September 2008, Anabelle Cordoba. Male: 05-SRNP-43080 (Dissected, COI Barcoded), Costa Rica, Prov. Alajuela, Sector Rincon Rain Forest, Anonas 10.90528 -85.27882, 405 m, 2 November 2005, Jose Perez.

Other material examined. Barcoded: 198 specimens that divided into four haplotypes with slight differences from the most common haplotype (163 specimens) of 0.13% or less; we do not consider these differences to be of species-level significance and many are due to slightly shorter barcode sequences. No specimens from Heredia Province were barcoded. Museum specimens: (45 specimens) 2♂ 3♀ Guanacaste, 20♂ 10♀ Alajuela, 10♂ Heredia. Dissections: 1♂ 2♀ Guanacaste, 2♂ 1♀ Alajuela, 2♂ Heredia. INBio, USNM, JBS. **Janzen & Hallwachs vouchers of reared specimens.**



Figures 7–14. *Dunama jessiehillae* **7, 8** Male dorsal and ventral 99-SRNP-4120 **9, 10** Female dorsal and ventral 04-SRNP-42836 **11** Male St8 **12** Male genitalia 99-SRNP-4120 **13** Phallus **14** Female genitalia 04-SRNP-42836.

Male: 07-SRNP-23702 (COI Barcoded), Costa Rica, Prov. Guanacaste, Sector del Oro, Rio Chon 11.04118 -85.44170, 320 m, 28 September 2007, Elieth Cantillano. Male: 04-SRNP-42845 (COI Barcoded), Costa Rica, Prov. Alajuela, Sector San Cristobal, Sendero Vivero 10.86739 -85.38744, 730 m, 16 December 2004, Gloria Sihezar. Female: 05-SRNP-43079 (COI Barcoded), Costa Rica, Prov. Alajuela, Sector Rincon Rain Forest, Anonas 10.90528 -85.27882, 405 m, 2 November 2005, Jose Perez.

Female: 07-SRNP-23690 (COI Barcoded), Costa Rica, Prov. Guanacaste, Sector del Oro, Rio Chon 11.04118 -85.44170, 320 m, 27 September 2007, Elieth Cantillano. Male: 04-SRNP-42845 (COI Barcoded), Costa Rica, Prov. Alajuela, Sector San Cristobal, Sendero Vivero 10.86739 -85.38744, 730 m, 1 February 1999, Gloria Sihezar (INBio). Female: 99-SRNP- 4118, Costa Rica, Prov. Alajuela, Sector San Cristobal, Sendero Vivero 10.86739 -85.38744, 730 m, 28 January 1999, Gloria Sihezar. **INBio specimens.** Male: INBIOCRI002582936 (Dissected), Costa Rica, Prov. Heredia, La Selva Biol. Sta., Puerto Viejo de Sarapiqui 10.431958 -840091, 40 m, February 1986, M.M. Chavarria, A. Chacon. Male: INB0004268497 (COI Barcoded), Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, October 2009, R. Rojas (reared). Male: INB0004251816 (COI Barcoded, Dissected), Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, October 2009, R. Rojas (reared). Female: INB0004268498 (COI Barcoded), Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, October 2009, R. Rojas (reared). Female: INB0004268499 (COI Barcoded), Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, October 2009, R. Rojas (Reared). Female: INB0004251817 (COI Barcoded), Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, October 2009, R. Rojas (reared).

Etymology. This species is named in honor of Ms. Jessie Hill of Hawaii and Philadelphia, and great-great-grandaughter of Ms. Jessie Barron, and in emphatic recognition of Jessie Hill's contribution to saving and inventorying the conserved ACG rain forest in which reside *Dunama jessiehillae* and four other new species of *Dunama* described in this report.

Diagnosis. St8 wide, short, anterior margin simple, posterior margin bearing a pair of small, widely separated processes, a second long pair of processes arises between this more basal pair. Phallus thin basally, wider medially, with a pair of short, serrate projections on each margin, distal part with a pair of opposite, marginal, non-serrate projections, longer than anterior ones. Vesica short, unsclerotized, no cornuti. The tripartite distal structure of the phallus and the two pairs of processes on St8 distinguish *D. jessiehillae* from its known congeners.

Description. Male (Figs 7, 8, 11–13). ***Head*** – Antenna pectinate in basal 4/5, rami moderately long, reddish brown, distal fifth of shaft simple, cream colored with an intermix of reddish-brown and gray-brown scales; scape with scale tuft reddish brown and cream colored; frons with cream-colored scales interspersed with a few reddish-brown scales, ocelli absent; labial palpus upcurved, reddish brown with a few scattered cream-colored scales; vertex reddish brown, cream colored laterally; patagium reddish brown near the midline, reddish brown laterally, margins cream colored. ***Thorax and abdomen*** – Tegula cream colored at base, a mix of cream and reddish-brown scales distally; mesoscutum reddish brown anteriorly, cream and reddish brown posteriorly; mesoscutellum mostly creamy white; thoracic pleuron cream colored to reddish brown; legs mostly reddish brown on outer surfaces, cream colored on inner surfaces. Abdominal dorsum light gray, venter cream colored. ***Wings*** – Forewing dor-

sal ground color a mixture of gray-brown, reddish-brown and beige-colored scales; veins lined with gray, especially distally; anal fold and cubitus reddish brown; orbicular spot diffuse reddish brown; reniform spot small, reddish brown; medial M line thin, reddish brown, a wide, vaguely-defined beige band beyond it; postmedial PM line thin, reddish brown, poorly defined; adterminal AD line reddish brown, fringe gray brown. Ventral surfaces of both wings gray brown. Dorsal hindwing dirty gray brown, lighter near base (Figs 7, 8). (WL 10.70–13.3 mm). ***Male genitalia*** (Figs 11–13) – T8 quadrate, posterior margin narrowly sclerotized; St8 wide, short, anterior margin simple, posterior margin bearing a pair of small, widely separated processes, a second, longer pair of processes arise between arms of fork (Fig. 11). Uncus lobule-like, short and pubescent; socci thin, short and slightly curved. Valva broad and membranous, with saccular margin serrate and inner surface with spine-like process, near appex (Fig. 12). Phallus thin basally, wider medially with a pair of short, serrate projections on each margin, distal part with a pair of opposite marginal non-serrate projections, longer than anterior ones. Vesica short, unsclerotized (Fig. 13). **Female** (Figs 9, 10, 14). Antenna filiform, shaft cream with a mix of reddish- and gray-brown scales; body color and wing pattern similar to male, wings longer and darker (Figs 9, 10). (WL 13.7–14.7 mm). ***Female genitalia*** (Fig. 14) – St8 forming a heavily sclerotized capsule; anterior apophyses thin and acute; posterior apophyses thin, CB small and rounded, signum absent; DB short; ostium recessed in St8. Ovipositor lobes triangulate and setose.

Natural history (Figs 74, 79, 80, 81). 506 rearing records: ACG locations: Sector Del Oro (n=84), Orosi (n=4), Pitilla (n=68), Rincon Rain Forest (n=132), San Cristobal (n=217); all mid-elevation rain forest and does not occur in ACG dry forest either as caterpillars or free-flying adults.

Food plants: exclusively Arecaceae: *Asterogyne martiana* (H. Wendl.) H. Wendl. ex Hemsel (n=9), *Astrocaryum alatum* F.H. Loomis (n=5), *Calyptrogyne trichostachys* Burret (n=3), *Chamaedorea pinnatifrons* (Jacq.) Oerst. (n=14), *Chamaedorea tepejilote* Liebm. (n=298), *Chamaedorea warscewiczii* H. Wendl. (n=1) *Cryosophila warscewiczii* (H. Wendl.) Bartlett (n=49), *Geonoma congesta* H. Wendl. ex Spruce (n=1), *Geonoma cuneata* H. Wendl. ex Spruce (n=3), *Geonoma ferruginea* H. Wendl. ex Spruce (n=42), *Geonoma interrupta* (Ruiz & Pav.) Marz. (n=5), *Iriartea deltoidea* Ruiz & Pav. (n=41), *Prestoea decurrens* (H. Wendl. ex Burret) H.E. Moore (n=21), *Welfia regia* H. Wendl. (n=14).

Eggs laid in small batches of 5–40, and caterpillars may remain together through the penultimate instar, but generally forage separately in the last instar. Cocoons are solitary, generally in a fold of the palm leaf or two pinnae one on top of the other, lightly silked together. The relatively conspicuous caterpillars remain on the leaf when disturbed rather than drop to the ground, implying that they may be aposematic or mimetic even though they are commonly difficult to encounter among overlapping leaf parts, and often on the underside of the leaf.

Altitude (meters): 340, 405, 420, 645, 680.

Parasitoids. 27 records from 506 wild-caught caterpillars over 24 years of rain forest search. **Braconidae:** Macrocentrinae: *Austrozele* Janzen03 (n=6) DHJPAR0029342, DHJPAR0029346, DHJPAR0029344, DHJPAR0029347, DHJPAR0029378,

DHJPAR0029377; shared only with *Dunama mexicana*DHJ01. Microgastrinae: *Diolcogaster* Choi71 (n=1) DHJPAR0004716; unique to this species of caterpillar. **Tachinidae:** *Calolydella* Wood01DHJ06 (n=13) DHJPAR0017779, DHJPAR0017778, DHJPAR0017777, DHJPAR0017781, DHJPAR0017780, DHJPAR0007021, etc., which it shares with 4 species of *Dioptis* Hübner, *Dottia* Schaus and *Tithraustes* Druce (26 total rearings of this fly), which are similar-sized notodontids that eat the same species of palms in the same forest; *Lespesia* Wood33DHJ06 (n=3) DHJPAR0037477, DHJPAR0037483, DHJPAR0037482, which it shares with six other species of similar-sized notodontids *Dunama* (n=4), *Dottia* (n=1), and *Heorta* Walker (n=1) feeding on the same palms in the same rain forest habitat; four nematodes and two fungi.

Hyperparasitoids. One puparium of *Calolydella* Wood01DHJ06 was hyperparasitized by *Taeniogonalos woodorum* Smith (DHJPAR0010604), Trigonalidae (Smith et al. 2012).

Distribution. Adults of *Dunama jessiehillae* have been collected on the east slope of Cordillera Volcanica de Guanacaste and Tilaran, and in the Sarapiqui lowlands, from 40 to 1500 m elevation (Fig. 85), but larvae have only been encountered at mid-elevations on the same slopes.

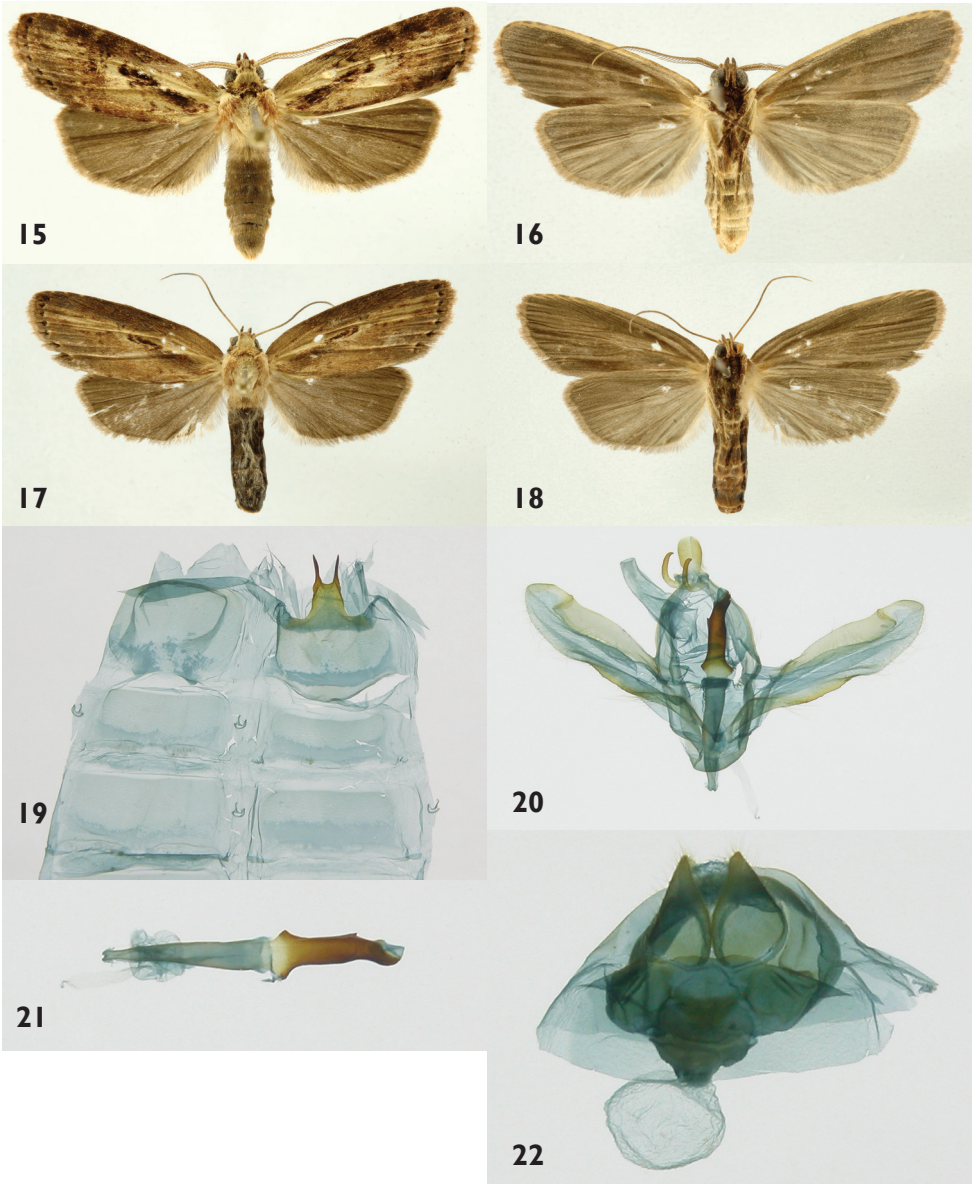
Remarks. This species feeds exclusively on Arecaceae. Several barcode haplotypes are present in populations from La Selva, Heredia west to the Pacific coast, but they are all very similar (Fig. 86). The most common haplotype is shared with *D. angulinea*, which ocupies the Caribbean coastal area and differs only in the structure of its sternum. We elected on that basis to describe it as a new species, following both the advice of a reviewer and our own analysis. If later studies support the doubtful hypothesis that this is merely geographic variation in a widely distributed species, then *D. jessiehillae* would be synonymized with *D. angulinea*.

Dunama jessiebarronae Chacón, sp. n.

urn:lsid:zoobank.org:act:F073A2EC-C71B-49C5-B601-350005110680
http://species-id.net/wiki/Dunama_jessiebarronae
Figs 15–22, 65–70

Type material. Holotype male: 04-SRNP-4063 (Dissected, COI Barcoded) Costa Rica. Prov. Alajuela. Sector San Cristobal, Puente Palma 10.9163 -85.37869, 460m. 7 September 2004. Elda Araya (INBio). **Paratypes**: 2♂ 1♀. Female: 04-SRNP-4060 (Dissected, COI Barcoded), Costa Rica, Prov. Alajuela, Sector San Cristobal, Puente Palma 10.9163 -85.37869, 460 m, 5 September 2004, Elda Araya (INBio). Female: 00-SRNP-1959, Costa Rica, Prov. Alajuela, Sector San Cristobal, Rio Blanco Abajo 10.90037 -85.37254, 500 m, 26 May 2000, Osvaldo Espinoza. Male: 00-SRNP-1935 (COI Barcoded), Costa Rica, Prov. Alajuela, Sector San Cristobal, Rio Blanco Abajo 10.90037 -85.37254, 500 m, 26 May 2000, Osvaldo Espinoza.

Other material examined. Barcoded: 25 specimens that divided into 6 apparent haplotypes with differences from the most common haplotype (16 specimens) of 0.3% or less (Fig. 86). Barcoded specimens were from Alajuela and Limon Provinces. Many



Figures 15–22. *Dunama jessiebarronae* **15, 16** Male dorsal and ventral 04-SRNP-4063 **17, 18** Female dorsal and ventral 04-SRNP-4060 **19** Male St8 **20** Male genitalia 04-SRNP-4063 **21** Phallus **22** Female genitalia 04-SRNP-4060.

hundreds more of this species were reared and barcoded, but there is no cause to list them here. Museum specimens: (67 specimens) 22♂ 26♀ Alajuela, 13♂ Heredia, 6♂ Limon. Dissections: 4♂ 5♀ Alajuela, 2♂ Heredia, 5♂ Limon. INBio, USNM, JBS. **Janzen & Hallwachs vouchers of reared specimens**: Female: 00-SRNP-1940, Costa Rica, Prov. Alajuela, Sector San Cristobal, Rio Blanco Abajo 10.90037 -85.37254, 500

m, 26 May 2000, Osvaldo Espinoza. Male: 00-SRNP-1942, Costa Rica, Prov. Alajuela, Sector San Cristobal, Rio Blanco Abajo 10.90037 -85.37254, 500 m, 26 May 2000, Osvaldo Espinoza. Female: 00-SRNP-1943, Costa Rica, Prov. Alajuela, Sector San Cristobal, Rio Blanco Abajo 10.90037 -85.37254, 500 m, 26 May 2000, Osvaldo Espinoza. Female: 00-SRNP-1959, Costa Rica, Prov. Alajuela, Sector San Cristobal, Rio Blanco Abajo 10.90037 -85.37254, 500 m, 26 May 2000, Osvaldo Espinoza. Male: 00-SRNP-1967, Costa Rica, Prov. Alajuela, Sector San Cristobal, Rio Blanco Abajo 10.90037 -85.37254, 500 m, 23 May 2000, Osvaldo Espinoza. Female: 01-SRNP-4001, Costa Rica, Prov. Alajuela, Sector Rincon Rain Forest, Camino Rio Francia 10.90425 -85.28651, 410 m, 12 January 2001, Jose Perez. Female: 01-SRNP-4003, Costa Rica, Prov. Alajuela, Sector Rincon Rain Forest, Camino Rio Francia 10.90425 -85.28651, 410 m, 12 January 2001, Jose Perez. Female: 01-SRNP-4006, Costa Rica, Prov. Alajuela, Sector Rincon Rain Forest, Camino Rio Francia 10.90425 -85.28651, 410 m, 12 January 2001, Jose Perez. Male: 01-SRNP-4008, Costa Rica, Prov. Alajuela, Sector Rincon Rain Forest, Camino Rio Francia 10.90425 -85.28651, 410 m, 11 January 2001, Jose Perez. Female: 01-SRNP-4001, Costa Rica, Prov. Alajuela, Sector Rincon Rain Forest, Camino Rio Francia 10.90425 -85.28651, 410 m, 12 January 2001, Jose Perez. Male: 01-SRNP-4177, Costa Rica, Prov. Alajuela, Sector Rincon Rain Forest, Quebrada Escondida 10.89928 -85.27486, 420 m, 5 February 2001, Jose Perez. Female: 01-SRNP-23045, Costa Rica, Prov. Alajuela, Sector Rincon Rain Forest, Montaña Figueres 10.88367 -85.29081, 460 m, 1 November 2001, Jose Perez. Male: 04-SRNP-4056, Costa Rica, Prov. Alajuela, Sector San Cristobal, Puente Palma 10.9163 -85.37869, 460 m, 5 September 2004, Elda Araya. Female: 07-SRNP-1085, Costa Rica, Prov. Alajuela, Sector San Cristobal, Puente Palma 10.9163 -85.37869, 460 m, 20 March 2007, Osvaldo Espinoza. **INBio specimens**: Male: INBIOCRI000702122 (Dissected), Costa Rica, Prov. Heredia, P. N. Braulio Carrillo, Est. Magsasay 10.401255 -84.049314, 200 m, January 1991, M. Barrelier. Male: INB0003319795, Costa Rica, Prov. Limon, Valle La Estrella, R. B.Hitoy Cerere, Est. Hitoy Cerere 9.671035 -83.026156, 100 m, November 2001, L. Chavarria. Male: INB0003558871 (Dissected), Costa Rica, Prov. Heredia, Fca. La Selva, Puerto Viejo de Sarapiqui 10.431958 -84.0091, 55 m, 4 August 1981, D.H. Janzen & W. Hallwachs. Male: INB0004268509, Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, September 2009, R. Rojas (Reared). Male: INB0004268510, Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, September 2009, R. Rojas (Reared). Male: INB0004251494 (Dissected), Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, August 2009, R. Rojas (Reared). Male: INB0004251489, Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, July 2009, R. Rojas (Reared). Male: INB0004251485, Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, July 2009, R. Rojas (Reared). Male: INB0004251493, Costa Rica, Prov. Alajuela, San Ramon. Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, August 2009, R. Rojas (Reared). Male: INB0004251492, Costa Rica, Prov. Alajuela, San Ra-

mon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, August 2009, R. Rojas (Reared). Male: INB0004251491, Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, August 2009, R. Rojas (Reared). Male: INB0004251496, Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, August 2009, R. Rojas (Reared). Male: INB0004251495, Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, August 2009, R. Rojas (Reared). Male: INB0004251494 (Dissected), Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, 12 July 2010, M. Gutierrez, R. Rojas (Reared). Male: INB0004301720 (Dissected), Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, August 2009, R. Rojas (Reared). Female: INBIOCRI002112258, Costa Rica, Prov. Alajuela, San Ramon 10.224969 -84.587984, 800 m, September 1994, G. Carballo. Female: INB0004301719 (Dissected), Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, 12 July 2010, M. Gutierrez, R. Rojas (Reared). Female: INB0004268508, Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, September 2009, R. Rojas (Reared). Female: INB0004268511, Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, September 2009, R. Rojas (Reared). Female: INB0004251484 (Dissected), Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, July 2009, R. Rojas (Reared). Female: INB0004251497, Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, August 2009, R. Rojas (Reared). Female: INB0004251486, Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, July 2009, R. Rojas (Reared). Female: INB0004251488, Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, July 2009, R. Rojas (Reared). Female: INB0004251487, Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, July 2009, R. Rojas (Reared). Female: INB0004301721 (Dissected), Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, 14 June 2010, M. Gutierrez (Reared). Female: INB0004301704, Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, 12 July 2010, M. Gutierrez, R. Rojas (Reared). Female: INB0004301705, Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, 12 July 2010, M. Gutierrez, R. Rojas (Reared). Female: INB0004301706, Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, 12 July 2010, M. Gutierrez, R. Rojas (Reared). Female: INB0004301707, Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, 12 July 2010, M. Gutierrez, R. Rojas (Reared). Female: INB0004301708, Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, 12 July 2010, M. Gutierrez, R. Rojas (Reared). Female: INB0004301709, Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, 12 July 2010, M. Gutierrez, R. Rojas (Reared). Female: INB0004301710,

Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, 12 July 2010, M. Gutierrez, R. Rojas (Reared). Female: INB0004301711, Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, 12 July 2010, M. Gutierrez, R. Rojas (Reared). Female: INB0004301712, Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, 12 July 2010, M. Gutierrez, R. Rojas (Reared). Female: INB0004301713, Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, 12 July 2010, M. Gutierrez, R. Rojas (Reared). Female: INB0004301714, Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, 12 July 2010, M. Gutierrez, R. Rojas (Reared). Female: INB0004301715, Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca. 10.201361 -84.485101, 1115 m, 12 July 2010. M. Gutierrez, R. Rojas (Reared). Female: INB0004301716, Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, 12 July 2010, M. Gutierrez, R. Rojas (Reared). Female: INB0004301717, Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, 12 July 2010, M. Gutierrez, R. Rojas (Reared). Female: INB0004301718, Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, 12 July 2010, M. Gutierrez, R. Rojas (Reared).

Etymology. This species is named in honor of Ms. Jessie Barron, great-great-grandmother of Jessie Hill of Philadelphia and Hawaii, and in emphatic recognition of Jessie Hill's contribution to saving and inventorying the conserved ACG rain forest in which *Dunama jessiebarronae* breeds.

Diagnosis. St8 wide, short, anterior margin simple, posterior margin bearing a pair of long, widely separated processes with serrate margins. Phallus thin at the base, wider and sclerotized in the distal part, with a pair of opposite basal projections at the base of the sclerotized portion and a small subterminal projection distally on the left side and a small finger-like terminal projection.

Description. Male (Figs 15, 16, 19–21). ***Head*** – Antenna pectinate in basal 4/5, rami moderately long, black, distal fifth simple, shaft cream with a few reddish-brown scales, scape with scale tuft reddish brown and creamy; haustellum well developed, frons with a mix of creamy and reddish-brown scales; labial palpus upcurved, blackish brown with a few scattered cream-colored scales; ocelli absent; vertex cream, reddish brown laterally; patagium reddish brown near midline, blackish brown laterally, margins cream colored. ***Thorax and abdomen*** – Tegula cream colored at the base, a mix of cream and reddish-brown scales distally, mesoscutum reddish brown anteriorly, cream and reddish brown posteriorly, mesoscutellum mostly creamy white; thoracic pleuron cream colored to reddish brown; legs mostly reddish brown on outer surfaces, cream colored on inner ones. Abdominal dorsum light gray, venter cream colored. ***Wings*** – Forewing dorsal ground color cream at base, 2/3 black brown; a prominent black-brown, slightly oblique bar between base of reniform spot and base of inner margin of forewing in both sexes; veins lined with gray, especially distally; anal fold and cubitus blackish brown; orbicular spot diffuse, blackish brown; reniform spot small, blackish brown; M-line thin, blackish brown, a wide, vaguely-defined beige band beyond

it; AD-line with blackish-brown spots, fringe gray brown. Ventral surfaces of both wings gray brown. Forewing costal margin cream ventrally. Hindwing dorsal dirty gray brown, lighter near base (Figs 15, 16). (WL 13.5–13.7 mm). ***Male genitalia*** (Figs 19–21) – T8 quadrate, posterior margin narrrowly sclerotized; St8 wide, short, anterior end with simple margin, posterior margin bearing a pair of long, widely-separated processes with serrate margins (Fig. 19). Uncus elongated lobule-like and lightly pubescent, socci thin and curved. Valva broad and membranous, with slightly undulating serrate saccular margin, inner surface with a small spine-like process near apex (Fig. 20). Phallus thin at base, widening and sclerotized distally, with a pair of opposite basal projections at base of sclerotized portion, which has a small subterminal projection on left side and a small finger-like terminal projection (Fig. 21). Vesica small. **Female** (Figs 17, 18, 22). Antenna filiform, shaft cream; body color and wing pattern similar to male but wings longer and darker (Figs 17, 18). (WL 16.6–17.2 mm). ***Female genitalia*** (Fig. 22) – Segment 8 forming a heavily sclerotized capsule; anterior apophyses acute; posterior apophyses tiny, CB small and rounded, signum absent; DB short; ostium recessed in St8. Ovipositor lobes acute and setose.

Natural history (Figs 65–70). 489 rearing records, all from intermediate elevation rain forest in ACG.

Food plants: Heliconiaceae: *Heliconia irrasa* R.R Sm. (n=169). *Heliconia latispatha* Benth. (n=126), *Heliconia pogonantha* Cufod. (n=9); Musaceae; *Musa acuminata* Colla (introduced) (n=185). All other *Dunama* spp. food plant records are from Arecaceae, and there are no *Dunama jessiebarronae* reared from Arecaceae.

Parasitoids. Tachinidae: out of 489 rearing records of wild-caught caterpillars, 10 records generated *Lespesia* Wood33DHJ06, DHJPAR0015889, DHJPAR0015890, DHJPAR0015880, DHJPAR0015878, DHJPAR0015903, DHJPAR0008353, DHJPAR0015879, DHJPAR0015875, DHJPAR0015876, DHJPAR0015882. This fly parasitizes only Notodontidae feeding on Heliconiaceae and Musaceae, and also parasitizes three other species of *Dunama* feeding on Arecaceae, as well as *Dottia* and *Heorta* feeding on the same family. A single record (DHJPAR0016614) of *Lespesia* Wood03bDHJ05 parasitizing *Dunama jessibaronae* is not surprising, given that this fly parasitzes five caterpillar families feeding on a large variety of plant species and families, and as such is quite "generalist."

Distribution. *Dunama jessiebarronae* has been collected on the east slope of Cordillera Volcanica de Guanacaste, Cordillera Volcanica Central, Cordillera de Talamanca, llanuras de Sarapiqui, and the lowlands of the Caribbean, from 50 to 1115 m elevation (Fig. 85).

Remarks. Adults of *Dunama jessiebarronae* have almost the exact maculation pattern of *Dunama tuna* (Schaus), but the latter moth is larger. In addition, there are two lateral prongs at the base of the posterior projection of the sternum. Todd (1976) made *D. sagittula* (Dognin, 1914), a Colombian species, a synonym of *D. tuna*, whose type locality is also in Colombia. Although he did not dissect the type of *D. tuna*, we did, and it agrees with that of *D. sagittula*. Todd also reported a male specimen from Porto Bello, Panama and from Sixaola River, Costa Rica. These two Central American specimens are smaller than are those from Colombia, and they also have lateral prongs

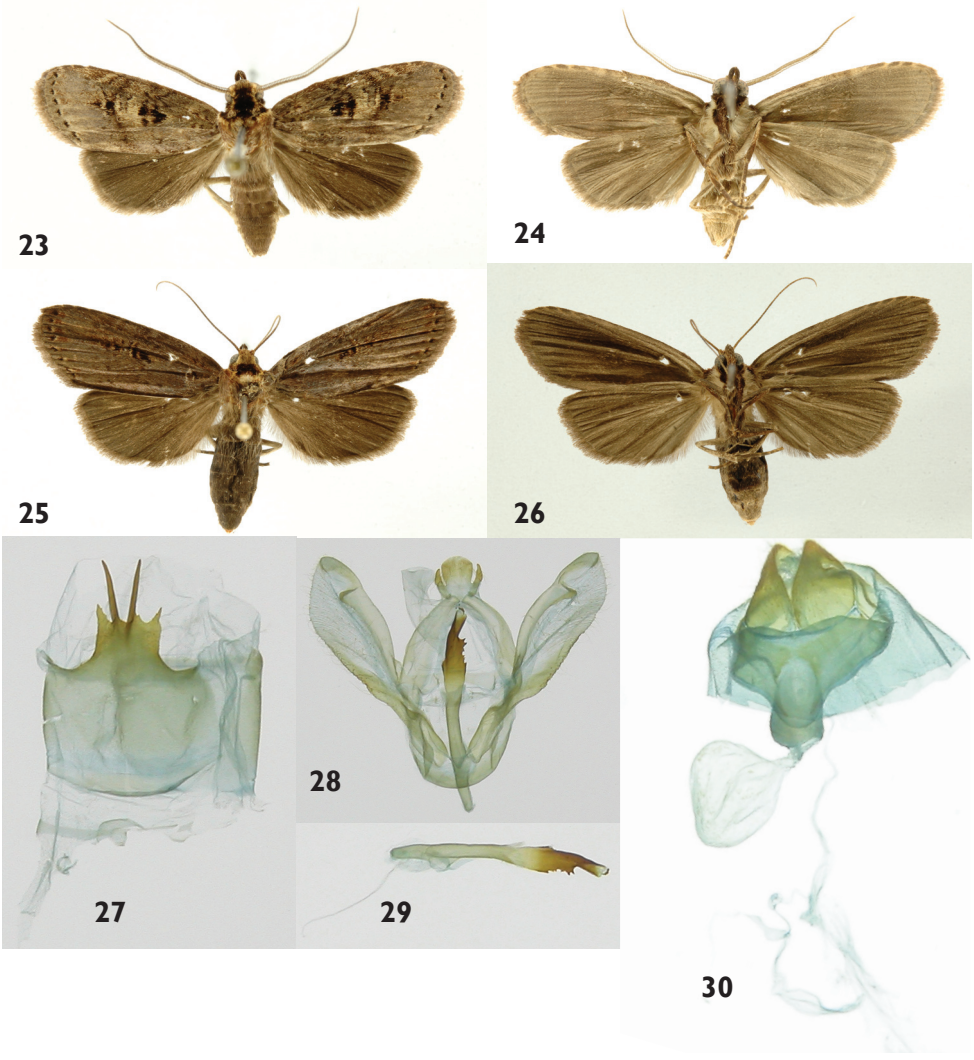
on the sternum, which are absent in all Costa Rican specimens of *D. jessiebarronae* we have examined, including 2 males from Hitoy Cerere, Limon Province, which is located not far from Sixaola River. Because we were unable to find any recent specimens with lateral prongs on the tergum, and because barcoding has shown few species in common between Costa Rica and northern South America (unpublished), we have chosen to treat the Costa Rican populations as a new species, *D. jessiebarronae*. The specimens from Sixaola River and Panama cited by Todd are believed to be *D. jessiebarronae*. Changes in the form of the sternum along the Atlantic Coast are also seen in the closely related species *D. jessiehillae* and *D. angulinea*, albiet it is the reverse change. Future examination and barcoding of specimens collected in Panama and northern Colombia should resolve this issue.

***Dunama janewaldronae* Chacón, sp. n.**
urn:lsid:zoobank.org:act:6A297DF2-4FB7-4D49-AD12-6759563E8240
http://species-id.net/wiki/Dunama_janewaldronae
Figs 23–30, 75–78

Type material. Holotype male: 08-SRNP-430 (Dissected, COI Barcoded), Costa Rica, Alajuela, Sector San Cristobal, Suampo Uncaria 10.93597 -85.37135, 506 m, 16 February 2008, Gloria Sihezar. **Paratypes** (all reared from wild-caught caterpillars): (2♂ 2♀). Male: 08-SRNP-382 (COI Barcoded), Costa Rica, Prov. Alajuela, Sector San Cristobal, Suampo Uncaria 10.93597 -85.37135, 506 m, 16 February 2008, Gloria Sihezar. Male: 08-SRNP-433 (Dissected, COI Barcoded), Costa Rica, Prov. Alajuela, Sector San Cristobal, Suampo Uncaria 10.93597 -85.37135, 506 m, 16 February 2008, Gloria Sihezar. Female: 08-SRNP-407 (COI Barcoded), Costa Rica, Prov. Alajuela, Sector San Cristobal, Suampo Uncaria 10.93597 -85.37135, 506 m, 16 February 2008, Gloria Sihezar. Female: 00-SRNP-21518 (Dissected, COI Barcoded), Costa Rica, Prov. Alajuela, Sector San Cristobal, Rio Blanco Abajo 10.90037 -85.37254, 500 m, 5 November 2000, Freddy Quesada.

Other material examined. Barcoded: 78 specimens, which divided into four haplotypes with differences from the most common haplotype (44 specimens) of 0.25% or less, except for the specimens from Limon that were idéntical, or about 0.6% different. Barcoded specimens were from Alajuela and Limon Provinces (Fig. 86). Museum specimens: (18): 2♂ 1♀ Guanacaste, 4♂ 6♀ Alajuela, 1♂ Heredia, 4♂ Limon. Dissections: 2♂ 1♀ Guanacaste, 1♂ 1♀ Alajuela, 1♂ Heredia, 1♂ Limon.

Janzen & Hallwachs voucher specimens: Male: 08-SRNP-390 (COI Barcoded), Costa Rica, Prov. Alajuela, Sector San Cristobal, Suampo Uncaria 10.93597 -85.37135, 506 m, 16 February 2008, Gloria Sihezar. Male: 00-SRNP-21521, Costa Rica, Prov. Alajuela, Sector San Cristobal, Rio Blanco Abajo 10.90037 -85.37254, 500 m, 23 October 2000, Freddy Quesada. Female: 08-SRNP-399 (Dissected, COI Barcoded), Costa Rica, Prov. Alajuela, Sector San Cristobal, Suampo Uncaria 10.93597 -85.37135, 506 m, 15 February 2008, Gloria Sihezar. Female: 08-SRNP-419 (COI



Figures 23–30. *Dunama janewaldronae* **23, 24** Male dorsal and ventral 08-SRNP-430 **25, 26** Female dorsal and ventral 00-SRNP-21518 **27** Male St8 **28** Male genitalia 08-SRNP-430 **29** Phallus **30** Female genitalia 00-SRNP-21518.

Barcoded), Costa Rica, Prov. Alajuela, Sector San Cristobal, Suampo Uncaria 10.93597 -85.37135, 506 m, 15 February 2008, Gloria Sihezar. Female: 08-SRNP-423 (COI Barcoded), Costa Rica, Prov. Alajuela, Sector San Cristobal, Suampo Uncaria 10.93597 -85.37135, 506 m, 16 February 2008, Gloria Sihezar.

INBio specimens: Male: INBIOCRI001288520 (Dissected, COI Barcoded), Costa Rica, Prov. Guanacaste, P. N. Guanacaste, 9 Km S Santa Cecilia, Est. Pitilla 10.992609 -85.429477, 700 m, 30 January 1993, P. Rios. Female: INBIOCRI002583021, Costa Rica, Prov. Alajuela, Santa Cecilia, 8 Km S. Estacion Pitilla 10.990808 -85427641, 680 m, February 1988, A. Chacon & M. Espinoza.

Etymology. This species is named in honor of Ms. Jane Waldron, great-grandmother of Jessie Hill of Philadelphia and Hawaii, and in emphatic recognition of Jessie Hill's contribution to saving and inventorying the conserved ACG rain forest in which *Dunama janewaldronae* breeds.

Diagnosis. St8 wide, short, anterior margin simple, posterior margin bearing a pair of small, widely separated processes with serrate margins, a second, long pair of processes arising between arms of first pair. Phallus thin in the base, wider and sclerotized in distal part, ventral margin of distal part with six teeth and dorsal margin with two small teeth.

Description. Male (Figs 23, 24, 27–29). ***Head*** – Antenna pectinate in basal 4/5, rami moderately long reddish brown, distal fifth simple, shaft with a mix of reddish-brown and gray brown scales, scape with scale tuft blackish brown at base and cream to tip; frons with a mix of cream and blackish-brown scales; labial palpus upcurved blackish brown with a few scattered cream-colored scales; ocelli absent; vertex blackish brown, cream colored laterally; patagium blackish brown near midline, blackish brown laterally, margins cream colored. ***Thorax and abdomen*** – Tegula cream colored at base, a mix of cream and blackish-brown scales distally; mesoscutum blackish brown anteriorly, cream and reddish brown posteriorly; mesoscutellum mostly creamy white; thoracic pleuron cream colored to blackish brown; legs mostly blackish brown on outer surfaces, cream colored on inner surfaces. Abdominal dorsum light gray, venter cream colored. ***Wings*** – Dorsal ground color a mixture of gray-brown and beige scales; veins lined with gray, especially distally; anal fold and cubitus blackish brown; orbicular spot diffuse blackish brown; reniform spot small, blackish brown; M-line thin, blackish brown, a wide, vaguely-defined beige band beyond it; PM-line thin, blackish brown, poorly defined; AD-line with blackish-brown spots, fringe gray brown. Ventral surfaces of both wings gray brown. Dorsal hindwing dirty gray brown, lighter near base (Figs 23, 24). (WL 12.5–13.4 mm). ***Male genitalia*** (Figs 27–29) – St8 wide, short, anterior margin simple, posterior margin bearing a pair of small, widely separated processes with serrate margins; a second, long pair of processes arising between arms of first pair (Fig. 27). Uncus lobule-like and lightly pubescent, socci thin and lightly curved. Valva broad and membranous, with serrate saccular margin, inner surface with a hook-like process near apex (Fig. 28). Phallus thin at base, wider and sclerotized distally, ventral margin of distal part with six teeth and dorsal margin with two small teeth. Vesica tiny, bearing a minute cornutus (Fig. 29). **Female** (Figs 25, 26, 30). Antenna filiform, shaft gray brown; body color and wing pattern similar to male but wings longer and darker (Figs 25, 26). (WL 16.5–16.8 mm). ***Female genitalia*** (Fig. 30) – Segment 8 forming a heavily sclerotized capsule; anterior apophyses acute; posterior apophyses tiny, CB small and rounded, signum absent; DB short; ostium recessed in St8. Ovipositor lobes triangulate and setose.

Natural history (Figs 75, 76, 77, 78). 201 records reared from Sector Pitilla (n=13), Rincon Rain Forest (n=57), and San Cristobal (n=131), all rain forest sites.

Food plants: Arecaceae: *Chamaedorea dammeriana* Burret (n=42), *Geonoma congesta* (n=22), *Geonoma cuneata* (n=114), *Prestoea decurrens* (n=13), *Welfia regia* (n=10).

Parasitoids: **Braconidae**: Macrocentrinae, *Austrozele* Janzen03 (n=5), shared with *Dunama jessiebarronae*. **Tachinidae**: *Lespesia* Wood33DHJ06 (n=7), shared with *Dunama jessiebarronae*, and *Jurinella* Wood06 (n=1). The latter species parasitizes only Notodontidae and Hesperiidae feeding on rain forest Arecaceae.

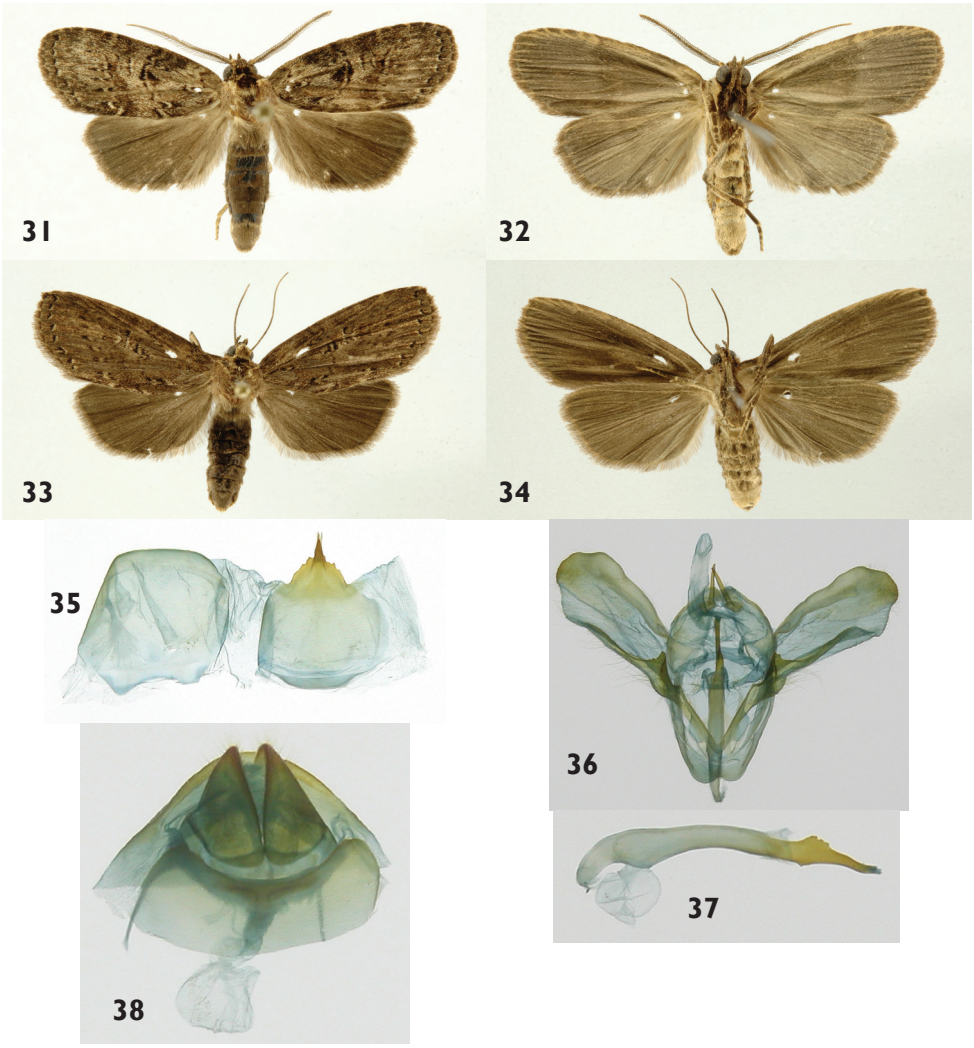
Distribution. *Dunama janewaldronae* has been reared from intermediate elevations of the eastern side of the Cordillera Volcanica de Guanacaste from 400 to 680 m elevation (Fig. 85).

Remarks. This species shows identical genitalia and very similar barcodes throughout Costa Rica (Fig. 86). Specimens from the Caribbean side of Costa Rica have the most divergent barcodes, but are still within the range of variation seen for most species. Nearest neighbor analyses pair *D. janewaldronae* with *D. angulinea* and they differ mostly in being slightly different in size. They share several species of understory Arecaceae as caterpillar food plants.

***Dunama jessiebancroftae* Chacón, sp. n.**
urn:lsid:zoobank.org:act:954407D9-FA83-44B5-9BEA-EEE1612AA585
http://species-id.net/wiki/Dunama_jessiebancroftae
Figs 31–38, 82–84

Type material. Holotype male: 09-SRNP-56330 (Dissected, COI Barcoded), Costa Rica, Prov. Guanacaste, Sector Pailas, Gemelos 10.76928 -85.34662, 1276 m, 18 June 2009, Daniel M. Acuna (INBio). **Paratypes**: 2♂ 2♀. Male: 06-SRNP-36778 (COI Barcoded), Costa Rica, Prov. Guanacaste, Sector Cacao, Sendero Abajo 10.92547 -85.47158, 1020 m, 12 December 2006, Harry Ramirez. Male: 08-SRNP-57204, Costa Rica, Prov. Guanacaste, Sector Mundo Nuevo, Vado Chamaedorea 10.77638 -85.40024, 570 m, 16 August 2008, Mariano Pereira. Female: 06-SRNP-47624 (COI Barcoded), Costa Rica, Prov. Guanacaste, Sector Cacao, Puente Gongora 10.88489 -85.47203, 540 m, 10 September 2006, Dunia Garcia. Female: 06-SRNP-36773 (Dissected, COI Barcoded), Costa Rica, Prov. Guanacaste, Sector Cacao, Sendero Abajo 10.92547 -85.47158, 1020 m, 12 October 2006, Harry Ramirez. Female: 08-SRNP-57269 (COI Barcoded), Costa Rica, Prov. Guanacaste, Sector Mundo Nuevo, Vado Chamaedorea 10.77638 -85.40024, 570 m, 15 August 2008, Jose Cortez.

Other material examined. Barcoded: 75 specimens from Guanacaste and Puntarenas Provinces that divide into 3 principal haplotypes (excluding 2 partial sequences), which differed from each other by less than 0.25%. One haplotype predominated (66 specimens). Museum specimens: 6 specimens: 3♂ 2♀ Guanacaste, 1♂ Puntarenas. Dissections: 2♂ 1♀ Guanacaste, 1♂ Puntarenas. **Janzen & Hallwachs voucher specimens**: Male: 08-SRNP-57752 (Dissected, COI Barcoded), Costa Rica, Prov. Guanacaste, Sector Mundo Nuevo, Vado Chepon 10.77816 -85.41629, 440 m, 10 October 2008, Jose Cortez. Male: 06-SRNP-47625 (COI Barcoded), Costa Rica, Prov. Guanacaste, Sector Cacao, Puente Gongora 10.88489 -85.47203, 540 m, 10 September 2006, Dunia Garcia. Female: 08-SRNP-57739 (Dissected, COI Barco-



Figures 31–38. *Dunama jessiebancroftae* **31, 32** Male dorsal and ventral 09-SRNP-56330 **33, 34** female dorsal and ventral 06-SRNP-36773 **35** Male St8 **36** Male genitalia 09-SRNP-56330 **37** Phallus **38** Female genitalia 06-SRNP-36773.

ded), Costa Rica, Prov. Guanacaste, Sector Mundo Nuevo, Vado Chepon 10.77816 -85.41629, 440 m, 8 October 2008, Jose Cortez. Female: 09-SRNP-56324 (COI Barcoded), Costa Rica, Prov. Guanacaste, Sector Pailas, Gemelos 10.76928 -85.34662, 1276 m, 17 July 2009, Daniel M. Acuña. **INBio specimens**: Male: INB0003435267 (Dissected, COI Barcoded), Costa Rica, Prov. Guanacaste, Z.P. Nosara, Cerro Romo 10.002648 -85.404627, 885 m, 10–15 February 2002, H. Mendez. Male: INBIOCRI0020454417 (Dissected, COI Barcoded), Costa Rica, Prov. Puntarenas, R.B. Carara, Quebrada Bonita 9.774233 -84.608124, 50 m, October 1994, J.C. Saborio.

Etymology. This species is named in honor of Ms. Jessie Bancroft, grandmother of Jessie Hill of Philadelphia and Hawaii, and in emphatic recognition of Jessie Hill's contribution to saving and inventorying the conserved ACG rain forest in which *Dunama jessiebancroftae* breeds.

Diagnosis. St8 wide and short, anterior margin simple, posterior margin bearing a simple acute and triangulate process. Phallus narrow at base, expanding medially, heavily sclerotized at distal third, with dorsal margin serrate, narrowing to tip.

Description. Male (Figs 31, 32, 35–37). ***Head*** – Antenna pectinate in basal 4/5, rami moderately long reddish brown, distal fifth simple, shaft gray brown with reddish-brown scales at base, scape with scale tuft gray brown and cream; frons with a mix cream and gray-brown scales; labial palpus upcurved blackish brown with a few scattered cream-colored scales; ocelli absent; vertex gray brown, cream colored laterally; patagium blackish brown with margins cream colored. ***Thorax and abdomen*** – Tegula cream colored at base, a mix of cream and gray-brown scales distally; mesoscutum blackish brown anteriorly, cream and blackish brown posteriorly; mesoscutellum mostly creamy white; thoracic pleuron cream colored to blackish brown; legs mostly reddish brown on outer surfaces, cream colored on inner surfaces. Abdominal dorsum light gray, venter cream colored. ***Wings*** – Dorsal ground color with a mixture of gray-brown, blackish-brown and beige scales; veins lined with gray, especially distally; anal fold and cubitus blackish brown; orbicular spot diffuse blackish brown; reniform spot small, blackish brown; M-line thin, wavy, blackish brown, a wide, vaguely-defined beige band beyond it; PM-line thin, blackish brown, poorly defined; AD-terminal line with blackish-brown spots, fringe gray brown. Ventral surfaces of both wings gray brown. Dorsal hindwing dirty gray brown, lighter near base (Figs 31, 32). ***Male genitalia*** – (Figs 35–37) St8 wide and short, anterior margin simple, posterior margin bearing a simple acute and triangulate process (Fig. 35). Uncus small with a hollow depression in middle, socci thin, long and acute. Valva wide and membranous with saccular margin serrate, heavily sclerotized at base (Fig. 36). Phallus narrow at base, expanding medially, heavily sclerotized at distal third, with dorsal margin serrate, narrowing to tip. Vesica tiny (Fig. 37). **Female** (Figs 33, 34, 38). Antenna filiform, shaft gray brown with a mix of reddish-brown scales; Body color and wing pattern similar to male but wings longer and darker (Figs 33, 34). (WL 16.4–17.0 mm). ***Female genitalia*** (Fig. 38) – Segment 8 forming a heavily sclerotized capsule; anterior apophyses thin and acute; posterior apophyses thin, CB small and round, signum absent; DB short; ostium recessed in St8. Ovipositor lobes acute and setose.

Natural history (Figs 82, 83, 84). 318 caterpillars reared from the western lower and intermediate elevations of the Cordillera Volcanica de Guanacaste (220–1276 m elevation), and the only ACG species of *Dunama* that even marginally occurs in the edge of ACG dry forest. Sector Cacao (n=122), Del Oro (n=8), El Hacha (n=2), Mundo Nuevo (n=169), Pailas (n=16).

Food plants: Arecaceae: *Bactris major* Jacq. (n=2), *Chamaedorea costaricana* Oerst. (n=307), *Geonoma cuneata* (n=8).

Parasitoids. Braconidae: Macrocentrinae? *Austrozele*? (n=1); Meteorinae, *Meteorus* Zitani01DHJ05 (n=1). **Tachinidae**: *Lespesia* Wood33DHJ06 (n=6), a species of tachinid parasitoid that it shares with two other species of *Dunama.*

Distribution and habitat. In addition to the rearing records from ACG, *Dunama jessiebancroftae* has been collected in the Peninsula de Nicoya, and the lowland of Central Pacific Costa Rica, from 50 to 1286 m elevation (Fig. 85); all of these extra-ACG sites are also intergrades between rain forest and dry forest, at least before they were largely deforested.

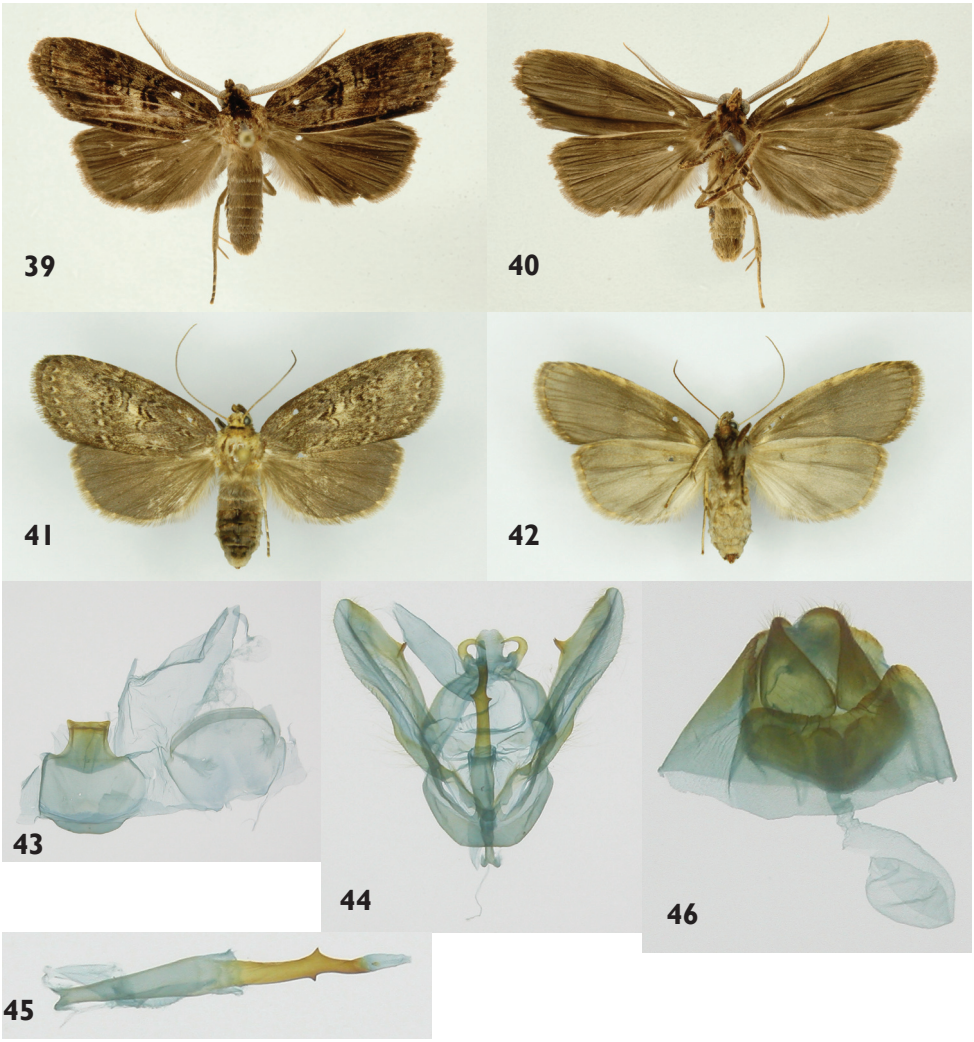
Remarks. This species is homogeneous over its limited range. Nearest neighbor analyses (Fig. 86) suggest that it is the most different from all other *Dunama* in Costa Rica, which suggests the highly unlikely scenario that it was orginally a species of the intergrade of dry forest with rain forest, and then evolutionarily spread into rain forest ecosystems.

Dunama janecoxae Chacón, sp. n.

urn:lsid:zoobank.org:act:8A6B7BD5-50DD-4231-9B79-AECE8B977669
http://species-id.net/wiki/Dunama_janecoxae
Figs 39–46, 71–73

Type material. Holotype male: 05-SRNP-36040 (Dissected, COI Barcoded), Costa Rica, Prov. Guanacaste, Sector Cacao, Sendero Toma Agua 10.92847 -85.46680, 1140 m, 12 June 2005, Manuel Pereira (INBio). **Paratypes**: 6♂ 3♀. Male: 03-SRNP-3122 (Dissected), Costa Rica, Prov. Guanacaste, Sector Cacao, Sendero Circular, 10.92714 -85.46683, 1185 m, 20 February 2003, Freddy Quesada. Male: 03-SRNP-3121, Costa Rica, Prov. Guanacaste, Sector Cacao, Sendero Circular, 10.92714 -85.46683, 1185 m, 20 March 2003, Freddy Quesada. Female: 05-SRNP-36044 (Dissected, COI Barcoded), Costa Rica, Prov. Guanacaste, Sector Cacao, Sendero Toma Agua 10.92847 -85.46680, 1140 m, 12 March 2005, Manuel Pereira. Female: 03-SRNP-3125, Costa Rica, Prov. Guanacaste, Sector Cacao, Sendero Circular 10.92714 -85.46683, 1185 m, 19 February 2003, Freddy Quesada. Female: 03-SRNP-3223 (Dissected, COI Barcoded), Costa Rica, Prov. Guanacaste, Sector Cacao, Sendero Circular 10.92714 -85.46683, 1185 m, 21 February 2003, Freddy Quesada.

Other material examined: Barcoded: 22 specimens that segregated into four haplotypes with differences from the most common haplotype from Alajuela (14 specimens) of 0.1% for a single haplotype from Alajuela, 1.1% for four specimens from Puntarenas, and 1.4% for three specimens from Cartago. The Cartago and Puntarenas specimens differed by 0.6%. Musem specimens: (14 specimens) 2♂ 1♀ Alajuela, 8♂ Cartago, 2♂ Puntarenas. Dissections: 1♂ Alajuela, 2♂ 1♀ Guanacaste, 3♂ 1♀ Cartago, 2♂ Puntarenas. **INBio specimens**: Male: INB0004298089 (COI Barcoded), Costa Rica, Prov. Puntarenas, Altamira, Cerro Biolley 9.039314 -83.009966, 1700–1800 m, 10 August 2004, R. Delgado. Male: INB0004298088 (COI Barcoded), Costa Rica, Prov. Puntarenas, Altamira, Cerro Biolley 9.039314 -83.009966, 1700–1800 m, 10 August 2004, R. Delgado. Male:



Figures 39–46. *Dunama janecoxae* **39, 40** Male dorsal and ventral 03-SRNP-36040 **41, 42** Female dorsal and ventral 03-SRNP-3223 **43** Male St8 **44** Male genitalia 03-SRNP-36040 **45** Phallus **46** Female genitalia 03-SRNP-3223.

INB0004298087 (COI Barcoded), Costa Rica, Prov. Puntarenas, Altamira, Cerro Biolley 9.039314 -83.009966, 1700–1800 m, 10 August 2004, R. Delgado. Male: INB0004298086 (COI Barcoded), Costa Rica, Prov. Puntarenas, Altamira, Cerro Biolley 9.039314 -83.009966, 1700–1800 m, 10 August 2004, R. Delgado. Male INB0004298089 (COI Barcoded), Costa Rica, Prov. Puntarenas, Altamira, Cerro Biolley 9.039314 -83.009966, 1700–1800 m, 10 August 2004, R. Delgado. Male: INB0004298088 (COI Barcoded), Costa Rica, Prov. Puntarenas, Altamira, Cerro Biolley 9.039314 -83.009966, 1700–1800 m, 10 August 2004, R. Delgado. Male: INB0004298087 (COI Barcoded), Costa Rica, Prov. Puntarenas, Altamira, Cerro

Biolley 9.039314 -83.009966, 1700–1800 m, 10 August 2004, R. Delgado. Male: INB0004298086 (COI Barcoded), Costa Rica, Prov. Puntarenas, Altamira, Cerro Biolley 9.039314 -83.009966, 1700–1800 m, 10 August 2004, R. Delgado. Male: INBIOCRI002010968 (Dissected, COI Barcoded), Costa Rica, Prov. Puntarenas, Est. La Casona, Monteverde 10.298429 -84.792544, 1520 m, 30 January–18 February 1995, K. Martinez, Male: INB0003058436 (Dissected, COI Barcoded), Costa Rica, Prov. Cartago, A.C.L.A.P, Paraiso, Pque Nal Tapanti, Sect La Represa, del Puente del Rio Porras 300 m S. 9.695214 -83.781156, 1660 m, February 2000, L. Chavarria.

Etymology. This species is named in honor of Ms. Jane Cox, mother of Jessie Hill of Philadelphia and Hawaii, and in emphatic recognition of Jessie Hill's contribution to saving and inventorying the conserved ACG rain forest in which *Dunama janecoxae* breeds.

Diagnosis. St8 wide, short, anterior margin simple, posterior margin densely sclerotized with a rectangular shape lacking any processes; phallus simple, thin at base, heavily sclerotized distally part, with a pair of small triangular projections subopposite on each margin. The medial projection from the costa of the male genitalia is unique among species of *Dunama*.

Description. Male (Figs 39, 40, 43–45). ***Head*** – Antenna pectinate in basal 4/5, rami moderately long, reddish brown, distal fifth of shaft simple, gray brown with a mix reddish-brown scales, scape with scale tuft cream; frons with cream scales mixed with blackish-brown scales; labial palpus upcurved, blackish brown with a few scattered cream-colored scales; ocelli absent; vertex blackish brown, cream colored laterally; patagium blackish brown near midline, blackish brown laterally, margins cream colored. ***Thorax and abdomen*** – Tegula cream colored at base, a mix of cream and blackish-brown scales distally; mesoscutum blackish brown anteriorly, cream and blackish brown posteriorly; mesoscutellum mostly creamy white; thoracic pleuron cream colored; legs mostly blackish brown on outer surfaces, cream colored on inner surfaces. Abdominal dorsum light gray, venter cream colored. ***Wings*** – Dorsal ground color a mixture of gray-brown and beige scales; veins lined with gray, especially distally; anal fold and cubitus blackish brown; orbicular spot diffuse blackish brown; reniform spot small, blackish brown; M-line blackish brown, a wide, vaguely-defined beige band beyond it; PM-line thin, blackish brown, poorly defined; subterminal (St) line marks light brown, AD-line with spots ligth brown, fringe gray brown. Dorsal hindwing dirty gray brown, lighter near base. Ventral surfaces of both wings gray brown (Figs 39, 40). (WL 16.1–17.4 mm). ***Male genitalia*** (Figs 43–45) – St8 wide, short, anterior margin simple, posterior margin densely sclerotized with a rectangular shape lacking any process (Fig. 43). Uncus lobule-like with pubescent, thin socii prominently hooked. Valvae with smooth costal margin with a sclerotized, spine-like process near middle. Saccular margin slightly sclerotized at base with a notch in middle (Fig. 44). Phallus thin at base, expanding medially and heavily sclerotized distally, with a pair of small triangular projections, subopposite on each margin; vessica small and without cornuti (Fig. 45). **Female** (Figs 41, 42, 46) – Antenna filiform, shaft cream with a mix of reddish-

brown scales; body color and wing pattern similar to male but wings longer (Figs 41, 42). (FW 18.3–18.7 mm). ***Female genitalia*** (Fig. 46) – Segment 8 forming a heavily sclerotized capsule; anterior apophyses acute; posterior apophyses tiny, CB small and rounded, signum absent; DB short; ostium recessed in St8. Ovipositor lobes acute and setose.

Natural history (Figs 71, 72, 73). 61 rearing records from ACG. Sector Cacao (n=35) only. Food plants: Arecaceae*, Chamaedorea costaricana* (n=35) only. *Geonoma* sp. (Arecaceae). Four males RDR00153 reared by Roberto Delgado, Cerro Biolley, Puntarenas Province. Elevational distribution 1090–1185 m.

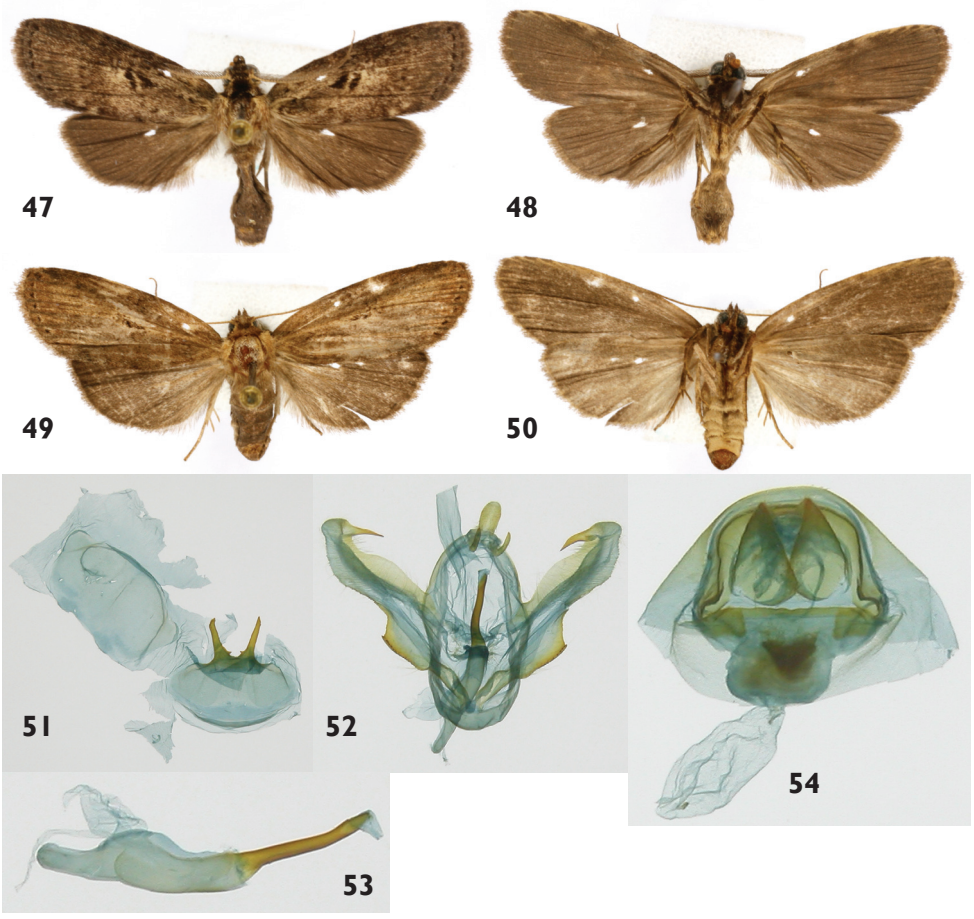
Parasitoids. Braconidae: Microgastrinae, *Parapanteles paradoxus*DHJ03 (n=10), shared with three species of *Tithraustes* Druce (n=4) (Notodontidae: Dioptinae) feeding on the same Arecaceae in the same habitats.

Distribution. *Dunama janecoxae* is the upper elevational species of *Dunama* on the Cordillera Volcanica de Guanacaste, and the eastern slope of Cordillera de Tilaran and Talamanca, occurring from 1090 to 1185 m elevation (Fig. 85).

Remarks. *Dunama janecoxae* seems to offer the classic conundrum of isolated populations in the upper elevations of isolated mountains. Each population has a unique and slightly different barcode (Fig. 86), but the genitalia differ only slightly among populations and far less than that displayed among most other species of *Dunama* in Costa Rica. In as much as we have life history data for only the ACG population, we elect to leave these mountaintop populations as one species, even though their morphological and barcode differences are of the same degree as other ACG sympatric/parapatric pairs of species with distinct but similar barcodes (e.g., Janzen et al. 2005; *Neoxeniades luda* (Hewitson) and *N. pluviasilva* Burns (Burns et al. 2007); four sympatric/parapatric species of *Perichares* Scudder (Burns et al. 2008)). Additional material will be needed to determine the extent of separation of these different montane populations.

Dunama biosise **Chacón, sp. n.**
urn:lsid:zoobank.org:act:3EACC77B-1111-45B5-A55D-A66FB60B054A
http://species-id.net/wiki/Dunama_biosise
Figs 47–54

Type material. Holotype male: INB0003558870 (Dissected), Costa Rica, Prov. Puntarenas, Sirena, Corcovado Nat. Pk., Osa Penin 8.479267 -83.588565, 0–100 m, 19–27 March 1981, D.H. Janzen & W. Hallwachs (INBio). **Paratypes**: 3♂ 1♀. Male: INBIOCRI000494661 (COI Barcoded), Costa Rica, Prov. Puntarenas, P. N. Corcovado, Est. Sirena 8.479267 -83.588565, 0–100 m, December 1991, G. Fonseca. Male: INBIOCRI000674591, Costa Rica, Prov. Puntarenas, P. N. Corcovado, Est. Sirena 8.479267 -83.588565, 0–100 m, March 1991, G. Fonseca. Male: INBIOCRI002583632, Costa Rica, Prov. Puntarenas, Sirena, Corcovado Nat. Pk., Osa Penin. 8.479267 -83.588565, 0–100 m, 10–12 August 1980, D.H. Janzen & W. Hallwachs. Female: INBIOCRI002527271 (Dissected), Costa Rica, Prov. Puntarenas, Si-



Figures 47–54. *Dunama biosis*e **47, 48** Male dorsal and ventral INB0003558870 **49, 50** Female dorsal and ventral INBIOCRI002527271 **51** Male St8 **52** Male genitalia INB0003558870 **53** Phallus **54** Female genitalia INBIOCRI002527271.

rena, Corcovado Nat. Pk., Osa Penin. 8.479267 -83.588565, 0–100 m, 15–25 March 1981, D.H. Janzen & W. Hallwachs.

Other material examined. Museum specimens: 4♂ Puntarenas, Dissections: 2♂ 1♀ Puntarenas. **INBio specimens**: Male: INBIOCRI002583652, Costa Rica, Prov. Puntarenas, Sirena, Corcovado Nat. Pk., Osa Penin. 8.479267 -83.588565, 0–100 m, 15–16 August 1980, D.H. Janzen & W. Hallwachs. Male: INBIOCRI002582980 (Dissected), Costa Rica, Prov. Puntarenas, Sirena, Corcovado Nat. Pk., Osa Penin. 8.479267 -83.588565, 0-100 m, 19-27 March 1981, D.H. Janzen & W. Hallwachs. Male: INBIOCRI002582985, Costa Rica, Prov. Puntarenas, Sirena, Corcovado Nat. Pk., Osa Penin. 8.479267 -83.588565, 0–100 m, 19–27 March 1981, D.H. Janzen & W. Hallwachs. Male: INBIOCRI002582981, Costa Rica, Prov. Puntarenas, Sirena, Corcovado Nat. Pk., Osa Penin. 8.479267 -83.588565, 0–100 m, 19–27 March 1981, D.H. Janzen & W. Hallwachs.

Etymology. *Dunama biosise* is named in honor of BIOSIS, the non-profit publishing company, the sale of which generated the JRS Biodiversity Foundation (http://www.jrsbdf.org), which in turn supports biodiversity information management for conservation in many places, including INBio and ACG.

Diagnosis. St8 wide, short, anterior margin simple, posterior margin sclerotized with a pair of forceps-like processes, a small and sclerotized triangular projection at the base of each process. Phallus with subbasal, unsclerotized expansion, distal half narrow and sclerotized.

Description. Male (Figs 47, 48, 51–53). ***Head*** – Antenna pectinate in basal 4/5, rami moderately long, reddish brown, distal fifth simple, shaft cream colored, scape with scale tuft reddish brown and cream colored; frons with cream scales mixed with reddish-brown scales; labial palpus upcurved reddish brown with a few scattered cream-colored scales; ocelli absent; vertex reddish brown, cream colored laterally; patagium blackish brown near the midline, blackish brown laterally, margins cream colored. ***Thorax and abdomen*** – Tegula cream colored at base, a mix of cream and reddish-brown scales distally; mesoscutum blackish brown anteriorly, cream and blackish brown posteriorly; mesoscutellum mostly creamy white; thoracic pleuron cream colored; legs mostly blackish brown on outer surfaces, cream-colored on inner surfaces. Abdominal dorsum light gray, venter cream colored. ***Wings*** – Dorsal ground color a mixture of gray-brown and beige scales; veins lined with gray, especially distally; anal fold and cubitus ligth brown; orbicular spot diffuse blackish brown; M-line diffuse blackish brown; AD-line with ligth brown spots, fringe gray brown. Dorsal hindwing dirty gray brown, lighter near base. Ventral surfaces of both wings gray brown (Figs 47, 48). (WL 11.7–12.8). ***Male genitalia*** – (Figs 51–53). Tg8 oval, posterior margin narrroly sclerotized; St8 wide, short, anterior margin simple, posterior margin sclerotized with a pair of forceps-like processes, a small and sclerotized triangular projection at base of each process (Fig. 51). Uncus lobule-like and elongate with thin, pubescent socci, up-curved. Valva with costal margin smooth, bearing an apical spine-like projection, long and sclerotized; saccular margin serrate and heavily sclerotized at base, with laminate-like structure (Fig. 52). Phallus with subbasal unsclerotized expansion, distal half narrow and sclerotized. Vesica small, without cornuti (Fig. 53). **Female** (Figs 49, 50, 54). Antenna filiform, shaft cream colored; body color and wing pattern similar to male but wings longer (Figs 49, 50). (WL 13.9 mm). ***Female genitalia*** – (Fig. 54) segment 8 forming a heavily sclerotized capsule; anterior apophyses acute; posterior apophyses tiny, CB small and round, signum absent; DB short; ostium recessed in St8. Ovipositor lobes acute and slightly pubescent.

Natural history. Unknown, except that it is a moth of Costa Rica's lowland Pacific coast rain forest and both sexes can be captured at light at night.

Distribution. *Dunama biosise* has been collected from 0 to 100 m elevation in the Osa Peninsula, Area de Conservacion Osa (Fig. 85).

Remarks. The single sample submitted for barcode analysis produced only a 349 base pair DNA barcode instead of the hoped-for 658 base pairs (Fig. 86). However, its barcode differences, and its distinctive genitalia, as well as the ecosystem it occupies, all indicate that it is a species distinct from the other known Costa Rican *Dunama*.

Dunama indereci **Chacón, sp. n.**
urn:lsid:zoobank.org:act:B5159750-A549-4F2F-932C-521D9FD1FC12
http://species-id.net/wiki/Dunama_indereci
Figs 55–62, 63–64

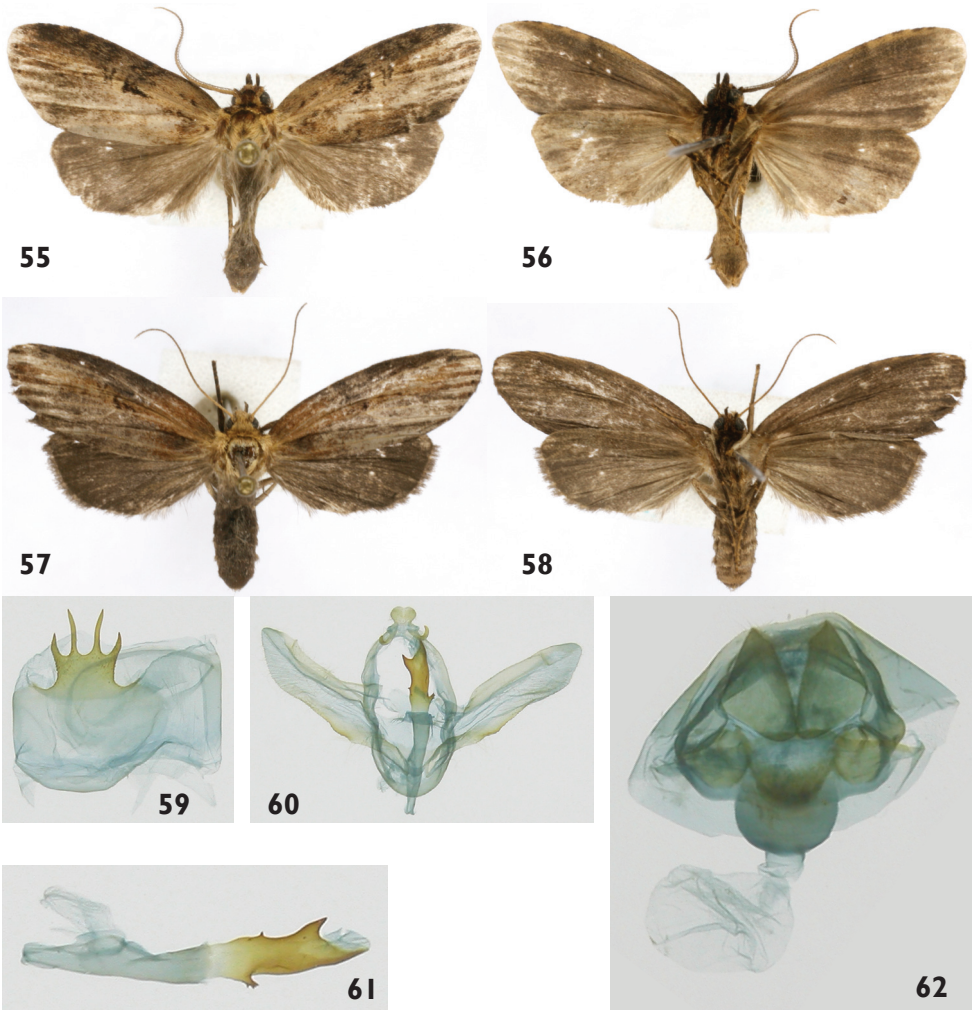
Type material. Holotype male: INB0004251736 **(**Dissected, COI Barcoded), Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, September 2009, R. Rojas (Reared). **Paratypes**: 1♂ 2♀. Male: INB0004251737 (COI Barcoded), Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, September 2009, R. Rojas (Reared). Female: INB0004251729 (COI Barcoded), Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, September 2009, R. Rojas (Reared). Female: INB0004251730 (Dissected, COI Barcoded), Costa Rica, Prov. Alajuela, San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, September 2009, R. Rojas (Reared).

Other material examined. Barcoded: 5 Alajuela (Fig. 86). Musem specimens: (5 specimens) 3♂, 2♀ Alajuela. Dissections: 3♂, 3♀Alajuela. **INBio specimens**: Male: **INB0004251734**. (COI Barcoded) Costa Rica. Prov. Alajuela. San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, September 2009, R. Rojas (Reared). Male: **INB0004251733**. Dissected. (COI Barcoded) Costa Rica. Prov. Alajuela. San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, September 2009, R. Rojas (Reared). Male: **INB0004251731**. Dissected. (COI Barcoded) Costa Rica. Prov. Alajuela. San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, September 2009, R. Rojas (Reared). Female: **INB0004251732**. Dissected. (COI Barcoded) Costa Rica. Prov. Alajuela. San Ramón, Est. Biol. Villa Blanca. 10.201361 -84.485101, 1115 m, September 2009, R. Rojas (Reared). Female: **INB0004251735**. Dissected. (COI Barcoded) Costa Rica. Prov. Alajuela. San Ramon, Est. Biol. Villa Blanca 10.201361 -84.485101, 1115 m, September 2009, R. Rojas (Reared).

Etymology. *Dunama indereci* is named in honor of the International Development Research Centre (IDRC) of Canada in recognition of their support of information management and DNA barcode taxonomy at INBio for conservation, and particularly for its support of the International Barcode of Life Project (iBOL initiated by the Biodiversity Institute of Ontario at the University of Guelph, Canada).

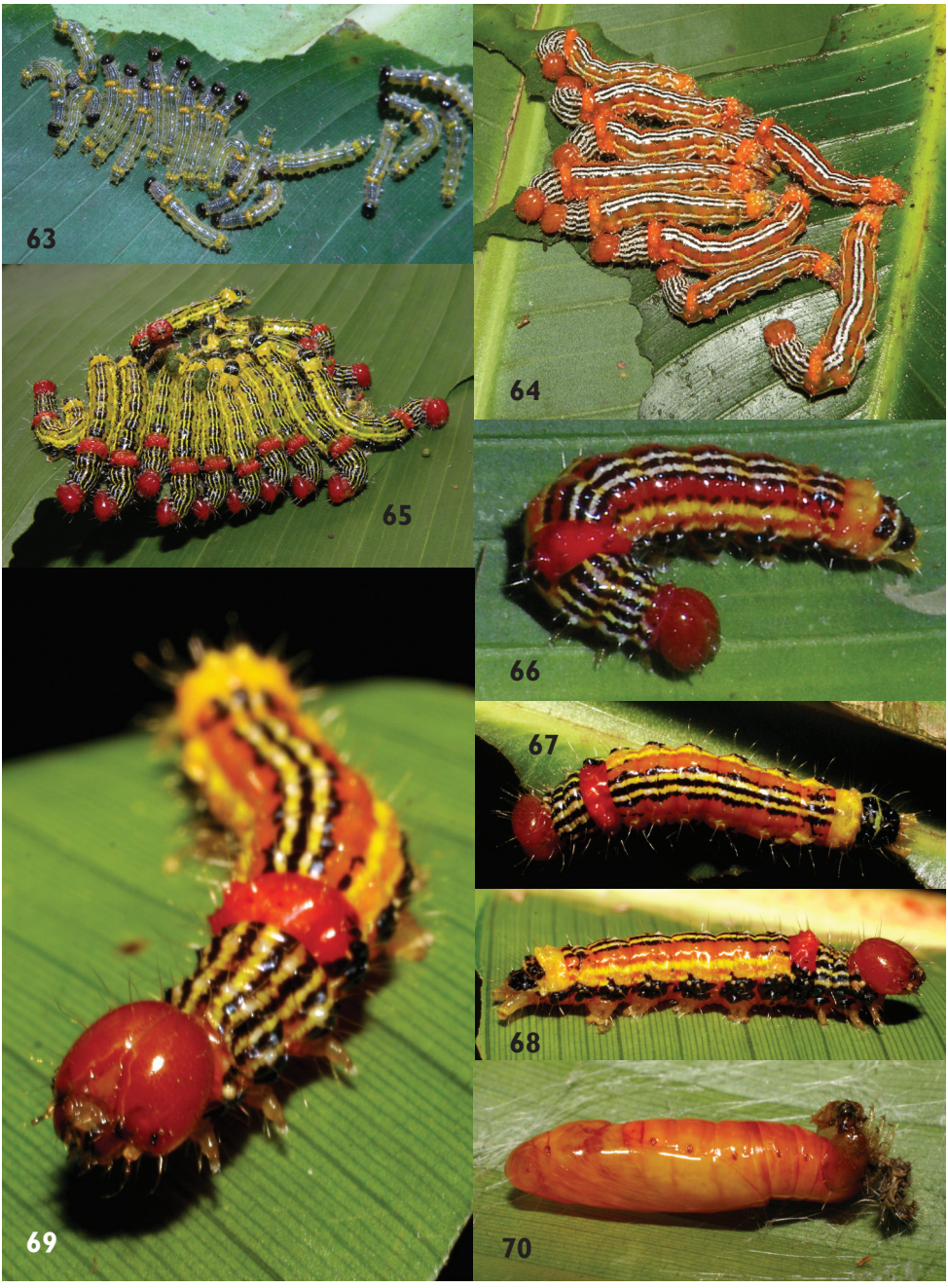
Diagnosis. St8 wide, short, anterior margin simple, posterior margin sclerotized and serrate with four processes, lateral processes shorter than the medial processes; phallus thin, unsclerotized and expanding subbasally, distal half sclerotized with a small trifurcate, spine-like projection on basal ventral margin, on the dorsal margin a tiny spine-like projection; tip with two, large spine-like projections. Vesica very small, without cornuti.

Description. Male (Figs 55, 56, 59–61). ***Head*** – Antenna pectinate in basal 4/5, rami moderately long and reddish brown, distal fifth simple, shaft cream colored, scape with scale tuft blackish brown and cream colored; frons with cream scales mixed with reddish-brown scales; labial palpus upcurved reddish brown with a few scattered cream-colored scales; ocelli absent; vertex reddish brown, cream colored laterally;



Figures 55–62. *Dunama indereci* **55, 56** Male dorsal and ventral INB0004251736 **57, 58** Female dorsal and ventral INB0004251730 **59** Male St8 **60** Male genitalia INB0004251736 **61** Phallus **62** Female genitalia INB0004251730.

patagium blackish brown near de midline, blackish brown laterally, margins cream colored. ***Thorax and abdomen*** – tegula cream colored at base, a mix of cream and reddish-brown scales distally; mesoscutum blackish brown anteriorly, cream and blackish brown posteriorly; mesoscutellum mostly creamy white; thoracic pleuron cream colored; legs mostly reddish brown on outer surfaces, cream colored on inner surfaces. Abdominal dorsum light gray, venter cream colored. ***Wings*** – Dorsal ground color a mixture of gray-brown and beige scales; veins lined with gray, especially distally; anal fold and cubitus light brown; orbicular spot blackish brown; reniform spot diffuse, blackish brown; fringe gray brown. Dorsal hindwing gray brown. Ventral surfaces of



Figures 63–70. Instars of *Dunama indereci* and *Dunama jessiebarronae* on food plants *Musa* and *Heliconia* **63** Intermediate instar *D. indereci* **64** Last instar *D. indereci* **65** Penultimate instar *D. jessiebarronae* **66–69** Last instar *D. jessiebarronae* 06-SRNP-40360 **70** Pupa of *D. jessiebarronae* 06-SRNP-40401.

Figures 71–84. Instars of *Dunama* on food plant (Arecaceae) **71–73** Last instar *Dunama janecoxae* 03-SRNP-3122 **74** Eggs of *Dunama jessiehillae* **75–77** Last instar of *Dunama janewaldronae* 02-SRNP-6497 **78** Pupa of *Dunama janewaldronae* 09-SRNP-40001 **79** Penultimate instar *Dunama jessiehillae* 00-SRNP-11377 **80** Last instar *Dunama jessiehillae* 99-SRNP-4114 **81** Prepupa of *Dunama jessiehillae* 06-SRNP-4940 **82–84** Last instar *Dunama jessiebancroftae* 09-SRNP-56324.

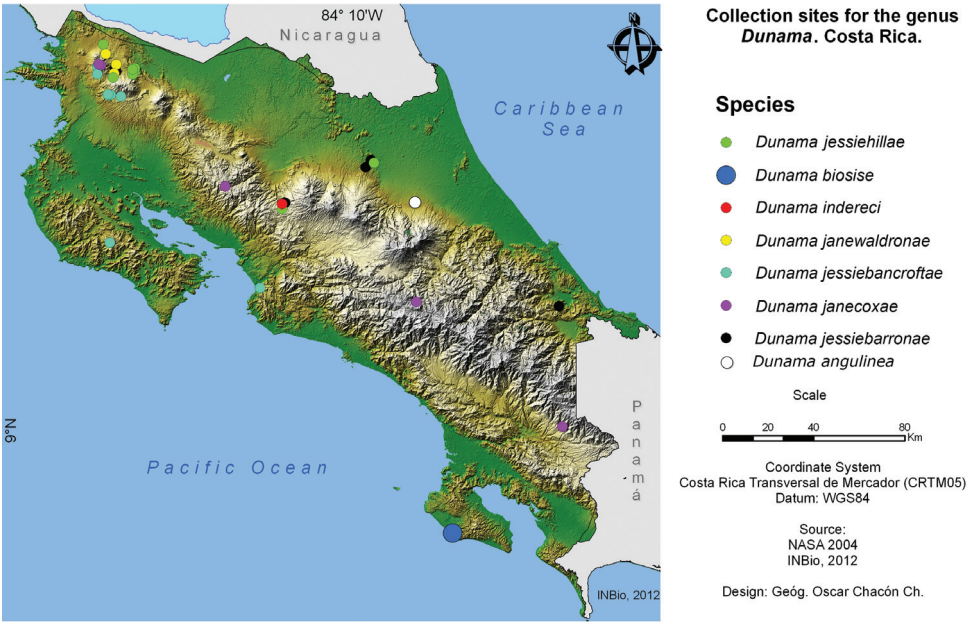


Figure 85. Map of Costa Rican collection sites for the eight species of *Dunama* (Notodontidae) discussed here.

both wings gray brown (Figs 55, 56). (WL 11.8–12.9 mm). ***Male genitalia*** (Figs 59–61) – St8 wide, short, anterior margin simple, posterior margin sclerotized and serrate with four processes, lateral processes shorter than medial ones (Fig. 59). Uncus wide, pubescent, lobulate-like, with a hollow depression in middle. Socii thin up-curved and hook-like. Valva sclerotized along margins and membranous centrally, distal margin simple, saccular margin serrate with a small spine-like projection in ventral surface near apex (Fig. 60). Phallus thin, unsclerotized and expanding subbasally, distal half sclerotized with a small trifurcate, spine-like projection on basal ventral margin, on dorsal margin a tiny spine-like projection; tip with two, large spine-like projections. Vesica very small, without cornuti (Fig. 61). **Female** (Figs 57, 58, 62). Antenna filiform with yellow-cream shaft; body color and wing pattern similar to male but wings longer (Figs 57, 58). (FW 13.0–14.3 mm). ***Female genitalia*** (Fig. 62) – Segment 8 forming a heavily sclerotized capsule; anterior apophyses acute; posterior apophyses tiny, CB evident and rounded, signum absent; DB short; ostium recessed in St8. Ovipositor lobes pubescent, with acute apex.

Natural history (Figs 63, 64). Food plant: Heliconiaceae: *Heliconia latispatha* Benth., Villa Blanca (9). No parasitoids were reared from this small sample.

Distribution and habitat. *Dunama indereci* has been collected only in Villa Blanca, in San Ramon, Alajuela province, at 1115 m elevation, in a montane pass between Costa Rica's Cordillera de Tilaran and Volcanica Central (Fig. 85).

Remarks. This species feeds exclusively on *Heliconia latispatha*. One barcode haplotype was recored in the population from Villa Blanca (Fig. 86).

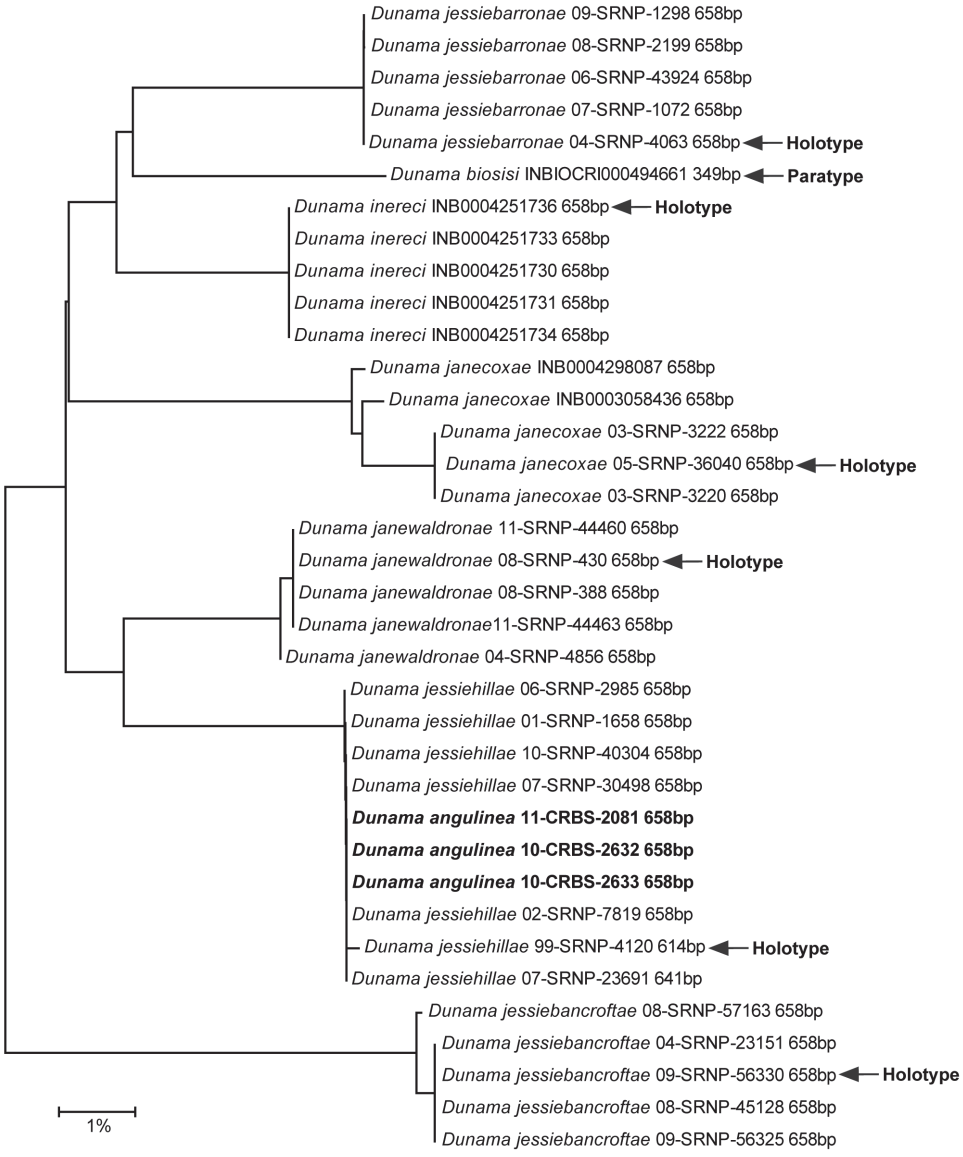


Figure 86. The *Dunama* species from Costa Rica in an NJ barcoding tree. Sample sizes are restricted to a haphazardly selected set of five specimens for each species. Many specimens were reared from wildcaught caterpillars and further information on each can be found at Janzen and Hallwachs (2012).

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RESEARCH ARTICLE

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Four new Neotropical *Lophocampa* species with a redescription of *Lophocampa atriceps* (Hampson) (Lepidoptera, Erebidae, Arctiinae)

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Abstract

Four new species of *Lophocampa* Harris, are described and illustrated: *Lophocampa flavodorsata* **sp. n.**, *Lophocampa griseidorsata* **sp. n.**, *Lophocampa herbini* **sp. n.** and *Lophocampa sullivani* **sp. n.** *Lophocampa atriceps* (Hampson) is redescribed, illustrated and compared to the new species.

Résumé

Quatre nouvelles espèces de *Lophocampa* Harris sont décrites et illustrées, *Lophocampa flavodorsata* **sp. n.**, *Lophocampa griseidorsata* **sp. n.**, *Lophocampa herbini* **sp. n.** et *Lophocampa sullivani* **sp. n.** *Lophocampa atriceps* Hampson, est redécrite illustrée, et compareé aveć les especies nouvelles.

Keywords

Lepidoptera, Erebidae, Arctiinae, *Lophocampa*, new species, Costa Rica, Venezuela, Colombia, Ecuador, Peru, Bolivia

Introduction

The genus *Lophocampa* Harris is one of the most speciose of the Neotropical tiger-moths, with 80 species and 10 subspecies described (Vincent 2011). The classification of this complex genus is far from complete and in spite of the work of Watson and Goodger (1986), numerous nomenclatural changes are needed to achieve a better taxonomic understanding of the genus.

After several expeditions to the Andean mountains, we now have good series of the *Lophocampa* species previously treated as *Lophocampa atriceps* (Hampson), described from Colombia. Examination of the male genitalia of specimens from Venezuela to Bolivia shows that several undescribed species are presently included in the concept of *L. atriceps*. Examination of additional material housed in MNHN showed that five species are involved, four of which were new and described here. *Lophocampa atriceps* is redescribed and compared to closely related species, and a key to the *Lophocampa atriceps* group is provided.

Methods and materials

Abdomens were removed and genitalia were dissected, examined and mounted on slides using standard procedures prior to being photographed. Nomenclature for abdominal and genital morphology follows Klots (1970). The types of *Lophocampa atriceps* (Hampson), *Lophocampa hyalinipuncta* (Rothschild) and *Lophocampa andensis* Schaus were examined and photographed, the two first ones being not dissected.

Treatment of the Arctiinae as a subfamily of Erebidae follows Zahiri et al. (2012); tribal placement follows Lafontaine and Schmidt (2010).

Collections where material used in this study is located are as follows:

BMNH The Natural History Museum, London, UK
INBio Instituto Nacional de Biodiversidad, San José, Costa Rica
MNHN Muséum National d'Histoire Naturelle, Laboratoire d'Entomologie, Paris, France
MUSM Museo de Historia Natural, Universidad Nacional de San Marco, Lima, Peru
USNM Smithsonian Institution National Museum of Natural History, Washington DC, USA
BSC Personal collection of Bolling Sullivan, Beaufort, North Carolina, USA
BVC Personal collection of Benoit Vincent, Rosny sous Bois, France
MLC Personal collection of Michel Laguerre, Léognan, France

Molecular Analyses. Tissue samples of the newly described species were sequenced at the Canadian Centre for DNA Barcoding in Guelph (Ontario, Canada), as part of a DNA barcoding project for neotropical tiger-moths, developed as part of the iBOL

Lepidoptera campaign (see www.lepbarcoding.org for details). DNA extraction, PCR amplification and sequencing follow the protocols described in Vaglia et al. (2008).

The taxa included in this study are listed in Table 1. Unfortunately, recently collected material of *L. andensis* was not available for sequencing. A set of twenty-four specimens of five species was sequenced for the 658 barcode base pairs fragment. Sequences were analyzed using maximum likelihood (ML) and maximum parsimony (MP) methods. MP analyses were carried out with MEGA 5 software (Tamura et al. 2011).

Systematics

Key to species of the *Lophocampa atriceps* species-group

1 Dorsal surface of abdomen with long yellowish hair; last spot on subterminal band with ovate apex and compressed base (fig. 25a); Distance between last apical spots of the postmedial and subterminal bands greater than the diameter of the apical spot of the subterminal band (fig. 25b) **2**

– Dorsal surface of the abdomen with long greyish or brownish hair; last spot of subterminal band with apex ovate (fig. 26a); distance between the last apical spot of the postmedial and subterminal bands less than the diameter of the apical spot of the subterminal band (fig. 26b) **4**

2 Patagia with uniformly black spot ..... ***L. atriceps***

– Patagia with a yellow spot outlined with brown **3**

3 Male valvae long and slender with apex slightly bent; eastern slope of the Andes (fig. 27) ..... ***L. flavodorsata* sp. n.**

– Male valvae wide and relatively short with apex notched, forming two points, one blunt and one acute (fig. 28); western slope of the Andes ..... ***L. sullivani* sp. n.**

4 Spots of subterminal band significantly smaller than spots of postmedial band (fig. 2) ..... ***L. hyalinipuncta***

– Spots of subterminal band same size as spots of postmedial band (fig. 5, 6) **5**

5 Length of male forewing less than 20 mm; apex of forewing rounded; spots between M2 and CuA1 at least as large as the other spots (fig. 9b in Watson, 1973) ..... ***L. andensis***

– Length of male forewing than 20 mm; apex of forewing pointed; spots between M2 and CuA1 smaller than other spots (fig. 5,6) **6**

6 uncus lozenge-shaped with apex truncated (fig. 12); valvae without a prominent costa, with bifid apex with both tips symmetrical, short and acute (fig. 30); aedeagus moderately narrow and rectilinear (fig. 18); female ductus bursae short, square (fig. 24) ..... ***L. herbini* sp. n.**

– Uncus spatulate (fig. 11); male valvae with a prominent costa ending in an acute apex. Apex of the valvae bifid; one tip short and rounded, other very long and acute (fig. 29); aedeagus narrow and rectilinear (fig. 17); ductus bursae rectangular (fig. 23) ..... ***L. griseidorsata* sp. n.**

Species accounts

***Lophocampa atriceps* (Hampson)**
http://species-id.net/wiki/Lophocampa_atriceps
Figs 1, 7, 13 and 19

Elysius atriceps Hampson, 1901: 113.

Type material. *Elysius atriceps*: Male holotype [BMNH], examined. Type locality: Colombia. The holotype is labeled "*sychesia atriceps type ♂ Hmpsn*" (Hampson's hand); "*Colombia 98-108*" and "*TYPE*" (typeset).

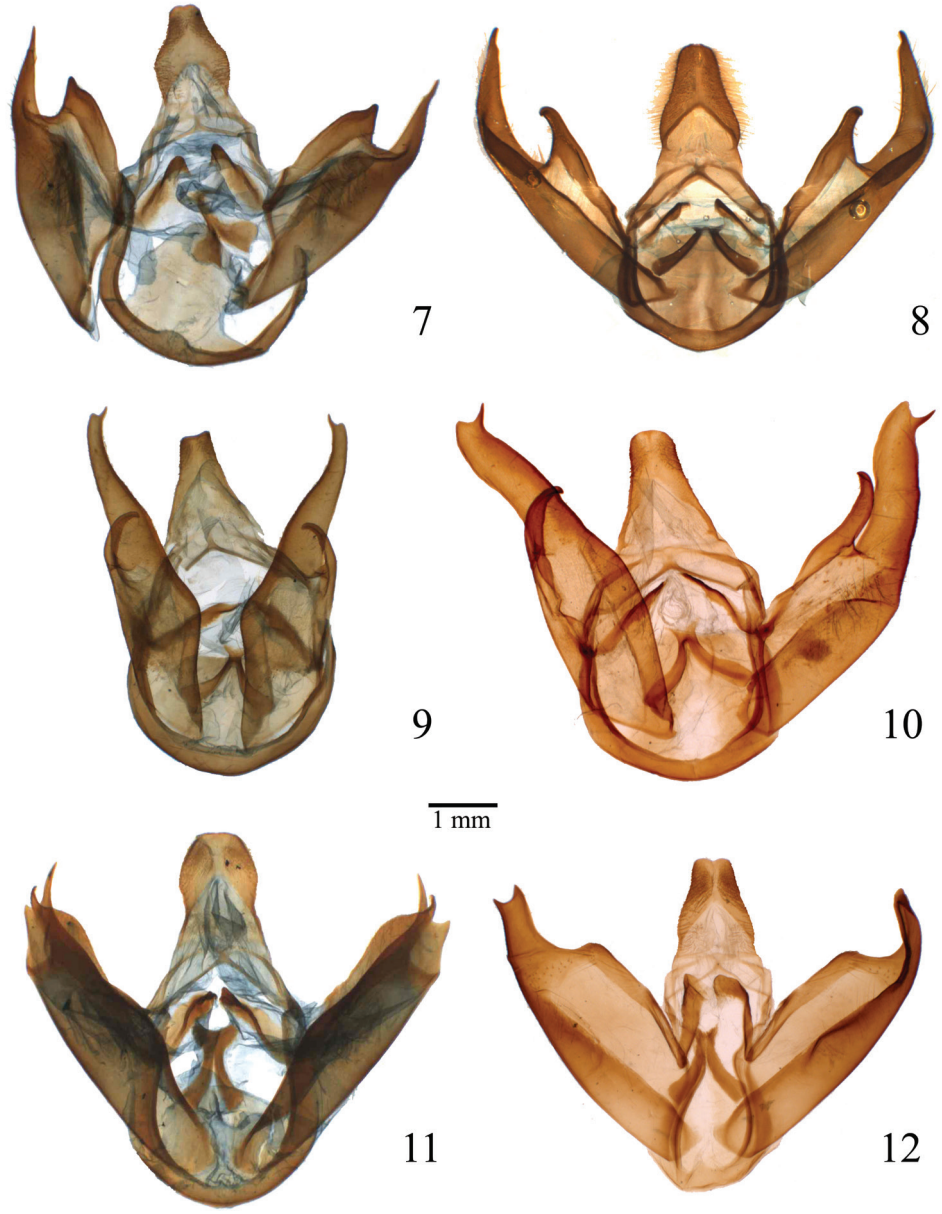
Redescription. Head - Antenna bipectinate, brown with yellow base and brown cilia. Frons light yellowish white, separated at base of antenna by transverse black line. Vertex yellowish white with a prominent black central spot. Palpi erect, yellow with second joint black at sides and third black and very short. **Thorax -** Patagia yellowish white with square black spot. Tegulae exteriorly yellowish white, medially brown, bordered with black. Thorax yellow-white with posterior medial brown spot. Legs with femur dull white spotted with brown; dorsal face of femur vivid yellow. Tibia dull white with brown spots. Tarsal segments brown with small whitish spots. **Forewing -** Brown irrorated with light and dark brown. One yellow spot and two small blacks dots at base. A series of bands formed by whitish spots, arranged as follows: antemedial band comprised of three spots; medial band curved, comprised of seven dark spots; postmedial band sinuous, a series of different size spots, the three adjacent to costa largest. Three spots forming triangle between median and postmedian bands, outermost on costa. Subterminal band comprised of spots of different shapes: arrowhead-shaped spot nearest tornus, second spot larger, spots above veins CuA1 and M2 very small and flattened, three near apex large, last one on apex ovate and compressed basad. Terminal line a series of white dots along margin. Ventral markings as above but paler. **Hindwing -** White slightly tinged with yellow marks on apex and along costa, with yellow tint along the anal border. Markings on ventral surface more contrasting. **Abdomen -** Tergites pale orange, almost entirely covered with long yellow hairs, and with a lateral series of black spots. Last segment pale orange, without hair. Sternites white with yellow-centered brown patches. **Male genitalia -** Uncus lozenge-shaped, setose, apex truncate. Tegumen and vinculum very slender. Saccus tongue-shaped, folded ventrally. Valve symmetrical, enlarged at base, slightly exceeding apex of uncus. Valvula slender, oblong and slightly twisted internally. Cucullus short, pointed and folded toward uncus. Juxta slender, with two arms fused in middle forming a stem with a elongated sclerotized patch at apex. Transtilla with two arms folded and converging, arms not fused, showing a large disconnect in the structure. Penis rectilinear, narrow with elongated caecum penis. Vesica large with two large and one small diverticulum. Five patches of cornuti: one at base, one on small diverticulum, and one on each of two large diverticuli. **Female** - identical to male except as follows: wingspan slightly larger. Antennae with pectinations shorter than in male; two small black points laterally on the collar, the central pair always present.

Figures 1–6. Habitus of *Lophocampa* species. **1** *Lophocampa atriceps* (Hampson, 1901), Holotype, male **2** *Lophocampa hyalinipuncta* (Rothschild, 1909), male syntype **3** *Lophocampa flavodorsata* sp. n., Holotype, male **4** *Lophocampa sullivani* sp. n., Holotype, male **5** *Lophocampa griseidorsata* sp. n., Holotype, male **6** *Lophocampa herbini* sp. n., Holotype, male.

Female genitalia - Lamella antevaginalis subrectangular, lightly sclerotized. Apophyses posteriores straight, enlarged at base, 1.3 mm long; apophyses anteriores slightly curved, 0.75 mm long. Papillae anales rectangular, setose, with a pair of small pseudopapillae. Dorsal sac-like pheromone glands absent. Ductus bursae rectangular, striped. Corpus bursae ovate, wrinkled, with large signum. Insertion of ductus seminalis ventrad and close to juncture of ductus bursae with corpus bursae.

Biology and distribution. Early stages unknown. Colombia (Valle del Cauca), Ecuador (Guayas) and Costa Rica (Alajuela, Guanacaste, Puntarenas, Cartago). Hampson associated with the holotype an unspecified number of specimens from Bolivia, R[io] Tanampaya, [La Paz]. A second male specimen in the BMNH labeled *atriceps* is a specimen of *Lophocampa griseidorsata* Vincent & Laguerre, sp. n.

Remarks. The holotype in the BMNH has not been dissected. The type locality on the label states only "Colombia", so it is not possible to compare specimens from the

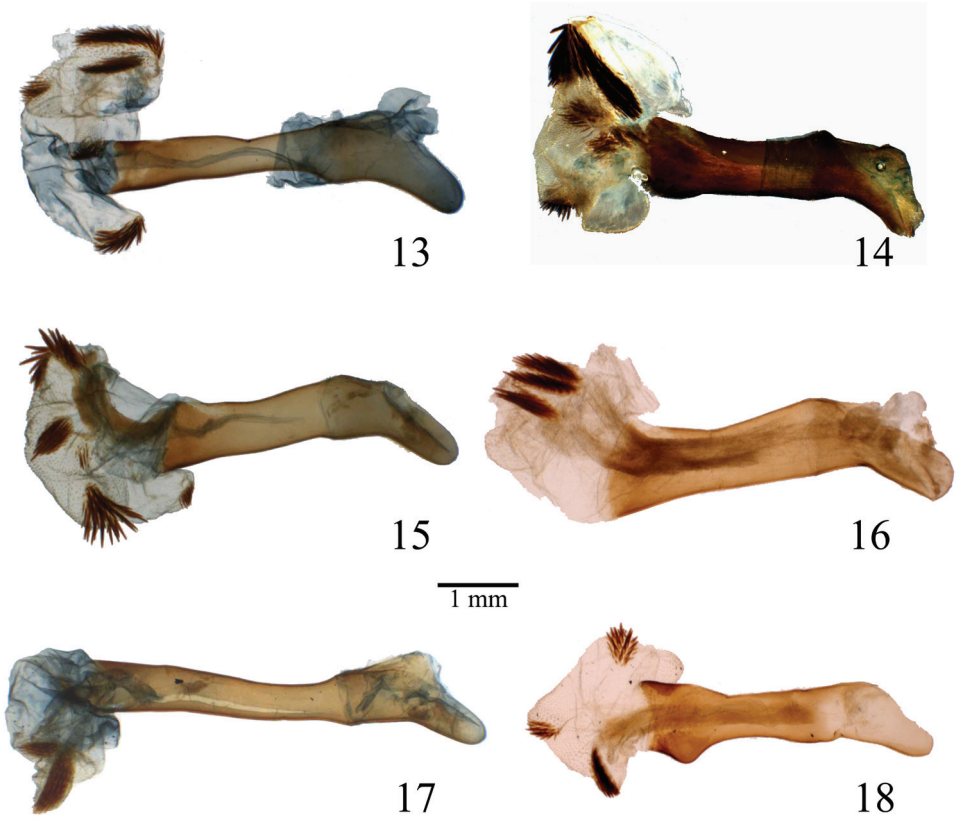


Figures 7–12. Male genitalia of *Lophocampa* species. **7** *Lophocampa atriceps* (Hampson, 1901), specimen from Ecuador **8** *Lophocampa hyalinipuncta* (Rothschild, 1909), specimen from Ecuador **9** *Lophocampa flavodorsata* sp. n., Holotype **10** *Lophocampa sullivani* sp. n., Holotype **11** *Lophocampa griseidorsata* sp. n., Holotype **12** *Lophocampa herbini* sp. n., Holotype.

same locality. However, the tips of the valves of the holotype are visible, and were compared with those of superficially identical specimens which were dissected. Specimens with valves matching those of the holotype are from the western slopes of the Andes in Colombia and Ecuador and the mountains of Costa Rica. The description for the genitalia of *L. atriceps* provided here is based on a male originating from the western slope of Ecuador. A female from the same locality in Ecuador with similar habitus is described and illustrated, including the genitalia.

***Lophocampa flavodorsata* Vincent & Laguerre, sp. n.**
urn:lsid:zoobank.org:act:DF055548-5A76-4621-8041-B98A35C750F0
http://species-id.net/wiki/Lophocampa_flavodorsata
Figs 3, 9, 16, 18 and 27

Type material. Holotype - ♂, Ecuador, Napo, Route de Baeza à Tena, Km 7, 1.8 km after intersection on the right, 2097 m, 18-II-2006, 0.585°S 77.877°W, genitalia dissected by B. Vincent. n° BV 286 (fig. 9), Barcode ID ARCTA930-09, Sample ID BEVI0825, B. Vincent leg, [MNHN]. **Allotype** - ♀, same data as holotype, B. Vincent leg, [MNHN]. **Paratypes** - Venezuela: 1 ♂, Aragua, Geremba, 2050 m, 13-V-1994 P. Rouche; 1 ♂, Aragua, Road Colonia Tovar - Pto Maya, PK 4, 2100 m, 29-VII-1995, genitalia dissected by M. Laguerre n° ML 1151, M. Laguerre leg. ; 1 ♂, Aragua, Road Colonia Tovar - Pto Maya, PK 5, 2200 m, 30-VII-1995, M. Laguerre leg. ; 1 ♂, Aragua, Road Colonia Tovar - Pto Cruz, PK 4, 1800 m, 15-VIII-1995, M. Laguerre leg. all [MLC] ; 1 ♂, Lara, Parc National Yacambu, 1650 m, 17-XI-2001, genitalia dissected by B. Vincent. n° BV 229, B. Vincent leg. 1 ♂, Merida, Road la Azulita - Lagunillas, Km 15, 1700 m, 12-XI-2001, genitalia dissected by B. Vincent. n° BV 101, B. Vincent leg.; 2 ♂, Trujillo, Road Bocono - Biscucuy, Km 7, 1900 m, 10-XI-2001, genitalia dissected by B. Vincent. n° BV 227, B. Vincent leg. all [BVC] ; Ecuador: 1 ♂, Morona-Santiago, Road Gualaquiza - Limon, Km 23, 1610 m, 11-II-83, C. Lemaire & P.Thiaucourt leg., genitalia dissected by H. de Toulgoët. n°AS 38, [MNHN] ; 1 ♂, Sucumbios, Road Julio Andrade - La Bonita, PK 57, 2100 m, 3-VIII-1997, genitalia dissected by M. Laguerre. n° ML 1152 + 1 ♀ genitalia dissected by M. Laguerre. n° ML 1063, M. Laguerre leg. ; 1 ♀, Napo, Road Cosanga - Tena, PK 15, 1900 m, 5-VIII-1997, Barcode ID ARCTA838-07, Sample ID MILA0557, M. Laguerre leg. ; 1 ♂, Napo, Cordillera Huacamayos, 1850 m, XI-1992, genitalia dissected by M. Laguerre. n° ML 314, Barcode ID ARCTA839-07, Sample ID MILA0558, T. Porion leg. ; 2 ♂, Napo, Road Baeza - Tena, Km 17, 1.8 km after intersection on the right, 2097 m, 18-II-2006, S 0.585 W 77.877, Barcode ID ARCTA330-07, Sample BEVI0048, Barcode ID ARCTA538-07, Sample ID BEVI0256 and Barcode ID ARCTA930-09, Sample ID BEVI0275, B. Vincent leg. ; 1 ♂, Napo, Route Cosanga - Tena PK 8, 2300 m, 19-VII-1990, Jean Haxaire & Daniel Herbin leg. Barcode ID ARCTA556-07, Sample BEVI0274, all [BVC] ; Peru: 1 ♂, Cuzco, Road Cuzco - Manu, PK 151, 1650 m, 15/18-XII-1979, T. Porion leg. genitalia dissected by B. Vincent. n° BV 251 ; 1 ♀,



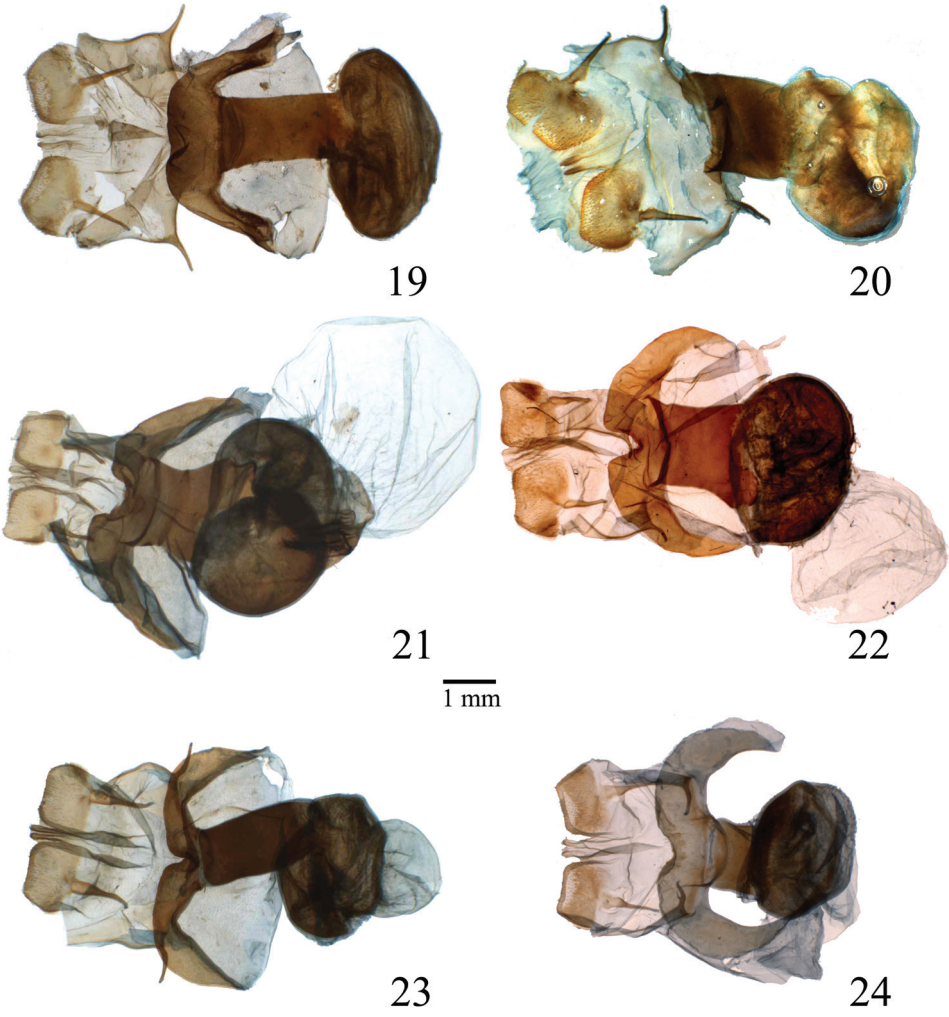
Figures 13–18. Penis of *Lophocampa* species. **13** *Lophocampa atriceps* (Hampson, 1901), specimen from Ecuador **14** *Lophocampa hyalinipuncta* (Rothschild, 1909), specimen from Ecuador **15** *Lophocampa flavodorsata* sp. n., Holotype **16** *Lophocampa sullivani* sp. n., Holotype **17** *Lophocampa griseidorsata* sp. n., Holotype **18** *Lophocampa herbini* sp. n., Holotype.

idem, genitalia dissected by B. Vincent. n° BV 28 ; 1 ♂, Road Lima - Pucallpa, 30 km after Tingo-Maria, 1000 m, 19 and 20-XI-1979, T. Porion leg, genitalia dissected by B. Vincent, n° BV 252, all in MNHN.

Etymology. The specific epithet, *flavodorsata*, refers to the yellowish hairs of the abdominal tergites.

Diagnosis. *Lophocampa flavodorsata* sp. n. can be distinguished from *L. atriceps* by the absence of black dots on the collar, the dark color of the head, collar and the base of the tegulae, as well as the different structure of both the male and female genitalia.

Description. Head - Antenna bipectinate, brown with yellowish base and brownish cilia. Frons light yellow on inferior half, deep brown on superior half. Vertex light yellow with strong brown central spot. Palpi erect, deep brown with second segment light yellow and third very short. **Thorax** - Patagia light yellow with a square brown spot centered with brownish orange. Tegulae exteriorly brown, medially yellow-white,



Figures 19–24. Female genitalia of *Lophocampa* species. **19** *Lophocampa atriceps* (Hampson, 1901), specimen from Ecuador **20** *Lophocampa hyalinipuncta* (Rothschild, 1909), specimen from Ecuador **21** *Lophocampa flavodorsata* sp. n., Allotype female **22** *Lophocampa sullivani* sp. n., Allotype female **23** *Lophocampa griseidorsata* sp. n., Allotype female **24** *Lophocampa herbini* sp. n., Allotype female.

bordered with dark brown. Thorax light yellow with a median brown spot. Legs: Femur white spotted with brown, dorsal surface vivid yellow. Tibia white with brown spots. Tarsal segments brown with small white spots. **Forewing -** Brown irrorated with light and dark brown: one yellow spot with two small black dots at base. A series of bands formed by white spots arranged as follows: antemedial band broken; medial band slightly curved; postmedial band sinuous, originating at anal border and splitting between veins CuA2 and CuA1 into two branches reaching costa. After their separation the branches surround a strong brown reniform spot. Size of spots in this band

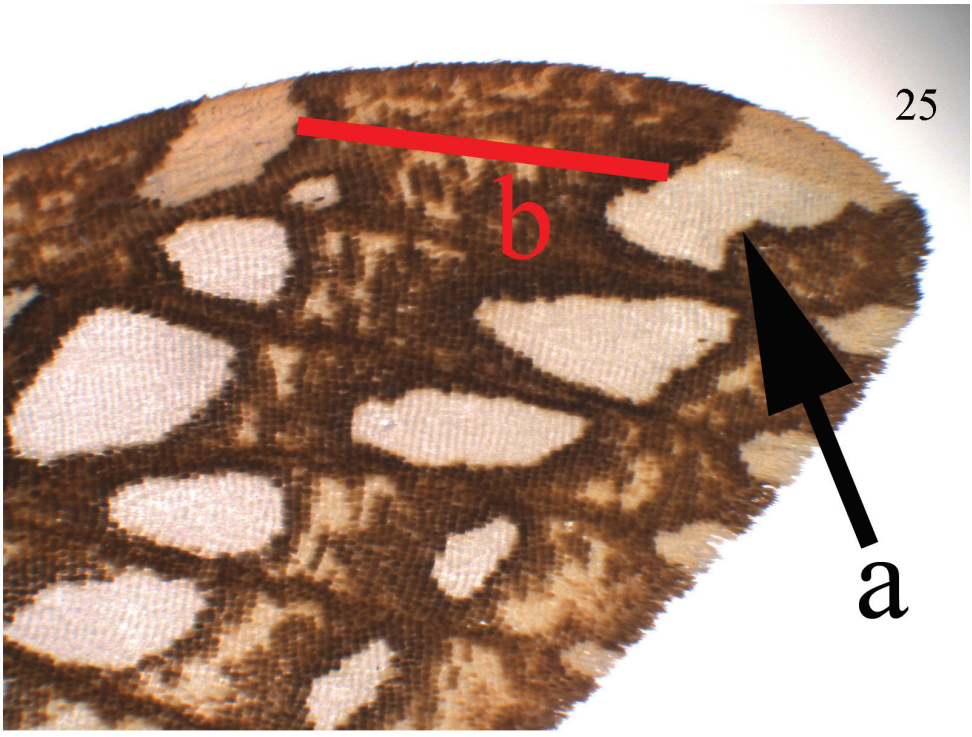


Figure 25. *Lophocampa flavodorsata* sp. n. forewing apex.

relatively constant. Basal branch slightly contrasting due to clear background. Subterminal band made up of different-shaped spots: spot near tornus arrowhead shaped, 2nd spot larger than first, those above veins CuA1 and M2 very small and flattened; three spots near apex larger; last one at apex ovate and compressed basally. Terminal line of white dots on margin. Ventrally as above but paler. **Hindwing -** Yellow-white slightly tinged with yellow-brown marks on apex and along the costa, with yellow tinge along anal border. Ventrally, marks more contrasting, deep brown centered with yellow-brown. **Abdomen -** Tergites pale orange and almost entirely covered with long yellow hair, with a lateral series of very faint brown spots. Last segment pale orange, without hair. Sternites white with brown patches centered with yellow. **Male genitalia -** Uncus rectangular, setose. Tegumen and vinculum slender. Saccus tongue-shaped, folded ventrally. Valves symmetrical, slender and long with apex slightly angled, extending beyond apex of the uncus. Valves slender, very elongate, terminating in a small tooth. Cucullus slender, elongated, folded toward uncus. Juxta very narrow, with two arms fused apically into a small V-shaped sclerotized patch. Transtilla slender, tongue-shaped, interrupted in the middle. Aedoeagus. Penis rectilinear; caecum penis present. Vesica wide with four diverticuli, with four patches of cornuti, two with small spines and two with larger spines. **Female** - identical to male except as follows: Antennae with pectinations shorter than male. **Female genitalia** - Lamella antevaginalis slightly sclerotized, semicircular with a large medial U-shaped notch on the posterior margin.

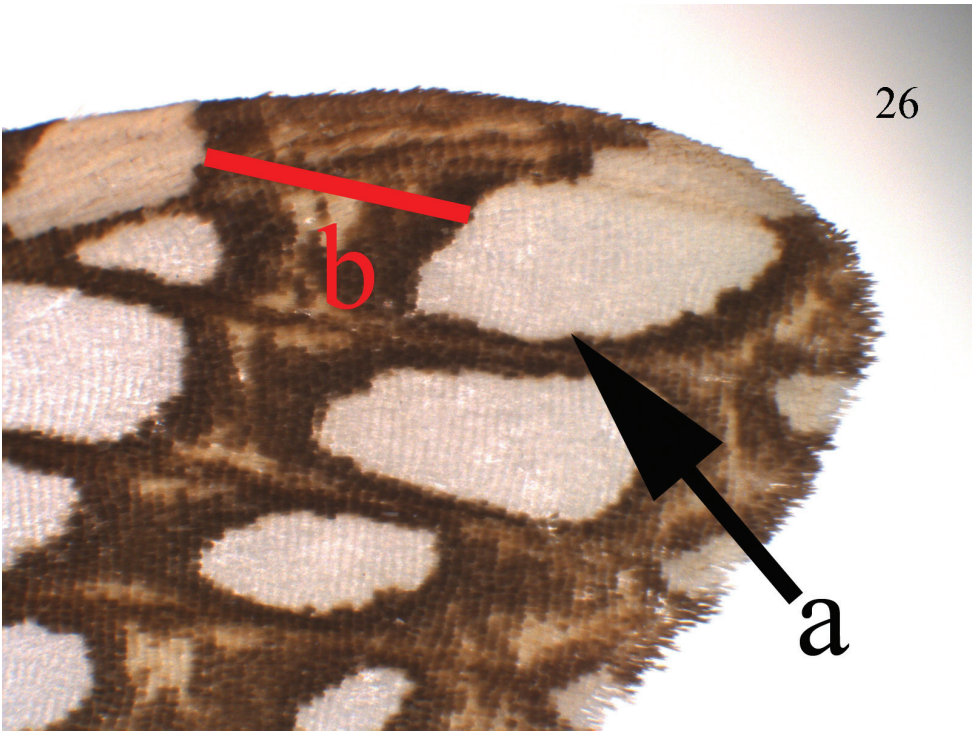


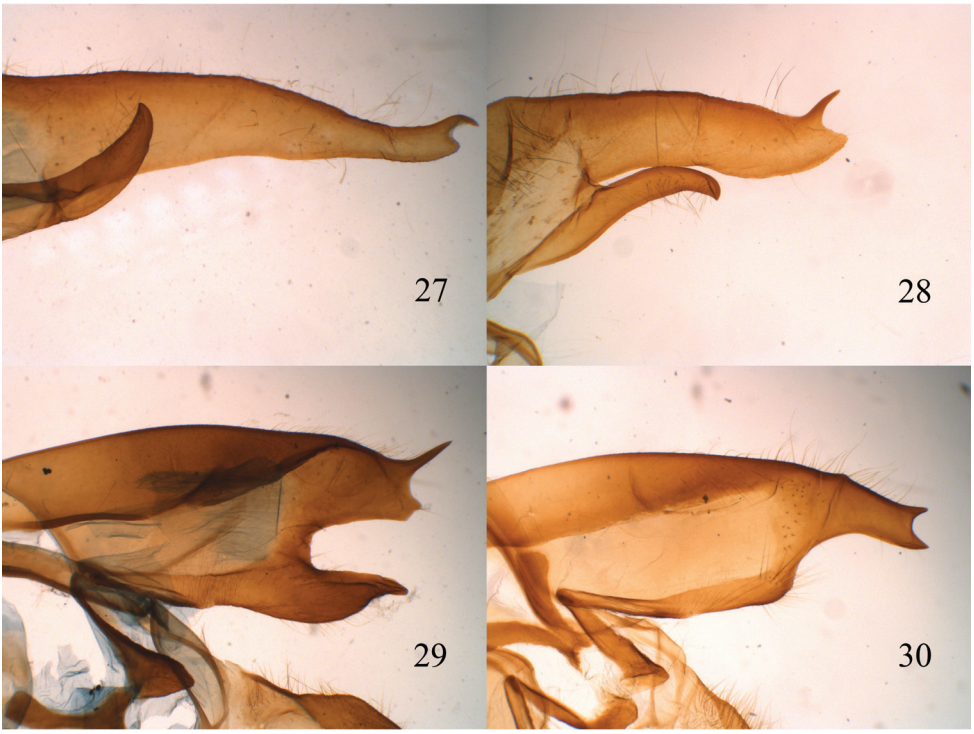
Figure 26. *Lophocampa griseidorsata* sp. n. forewing apex.

Apophyses posteriores straight, 0.9 mm long, apophyses anteriores slender, 0.6 mm long. Papillae anales rectangular, setose, with a pair of small pseudopapillae. Dorsal saccular pheromone glands absent. Ductus bursae asymmetrical with an extension on the right (ventral view). Corpus bursae reduced and ovate, bearing a large field of signa. Appendix bursae as large as corpus bursae. Ductus seminalis ventrally inserted at apex of corpus bursae and immediately transformed into seminal vesicle.

Biology and distribution. Early stages unknown. Venezuela (Aragua, Lara, Merida), Ecuador (Napo, Morona-Santiago, Sucumbios), Peru (Cuzco, Huanuco).

***Lophocampa griseidorsata* Vincent & Laguerre, sp. n.**
urn:lsid:zoobank.org:act:A4BEFCB0-2305-4C8F-9881-7FD02C377880
http://species-id.net/wiki/Lophocampa_griseidorsata
Figs 5, 11, 17, 23 and 29

Type material. Holotype - ♂, Bolivia, Sud Yungas, Rte Caranavi - Palos Blancos, K 41, 1400 m 16-III-84, G. Lachaume & T. Porion leg., genitalia dissected by B. Vincent n° BV 257, Barcode ID ARCTA931-09, Sample ID BEVI0826 [MNHN]. **Allotype** - ♀, Bolivia, Sud Yungas, Rte Caranavi - Palos Blancos, K 41, 1400 m 16-III-84, G. Lachaume & T. Porion leg., genitalia dissected by B. Vincent n° BV 280 [MNHN].



Figures 27–30. lateral view of male valve. **27** *Lophocampa flavodorsata* sp. n. **28** *Lophocampa sullivani* sp. n. **29** *Lophocampa griseidorsata* sp. n. **30** *Lophocampa herbini* sp. n.

Paratypes - 1 ♂, Bolivia: Cochabamba, Road Cochabamba - Villa Tunari, PK 103, 2100 m, 28-I-1997, genitalia dissected by M. Laguerre. n° ML 1180, M. Laguerre leg. ; 2 ♀, Cochabamba, Road Cochabamba - Villa Tunari, PK 111, 1500 m, 29-I-1997, genitalia dissected by M. Laguerre. n° ML 1064, M. Laguerre leg. all [MLC] ; 1 ♂, Coroico, 1700 m, XII-1981, G. Jeannot & G. Lachaume leg. genitalia dissected by B. Vincent n° BV 254, [MNHN] ; Peru: 1 ♂, Road Olmos - Tarapoto, 1700 m, 10/12 -I-80, T. Porion leg., with one genitalia dissected by B. Vincent n° BV 256, [MNHN] ; 2 ♂ and 1 ♀, Cuzco, Road Cuzco-Manu PK 151, 1650 m, 15/18-XII-79, T. Porion leg., genitalia dissected by B. Vincent n° BV 255, [MNHN]; 1 ♀, Pasco, Route d'Oxopampa - Pozuzo, km 47, 1500 m, 30-IX-2003, B. Vincent leg., Barcode ID ARCTA929-09, Sample ID BEVI0824 all [BVC] ; Ecuador: 3 ♂, Sucumbios, Road Julio Andrade - La Bonita, PK 57, 2100 m, 3-VIII-1997, genitalia dissected by M. Laguerre. n° ML 317 & 1156, M. Laguerre leg. [MLC]; 1 ♂, Napo, Road Baeza - Tena, Km 17, 1.8 km after intersection on the right, 2097 m, 18-II-2006, S 0.585 W 77.877, B. Vincent leg., Barcode ID ARCTA538-07, Sample ID BEVI0256 ; 1 ♂, Morona-Santiago, Road Limon - Gualaceo, Km 28.6, 2114 m, 22-II-2006, S 3.022 W 78.586, Barcode ID ARCTA539-07, Sample ID BEVI0257, B. Vincent leg. [BVC]; 1 ♂, Road Gualaceo - Mendez, Km 49, 1700 m, 23-I-1979, T. Porion leg, genitalia dissected by H. de Toulgoët. n°AS 55, [MNHN].

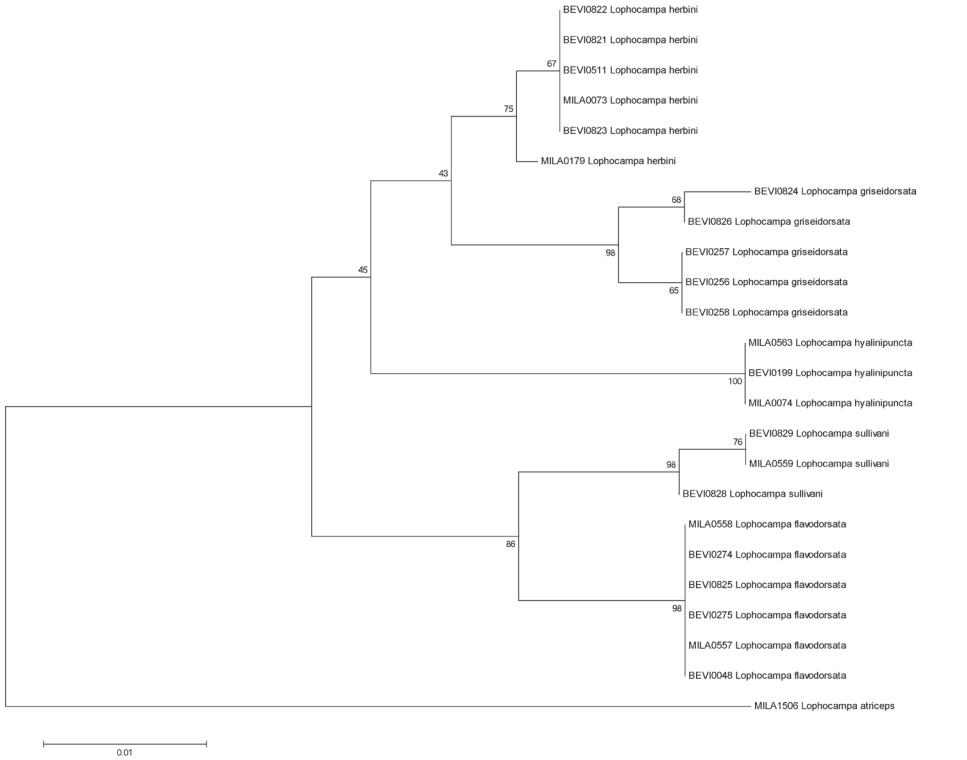


Figure 31. Neighbor-Joining Tree for the 24 specimens of the *Lophocampa atriceps* group. Boot-strap values (in %, 1000 replicates) are given on each branch (obtained with MEGA5, see Tamura et al. 2007).

Etymology. The specific epithet *griseidorsata* refers to the gray color of the abdominal tergites.

Diagnosis. *Lophocampa griseidorsata* sp. n. is best distinguished from *L. flavodorsata* by the difference in the coloration of the abdominal scales, the larger whitish spots on forewings and by the structure of male and female genitalia, as given in the key. This species can also be distinguished from *L. atriceps* with the characters above along with the absence of black spots on the collar.

Description. Head - Antenna bipectinate, brown with basal third vivid yellow and with brownish cilia. Frons whitish with black T-shaped mark, vertex whitish anteriorly and black centered with brown posteriorly. Palpi erect, deep brown with 2nd segment whitish and 3rd segment very short. **Thorax -** Patagiae whitish with square brown spot centered with brownish orange. Tegulae exteriorly whitish, medially brown, bordered with dark brown. Thorax whitish with median brown line. Legs. Femur whitish, spotted with brown and with dorsum vivid yellow. Tibia whitish, spotted with brown. Tarsal segments brown with small whitish spots. **Forewing -** Brown irrorated with pale and deep brown. At base, one whitish spot with a yellow and two small blacks dots. Series of bands formed by whitish spots and organized as follows: broken antemedial band; slightly curved medial band, the size of the spots decreasing from anal border to

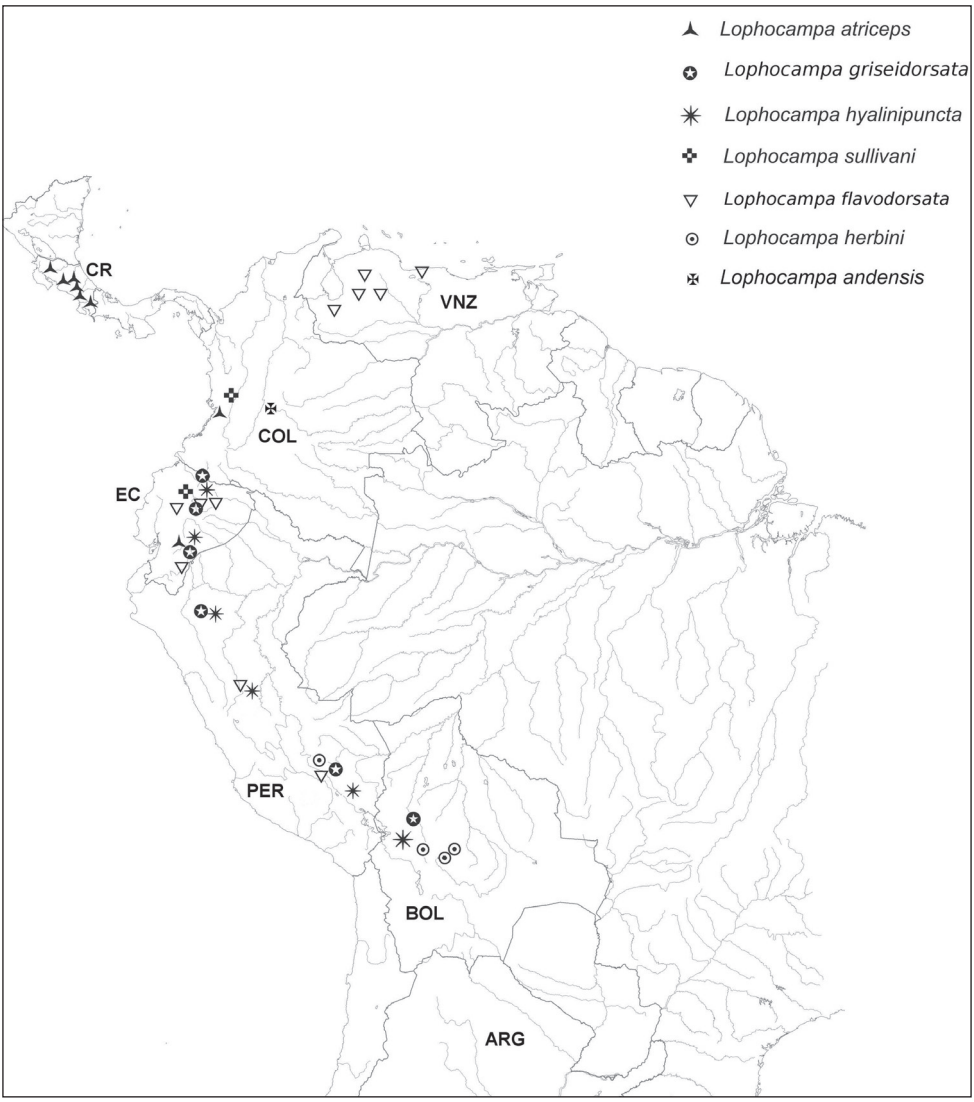


Figure 32. Distribution of examined specimens of the *Lophocampa atriceps* group.

the costa; sinuous postmedial band starts on the anal border and splits between veins CuA2 and CuA1 into two branches that reach the costa. Size of spots constant on basal portion and basal branch. Apical branch constituted of larger spots. After their separation branches surround a strong brown reniform spot. Subterminal band constituted of different-shaped spots: spot near tornus forms a <-mark, 2nd spot larger, spots above veins CuA1 and M2 very small and flattened; three spots near apex large; last one at apex is large and ovate. A terminal line of white dots on the margin. Ventrally, the ornamentation is the same but paler. **Hindwing -** Whitish slightly tinged with grey on apex and along the costa. Ventrally, the marks are more contrasted, deep brown centered with yellowish brown. **Abdomen -** Tergites pale orange and almost

entirely covered with long grayish brown hairs, with lateral series of black spots. Last segment pale orange without hairs. Sternites brown. **Male genitalia -** Uncus spatulated and setose. Tegumen and vinculum very slender. Saccus tongue shaped and folded ventrally. Valvae symmetrical, wide, reaching uncus apex. Valvae with prominent costa and acute, bifid apex, one tip short and rounded, the other very long and acute. Juxta with two curved arms fused apically to give a crescent-like sclerotized patch. Transtilla with two arms moving away at apex and which are not fused. Aedoeagus. Penis narrow and rectilinear. Caecum penis present. Vesica with a small and a large area of cornuti distally. **Female** - (Description based on allotype): identical to male excepted the following differences: Antennae with pectinations shorter than male. Wingspan slightly larger. **Female genitalia** - Lamella antevaginalis slightly sclerotized, rectangular with a medial notch on the posterior margin. Apophyses posteriores straight, enlarged at base, 1.2 mm long. Apophyses anteriores slightly curved, slender and 0.7 mm long. Papillae anales rectangular and setose, with a pair of large pseudopapillae. Dorsal saccular pheromone glands absent. Ductus bursae rectangular and striped. Corpus bursae reduced, oval, very wrinkled. Appendix bursae slightly smaller than corpus bursae, without signa. Apical insertion of the ductus seminalis.

Biology and distribution. Rab Green et al. (2011) described and figured the larva of this new species under the name *Lophocampa atriceps*. The comparison with the male genitalia of the studied specimen confirms it belongs to *Lophocampa griseidorsata* sp. n. (Rab-Green pers. comm.). According to Rab Green et al. (2011), the larva feeds on several species of Urticaceae, but also on Poaceae, Fabaceae, Ericaceae, Melanostomaceae, and Rubiaceae. Distribution: Bolivia (Cochabamba, La Paz), Ecuador (Napo, Morona-Santiago, Sucumbios, Azuay), Peru (San Martin, Cuzco, Pasco).

***Lophocampa herbini* Vincent & Laguerre, sp. n.**
urn:lsid:zoobank.org:act:17E08972-5886-4A15-8F70-A4426AE06342
http://species-id.net/wiki/Lophocampa_herbini
Figs 6, 12, 18, 24 and 30

Type material. Holotype - ♂, Bolivia, Santa Cruz, Road Samaipata to Santa Cruz, Km 6, 2037 m, 14-XI-2007, 18.118°S 63.801°W, Barcode ID ARCTA926-09, Sample ID BEVI0821, B Vincent leg., genitalia dissected by B Vincent n° BV 351 [MNHN]. **Allotype** - ♀, Bolivia, Cochabamba, Road Cochabamba - Villa Tunari, PK 85, 2400 m, track to Inca Chaca, PK 4, 14-II-1997, M. Laguerre leg. genitalia dissected by M. Laguerre n° ML 1181 [MNHN] ; **Paratypes** - Bolivia: 3 ♂ + 1 ♀, Cochabamba, Road Cochabamba - Villa Tunari, PK 87, 2000 m, 15-II-1997, genitalia dissected by M. Laguerre n° ML 1155, ML 310, Barcode ID ARCTA179-07, Sample ID MILA0179, M. Laguerre leg. 1 ♂, La Paz, Road Chulumani - Inquisivi, PK 100, 2170 m, 21-X-2000, M. Laguerre leg., genitalia dissected M. Laguerre n° ML 1049, Barcode ID ARCTA073-07, Sample ID MILA0073, all [MLC] ; 3 ♂, Santa Cruz, Road Comara-

pa to Pojo, Km 26.8, 2548 m, 13-XI-2007, S 17.824 W 64.686, Barcode ID ARCTA601-08, ARCTA927-09, ARCTA928-09, Sample ID BEVI0511, BEVI0822 and BEVI0823, B Vincent leg. [BVC] ; Peru: 6 ♂, Cuzco, Road Cuzco to Quillabamba, PK 177, 1.3 km after Alfamayo, 2395 m, 20-II-2009, S 13.061 W 72.413, B. Vincent leg., 3 specimens in [BVC], 3 specimens will be deposited in [MUSM].

Etymology. *Lophocampa herbini* is named in honor of Daniel Herbin, specialist of Saturniidae and friend of the authors.

Diagnosis. *Lophocampa herbini* sp. n. is best distinguished from *L. atriceps* and *L. flavodorsata* sp. n. by the difference in the coloration of the abdominal pilosity, the larger whitish spots on forewings and by the conformation of male and female genitalia. This species can also be distinguished from *L. griseidorsata* with the same characters along with the absence of black spots on the collar. It is also the only species with a thin black line crossing the white ovate apical spot on the forewing.

Description. Head - Antenna bipectinate, brown with basal third vivid yellow and with brownish cilia. Frons whitish with a black T-shaped mark, vertex whitish anteriorly and black centered with brown posteriorly. Palpi erect, deep brown 2nd segment whitish, 3rd segment very short. **Thorax -** Patagia whitish with a square brown spot centered with brownish orange. Pterygodes exteriorly whitish, medially brown, bordered with dark brown. Thorax whitish with a median brown line. Femur whitish, spotted with brown, dorsum vivid yellow. Tibia whitish, spotted with brown. Tarsal segments brown with small whitish spots. **Forewing -** Brown irrorated with pale or deep brown. At base, one whitish spot with one yellow and two small blacks dots. Presence of a series of bands formed by whitish spots and organized as follows: a broken antemedial band. A slightly curved medial band. The size of the spots decreasing from anal border to the costa. A sinuous postmedial band starts on the anal border and splits between veins CuA2 and CuA1 into 2 branches that reach the costa. The size of the spots is constant on the basal portion and the basal branch. The apical branch is constituted by larger spots. After their separation the branchs surround a strong brown reniform spot. Ssubterminal band constituted of different-shaped spots: spot near tornus forming a <-mark, 2nd spot larger, spots above veins CuA1 and M2 very small and flattened; three spots near apex large, last one on apex ovate. Terminal line of white dots on margin. Ventral pattern similar to dorsal, but paler.

Hindwing - Whitish, slightly tinged with grey on apex and along the costa. Ventral pattern more contrasting, deep brown centered with yellowish brown. **Abdomen -** Tergites pale orange, almost entirely covered with long grayish brown hairs, with lateral series of black spots. Last segment pale orange without hairs. Sternites brown. **Male genitalia -** Uncus setose, lozenge shaped, apex truncated and blunt. Tegumen and vinculum very slender. Saccus virtually absent. Valvae symmetrical, wide, reaching uncus apex, without prominent costa. Apex of valvae bifid, the two tips symmetrical, short and acute. Juxta with two curved arms fused apically to give a crescent-like sclerotized patch. Transtilla with two semi-rounded arms which are not fused. Aedoeagus. Penis moderately narrow and rectilinear. Caecum penis present. Vesica wide with four diverticuli and four spine patches: two with small spines and

two with strong spines. **Female** - (description based on allotype): identical to male excepted the following differences:

Antennae with pectinations shorter than male. Wingspan slightly larger. **Female genitalia** - lamella antevaginalis slightly sclerotized, semicircular with a large medial median U-shaped notch on the posterior margin. Apophyses posteriores straight, enlarged at base, 0.9 mm long. Apophyses anteriores narrower, slightly curved and 0.6 mm long. The left apophysis (ventral view) displays a fork at its apical extremity. Papillae anales rectangular and setose with a pair of small pseudopapillae. Dorsal saccular pheromone glands absent. Ductus bursae short, square and striate. Corpus bursae ovate, bearing a large signa. Ductus seminalis ventrally inserted at the extremity of a wide projection of corpus bursae and immediately transformed into a seminal vesicle.

Biology and distribution. Early stages unknown. Distribution: Bolivia (Santa Cruz, Cochabamba), Peru (Cuzco).

***Lophocampa sullivani* Vincent & Laguerre, sp. n.**
urn:lsid:zoobank.org:act:428502AC-C12A-480D-B147-5C759716E1BA
http://species-id.net/wiki/Lophocampa_sullivani
Figs 4, 10, 16, 22 and 28

Type material. Holotype - ♂, Ecuador, Pichincha, Road Chiriboga- Santo Domingo de los Colorados, Km 11, Réserve Rio Gualajito, 1969 m, 01-III-2006, 0.249°S 78.817°W, Barcode ID ARCTA933-09, Sample ID BEVI0828, B. Vincent leg., genitalia dissected by B. Vincent n° BV 289, [MNHN]. **Allotype** - ♀, Ecuador, Pinchicha, Rte Nono – Nanegalito, Km 25, 1840 m, 10-I-1983, C. Lemaire and N. Venedictoff leg., genitalia dissected by B. Vincent n° BV 282, Barcode ID ARCTA934-09, Sample ID BEVI0829, [MNHN]. **Paratypes** - Ecuador: 1 ♂, Pichincha, Road Nono -Nanegalito, pK 25, 1850 m, 30-VII-1997, Barcode ID ARCTA840-07, Sample ID MILA0559, M. Laguerre leg., genitalia dissected by M. Laguerre n° ML 316 ; 1 ♂, same data, genitalia dissected by M. Laguerre n° ML 1224, all [MLC] ; Colombia: 2 ♂, Valle del Cauca, Finca Monte Bello, 5 km South of Bitaco, 30-I-1988, 2000 m, Bo Sullivan leg. [BSC].

Etymology. *Lophocampa sullivani* is named in honor of J. Bolling Sullivan who collected this species in 1988.

Diagnosis. *Lophocampa sullivani* sp. n. can be best distinguished from *L. atriceps* by the absence of black dots on the collar and by the structure of the genitalia. It can be distinguished from *L. griseidorsata* sp. n. and *L. herbini* sp. n. by the difference in color of the abdominal scales. *Lophocampa sullivani* sp. n. is very close in appearance to *L. flavodorsata* sp. n. but can be separated by characters of the male genitalia, including the very prominent cucullus on the valve, the more robust genitalia and the presence of only three spine fields on the vesica. The female genitalia appear to be identical to those of *L. flavodorsata*.

Description. Head - pale yellowish, vertex brown with horizontal yellow bar, palpi dark fuscous with 2nd segment yellowish orange; antenna yellowish brown with brown-

ish ciliae. **Thorax -** Patagia yellowish brown with a square brown spot centered with yellow, pterygodes striated with yellowish brown and chestnut brown, thorax yellowish with admixture of brown hairs. Legs yellowish, spotted with chestnut brown, fore coxae orange. **Forewing -** Yellowish irrorated with chestnut brown and a series of creamy-white spots with diffuse brown edges. At base, one orange spot with two small black dots. An antemedial, very oblique series of three creamy-white spots; a medial series angled on median vein, then very oblique, the two spots towards costa small; a spot at end of cell; an oblique postmedial series of six spots starting from anal border extending to end of cell followed by two series of three large spots, one basad and one distad, the last one just on the apex has the bottom constricted; a subterminal series of four spots, one near tornus forming a <-mark, the 2nd large, those above veins 3 and 4 smaller; a terminal line of white dots on the margin. **Hindwing -** Yellowish white slightly tinged with fuscous on apex and along the costa. **Abdomen** - entirely yellowish, with lateral series of black spots and ventral surface whitish. **Male genitalia -** Genitalia very robust. Uncus rectangular and setose, with slightly rounded apex. Tegumen and vinculum slender. Saccus tongue shaped and folded ventrally. Valvae symmetrical, wide and relatively short with apex notched into two points: one blunt and one acute. Cucullus prominent, slender and elongate, folded inward. Juxta very narrow, with two arms fused apically in a small V-shaped sclerotized patch. Transtilla slender, shaped like a tongue interrupted in the middle. Penis rectilinear. Caecum penis present. Vesica wide with four lobes. Presence of three areas of cornuti, two densely covered with small spines and one sparsely covered with strong spines. **Female** – (description based on allotype): identical to male except for antennae with pectinations shorter than male and wingspan slightly larger. **Female genitalia** - identical to those of *Lophocampa flavodorsata*.

Biology and distribution. Early stages unknown. Distribution: Ecuador (Pichincha), Colombia (Valle del Cauca).

***Lophocampa andensis* (Schaus, 1896)**
http://species-id.net/wiki/Lophocampa_andensis

Halisidota andensis Schaus, 1896: 138

Type material. Lectotype male n° 11079 designated by Watson 1973: 7 [USNM] examined. Type locality: Colombia. The genitalia was dissected by A. Watson (slide N° AW 626 in USNM). The lectotype specimen and genitalia are figured in Watson (1973).

Diagnosis. *Lophocampa andensis* is the smallest species of the group, with the length of the male forewing less than 20 mm. It is also distinguished from other species by the rounded apex of the forewings and by the spots between M2 and CuA1 on the forewing subterminal band, which are at least as large as the others.

Biology and distribution. Early stages unknown. Distribution: Only known from Colombia.

***Lophocampa hyalinipuncta* (Rothschild, 1909)**
http://species-id.net/wiki/Lophocampa_hyalinipuncta
Figs 2, 8, 14 and 20

Halisidota hyalinipuncta Rothschild, 1909: 217.

Type material. Described from four male syntypes [BMNH]. Type locality: [Peru], [Puno], Agualani, Carabaya. One specimen of this syntype series is labelled 'TYPE'. The same specimen is labelled "Halisidota hyalinipuncta Rothschild Type" on a pink label in Rothschild's hand.

Diagnosis. *Lophocampa hyalinipuncta* can be distinguished from *L. atriceps*, *L. flavodorsata* sp. n. and *L. sullivanni* sp. n. by the different pattern of scales on the **Abdomen -** The spots of the subterminal band of the forewing are also significantly smaller than the spots on the postmedial band, a character that separates *hyalinipuncta* from the other species of the group.

Biology and distribution. Early stages unknown. Distribution: Ecuador (Morona-Santiago, Carchi); Peru (Huanuco, Puno, Amazonas); Bolivia (La Paz, Cochabamba, Chuquisaca).

Discussion

Distribution patterns. Each of the five species is restricted to only one slope of the Andean Cordillera (Table 1; Fig. 25); *L. atriceps* and *L. sullivani* are restricted to the western slope; *L. flavodorsata*, *L. griseidorsata*, *L. herbini* occur only on the eastern slope. *Lophocampa atriceps* and *L. sullivani* occur at different elevations, with *L. sullivani* at elevations of 700–1450 m, and *L. atriceps* from 1840 - 2000 m, which will help separate the two taxa. The three taxa occurring on the eastern slope of the Andes overlap in range, and *L. flavodorsata* and *L. griseidorsata* have been collected several times at the same locality. The *atriceps* group occupies a very large area of the Andean Cordillera and extends north to the central mountain range in Costa-Rica at medium to high altitudes.

The Andean Cordillera appears to have created a barrier between the species studied here. *Lophocampa atriceps* is distributed from Central America in the north to Ecuador in the south but is restricted to the western slope in South America. A similar pattern has been observed for several plant species (Schnell 1987). In northern Peru, the presence of a very dry region on the Pacific slope prevents a more southerly range extension.

Molecular data. Twenty-four voucher specimens provided barcode sequences (Table 2). Calculations of genetic distances between species of the *L. atriceps* group (Table 3) support the distinctness of the five species. Intraspecific divergence ranged from 0 – 0.99 % with a mean divergence of 0.21 %. Interspecific divergence ranged from 2.02 – 5.46 % with a mean divergence of 3.61 %.

Table 1. Distribution of *Lophocampa* species. Max. alt: Maximum altitude; Min. alt.: Minimum altitude; P: Pacific; A: Atlantic.

Species	Country (Province)	Min. Alt. (meters)	Max alt. (meters)	Slope
L. atriceps	**Colombia** (Valle del Cauca), **Ecuador** (Guayas) and **Costa Rica** (Alajuela, Guanacaste, Puntarenas, Cartago).	700	1450	P
L. flavodorsata sp. n.	**Venezuela** (Aragua, Lara, Merida), **Ecuador** (Napo, Morona-Santiago, Sucumbios), **Peru** (Cuzco, Huanuco) and **Bolivia** (Cochabamba, La Paz)	1000	2200	A
L. griseidorsata sp. n.	**Ecuador** (Napo, Morona-Santiago, Sucumbios, Azuay), **Peru** (San Martin, Cuzco, Pasco), **Bolivia** (Cochabamba, La Paz)	1400	2100	A
L. herbini sp. n.	**Peru** (Cuzco), **Bolivia** (Santa Cruz, Cochabamba, La Paz)	2000	2500	A
L. sullivani sp. n.	**Colombia** (Valle del Cauca), **Ecuador** (Pichincha)	1840	2000	P
L. andensis	**Colombia** (Cundinamarca)	-	-	A
L. hyalinipuncta	**Ecuador** (Morona-Santiago, Carchi), **Peru** (Huanuco, Puno, Amazonas), **Bolivia** (La Paz, Cochabamba, Chuquisaca)	2000	3350	A

The four new species described herein were all originally identified as *L. atriceps*. Differences in barcode sequences of *L. atriceps* and the four new species described herein range from 8.05 – 9.64 %. These values are significant and confirm the significance of the morphological differences observed and the discrimination of the taxa. The greatest difference (9.64 %) is observed between *L. atriceps* and *L. sullivani*, the unique sympatric species. The geographic isolation that occurred with the species on the eastern slopes of the Andes did not result in the highest divergence values.

The lowest interspecific divergence was observed between *L. griseidorsata* and *L. herbini* with 2.02 %. Morphologically both species are in fact the closest with similar male genitalia structure. They do not appear to be sympatric because their altitudinal difference is in the range of 400 m. Similarly low interspecific divergence is observed also between *L. flavodorsata* and *L sullivani*, with 2.27 %. Again the two species are morphologically similar and show little difference in male genitalia structure, but they occur on different slopes of the Andes. *Lophocampa hyalinipuncta* differs from the new taxa by 3.56 - 5.19 %. These values are significantly lower than for *L. atriceps* (9.33 %) even if the new species have hitherto been confused with *L. atriceps*. Specimens of *L. andensis* were not available for DNA sequencing.

The barcode data shows that *L. flavodorsata* is most closely related to *L. sullivani*, with each restricted to only one slope of the Andes, but with a broader geographic

Table 2. Samples used for the molecular analyses "COI" refers to the barocde sequence length, holotypes in bold.

Species	Country, Province	Collection	COI	SampleID	GenBank
***Lophocampa flavodorsata* sp. n.**	**Ecuador, Napo**	**MNHN**	**658**	**BEVI0825**	**JX887762**
Lophocampa flavodorsata sp. n.	Ecuador, Napo	BVC	658	BEVI0048	JX887766
Lophocampa flavodorsata sp. n.	Ecuador, Napo	BVC	502	BEVI0274	JX887765
Lophocampa flavodorsata sp. n.	Ecuador, Napo	BVC	657	BEVI0275	JX887764
Lophocampa flavodorsata sp. n.	Ecuador, Napo	MLC	267	MILA0557	JX887763
Lophocampa flavodorsata sp. n.	Ecuador, Napo	MLC	267	MILA0558	JX887761
***Lophocampa griseidorsata* sp. n.**	**Bolivia, La Paz**	**MNHN**	**307**	**BEVI0826**	**JX887769**
Lophocampa griseidorsata sp. n.	Ecuador, Napo	BVC	658	BEVI0256	JX887767
Lophocampa griseidorsata sp. n.	Ecuador, Morona-Santiago	BVC	658	BEVI0257	JX887770
Lophocampa griseidorsata sp. n.	Peru, Pasco	BVC	658	BEVI0824	JX887768
Lophocampa griseidorsata sp. n.	Ecuador, Napo	BVC	658	BEVI0258	JX887771
***Lophocampa herbini* sp. n.**	**Bolivia, Santa Cruz**	**MNHN**	**658**	**BEVI0821**	**JX887773**
Lophocampa herbini sp. n.	Bolivia, Santa Cruz	BVC	656	BEVI0511	JX887774
Lophocampa herbini sp. n.	Bolivia, Santa Cruz	BVC	658	BEVI0822	JX887772
Lophocampa herbini sp. n.	Bolivia, Santa Cruz	BVC	658	BEVI0823	JX887777
Lophocampa herbini sp. n.	Bolivia, La Paz	MLC	619	MILA0073	JX887775
Lophocampa herbini sp. n.	Bolivia, Cochabamba	MLC	269	MILA0179	JX887776
***Lophocampa sullivani* sp. n.**	**Ecuador, Pichincha**	**MNHN**	**658**	**BEVI0828**	**JX887782**
Lophocampa sullivani sp. n.	Ecuador, Pichincha	MNHN	307	BEVI0829	JX887781
Lophocampa sullivani sp. n.	Ecuador, Pichincha	MLC	267	MILA0559	JX887783
Lophocampa hyalinipuncta	Bolivia, Chuquisaca	BVC	578	BEVI0199	JX887778
Lophocampa hyalinipuncta	Bolivia, La Paz	MLC	619	MILA0074	JX887780
Lophocampa hyalinipuncta	Bolivia, La Paz	MLC	573	MILA0563	JX887779
Lophocampa atriceps	Costa Rica, Cartago	MLC	658	MILA1506	JX887760

Table 3. Mean Kimura-2-parameter distances for DNA barcode sequences calculated within and between each of the taxa included in the dataset.

	Lophocampa flavodorsata sp. n.	*Lophocampa griseidorsata* sp. n.	*Lophocampa herbini* sp. n.	*Lophocampa sullivani* sp. n.	*Lophocampa hyalinipuncta*	*Lophocampa atriceps*
Lophocampa flavodorsata sp. n.	0 %					
Lophocampa griseidorsata sp. n.	4,98%	0,99%				
Lophocampa herbini sp. n.	3.58%	2,02%	0.39%			
Lophocampa sullivani sp. n.	2.27%	4.58%	4.05%	0.39%		
Lophocampa hyalinipuncta	4.91%	4.14%	3.56%	5.19%	0 %	
Lophocampa atriceps	8,41%	8,55%	8,05%	9.64%	9,33%	-

distribution for *L. flavodorsata*. On the other hand, the pair *griseidorsata* + *herbini* is closest to *hyalinipuncta* and well-differentiated from *flavodorsata* + *sullivani*. Here also one species (*griseidorsata*) has a broad distribution whereas the second (*herbini*) appears to have a very restricted range in Bolivia. *Lophocampa flavodorsata* and *L. griseidorsata* which share a broad range on the Atlantic slope of the Andes display the largest difference in the COI gene sequence (4.9–5.3 %) for the whole group along with the pair *sullivani* + *hyalinipuncta* (which seems normal for such widely differentiated species).

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RESEARCH ARTICLE

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Description of a new species and subspecies of *Idalus* Walker from Costa Rica, Honduras and Guatemala (Lepidoptera, Erebidae, Arctiinae, Arctiini)

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Abstract

A new species and subspecies of *Idalus* Walker are described from Costa Rica, Honduras and Guatemala. Images of males and females and their genitalia are provided. Locality information and distribution maps for Costa Rica and for Guatemala are included. The biology and phylogeny of *Idalus* are discussed.

Keywords

Lepidoptera, Erebidae, Arctiinae, Arctiini, *Idalus paulae* sp. n., *Idalus maesi faustinoi* subsp. *n.*, *Idalus maesi* Laguerre, Myrtaceae, Costa Rica, Honduras, Guatemala

Introduction

Walker (1855) described the genus *Idalus* based on the species *Phalaena admirabilis* Cramer from Surinam. Hampson (1901) provided a further description of the genus, and described only one additional species, with Rothschild subsequently describing nearly half the species currently placed in the genus (Watson and Goodger 1986). Travassos (1949) reviewed 19 species, comparing them to *I. admirabilis* from Amazonas and Southeastern Brazil as well as from Cayenne, French Guiana. The genus presently includes 50 species from the Neotropical region (Watson and Goodger 1986). Collecting in Costa Rica over the past 20 years has revealed 17 distinct species when compared to types in the British Museum of Natural History and the United States National Museum (B. Espinoza, unpublished). Some of these "species" appear to contain several sibling species as revealed by CO1 barcoding (D. H. Janzen, W. Hallwachs, B. Espinoza, unpublished; Janzen et al. 2009). This paper describes one of the distinct new species and compares it to populations with similar wing patterns found throughout Central America which also required that we name a new subspecies as well. The Arctiinae of our usage is the same as Arctiidae of earlier usage (Fibiger and Lafontaine 2005), with *Idalus* in the tribe Arctiini (Watson and Goodger 1986).

Materials and methods

Genitalia were prepared following procedures detailed by Lafontaine (2004). Photographs of adults and genitalia were taken with a Nikon CoolPix 4500, using a super micro lens. Samples of five specimens from Costa Rica and 24 from Guatemala were taken for DNA barcoding and sent to the Canadian Center for DNA barcoding in Guelph, Ontario. The resulting nucleotide sequences, a.k.a. "DNA barcodes" were compared with neighbor-joining trees using Kimura 2-parameter distances (methods in Ratnasingham and Herbert 2007).

Repository abbreviations

INBio	Instituto Nacional de Biodiversidad, Heredia, Costa Rica
USNM	Natural Museum of Natural History, Smithsonian Institution, Washington D. C.
BMNH	The Natural History Museum (formerly, the British Museum of Natural History), London, UK
MNHN	Museum National d' Histoire Naturelle, Paris, France
UVG	Departamento de Biologia de la Universidad del Valle de Guatemala
JBS	Personal collection of J. Bolling Sullivan, Beaufort, North Carolina
JMS	Personal collection of Jose Monzon Sierra, Guatemala
ML	Personal collection of Michel Laguerre, Bordeaux, France

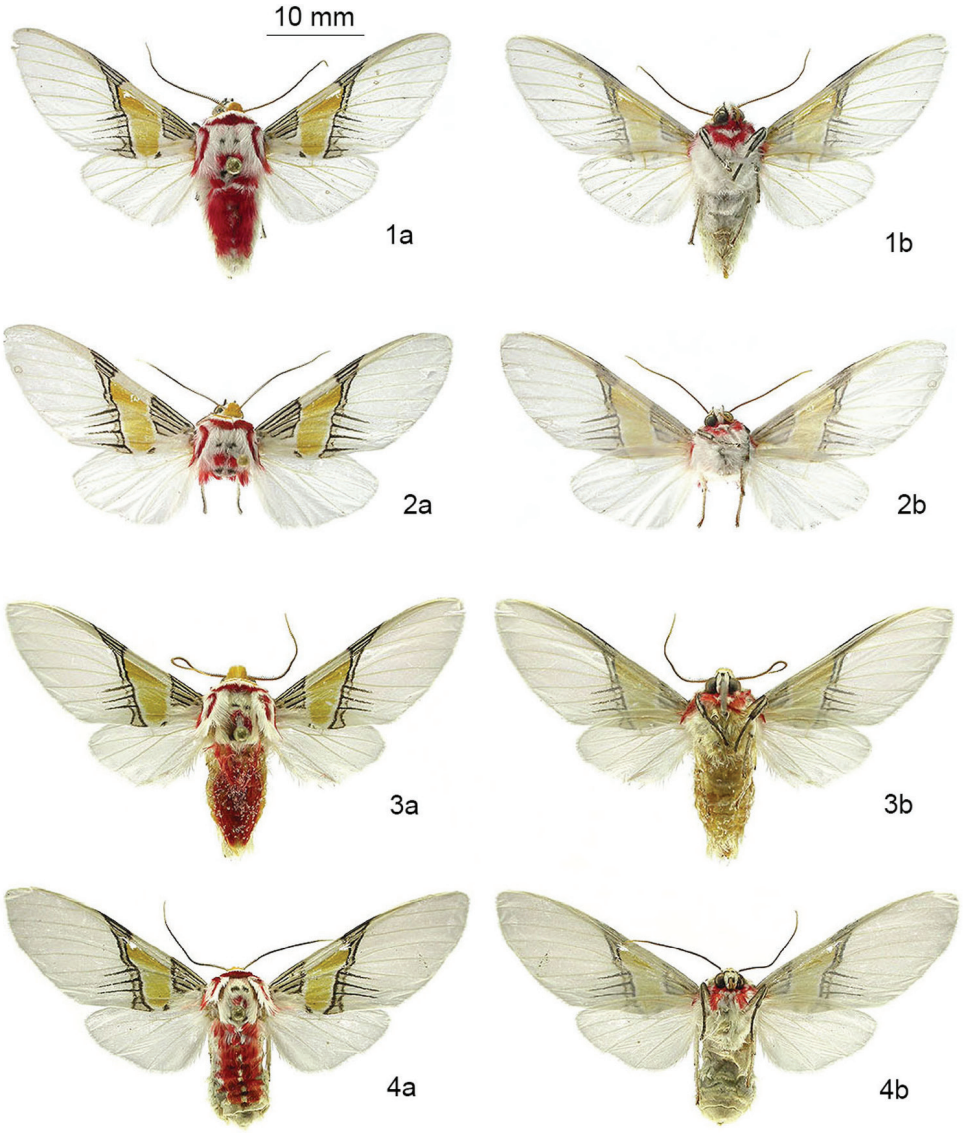
Systematics

***Idalus paulae* Espinoza, sp. n.**
urn:lsid:zoobank.org:act:4002FE75-D422-476C-92C1-4C43ED2466B0
http://species-id.net/wiki/Idalus_paulae
Figs 1, 2, 5, 7

Type material. Holotype. ♂: COSTA RICA: Prov. Heredia, Santa Barbara, Finca La Kandela, 1400–1500m, 10.079°N, 84.159°W, 19–23.Oct.2011, leg. B. Espinoza; Trampa de Luz; Voucher # INB0004301794; GenBank accession # JX681671. [INBio].

Paratypes. 9♂5♀ COSTA RICA: 1 ♂, Prov. Cartago, Tapantí, Río Grande de Orosi, 1300–1400m, 9.775°N, 83.796°W, 09.Apr.1984, leg. DH Janzen & W. Hallwachs; Voucher # INB0003455064, (dissected); 1 ♂, Prov. Puntarenas, Las Tablas, P. Internac. La Amistad, 1920 m, 8.949°N, 82.744°W, 13.Apr.1989, leg. G. Mora, M. Ramirez; Voucher # INBIOCRI000014399, (dissected); 1 ♂, Prov. Puntarenas, P.N. Piedras Blancas, Sector Riyito, 100m, 8.736°N, 83.288°W, 10.Sep.2002, leg. H. Mendez; Tp. de Luz; Voucher # INB0003536513; 1 ♂, Prov. S. José, P. N. Braulio Carrillo, Est. Zurqui, 500 m antes del Tunel, 1600m, 10.059°N, 84.012°W, 01.May.1991, leg. G. Maass; Voucher # INBIOCRI000358645; 2 ♂, Prov. Here, Res. Biol. Chompipe, C. Chompipe, 2100m, 10.088°N, 84.071°W, 9.Set.1991, leg. J. F. Corrales; Voucher # INBIOCRI000392944, INBIOCRI000392945; 1 ♂, Prov. Alajuela, La Paz Waterfall Gardens, alrededores del hotel. 1480m, 10.204°N, 84.167°W, 5–10.Aug.2007, leg. B. Espinoza; Tp. de Luz; Voucher # INB0004313093; 1 ♂, Prov. Cartago, La Unión. Z. P. C. Carpintera, Campo Esc. Istarú, 1750m, 9.891°N, 83.971°W, 16–17.Aug.2008, leg. R. Rojas; Tp. Luz Mercurio; Voucher # INB0004160698; GenBank accession # JX681685; 1 ♂, Prov. Heredia, Santa Barbara, Finca La Kandela, 1400–1500m, 10.079°N, 84.159°W, 19-23.Oct.2011, leg. B. Espinoza; Trampa de Luz; Voucher # INB0004301795; GenBank accession # JX681694; 1♂, Prov. San José, San Gerardo de Dota, QERC, 2230m, 9.619°N, 83.835°W, 16–27.Mar.2003, leg. J. B. Sullivan, J.D. Lafontaine; 1♀, Prov. San José, Par. Nac. Braulio Carrillo, Estación Zurquí (el Túnel), 1500m, 10.063°N, 84.011°W, 01.Oct.1985, leg. I. y A. Chacón; Voucher # INB0003506722; 1 ♀, Prov. San José, Par.Nac. Braulio Carrillo Estación Zurquí (el Túnel), 1500m, 10.063°N, 84.011°W, 9–11.Jun.1986, leg. I. y A. Chacón; Voucher # INB0003428272; 1♀, Prov. S. José, P. N. Braulio Carrillo, Est. Zurquí, 500 m antes del Tunel, 1600m, 10.059°N, 84.012°W, 01.May.1991, leg. G. Maass; Voucher # INBIOCRI000654190, (dissected); 1 ♀, Prov. Cartago, Paraíso, Pque Nal Tapantí, Sect La Represa, del Puente del Río Porras 300m SE, 1660m, 9.695°N, 83.781°W, 01.Jul.2002, leg. R. Delgado; Tp de Luz; Voucher # INB0003520571, (dissected); GenBank accession # JX681695. Paratypes deposited in INBio, BMNH, USNM, JBS.

Etymology. This species is named for Ana Paula Zamora Espinoza, the author's niece who has brought much happiness to her family.

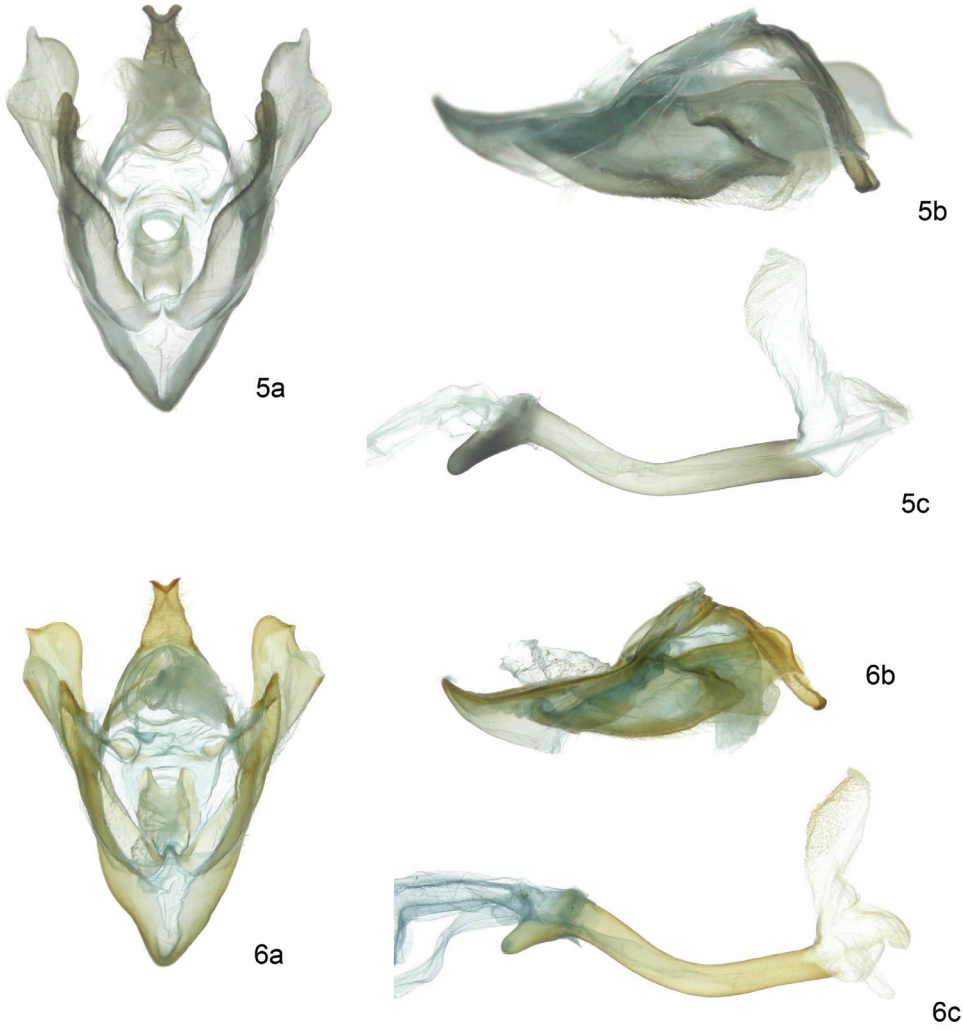


Figures 1–4. Adults of *Idalus paulae* sp. n. and *Idalus maesi faustinoi sub*sp. n. **a** dorsal view, **b** ventral view. **1a, b** *I. paulae*, sp. n., male holotype, INB0004301794 **2a, b** *I. paulae* sp. n., female paratype, INB0003520571 **3a, b** *I. maesi faustinoi*, subsp. n., male holotype, BAES000004 **4a, b** *I. maesi faustinoi*, subsp. n., female, BAES000012

Diagnosis. This species can be recognized by the four dark-brown horizontal stripes on the medial area of forewings, between vein Cu1 and the posterior margin together with the yellow medial area (Figs 1, 2), uncus with a bifid and U-shaped terminus in dorsal view, valve with the saccular margin lobulated in the middle (Figs 5a, 5b) and by

its distinctive DNA barcode. It is very similar to *Idalus maesi faustinoi*, which has only three dark brown horizontal stripes on postmedial area of forewing.

Description. Adult male (Figs 1a, 1b, 5a, 5b, 5c). *HEAD*: Small head and large eyes; antennae serrate, base and antennae tip white, mid shaft brown; vertex slightly raised and hairy, yellow-orange; frons white with irregular mesial dark brown patch; labial palpi short and robust, upper half dark brown and lower half white; proboscis well developed. *THORAX*: Patagium white with red posterior edge and transverse yellow-orange band; tegula white, red laterally with a stripe curving inward extending from the base to the apex; thorax robust, white, with two small and elongate dark brown anterior patches, two large, red mid-dorsal patches and two small dark brown rounded patches on the posterior margin, ventrally white, hairy and with a red, longitudinal and ventrolateral stripe below the wings; anterior coxae striped with red. Forelegs white, femur dark brown on the proximal surface, tibia double striped with dark brown from base to tips, tarsal segments brown on the anterior surface; middle legs white, femur with a dark brown patch on tips, tibia double striped with dark brown on the proximal half, tarsi white with brown irregularly on posterior surface; hind legs white, a dark brown patch at the junction of the femur and tibia, tarsi white with irregular brown on posterior surface. *ABDOMEN*: White ground color, dorsally red between terga 1 and 7, basal segment with an irregular patch of long white hair and a series of small white dots between terga 3 and 7; white ventrally. *WINGS*: Forewing length 20.4 mm (n = 10). Semihyaline, white ground color, a creamy-white triangular basal patch edged with brown and with four fine dark brown longitudinal lines between the costal margin and the anal vein; a small brown spot in the postbasal area running to the posterior margin; medial area with a large yellow-orange patch between anal margin and R1; a fine transverse dark brown line goes from the anal margin toward the costal margin and turns medially on it; a second parallel fine line, straight from the costal margin to the vein Cu1, then undulating from below it to the anal margin; on the costal margin and between the transverse lines, two very fine dark brown lines between the costal vein and R1 and four more stripes, one between Cu1 and Cu2, two between Cu2 and the anal vein and one between the anal vein and the posterior margin. Hindwing semihyaline white, expanded in humeral area. *GENITALIA* (Figs 5a,b,c): uncus elongate, slightly flattened dorso-ventrally and with an acute shape distally, on its dorsum a thin, longitudinal mesial ridge arising from near the base and almost reaching the tip, terminus bifid and U-shaped in dorsal view and with an acute edge. Valve sclerotized, very wide at the base, acute and slightly concave at the apex and with the saccular margin lobulated in the middle; a large lobe arising distally from the outer surface with a straight costal margin, the saccular margin lobulated in the middle and with a small and acute projection at the tip. Juxta convex, very slightly sclerotized but not well defined; transtilla membranous and very slightly sclerotized at the base of valvae; saccus short and V-shaped; aedeagus long, thin, curved ventrally in the anterior part and curved dorsally in the distal part; vesica short, with two basal diverticuli, one small lateral diverticulum on the right side and another in front projecting slightly ventrally and spinulose, distal



Figures 5–6. Male genitalia of *Idalus*. **a** ventral view of genital capsule **b** lateral view of genital capsule **c** left lateral view of aedeagus **5a, b, c** *Idalus paulae*, paratype, INBIOCRI000014399 **6a, b, c** *Idalus maesi faustinoi,* paratype, BAES000017

portion of vesica with a large spinulose patch. **Adult female** (Figs 2a, 2b, 7). *HEAD*: antennae serrate but less so compared to male antennae; sensillae less dense and shorter in length compared to males. *THORAX*: markings as in male. *ABDOMEN*: markings as in male, but more robust and rounded at the tip. *WINGS*: Slight sexual dimorphism, with the only differences being that the shape and size of the female wing (forewing length**:** 22.8 mm (n = 04)), is broader and longer than that of the male, and the wing apices of the females are more rounded than in the males. *GENITALIA* (Fig. 7): Anal papillae flattened laterally and rectangular in lateral view with a dense patch of short setae dorso-laterally; posterior apophysis 2.5 x as long as anterior apophysis; ostium scle-

rotized, very wide, dorsal margin rugose, ventral margin deeply concave and U-shaped; ductus bursae elongate, sclerotized and compressed dorsoventrally; corpus bursae oval, membranous and rugose with two small spiculate signa, one on each side the bursa; appendix bursa oval, slightly smaller than corpus bursa.

Distribution and biology. *I. paulae* has been collected between 1400 and 2230 m elevation in rain forest and the margins of cloud forest, on both Pacific and Atlantic slopes, from 1400 to 2230 m in the Cordillera Volcanica Central and the Cordillera de Talamanca of Costa Rica. There is a single specimen from the rain forest lowlands on the lowest slopes of the Cordillera Talamanca (100 m.) (Fig. 9). This is an unexpected locality but we are unable to find any differences between it and the remaining series of this species. Adults of *I. paulae* have been collected throughout the year but only in short series as the species is uncommon at lights and in light traps. No immature stages have been found but *I. admirabilis,* a related species, is known to feed on plants of the family Myrtaceae (Porto Santos et al. 2006).

Idalus maesi faustinoi **Espinoza subsp. n.**
http://species-id.net/wiki/Idalus_maesi_faustinoi
Figs 3, 4, 6, 8

Type material. Holotype. ♂**:** GUATEMALA: Zacapa, San Lorenzo, El Naranjo, 1616m, 15.073°N, 89.685°W, 06.Jan.2010, leg. José Monzón; Voucher # BAES000004; GenBank accession # JX681678. [INBio]. **Paratypes. GUATEMALA:** 3♂, Zacapa, San Lorenzo, El Naranjo, 1616m, 15.073°N, 89.685°W, 06.Jan.2010, leg. José Monzón; Voucher # BAES000001, BAES000002, GenBank accession # JX681669; BAES000003, GenBank accession # JX681672; 7♂1♀, Suchitepequez, Santa Barbara, Ref. Quertzal UVG, 1600m, 14.542°N, 91.197°W, leg. Monzón y Camposeco; 1♂, 2010, Voucher # BAES000013; GenBank accession # JX681670; 1♀, 2010; Voucher # BAES000016; GenBank accession # JX681693; 1♂, 8.Feb.10, Voucher # BAES000014; GenBank accession # JX681691 (dissected); 5♂, 13.Jan.10, Voucher # BAES000017, GenBank accession # JX681681 (dissected); BAES000019, GenBank accession # JX681675 (dissected), BAES000020, GenBank accession # JX681677, BAES000021, GenBank accession # JX681687; BAES000018, GenBank accession # JX681667; 4♂2♀, San Marcos, Camino Fraternidad a Bojonal, 1600m, 14.946°N, 91.881°W, 12.Apr.2010, leg. José Monzón S.; 4♂, Voucher # BAES000007, GenBank accession # JX681698; BAES000008, GenBank accession # JX681683; BAES000009, GenBank accession # JX681665; BAES000010, GenBank accession # JX681676; 2♀, Voucher # BAES000011, GenBank accession # JX681674; BAES000012, GenBank accession # JX681682; 2♂, Huehuetenango, Barillas Unión Las Palmas, 1444m, 15.931°N, 91.299°W, 12.Apr.10, leg. Camposeco y Monzón; Voucher # BAES000005, GenBank accession # JX681689 (dissected); BAES000006, GenBank accession # JX681668. **Additional material examined. HONDURAS**: 1♀, Tegucigalpa, Cloud

Figures 7–8. Female genitalia of *Idalus*. **7** *Idalus paulae*, paratype, INB0003520571, ventral view **8** *Idalus maesi faustinoi*, BAES000024, ventral view.

forest, 7000ft, 8.Aug.1972, leg. Robert D. Lehman; Black light (dissected). **GUATEMALA:** 9♂2♀, Suchitepequez, Santa Barbara Ref. Quertzal UVG, 1600m, 14.542°N, 91.197°W, leg. Monzón y Camposeco. 1♂, 13.Mar.2010, Voucher # BAES000022, GenBank accession # JX681690; 2♀, 13.Mar.2010, Voucher # BAES000023, GenBank accession # JX681696; BAES000024, GenBank accession # JX681697 (dissected); 1♂, 10.Apr.2010, Voucher # BAES000015, GenBank accession # JX681686; 2 ♂, 10.Sep.2007; 1♂, 01.Oct.2008; 1♂, 20.Sep.2009; 1♂, 15.Nov.2009; 2♂, 12.Dec.2009; 5♂2♀, San Marcos, Camino Fraternidad a Bojonal, 1600m, 14.946°N, 91.881°W, leg. José Monzón S. 2♂, 1♀, 27.Jul.2008; 1♀, 8.Aug.2008; 1♂, 6.Oct.2008; 2♂, 22.Sep.2009; 1♂, Huehuetenango, Barillas Unión Las Palmas, 1444m, 15.931°N, 91.299°W, 03.Sep.2010, leg. Camposeco y Monzón; 2♂, Baja Verapaz, Cerca Purulha, Hotel Ranchitos del Quetzal, 1656m, 13.Jul.2009, 15.216°N, 90.219°W, leg. Col. José Monzón S.; 1♀, Suchitepequez, Atitlan Reserve, 1570m, 14°328N 91°116W, 9–10.May.2007, leg. M. Laguerre; Voucher # MILA.0407; Dissected, Gen. Voucher # MILA 1784; 1♂, Sacatepequez, San Cristobal el Bajo, Finca El Pilar, 1960m, 14°323N 90°422W, 24.Jul.2004, leg. J.Haxaire & O.Paquit. Paratypes deposited in INBio, BMNH, USNH, UVG, JMS, ML, MNHN.

Etymology. This subspecies is named after Faustino René Camposeco López, a field technician of the Universidad del Valle de Guatemala, who with José Monzón helped collect the type series.

Diagnosis. This subspecies is closely related to *Idalus paulae* which has four dark-brown horizontal stripes on postmedial area of forewings but can be distinguished by the three dark brown horizontal stripes distal to the yellow median area, between vein Cu1

and the anal vein (Figs 3, 4), uncus with a bifid and V-shaped terminus in dorsal view, valve with the saccular margin very slightly lobulated in the middle (Figs 6a, 6b) and by its distinctive DNA barcode. From *Idalus maesi maesi* it is easily recognized by it maculation patterns, in *I. maesi maesi* the basal and medial area of forewings, as well as patagium are white, the thorax has no red mid-dorsal patches and the basal abdominal segments are white. DNA barcode of *I. maesi maesi* and *I. maesi faustinoi* differ by 0.65%.

Description. Adult male (Figs 3a, 3b, 6a, 6b, 6c). *HEAD*: Head small and eyes large; antennae serrate, base and antenna tip white, mid shaft brown; vertex yellow-orange, slightly raised and hairy; frons white with irregular mesial dark brown patch; labial palpi short and robust, upper half dark brown and lower half white; proboscis well developed; *THORAX*: Patagium white with a red posterior edge and transverse yellow-orange band; tegula white, red laterally and with a stripe curving inward extending from the base to near the apex; thorax robust, white, with two small, elongated dark brown anterior patches, two large, red mid-dorsal patches and two small dark brown rounded patches on the posterior margin, ventrally white, hairy and with a red, longitudinal and ventrolateral stripe below the wings; anterior coxae striped with red. Forelegs white, femur dark brown on the proximal surface, tibia double striped with dark brown from base to tips, tarsal segments brown on the anterior surface; middle legs white, femur with a dark brown patch on tips, tibia double striped with dark brown on the proximal half and with a small dark brown patch on tips, tarsi white with brown irregularly on posterior surface; hind legs white, a dark brown patch at the junction of the femur and tibia and at the junction of the tibia with the tarsi, tarsi white with irregular brown on posterior surface. *ABDOMEN*: White ground color, dorsally red between terga 1 and 7, basal segment with an irregular patch of long white hair and a series of small white dots between terga 3 and 7; white ventrally. *WINGS*: Forewing length 19.2 mm (n = 19). Semihyaline, white ground color, a creamy-white triangular basal patch edged with brown and with four fine dark brown longitudinal lines between the costal margin and the anal vein; a small brown spot in the postbasal area running to the posterior margin; medial area with a large yellow-orange patch between anal margin and R1; in the medial area, a fine transverse dark brown line goes from the anal margin toward the costal margin and turning medially on it; a second parallel fine line, straight from costal margin to the vein Cu1 and then undulating from below it to the anal margin; on the costal margin and between the transverse lines, two very fine dark brown lines between the costal vein and R1 and three more stripes, one between Cu1 and Cu2 and two between Cu2 and the anal vein. Hindwing semihyaline white, expanded in humeral area. *GENITALIA* (Figs 6a,b,c): uncus elongate, slightly flattened dorso-ventrally and acute distally, on its dorsum a thin, longitudinal mesial ridge arising from near the base and almost reaching the tip, terminus bifid and V-shaped in dorsal view and with acute edges. Valve sclerotized, very wide at the base, acute and slightly concave at the apex and the saccular margin very slightly lobulated in the middle; a large lobe arising distally from the outer surface with a straight costal margin, the saccular margin lobulated in the middle and with a very small, acute projection at the tip. Juxta convex, very slightly sclerotized but not well defined; transtilla mem-

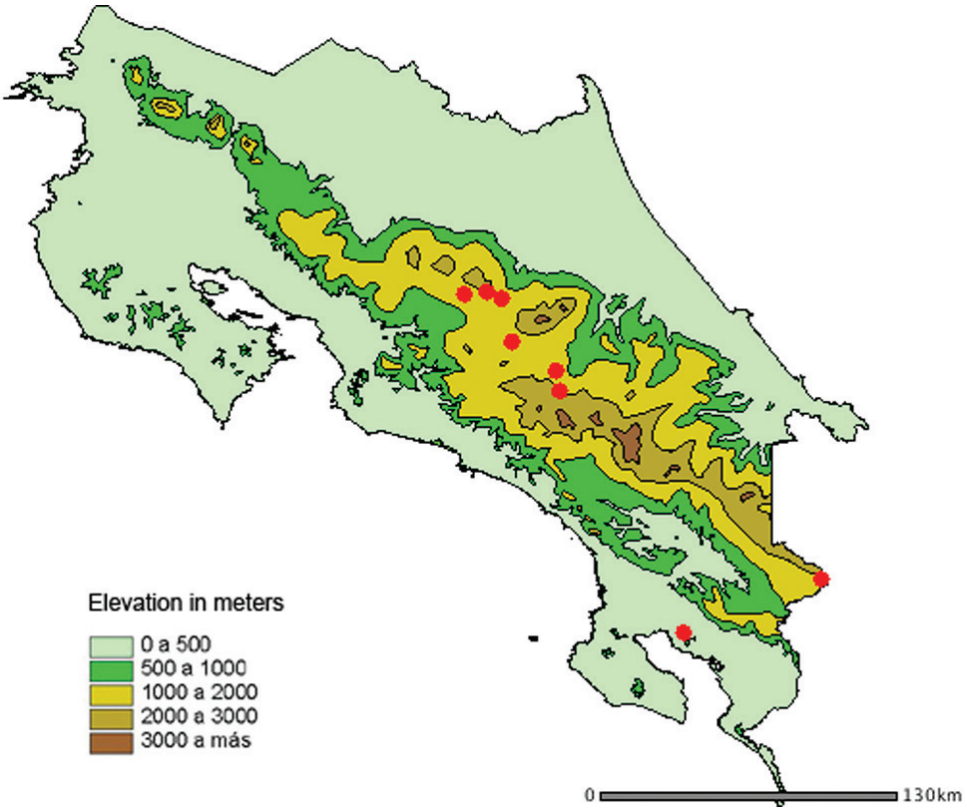


Figure 9. Distribution map of *Idalus paulae* sp. n. in Costa Rica.

branous and very slightly sclerotized at the base of valvae; saccus short and V-shaped; aedeagus long, thin, curved downward ventrally in the anterior portion and upward dorsally in the distal part; vesica short, with two basal diverticuli, one small lateral diverticulum on the right side and another in front projecting slightly ventrally and spinulose, distal portion of the vesica with a large spinulose patch. **Adult female** (Figs 4a, 4b, 8). *HEAD*: antennae serrate but less so compared to male antennae; sensillae less dense and shorter in length compared to males. *THORAX*: markings as in male. *ABDOMEN*: markings as in male, but more robust and rounded at the tip. *WINGS*: Slight sexual dimorphism, with the only differences being that the shape and size of the female wing (forewing length**:** 22.2 mm (n = 5)), is broader and longer than that of the male, and the wing apices of the females are more rounded than in the males. *GENITALIA* (Fig. 8): Anal papillae flattened laterally and rectangular in lateral view with a dense patch of short setae dorso-laterally; posterior apophysis 2.5 x as long as anterior apophysis; ostium sclerotized, very wide, dorsal margin rugose, ventral margin deeply concave and V-shaped; ductus bursae elongate, sclerotized and compressed dorsoventrally; corpus bursae oval, membranous and rugose with two small spiculate signa, one on each side the bursa; appendix bursa oval, same size as corpus bursa.

Distribution and biology. In Guatemala (Fig. 10) *I. maesi faustinoi* is reported from cloud forest at 1444 to 1616 m elevation (José Monzón personal comm.). A single female specimen from Honduras, Tegucigalpa is recorded from cloud forest at 2133 m. Adults have been captured throughout the year. No immature stages have been found but *I. admirabilis,* a related species, is known to feed on Myrtaceae (Porto Santos et al. 2006).

Comments. The Arctiinae (formerly Arctiidae) are estimated to have 11,000 species worldwide, with 6,000 species in the Neotropics (Watson and Goodger 1986). Some 20 years ago the Costa Rican fauna was estimated to be 350 species in 80 genera (INBio collections). At present there are an estimated 1,000 species in 215 genera in Costa Rica (INBio collections), which is remarkable given the small size of the country. Comparative DNA sequencing of the CO1 locus indicates that even more species are present (D. H. Janzen, W. Hallwachs, B. Espinoza, J. B. Sullivan, unpublished data).

According to Travassos (1949, 1950) *Idalus* species have a well-developed proboscis; short and upright labial palpi with the third segment tiny; antenna serrate in both sexes; elongate wings; forewing venation with Sc ending before the apex of wing, R1 arising from discal cell and ending before reaching the apex of wing, R2 and R3 ending before the apex of wing, R4 ending on the apex, R5 ending after apex, M1 arising from anterior angle of discal cell, M2 and M3 arising from posterior angle of discal cell, Cu1 arising from near the posterior angle of discal cell, Cu2 arising from the distal third of the cell, anal vein ending on tornus; hindwing venation with Sc arising from the distal half of cell and not reaching the costal margin of wing, R arising from anterior angle of cell, M and Cu1 arising from posterior angle of cell, Cu2 arising from the distal half of cell, A1 ending before reaching tornus and A2 ending on tornus. The newly described taxa *I. paulae* and *I. maesi faustinoi* are consistent with these characters. DNA barcoding and neighbor-joining analyses (Ratnasingham and Hebert 2007) of almost all the species of *Idalus* in Costa Rica (*I. aleteria* (Schaus), *I. carinosa* Schaus, *I. crinis* Druce, *critheis* Druce, *I. dares* Druce, *fasciipuncta* Rothschild, *I. herois* Schaus, *I. perlineosa* Rothschild, *I. tuisiana* Schaus, *I. tybris* (Cramer), *I. veneta* Dognin, *I. borealis* (Rothschild), *I. vitrea* (Cramer), *I. vitreoides* (Rothschild), plus several unnamed species) group them in two groups that appear to be related groups. *I. paulae*, *I. maesi maesi* (Laguerre, 2006) and *I. maesi faustinoi* form a related group to *I. admirabilis, I. crinis* and *I. herois.* The caterpillars of this latter group of three species is known to eat foliage of Myrtaceae (Porto Santos et al. 2006), (D. H. Janzen and W. Hallwachs, unpublished). The *admirabilis-maesi* groups make up one of the primary branches of *Idalus*. The other primary branch divides into a *vitrea* group and a *perlineosa* group. *I. borealis* is in the *vitrea* group and caterpillars have been found feeding on Combretaceae (*Combretum*) (D. H. Janzen and W. Hallwachs, unpublished). *I. perlineosa* and a likely undescribed sibling species both in the p*erlineosa* group feed on Proteaceae (*Roupala*) (D. H. Janzen and W. Hallwachs, unpublished). Interestingly, while maculation patterns vary widely in the genus, these patterns unlike the foodplant associations, do not cluster cleanly among the four groups. The color patterns included by Travassos in his *admirabilis* group sort into all four barcode groups.

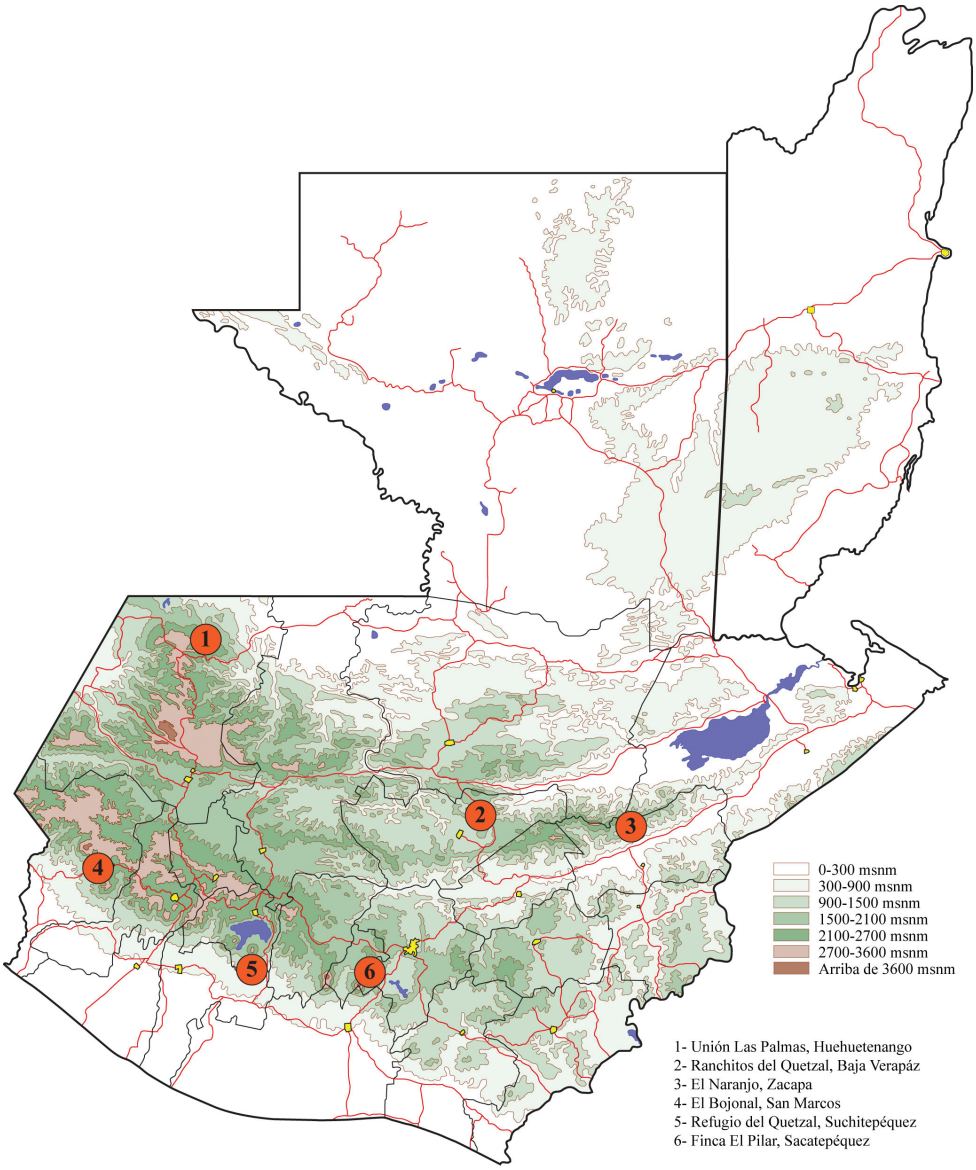


Figure 10. Distribution map of *Idalus maesi faustinoi*, subsp. n. in Guatemala.

I. paulae differs from *I. maesi* maesi and *I. maesi faustinoi* in DNA sequence of the CO1 locus by approximately 5%. *I. maesi maesi* and *I. maesi faustinoi* differ by at least 1% but *I. maesi faustinoi* breaks into two groups differing by 0.65%. *I. maesi maesi* clearly differs from *I. paulae* and *I. maesi faustinoi* in maculation (the median yellow area is white) but does not appear to differ in male and female genitalia (M. Laguerre, personal communication). Geographically, *I. maesi maesi* occurs in the mountains of northern and southern Pacific Nicaragua, *I. paulae* in the mountains of Costa Rica,

and *I. maesi faustinoi* in the mountains of Honduras and Guatemala. The two distinct haplotype groupings of *I. maesi faustinoi* may represent two taxa but because they seem to have identical maculation and genitalia and because they do not sort geographically, we have chosen not to name both groups. Instead, the holotype and paratypes are based on populations from the northern montane slopes in Guatemala. It will take additional studies to resolve the haplotype distributions and to establish the food plants upon which this group feeds.

We have not tried to establish morphological characters that separate the *maesi* group from the other three *Idalus* groups. However, we have noticed that in the *maesi* group, sexual modifications of scales and venation in the area of wing overlap are absent but present in those species we have examined from the other three groups. The humeral area is lobed but that character applies to most Arctiinae. The small differences in the CO1 sequences between *I. maesi maesi* and *I. maesi faustinoi* may reflect recent and rapid evolution of these species in the complex montane regions of Central America.

Acknowledgments

We thank the ACG parataxonomists for finding and rearing the caterpillars of *Idalus*, and light-trapping adults. We thank Michel Laguerre and Benoit Vincent for dissections and information provided from their personal collections; José Monzón, Jack C. Schuster, Enio B. Cano, Faustino Camposeco and the Departamento de Biología de la Universidad del Valle de Guatemala for the specimens from Guatemala that are included in this revision as well as CONAP for collecting and research permits in that country. We are indebted to the USNM for the loan of the specimen from Honduras, and to the Instituto Nacional de Biodiversidad (INBio) for the information, office and collection space, and specimens provided, to Carolina Garro Morales for reading and correcting to the manuscript, and finally to our colleagues Eugenie Phillips, Isidro Chacón and Ronald Zuñiga for their encouragement and support. This study was supported by Jessie Hill, the JRS Biodiversity Foundation, the Wedge Foundation, the Genome Canada, and NSF BS&I DEB 0515699 to D.H. Janzen.

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RESEARCH ARTICLE

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Five new species and three new subspecies of Erebidae and Noctuidae (Insecta, Lepidoptera) from Northwestern North America, with notes on *Chytolita* Grote (Erebidae) and *Hydraecia* Guenée (Noctuidae)

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Abstract

Several taxonomic issues in the moth families Erebidae and Noctuidae are addressed for Northwestern North America. *Drasteria parallela* Crabo & Mustelin and *Cycnia oregonensis tristis* Crabo in the Erebidae and *Eudryas brevipennis bonneville* Shepard & Crabo, *Resapamea diluvius* Crabo, *Resapamea angelika* Crabo, *Resapamea mammuthus* Crabo, *Fishia nigrescens* Hammond & Crabo, and *Xestia perquiritata orca*

Crabo & Hammond in the Noctuidae are described as new. The following new synonyms are proposed: *Chytolita petrealis* Grote with *Herminea morbidalis* Guenée; *Gortyna columbia* Barnes & Benjamin and *Gortyna ximena* Barnes & Benjamin with *Gortyna obliqu*a Harvey; and *Hydroecia pallescens* Smith with *Hydroecia medialis* Smith. The type locality of *Gortyna intermedia* Barnes & Benjamin is restricted to Lundbreck, Municipality of Crowsnest Pass, Alberta, Canada.

Keywords
Canada, United States, Alaska, CO1, mitochondrial DNA, barcodes

Introduction

A website devoted to the macromoths (excluding the Geometridae) of the Pacific Northwest was recently created by a team that includes the authors of the current paper. The Pacific Northwest (PNW) is defined as all of Idaho, Oregon, and Washington and the western part of Montana in the United States and all of British Columbia in Canada. This site, called Pacific Northwest Moths (http://pnwmoths.biol.wwu.edu/), has been available to the public since July 2012. The Internet format–as opposed to a book or journal article–lends itself to continuous updating of things such as additional species, range extensions and life histories. However, it is not an appropriate format for taxonomic work intended for a larger audience, nor does it satisfy the requirements for the description of new taxa.

We are aware of several undescribed species of Erebidae and Noctuidae in the Pacific Northwest (PNW). Three of these are described here so that they can be included on the website.

The thorough vetting of PNW moth collections that was part of the website work confirmed that three superficially distinctive populations of previously named moths are isolated segregates. These are sufficiently different to warrant recognition as subspecies, a taxonomic category that we reserve for populations that are both geographically isolated and differ significantly in appearance from other populations of their species. Three subspecies are named in this paper.

One of the new PNW species is in the genus *Resapamea* Varga & Ronkay (Noctuidae). This presents an opportunity to name two additional species in this genus even though they are from parts of western North America outside the PNW.

A large number of taxonomic changes in the superfamily Noctuoidea have recently been advanced in a new check list for North America north of Mexico (Lafontaine and Schmidt 2010) and in the first update to this list (Lafontaine and Schmidt 2011). Additional synonyms to those published by these authors were discovered during the website work, usually because a PNW species is known by more than one name. The new synonyms that are discussed in this paper are in the genera *Chytolita* Grote (Erebidae) and *Hydraecia* Guenée (Noctuidae).

The genus *Hydraecia* is represented by *Hydraecia perobliqua* Hampson and the *Hydraecia obliqua* species-group in the PNW. The number of species in the latter group

is confusing to collectors, with seemingly more names than species. An attempt by the senior author to revise it in the late 1990s was never published because of difficulties in assigning species boundaries using standard morphological methods. More recent DNA data allows many of these issues to be resolved. The PNW species *Hydraecia obliqua* (Harvey) and *Hydraecia medialis* Smith are discussed and illustrated herein, and the type locality of the third North American species in the species-group, *Hydraecia intermedia* (Barnes & Benjamin), is restricted.

This paper is arranged in check list order following Lafontaine and Schmidt (2010).

Materials and methods

Genitalia were prepared using standard methods for inflating the male vesica and female bursa (Lafontaine 2004). Terminology for wing markings and anatomy also follows Lafontaine (op. cit.) except in *Drasteria* Hübner (Erebidae) where they are modified from Metlevski and Zolnerowich (2009). The term ductus bursae is used herein for the entire length of the tube connecting the ostium bursae to the corpus bursae. Metlevski and Zolnerowich (op. cit.) divide this structure into two parts–the ductus bursae and antrum–restricting the use of ductus bursae to the anterior sclerotized portion. In *Resapamea,* a stout process extending dorsad from the base of the sacculus is herein named the basal saccular process. This structure was called the clavus by Zilli et al. (2005), a term that is potentially confusing because the term clavus has been used previously for a rod-like sensory organ with apical setae located adjacent to the base of the valve in some noctuid genera (Forbes 1954, Lafontaine 2004).

The sequence of the 658 base pair "barcode" region of the mitochondrial cytochrome oxidase *c* subunit 1 (hereafter called CO1 or barcode) were obtained from the Barcodes of Life initiative through the courtesy of Dr. J. Donald Lafontaine. Only pre-existing data were used during this study. The barcode sequences were compared using phylograms constructed using the Kimura-2-Parameter distance model as implemented on the BOLD Systems website (Ratnasingham and Hebert 2007).

The following collection acronyms are used:

AMNH American Museum of Natural History, New York, New York, USA
BMNH The Natural History Museum, formerly the British Museum (Natural History), London, England
CNC Canadian National Collection of Insect, Arachnids, and Nematodes, Ottawa, Ontario, Canada
CSUC C. P. Gillette Arthropod Biodiversity Museum, Colorado State University, Fort Collins, Colorado, USA

GPC Gary Peters Collection, Ocean Shores, Washington, USA
JHS Jon Shepard Collection, Nelson, British Columbia, Canada
JTT Jim Troubridge Collection, Selkirk, Ontario, Canada
LGCC Lars Crabo Collection, Bellingham, Washington, USA
ODA Oregon Department of Agriculture Collection, Salem, Oregon, USA
OSAC Oregon State Arthropod Collection, Oregon State University, Corvallis, Oregon, USA
TMC Tomas Mustelin Collection, Potomac, MD, USA
USNM National Museum of Natural History (formerly United States National Museum), Washington, D.C., USA
WFBM W. F. Barr Museum, University of Idaho, Moscow, Idaho, USA
WSU M. T. James Entomological Collection, Washington State University, Pullman, Washington, USA

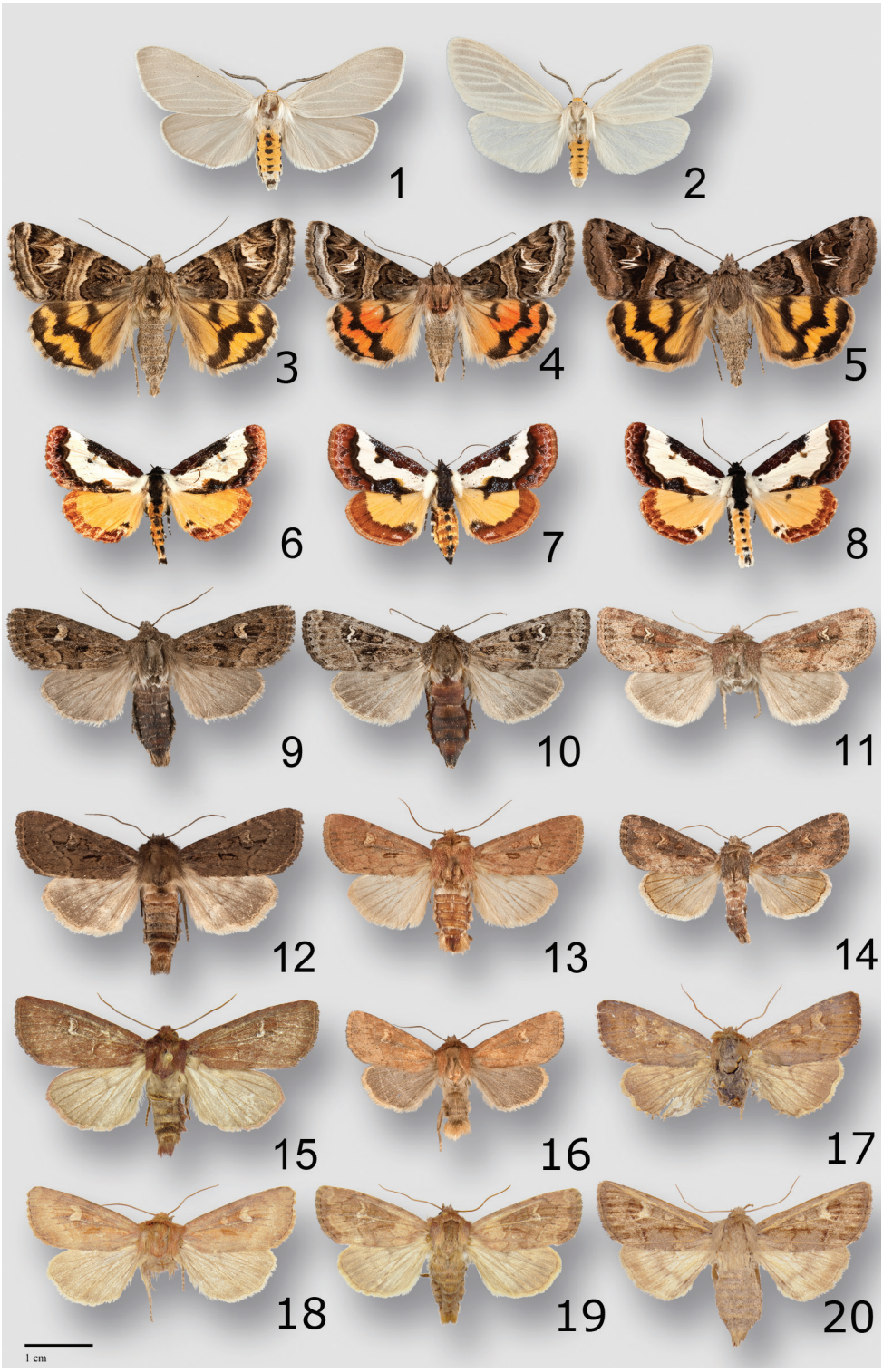
Species accounts

Family Erebidae Leach, [1815]
Subfamily Arctiinae Leach, [1815]
Tribe Arctiini Leach, [1815]

***Cycnia oregonensis tristis* Crabo, ssp. n.**
http://species-id.net/wiki/Cycnia_oregonensis_tristis
Figs 1, 32

Type material. Holotype male, USA, Washington, Thurston County, [WA]DNR Rocky Prairie, 4.2 mi. N of Tenino at Plumb, 46.92°N, 122.85°W, 75 m., 20.VI.1998, L. G. Crabo leg./ Barcodes of Life #CNCNoctuoidea12243. CNC. **Paratypes** 8 males.

Figures 1–20. Adults of Erebidae and Noctuidae. **1** *Cycnia oregonensis tristis* Crabo, male paratype, WA, Thurston Co., Plumb **2** *Cycnia o. oregonensis* (Stretch), male, Canada, BC, 5 mi W of Nelson **3** *Drasteria parallela* Crabo & Mustelin, male paratype, WA, Chelan Co., Chumstick Mountain **4** *Drasteria convergens* Mustelin, male, CA, Mono Co., Lee Vining **5** *Drasteria divergens* (Behr), male, WA, Garfield Co., FR40 at Sunset Point **6** *Eudryas brevipennis bonneville* Shepard & Crabo, female paratype, ID, [Gooding Co.], Wendell **7** *Eudryas brevipennis brevipennis* Stretch, male, USA, CA, [Riverside Co.], Riverside **8** *Eudryas unio* (Hübner), male, USA, MA, Norfolk Co., Ponkapoag Bog **9** *Resapamea diluvius* Crabo, male paratype, WA, Grant Co., Potholes **10** *R. diluvius* Crabo, female paratype, WA, Grant Co., Potholes **11** *R. diluvius* Crabo, female paratype, WA, Adams Co., Washtucna **12** *Resapamea passer* (Guenée), male, Canada, SK, 2 mi N Burstall **13** *R. passer* (Guenée), male, USA, WA, Island Co., Joseph Whidbey State Park **14** *R. passer* (Guenée), female, USA, Douglas Co., Badger Mountain **15** *Resapamea angelika* Crabo, male holotype, USA, NV, Elko Co., Angel Lake **16** *Resapamea innota* (Smith), male, USA, OR, Lake Co., Bull Prairie **17** *Resapamea mammuthus* Crabo, male holotype, Canada, YT, Old Crow **18** *Resapamea hedeni* (Graeser), male, Russia, Magadan Oblast, Tenkinsky District, Stokovyi **19** *Resapamea* species, possibly *R. hedeni*, female, USA, AK, Unalakleet **20** *Resapamea* species, possibly *R. mammuthus*, female, Canada, NWT, Aklavik.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USA. Washington. Thurston County: Plumb, N of Tenino, TNC Rocky Prairie, elev 50 m., 46.92°N, 122.85°W, 26.VI.1990, L. G. Crabo leg. (1 male); [same locality and collector], 24.VII.1996; Puget Trough prairie (1 male); Rocky Prairie, 12.VII.1982, Don Frechin leg. (1 male); [same location data and collector as holotype], 4.VI.1998 (1 male); 20.VI.1998 (1 male); 24.VII.1998 (1 male); WA DNR Mima Mounds State Natural Area, 46.907°N, 123.049°W, 240' [73 m.], 4.VI.1998, L. G. Crabo leg., mounded prairie (1 male); Mima Prairie, Thurston County Glacial Heritage Site, 46.86°N, 123.04°W, 120' [37 m.], 10.VII.1998, D. Grosboll leg., prairie (1 male). CNC, LGCC, WSU.

Etymology. The name is from the Latin *tristis* meaning sad, a reference to the gray color of this moth and the weather in its western Washington distribution.

Diagnosis. *Cycnia oregonensis tristis* is distinguished by the uniform medium gray color of both wings. The nominate subspecies of *C. oregonensis* (Fig. 2), found elsewhere in North America, has lighter yellow-cream to grayish-cream forewings with lighter veins and nearly white hindwings. *Cycnia oregonensis tristis* resembles superficially *Euchaetes egle* (Drury), an eastern North American tiger moth that occurs west to the eastern Great Plains. These moths are easily distinguished by locality.

Description. Head – Antenna of male moderately bipectinate with each branch covered with fine cilia, black, dorsal shaft covered with light-gray scales. Female unknown. Scape light to medium dark gray with slightly lighter underside. Eye rounded, smooth. Labial palp moderately short with short apical segment, covered by short flat scales except slightly longer at ventral base; basal half yellow and distal half dark gray. Head covered in hair-like yellow scales except inferior and lateral border of frons whitish gray. **Thorax** – Vestiture of simple hair-like scales, light to medium dark brownish gray, slightly browner than forewing color, anterior portion near head yellow. Prothoracic collar slightly lighter than central thorax, with a gradual transition to yellow on each side. Tegula covered by long hair-like scales, lighter cream than central thorax. Legs: femur of foreleg yellow with gray ventral surface; other femora and the tibiae of all legs slightly brownish gray, smoky gray dorsally and lighter gray ventrally, tibiae lacking spiniform setae; tarsi light tan gray with a slight ochre tint, with three rows of short spiniform setae on each segment. **Wings** – Forewing length: males 19–20 mm. Forewing nearly even slightly smoky brownish gray, slightly darker on distal third; most specimens with a thin pale streak in fold and approximately half of specimens with veins on distal wing, cubital vein, and 1A+2A similarly pale. Transverse lines and all spots absent. Fringe white with base gray like terminal wing. Dorsal hindwing slightly brownish gray, slightly darker than forewing; half of specimens with slightly paler veins similar to those on forewing, lacking lines and discal spot. Hindwing fringe white with gray base. **Abdomen** – Color light putty gray with dorsal half of segments I–VI dark orange yellow; with rows of half-round black spots on segments I–VII comprised of a single larger spot in the dorsal midline and smaller rounded spots on lateral abdomen adjacent to lighter venter; ventral segment VII with a bilobed protuberance covered by modified scales

(likely for pheromones). **Male genitalia** – Uncus short, hook-like, evenly tapered to a point, flanked on each side by a large strongly sclerotized block-like process directed posterolaterally with dorsal surface smoothly convex and ventral aspect concave, covered dorsally by innumerable velvety setae. Valve simple, membranous and strap-like, 3 × as long as wide; sacculus modified into a large sclerotized thorn-like process approximately 0.6 × as long and wide as valve, with acute tip directed slightly posteromedially. Aedeagus 7 × as long as wide, mesially constricted, with a pointed narrow cylindrical process arising from ventral aspect of distal third just to left of midline, projecting posteriorly and 20° toward right, and curving slightly dorsad. Vesica approximately 2/3 × as long as aedeagus, curved 90° dorsad from the tip of the aedeagus, with a large elongate conical apical diverticulum directed anteriorly–producing appearance of entire vesica curving 180°–and bearing a small basal patch of short cornuti. **Female genitalia** – Unknown.

Distribution and biology. This subspecies is restricted to gravel prairies south of Puget Sound, Washington. These prairies were created by the outwash from the Vashon Lobe of the Pleistocene glaciation, and might have been maintained as open prairies by burning by native humans to promote the growth of camas lilies (*Camassia* spp., Liliaceae) as a food source. The moth is associated with Dogbane (*Apocynum* spp., Apocynaceae), the known foodplant of *C. oregonensis* elsewhere in North America (Tietz 1972). This is almost certainly the larval foodplant of *C. o. tristis*, although this has not been confirmed. This moth flies during June and July.

Remarks. *Cycnia oregonensis* is found in a large part of North America, occurring from coast to coast and from the border with Mexico north to central Saskatchewan and Nova Scotia (Covell 1984, Ferguson et al. 2000). This range includes much of the PNW, including western Oregon and the area east of the Cascade Range as far north as south-central British Columbia. Throughout most of its range it is nearly uniform in color and pattern. *Cycnia oregonensis tristis* is limited to a small area near Olympia, Washington and is the only known population of this species in Washington west of the Cascades. It is distinctly grayer and less patterned than all other populations, but has an identical CO1 barcode sequence.

The type specimen of *Euchaetes oregonensis* Stretch was collected by Lord Walsingham on a trip through Oregon during 1871–1872 (Stretch 1872–[1874]). Comparison of his itinerary (Essig 1941) with the flight period of the moth suggests strongly that it was collected in the southwestern corner of the state between Roseburg and the California border. *Cycnia oregonensis tristis* is separated from the closest west-side populations in western Oregon by 225 kilometers. All of the specimens of *C. o. oregonensis* examined from near the likely type locality are similar to those from elsewhere in North America.

The Puget Prairies where *C. oregonensis tristis* flies are inhabited by several other distinctive Lepidoptera with limited distributions, including the noctuid moth *Apamea inordinata olympia* Crabo and several uncommon butterflies.

Subfamily Herminiinae Leach, [1815]

***Chytolita morbidalis* (Guenée)**
http://species-id.net/wiki/Chytolita_morbidalis

Herminea morbidalis Guenée 1854: 56. Type locality: North America.
Chytolita petrealis Grote 1880: 219. Type locality: [USA], Ohio, Illinois, **syn. n.**
Chytolita fulicalis Smith 1907: 143. Type locality: [USA], Tennessee, **syn. rev.**
Zanclognatha punctiformis Smith 1895: 37. Type locality: [USA], District of Columbia, **syn. rev.**

Remarks. Two species of *Chytolita* Grote have until now been recognized for North America (Lafontaine and Schmidt 2010): *Chytolita morbidalis* (Guenée) and *Chytolita petrealis* Grote. Both species names have at various times been used for material collected in the PNW; however, only a single species with slight variation in size and darkness exists in this region. Material from eastern North America, the type specimens of the available names, and material previously submitted for CO1 sequencing were therefore examined to attempt to elucidate the correct name for the PNW species. It was found that there is virtually no variation in barcodes in this genus despite the fact that the sample is diverse and includes larger light-colored specimens identified as *C. morbidalis* and smaller dark ones submitted as *C. petrealis* from a large portion of eastern North America. The two previously recognized species have been described as "identical in pattern" (Forbes 1954) and were only distinguished by size and darkness without structural differences. The dark small forms known as *C. petrealis* are from swamps and acid bogs (Forbes op. cit.) and are consistent with an ecophenotype. This evidence indicates that *Chytolita petrealis* Grote is a synonym of *Herminea morbidalis* Guenée.

The two syntypes of *Herminea morbidalis* Guenée could not be located and might be lost; however, the original description is sufficient to identify the species and associate it with the genus *Chytolita* based on features of the labial palpus and the presence of an accessory cell on the forewing. A neotype designation is not necessary since there is only one *Chytolita* species in North America.

Subfamily Erebinae Leach, [1815]
Tribe Melipotini Grote, 1895

***Drasteria parallela* Crabo & Mustelin, sp. n.**
urn:lsid:zoobank.org:act:1FA8C27B-2159-41CA-BCF5-246F99B9F8B5
http://species-id.net/wiki/Drasteria_parallela
Figs 3, 33, 45

Type material. Holotype male, USA, Washington, Chelan County: Chumstick Mtn, 47.63–.64°N, 120.44°W, 5100' [1554 m.], 21.VI.2004, L. G. & E. K. Crabo leg.

CNC. **Paratypes** 22 males, 2 females. **USA**. **Oregon.** Jackson County: Siskiyou Mts., Mt. Jackson summit and S slope on Rt. 20, 42.07–.08°N ,122.71–.72°W, 3.VIII.1995, Troubridge & Crabo leg., alpine and subalpine (1 male); Soda Mt. Rd., [42.065° -122.478°], 28.VI.1986 (1 female); Klamath County: Keno, [1248 m.], 30.V.1939, S. Jewett, Jr. leg. (1 male); Lake County: Drake Pk., 6400' [1951 m.], 29.VI.2006, H. E. Rice leg. (1 male); Warner Mts., S slope & summit of Drake Peak, 42.29°N, 120.14–.15°W, 7860–8220' [2396–2505 m.], 2.VIII.1995, J. Troubridge & L. G. Crabo leg. (1 male). **Washington**. Chelan County: Chumstick Mtn, 47.63–.64°N, 120.44°W, 5100' [1554 m.], 21.VI.2004, L. G. & E. K. Crabo leg. (6 males); Derby Cyn., 47.60–.62°N 120.49–.55°W, 2130–3130' [649–954 m.], L. G. & E. K. Crabo leg. (1 male); Kittitas County, Quartz Mts., 47.074°N, 121.061°W, 1900 m., 7.VII.2005 (1 male); [same locality and collector], 14.VII.1990 (1 male); [same locality], 28.VII.2003, L. G. & E. K. Crabo leg. (1 male); Quartz Mtn., 6232' [1900 m.], 1.VII.1998, K. Romain leg. (1 male); [same locality and collector], 7.VII.1998 (1 male); 28.VII.1998 (1 male); Klickitat County: Simcoe Butte, 45.99°N, 120.66–.71°W, 3240–4720' [988–1439 m.], 7.VII.2000, L. G. & E. K. Crabo leg. (4 males); Yakima Co., Satus Cr., [46.217° -120.433°], 28.V.1949, E. C. Johnston leg. (1 female); [same locality and collector], 29.V.1949 (1 male). CNC, LGCC, OSAC, TMC, WSU.

The type series is restricted to Oregon and Washington.

Etymology. The name refers to the parallel lines across the pale medial area of the forewing of this species. This name perpetuates the geometry references of the related species *Drasteria divergens* (Behr) and *Drasteria convergens* Mustelin.

Diagnosis. *Drasteria parallela* is most closely related to *D. convergens* (Fig. 4), a species that occurs to the south of its range in California as far north as Mono County. Both have a medial line comprised of distinct parallel components, but the dorsal hindwing of *D. convergens* is light red rather than orange. In the Pacific Northwest *D. parallela* is most likely to be confused with *D. divergens* (Fig. 5), which is similar in size and has a similarly colored orange hindwing. They can be distinguished without dissection by the pattern of the medial areas of both wings. The forewing medial line of *D. parallela* is double with parallel component, whereas *D. divergens* has a single broader medial line. On the hindwing, the discal spot of *D. parallela* is nearly rectangular and the veins between it and the postmedial line are dark and contrasting. The discal spot of *D. divergens* is joined broadly to the postmedial line giving it a long curved C-shape and the adjacent veins are orange. They also differ in other features of the maculation, including a smoother subterminal line in *D. parallela*.

Structurally, the valves of *D. parallela* and *D. convergens* (Fig. 34) can be distinguished from those of *D. divergens* by the nearly equal lengths of the two claspers and more rounded valvulae. In *D. divergens* (Fig. 35) the right clasper is longer and more slender than the left and the posterodorsal valvulae are angular. *Drasteria parallela* has a relatively short and wide costal process of the right valve compared to that of *D. convergens* in which it is long and narrow. In the vesica, the posteriorly-directed process arising from the glove-like diverticulum on the left side of the dorsal vesica is conical in *D. parallela* and conical with two small finger-like projections in *D. convergens*.

The female genitalia of *D. parallela* and *D. convergens* (Fig. 46) are told easily from those of *D. divergens* (Fig. 47) by their much shorter antevaginal plates, which are rectangular and over half the length of the ductus bursae in *D. divergens*, and by the presence of a narrow curved extensions of the pseudobursae that is absent in *D. divergens*. The female genitalia of *D. parallela* differ from those of *D. convergens* by the size of the antrum of the ductus bursae, which is similar in length to the colliculus in *D. parallela*, but twice as long in *D. convergens*, and by the shape of the corpus bursae, which is rounded in *D. parallela*, but ovoid in *D. convergens* (ratio of width:length 0.87 and 0.7, respectively).

Description. Head – Antenna of male filiform, densely ciliate ventrally with length of cilia approximately 1 × width of central shaft. Antenna of female filiform with single short cilia on sides of each segment. Scape covered in short tan scales. Eye round, smooth. Palpus covered in short gray-tan and scattered dark-gray scales, longer and lighter colored on ventral third. Frons smooth, it and top of head covered in long gray-tan scales. **Thorax** – Vestiture of long, narrow, apically notched, gray-tan and brown scales, forming vague tufts on posterior thorax. Prothoracic collar tan with longitudinal dark gray stripes at each side of head. Tegula covered in similar scales as thorax, with dark-brown medial and lateral stripes. Legs covered in gray-tan and scattered dark-gray scales; tibiae lacking spiniform setae; tarsal segments with three rows of spiniform setae. **Wings** – Forewing length: males 17–20 mm; females 18 mm (n=1). Forewing covered with brown, tan, and gray scales, ground color of wing base to antemedial line and subterminal areas dark brown with tan and lead-gray mottling, medial area light tan, darker near costa, and terminal area whitish gray to gray medially and blue gray to brown gray at margin, with a dark gray to black spot at apex; a complex mark resembling a large reniform spot in distal medial area between true reniform spot and strongly dentate postmedial line white medially and along dark crossing veins, tan laterally. Basal, antemedial, and postmedial lines similar, wide, partially double, black with chestnut-brown filling; basal line oblique from medial costa near wing base toward outer margin, fading at mid-wing; antemedial line complete, convex toward outer margin, drawn strongly toward wing base on costa, mid-wing, and posterior margin; postmedial line complex, costal origin near reniform spot, anterior portion strongly oblique toward outer margin to strong tooth on M1, slightly concave between M1 and M3, less strongly toothed on M3 and CuA1, then drawn strongly toward base and bending slightly anteriorly to posterior end of reniform spot, then bending sharply to meet posterior margin at a slight angle toward outer margin, portion posterior to reniform spot appearing to form a continuous line with medial margin of spot. Medial line dark gray, double ,with nearly parallel components of equal strength across width of wing. Subterminal line double with dark brown to black inner and gray outer components, filled with tan, smooth with slight undulations, slightly offset toward base below the costa and convex toward outer margin elsewhere, preceded by a black line or series of black wedges or smudged marks between veins. Terminal line black, slightly scalloped. Orbicular and claviform spots absent. Reniform spot ovoid or weakly C-shaped with wider posterior end, black, open posteriorly, filled with dark

brown, much less conspicuous than pale medial area lateral to it. Fringe slightly scalloped, dark gray brown with tan to brown base, weakly checkered in a few specimens. Dorsal hindwing ground color dull light yellow orange to dull orange, with strong suffusion of gray scales at base and along inner margin and gray on veins from base to postmedial line; discal spot black, nearly trapezoidal, with wider posterior end and concave lateral margin, posterior portion not reaching or barely touching postmedial line; postmedial line black, slightly wider than discal spot, irregularly zigzag with three angulations, lateral on M2, medial on CuA1 and CuA2, and lateral between CuA2 and inner margin; terminal line black, slightly thinner than postmedial line with inner border roughly parallel to outer edge of postmedial line. Hindwing fringe similar to hindwing ground color, but with variable gray suffusion on and adjacent to veins, strongest near Rs, M1, and M3–CuA2. **Abdomen** – covered with a mixture of gray-tan and dark-gray flat and tan hairlike-scales, appearing even medium-dark gray brown. **Male genitalia** – Uncus strongly curved, slightly compressed laterally, with a dorsal ridge on distal half, tapering to acute apex. Scaphium long and narrow with articulation at uncus base. Juxta H-shaped, 1.2 × as high as wide. Valves racquet shaped, asymmetrical, right longer and wider than left (width:length 0.34 versus 0.26, respectively), with slight posterior projection from dorsolateral left valvula and rounded dorsolateral right valvula. Sacculus 4 × as long as wide, extending distally to mid-valve; saccular extensions asymmetrical, stronger on right with distal long tooth-like process projecting dorsomedially and weaker one on left with distal small point; pulvinus moderately strong on both sides. Costal processes roughly triangular, asymmetrical, 4 × as large on right as on left. Claspers symmetrical in length, 0.25 × length of valve, cylindrical, distal portions slightly asymmetrical with stronger curve toward midline on left than right; base of clasper raised into small rod-like cone with patch of fine setae at apex on both sides. Aedeagus tubular, 4 × as long as wide, with membranous granulose patch at dorsal left apex extending onto adjacent vesica base and sclerotized narrow extension onto ventral left vesica base (ventral plate of carina). Vesica bulbous, approximately 1 × as long as aedeagus and 1.2 × as wide as long, larger on left, with complex anatomy of multiple diverticula; ventral diverticula from left to right: mid-left-lateral spherical with granulose surface, basilar-left-lateral triangular with pointed anterior projection and granulose surface, ventral-basilar ovoid with two short projections to left, and mid-right-lateral spherical with granulose surface; dorsal diverticula from left to right: distal-left-lateral glove-shaped with seven small radial projections and single larger posterior projection at base, dorsal-distal ovoid with posteriorly-directed apex, and distal-right-lateral glove-shaped with four finger-like projections. **Female genitalia** – Ovipositor strongly telescopic. Ovipositor lobe long and narrow, 5 × as long as wide, tapering to a rounded point, covered sparsely by long hair-like setae that are most dense at apex. Abdominal segment VIII slightly longer than wide, covered by hair-like setae that are most dense at posterior margin; anterior apophysis 1.25 × as long as segment VIII and posterior apophysis 1.8 × as long as segment VIII. Ostium bursae nearly as wide as segment VIII, membranous ventrally, with sclerotized, broadly V-shaped, lamina postvaginalis posterior to ostium. Ductus

bursae 1.5 × as long as segment VIII, nearly straight except for slight rightward bend at anterior end; antrum at posterior end short, similar in width to ostium and 1× as wide as long; lamella antevaginalis weak, 0.5 × as long as wide; strongly sclerotized tubular colliculum 1.8 × as long as wide, slightly longer on left side. Corpus bursae slightly asymetrically ovoid, nearly round, 1.15 × as long as wide, with small pseudobursa at right posterior end with narrow tubular extension from posterior end curving dorsad, anterior, and to right to project toward anterior right with ductus seminalis at tip.

Distribution and biology. *Drasteria parallela* is found in the Cascade Mountains of Washington, the Klamath and Siskiyou Mountains of southwestern Oregon and northern California, and the northern Sierra Nevada in California. It is most commonly collected on exposed ridges in forests at middle elevations. It flies during July. The early stages and foodplant are unknown. Barcodes suggest a close relationship of *D. parallela* and *D. convergens* to *Drasteria howlandii* (Grote), which feeds on *Eriogonum* Michaux (Polygonaceae) (Powell and Opler 2009).

Remarks. This species has until now been called *Drasteria convergens* in the PNW.

The barcode of a single sample of this species from Plumas County, California (BOLDSYSTEMS Sample ID: CNCNoctuoidea7767) differs by 1.3% from that of *Drasteria convergens* from Mono County, California.

Family Noctuidae Latreille, 1809
Subfamily Agaristinae Herrich-Schäffer, [1858]

Eudryas brevipennis bonneville Shepard & Crabo, ssp. n.

http://species-id.net/wiki/Eudryas_brevipennis_bonneville
Figs 6, 36, 48

Type material. Holotype male, USA, Idaho, [Twin Falls County], Twin Falls, 10.VII.1953, J. R. Douglass leg./ Database # CNC LEP 00094168/ Genitalia CNC slide #15232 male. CNC. **Paratypes** 5 males, 5 females. **USA. Idaho.** Gooding County: Wendell, 3500’ [1067 m.], 25.VII.1965, R. E. Miller leg. (1 female); Power County: Massacre Rocks S[tate] P[ark], 4290’ [1308 m.], 42.679°N 112.987°W, 17.VII.2010, J. & S. Shepard leg. (1 male); Twin Falls County: Buhl, 3500’ [1067 m.], 29.VI.1961, R. E. Miller leg. (1 male); Kimberly, 1 mi. E., 10.VII.1970, A. C. Antonelli collector (1 female); Twin Falls [42.57°-114.47°], 10.VII.1953, J. R. Douglas leg. (1 male); [same locality and collector], 7.VII.1945 (1 male), 9.VIII.1945 (1 female), 12.VII.1952 (1 female), [same locality and collector], 3700’ [1128 m.], 25.V.1953 (1 male); [same locality], 15.VI.1959, K. E. Gibson leg., Genitalia CNC slide #16535 (1 female). CNC, JHS, WFBM.

Etymology. The species name is derived from Lake Bonneville. This glacial lake covered much of Utah and southern Idaho during the late Pleistocene epoch. The distribution of this moth is in the Lake Bonneville Basin and along its historic flood path along the Snake River.

Diagnosis. No other Pacific Northwest noctuid is likely to be confused with this brightly colored moth. *Eudryas brevipennis bonneville* is superficially nearly identical to *Eudryas unio* (Hübner) (Fig. 8), which occurs in eastern North America as far west as the eastern Great Plains and Texas, but the genitalia of *E. b. bonneville* are indistinguishable from those of *Eudryas b. brevipennis* Stretch from California. The long distal processes of the male aedeagus of *E. brevipennis* (Fig. 36) are shorter by 20–25% compared to the lengths of the corresponding structures in *E. unio* (Fig. 37). Similarly, the ductus bursae of females of *E. brevipennis* (Fig. 48) is shorter than that of *E. unio* (Fig. 49). The valves of *E. brevipennis* (Fig. 36) are slightly shorter and less pointed than those of *E. unio* (Fig. 37). In the females, the ductus bursae of *E. brevipennis* is about 25% shorter than that of *E. unio*, although these structures are difficult to measure precisely.

Subspecies *E. b. bonneville* differs from the nominate subspecies from California (Fig. 7) by the width of the dark marginal borders of both wings and darkness of the discal spots. The red-brown hindwing marginal band is relatively narrow and mottled in *E. b. bonneville***,** resembling those of *E. unio*, whereas that of *E. b. brevipennis* is wider and uniformly darker. The reniform spot and hindwing discal spot are both black in *E. b. brevipennis*. Only the posterior part of the reniform spot is black in *E. b. bonneville* and its hindwing discal spot is smaller and fainter.

Description. Head – Antenna of male nearly filiform with slight narrowing of the basal portion of each segment, covered with very short cilia on ventral portion. Antenna of female filiform similar, with longer cilia reduced in number to a single cilium on each side of each segment. Scape covered in short black scales, white ventrally. Eye round, smooth. Palpus covered in short black and occasional white scales, the latter most numerous on distal basal segment and near apex; middle segment relatively long. Frons with a conical central projection with slightly down-turned apex, covered in narrow black scales and a few white scales near base of antenna. Top of head covered with shiny black scales. **Thorax** – Vestiture centrally of shiny brown-black spatulate scales that form a loose posterior tuft, and laterally of hair-like white scales. Prothoracic collar covered centrally with shiny black scales, shorter anteriorly where they are mixed with a few white scales and longer posteriorly, and laterally with long pure white hair-like scales. Tegula covered entirely by long hair-like pure-white scales. Legs covered with shorter dark-gray, short white, and long white scales, longest on femur and tibia of foreleg and femora of mid-leg and hind-leg; with white rings on ends of segments; ventral tarsal segments with three rows of spiniform setae. **Wings** – Forewing length: males 15–16 mm; females 16–17 mm. Forewing ground color white with a pearly sheen; basal two-thirds of anterior wing from anterior cell to costal margin covered in dark-maroon, charcoal-gray, and a few lavender scales, darkest gray on costal margin and in distal cell and dark brown red in base of cell; middle third of posterior margin and subterminal area adjacent to postmedial line similar black, maroon, and lavender, widest on mid-wing to form a black and lavender patch bordered anteromedially by dark ochre; remainder of distal wing mottled red brown and lavender. Basal, antemedial and medial lines absent. Postmedial line thick olive brown, smoothly waved, positioned closer to outer margin than end of cell, roughly

parallel to outer margin on anterior and mid-wing and more strongly curved basad near posterior margin to blend with posterior margin. Subterminal line powdery lavender, undulating, preceded by ill-defined patches of black, strongest opposite cell and between veins posterior to CuA1. Terminal line a series of red-brown lunules between veins. Orbicular spot blackish gray, elongate, fused to dark color of costa to form posterior margin of area in medial cell. Reniform spot diffuse, C-shaped, anterior portion blackish gray fused to dark costa like orbicular spot, mid-portion narrow, olive, and posterior end a diffuse black spot. Claviform spot absent. Fringe graybrown. Dorsal hindwing bright yellow. Hindwing discal spot dark gray to black, diffuse. Hindwing postmedial line reduced to a black spot at inner margin; marginal band circa 0.2× width of wing with undulating inner border, chestnut brown, darkest at anal angle and interrupted by yellow scales near veins; terminal line dark chestnut brown. Hindwing fringe red tan. **Abdomen** – Dorsal half bright yellow and venter whitish gray, with black spots on dorsal midline and each side of each segment and loose tufts of metallic brown-black scales on dorsal segments I–III. **Male genitalia** – Uncus rod-like, slightly curved, tapering gradually from base to apex with slight lateral widening near tip, distal portion slightly dorsoventrally flattened with a dorsal medial ridge, tapering to a downturned point. Anal tube sclerotized at base of dorsal portion and more extensively and strongly ventrally and laterally, ventral portion bulbous at base with ventral medial groove, tapering distally. Juxta bell shaped, 1.2 × as tall as wide, widest ventrally. Valve birdwing shaped; costal margin divided into two straight segments separated by a 45° downward bend at junction of proximal two-thirds and distal third, basal segment of costa sclerotized and angled 45° dorsad relative to attachment; posterior margin with bend dorsad at mid-point beyond sacculus, meeting costal margin at a point. Sacculus heavily sclerotized, extending to mid-point of valve, base 0.65 × as wide as valve tapering to 0.3 × as wide as valve near origin; modified rod-like clasper extending laterally from end of sacculus posterior and parallel to posterior margin of valve, tapering gradually from base to acute upturned tip. Distal valve lacking digitus, expanded cucullus, or corona, inner surface covered with innumerable fine setae distal to mid-portion. Aedeagus unusual, with very short basal segment divided at apex into two very long and narrow processes, longer distal portion identified as true aedeagus by small vesica at tip approximately 6× as long as base, arched strongly ventrad near base and becoming gradually straighter toward apex, total arc 180°; proximal process similar but shorter and more strongly arched, approximately 0.65 × as long as distal aedeagus, with slightly bulbous tip. Vesica membranous, minute. **Female genitalia** – Ovipositor lobes pad-like, covered sparsely with long and short fine setae. Abdominal segment VIII 0.75 × as long as wide; anterior apophysis 0.85 × as long as segment VIII, and posterior apophysis slightly shorter. Ostium bursae lightly sclerotized, ventral margin narrow and V-shaped. Ductus bursae sclerotized, very narrow, sinuous and crenulate, difficult to measure when mounted. Corpus bursae membranous, delicate, slightly ovoid (collapsed in figure), approximately 2.5 × as long as segment VIII, ductus seminalis joining posterior portion near junction with ductus bursae.

Distribution and biology. *Eudryas brevipennis bonneville* occurs near large rivers and lakes in the northern Intermountain Region. Most specimens have been collected near the Snake River in south-central Idaho.

The moth flies during late spring and summer and has been collected from late May through early August. The early stages are unknown. California populations of *E. brevipennis* feed on the willowherb *Epilobium ciliatum* Raf. and evening primroses (*Oenothera* spp.) (Comstock and Dammers 1938), all in the evening primrose family (Onagraceae). It is likely that *E. b. bonneville* utilizes similar plants in this family.

Remarks. *Eudryas brevipennis*, including the Utah populations, is considered to be conspecific with *Eudrya unio* by Poole on the website Nearctica.com. These taxa differ in the structure of the genitalia of both sexes indicating that they are distinct species.

The identical male and female genitalia of the California and Intermountain populations of *E. brevipennis* suggest strongly that they are the same species despite the differences in wing pattern and the 700 kilometer gap that separates them. A single specimen from Modesto, California in the CNC resembles subspecies *bonneville* more than other California populations. *Eudryas* should be sought in riparian habitats in the area between California and the range of *E. b. bonneville* to see if this subspecies has a larger range than is known currently. There is no barcode data for either subspecies of *E. brevipennis*.

Subfamily Noctuinae Latreille, 1809
Tribe Apameini Guenée, 1841

***Resapamea diluvius* Crabo, sp. n.**
urn:lsid:zoobank.org:act:B5ED782B-3A1F-4404-92D8-DBEB0F415656
http://species-id.net/wiki/Resapamea_diluvius
Figs 9–11, 38, 50, 53

Type material. Holotype Male. USA, Washington, Grant County: Potholes, 1110' [338 m.], 46.982°N, 119.451°W, 23.V.2001, L. G. & E. K. Crabo leg./ Database # CNC LEP 00094165. CNC. **Paratypes** 80 males, 25 females. **USA**. **Oregon**. Sherman County: Biggs, 1 VI 1960, S. G. Jewett (1 female); Biggs Junction, 28 IV 1959, S. G. Jewett (1 male). **Washington**. Adams County: Sand Hills near Washtucna, 9 mi. N. of Kahlotus, 46.78°N, 118.53°W, 445 m., 22.V.1999, L. G. Crabo leg., sand dunes (1 male, 1 female); Irrigation Exper. Sta. Basin unit [47.008° -118.567°], 30.V.1963, E. C. Klostemeyer leg. (1 male); Franklin County: White Bluffs ferry, 46.675°N, 119.449°W, 25.IV.2002, Strenge/Zack leg. (1 male); Grant County: [same data as holotype] (30 males, 10 females); [same locality as holotype], 1095' [334 m], 1.VI.2002, Crabo & Troubridge leg. (9 males, 2 females); [same locality and date as previous], Barcodes of Life CNCLEP70179 (1 male); stable dunes S of Moses Lake, 21.V.1994, J. Troubridge leg. (1 male); Road C SE at The Potholes, [same coordinates as holotype], 19.V.2001, J. Troubridge leg. (32 males, 9 females); [same locality and date

as previous], Barcodes of Life CNCLEP70181 (1 female); Potholes, 1095' [334 m.], 46.989°N, 119.425°W, 4.VI.2005, E. K. & L. G. Crabo leg. (1 male, 1 female); Vantage, 46° 54'N, 119° 56'W, 22.IV.1998, J. Troubridge leg. (2 males). CNC, CSUC, JHS, JTT, LGCC, OSAC, TMC, WSU.

Etymology. The name is derived from the Latin *diluvium* meaning deluge or flood. The Columbia Basin where this moth occurs in Washington was scoured repeatedly by cataclysmic floods at the end of the Ice Age.

Diagnosis. *Resapamea diluvius* is most likely to be confused with *Resapemea passer* (Guenée) (Figs 12–14), a common and widespread moth in North America. *Resapamea passer* is found in the Pacific Northwest where it flies on both sides of the Cascade Mountains, including at the type locality of *R. diluvius*. *Resapamea diluvius* is less variable than *R. passer*, which comes in a range in colors and patterns that includes dark brown, reddish brown, dull light yellow brown, or a mixture of light- and dark-brown forms. *Resapamea diluvius* is dark hoary gray brown or red brown, grayer than *R. passer* on both wings, with a more streaky pattern distal to the cell due to pale-gray veins. A few specimens of *R. passer* have streaky distal forewings, but this is due to dark veins against a lighter ground (the veins of most *R. passer* are dark gray under magnification but do not contrast with the ground color). Most specimens of *R. diluvius* have the streaky pattern accentuated by black between the veins in the distal subterminal area and terminal area across the width of the wing. In *R. passer*, black scaling on the distal wing is uncommon, and is usually limited to the area distal to the cell and in the fold. Finally, white or cream in the lateral reniform spot is typical in *R. diluvius*, whereas pale scales in the spot are variable in *R. passer*: absent, darker yellow or tan if limited to the lateral portion, or filling the entire spot. Habitat association with dunes and early flight period are also characteristic of *R. diluvius*, whereas *R. passer* is found in a variety of wetland and agricultural habitats and usually flies later in the summer with a peak during late June and July.

The male genitalia of *R. diluvius* are similar to those of *R. passer* (Fig. 39). The cucullus of the valve is more massive than that of *R. passer*, especially relative to the width of the valve, and the anal margin is more rounded. In the vesicas, the diverticulum bearing a ridge of spines (cock's comb) on the ventral surface is positioned slightly closer to the base in *R. diluvius*, is smaller in size, and has a less pronounced ridge of spines than in *R. passer*.

The female genitalia of these species are also similar. The bursa copulatrix of *R. diluvius* is rounder than that of *R. passer* (Fig. 51), with the ratio of length to width approximately 1.5 in *R. diluvius* and 1.75 in *R. passer*.

Description. Head – Antenna of male nearly filiform with a slight constriction at base of each segment, with dense ventral covering of short cilia. Antenna of female filiform with single cilia on each side of each segment. Scape light tan, with dorsal tuft of light-tipped brown to dark brown-gray scales. Eye round, smooth. Labial palp with lateral aspect of first two segments and entire short distal segment covered in short and flat gray-tan, gray-brown, and dark gray scales, elongating to a ventral fringe of brush-like dark gray-brown scales. Frons smooth, covered in narrow dark brown-gray

scales. Top of head covered in relatively long and narrow light-tipped gray-tan to dark brown-gray scales. **Thorax** – Vestiture of collar, thorax, and tegula similar, a mixture of long, narrow, apically notched light-tipped dark gray-tan to gray-brown scales, appearing medium-dark to dark gray-brown with dusting of lighter scales on central tegulae. Legs even dark gray brown, with three rows of spiniform setae on basitarsus and four irregular rows on other tarsal segments. **Wings** – Forewing length: males 16–19 mm; females 15–18 mm. Forewing with a mixture of gray brown, gray tan, red brown, gray, and blackish-gray scales, ground color appearing medium-dark to dark gray brown or reddish-gray brown, usually slightly darker in cell and in medial area distal to reniform spot and often also posterior to cubital vein from base to postmedial line and in terminal area; costa anterior to radial vein hoarier gray; cubital vein and distal branches lighter gray-tan or gray, often with black suffusion between veins in medial area distal to reniform spot and across width of wing in distal subterminal and terminal areas. Basal and antemedial lines similar, gray, faint and incomplete, partially double filled with ground or a slightly lighter shade thereof; basal line evident as patches of gray scales on costa and near base of cubital line; antemedial line usually evident as a faint gray spot on costa and a strongly zigzag gray line posterior to cubital vein. Medial line gray to dark gray, diffuse, gently excurved, variable in prominence from absent, a faint shade on mid-wing, or complete. Postmedial line double with consistent medial black component and variable absent to faint-gray lateral component, filled with a light shade of ground color, drawn sharply basad to level of mid-reniform spot on costa, smoothly excurved around reniform spot with lateral apex on R5 or M1, then oblique and slightly concave toward base from near subterminal line to junction of basal two-thirds and distal third of posterior margin, very weakly toothed on veins except for a stronger tooth on 1A+2A. Subterminal line light gray tan, diffuse, slightly offset toward base near costa and undulating elsewhere, variable from a faint spot on costa to complete, preceded by aforementioned black scaling in distal subterminal area. Terminal line a series of black chevrons on veins. Orbicular and reniform spots completely or partially outlined in black; orbicular spot variably absent, faint, or prominent, a small to medium-sized oval filled with color of adjacent wing; reniform spot moderate sized, weakly to strongly kidney shaped, filled with white to cream laterally, less prominently inferiorly, and in a few specimens as an incomplete row of medial scales, ground color medially, and with a central dark-gray to black lunule that is strongest at posterior end. Claviform spot black, strongest anteriorly, narrow, small to moderate sized, filled with ground color or a darker gray shade thereof. Fringe ground color, usually with a lighter base and gray medial line. Dorsal hindwing slightly brownish gray, darker and grayer on distal half, with a gray ill-defined oval discal spot and thin terminal line. Hindwing fringe light gray brown with a gray medial line. **Abdomen** – dark brown gray. **Male genitalia** – Uncus cylindrical, evenly downcurved, distal portion tapering to a fine point. Tegumen with large penicillus lobes. Juxta shield shaped, 0.75 × as high as wide, with shallow V-shaped ventral margin. Valve S-shaped, 4.5 × as long as wide (measured at mid-portion), nearly even in width except for slight constriction at base of cucullus; with stout knob-like basal saccular process extending dorsolater-

ally from base and nearly reaching base of costa, medial margin of this process with triangular mesial projection at base and concave mid-section, apex rounded. Sacculus reaching to or slightly dorsal to costal margin and extending distally to mid-valve. Clasper a smooth ridge. Ampulla short, nearly spherical. Digitus a weak ridge, partially covered by medial edge of cucullus. Cucullus well developed with rounded apical and anal ends, 1.75 × as wide as mid-valve; mesial surface covered by fine setae; corona an irregular row of stout curved setae, partially double at anterior end. Aedeagus tubular, 4.5 × as long as wide, with a slightly elevated patch of minute spinules on ventral distal end. Vesica 0.67 × as long as aedeagus, bent 135° toward right at base to project anteriorly and toward right, basal half bulbous and distal half tubular, adorned with several diverticula and cornuti; a broad diverticulum on subbasal ventral surface with sclerotized apex with a cocks-comb row of short spines oriented along aedeagus axis and projecting ventrad; a membranous conical apical diverticulum on posterior vesica projecting anteriorly and rightward; a solitary cornutus on medial posterior surface comprised of a proximally-angled spine arising from a button-like base; and subapically, a patch of variable-sized spine-like cornuti directed proximally. **Female genitalia** – Ovipositor lobe elongate, dorsoventrally flattened and curved slightly ventrad at apex, 0.33 × as wide as long at base, narrowing near base to 0.25 × length, and tapering over distal third to a blunt point; proximal segments fused ventrally and dorsally to past mid-point; covered entirely but sparsely by long fine hair-like setae. Abdominal segment VIII 2 × as wide as long, anterior apophysis 1.25 × length of segment VIII and posterior apophysis 2.25 × length of segment VIII. Ostium bursae moderately sclerotized, ventral lip smoothly rounded and projecting posteriorly to cover ostium. Ductus bursae cylindrical, rugose, 1× as long as segment VIII and 1.33 × as long as wide. Corpus bursae unisaccate, broadly ovoid, 1.50–1.56 × as long as wide, slightly asymmetrical with rounded projection on left extending slightly posterior to attachment of ductus bursae with ductus seminalis at apex.

Distribution and biology. This species occurs in the Columbia Basin in Washington and northern Oregon. Specimens from dunes in northern Nevada and the northern Great Plains have been examined but the limits of its distribution are not well known.

The early stages of *R. diluvius* are unknown. The larvae most likely feed on *Rumex venosus* Pursh (Polygonaceae) based on their close association with this plant in the Columbia Basin. This rue is abundant on the dunes where *R. diluvius* occurs (Fig. 53) and the moth has not been found in Columbia Basin dune systems from which the plant is absent. Some other *Resapamea* species such as *Resapamea passer* are known to feed on *Rumex* species (Tietz 1972).

Adults fly from late April to early June. No specimens have been found at the type locality during summer or fall, although *Resapamea passer* occurs there during the summer. *Resapamea diluvius* is local but is often abundant where it occurs.

Remarks. The CO1 sequences of *R. diluvius* and *R. passer* are nearly uniform within each species but differ from each other by over 3.5%.

Hadena hulstii Grote, *Hadena morna* Strecker, and *Hadena virguncula* Smith are considered to be synonyms of *Mamestra passer* Guenée (Lafontaine and Schmidt 2010).

All were described from Colorado. The holotype of *H. hulstii* could not be located and is presumed lost (Lafontaine JD pers. comm. 2012). The holotypes of the other two were examined (*Hadena virguncula* from a photograph) to exclude the possibility that they refer to *Resapamea diluvius*.

Resapamea angelika **Crabo, sp. n.**
urn:lsid:zoobank.org:act:0F672160-B1C9-4A79-AEDC-0A01C47F6F0D
http://species-id.net/wiki/Resapamea_angelika
Figs 15, 40

Type material. Holotype Male. USA, Nevada, Elko County, Angel Lake (S side), SW of Wells, light trap, 1–2.VIII.2003, James K. & Eleaner Adams leg./ Database # CNC LEP 00094166. CNC. **Paratype** Female. USA, Nevada, Elko County, Rt 231, 11 mi SW Wells [Angel Lake], 23 July 2001, J. Troubridge/CNCNoctuoidea6305. JTT.

Etymology. The name is derived from the type locality at Angel Lake, Nevada.

Diagnosis. *Resapamea angelika* is a distinctive *Resapamea* species due to the combination of large size, even dark red-brown forewing color, small or absent orbicular spot, and narrow reniform spot with well-demarcated thin black outline and prominent cream to light orange filling. It is most likely to be confused with *R. passer* (Figs 12–14) and *R. innota* (Smith) (Fig. 16). *Resapamea passer* is variable, usually brown or mottled tan and brown, but is not dark red brown like *R. angelika*. *Resapamea innota* has red-brown or orange-brown forewings and could potentially be confused with *R. angelika* on this basis. Its orbicular spot is similar to the reniform spot, not very small or absent as in *R. angelika*, and the reniform spot is broader, lacks a black outline and is filled with uniform light ochre, unlike that of *R. angelika*. The dorsal hindwing of *R. innota* is darker gray than in *R. angelika*. *Resapamea angelika* appears to be a significantly larger moth (FW length 19 mm) compared to *R. innota* (FW length 14–17 mm) .

The male genitalia of *R. angelika* are similar to those of *R. passer* (Fig. 39). Based on the holotype, *R. angelika* has a slightly broader distal uncus, a more V-shaped inferior juxta, and a larger and more angular basal saccular process. In the vesica, the ridge of spines with a sclerotized base (cock's comb) adorning a ventral diverticulum is smaller than in *R. passer*.

Description. Head – Antenna of male nearly filiform with slight constriction at base of each segment, covered ventrally by short cilia. Antenna of female filiform. Eye round, naked. Labial palp covered by short flat scales on sides, elongating to form a brush-like ventral fringe. Frons smooth, covered by narrow red-brown scales. Top of head covered by long and narrow red-brown scales. **Thorax** – Vestiture of collar, thorax, and tegula similar, a mixture of long, narrow, apically notched red-brown-tipped tan and red-brown scales, appearing even dark red brown, weakly tufted. Legs even gray brown, with three rows of spiniform setae on basitarsus and four irregular rows on other tarsal segments. **Wings** – Forewing length: male 19 mm. Forewing with a mixture of red-brown and gray-brown scales, ground color appearing even dark red brown,

minimally darker in basal, medial and terminal areas; veins brownish gray, especially along radial and cubital veins, but not contrasting. Basal line absent. Antemedial line single, dark red brown, faint, ill-defined and incomplete, most evident on costa, in cell, and in fold, slightly offset toward base on costa and nearly transversely-oriented elsewhere. Postmedial line similar but more diffuse, oriented at 45° angle to wing from near end of cell to posterior margin, obsolete near costa. Subterminal line absent, its position in paratype indicated by a faint dark spot on costa in distal subterminal area and in holotype by proximal margin of darker terminal area. Terminal line thin, black, slightly thicker between veins. Orbicular spots small, oval, very faint in holotype, partially outlined in thin black bordered internally by cream, and filled centrally with ground color in paratype. Reniform spot moderate sized, narrowly kidney shaped, posterior portion partially fused to cubital vein in holotype, extending slightly posterior to vein in paratype, partially outlined by a thin black line strongest medially and absent anteriorly, filled peripherally with light whitish cream to light orange and containing a central or medially-positioned ground-color lunule. Claviform spot small, absent in holotype specimen and a small black smudge in paratype. Fringe brown gray with gray-orange base and darker gray medial line. Dorsal hindwing light gray orange to light fuscous, minimally darker and grayer on distal half, with slightly darker gray ill-defined narrow discal spot, veins, and terminal line. Hindwing fringe pinkish red brown with a light yellow-tan base. **Abdomen** – medium-dark brown-gray with slight red tint, especially posteriorly. **Male genitalia** – Uncus cylindrical at base, evenly downcurved, distal portion slightly dorsoventrally flattened and tapering to a fine point. Tegumen with large penicillus lobes. Juxta shield shaped, 0.5 × as high as wide, with V-shaped ventral margin. Valve weakly S-shaped, 5 × as long as wide (measured at mid-portion), tapering slightly from base to neck of cucullus; clavus large, reaching base of costa, rectangular with concave medial contour and angular apex. Sacculus reaching two-thirds of distance toward costa and extending distally to mid-valve. Clasper a smooth ridge. Ampulla short, nearly spherical. Digitus a weak ridge with a weak triangular projection, partially covered by medial cucullus. Cucullus well developed with rounded apical and slightly pointed anal ends, 1.65 × as wide as mid-valve; mesial surface covered by fine setae; corona an irregular row of stout curved setae, row partially double on dorsal half. Aedeagus tubular, 4.5 × as long as wide, with granulose patch on ventral aspect at base of vesica. Vesica 0.65 × as long as aedeagus, bent 135° toward right at base to project anteriorly and toward right, basal half bulbous, distal half tubular, with several diverticula and cornuti: weakly bulging subbasal diverticulum on ventral surface with sclerotized apex with a cock's-comb row of short spines oriented along aedeagus axis and projecting ventrad; a membranous conical apical diverticulum on ventral vesica projecting anteriorly and toward right; a medial proximally-angled spike-like cornutus arising from a button-like base; and a subapical patch of short variable-sized spine-like cornuti directed basad. **Female genitalia** – Not available.

Distribution and biology. This species is only known from the vicinity of Angel Lake in the East Humboldt Range of northeastern Nevada. The habitat is sedge meadows along tributaries of Angel Creek. These meadows appear to lack *Rumex* but harbor

dense stands of an iris (*Iris* spp., Iridaceae) which might be the larval foodplant. The early stages of *R. angelika* are unknown. The few known specimens have been collected during late July and early August.

Remarks. The CO1 sequence of the female paratype differs from those of all other North American *Resapamea*, including *R. passer* and *R. innota*, by over 3.4%.

The holotypes of *Luperina innota* Smith, type locality Wyoming, Yellowstone Park, and *Luperina enargia* Barnes & Benjamin, type locality California, Tulare County, Monachee Meadows, were examined from photographs to ensure that neither name is referable to *R. angelika*. These specimens are superficially very similar to each other and may represent the same species. Somewhat variable *Resapamea* populations resembling these types are found at mid-elevations in a large portion of the western United States and require further study to determine the number of species that are involved. Because of this, we feel that it is premature to consider *Resapamea innota* and *R. enargia* to be synonyms.

***Resapamea mammuthus* Crabo, sp. n.**
urn:lsid:zoobank.org:act:5D5927C7-717D-4DC4-B855-37389C705002
http://species-id.net/wiki/Resapamea_mammuthus
Figs 17, 41

Type material. Holotype Male. Canada, Yukon Territory, Old Crow, 5.VII.1983, R. J. Cannings leg./ Malaise trap. Forest edge on S-facing bluff/ Database CNC LEP 0094163/ SLIDE *Luperina* male ER8824. CNC. **Paratypes** None.

Etymology. The name is derived from the genus of the wooly mammoth– *Mammuthus*. It is befitting of the moth because its Beringian distribution and relatively large size for the genus. It is a noun in apposition.

Diagnosis. *Resapamea mammuthus* is unlikely to be confused with most other species of *Resapamea* in North America due to its northerly distribution and orange-tan color. It is superficially similar to *Resapamea hedeni* (Graeser) (Fig. 18), which occurs in Asia and might also occur in Alaska (see Remarks, below). The male genitalia of these species differ in the shape of the distal uncus. It is truncated in *R. mammuthus* with a small T-shaped expansion at the tip (Fig. 41 inset) and tapered to a point in *R. hedeni* (Fig. 43) as well as in all other North American *Resapamea* species. The vesica of *R. mammuthus* differs from those of all other *Resapamea* discussed in this paper in lacking the subbasal diverticulum and medial cornuti. It differs from that of *R. hedeni* in lacking a subbasal serrate (cock's comb) cornutus.

Description. Head – Antenna of male nearly filiform, with slight constriction at base of each segment, covered ventrally by short fine cilia. Antenna of female unknown. Scape orange tan, with dorsal tuft. Eye rounded, smooth. Labial palp covered laterally by short flat tan scales, lengthening to a brush-like fringe on ventral surface of first two segments. Frons smooth, covered in narrow orange-tan scales. Top of head covered in long narrow orange-tan scales. **Thorax** – Vestiture of collar, thorax, and tegula long,

narrow, apically notched orange-tan scales, appearing medium-dark orange-tan [central thorax of holotype partially mildewed]. Legs light tan; with three ventral rows of spiniform setae on basitarsus and four irregular rows on other tarsal segments. **Wings** – Forewing length: male 21.5 mm. Forewing with a mixture of tan, orange-tan, gray-tan, light-gray, brown-gray, and gray scales, appearing medium-dark orange tan, grayer near anterior and posterior margins and darker gray-brown in terminal area; veins near costa, distal to postmedial line, and near posterior margin gray but not strongly contrasting; an ill-defined dark mark in medial area distal to lower reniform spot. Basal, antemedial, and postmedial lines faint, ill-defined dark gray with adjacent light orange tan. Basal line only evident near costa. Antemedial line evident on costa and posterior to claviform spot, forming an oblique dark mark on costa and a zigzag line from claviform spot to posterior margin. Medial line absent. Postmedial line very faint, ill-defined, smooth, strongly oblique toward base anterior to reniform spot, straight and parallel to outer margin lateral to spot, and slightly angled and concave toward base below spot to meet posterior margin at a right angle. Subterminal line light orange tan, faint, undulating; preceded by a faint indistinct shade of dark gray that is strongest opposite cell and in fold. Terminal line thin, dark gray. Orbicular spot round, outlined by ill-defined faint gray and filled with light orange tan. Reniform spot moderately large, kidney shaped with strong lateral indent, dark gray along medial and lateral sides and open anteriorly and posteriorly, filled with cream, slightly grayer at posterior end. Claviform spot black, ill defined, strong anteriorly and weak posteriorly, narrow, filled with ground color. Fringe gray tan, with a lighter tan base and gray medial line. Hindwing light gray tan with gray suffusion, very faint postmedial line, marginal band, terminal line, veins, and chevron-shaped discal spot. Hindwing fringe slightly lighter than hindwing ground color. **Abdomen** – tan [abdomen of holotype mildewed]. **Male genitalia** – Uncus cylindrical at base, evenly downcurved, distal portion slightly dorsoventrally flattened and truncated at apex with small lateral projections to appear T-shaped (Fig. 41 inset). Tegumen with large penicillus lobes. Juxta shield shaped, 0.5 × as high as wide, with V-shaped ventral margin. Valve S-shaped, 5.5 × as long as wide (measured at mid-valve), widest at base and cucullus, mid-section 2/3 as wide as base and tapering slightly to narrow neck at base of cucullus; stout sclerotized knob-like basal saccular process extending dorsolaterally from base to just dorsal to costal attachment of valve, medial margin of this process irregular and apex rounded. Sacculus reaching 2/3 of distance to costal margin and extending distally to mid-valve. Clasper a smooth ridge. Ampulla short, round. Digitus a weak ridge, partially covered by medial cucullus. Cucullus well developed with rounded apical and anal ends, 2 × as wide as mid-valve; mesial surface covered by fine setae; corona of stout curved setae, dorsal half partially double. Aedeagus tubular, 3.6 × as long as wide, with short linear extension onto ventral vesica bearing a loose row of very small spines. Vesica 0.7 × as long as aedeagus, bent 135° toward right at base to project anteriorly and toward right, basal two-thirds bulbous and distal half tapering, with a single conical membranous diverticulum on anterior side of distal vesica projecting anteriorly and a subapical posterior patch of variable-sized spine-like cornuti directed basad. **Female genitalia** – Unknown.

Distribution and biology. This species is known only from the type locality at Old Crow, Yukon Territory. The habitat is described as forest edge on a south-facing hillside on the specimen label. The holotype was collected during early July. The early stages are unknown.

Remarks. Two unidentified *Resapamea* females in the CNC, one from Unalakleet, Alaska (Fig. 19) and the other from Reindeer Station, Aklavik, Northwest Territories (Fig. 20), resemble *R. mammuthus* and *R. hedeni*. We exclude them from the type series of *R. mammuthus* because their identity is uncertain until either population can be associated with males or until females of the Old Crow population of *R. mammuthus* are found. Their superficial appearances suggest that the Aklavik specimen is the female of *R. mammuthus* and that the Unalakleet specimen is *R. hedeni* or a closely related species.

***Hydraecia obliqua* (Harvey)**
http://species-id.net/wiki/Hydraecia_obliqua
Figs 21–23

Gortyna obliqua Harvey 1876: 53. Type locality: [USA], California, [Mendocino]. NOTE: *Gortyna obliqua* was described from a single specimen. Poole (1989) states that the holotype is in the BMNH. This appears to be incorrect because all Harvey type material, including that in the BMNH, was examined by Barnes and Benjamin (1924) who concluded that a specimen in the AMNH labeled "Mendocino, California/4410/No. 10703 Collection Hy. Edwards/*Apamea obliqua*. Harv." is the type.

Gortyna ximena Barnes and Benjamin 1924: 160. Type locality: [USA], California, Truckee. **syn. n.**

Gortyna columbia Barnes and Benjamin 1924: 161. Type locality: [Canada], B[ritish] C[olumbia], Saanich District. **syn. n.**

Remarks. More than a decade ago, prior to the availability of mitochondrial DNA, the senior author conducted a study of the genus *Hydraecia* Guenée focusing on the western North American species related to *Hydraecia obliqua* (Harvey), herein referred to as the *Hydraecia obliqua* species-group for convenience. These moths occur over a large area spanning the Pacific Coast to the Great Plains west to east and British Columbia, Alberta, and Saskatchewan to southern California, northeastern Arizona, and northern New Mexico north to south. This study included examination of all primary types, assembling over 600 specimens from most large institutional and many private North American collections, and examination of over 60 genitalia preparations. The conclusion was that *Hydraecia intermedia* (Barnes & Benjamin), known only from the holotype from Fort Calgary, is distinct but that all other populations in the species-group exhibit nearly continuous clinal variation in maculation and genitalia to form a circle of races (rassenkreis) from California, across Montana, and ending in the montane forests of the Southwest. This work was accepted for publication but

was withdrawn because of the author's concern that somewhat distinctive populations on the Pacific Coast and in the Southwest might be different species from the widespread intervening population but that the genitalia structure lacked differences sufficient for resolving the species.

Since then, barcodes have demonstrated a consistent 2% difference between populations from near the Pacific Coast (northern California, Washington, and British Columbia (n=6)) and those from farther inland (Colorado, Washington, Wyoming, Alberta, and British Columbia (n=7)) that along with slight differences in maculation suggest that they are best treated as distinct species. The western species is *Hydraecia obliqua* and the eastern one is *Hydraecia medialis* Smith.

Hydraecia obliqua occurs east to the Sierra Nevada in California and the crest of the Cascade Range in Oregon and Washington. It occurs continuously on the coast north to southwestern British Columbia, with a disjunct northern population at Terrace, British Columbia. Its forewing is warm orange brown, varying considerably in darkness from dark brown on the California Coast (Fig. 21), lighter orange brown in the Pacific Northwest (Figs 22–23), and pale yellow brown in the Sierra Nevada. The hindwing is pale with a yellow tint, usually with dark veins and a gray suffusion in the submarginal area. The forewing pattern is similar to that of *H. medialis*, especially where they approach each other in the PNW, with slight differences that are described under *H. medialis*.

An area of possible intergradation between *H. obliqua* and *H. medialis* in Oregon is discussed under *H. medialis*.

Hydraecia medialis **Smith**

http://species-id.net/wiki/Hydraecia_medialis
Figs 24–26

Hydroecia medialis Smith 1892: 251. Type locality: [USA], Colorado.
Hydroecia pallescens Smith 1899: 25. Type locality: [Canada], Alberta, Calgary. **syn. n.**

Remarks. *Hydraecia medialis* is the widespread and variable species that occurs east of the range of *H. obliqua*. It is similar to it in size and pattern but is duller gray brown in the PNW, ranging from very pale (Fig. 24) to darker gray brown (Figs 25–26). The

Figures 21–31. Adults of Noctuidae. **21** *Hydraecia obliqua* (Harvey), male, USA, CA, Sonoma Co., Bodega Bay Dunes **22** *H. obliqua* (Harvey), male, USA, WA, Island Co., Deception Pass State Park **23** *H. obliqua* (Harvey), male, USA, OR, Lane Co., S Fork McKenzie River near Cougar Reservoir **24** *Hydraecia medialis* Smith, male, USA, WA, Douglas Co., Jameson Lake **25** *H. medialis* Smith, male, USA, OR, Grant Co., South Fork John Day River **26** *H. medialis* Smith, male, Canada, BC, Princeton, Hayes Creek **27** *Fishia nigrescens* Hammond & Crabo, male paratype, USA, OR, Klamath Co., 6 mi. SE of Klamath Falls **28** *Fishia nigrescens* Hammond & Crabo, male holotype, USA, NV, Lander Co., 3 mi. W of Kingston **29** *Fishia yosemitae* (Grote), male, USA, OR, Lake Co., Deep Creek W of Adel **30** *Xestia perquiritata orca* Crabo & Hammond, male paratype, OR, [Lincoln Co.], Newport **31** *Xestia perquiritata partita* (McDunnough), male, WA, Pend Oreille Co., Salmo Mountain.


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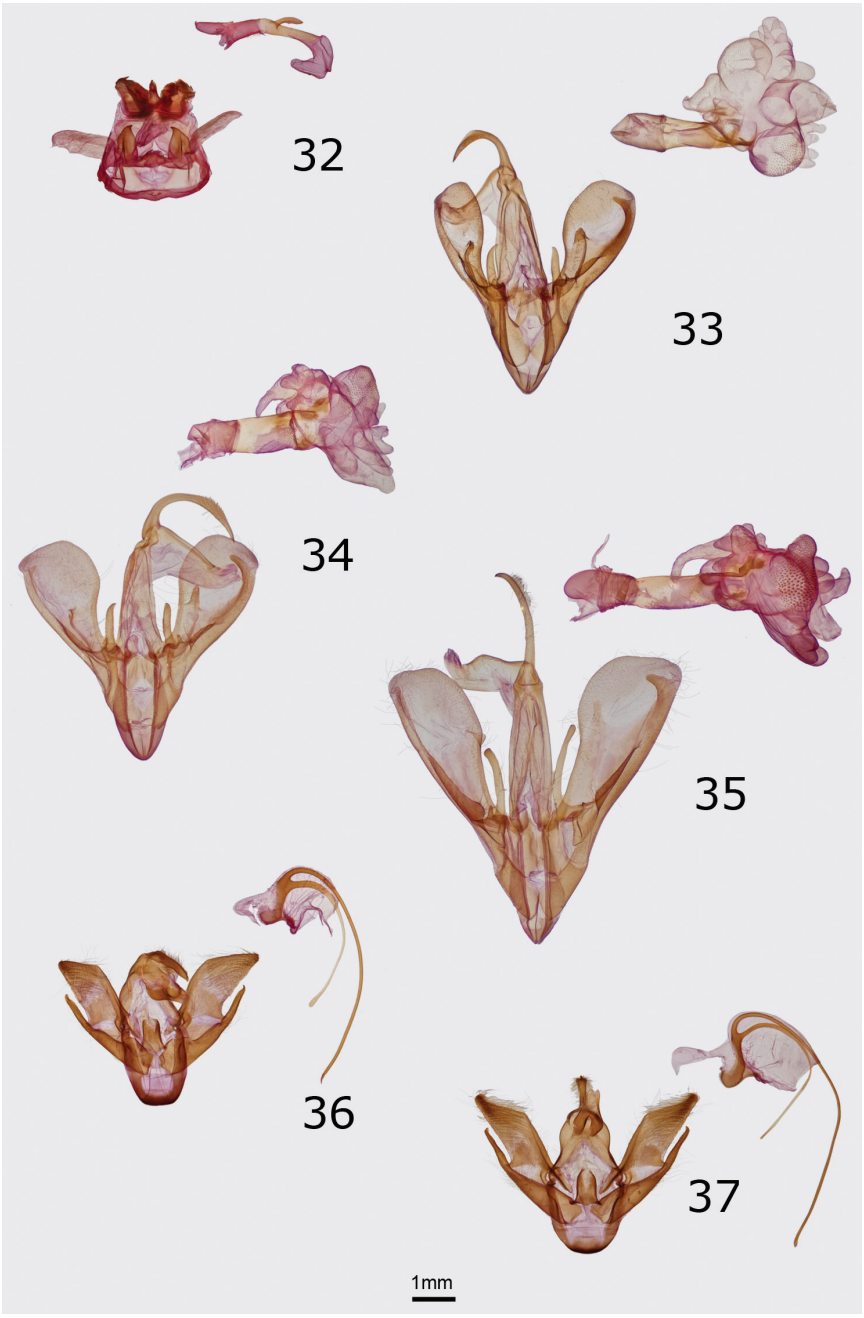


Figures 32–37. Male genitalia of Erebidae and Noctuidae. Ventral or right aspect of aedeagus is shown. **32** *Cycnia oregonensis tristis* Crabo, paratype, USA, WA, Thurston Co., Plumb (ventral aspect) **33** *Drasteria parallela* Crabo & Mustelin, paratype, USA, WA, Klickitat Co., Simcoe Butte **34** *Drasteria convergens* Mustelin, USA, CA, Mono Co., Lee Vining **35** *Drasteria divergens* (Behr), USA, OR, Baker Co., Burnt River Canyon **36** *Eudryas brevipennis bonneville* Shepard & Crabo, paratype, USA, ID, Twin Falls Co., Buhl **37** *Eudryas unio* (Hübner), USA, MA, Norfolk Co., Ponkapoag Bog.

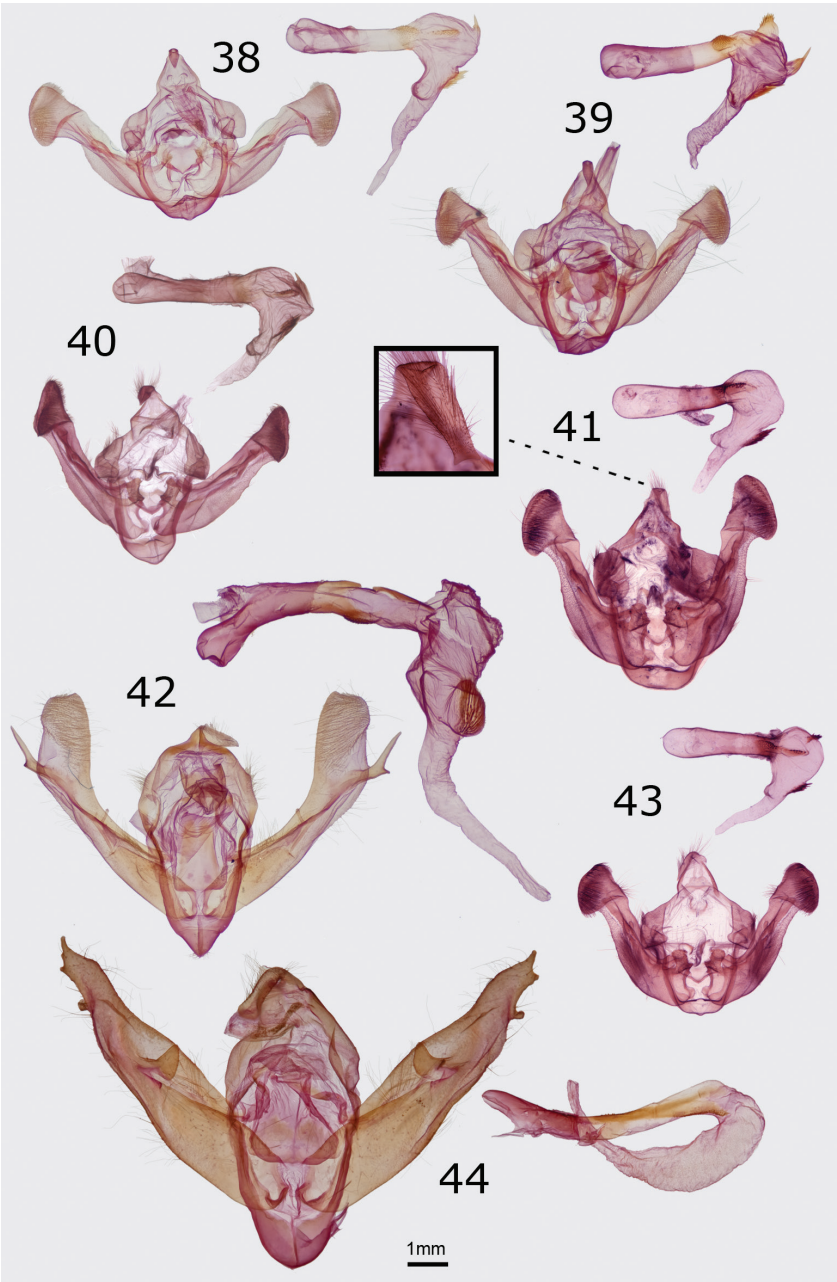
forewing postmedial line tends to be more angled relative to the posterior margin than in *H. obliqua* and usually lacks a slight bend in or near the fold that is found commonly in that species. The hindwing ground color is variable, most commonly off-white, but lacks a yellow tint. Gray scaling on the hindwing varies from absent to covering the entire wing. When present on the distal portion, it often forms a band to the outer margin, whereas in *H. obliqua* gray shading usually leaves the outer edge of the wing pale. Specimens of *H. medialis* from forests tend to be darker than those from open sage steppe habitats, especially in southern British Columbia and western Montana. Its northern limit in the PNW is at 100 Mile House in south-central British Columbia.

Specimens of *H. medialis* from the Great Plains are similar to those in the PNW but tend to be more uniform with dull gray-tan color, smooth lines, and less contrast between the antemedial and medial areas on the inner third of the forewing. Populations from the southern Rocky Mountains have a similar pattern to those from the Great Plains but are more colorful and variable, with gray or red-brown individuals and paler gray-white subterminal areas. Those from Utah and Arizona are red brown, darkest in Arizona.

As mentioned under *H. obliqua*, the barcodes of *H. obliqua* and *H. medialis* differ by 2%. A third barcode haplotype differing from both of these by slightly more than 2% exists for a single specimen of *H. medialis* from Wyoming (BOLDSYSTEMS Sample ID: CNCNoctuoidea6703). This specimen is superficially indistinguishable from two other Wyoming specimens with barcodes that match those of other *H. medialis* and this haplotype is therefore interpreted as a DNA polymorphism rather than evidence of a cryptic species.

A discussion of *Hydraecia intermedia*–known only from the holotype–is warranted in this section because its type locality of Fort Calgary suggests that it should be sympatric with *H. medialis* near present-day Calgary in southwestern Alberta. Its forewing is warm yellow brown unlike those of *H. medialis*, with markings that are more like those of *H. obliqua* than *H. medialis*. Structurally, its digitus is shorter and more bluntly rounded than those of all other populations in the *H. obliqua* species-group (n=45). The following discussion regarding its type locality is contributed by B. C. Schmidt:

"*Hydraecia intermedia* is an enigmatic taxon that has not been recorded near the stated type locality, nor anywhere else in Alberta (Pohl et al. 2010), since the collection of the type specimen about a century ago. In Barnes and McDunnough's (1924) original description, the type specimen data is given as "Ft. Calgary, N. W. Brit. Columbia" and "VIII, 16" without a mention of year or collector. Virtually all of the moth specimens originating from the Calgary area in the early 1900's were collected by the well-known pioneer lepidopterist Frederic Hova Wolley Dod who resided in the foothills just west of Calgary (Bird et al. 1995), and who was the source of many moths named by J. B. Smith (Todd 1982). However, Dod's specimens were never labelled as "Ft. Calgary" nor "N. W. Brit. Columbia" – this convention appears to have been used solely by J. Gamble Geddes, who made extensive Lepidoptera collections in southwestern Alberta during his visits in 1883 and 1884 (Geddes 1889). It is not clear why Geddes referred to the region as North West British Columbia, as the modern bound-



Figures 38–44. Male genitalia of Noctuidae. Ventral aspect of aedeagus is shown. Distal uncus of Fig. 41 is inset. **38** *Resapamea diluvius* Crabo, paratype, USA, WA, Grant Co., Potholes **39** *Resapamea passer* (Guenée), USA, WA, Douglas Co., 5 km ESE of Orondo **40** *Resapamea angelika* Crabo, holotype, USA, NV, Elko Co., Angel Lake **41** *Resapamea mammuthus* Crabo, holotype, Canada, YT, Old Crow **42** *Fishia nigrescens* Hammond & Crabo, paratype, USA, OR, Klamath Co., 6 mi. SE of Klamath Falls **43** *Resapamea hedeni* (Graeser), Russia, Magadan Oblast, Tenkinsky District, Stokovyi **44** *Xestia perquiritata orca* Crabo & Hammond, paratype, USA, WA, Clallam Co., Neah Bay.

aries of British Columbia were already established at that time, while southern Alberta was known as the district of Alberta and was part of the North West Territories. A subsequent note on his collecting again shows that he referred to the region as British Columbia (Geddes 1889), possibly because he considered the mountains and passes he visited to be part of B.C. (the passes indeed straddling the Alberta – B.C. boundary). Several butterflies (*Lycaena dorcas florus* W. H. Edwards, *Colias elis* Strecker) and moths collected by Geddes during these trips were named as new species. Geddes' handwritten catalogue of butterflies in the CNC Entomology Library indicates that Geddes collected butterflies in the Crowsnest Pass area in August of 1883, and was collecting in the Crowsnest Pass proper on August 16th, corresponding to the "VIII 16" of the *intermedia* holotype. As there was no direct rail line between the Crowsnest Pass and Calgary, some 350 km distant, it is very unlikely that the *intermedia* type could have been collected on the same day in Calgary, and it appears that Geddes simply recorded the nearest major settlement before distributing the specimens and associated label data. A week earlier, Geddes collected the type specimens of *Lycaena dorcas florus* (W. H. Edwards) at "Garnett's Ranche" near Lundbreck at the mouth of the Crowsnest Pass (Bird and Ferris 1979). As Geddes visited and likely also stayed at Garnett's Ranch, which served as a base for geology field parties (Inglis 1978), Geddes undoubtedly also collected moths at the ranch. The type locality of *Gortyna intermedia* Barnes & Benjamin is therefore restricted to Lundbreck, Municipality of Crowsnest Pass, Alberta. The diverse montane fauna of southwestern Alberta continues to yield previously undocumented moth species (Schmidt 2007), and the persistence of an undiscovered population of *H.intermedia* is certainly possible."

The holotype of *H. intermedia* resembles the single specimen of *H. obliqua* in the CNC from Terrace in west-central British Columbia. This locality is far north of the continuous distribution of *H. obliqua*, which ends near Vancouver, British Columbia. This specimen is structurally similar to other *H. obliqua* populations, not *H. intermedia*. All British Columbia *H. obliqua* species-group specimens from east of the Cascade Mountains and British Columbia Coast Ranges are typical *H. medialis*, including from Cranbrook which is the closest locality to the Crowsnest Pass locality of *H. intermedia*. Nonetheless, it is interesting to speculate that *H. intermedia* could be an eastern population of *H. obliqua*. We retain *H. intermedia* as a species because of the structural differences between it and *H. obliqua*, and because there are no records of similar specimens in central British Columbia between Terrace and Crowsnest Pass.

Although the present reduction of this species-group to three species–*H. intermedia*, *H. medialis*, and *H. obliqua*–is best supported by the available data there are two remaining issues that cannot be solved with the information at hand. A large series of specimens from the east slope of the Cascades at Camp Sherman, Jefferson County, Oregon at OSAC show possible intergradation between *H. obliqua* and *H. medialis*, with some specimens that are difficult to assign to either species. This raises the possibility that the original hypothesis that *H. obliqua* and *H. medialis* are the same species could be correct despite the different barcodes in coastal and interior populations. Barcode or other DNA data from this population might help to elucidate its significance but is not available.

Similarly in the Southwest, at the other end of the rassenkreis, more DNA samples from Colorado, Utah, and Arizona would be helpful to exclude the presence of an undiscovered species amongst the colorful populations that occur there. Of these, a dusky red-brown population from east-central Arizona is the most distinctive.

Tribe Xylenini Guenée, 1837
Subtribe Antitypina Forbes & Franclemont, 1954

***Fishia nigrescens* Hammond & Crabo, sp. n.**
urn:lsid:zoobank.org:act:B23F75CA-E5EA-4891-AEFC-19C4DE6035CD
http://species-id.net/wiki/Fishia_nigrescens
Figs 27–28, 42, 52

Type material. Holotype Male. [USA], Nevada, Lander Co., 3 mi W of Kingston, Kingston Cr., 7150' [2179 m.], 30.IX.2000, Laurence L. Crabtree leg./Database for Noctuoidae [sic] 14832/Genitalia CNC #15215/Barcodes of Life Project, Leg removed, DNA extracted. CNC. **Paratypes** 7 males, 1 female. **USA**. **California.** Mono County: Dunes NE of Mono Lake, 23.IX.1995, R. Robertson leg. Barcodes of Life Noctuoidea 14834 (1 male); [same data as previous], Barcodes of Life Noctuoidea 14833 (1 male); Riverside County: Pinyon Crest, 4000' [1219 m], 5.XI.1966, R. H. Leuschner leg. Genitalia slide CNC 15223 (1 male). **Oregon**. Deschutes County: Cline Falls State Park, J. C. Miller coll., Larva 25.V.1995 on *Chrysothamnus nauseosus*, Pupa 19.VI.1995, Adult 28.IX.1995 (1 male); Grant County: John Day Fossil Bed N. M., Sheep Rock Unit U. C., 2.X.2003, U.S. Natl. Park Service leg. (1 male); Jefferson County: Warmsprings, 27.X.[19]52, S. G. Jewett Jr. (1 female); Lake County: Hwy. 20 at Glass Butte, 23.X.2009 U.S.D.A (1 male); Klamath County: 6 mi. SE of Klamath Falls, 14.X.1964, Kenneth Goeden, Blk. Light trap (1 male). CNC, OSAC.

The type series is restricted to California, Nevada, and Oregon. Two additional specimens from Mt. Lemmon Highway, Pima County, Arizona at the CNC are excluded from the type series.

Etymology. The name is derived from the Latin *niger* meaning black or dusky. It refers to the forewing color of the moth.

Diagnosis. *Fishia nigrescens* is distinguished from other North American *Fishia* species by the charcoal-gray forewing without warm brown or reddish shades. Other western North American species are either much lighter gray (*Fishia yosemitae* (Grote) (Fig. 29)) or have brown color on the forewing (*Fishia discors* (Grote) and *Fishia connecta* (Smith)). The reniform spot of *F. nigrescens* is arrowhead shaped with a deep lateral indentation. That of *F. yosemitae* is an upright ovoid shape with only a weak lateral indentation.

In the male genitalia, the valve of *F. nigrescens* can be told from that of *F. yosemitae* by the shape of the digitus. In *F. nigrescens* the two prongs of the bifid digitus are unequal in length with a long dorsal and short ventral process. In *F. yosemitae* these processes are shorter and of similar length.

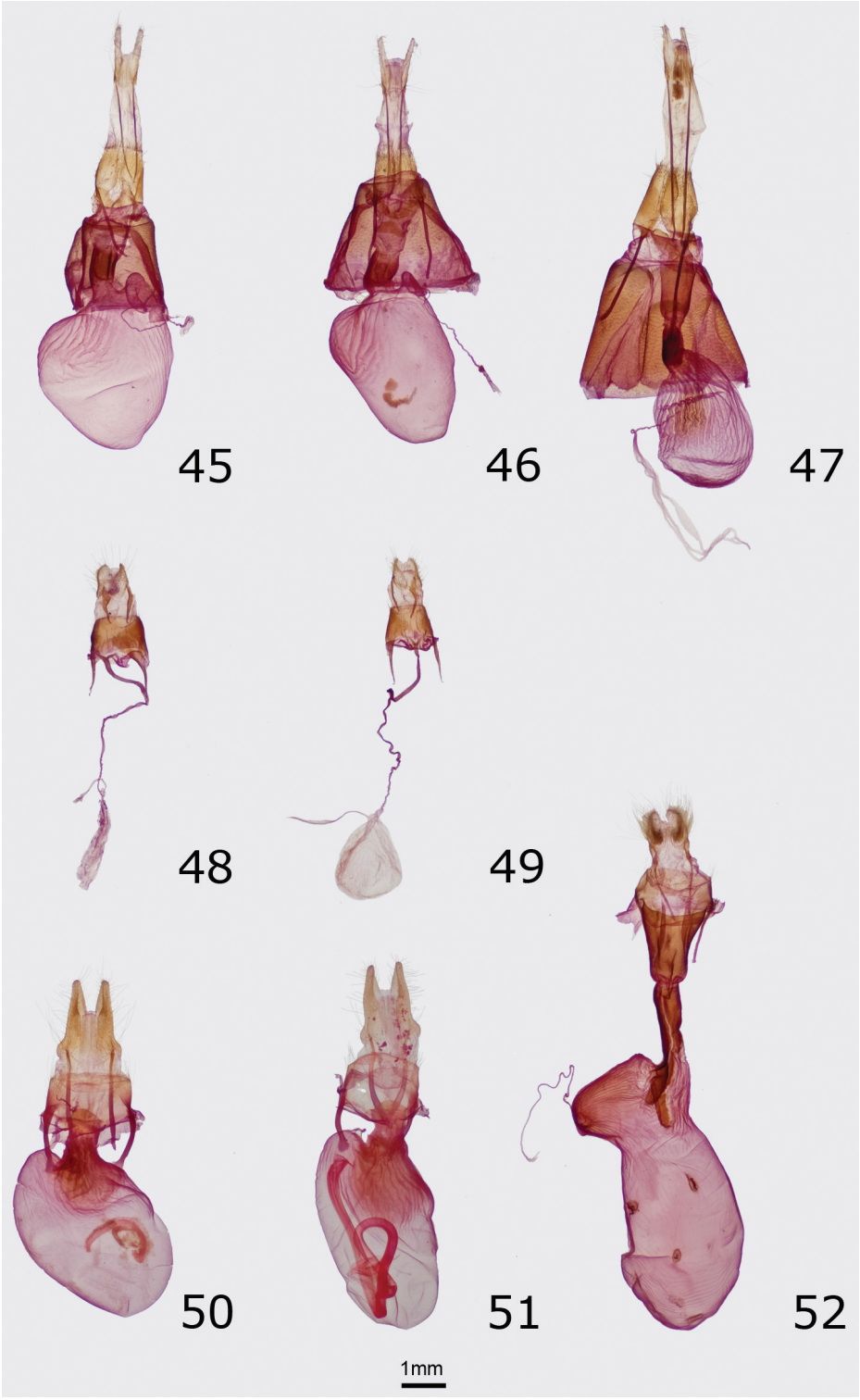
The female genitalia of *F. nigrescens* differ from those of *F. yosemitae* in the shape of the left posterior projection of the corpus bursae, blunter and more conical in *F. nigrescens* and rounder in *F. yosemitae*. The bursa of *F. nigrescens* has five signa whereas that of *F. yosemitae* has three, lacking two small signa at the anterior end.

Description. Head – Antenna of male biserrate and fasciculate. Antenna of female filiform. Scape with anterodorsal tuft of long gray scales and an anteroventral tuft of white scales. Eye rounded, smooth. Labial palp covered laterally by a mixture of short flat tan and black scales, lengthening to a brush on ventral portion of first two segments; short distal segment covered in white and gray scales. Frons covered in short, narrow, bifurcate scales, light gray centrally and dark gray laterally. Top of head covered in longer white-tipped gray scales. **Thorax** – Vestiture of bifurcate and trifurcate gray, white, and white-tipped gray scales, appearing slightly hoary dark gray, with short paired anterior tufts behind collar. Prothoracic collar gray with a gull-wing-shaped black transverse line across mid-portion and a pale edge. Tegula gray with black lines parallel to medial and lateral margins. Legs gray with dark- and light-gray barring on tarsal segments; lateral tibia with partial loose row of spiniform setae; tarsal segments with three ventral rows of spiniform setae. **Wings** – Forewing length: males 19–20 mm; female 18 mm. Forewings of males and females similar. Forewing ground color slightly mottled charcoal gray, darkest in median area in fold and in subterminal and terminal areas opposite cell and in fold; lightest near apex and in mid-terminal area; distal veins black; basal dash thin, black; a thicker black line spans median area in fold, and a similar shorter line present anterior to M2 distal to reniform spot. Basal and antemedial lines similar, dark gray with lighter-gray filling. Basal line evident on costa and near cell, appearing broken. Antemedial line dentate, strongly on mid and posterior part of wing, with a long tooth toward lateral margin on 1A+2A. Medial line dark gray, faintly evident only on costa. Postmedial line two black spots on costa, faint and difficult to identify near end of cell, gray to black and filled with white on mid- and posterior part of wing, strongly serrate on mid-wing, forming a strong black and white tooth toward base in fold. Subterminal line pale gray, incomplete, with a series of white spots between veins on mid-wing; preceded by a series of long black chevrons between veins on mid-wing. Terminal line a series of black wedge-shaped spots between veins. Orbicular and reniform spots outlined incompletely by thin black line. Orbicular spot elongate, oval, filled with light gray with a central dark-gray line parallel to long axis. Reniform spot moderately large, broadly C-shaped with deep lateral indentation, posterior part extending farther laterally than anterior part, filled with light gray with a dark-gray line in medial and inferior portion. Claviform spot black, darkest posteriorly, inconspicuous due to dark adjacent ground. Fringe scalloped, dark gray with a medial black line, checkered with whitish gray at ends of veins. Dorsal hindwing white with a slight sheen in males and medium-dark gray in females, with dark gray veins, faint gray discal spot, and black terminal line in both sexes. Hindwing fringe white in male, light gray in female, with an incomplete gray medial line and scattered gray scales in basal row in both sexes. **Abdomen** – Abdomen covered with a mixture of white-tipped gray and white flat and gray hair-like scales, appearing powdery medium gray. **Male genitalia** – Uncus

relatively short and nearly straight, pointed at tip. Tegumen with weak penicillus lobes. Juxta nearly rectangular, 1.4 × as long as wide, dorsal portion at opening for aedeagus slightly narrower than base. Valve elongate, 5.5 × as long as wide, widest at junction of proximal two-thirds and distal third near digitus, distal third angled 30° dorsad relative to base; sacculus fairly weak, tapering evenly from base to slightly beyond mid-valve; small ampulla present; clasper a sclerotized ridge; digitus prominent, cylindrical, projecting 45° ventrad and distal relative to basal axis of valve, with bifurcation at midpoint with long dorsal and short ventral projections with sharply-pointed tips; cucullus weak, apically truncate, inner surface covered entirely with fine setae but lacking a corona. Aedeagus tubular, 5 × as long as wide, with a spinulose patch on distal right side and an elongate extension onto base of vesica on left. Vesica as long as aedeagus and 0.5 × as wide as long, oriented 90° to aedeagus, anvil-shaped with short blunt projection dorsad and leftward and long tapering distal portion extending ventrad and rightward; with two subapical diverticula, larger diverticulum on posteroventral aspect ovoid with dense covering of short cornuti oriented basad, smaller diverticulum on ventral portion rounded, without cornuti. **Female genitalia** – Ovipositor lobes pad-like, covered densely with long thin setae. Abdominal segment VIII 3 × as wide as long; anterior and posterior apophyses nearly equal in length, 0.67 × as long as segment VIII. Ostium bursae moderately sclerotized similar to adjacent posterior ductus bursae, nearly as wide as segment VIII. Ductus bursae 6.8 × as long as segment VIII, divided into two segments of equal length; posterior segment trapezoidal, evenly sclerotized, tapering anteriorly to a narrow waist 1/3 × as wide as ostium bursae; anterior segment cylindrical, strongly sclerotized except for thin ventral slit along entire length, anterior portion with long extensions onto dorsal and ventral corpus bursae. Corpus bursae membranous, unisaccate and elongate, 1.75 × as long as ductus bursae and 0.4 × as wide as long; larger anterior portion ovoid, widest anteriorly, bearing five small rugose ovoid signa, two on mid ventral surface and three on dorsal and anterior end; smaller posterior end with broadly conical projection toward left with ductus seminalis at anterior apex.

Distribution and biology. *Fishia nigrescens* occurs in central and eastern Oregon, Nevada, eastern California, and Arizona. Its flight season is late fall, usually during October. The habitat is sage steppe, often in open juniper forest in Oregon. A specimen of this species was reared from rabbitbrush (*Ericameria nauseosa* (Pallas ex Pursh) G.L. Nesom & Baird) (Asteraceae) in Oregon. The larva was collected in May, pupated in June, and emerged in late September of the same year. It was described as green with a white lateral band.

Figures 45–52. Female genitalia of Erebidae and Noctuidae. Ventral aspect. **45** *Drasteria parallela* Crabo & Mustelin, USA, CA, Siskiyou Co., Deadfall Meadow **46** *Drasteria convergens* Mustelin, USA, CA, Mono Co., Lee Vining **47** *Drasteria divergens* (Behr), USA, Baker Co., Burnt River Canyon **48** *Eudryas brevipennis bonneville* Shepard & Crabo, paratype, USA, ID, Twin Falls Co., Kimberly **49** *Eudryas unio* (Hübner), USA, WI, St. Croix Co., S18 Springfield Township **50** *Resapamea diluvius* Crabo, paratype, USA, WA, Adams Co., Washtucna **51** *Resapamea passer* (Guenée), USA, WA, Douglas County, 3 mi. ESE of Orondo **52** *Fishia nigrescens* Hammond & Crabo, paratype, USA, OR, Jefferson Co., Warm Springs.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48
49
50
51
52
1mm

Remarks. *Fishia yosemitae* was described as *Cucullia yosemitae* Grote. The extant type at the AMNH and those of its synonyms described from western North America, *Fishia exhilarata* Smith and *Fishia betsia* Smith, were examined from photographs to exclude the possibility that one of them could be the correct name for *Fishia nigrescens*.

Specimens of *F. nigrescens* from Oregon are darker than those from Nevada and eastern California, whereas those from Arizona are slightly lighter gray.

Tribe Noctuini Latreille, 1809

Xestia perquiritata orca Crabo & Hammond, ssp. n.

http://species-id.net/wiki/Xestia_perquiritata_orca
Figs 30, 44

Type Material. Holotype Male. [USA], Oregon, [Lincoln County], Newport, 25.VII.1961. CNC. **Paratypes** 5 Males, 1 Female. **USA**. **Oregon**. Lincoln County: Newport, 20.VIII.1968, K. J. Goeden collector, black-lite trap (1 female); [same locality and collector], 1.VIII.1970 (2 males). 5 mi. S. Newport 4 VIII 1968, Ore. Dept. Agric. (2 males); [same locality], 30 VII 1970, Brown and Goeden leg. (1 male). **Washington**. Clallam County: Neah Bay, 14.VIII.1961, R. E. Miller (1 male); Grays Harbor County: 3 mi. N Copalis Beach, 11.VIII.2010, MV, Gary L. Peters (1 male). WFBM, GPC, LGCC, ODA, OSAC.

Etymology. The subspecies name is derived from *Orcinus orca*, the killer whale, and is a noun in apposition. It refers to the moth's Pacific Coast distribution, large size, and nearly black and white forewing.

Diagnosis. Subspecies *orca* is larger than other populations of *Xestia perquiritata* (Morrison). It is the only subspecies in which the wing is uniform black with unmarked white filling of the lines and spots. The western mountain subspecies *X. p. partita* (McDunnough) (Fig. 31) has occasional melanic specimens. These are smaller than *X. p. orca* (forewing length 16–20 mm for subspecies *partita*; 21–23 mm for *X. p. orca*) and differ in having light gray forewing lines and spots as well as darker gray scales in the central reniform spot. These markings are pure white or cream in subspecies *orca*.

The valve of the male genitalia of *X. p. orca* is more massive than that of subspecies *partita*, reflecting the larger size of the moth. The female genitalia of *X. p. orca* were not examined but are unlikely to differ significantly from those of other *X. perquiritata* populations illustrated in Lafontaine (1998).

Description. Head – Antenna of male beadlike with short anterior and posterior fasciculations. Antenna of female filiform. Scape with black and white scales, predominantly black dorsally and white ventrally. Eye rounded, smooth. Labial palp covered in gray and blackish-gray scales, scales short on sides and lengthening to a ventral fringe on first two segments. Frons smooth, covered by thin scales that are white centrally and black on sides of head. Top of head covered by thin black scales with scattered white scales in midline and on posterior aspect. **Thorax** – Vestiture of weakly spatulate white-tipped

black and scattered white scales, appearing black. Prothoracic collar black with pale-gray edge. Tegula covered by black scales. Legs covered by dark-gray scales with a white ring on each distal segment; medial tibia with a loose row of spiniform setae; ventral tarsal segments with three rows of spiniform setae. **Wings** – Forewing length of males 21–23 mm; females 22 mm. Forewing ground color nearly even brownish black; darkest black in basal area posterior to cubital vein, in fold in medial area, opposite cell and in fold in subterminal area, and between veins in subterminal area; palest whitish gray anterior to cubital vein across antemedial area; slightly mottled with smudged darker veins in terminal area. Basal, antemedial, and postmedial lines similar, black, double, with nearly white pale-cream filling; mostly evident as filling because of dark ground. Basal line pale filling fused to adjacent pale anterior antemedial area. Antemedial line strongly excurved with apex at base of claviform spot, drawn toward base on veins. Medial line absent. Postmedial line toothed on veins; sharply displaced toward base on costa to top of reniform spot, nearly straight from below costa to M3, then angled toward base and slightly curved to meet posterior margin at nearly a right angle. Subterminal line pale gray near costa and evident elsewhere as a transition between black in subterminal area and slightly lighter terminal area. Terminal line a series of black spots between veins. Orbicular and reniform spots completely filled with light cream, often fused. Orbicular spot irregularly ovoid. Reniform spot sideways heart shaped with a deep lateral indentation. Fringe dark gray, weakly scalloped with black. Dorsal hindwing sooty dark gray, faintly brown tinted in some specimens, with faintly darker thin discal spot, postmedial line, veins, and thin terminal line. Hindwing fringe light gray with darker base. **Abdomen** – Blackish gray, slightly lighter than thorax. **Male genitalia** – Uncus strap-like, dorso-ventrally flattened with a spatulate tip. Tegumen with weak penicillus lobes. Juxta broad, 1.8 × as wide as long, with straight transverse ventral margin and bilobed dorsal margin with a slight notch at base of aedeagus. Valve elongate, 4.5 × as long as wide, with slightly undulating costal and ventral margins, tapering to a point distal point with additional small projection from subapical ventral margin and an elongate pollex typical of genus *Xestia* (Lafontaine 1998). Sacculus moderate, expanded to reach costal margin at base of valve and tapering distally to end at mid-valve. Clasper shark-fin shaped, oriented slightly mesially at origin and curved nearly 90° laterally to project dorsolaterally with tip slightly dorsal to costa. Digitus weak, broadly triangular. Apex of valve as described above without an expanded cucullus or corona. Aedeagus long and tubular, 8 × as long as wide, gradually widening from mid-shaft to apex, bearing patches of fine spinules on left side of mid-portion and on right side of apex. Vesica a simple membranous tube, 0.8 × as long as aedeagus and 0.3 × as wide as long; basilar vesica recurved 180° dorsad and rightward so that mid-vesica projects toward base of aedeagus and distal portion curved additional 45° leftward to overlap aedeagus. **Female genitalia** – Not examined.

Distribution and biology. This moth is restricted to the immediate Pacific Coast of Oregon and Washington, usually within several hundred meters of the shore. It has been collected from the vicinity of Newport on the central Oregon coast north to Neah Bay on the northwest tip of the Olympic Peninsula in Washington. Subspecies *X. p. orca* flies during late July and August. The food plant is unknown, but other subspecies

of *X. perquiritata* have been reared from conifers in the family Pinaceae, particularly firs (*Abies* spp.) and spruces (*Picea* spp.) (Lafontaine 1998). Based on the composition of the forests where *X. p. orca* occurs the most likely food plant is Sitka spruce (*Picea sitchensis* (Bong.) Carr.), although grand fir (*Abies grandis* (Dougl.) Forbes) is possible.

Remarks. The genus *Xestia* was revised for North America by Lafontaine (1998). He considered a specimen in the CNC from Newport, Oregon to be a melanic *X. p. partita* (McDunnough), the western North American subspecies of this boreal and montane moth. At the time, the coast population was only known from a few specimens from this locality and only one of these was at the CNC. It is now apparent that distinct coastal populations of *X. perquiritata* have a range that extends at least as far north as the Olympic Peninsula and are nearly uniform in appearance. This subspecies might have a wider distribution on the coasts of northwestern California, British Columbia, and Alaska.

Figure 53. Dune habitat of *Resapamea diluvius* at Potholes, Grant County, Washington, showing the likely foodplant *Rumex venosus* in flower during May.

Discussion

The taxonomic changes and new taxa descriptions in this paper are part of an ongoing effort to understand fully the macromoth fauna of the PNW. Once published, these changes will be added to the website Pacific Northwest Moths (http://pnwmoths.biol.wwu.edu/).

Although the focus of this work is regional, the genera *Resapamea* and *Hydraecia* in the tribe Apameini of the Noctuidae are partially revised herein. This piecemeal ap-

proach may be less optimal than an all-encompassing generic revision, however, there are at present barriers that preclude satisfactory completion of such a study in both genera. *Resapamea* and the species in the *Hydraecia obliqua* species-group are similar in that structural differences between species are slight (e. g., Figs 38–41). Therefore, other distinguishing features such as differences in biology or DNA sequences, like barcodes, assume greater importance for defining species boundaries. The most readily available DNA sequencing techniques require recently collected material, preferably less than ten years old. Most North American museum material is significantly older than this and fresher material is not currently available for these species from areas that are likely to be critical to solving the remaining quandaries. Collectors are encouraged to seek out and submit specimens for DNA sequencing of *Hydraecia* from the east slope of the Cascades in Oregon and the Southwest, and *Resapamea innota* and *Resapamea enargia* from any part of the western United States. Any *Hydraecia* specimens from central British Columbia or near the border of Alberta and British Columbia might shed light on the relationship of *H. intermedia* to *H. obliqua*.

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RESEARCH ARTICLE

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A review of the *Paectes arcigera* species complex (Guenée) (Lepidoptera, Euteliidae)

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Abstract

Five new species of *Paectes* Hübner [1818] related to *Paectes arcigera* (Guenée) (Puerto Rico, U.S. Virgin Islands, British Virgin Islands, Guadeloupe, Dominica, St. Lucia, Trinidad) and *P. longiformis* Pogue (Brazil) are described: *P. asper* **sp. n.** (Florida, Bahamas, Cuba, Cayman Islands, Jamaica, Haiti, Dominican Republic, Puerto Rico, British Virgin Islands, U.S. Virgin Islands, Dominica, Colombia), *P. medialba* **sp. n.** (Argentina), *P. similis* **sp. n.** (Brazil), *P. sinuosa* **sp. n.** (Argentina, Brazil, Paraguay), and *P. tumida* **sp. n.** (Colombia, Guyana, Suriname, French Guiana). Adults and genitalia are illustrated for all species. Taxonomic changes include the **rev. stat.** of *P. nana* (Walker) (Florida, Greater Antilles, Mexico, Guatemala, Galapagos) as a valid species and **revised synonyms** *P. indefatigabilis* Schaus and *P. isabel* Schaus as junior synonyms of *P. nana* instead of *P. arcigera.* New host records for *P. sinuosa* and *P. nana* reared on Brazilian peppertree (*Schinus terebinthifolius* Raddi, Anacardiaceae) are presented. The holotype and female genitalia of *P. obrotunda* (Guenée) are illustrated.

Keywords

Taxonomy, new species, Brazilian peppertree, *Schinus terebinthifolius*, Anacardiaceae, invasive species, new host records

Introduction

Specimens of a species described as *Paectes longiformis* Pogue were sent to me for identification from scientists at the Biological Control Research and Containment Laboratory, University of Florida, Ft. Pierce, FL. This species is being tested for possible release as a biological control agent of the Brazilian peppertree (*Schinus terebinthifolius* Raddi, Anacardiaceae), an invasive species with severe economic impact. Specimens originated near the airport in Salvador, Bahia, Brazil. Originally thought to be *Paectes obrotunda* (Guenée), it proved to be a new species (Manrique et al. 2012).

In the collection of the USNM there were over 250 specimens identified as *P. obrotunda*. The results of this study showed that these specimens consisted of two described species, *Paectes arcigera* (Guenée) and *Paectes nana* (Walker) and five additional new species that are described here. Taxonomic changes included the revised status of *P. nana* as a valid species and not a synonym of *P. arcigera*. *Paectes burserae* (Dyar) is a syn. n. of *P. nana*. *Paectes indefatigabilis* Schaus and *P. isabel* Schaus, both from the Galapagos Islands, Ecuador, are synonyms of *P. nana* and not *P. arcigera* as previously thought (Poole 1989; Roque-Álbelo and Landry 2011). *Paectes obrotunda* (Guenée) is also referred to the *Paectes arcigera* group.

The *Paectes arcigera* group includes only the species referred to in this paper. Species in this group can be recognized by the elongate free saccular extension in the male genitalia. Including the species in this revision there are 12 species of *Paectes* in North America and 40 species in the Neotropics. Two of these species, *P. nana* and *P. asper* Pogue, occur both in North America and the Neotropics.

Material and methods

Repository abbreviations

Specimens and images were examined from the following collections:

BMNH The Natural History Museum, London, UK
LAN Peter J. Landolt collection, Yakima, WA, USA
MGCL McGuire Center for Lepidoptera and Biodiversity, University of Florida, Gainesville, FL, USA
TDC Terhune S. Dickel Collection, Ocala, FL, USA
UFPC Coleção Entomológica Padre Jesus Santiago Moure, Universidade Federal do Paraná, Curitiba, BRAZIL
USNM National Museum of Natural History, Washington, DC, USA
WSU Washington State University, Pullman, WA, USA

Dissection of genitalia follows the method of Pogue (2002) except specimens were mounted in Euparal and stained exclusively in Mercurochrome. Male genital morphol-

ogy follows Forbes (1954) and female morphology follows Lafontaine (2004). Terms used in describing forewing morphology follow Lafontaine (2004). Images of adult moths were taken with a Visionary Digital Imaging System using a Canon EOS 5D Mark II camera with a modified K2 long-distance lens and a pulsed xenon flash. Forewing length was measured using a calibrated ocular micrometer from the juncture of the thorax to the apex, including fringe.

Distribution maps (Figs 48–52) were generated using ESRI® ArcMap™ 10.0 (ESRI, Redland, CA). Latitude and longitude coordinates were obtained from the label data or from a localities database that I maintain. The data points were entered into a FileMaker Pro 11.0 v 3 database and then directly assembled as a data layer onto a world map projection using a GCS-WGS-1984 Geographic Coordinate System.

Key to species based on male genitalia

1 Free saccular extension extending above costa (Fig. 29) **2**
– Free saccular extension extending below costa (Fig. 31) **6**
2 Free saccular extension wide, apex enlarged (Fig. 29)..... ***P. arcigera***
– Free saccular extension narrow, apex not enlarged (Fig. 30)..... **3**
3 Setae on dorsal surface of valve hairlike, straight (Fig. 30)..... ***P. longiformis***
– Setae on dorsal surface of valve thick, curved (Fig. 32)..... **4**
4 Lateral margin of valve bearing wide, flat setae on sclerotized ridge (Fig. 32) ..... ***P. nana***
– Lateral margin of valve lacking wide flat setae **5**
5 Free saccular extension sinuate; base covered with minute spicules (Fig. 35)... ..... ***P. sinuosa***
– Free saccular extension straight, curved near apex; base lacking minute spicules (Fig. 33)..... ***P. asper***
6 Setae on dorsal surface of valve hairlike, straight; free saccular extension lacking spicules (Fig. 31)..... ***P. similis***
– Setae on dorsal surface of valve thick, curved; free saccular extension covered with minute spicules **7**
7 Base of free saccular extension bulbous, more than twice width of arm below apex (Fig. 36)..... ***P. tumida***
– Base of free saccular extension gradually narrowing toward apex, not bulbous (Fig. 34) ..... ***P. medialba***

Key to species based on female genitalia

1 Lateral margin of 8th sternite produced into short, triangular projections (Fig. 40)..... **2**
– Lateral margin of 8th sternite smooth, lacking projections (Fig. 37) **6**

2 Ductus bursae at juncture with appendix bursae approximately same width as juncture with corpus bursae (Fig. 38) **3**
– Ductus bursae at juncture with appendix bursae narrow at juncture with appendix bursae and widens at juncture with corpus bursae (Fig. 41) ..... ***P. medialba***
3 Ostium bursae with a medial, curved, sclerotized bar (Fig. 43) ..... ***P. tumida***
– Ostium bursae without an obvious sclerotized structure (Fig. 38) **4**
4 Lateral margin of 8th sternite not well developed, apex pointing laterally (Fig. 38)..... ***P. longiformis***
– Lateral margin of 8th sternite well developed, apex pointing ventrally (Fig. 40)..... **5**
5 Juncture of appendix bursae and ductus bursae just distal to ostium bursae (Fig. 40)..... ***P. asper***
– Juncture of appendix bursae at middle of ductus bursae (Fig. 42)... ***P. sinuosa***
6 Ostium bursae a round circle (Fig. 39) ..... ***P. nana***
– Ostium bursae a sclerotized band or half-circle **7**
7 Ostium bursae a large, heavily sclerotized half-circle shape (Fig. 37) ..... ***P. arcigera***
– Ostium bursae a sclerotized band with narrowed lateral apices (Fig. 46) ..... ***P. obrotunda***

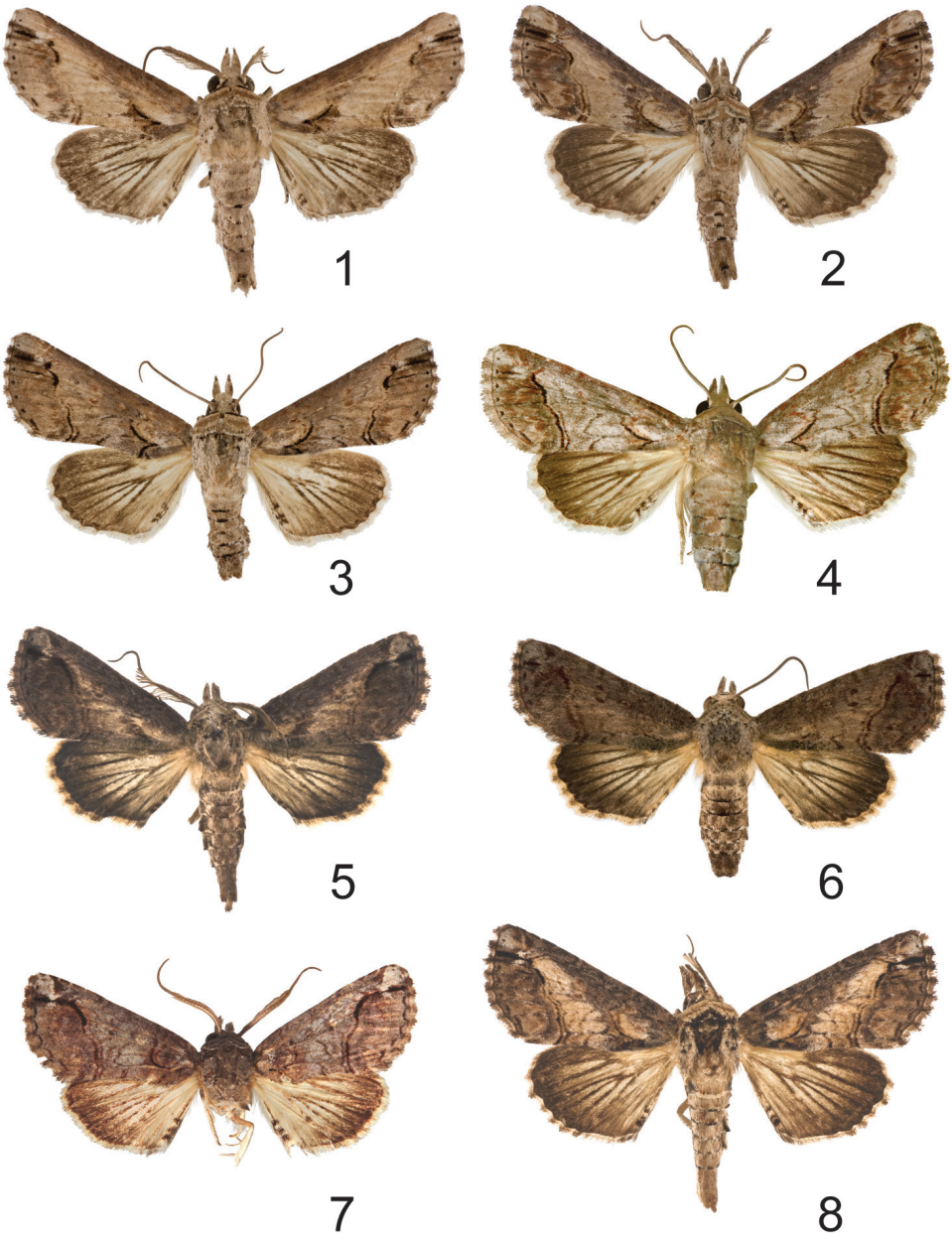
Descriptions

***Paectes arcigera* (Guenée, 1852)**
http://species-id.net/wiki/Paectes_arcigera
Figs 1–4, 29, 37, 48

Ingura arcigera Guenée *in* Boisduval and Guenée 1852: 312.

Type material. St. Thomas: lost. **Neotype:** Dominica. USNM, here designated. This is a confusing group of species that can only be identified reliably by genitalic characters, so to ensure the stability of the name, a male labeled "DOMINICA: Grande Savane, 1 July 1964, O. S. Flint, Jr., genitalia slide male, USNM 135918 [green label]" is designated as neotype for *Ingura arcigera* Guenée, 1852.

Other material examined. All specimens in USNM unless noted (62 males, 49 females). **BRITISH VIRGIN ISLANDS:** Guana Island, 1–14 July 1984 (22 males, 11 females), Genitalia slides m, USNM 135957, 1359980, 135991, 135993, 136010, S.E. & P.M. Miller; Virgin Gorda Island, Virgin Gorda Peak, ca. 400 m, 17–19 July 1986 (4 males, 1 female), Genitalia slide m, USNM 135958, S.E. Miller & M.G. Pogue. **DOMINICA:** same data as neotype (1 male, 1 female), genitalia slide male, USNM 136004, 13 May 1964 (1 male), 14 June 1964 (1 male), 28 Oct. 1966 (2 males), E.L. Todd, 31 Oct. 1966 (2 males), genitalia USNM 136003, E.L. Todd, 1 Nov. 1966 (1male), E.L. Todd; Clarke Hall, 11 Jan. 1965 (1 female), J. F.



Figures 1–8. *Paectes* adults. **1** *P. arcigera* ♂, Virgin Gorda Peak, Virgin Gorda Island, British Virgin Islands, 17–19 July 1986, S. E. Miller & M. G. Pogue **2** *P. arcigera* ♂, Grand Savane, Dominica, 1 July 1964, O. S. Flint, Jr. **3** *P. arcigera* ♀, Grand Savane, Dominica, 1 July 1964, O. S. Flint, Jr. **4** *P. arcigera* , Guana Island, British Virgin Islands, 1–14 July 1984, S. E. & P. M. Miller **5** *P. longiformis* ♂, Holotype, nr. Salvador Airport, Bahia, Brazil, March 2010, R. Diaz, V. Manrique & M. Vitorino **6** *P. longiformis* ♀, nr. Salvador Airport, Bahia, Brazil, March 2010, R. Diaz, V. Manrique & M. Vitorino **7** *P. similis* ♂, Holotype, Pernambuco [Recife], Pernambuco, Brazil, Pickel Coll. **8** *P. nana* ♂, nr. San Vicente, Hidalgo, Mexico, 2 July 1965, Flint & Ortiz.

G. Clarke & Thelma M. Clarke, 16 Jan. 1965 (1 male), J. F. G. Clarke & Thelma M. Clarke; 2.2 mi E of Pont Casse, 7 May 1964, O. S. Flint, Jr. (1 male); Roseau, Nov. 1967 (1 female), N.L.H. Krauss; S. Chiltern (1 female), 8–10 Dec. 1964 (1 female), P.J. Spangler; no specific locality, May-June 1905 (1 male, 4 females), Genitalia slide m MGP 1325, E. A. Agar [BMNH], Oct. 1904 (1 male, 3 females), Nov. 1904 (1 female), Apr. 1905 (1 male), E. A. Agar [BMNH], (2 males, 2 females), Genitalia slide m MGP 1324, E. A. Agar [BMNH], (2 males, 6 females) [BMNH]; Portsmouth, 8 Oct. 1956 (1 female), E. Hamblett [BMNH]. **GRENADA:** St. George's Cave, July 18 (1 male, 1 female), genitalia slide male MGP 1321 [BMNH]. **GRENADINES:** Union I., June 1905 (1 male), genitalia slide MGP 1322 [BMNH]. **GUADELOUPE:** Port de Jaray, 14 Sep. 1982 (1 male), B. Lalanne-Cassou. **PUERTO RICO:** Bayamón, 15 Jan. 1933 (1 female), Anderson & Lesesny; Guanica, Fajardo, 29 July 1913 (1 male), E. G. S. Collector; Maricao, Centro Vacacional, Monte del Estado, nr. Maricao, 1–9 Mar. 1971 (1 male), C.P. Kimball; Puerto Rico, Mayaguez, 3–4 Aug. 1955 (1 female), J.A. Ramos; San Juan, June–July 1932 (1 male), Genitalia slide USNM 135929, C.G. Anderson. **ST. LUCIA:** no specific locality, (2 males, 4 females), Branch; (4 males, 3 females), Maj. Cowrie, (2 males, 1 female) [BMNH]; 1 mi NW Soufriere, 18–23 Nov. 1975 (1 male), Genitalia slide USNM 135933, E.L. Todd. **ST. VINCENT:** Bequia I., Sep. 1903 (2 females); windward side, (1 male), H. H. Smith [BMNH]. **TRINIDAD:** No specific locality (1 female), A. Busck. **U. S. VIRGIN ISLANDS:** ST. CROIX: 1 mi W airport, 6–16 July 1967 (1 male), Genitalia slide USNM 42808; Christiansted, 19 Nov. 1941 (1 male), H.A. Beatty; Gallows Point, 9 July 1956 (1 female), genitalia slide USNM 136045, J.G. Coutsis; Orangegrove, W. End, 6–16 July 1967 (1 male), E.L. Todd.

Diagnosis. The only reliable way to distinguish *P. arcigera* from *P. asper* Pogue is by characters in the male and female genitalia. Male genitalia of *P. arcigera* consist of a reduced, fingerlike valve and costa, and a greatly expanded free saccular extension (Fig. 29). In *P. asper* the valve is triangulate, the costa has a truncate apex, and the free saccular extension (Fig. 33) is approximately half the width as in *P. arcigera.* Female genitalia of *P. arcigera* have a large, half-round ostium bursae covered with thorn-like spines and the lateral apices of the eighth sternite are not produced (Fig. 37). In *P. asper*, the ostium bursae is a crescent-shaped invagination covered with fine spicules and the lateral apices of the eighth sternite are produced (Fig. 40).

Redescription. Adults. Sexes dimorphic. **Male.** *Head* – antenna broadly bipectinate to 3/5 length, then filiform; eyes large, globular; vertex with broad scales, cream colored, thin black lines adjacent to scape; frons with broad scales, projecting slightly beyond anterior eye margin, mostly cream colored with a few gray and ferruginous scales, two black dots along eye margin, one ventral to antenna, other dorsal to palp; labial palp porrect, mixture of cream-colored, gray, and ferruginous scales, internal surface white. *Thorax* – prothorax somewhat variable, well-marked specimens cream colored with medial ferruginous band, anterior margin a thin black line, posterior margin gray to black and not as well defined as anterior line; patagium with cream-colored hairlike scales mixed with ferruginous, gray, and black

scales; protibia cream colored mixed with a few black scales; tarsi gray with white apical bands; middle legs mixture of cream-colored and pale gray scales, scales much longer than either the pro- or hind tibia, tarsi pale gray with cream-colored apical bands; hind tibia cream colored, tarsi cream colored; underside with white hairlike scales; forewing length 9.5–12.2 mm; costal area a gray; ovate basal spot white in ventral half, pale gray white-tipped scales in dorsal half; antemedial line thin, black, from posterior margin to Cu vein, forming ventral border of basal spot; medial area between antemedial and postmedial lines mostly white mixed with pale-gray scales; some specimens with medial line consisting of two very thin crescent-shaped lines from posterior margin to just below M3 vein; reniform spot obscure, consists of two small ferruginous dots in a vertical pattern, or may only be represented by a single dot in some specimens; postmedial line a mixture of ferruginous and black scales, double line from posterior margin to vein M2 then single until merging with black dash at vein R5 that extends to outer margin; white apical spot; subterminal area variable, gray to cream colored, mixed with ferruginous scales; terminal line a series of black dashes between veins; fringe light brown to gray with gray patches at wing veins resulting in a somewhat checkered appearance; hind wing with marginal shading dark gray, veins highlighted dark gray, white between veins and at base, anal fold a white and dark gray striped pattern. *Abdomen* – variable, mixture of cream-colored, light-brown, and ferruginous scales, posterior margin of dorsal segments with short, black line; venter variable, can be white with faint, black medial stripe to a pair of wide black or brown stripes with a thin central line of the same color on a white background; male eighth segment membranous with a pair of short, sternal, sclerotized bars and a pair of longer, wider, dorsal sclerotized bars; a pair of lateral, coremata bearing numerous, fine, elongate setae. *Genitalia* (Fig. 29) – Uncus triangulate, apex recurved and pointed, 0.62–0.64 × length of subscaphium; subscaphium triangulate, decurved, pointed apex; valve membranous, reduced, widest at base and tapering to a fingerlike projection, setose; costal margin sinuate, apex produced, fingerlike projection wider than valve, setose; sacculus well developed, proximal half fused with valve, distal half free, elongate, broad, curved inward, longer than valve, apex broadly rounded; saccus U-shaped; aedeagus straight, slightly curved in distal half, dorsum near apex covered with minute spicules; vesica irregularly-shaped oval, wide diverticulum lateral to apex of aedeagus, a long, flat cornutus at base of vesica directed posteriorly, short, thumb-like diverticulum near apex and adjacent to irregular sclerotized area bearing a short, narrow cornutus. **Female.** As in male except: antenna filiform; forewing length 9.8–11.6 mm; medial area less contrasting with fewer white scales than male; overall more drab in appearance than male. *Genitalia* (Fig. 37) – Papillae anales ovate, soft, fleshy, covered with numerous setae; anterior apophyses fused with eighth segment; posterior apophyses present; venter of eighth segment covered with minute spicules; ostium bursae sclerotized, rectangulate, dorsal invagination covered with thorn-like spines, dorsal spines largest; base of ductus bursae rectangulate and fused with eighth segment; ductus bursae juncture with appendix bursae below base, striate; duct of appendix bursae narrow, striate 2/3

length; appendix bursae membranous, round; corpus bursae ovate to round, covered internally with numerous thorn-like signa.

Distribution and biology. *Paectes arcigera* is restricted to the eastern Caribbean Islands from Puerto Rico and the Lesser Antilles, including U.S. Virgin Islands, British Virgin Islands, Guadeloupe, Dominica, St. Lucia, and Trinidad (Fig. 48). Probably flies throughout the year with flight records for all months except February. Nothing is known about biology or host plants. McMullen (1986) remarked that adults of *P. arcigera* were seen near *Crytocarpus pyriformis* Kunth (Nyctaginaceae) on Isla Santa Fe, Galapagos Islands, but this record can be referred to *P. nana*.

Remarks. *Paectes arcigera* has been confused in collections and in the literature as *P. obrotunda*. Kimball (1965) and Minno (1992) listed *P. arcigera* as occurring in Florida, but these are based on a broad concept of *P. arcigera* that made this revision of the species complex necessary. These Florida records are now known to be referable to *P. asper* and *P. nana*. Franclemont and Todd (1983) and Lafontaine and Schmidt (2010) also listed *P. arcigera* as occurring in North America, unaware that the name represented a species complex. Askew (1994) listed *P. arcigera* as occurring on Little Cayman Island, but this is probably referable to *P. asper*. *Paectes arcigera* and *P. asper* occur sympatrically in the U.S. Virgin Islands, British Virgin Islands, and Dominica.

Paectes longiformis Pogue, 2012

http://species-id.net/wiki/Paectes_longiformis
Figs 5–6, 30, 38, 49

Paectes longiformis Pogue *in* Manrique et al. 2012: 167.

Type material. Holotype male – **BRAZIL**: Bahia, nr. Salvador airport (12.91007°S, 38.3380°W), March 2010, R. Diaz, V. Manrique, M. Vitorino; USNM ENT 00148675; HOLOTYPE / *Paectes longiformis* Pogue" [red label]. UFPC. Paratypes – (29 males, 30 females) Same data as holotype; genitalia slide male USNM 134921; genitalia slides female USNM 135919, 135976, 135920, 135015, 135016. UFPC, USNM, CNC, BMNH.

Diagnosis. *Paectes longiformis* is most likely to be confused with *P. similis* Pogue, but can be differentiated by the color of the medial area of the forewing. In *P. longiformis* (Figs 5–6), the medial area is cream colored interspersed with some dark-ferruginous scales and in *P. similis* (Fig. 7) this area is shiny white with some gray scales. The tarsi in *P. longiformis* are dark gray, whereas in *P. similis* they are mostly white with some gray scales. There are several differences in the male genitalia to differentiate *P. longiformis* from *P. similis*. The uncus is 0.62–0.70 × the length of the subscaphium in *P. longiformis* (Fig. 30) and 0.80 × in *P. similis* (Fig. 31). The distal, free saccular extension is longer than the valve in *P. longiformis* (Fig. 30) and shorter than the valve in *P. similis* (Fig. 31). The female genitalia are easily separated from the other species in this group by the form of the lateral margins of the eighth sternite. In *P. longiformis*, the lateral

margins of the eighth sternite are slightly produced and form a right angle (Fig. 38). In *P. arcigera* and *P. nana*, the lateral margins are not evident (Figs 37, 39) and in *P. asper, P. medialba* Pogue, and *P. sinuosa* Pogue, the lateral margins are produced (Figs 40–42).

Distribution and biology. Known only from the type locality in northeastern Brazil in the state of Bahia (Fig. 49). Larvae have been reared from the Brazilian peppertree. It is possible that this species has a much broader range, considering the wide range of its host plant, but so far no other specimens have been collected.

Remarks. As a potential biological control agent against the Brazilian peppertree in Florida, baseline data was developed about the biology and temperature requirements of *P. longiformis* (Manrique et al. 2012).

***Paectes similis* Pogue, sp. n.**
urn:lsid:zoobank.org:act:054BD467-B4DA-4B4A-A923-E54FB873577E
http://species-id.net/wiki/Paectes_similis
Figs 7, 31, 49

Type material. Holotype male – **BRAZIL:** Pernambuco [Recife], Pickel Coll. Genitalia slide, USNM 135911 [green label]; HOLOTYPE / *Paectes similis* Pogue" [red label]. USNM.

Etymology. The species name is the Latin term for "like" which refers to the similarity between this species and *P. longiformis.*

Diagnosis. Comparison of *P. similis* to *P. longiformis* was given above.

Description. Adult. Male. FW length 10.5 mm. *Head* – vertex with broad scales, pale gray; labial palp porrect, mixture of pale-gray, ferruginous, and brown scales tipped white, internal surface white; eyes large, globular; frons with broad scales, pale gray, dark brown scales at margin of vertex; male antenna broadly bipectinate to just beyond half length then filiform. *Thorax* – prothorax pale gray, anterior margin with thin black line; patagium pale-gray scales tipped white, a few dark-brown scales anteriorly, mixed with hairlike scales; protibia mixed with white and brown scales, anterior margin white, tarsi brown with white apical bands; midtibia mostly white with some light-brown scales medially, tarsi white; hind tibia white, tarsi white; forewing costal area with pale-gray scales tipped white, minute white dots from postmedial line to apex; prominent white apical spot; basal area ferruginous mixed with a few pale-gray tipped white and white scales; antemedial line black, incomplete, from anal vein to R vein, forming distal border to basal area; medial area slightly paler in overall color from terminal area, consisting of pale-gray and white scales; reniform spot obscure, a pair of tiny dark-brown dots, ventral dot just above M vein in discal cell and larger than dorsal dot, which consists of only a few dark scales; postmedial line black outlined with some ferruginous scales, a double line from posterior margin to vein CuA2, continuing as single line to connecting point with black dash between veins R5 and M1 that extends to outer margin; subterminal area a mixture of light-brown, gray, white, and ferruginous scales, darker than medial area; terminal line a series of black,

recurved lines between veins; fringe dark gray at veins, pale gray between veins giving checkered appearance; hind wing white, marginal shading and veins highlighted dark gray, anal fold diffuse white and dark-gray striped pattern. *Abdomen* – eighth segment membranous with pair of dorsal sclerotized bars; pair of lateral coremata bearing numerous, fine, elongate setae. *Genitalia* (Fig. 31) – Uncus triangulate, apex recurved and pointed, 0.8 × length of subscaphium; subscaphium triangulate, decurved, apex pointed; valve membranous, rectangulate, apex truncate, ventrally covered with elongate setae; costal margin sinuate, produced into a truncate lobe, apex round, elongate setae dorsally from middle to apex; sacculus well developed, proximal half fused with valve, distal half free, curved toward midline, apex narrowly rounded; saccus elongate, V-shaped; aedeagus slightly decurved, dorsally spiculate in distal half; base of vesica slightly wider than apex of aedeagus, spiculate ventrally with 2 leaf-like ventral cornuti, becomes ovate with lateral, slightly curved diverticulum, opposite lateral diverticulum a sclerotized, spiculate, grooved area with very short cornutus, two bump-like diverticula on either side of grooved area. **Female.** Unknown.

Distribution. Known only from the type locality (Fig. 49).

Remarks. The holotype of *P. similis* was in a series of specimens in the USNM collection identified as *P. obrotunda.* Though known only from the type specimen, it is described so as to help eliminate confusion in this complex group of look-a-like species.

***Paectes nana* (Walker), stat. rev.**
http://species-id.net/wiki/Paectes_nana
Figs 9–11, 32, 39, 50

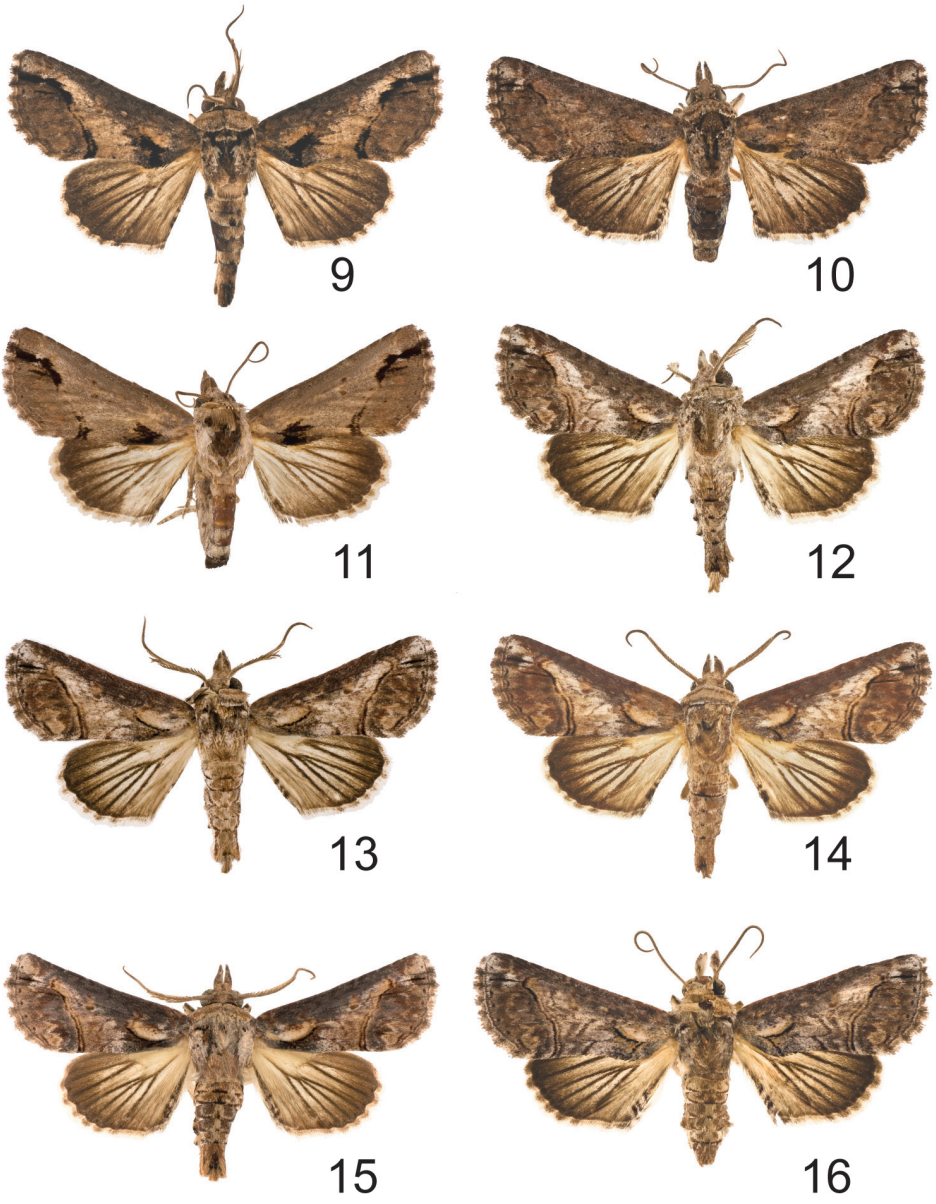
Edema nana Walker, 1865: 425.
Ingura burserae Dyar, 1901: 455. **syn. n.**
Paectes indefatigabilis Schaus, 1923: 38. **syn. rev.** (previously synonymized by Poole 1993 under *P. arcigera*)
Paectes isabel Schaus, 1923: 39. **syn. rev.** (previously synonymized by Poole 1993 under *P. arcigera*)

Type material. *Edema nana* – Type locality: "Dominican Republic, Santo Domingo" Holotype male. UMO; photograph examined.

Ingura burserae – Type locality: USA: Florida, Palm Beach. Syntypes male, female. USNM; types examined. Dyar listed two types, a male and female, in his original description. I hereby designate the male as lectotype to avoid confusion in this complicated group.

Paectes indefatigabilis – Type locality: [Ecuador]: [Galapagos Islands]: Indefatigable, Conway Bay. Lectotype male. USNM; examined. Todd (1973) designated the lectotype.

Paectes isabel – Type locality: [Ecuador]: [Galapagos Islands]: Indefatigable, Conway Bay. Holotype male. USNM; examined.



Figures 9–16. *Paectes* adults. **9** *P. nana* ♂, nr. San Vicente, Hidalgo, Mexico, 2 July 1965, Flint & Ortiz **10** *P. nana* ♀, Rancho Grande, Aragua, Venezuela, 1100 m, 8–14 Aug. 1967, R. W. Poole **11** *P. nana* ♀, Rancho Grande, Aragua, Venezuela, 1100 m, 8–14 Aug. 1967, R. W. Poole **12** *P. asper* ♂, Grand Savane, Dominica, 31 Oct. 1966, E. L. Todd **13** *P. asper* ♂, Santiago, Cuba **14** *P. asper* ♂, Santiago, Cuba **15** *P. asper* ♂, Palm Beach, Florida, Dec. 1898, R. Thaxter **16** *P. asper* ♀, Nassau, New Providence, Bahamas, J. Doll

Other material examined. All from USNM unless noted. (121 males, 91 females). **COLOMBIA:** BOYACA: Muzo, 400–800 m, (1 female), Fassl [BMNH]. CAUCA: Popayan, May 1972 (1 male), R. Perry [BMNB]. MAGDALENA: Don Amo, 2000

ft., June 1911 (6 males, 1 female), genitalia slide male MGP 1302, female MGP 1304, 4000 ft., (2 males, 1 female), H. H. Smith [BMNH]; Minca, 2000 ft., (2 males), June (1 male, 1 female), H. H. Smith [BMNH]; Valparaiso, 4000 ft., (2 males, 1 female), genitalia slide male MGP 1300, H. H. Smith [BMNH]. SANTA MARTA: Onaca, June–Aug. (2 males, 6 females), genitalia slide male MGP 1301, female MGP 1303, C. Engelke [BMNH]. **COSTA RICA:** no specific locality, (1 male) genitalia slide MGP 1329, Underwood, BMNH; GUANACASTE: Area de Conservacion Guanacaste, Mundo Nuevo, Quebrada Tibio Perla, 300 m, 26 Nov. 2009 (1 female), J. Cortez, host: *Bursera simaruba*; Area de Conservacion Guanacaste, Potrerillos, Rio Azufrado, 95 m, 29 Sep. 2002 (1 female), G. Pereira, host: *Bursera simaruba*; Area de Conservacion Guanacaste, Santa Rosa, Quebrada Guapote, 240 m, 12 July 1994 (1 female), 280 m, 7 July 1993 (3 males, 1 female), gusaneros, host: *Bursera tomentosa*; Area de Conservacion Guanacaste, Santa Rosa, Area Administrativa, 295 m, 4 May 1995 (5 males, 14 females), genitalia slide male USNM 136087, gusaneros, 22 Aug. 1984 (1 female), D.H. Janzen, host: *Bursera simaruba*; Area de Conservacion Guanacaste, Santa Rosa, Bosque San Emillio, 300 m, 30 June 1983 (1 male), 7 July 1983 (2 males), D.H. Janzen, host: *Bursera tomentosa*; Area de Conservacion Guanacaste, Santa Rosa, Laguna Escondida 285 m, 23 June 2005 (1 male, 1 female), R. Franco, host: *Bursera tomentosa*; Area de Conservacion Guanacaste, Santa Rosa, Bosque Humedo, 290 m, 21 Aug. 1991 (1 male), gusaneros, host: *Bursera tomentosa*; Area de Conservacion Guanacaste, Santa Rosa, Luces, 6 July 1992 (1 female), gusaneros, host: *Bursera tomentosa*; Area de Conservacion Guanacaste, Pocosol, Casa Garzal, 245 m, 1 July 2004 (1 male), R. Franco, host: *Bursera simaruba*; Area de Conservacion Guanacaste, Cacao, Sendero Guayabal, 500 m, 7 Oct. 2004 (1 male, 1 female), D. Garcia, host: *Bursera simaruba*. **CUBA:** LA HABANA: Santiago de Las Vegas, 12 July 1931 (1 female), genitalia slide USNM 136068, A. Otero. ORIENTE: Santiago, (1 female), genitalia slide USNM 33943. **DOMINICAN REPUBLIC:** BARAHONA: nr. Filipinas, Larimar Mine, 20–26 June 1997 (5 males, 1 female), genitalia slide male MGP 1334, P. Landolt, R. Woodruff, P. Skelley [LAN]. DAJABON: 13 km S Loma de Cabrera, 400 m, 20–22 May 1973 (2 females), D. & M. Davis. LA VEGA: Hotel Montana, 520 m, 28 May 1973 (2 males, 1 female), genitalia slide male USNM 135936, D. & M. Davis; Constanza, Hotel Nueva Suiza, 1164 m, 29 May 1973 (1 female), D. & M. Davis; vic. Jarabocoa, 22 June 1981 (1male), 27 June 1981 (1 male), genitalia slide USNM 136266, C.V. Covell, Jr. NATIONAL DISTRICT: Santo Domingo, (1 female), A. Busck. **ECUADOR:** GALAPAGOS: Indefatigable, Conway Bay, 1 Apr. 1923 (1 male, 3 females), genitalia slide male USNM 135966; South Seymour, 23 Apr. 1923 (1 male). IMBABURA: Paramba, Jan. –May (1 male), genitalia slide MGP 1309 [BMNH]. **GUATEMALA:** BAJA VERAPAZ: Chejel, Schaus and Barnes Coll. (1 male), genitalia slide, USNM 135915. SUCHITEPEQUEZ: Univ. del Valle de Guatemala Research Station, nr. Aldea Adelaida/Finca Panama, nr. Santa Barbara, 1550 m, 12 Aug. 2010 (1 male), P.J. Landolt [LAN]. ZACAPA: Santa Cruz, Marble Quarry rd., NE of Teculutan, 560 m, 18 July 2007 (3 males, 1 female), genitalia slide MGP 1339, 290 m, 19 July 2007 (2 males), genitalia slide MGP 1342, P.J. Landolt

[LAN], (1 male), R.S. Zack [WSU]. **MEXICO:** DISTRICTO FEDERAL: Mexico City, (1 male), C. Mayer [BMNH]. HIDALGO: 5 mi E Tulancingo, 7400 ft., 24 July 1963 (1 male), genitalia slide USNM 136055, Duckworth & Davis; nr. San Vicente, 2 July 1965 (4 males), genitalia slide USNM 135954, Flint & Ortiz; Zacualpan, 15 Aug. (1 male, 2 females), genitalia slide male USNM 33942, R. Muller. JALISCO: Guadalajara, Coll. Wm. Schaus (1 female); Guadalajara, Oct. –Nov. 1898 (1 male), P. H. Goldsmith, Oct. 1896 (1 male), Schaus [BMNH]. OAXACA: Oaxaca, (1 male, 1 female), genitalia slide male USNM 42805, Coll. Wm. Schaus, June 1896 (1 male), Schaus [BMNH]. PUEBLA: Tehuacan, 11 June (1 female), R. Muller. TAMAULIPAS: Rancho del Cielo, 6 km NNW Gomez Farias, 3500 ft., July 1982 (1 female), genitalia slide USNM 135056, M.A. Solis. VERACRUZ: Orizaba, 11 June (1 male), R. Muller; Jalapa, (1 male), genitalia slide MGP 1326, M. Trujillo [BMNH]. YUCUTAN: Chichen Itza, 7 July 1955 (1 female), E. C. Welling [BMNH]. **U.S.A.:** FLORIDA: Collier Co., Chokoloskee, (1 male, 1 female), genitalia slides m USNM 136256, f USNM 136262. Hernando Co.: Bay Port, 24 Jan. 1989 (7 males, 2 females), genitalia slides male MGP 1274, 1277, 1281, J. Gillmore MGCL. Lee Co.: no specific locality, 18 Sep. 1987 (1 male), genitalia slide USNM 136052, D. Maloney USNM. Levy Co.: Cedar Key, 20 Sep. 1995 (1 male, 2 females), genitalia slide m MGP 1280, J. Gillmore & J. Medal MGCL. Manatee Co., Oneco, May 1954 (1 female), genitalia slide USNM 136258, P. Dillman. Miami-Dade Co.: Royal Palm State Park, (1 male, 1 female), Mar. (1 female), genitalia slides female USNM 136041, 136261, F.M. Jones; Oweissa-Bauer Hammock, 27 Dec. 1979 (1 female), genitalia slide MGP 1287, H.D. Baggett MGCL. Monroe Co.: Big Pine Key, Cactus Hammock, 20 Sep. 1989 (2 males), genitalia slides male MGP 1282, 1283, D. Habeck, J. Gillmore, M. Hennessey MGCL; Crawl Key, 22 Mar. 1988 (1 male), genitalia Vial #83, D.H. Habeck MGCL; Fleming Key, 20 June 1979 (1 male, 1 female), J.A. Acree & H.V. Weems, Jr. MGCL; Key Largo, 16 Sep. 1964 (1 female), Mrs. Spencer Kemp MGCL; Key Largo Key [sic], 20 Sep. 1964 (1 male, 1 female), genitalia slide male MGP 1278, Mrs. Spencer Kemp MGCL; Long Key State Park, 21 Dec. 1983 (1 male), T.S. Dickel TDC; No Name Key, 29 July 1992 (1 male), W.L. Adair, Jr. MGCL. Pinellas Co.: Dunedin, Hammock Park, 19 Jan. 1986 (1 female), 2 Feb. 1986 (1 female), 8 Feb. 1986 (1 female), J.D. Worsley MGCL. Sarasota Co.: Siesta Key, 3 Jan. 1960 (1 male), 21 Nov. 1953 (1 female), genitalia slide USNM 136259, C.P. Kimball USNM, 2 Apr. 1954 (1 female), genitalia slide MGP 1286, 18 May 1957 (1 female), 18 May 1960 (1 female), 5 Nov. 1953 (1 female), C.P. Kimball MGCL; St. Lucie Co.: 8 mi N Ft. Pierce n Turnpike, 22 Sep. 1995 (1 male), D.H. Habeck, R. Goodson, G. McDermott MGCL. **VENEZUELA:** ARAGUA: Rancho Grande, 1100 m, 30–31 Mar. 1978 (1 male, 1 female), 1–3 Apr. 1978 (3 males, 1 female), genitalia slide male USNM 135964, J.B. Heppner, 22–31 July 1967 (7 males, 5 females), genitalia slide male USNM 135963, genitalia slide female USNM 135960, 1–7 Aug. 1967 (7 males, 3 females), 8–14 Aug. 1967 (9 males, 5 females), 15–21 Aug. 1967 (1 male, 2 females), genitalia slide male USNM 42804, R.W. Poole. LARA: Yacambu Nat. Park, 13 km SE Sanare, 1560 m, 28–31 July 1981 (2 males), 1–5 Aug. 1981 (3 males), Genitalia slide USNM 135968, J.

Heppner. MERIDA: Mucy Fish Hatchery, 7 km E Tabay, 6600 ft., 10–13 Feb. 1978 (1 male), J.B. Heppner. NORTE DE SANTANDER: Cucuta, (1 male), genitalia slide MGP 1305 [BMNH]. T.F. AMAZONIA: Cerro de la Neblina, Basecamp, 140 m, 1–10 Mar. 1984 (1 female), D. Davis & T. McCabe. YARACUY: Aroa, (1 male, 1 female), Coll. Wm. Schaus.

Diagnosis. *Paectes nana* has two distinct forms. The most easily recognized bears exaggerated dark markings on the apical portion of the postmedial line that is contiguous with the subapical dash, the posterior portion of the postmedial line from CuA1 to posterior margin, and the antemedial line from just dorsal to anal vein to posterior margin (Fig. 11). This form is not present in *P. asper*. The other form of *P. nana* most resembles both *P. asper* (Figs 8–10). The forewing costa in *P. nana* is gray with small, faint, dark-gray quadrate spots along the margin at approximately 1/4 and 1/2 length of wing. In *P. asper* the forewing costa is ferruginous mixed with some gray and the quadrate spots are absent (Figs 12–15). In females of *P. nana* (Figs 10–11), the medial area of the forewing is gray, or can have gray scales tipped with white, giving a slightly lighter overall color than the remainder of the forewing. In *P. asper*, the medial area is somewhat lighter in coloration than the remainder of forewing and entirely white scales are present as are white-tipped gray scales (Figs 16–18). A cream-colored basal spot is present and contrasts with the remainder of the forewing in *P. asper,* and in *P. nana* the basal area is only very slightly contrasting with white-tipped gray scales.

Both the male and female genitalia are distinct between these species. In the male genitalia, the costa is thumb-like with a more produced apex in *P. nana* (Fig. 32), whereas in *P. asper* the costa in truncate and the apex is not produced (Fig. 33). In *P. nana*, there are several flat setae arising from a sclerotized ridge on the dorsal surface of the valve (Fig. 32), these flat setae are absent in *P. asper* (Fig. 33). The cornutus at the base of the vesica is wide in *P. nana* (Fig. 32), but narrow in *P. asper* (Fig. 33). In the female genitalia, *P. nana* is easily recognized by the ostium bursae being a sclerotized circle (Fig. 39), but in *P. asper* the ostium is crescent shaped (Fig. 40).

Redescription. Male. Sexes dimorphic. *Head* – vertex with broad scales, mixture of cream-colored and light-brown scales, anterior margin with a few black scales; labial palp porrect, a mixture of gray, light-brown, dark-ferruginous, and black scales, internal surface white; eyes large, globular; frons with broad scales, projecting slightly beyond anterior eye margin, with cream-colored and light-brown scales with a few black scales medially; male antenna broadly bipectinate to 2/3 length then filiform. *Thorax* – prothorax concolorous with vertex, anterior margin with a thin black line; patagium concolorous with prothorax, mixed with hairlike scales; protibia white mixed with black, apical band white, obscure, tarsi black with distinct white apical bands; middle tibia grayish brown, tarsi gray with white apical bands; hind tibia cream-colored, tarsi cream colored; underside with white hairlike scales; forewing length 10.9–11.6 mm; costal area a mixture of dark-gray scales tipped a lighter color and a few black scales; distinct ovate cream-colored basal spot margined posteriorly with a few black scales; thin black antemedial line from posterior margin to middle of basal spot; interior of wing from distal margin of ovate spot to postmedial line mostly white and contrasted

with subterminal and terminal areas; reniform spot obscure, with only a few pale-ferruginous scales; postmedial line black, a double line from posterior margin to vein M2 then single until merging with black dash between veins R5 and M1 that extends to outer margin; apical spot white; subterminal area brown, veins gray, color extending on to fringe; terminal line a series of black, shallow scalloped lines between veins; fringe brown, gray patches from wing veins resulting in a somewhat checkered appearance; hind wing white, marginal shading dark gray, veins highlighted dark gray, anal fold a white and dark gray striped pattern. *Abdomen* – cream colored scattered with a few pale-ferruginous scales; male eighth segment membranous with a pair of short, sternal, sclerotized bars and a pair of longer, wider, dorsal sclerotized bars; a pair of lateral coremata bearing numerous, fine, elongate setae. *Genitalia* (Fig. 32) – Uncus triangulate, apex recurved and pointed; subscaphium longer than uncus, triangulate, decurved, apex pointed; valve membranous, elongate, narrowed distally, apex round, covered with many elongate setae, basal-dorsal margin sclerotized, with several wide, spine-like setae; costa of valve short, deeply curved, apex produced and rounded, densely covered with elongate setae; sacculus well developed, proximal half fused with valve, distal half free, elongate, curved inward, longer than valve, apex round; saccus triangulate; aedeagus straight, slightly bent at distal third, dorsum in distal third covered with minute spicules; base of vesica a short tube with one flat, elongate cornutus with pointed apex directed posteriorly, vesica ovate, small round diverticulum just distal to flat basal cornutus, apex of vesica with an irregular sclerotized area bearing a short, thumb-like cornutus. **Female.** As in male except: *Head* –antenna filiform; forewing length 9.4–9.9 mm; ground color pale gray; antemedial line black, reduced to a concave line from just below Cu vein to anal vein connected to a convex line from anal vein to posterior margin; basal spot absent; interior of wing from base to postmedial line pale gray with scattered white scales or scales tipped white and only slightly paler than subterminal and terminal areas; medial line black, faint, dentate from just below Cu vein to posterior margin. *Genitalia* (Fig. 39) – Papillae anales truncate, soft, fleshy, covered with numerous setae; ninth sternite covered with minute spicules distally with spicules becoming larger and thicker closer to ostium bursae; anterior apophyses fused with eighth segment; posterior apophyses present; ostium bursae with sclerotized, crescent-shaped large dorsal and small ventral caps; base of ductus bursae, as it emerges from ostium bursae, sclerotized then becomes membranous and striated, after splitting with appendix bursae, ductus bursae narrower and more heavily striated; appendix bursae ovate, membranous; corpus bursae ovate, covered internally with numerous thornlike signa.

Distribution and biology. *Paectes nana* is widespread from Florida through the Greater Antilles, except for Puerto Rico, and from Mexico to Costa Rica; in South America distributed from Venezuela, Colombia, and northern Ecuador (Fig. 50). It has been introduced to the Galapagos Islands (Roque-Álbelo and Landry 2011).

Paectes nana is a native species from Florida that has been reared from Brazilian peppertree in several counties, including Hernando, Lee, Levy, Monroe, and St. Lucie. Larvae that were collected in September and October had a pupal stage from 9–18 days and larvae collected in January and February had a pupal stage from 11–15 days.

Adults probably fly all year with recorded dates from January–March, June–July, September–October, and December. Dyar (1901) stated that larvae of *P. nana* (referred to as *P. burserae*) are common on gumbo-limbo (*Bursera simaruba* (L.) Sarg., Burseraceae). In Costa Rica *P. nana* collecting dates range from May through November and has been reared from *B. simaruba* and *B. tomentosa* (Jacq.) Triana & Planch.

Remarks. *Paectes nana* has two forms. A form that is easily confused with *P. asper* and a more boldly marked form where the antemedial and postmedial lines and marginal dash are heavily marked with black and there are scattered black scales along the forewing posterior margin adjacent to the antemedial line. The holotype of *P. nana* is a heavily marked form.

***Paectes asper* Pogue, sp. n.**
urn:lsid:zoobank.org:act:16EDE70C-D0AF-4CF7-A020-27E4EB09AF8F
http://species-id.net/wiki/Paectes_asper
Figs 12–19, 33, 40, 51

Type material. Holotype male – **CUBA**: Santiago, Collection Wm. Schaus; HOLOTYPE / *Paectes asper* Pogue" [red label]. USNM. Paratypes – (134 males, 85 females). All from USNM unless noted. Same data as holotype (9 males, 9 females) genitalia slide male USNM 135978, genitalia slides female USNM 135977, 135981– 135983; (2 males), genitalia slide male MGP 1314 [BMNH]. **BAHAMAS**: no specific locality (1 male, 1 female) [BMNH]. ABACO ISLANDS: no specific locality, (2 males, 2 females), Mar. 1902 (1 male), genitalia slide male MGP 1313, J.J. Bonhote [BMNH]. ANDROS: Andros Town, 27–29 Jan. 1965 (1 male), genitalia slide USNM 135927, leg. W. U. R. Piath; Mangrove Cay, 11 Jan. 1902 (1 female), J.J. Bonhote [BMNH]. NEW PROVIDENCE: Nassau, (1 female), Col. Jacob Doll.; Nassau I., 8 July 1898 (2 males, 1 female), 14 July 1898 (3 females), J.J. Bonhote [BMNH]. **BRITISH VIRGIN ISLANDS**: Great Camanoe Is., 1/3 mi ESE Cam Bay, 18 Mar. 1974 (1 male), C.L. Remington; Guana Island, North Bay, 0 m, 15–25 July 1986 (1 female), S.E. Miller & M.G. Pogue; Guana Island, 0-80 m, 13–26 July 1986 (1 male), genitalia slide USNM 135931, S.E. Miller & M.G. Pogue; Guana Island, 1–14 July 1984 (11 males, 8 females), Genitalia slides male USNM 135979, 135990, 135992, 136009, genitalia slides female 135998, 136005, 136006, 136007, 9–15 July 1985 (1 female), S.E. and P.M. Miller; Tortola, 14 May 1980 (1 female), 29 May 1980 (1 female), 28 July 1973 (1 female), 23 Oct. 1972 (1 female), Oct. 1972 (3 males), genitalia slides MGP 1319, 1320, 12 Nov. 1973 (1 male), 14 Nov. 1972, (1 female), 18 Nov. 1972 (1 female), J. Lorimer, 5 June 1974 (1 female) [BMNH]. **CAYMAN ISLANDS:** CAYMAN BRAC: behind Stakes Bay, 20 May 1938 (3 females), 21 May 1938 (1 female), 22 May 1938 (1 male), C.B. Lewis, G.H Thompson; N. coast of Stakes Bay, 20 May 1938 (1 male, 1 female), 22 May 1938 (1 male), genitalia slide MGP 1318, C.B. Lewis, G.H Thompson; west end of Cotton-tree Land., 19 May 1938 (1 male), 22 May 1938 (1 male), C.B. Lewis, G.H Thompson [BMNH]. GRAND CAYMAN: east end of East End, 13

Figures 17–24. *Paectes* adults. **17** *P. asper* ♀, Grand Savane, Dominica, 14 June 1964, O. S. Flint, Jr. **18** *P. asper* ♀, 1 mi N Mahaut, Dominica, 12 June 1964, O. S. Flint, Jr. **19** *P. asper* ♀, Haiti **20** *P. medialba* ♂, Holotype, Tucuman, Argentina, R. Schreiter **21** *P. medialba* ♀, Tucuman, Argentina, Mar. 1905, E. Dinelli **22** *P. sinuosa* ♂, Salta, Argentina, Feb. [19]05, J. Steinbach **23** *P. sinuosa* ♂, Suncho Corral, Santiago del Estero, Argentina, J. Steinbach **24** *P. sinuosa* ♀, Sara, Santa Cruz, Bolivia, 450 m, Jan., J. Steinbach.

May 1938 (1 male), 16 May 1938 (1 female), C.B. Lewis, G.H Thompson; Georgetown, (2 males, 2 females), genitalia slide male MGP 1317, A.W. Cardinall; N. coast of North Side, 11 July 1938 (1 female), 14 July 1938 (1 female), 16 July 1938 (1 female),

C.B. Lewis, G.H Thompson; west end of Georgetown, 14 May 1938 (1 female), C.B. Lewis, G.H Thompson [BMNH]. LITTLE CAYMAN: south coast of South Town, 31 May 1938 (2 males), 2 June 1938 (1 male, 1 female), 4 June 1938 (1 female), C.B. Lewis, G.H Thompson [BMNH]. **COLOMBIA:** SAN ADRES, PROVIDENCIA, AND SANTA CATALINA: San Andrés, 300 ft., Apr. 1926 (2 males), genitalia slides MGP 1328, 1351, F.W. Jackson [BMNH]. **CUBA:** no specific locality, (10 males, 2 females), genitalia slide male USNM 42806, genitalia slides female USNM 135962, 135985, Coll. Wm. Schaus, (1 male), Dognin Coll.; no specific locality, (4 males, 4 females), genitalia slide male MGP 1315 [BMNH]. GUANTANAMO: Baracoa, (3 males, 1 female), Aug. Busck Collector, 12 Feb. 1958 (1 male), Genitalia slide USNM 135955, B. Wright. HOLGUIN: Holguin, (2 males, 2 females), H.S. Parrish [BMNH]. LA HABANA: Cayamas, (1 male), E.A. Schwarz. ORIENTE: Santiago, (1 male, 1 female), genitalia slide male MGP 1314, W. Schaus [BMNH], June 1902 (1 male), Nov. 1902 (1 male), W. Schaus [BMNH]. **DOMINICA:** 1 mi N Mahaut, 12 June 1964 (1 female), genitalia slide USNM 136002, O.S. Flint, Jr.; Clarke Hall, 3 June 1964 (1 female), genitalia slide USNM 135984, O.S. Flint, Jr.; Grande Savane, 13 May 1964 (1 female), genitalia slide USNM 135961, 20 May 1964 (1 male, 1 female), genitalia slide male USNM 135975, genitalia slide female USNM 136057, 14 June 1964 (1 female), genitalia slide USNM 135995, 31 Oct. 1966 (1 male, 1 female), genitalia slide male USNM 135994, genitalia slide female USNM 136008, O.S. Flint, Jr.; Macoucheri, 1 Feb. 1965 (1 male), genitalia slide USNM 136058, 12 Feb. 1965 (1 male, 1 female), genitalia slide female USNM 42810, 5 Mar. 1965 (1 male), J.F.G. & Thelma Clarke. **DOMINICAN REPUBLIC:** San Cristobal, 8–9 June 1969 (1 male), genitalia slide USNM 135986, Flint & Gomez. **HAITI**: No specific locality, (2 males, 1 female), genitalia slide male USNM 135928; no specific locality, (2 males, 1 female), genitalia slide male MGP 1322 [BMNH]. **JAMAICA**: no specific locality, (3 males), genitalia slide male USNM 135930; no specific locality, (6 males, 6 females) [BMNH]. ST. ANDREW: Newcastle, (1 male), genitalia slide MGP 1316 [BMNH]. ST. JAMES: Montego Bay, 24 Jan. 1924 (1 male, 1 female), Gillett; Up Camp (1 male) [BMNH]; Kingston, July 17, at electric light, several were taken, Cockerell (1 male). TRELAWNY: Runaway Bay, 28 Mar. 1905 (1 male) [BMNH]. **PUERTO RICO:** no specific locality, (1 male), genitalia slide MGP 1331 [BMNH]. **U.S.A.:** FLORIDA: Miami-Dade Co., Biscayne Bay, (1 male), Collection H.G. Dyar; Coconut Grove, Nov. 1897 (1 male), Roland Thaxter Coll. Florida City, 9 June 1937 (1 female); Miami, (5 males, 1 female), genitalia slide male USNM 136000, genitalia slide female USNM 136001. Monroe Co., Key Largo Key [sic], 13 Dec. 1968 (1 male), genitalia slide MGP 1285, Mrs. Spencer Kemp MGCL, 6 Jan. 1969 (1 female), genitalia slide USNM 136260, Mrs. Spencer Kemp USNM; Bahia Honda State Park, 6 Jan. 1989 (1 male), 17 Jan. 1990 (1 male), 21 Jan. 1996 (1 male, 1 female), 12 Mar. 1989 (1 male), 23 Mar. 1990 (1 male), 29 Mar. 1990 (1 male), 28 Oct. 1988 (1 male), 8 Nov. 1988 (1 male), 29 Dec. 1989 (1 male, 1 female), T.S. Dickel TDC; Long Key State Park, 5 Feb. 1986 (1 male), 16 Feb. 1985 (1 male), 4 Mar. 1994 (1 male), 26 Dec. 1994 (1 male), T.S. Dickel TDC; Key Largo Hammock Botanical State Park, 17 Jan. 1987 (1 male),

30 Jan. 1992 (1 male), 2 Feb. 1995 (1 male), 12 Feb. 1990 (1 male), 21 Feb. 1995 (2 males), T.S. Dickel TDC; No Name Key, 19 Oct. 1987 (1 male), T.S. Dickel TDC; Windley Key, 3 June 1983 (1 male), T.S. Dickel TDC. Palm Beach Co., Dec. 1897 (1 male), genitalia slide USNM 135932, Dec. 1898 (1 male), genitalia slide USNM 135999, R. Thaxter. Palm Beach Co., Palm Beach, Dec. 1897 (1 female), R. Thaxter. **U.S. VIRGIN ISLANDS:** ST. CROIX: Blue Mtn., 6–16 July (1 male), E.L. Todd; Christiansted, 19 Nov. 1941 (1 male, 1 female), H.A. Beatty; Gallows Point, 11 July 1956 (1 male), genitalia slide USNM 136044, J.G. Coutsis; Kingshill, 6–16 July 1967 (1 male), E.L. Todd; Mt. Eagle, 6–16 July 1967 (1 female), E.L. Todd; Orangegrove, W End, 6–16 July 1967 (3 males, 2 females), Genitalia slide m USNM 42807, E.L. Todd. USNM, CNC, BMNH

Etymology. The species name is the Latin term for rough, which refers to the roughened texture of the apex of the free saccular extension in the male genitalia.

Diagnosis. The forewing costa is ferruginous with some gray in *P. asper* and mostly gray with some ferruginous in *P. arcigera*. The medial area of the forewing is mostly white with a white apical spot in *P. asper*; in *P. arcigera* these areas are cream-colored.

The male genitalia are easily differentiated between *P. asper* and *P. arcigera*. The valve in *P. asper* has thick, curved dorsal setae; in *P. arcigera* the setae are hairlike. The costa is truncate in *P. asper* but triangulate in *P. arcigera.* The free saccular extension is narrow in *P. asper* and wide with an expanded apex in *P. arcigera.*

The female genitalia have small, curved lateral projections at the base of the eighth sternite in *P. asper*; these projections are absent in *P. arcigera*. The ostium bursae is crescent shaped bearing minute spicules in *P. asper* whereas in *P. arcigera* the ostium bursae is semicircular in shape and bears large conical spines.

Description. Male. *Head* – antenna broadly bipectinate to 3/5 length then filiform; eyes large, globular; vertex with broad scales, light-brown mixed with pale- and dark-ferruginous scales; frons with broad scales, projecting slightly beyond anterior eye margin, concolorous with vertex, two small black dots on eye margin; labial palp porrect, mixture of light-brown and ferruginous scales, internal surface white. *Thorax* – prothorax pale ferruginous, with a thin, black anterior margin, posterior margin pale gray, can be mixed with black or dark-ferruginous scales; patagium pale gray variably mixed with ferruginous and a few black scales, mixed with hairlike scales; pro and mid tibia gray and ferruginous mixed with white scales, apical band present, tarsi ferruginous with white apical bands; hind tibia ferruginous mixed with white scales, lighter than pro or mid tibia, tarsi white mixed with ferruginous scales, apical bands not distinct; underside with white hairlike scales; forewing length 9.4–12.9 mm; costal area dark gray and ferruginous; ovate basal spot distinct; antemedial line black, sharply angulate basally, continues around ventral margin of ovate spot, arrowhead shaped; reniform a pair of small ferruginous spots, vertically oriented; interior of wing a variable mix of white, pale- ferruginous, and ferruginous scales, always lighter than costa and subterminal area; postmedial line black, black and ferruginous, or ferruginous, a double line from posterior margin to below M vein, then a single line to M1 vein; black horizontal dash between R5 and M1 vein continuing to outer mar-

gin; apical spot white; subterminal area gray, distal border ferruginous and dentate; terminal area with irregularly shaped tan patch near tornus; terminal line a series of dark-ferruginous spots between wing veins; fringe pale gray becoming white at apex; hind wing white, marginal shading dark gray, veins highlighted dark gray, anal fold with a white and dark-gray striped pattern; fringe white. *Abdomen* – dorsum variable from pale gray to dark gray mixed with ferruginous scale patches, distal margin of segments usually with a darker line that can be ferruginous or black, obscure cream-colored dorsal band from middle to antemedial segment; venter variable from white to tan to ferruginous, medial line black to ferruginous flanked by paler, wider, lateral lines variable in color and intensity from black to gray, or can be represented by a thin medial line; male eighth segment membranous with a pair of short, sternal, sclerotized bars and a pair of longer, slightly wider, dorsal sclerotized bars; a pair of lateral coremata bearing numerous, fine, elongate setae. *Genitalia* (Fig. 33) – Uncus triangulate, apex sharply recurved and pointed, 0.62–0.64 × length of subscaphium; subscaphium, triangulate, decurved, apex pointed; valve membranous, elongate, narrow, covered with broad, curved setae; costa sclerotized, deeply recurved, apex rounded or truncate, sparse hairlike setae dorsally and at apex; sacculus well developed, proximal half fused with valve, distal half free, elongate, broad, curved inward, longer than valve, apex with roughened surface; saccus V-shaped; aedeagus straight; vesica ovate, large bulbous lateral diverticula just above vesica base; adjacent to basal diverticulum a second bulbous diverticulum with an irregular sclerotized patch bearing elongate somewhat flattened cornutus; thumblike diverticulum opposite sclerotized patch; ventral cornutus at base of vesica, stout, elongate, pointed caudally. **Female.** As in male except: antenna filiform; forewing length 9.2–12.5 mm; medial area of forewing white, suffused with pale gray scales and less contrasting than in male. *Genitalia* (Fig. 40) – Papillae anales ovate, soft, fleshy, covered with numerous setae; venter of eighth segment covered with minute spicules; anterior apophyses fused with eighth sternite; posterior apophyses present; ventrolateral corners of eighth sternite produced into small, outwardly curved projections; ostium bursae crescent shaped, sclerotized plate bearing minute spicules; ventral to ostium bursae, base of ductus bursae rectangular and fused to eighth sternite, short membranous section of ductus bursae at juncture of appendix bursae and ductus bursae, ductus bursae striate and gradually enlarges into corpus bursae; appendix bursae emerges from ductus bursae just ventral to rectangular part of ductus bursae, consists of two sacs, one at junction of ductus bursae then a constriction and a second, enlarged, membranous sac; corpus bursae tear-drop shaped, covered internally with numerous thornlike signa.

Distribution and biology. *Paectes asper* is distributed from southern Florida and Bahamas to the Greater Antilles (except Puerto Rico), and the British Virgin Islands, U.S. Virgin Islands, and Dominica in the Lesser Antilles (Fig. 51). A specimen in the BMNH is labeled Costa Rica, St. Andrews I. This specimen was interpreted to be from San Andrés Island in the western Caribbean, which is now part of Colombia.

Remarks. *Paectes asper* was in the series of specimens in the USNM collection identified as *P. obrotunda.* Specimens of *P. asper* can be confused with specimens of

P. arcigera from the British Virgin Islands, U.S. Virgin Islands, and Dominica. *Paectes asper* is sympatric with *P. arcigera* on Guana Island, B.V.I., St. Croix, U.S.V.I., and Dominica. In Florida, Cuba, and the Dominican Republic, *P. asper* can be confused with *P. nana*.

***Paectes medialba* Pogue, sp. n.**
urn:lsid:zoobank.org:act:8C58724A-B96F-42FE-B82B-E28C70FB8341
http://species-id.net/wiki/Paectes_medialba
Figs 20–21, 34, 41, 49

Type material. Holotype male – **ARGENTINA:** Tucuman, R. Schreiter Collr., Collection Wm. Schaus, USNM ENT 00148677, genitalia slide, USNM 136027 [green label]; HOLOTYPE / *Paectes medialba* Pogue" [red label]. USNM. Paratype 1 female – **ARGENTINA:** La Rioja, genitalia slide, USNM 136067. USNM

Etymology. The species name is derived from the combination of the Latin terms *medius* (middle) and *albus* (white) to refer to the white medial area of the male forewing.

Diagnosis. *Paectes medialba* has been confused with *P. longiformis* in the USNM collection. It differs from *P. longiformis* by the more pronounced white medial area of the male forewing and its distribution in northwestern Argentina versus the northeastern Brazil distribution of *P. longiformis.* There are many differences in the male genitalia of *P. medialba* and *P. longiformis.* The free extension of the sacculus in *P. longiformis* is much longer than in *P. medialba* and is spiculate in *P. medialba* and non-spiculate in *P. longiformis.* The setae on the dorsal surface of the valve are wide, elongate, curved apically, and numerous in *P. medialba* whereas in *P. longiformis* they are hairlike, shorter, straight, and more sparse. In the female genitalia the lateral projections of the eighth sternite are more produced and sharply pointed in *P. medialba* (Fig. 41) than in *P. longiformis* (Fig. 38). The ductus bursae between its juncture with the appendix bursae and its entering the corpus bursae is tapered in *P. medialba* but straight in *P. longiformis.* The signa are more numerous in the corpus bursae of *P. longiformis* than in *P. medialba.*

Description. Adult. Sexes dimorphic. **Male.** *Head* – antenna broadly bipectinate to just beyond half length then filiform; eyes large, globular; vertex with broad scales, pale gray, finely tipped with white; frons with broad scales, badly rubbed, pale gray with black posterior margin; labial palp porrect, mixture of pale-gray and black scales tipped with white, internal surface white. *Thorax* – prothorax mixture of gray and white scales, anterior margin a thin black line; patagium pale gray with dark-gray scales medially, all tipped with white, mixed with hairlike scales; protibia black scales tipped with white, more white scales along inner margin, tarsi black barely tipped with white, white apical bands; middle and hind legs absent from holotype; forewing length 9.4 mm; costal area dark gray mottled with white scales, faint white dashes along costa from just beyond middle to below apex; distinct ovate basal spot, few dark gray and white scales basally, remainder of scales tan; thin black antemedial line from posterior margin

to Cu vein, forming ventral border of basal spot; medial area mostly white mixed with a few tan and dark-brown scales; medial line dark gray, faint, straight from posterior margin to anal vein, curved from anal vein to Cu vein; reniform spot obscure, a pair of tiny dots, ventral dot just above Cu vein in discal cell, dorsal dot just below R vein, dark brown; postmedial line black, angulate, from posterior margin to vein R5, faint medially; black dash along vein R5 not quite extending to outer margin and not contiguous with postmedial line; white apical spot mixed with a few dark-gray scales; subterminal area brown, scattered with white scales; terminal line a series of dark-brown, recurved lines between veins; fringe brown; hind wing white, marginal shading dark gray, veins highlighted dark gray, anal fold with a white and dark-gray striped pattern. *Abdomen* – eighth segment membranous with pair of dorsal sclerotized bars; pair of lateral coremata bearing numerous, fine, elongate setae. *Genitalia* (Fig. 34) – Uncus triangulate, apex recurved and pointed, 0.7 × length of subscaphium; subscaphium triangulate, decurved, apex pointed; valve membranous, rectangulate, apex produced, round, dorsal surface covered with broad, apically curved, elongate setae; costa thumb shaped, dorsal margin curved, elongate setae dorsally in distal third; sacculus well developed, proximal half fused with valve, distal half free, angulate, spiculate, shorter than valve, apex curved inward; saccus V-shaped, arms wide; aedeagus straight, dorsally spiculate in apical 2/3; vesica uninflated, a single, basal leaf-like cornutus, grooved sclerotized area bearing short cornutus. **Female**. As in male except: *Head* –antenna filiform; eyes large, globular; vertex light brown, few scattered dark-brown scales; frons light brown, scattered with more dark-brown scales than vertex; labial palp porrect, brown with white-tipped scales, white internally. *Thorax* – prothorax light brown, anterior margin a thin black line, few dark-brown scales along posterior margin; patagium gray, few dark-gray scales, mixed with hairlike scales; protibia dark gray with white-tipped scales, tarsi dark gray, apical bands white; forewing length 9.9 mm; ground color brownish gray; basal area not differentiated from ground color; antemedial line black, straight from posterior margin, curved around basal area to Cu vein; medial area not differentiated from ground color; reniform spot a pair of tiny black dots on either side of Cu vein; postmedial line black, faint, double to Cu2 vein, single from Cu2 vein to R5 vein; black dash at R5 vein not contiguous with postmedial line, not quite continuing to outer margin; apical spot faint, white; subterminal area not differentiated; terminal line a black dash at tornus, then a series of black spots between veins; fringe brownish gray. *Genitalia* (Fig. 41) – Papillae anales crescent shaped, soft, fleshy, covered with numerous setae; anterior apophyses fused with eighth sternite; posterior apophyses present; venter of eighth segment spiculate in distal half, with sharply-pointed lateral projections; sclerotized ventral projection of eighth sternite enters membranous base of ductus bursae, which then becomes constricted, then widens for a short distance below constriction where appendix bursae branches, below junction of appendix bursae, ductus bursae widens as it enters corpus bursae; appendix bursae ovate, membranous; corpus bursae ovate, covered internally with numerous thornlike signa pointing inward, signa continue posteriorly into posterior part of ductus bursae.

Distribution and biology. Known from northwestern Argentina (Fig. 49). Nothing is known about the biology.

Remarks. *Paectes medialba* is another species that was confused as *P. obrotunda* in the USNM collection. It is being described to resolve confusion in this group.

***Paectes sinuosa* Pogue, sp. n.**
urn:lsid:zoobank.org:act:EEAB4B58-5284-418D-B865-D01A8A1CD124
http://species-id.net/wiki/Paectes_sinuosa
Figs 22–25, 35, 42, 52

Type material. Holotype male – **ARGENTINA:** BUENOS AIRES: Los Vasquez, Dognin Collection, genitalia slide male, USNM 135916 [green label]; HOLOTYPE / *Paectes sinuosa* Pogue" [red label]. USNM. Paratypes – (22 males, 19 females) **ARGENTINA:** COLON: Sierras de Cordoba, La Granja, (1 female), A. Garcia [BMNH]. LA RIOJA: La Rioja, (1 male), genitalia slide MGP 1353, Jan.–Feb. (1 female), [no date] (1 male) F. Giacomelli [BMNH]. SALTA: Salta, Feb. 1905 (1 male), genitalia slide MGP 1312, J. Steinbach [BMNH]. SANTIAGO DEL ESTERO: Santiago del Estero, (1 female), J. Steinbach [BMNH]. TUCUMAN: Tucuman, (2 males, 1 female), genitalia slides male, MGP 1311, MGP 1350, Schreiter, 450 m, Mar. 1902 (1 female), genitalia slide MGP 1353 [BMNH]. **BOLIVIA:** SANTA CRUZ: Ichilo, Buenavista, 750 m, Aug.-Apr. 1906-1907 (1 female), Steinbach [BMNH]; Sara, 450 m, Jan. (1 female), genitalia slide MGP 1349, Nov. (1 male, 1 female), J. Steinbach [BMNH]. **BRAZIL:** AMAZONAS: Humaitá, July-Sep. 1906 (1 female), W. Hoffmanns [BMNH]. BAHIA: S. Antonio de Barra, (10 males, 1 female), [BMNH]. GOIAS: Chapada dos Veadeiros, 18–24 km N of Alto Paraiso, 1400–1500 m, 2–5 Oct. 1985 (1 male), S.E. Miller, genitalia slide USNM 135970, USNM. MINAS GERAIS: Tijuco, Dec. (1 male) [BMNH]. PARANÁ: Curitiba, 23 Apr. 1988 (1 male), L. Crestana, Genitalia slide Vial #79, MGCL; Entre Rios, (1 female) [BMNH]. PERNAMBUCCO: Serra de Communaty, Dec. 1893 (1 female), E. Gounene [BMNH]. RIO DE JANIERO: Petropolis, 1888 (1 female), Germain [BMNH]. SÃO PAULO: Alambari, 3 Sep. 1988 (1 female), 8 Dec. 1988 (1 male), 16 Dec. 1988 (1 male), L. Crestana, Genitalia slide f Vial #86, genitalia slides male MGP 1279, MGP 1288, MGCL; Porto Feliz, 1 June 1988 (1 female), L. Crestana, genitalia slide MGP 1289, MGCL. **PARAGUAY:** BOQUERON [NUEVA ASUNCION]: Nueva Asuncion, 313 m, 23–25 Mar. 1986 (1 female), M. Pogue and M. Solis, genitalia slide USNM 136014. GUAIRA: Villarrica, Dec. 1922 (1 female), J. Schade [BMNH]. PARAGUARI: Sapucaí, 24 June 1902 (1 male, 1 female), genitalia slide male MGP 1310, W. Foster [BMNH]. PRESIDENTE HAYES: Primavera, 14 Apr. 1960 (1 female), E.J. Phillips [BMNH].

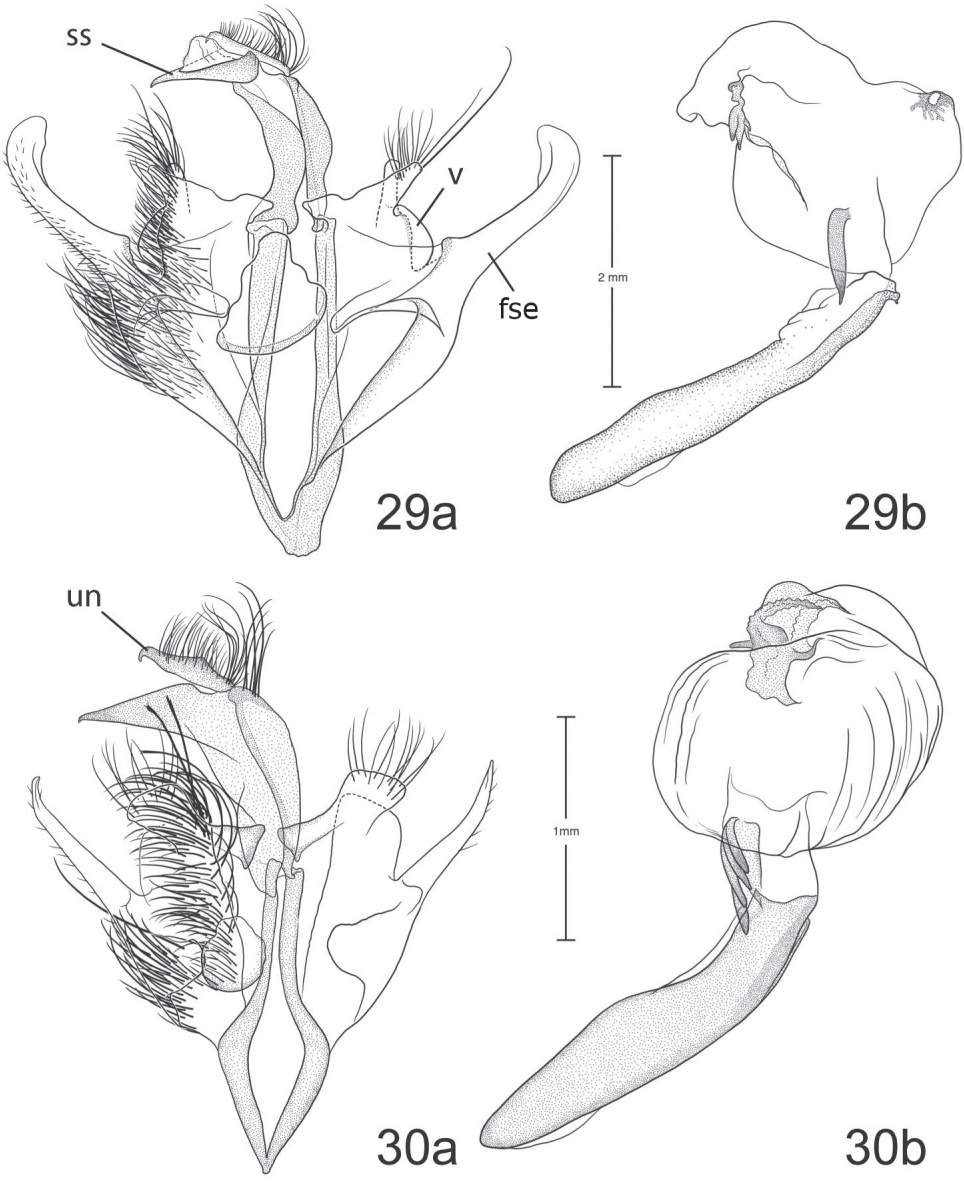
Etymology. The species name is derived from the Latin *sinuo* (bend), referring to the sinuate free saccular extension of the male genitalia.

Diagnosis. The forewing is longer in *P. sinuosa* than in *P. medialba*. The postmedial line is double in *P. sinuosa* (Figs 22–25) and single in *P. medialba* (Figs 20–21). In

Figures 25–28. *Paectes* adults. **25** *P. sinuosa* ♀, Buenavista, Santa Cruz, 750 m, Bolivia, Aug.-Apr. 1906–1907, Steinbach **26** *P. tumida* ♂, Holotype, Geldersland, Suriname **27** *P. tumida* ♂, St. Jean du Maroni, French Guiana, Le Moult **28** *P. tumida* ♀, Bartica, British Guiana [Guyana], June 1901.

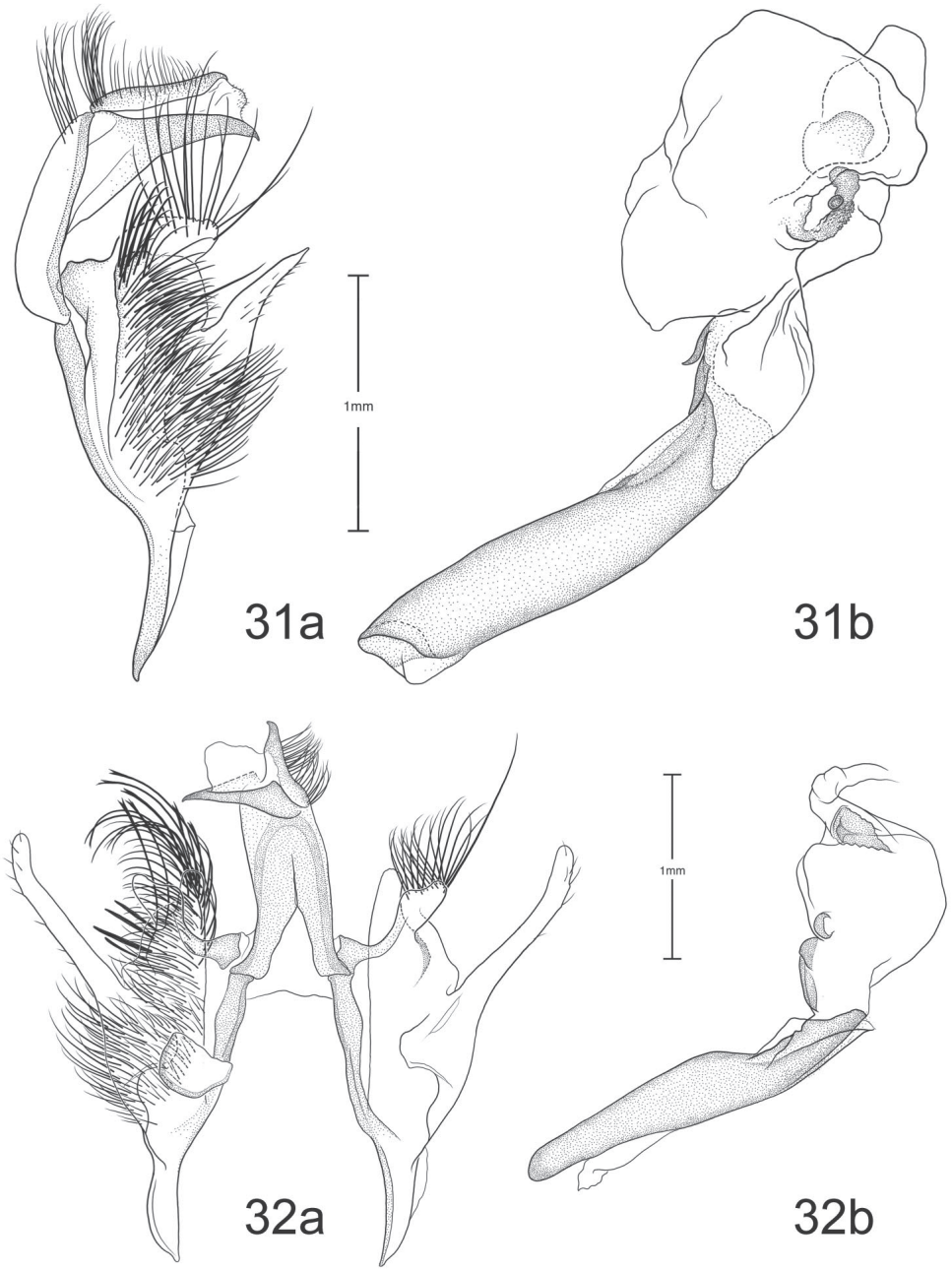
the male genitalia the dorsal margin of the costa is slightly concave in *P. sinuosa* (Fig. 35) but greatly convex in *P. medialba* (Fig. 34). The free saccular extension is sinuate in *P. sinuosa* (Fig. 35) but straight in *P. medialba* (Fig. 34). At the base of the vesica there are two wide cornuti in *P. sinuosa* (Fig. 35) but only one in *P. medialba* (Fig. 34).

Description. Adult. Male. *Head* – antenna broadly bipectinate to just beyond half length then filiform; eyes large, globular; vertex with broad scales, dark brown anteriorly, light brown posteriorly; frons with broad scales projecting slightly beyond anterior eye margin, mostly light brown with a posterior band of dark brown scales; labial palp porrect with mixture of light-brown and brown scales tipped with white, internal surface white. *Thorax* – prothorax light brown, anterior margin with thin black line; few scales forming a faint medial line; posterior margin with some dark-brown scales; patagium with dark-brown scales tipped with white, mixed with a few white scales, scales broad mixed with hairlike scales; protibia dark-brown scales tipped with white, mixed with white scales, apical band white, obscure, tarsi dark brown with distinct white apical bands; midtibia concolorous with protibia, but with more white scales giving a slightly lighter overall color, white apical band more distinct than in protibia, tarsi dark brown with white apical bands; hind tibia mostly white with a few dark-brown scales, tarsi white; underside with white hairlike scales; forewing length 10.5 mm; costal area dark gray with a few white scales forming short dashes along costa, especially from postmedial band to just below apex; distinct ovate cream-colored basal spot; thin black antemedial line from posterior margin forming



Figures 29–30. *Paectes* male genitalia; **fse** free saccular extension **ss** subscaphium **v** valve **un** uncus **29** *P. arcigera.*

ventral border to basal spot; medial area of wing white and light brown; medial line obscure, dark brown, from posterior margin to anal vein where it becomes arrow-shaped then continues vertically to Cu vein; reniform spot obscure, a pair of tiny dots, ventral dot just above M vein in discal cell dark brown and larger than dorsal dot, which consists of only a few ferruginous scales; postmedial line black, double from posterior margin to vein M1; black dash between veins R5 and M1 extending



Figures 31–32. *Paectes* male genitalia. **31** *P. similis* **32** *P. nana.*

to outer margin; white apical spot; subterminal area a mixture of light- brown, gray, white, and ferruginous scales, lighter than costa and darker than medial area; terminal line a series of gray, recurved lines between veins; fringe brown, gray patches opposite

vein apices; hind wing white, marginal shading dark gray, veins highlighted dark gray, anal fold with a white and dark gray striped pattern. *Abdomen* – dorsum mixture of pale gray, black, and ferruginous, with small patches of black scales at caudal apex of segments 2–3; ventrum white with a faint black medial line and partial lateral lines; male eighth segment membranous with a pair of short, sternal, sclerotized bars and a pair of longer, wider, dorsal sclerotized bars; a pair of lateral, coremata bearing numerous, fine, elongate setae. *Genitalia* (Fig. 35) – Uncus triangulate, apex recurved and pointed, approximately same length as subscaphium; subscaphium triangulate, decurved, apex pointed; valve membranous, rectangulate, slightly produced distally, apex round, covered with wide, elongate setae; costa short, recurved, apex produced, round, sparsely covered with elongate, hairlike setae; sacculus well developed, proximal 2/3 fused with valve, distal 1/3 free, sinuate, spiculate, longer than valve, apex round; saccus with broad arms; aedeagus straight; vesica emerges at a right angle ventrally from aedeagus; bulbous with a short, distal diverticulum and two elongate leaflike cornuti at base, longest laterally, shortest ventrally; rectangular, grooved sclerotized plate lateral to distal diverticulum, short slightly curved cornutus on grooved plate. **Female.** As in male except: antenna filiform; forewing length 9.5 mm; antemedial line from costa to R vein dark gray, angulate toward apex then angulate toward base with a pointed apex, black from R vein to anal vein, curved with a straight line extending to posterior margin; medial area less contrasted than male with white-tipped gray scales; postmedial line black, well developed from posterior margin to CuA2 vein then faint to M2 becoming more developed from M2 to R5; thin black line along R5 to outer margin; apical spot white. *Genitalia* (Fig. 42) – Papillae anales ovate, soft, fleshy, covered with numerous setae; venter of eighth segment covered with minute spicules; anterior apophyses fused with eighth sternite; posterior apophyses present, ventrolateral corners produced into triangular projections; ostium bursae a small dimple or absent; base of ductus bursae rectangular fused to eighth sternite, ductus bursae elongate, striate, approximately same width throughout, small ventrally produced pocket just below fused base; appendix bursae emerges dorsally from approximately middle of ductus bursae, ovate; corpus bursae ovate, covered internally with numerous thornlike signa.

Distribution and biology. Known from the states of Goias and São Paulo, Brazil, the Chaco of northwestern Paraguay, and in the state of Tucuman, Argentina (Fig. 52).

Specimens from the São Paulo, Alambari, Brazil, were reared from Brazilian Peppertree (*Schinus terebinthifolius*). A specimen from Porto Feliz, São Paulo, Brazil, was reared from *Lithraea molleoides* (Vell.) Engl., Anacardiaceae.

Remarks. *Paectes sinuosa* is described to differentiate the several species previously identified as *P. obrotunda* in the USNM collection.

Paectes sinuosa has two forms similar to those in *P. nana*. One form has bold markings of the antemedial and postmedial lines; the other form has faint antemedial and postmedial lines and an overall gray forewing. The male genitalia are identical in these two forms.

***Paectes tumida* Pogue, sp. n.**
urn:lsid:zoobank.org:act:6CF23F77-1A5E-46D6-A659-773A337E63B2
http://species-id.net/wiki/Paectes_tumida
Figs 26–28, 36, 43, 49

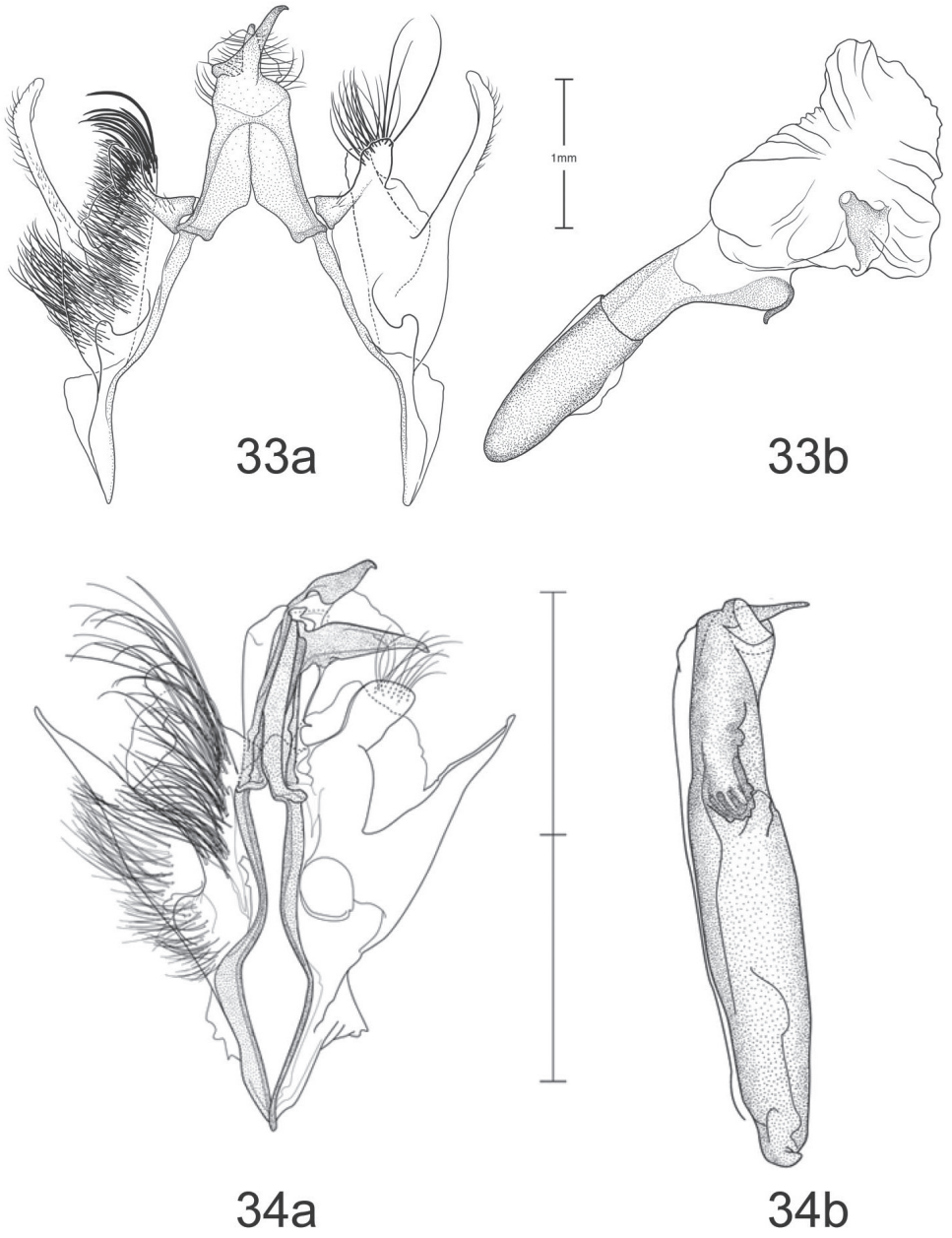
Type material. Holotype male – **SURINAME:** Geldersland, Collection Wm. Schaus, USNM ENT 00148679, genitalia slide male, USNM 135917 [green label]; HOLOTYPE / *Paectes tumida* Pogue" [red label]. Paratypes – (6 males, 4 females) **COLOMBIA:** META: Villavicencio, 400 m, (2 males), genitalia slides MGP 1299, MGP 1344, Fassl [BMNH]. **FRENCH GUIANA:** Nouveau Chantier, May (1 male), genitalia slide MGP 1308, Le Moult [BMNH]; St. Jean du Maroni, (1 male), genitalia MGP 1346, Le Moult [BMNH]. **GUYANA:** CUYUNI-MAZARUNI: Bartica, June 1901 (3 females), genitalia slide MGP 1307 [BMNH]; POTARO-SIPARUNI: Potaro River, 9-13 July 1912 (1male), genitalia slide MGP 1306, P. Rendall [BMNH]; Tumatumari, Dec. 1907 (1 female) [BMNH]. **SURINAME:** PARAMARIBO: Paramaribo, (1 male), Genitalia MGP 1347 [BMNH].

Etymology. The species name is derived from the Latin *tumeo* (swell), referring to the swollen base of the free saccular extension in the male genitalia.

Diagnosis. Forewing with a white medial area in *P. tumida*; in *P. similis* it consists of white-tipped gray scales, so the area is less contrasting than in *P. tumida*; in *P. obrotunda* medial area is mixed with gray, ferruginous, and a few cream-colored scales and also is less contrasting than in *P. tumida*. The postmedial line is faint and black in *P. tumida*; in *P. similis* it is black and well developed with a faint double line at the posterior margin; in *P. obrotunda* the postmedial line is ferruginous and double at the posterior margin and black and ferruginous where it curves toward the subapical black dash.

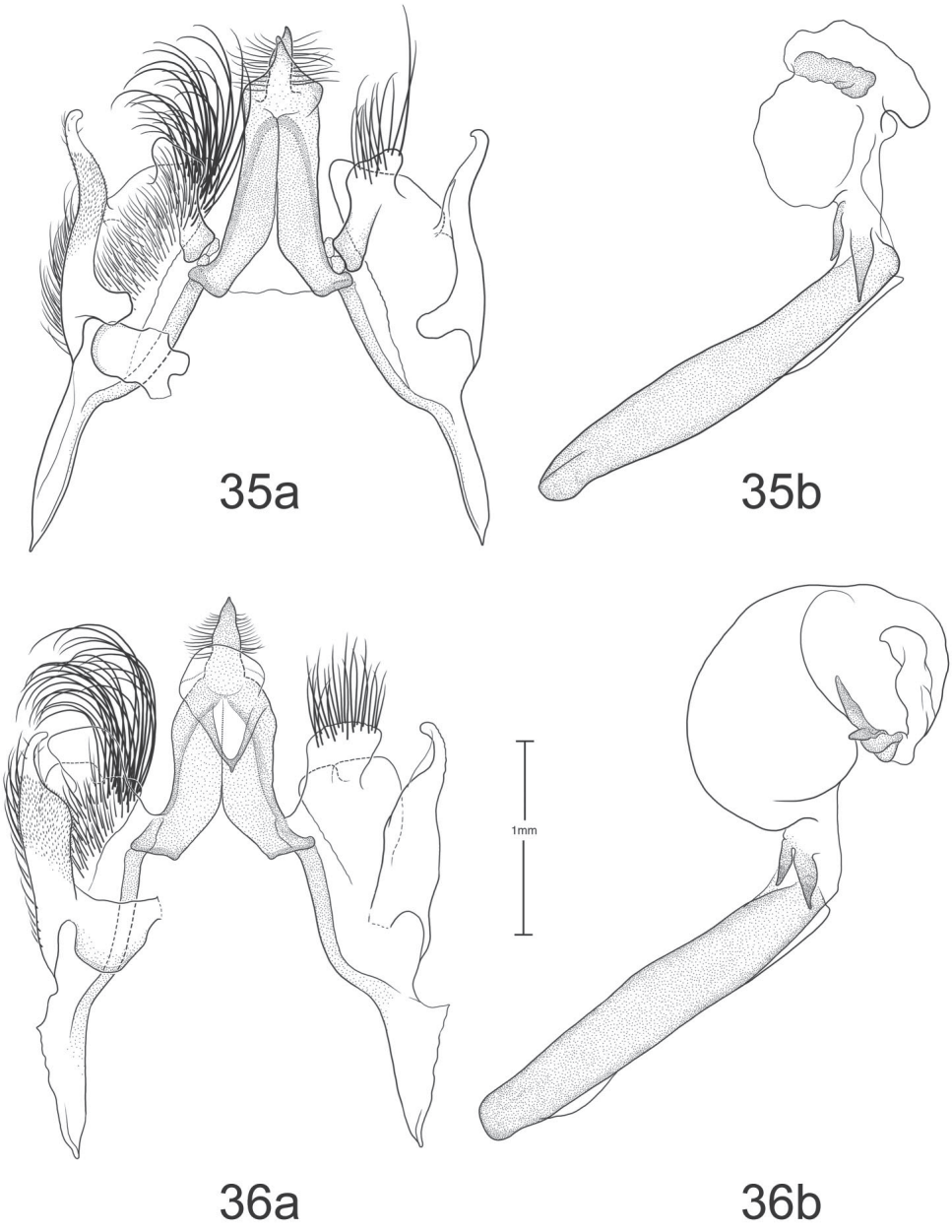
The male genitalia of *P. tumida* have elongate, curved setae on the dorsal surface of the valve, whereas in *P. obrotunda* and *P. similis* the valve has shorter, hairlike setae. The costal margin is convex in *P. tumida*, but straight in *P. similis*, and slightly concave in *P. obrotunda*. The free saccular extension is elongate and extends above the costa in *P. obrotunda*, but is shorter and does not extend above the costa in *P. tumida* and *P. similis*. In *P. tumida*, the base of free saccular extension is swollen and densely covered with spicules, but in *P. obrotunda* and *P. similis* the base is not swollen and without spicules.

Description. Male. *Head* – antenna broadly bipectinate to 1/2 length then filiform; eyes large, globular; vertex with broad scales, mixture of white, brown, and black scales; frons with broad scales, projecting slightly beyond anterior eye margin, white and brown scales; labial palp porrect, mixture of brown, white, and pale ferruginous scales, internal surface white. *Thorax* – prothorax mixture of pale-gray, gray, and brown scales, medial band dark brown; patagium of brown, pale-ferruginous, and white broad scales, mixed with hairlike scales; protibia white mixed with black, apical band white, obscure, tarsi black with distinct white apical bands; middle and hind legs missing in holotype; forewing length 10.9 mm; costal area brown; basal area mixture of white, pale-ferruginous, and brown scales, not a well-defined ovate spot; antemedial line consists of a few black scales between posterior margin and anal vein then extending along



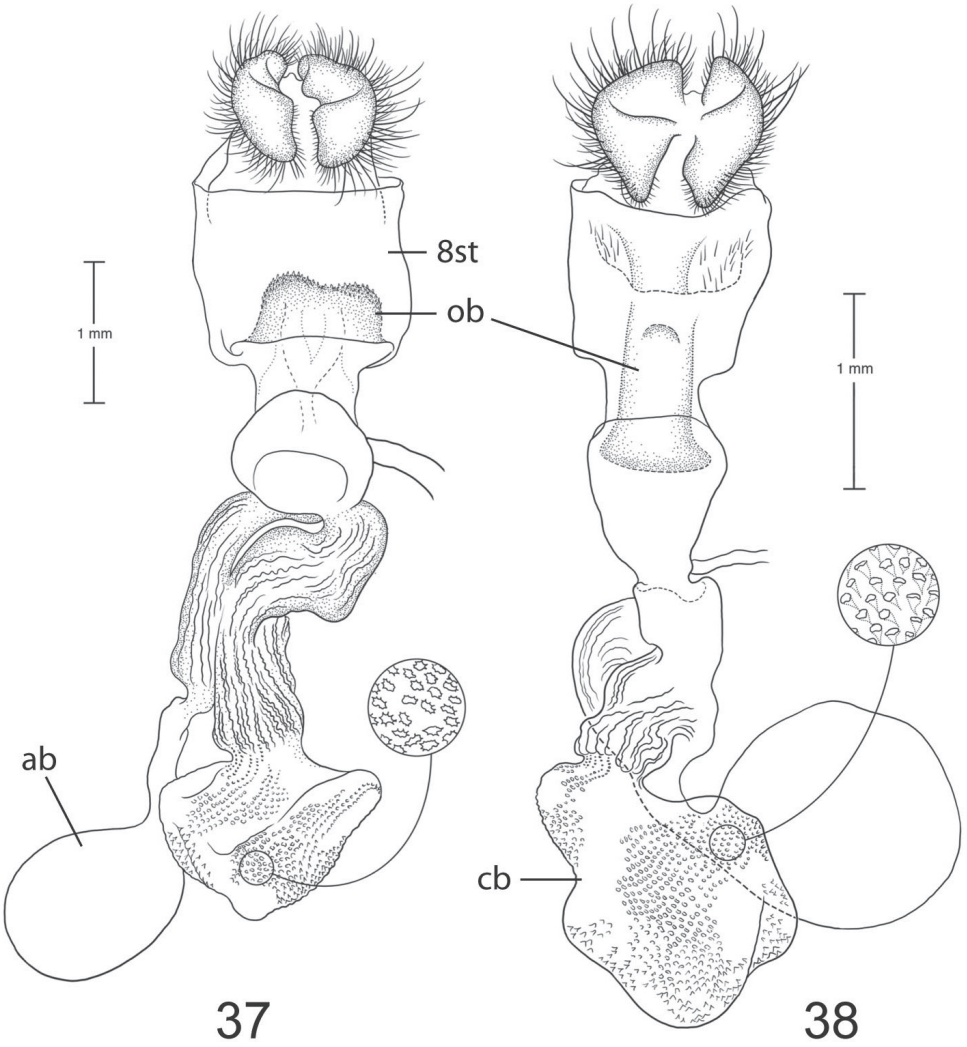
Figures 33–34. *Paectes* male genitalia. **33** *P. asper* **34** *P. medialba.*

anal vein a short distance before slightly curving upward; central area of wing from basal area to postmedial line mostly white mixed with brown scales and contrasted with subterminal and terminal areas, thin curved brown line from posterior margin to anal vein and contiguous with thin line from anal vein to CuA2 vein; reniform spot obscure, a pair of small, round brown spots; postmedial line brown and pale ferruginous,



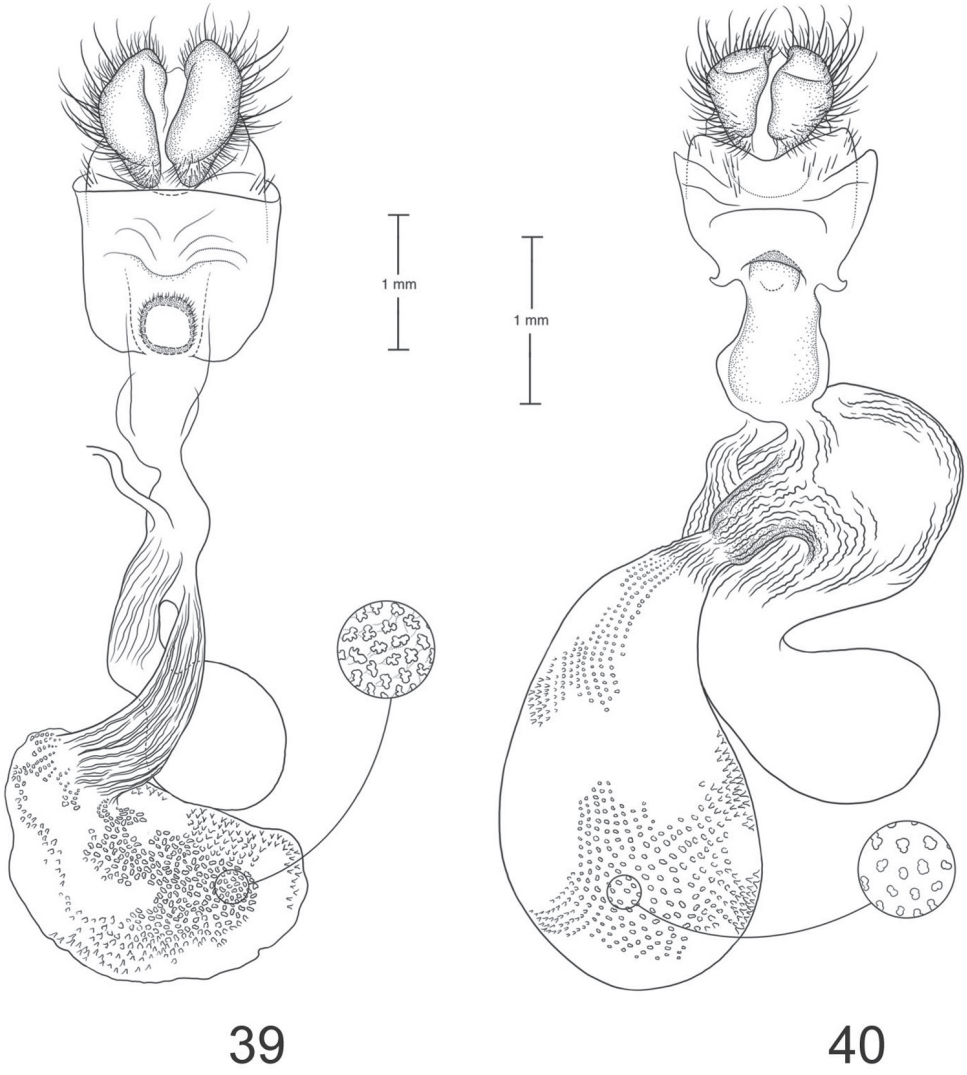
Figures 35–36. *Paectes* male genitalia. **35** *P. sinuosa* **36** *P. tumida.*

double line from posterior margin to vein CuA2, single curved line between M2 and M1; black dash between veins R5 and M1 that extends to outer margin; apical spot white; subterminal area brown mixed with pale ferruginous and white scales; terminal line a series of black, shallow scalloped lines between veins; fringe brown; hind wing marginal shading dark gray, veins heavily highlighted dark gray, areas between veins



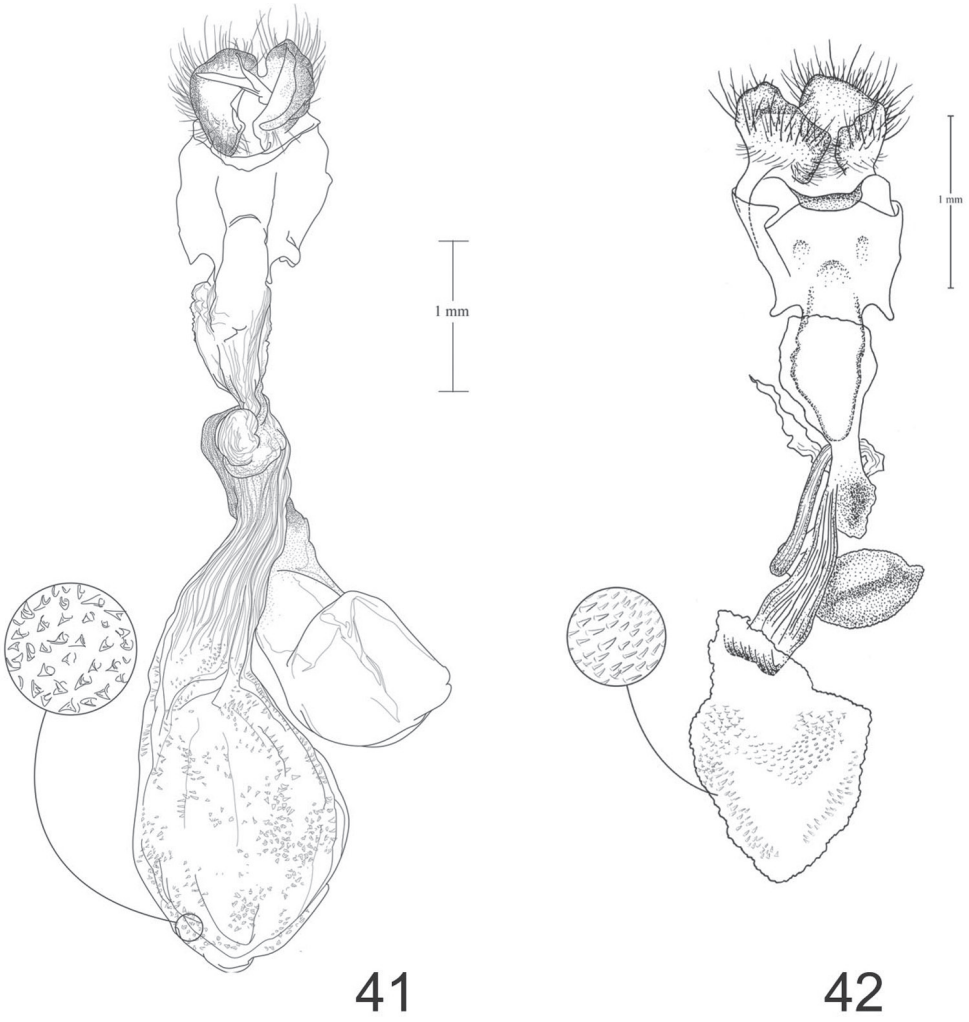
Figures 37–38. *Paectes* female genitalia; **8st** eighth sternite **ab** appendix bursae **ob** ostium bursae **cb** corpus bursae **37** *P. arcigera* **38** *P. longiformis*.

white; anal fold white with dark-gray striped pattern; fringe white. *Abdomen* –male eighth segment membranous with a pair of short, sternal, sclerotized bars and a pair of longer, wider, dorsal sclerotized bars; a pair of lateral, coremata bearing numerous, fine, elongate setae. *Genitalia* (Fig. 36) – Uncus triangulate, apex recurved and pointed, 1.3 × length of subscaphium; subscaphium, triangulate, decurved, apex pointed; valve membranous, short, truncate, covered with many elongate, curved setae; costa of valve extends above membranous part of valve, margin straight, apex broadly rounded, tuft of elongate setae near distal tip of apex; sacculus well developed, proximal half fused with valve, distal half free, sinuate, produced distally, apex round, covered with minute spicules; saccus triangulate; aedeagus straight, dorsum in distal third covered



Figures 39–40. *Paectes* female genitalia. **39** *P. nana* **40** *P. asper*.

with minute spicules; base of vesica a short tube with two flat, elongate cornuti with pointed apices directed posteriorly, emerging from tubelike base, vesica ovate, apex of vesica with an irregular sclerotized area bearing a short, thumblike cornutus. **Female.** As in male except: antenna filiform; forewing length 11.5 mm; antemedial line dark brownish gray, faint, angulate from R vein to Cu vein then curved becoming a prominent black partial curve just dorsal to anal vein then straight to posterior margin; medial area less white than male; medial line dark brownish gray, series of variously sized, coalesced excurved lines from R vein to posterior margin; postmedial line dark brownish gray, double, slightly sinuate and fades medially. *Genitalia* (Fig. 43) – Papillae



Figures 41–42. *Paectes* female genitalia. **41** *P. medialba* **42** *P. sinuosa.*

anales crescent shaped, soft, fleshy, covered with numerous setae; anterior apophyses fused with eighth sternite; posterior apophyses present; venter of eighth segment spiculate in distal half, sharply pointed projections laterally, small crescent-shaped, spiculate medial line; ostium bursae ovate with medial, curved, sclerotized bar; ductus bursae striate; appendix bursae juncture approximately midway between ostium bursae and corpus bursae, striate, curved; corpus bursae somewhat triangulate, covered internally with numerous thornlike signa pointing inward.

Distribution. Specimens have been collected from Villavicencio, Colombia, and from Guyana, Suriname, and French Guiana (Fig. 49).

Remarks. *Paectes tumida* is described to differentiate the several species previously identified as *P. obrotunda* in the USNM collection.

***Paectes obrotunda* (Guenée, 1852)**
http://species-id.net/wiki/Paectes_obrotunda
Figs 44–47

Ingura obrotunda Guenée *in* Boisduval and Guenée 1852: 312.
Paectes obrotunda; Hampson 1912: 130, pl. CLXXVII, Fig. 11; Franclemont and Todd 1983: 131; Poole 1989: 758; Poole and Gentili 1996: 762; Lafontaine and Schmidt 2010: 40.

Type material. Type locality: "Brazil" Holotype female. BMNH; photographs of adult and genitalia examined (Figs 44–47).

Diagnosis. Since *P. obrotunda* is only known from the female holotype it can be compared to females of *P. longiformis*, *P. sinuosa,* and *P. medialba*, which are found in Brazil, Argentina, and Paraguay. *Paectes obrotunda* has a distinct antemedial line that extends from the posterior margin to the anal vein then curves around faint basal area toward Cu vein. In *P. longiformis* the antemedial vein is faint and not well developed. The forewing subapical, marginal dash is black and distinct in *P. obrotunda*, but ferruginous and faint in *P. longiformis*. There is a faint area of white scales proximal to the postmedial line in *P. obrotunda*, which is absent in *P. longiformis. Paectes sinuosa* is distinct from *P. obrotunda* in having the antemedial line heavily developed with black scales along the anal vein and suffused with black scales along the posterior margin. The forewing subapical, marginal dash is longer in *P. sinuosa* than in *P. obrotunda*. In *P. medialba* the postmedial line is double from posterior margin to approximately middle of forewing whereas in *P. obrotunda* it is single and faint. The forewing subapical, marginal dash is slightly longer and more robust in *P. medialba* than in *P. obrotunda*. In the female genitalia the eighth sternite is longer than wide with lateral margins produced in *P. medialba* but sternite in *P. obrotunda* is wider than long and the lateral margins are not produced.

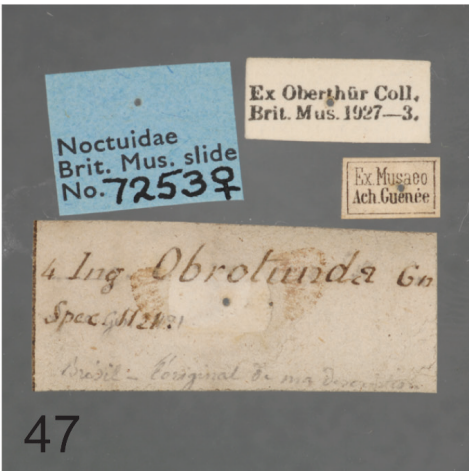
Redescription. Adult. Female. *Head* – antenna filiform; eyes large, globular; labial palp porrect. *Thorax* – prothorax light brown, anterior margin thin black line; forewing length 9.2 mm; a few white scales forming short dashes along costa, especially from postmedial band to just below apex; thin black antemedial line from posterior margin forming ventral border to faint basal spot; medial area of wing with some scattered white scales forming an indistinct area proximal to postmedial line; postmedial line black, faint at posterior margin becoming more distinct prior to subapical, marginal dash; black dash between veins R5 and M1 that extends to outer margin; apical spot white; terminal line a series of black, recurved lines between veins; fringe with white patches giving a checked appearance; hind wing with dark gray marginal band that extends to middle of wing with veins highlighted dark gray. *Genitalia* (Fig. 46) – Papillae anales crescent shaped, soft, fleshy, covered with numerous setae; ninth sternite probably covered with minute spicules; eighth sternite with no distal apical lateral projections, lateral margins straight; ostium bursae somewhat sclerotized, band-

Figure 43. *Paectes tumida* female genitalia.

like with lateral apices narrowed; base of ductus bursae narrower than ostium bursae; remainder of genitalia unknown.

Distribution. Known only from Brazil, with no specific locality.

Remarks. *Paectes obrotunda* belongs in this species group because it shares with them the shape of the antemedial line, white medial area, white apical spot, and black marginal dash in the forewing. The female genitalia are different from those of the other species in this group and no other specimens from other groups examined during this study matched them, so *P. obrotunda* is only known from the holotype.



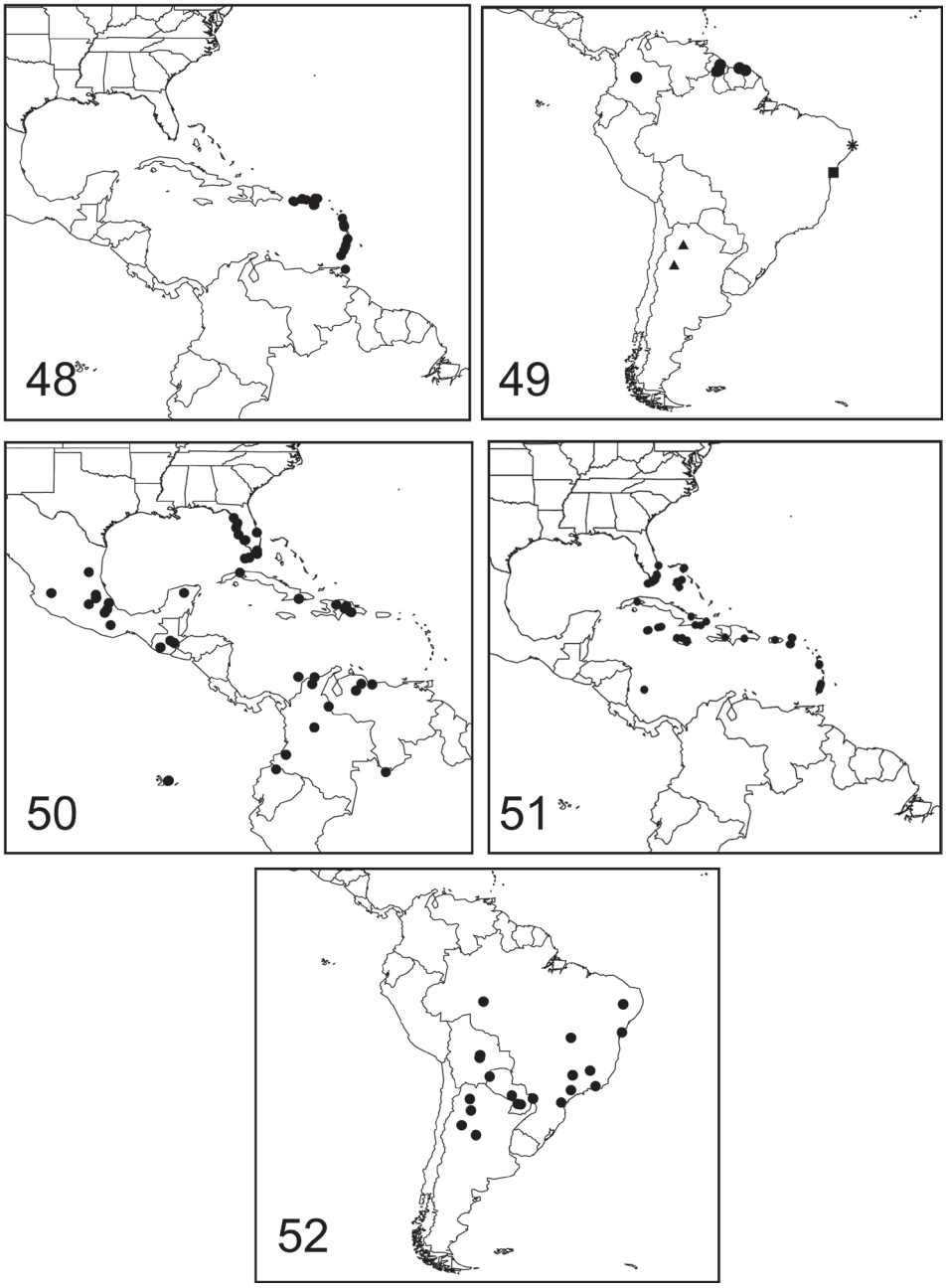
Figures 44–47. *Paectes obrotunda* (Guenée) female Holotype. **44** left forewing **45** right forewing **46** genitalia **47** labels.

Paectes obrotunda has never been correctly identified in the literature. Hampson (1912) gave a wide distribution of *P. obrotunda* extending from throughout the Caribbean to Paraguay. The Caribbean distribution could refer to either *P. asper*, *P. nana* or *P. arcigera*, and the Paraguay record is probably *P. sinuosa*. Kimball (1965) recorded *P. obrotunda* from Florida and these specimens can be referred to either *P. nana* or *P. asper*. Franclemont and Todd (1983) listed *P. obrotunda* from North America, undoubtedly following Kimball (1965).

Due to the cryptic nature of this species complex, the remaining species of Neotropical *Paectes* are currently being revised. A number of specimens from Costa Rica that have been analyzed using DNA barcoding of CO1 and their respective host plants will be included. A phylogenetic analysis using morphological characters of the Neotropical species included in this and the next study will be discussed.

Acknowledgements

I thank Jackie Miller, McGuire Center for Lepidoptera and Biodiversity, University of Florida, Gainesville, FL, for loan of important specimens in that collection and oth-



Figures 48–52. Distribution of collected specimens. **48** *Paectes arcigera* **49** *P. longiformis* (square); *P. similis* (asterisk); *P. medialba* (triangle); *P. tumida* (circle) **50** *P. nana* **51** *P. asper* **52** *P. sinuosa.*

ers that were reared from *S. terebinthifolius* in Brazil and Florida by the late Dale H. Habeck, University of Florida. For additional loans, I thank Peter J. Landolt, Yakima, WA and Richard S. Zack, Washington State University, Pullman, WA. Taina Litwak,

U.S.D.A. Systematic Entomology Lab, Washington, DC provided genitalic illustrations (Figs 29–33, 35–40, 42) and some adult images and assembled the plates. Under Taina's supervision, summer interns Caitlin Johnston prepared Fig. 41 and Martha Iserman prepared Figs 34, 43. Gary Ouellette, U.S.D.A. Systematic Entomology Lab, Washington, DC provided additional adult images. Martin Honey, The Natural History Museum, London, provided a loan of material and supplied the images of the holotype of *P. obrotunda*. J. Donald Lafontaine, Canadian National Collection of Insects, Arachnids, and Nematodes, Biodiversity Program, Ottawa, Canada provided holotype images of *Paectes* species that he photographed at the BMNH and University of Oxford Museum, Oxford, UK; and for his insightful review of an earlier version of this manuscript. For additional reviews of the manuscript I thank Matthew L. Buffington and Thomas J. Henry, U.S.D.A. Systematic Entomology Lab, Washington, DC and James K. Adams, Dalton State College, Dalton, GA. U.S.D.A. is an equal opportunity provider and employer.

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RESEARCH ARTICLE

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A review of the genus *Ogdoconta* Butler (Lepidoptera, Noctuidae, Condicinae, Condicini) from North America north of Mexico with descriptions of three new species

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Abstract

The species of the genus *Ogdoconta* Butler, 1891 (Lepidoptera, Noctuidae, Condicinae, Condicini) from North America north of Mexico are reviewed, and a description of the genus is given. *Ogdoconta satana* Metzler, Knudson & Poole, **sp. n.**, is described from New Mexico and Texas, *Ogdoconta rufipenna* Metzler, Knudson & Poole, **sp. n.**, is described from Arizona, and *Ogdoconta fergusoni* Metzler & Lafontaine, **sp. n.**, is described from Florida, Mississippi, and Louisiana. A key to the species of *Ogdoconta* of North America north of Mexico is provided. Adult moths and male and female genitalia of *Ogdoconta satana, O. rufipenna, O. fergusoni, O. cinereola* (Guenée, 1852), *O. moreno* Barnes, 1907, *O. sexta* Barnes & McDunnough, 1913, *O. altura* Barnes, 1904, and *O. tacna* (Barnes, 1904) are illustrated.

Keywords
Biological diversity, Condicinae, Condicini, Arizona, New Mexico, Texas, *Ogdoconta*, Carlsbad Caverns National Park, Louisiana, Mississippi, Florida

Introduction

Poole (1989) listed 13 species of *Ogdoconta* Butler, 1891 (Noctuidae, Condicinae, Condicini), all from the New World. In 2010, Lafontaine and Schmidt listed five described species of *Ogdoconta* from North America north of Mexico: *O. cinereola* (Guenée, 1852), described from New York, USA; *O. moreno* Barnes, 1907, described from Pima Co., Arizona, USA; *O. sexta* Barnes & McDunnough, 1913, described from Brownsville, Cameron Co., Texas, USA; *O. altura* Barnes, 1904, described from Kerrville, Kerr Co., Texas, USA; *O. tacna* (Barnes, 1904), described from Kerrville, Kerr Co., Texas, USA; and one undescribed species, *O*. sp. not *O. lilacina* (Druce, 1890), recorded from southern Arizona, USA. A name, *Ogdoconta rufipenna*, is provided for the undescribed species listed by Lafontaine and Schmidt (2010). Our investigations show that two additional undescribed species of *Ogdoconta* occur in the United States. *Ogdoconta satana* occurs in New Mexico and Texas, and *Ogdoconta fergusoni* occurs in Florida, Mississippi, and Louisiana.

Material and methods

Genitalia were examined following procedures outlined in Clarke (1941), Hardwick (1950), Lafontaine (2004), and Pogue (2002). Abdomens were removed, soaked in KOH, dissected, and slide mounted.

Wing pattern terminology is from Mikkola et al. (2009). Morphological structure terminology is from Richards (1933) and Scoble (1995). Genital structure terminology is from Lafontaine (2004), Klots (1970), and Mikkola et al. (2009). Forewing lengths, taken from wing base to apex, excluding fringe, were measured to the nearest one half mm using a stereo-microscope with a reticle. All specimens from New Mexico were collected as part of a ten-year faunal study of Lepidoptera of Carlsbad Caverns National Park.

Specimens of Lepidoptera cited in this study are deposited in the following collections (collection abbreviations where available from Evenhuis (1993)):

BMNH Natural History Museum, London, England (statutorily, British Museum of Natural History)
CDF Clifford D. Ferris, Laramie, Wyoming
CNC Canadian National Collection of Insects, Arachnids and Nematodes, Ottawa, Ontario
CUIC Cornell University Insect Collection, Ithaca, New York

EHM Eric H. Metzler, Alamogordo, New Mexico, for subsequent transfer to MSUC
JBW J. Bruce Walsh, Tucson, Arizona
LACM Natural History Museum of Los Angeles County, Los Angeles, California
MEM Mississippi Entomological Museum, Mississippi State University, Mississippi State, Mississippi
MSUC Albert J. Cook Arthropod Research Collection, Department of Entomology, Michigan State University, East Lansing, Michigan
TLSRC Texas Lepidoptera Survey Research Collection, Edward C. Knudson, Houston, Texas
UNMC Museum of Southwestern Biology, University of New Mexico, Albuquerque, New Mexico
USNM National Museum of Natural History, Smithsonian Institution, Washington, DC
VAB Vernon A. Brou, Jr., Abita Springs, Louisiana

Results

Key to the species of *Ogdoconta* in North America north of Mexico

1 Forewing solidly suffused with ash black, reniform and orbicular spots pale filled or obscure; postmedial line deeply zigzagged and without a pale area along distal margin ..... ***satana***
– Forewing not solidly suffused with ash black, but if mainly black, then with pale whitish-gray band by subterminal line; reniform and orbicular spots outlined in white in most species, but represented by diffuse pale patches in two species, postmedial line straight or sinuate, with pale band along distal side in most species **2**
2 Forewing color solidly red brown with purple tint (burgundy) ..... ***rufipenna***
– Forewing color not burgundy **3**
3 Forewing pale or dark clay-colored gray, medial area, particularly near postmedial line, darker than subterminal area; reniform spot distinctly lighter than medial area around it ..... ***moreno***
– Forewing not pale or dark clay-colored gray, reniform spot not distinctly lighter than medial area around it **4**
4 Forewing with postmedial line slightly sinuous, at 90°angle to posterior margin, curved outward to distal end of reniform, then broadly curved around reniform, turning basad towards costa **5**
– Forewing with postmedial line nearly straight from posterior margin to just before costa, not forming 90° angle at posterior margin **7**
5 Larger (forewing length 11.0–13.5 mm) **6**
– Smaller (forewing length 9.0–10.5 mm) ..... ***fergusoni***

6 Forewing with subterminal area lighter than medial and terminal areas; postmedial area usually shaded with pink (specimens from southern Arizona with less pink); hind wing of both sexes solidly dark brown ..... ***cinereola***

– Forewing with subterminal area barely lighter than medial and terminal areas; hind wing of male white; hind wing of female pale at base, darker towards outer margin ..... ***tacna***

7 Costa of forewing with a small streak of white scales extending from just before apex to just below inward angle of postmedial line; valve of male genitalia with cucullar region ovate, capitate; ostium of female genitalia flaring, opening larger than caudal part of ductus bursae ..... ***sexta***

– Costa of forewing without a small streak of white scales in apical area; valve of male genitalia with cucullar region more linear, not ovate; ostium of female genitalia not flaring, opening not significantly larger than caudal part of ductus bursae..... ***altura***

***Ogdoconta* Butler**
http://species-id.net/wiki/Ogdoconta

Ogdoconta Butler, 1891: 462.

Type species. *Placodes cinereola* Guenée, by original designation.

Diagnosis. *Ogdoconta* is a moderately-sized (approximately 15 species) New World genus with its largest concentration of species in the southwestern United States, Mexico, and Central America. The North American species of *Ogdoconta* are small to moderate in size (forewing length 9.5–16.0 mm), and their appearance is not particularly distinctive, because there are no external characters that uniquely characterize this genus. There are, however, characters in both the male and female genitalia unique to *Ogdoconta*. The most distinctive feature is the divided valve in the male genitalia. The saccular and cucullar regions are separate, although joined at the base. In the female genitalia the junction of the ductus bursae, corpus bursae, and appendix bursae are proximate.

Description. *Head*: Male and female antennae scaled above, naked below; occiput with dentate scales projecting slightly between antennal bases; a rough, poorly-developed line of scales just below antennal bases; front smoothly scaled, without frontal process, raised ring, or other modifications; eye normal, rounded, without hair; ocelli present; no lashes from either base of antenna or rear margin of eye; palpus unmodified, upturned, reaching about midpoint of front; third segment about one-third length of second; both second and third palpal segments smoothly scaled, first segment with a ventral tuft of scales; haustellum normal. *Thorax*: Wing venation normal for trifid noctuids; dorsum of thorax covered with elongate scales. Frenulum in female occasionally with a single bristle. Prothoracic leg: femur closely covered with flat scales except for a few rough scales projecting along ventral margin; tibia about one-half as long as femur, smoothly scaled, except for a few rough scales along outer margins; tibial claws

and spines absent; first tarsal segment almost as long as tibia; first three tarsal segments scaled both dorsally and ventrally, fourth and fifth tarsal segments may have reduced scaling, fifth tarsal segment mostly naked ventrally; tarsal segments with three rows of spines ventrally. Mesothoracic and metathoracic legs: femur about four times longer than wide, smoothly scaled, except for fringe of long hairs along ventral margin; tibia scaling rougher than on femur; usual one mesotibial and two metatibial pairs of spurs; tarsal segments as in prothoracic leg. External tympanal region with alula strong; tympanic membrane circular, not elongate. *Male abdomen*: Weak tufts of scales present or absent on dorsum of segments one and two; sternite 1+2 without basal hair pencils or Stobe's glands; sclerotized margin of eighth sternite appears U-shaped; eighth sternite with two separate strong lines of hairs, not clearly separated into two hair pencils; sclerotized region of eighth tergite Y-shaped. *Male genitalia*: Uncus straight, narrow, often hairy; scaphium variously sclerotized; subscaphium variously sclerotized; anal tube variously sclerotized; tegumen simple, with or without slight projecting lobe near articulation with vinculum; tegumen hairy; vinculum and tegumen articulating directly, neither extensions, processes, nor separate pleurites present; juxta variously triangular, drawn out posteriorly; valve with saccular and cucullar regions separated giving valve a bifid appearance; cucullar region rectangular, ovate, or elongate; mesial surface of distal part of cucullar region simple and densely hairy, projections from costal margin present or absent; type species with a clasper located near junction of cucullar and saccular parts of valve, clasper-like structure present or absent in other species; saccular part of valve long, shorter than cucullar part, narrow, mesially densely covered with hairs; shaft of aedeagus narrow, with slight apical process variable; vesica long, from one half loop to two full loops, with or without diverticula or spines. *Female genitalia*: Ovipositor lobes unmodified, setae present; anterior apophyses and posterior apophyses, short, approximately equal in length; ostium in membrane between seventh and eighth abdominal segments, closer to eighth segment, with varying amounts of sclerotization; ductus bursae generally narrow, sclerotized or membranous, of variable length; appendix bursae wide, membranous; corpus bursae globular, slightly narrowed at junction with ductus bursae and appendix bursae; signa present or absent.

Discussion. In North America north of Mexico, the species of *Ogdoconta* are placed in three groups. The first group (here called the *cinereola* species group) contains five species; *O. cinereola, O. moreno, O. sexta, O. altura,* and *O. satana.* This group has a simple divided valve without projections on the outer margin. The vesica of the aedeagus is elongate with a single large loop. In the female genitalia the ostium is sclerotized, partially sclerotized or membranous. The ductus bursae is variable in length, narrow or funnel shaped, straight or bent, and membranous or partially sclerotized. A single junction joins the ductus bursae, corpus bursae, and appendix bursae. The corpus bursae is globular, usually with a single concave signum. The appendix bursae is large and fully or partially coiled. The junction between the appendix bursae and ductus seminalis may not be distinct.

Ogdoconta cinereola differs from all other species in the group in that *O. cinereola* has a small clasper at the juncture of the cucullar and saccular regions of the valve. *Og-*

doconta altura, O. sexta, O. moreno, and *O. satana* have no clasper. The distribution of *O. cinereola* generally falls outside that of the other four species in the *cinereola* group.

The second group contains two species *O. tacna* and *O. fergusoni*. The outer margin of the cucullar part of the valve is less curved than the *cinereola* group, and the outer margin of the cucullar part has one or more projections. The vesica of the aedeagus has two rows of short, stubby spines. The female genitalia of the two species in the *tacna* group are dissimilar from each other, and they are dissimilar from the other species groups.

The third group contains the single species *O. rufipenna* that is characterized by the cucullar part of the valve, which is noticeably more narrow than the other species groups. The outer margin of the cucullar part of the valve has a conspicuous thumb-like projection. In the female genitalia the ostium is strongly sclerotized and the sclerotization continues down the ductus bursae. The ductus bursae, supported by the terminus of the sclerotization, is bent.

cinereola species group

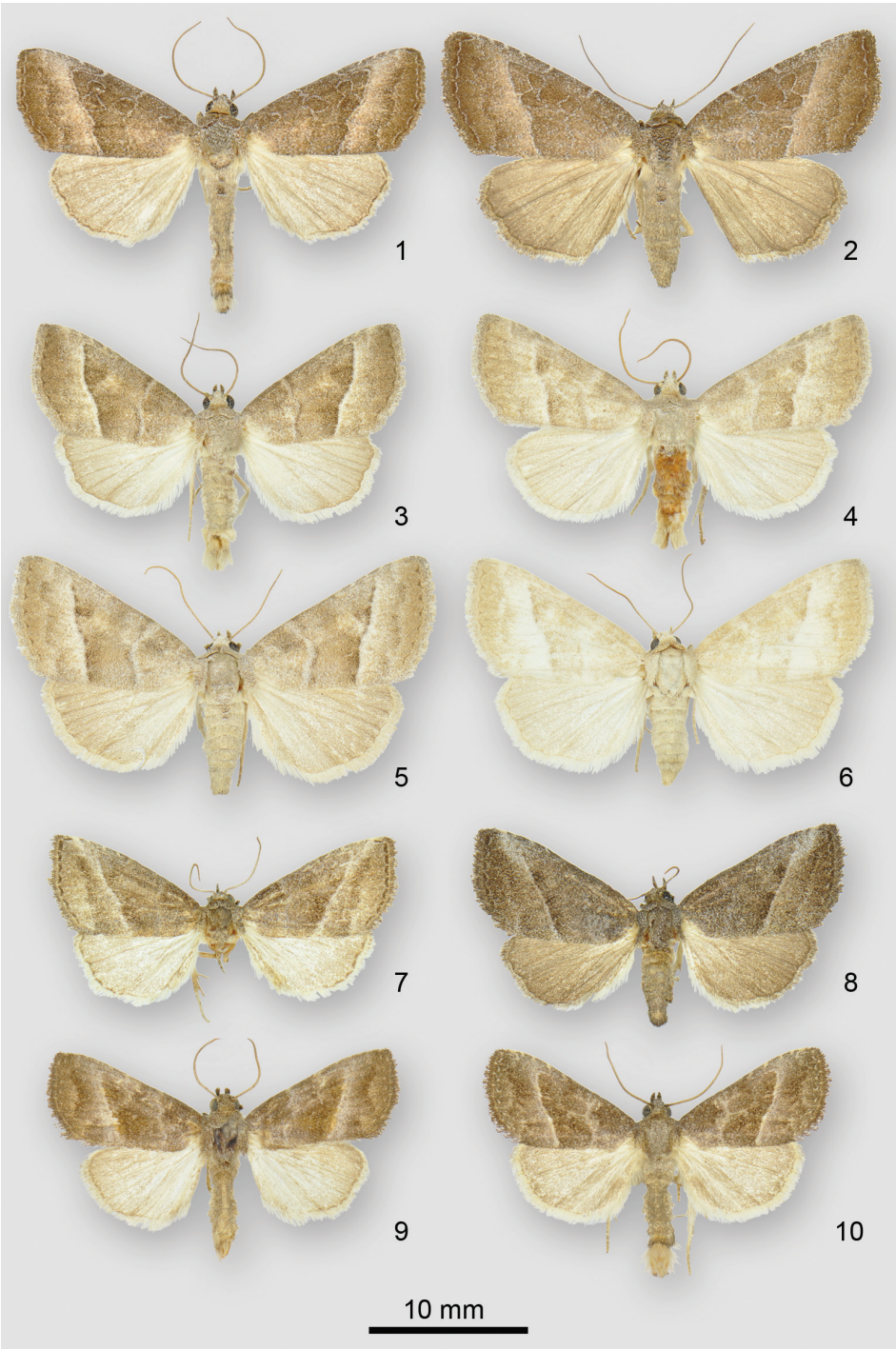
***Ogdoconta cinereola* (Guenée, 1852)**
http://species-id.net/wiki/Ogdoconta_cinereola
Figs 1, 2, 20, 21, 36

Placodes cinereola Guenée, 1852: 316, pl. 15, fig. 1.
Miana atomaria Walker, 1865: 675.

Type material. *Placodes cinereola* was based on two syntypes from New York, USA, from the Boisduval and Doubleday collections. A single syntype, labeled "U. S. America, Doubleday, 46–110" with a handwritten label "*Placodes cinereola*", now extant in the BMNH from the Doubleday collection, is labeled and hereby designated as **Lectotype** to ensure the stability of the name. Walker based *Miana atomaria* on three syntypes from the United States that were in the BMNH. The syntypes could not be located in the BMNH and Hampson (1910) does not list any types in his catalogue.

Diagnosis. Forewing is light fuscous brown, and the subterminal region (between the postmedial and subterminal lines) is suffused with a pinkish tinge. Medial and basal areas are minutely speckled with white. Antemedial line is an obscure, scalloped white line. Reniform and orbicular spots are obscure but often discernible by fine white outlines. Claviform spot is absent. Postmedial line is a white, almost straight, oblique line with a slight basally directed bend at CU_2. Subterminal line is marked primarily as a brown shade terminating the pink suffusion of the subterminal region. Hind wing is suffused with brown. Males and females are similar in appearance, although the female hind wing usually is darker. Forewing length: 9.5–14.5 mm. This appears to be the only species in the genus with a clasper near the junction of the saccular and cucullar regions of the valve.

Distribution and biology. *Ogdoconta cinereola* is the only widely distributed and commonly collected species of *Ogdoconta* in eastern, central, and southwestern North



Figures 1–10. *Ogdoconta* adults. **1** *O. cinereola* male **2** *O. cinereola* female **3** *O. moreno* male **4** *O. moreno* male **5** *O. moreno* female **6** *O. moreno* female **7** *O. sexta* male **8** *O. sexta* female **9** *O. altura* male **10** *O. altura* female

America. It occurs from southern Ontario and Quebec south to southern Florida. At the western edge of its distribution, *O. cinereola* occurs from Manitoba southward through the Great Plains of Nebraska and Iowa, south throughout most of Texas, and westward through southern New Mexico (Eddy County) to southeastern Arizona (Santa Cruz County). The distribution extends south to the state of Coahuila in northern Mexico. Reports of this species from British Columbia are based on a mislabeled specimen; several other species from the same collection, now in the CNC, are also mislabeled as to locality with the same "Vancouver, B.C." label.

The larva of *O. cinereola* was described by Coquillett (1880), Hampson (1910), Crumb (1956), and Wagner et al. (2011). Wagner et al. (2011) provided pictures of the larva. Recorded larval hosts include five plant families; Amaranthaceae, Asteraceae, especially *Ambrosia* spp. (ragweeds), Fabaceae, Labiatae, and Poaceae (Ashmead 1886, Crumb 1956, Tietz 1972, Robinson et al. 2002, Heppner 2003, Wagner et al. 2011, Robinson et al. 2012).

Remarks. This moth is easy to identify because of the pink in the subterminal area of the forewing. The adults are generally common and occur from May to September in the north, to as early as April and as late as October, in Texas and Florida. The saturation of pink in the postmedial area is reduced in specimens from southern Arizona. The pink postmedial area in some individuals is wider. Varying portions of the basal area of some specimens is replaced with pink.

Ogdoconta moreno Barnes, 1907

http://species-id.net/wiki/Ogdoconta_moreno
Figs 3–6, 22, 23, 37

Ogdoconta moreno Barnes, 1907: 96.

Type material. *Ogdoconta moreno* is based on an unspecified number of syntypes. There are currently two syntypes in the USNM bearing Barnes' syntype labels, a male and a female. The male syntype bearing the locality "Baboquivera [sic] Mts., Pima Co., Ariz." is labeled and hereby designated as **Lectotype** to ensure the stability of the name.

Diagnosis. Adults of *O. moreno* vary from brown to gray. This species is not likely to be confused with any other species of *Ogdoconta* in North America. Both the reniform and orbicular spots of the forewing are represented by contrasting light patches devoid of any defining lines or spots. Orbicular spot touches the antemedial line. Antemedial line is angled with the outward apex occurring just below the orbicular spot. Inner side of the antemedial line is a light band followed by a darker brown line. Postmedial line is an almost straight, light line, followed by a light tan or gray region of the subterminal area, which gradually becomes darker in the subterminal area. Medial and terminal areas of the forewings of individual specimens, of both sexes, range from pale tan to dark smoky gray. Hind wing of both the male and female is whitish, suffused with dull gray brown, more heavily in the female than the male. Forewing length: 10.0–14.0 mm.

Cucullar part of the valve is ovate, elongate, and the outer margin is unmodified. Vesica loop varies from 180° to 360°. Vesica has a prominent curved diverticulum. Female genitalia are almost entirely membranous. Corpus bursae is elongate with a conspicuous signum that is concave and imbedded with minute denticles.

Distribution and biology. This species is known only from southern Arizona, although its distribution likely extends into Mexico. The larva and its food plants are unknown. Adults were collected in July, August, and September.

Ogdoconta sexta Barnes & McDunnough, 1913

http://species-id.net/wiki/Ogdoconta_sexta
Figs 7, 8, 24, 25, 38

Ogdoconta sexta Barnes and McDunnough 1913: 117, pl. 5 fig. 6.

Type material. *Ogdoconta sexta* is based on an unspecified number of syntypes. There are currently two syntypes in the USNM labeled "Type ♂" and "Type ♀" respectively. The male syntype bearing the locality "Brownsville, Texas" is labeled and hereby designated as **Lectotype** to ensure the stability of the name.

Diagnosis. The best superficial character to separate *O. sexta* from *O. altura* is found near the apex of the forewing. *Ogdoconta sexta* has a small streak of white scales, best seen with low magnification, from just before the apex of the wing to just below the outward angulation of the postmedial line. This feature gives the forewing costa of *O. sexta*, just before the apex, a frosted appearance (Figs 7, 8). Otherwise, the region following the postmedial line of *O. sexta* is not lighter than the rest of the subterminal area. Most of the maculation of the forewing is obscure. However the postmedial line is moderately distinct, straight, except for a slight basally directed angulation near the costa, and white or yellow in color. Hind wing is suffused with dull brown; hind wings of some males are not as dark as the hind wings of females. There is no geographical variation. To the naked eye, *O. sexta* appears slightly larger than *O. altura;* the wing measurements show them to be the same size. Forewing length: 10.5–13.0 mm.

In the male genitalia the apex of the cucullar region of the valve is ovate-capitate in *O. sexta*, but narrower and more lineate in *O. altura*. In the female genitalia of *O. sexta* the ostium is wider than long, but the ostium of *O. altura* is longer than wide or the two measurements are approximately equal. The ostium of *O. altura* appears larger when compared to the ostium of *O. sexta*.

Distribution and biology. *Ogdoconta sexta* is known from Hidalgo and Cameron Counties in the southernmost Texas. Its distribution in Mexico is not known. The larva and its food plants are unknown. Adults were collected from March to June and again in September. *Ogdoconta sexta* is infrequently collected.

Remarks. *Ogdoconta sexta* and *O. altura* are difficult to separate superficially. Both species are similar in size, and the overall coloration is brown with a green-gray cast. Males tend to be slightly lighter than females, and in particular the subterminal area

of the male can be significantly lighter than the medial area. A few males have significantly weaker brown suffusion in the hind wing than do other males and all females. When held in the light at the correct angle, the wings appear to be shiny.

Ogdoconta altura Barnes, 1904

http://species-id.net/wiki/Ogdoconta_altura
Figs 9, 10, 26, 27, 39

Ogdoconta altura Barnes, 1904b: 243.

Type material. *Ogdoconta altura* is based on an unspecified number of syntypes. The USNM has three syntypes, 2 females and 1 male with red-bordered type labels that are verifiably part of the original syntype series. The male syntype bearing the locality "Kerrville Texas" is labeled and hereby designated as **Lectotype** to ensure the stability of the name.

Diagnosis. The best character to separate *O. altura* from *O. sexta* is found near the apex of the forewing. *Ogdoconta altura* is lacking the small smear of white scales near the apex described in the diagnosis of *O. sexta*. In *O. altura*, the forewing costa proximal to the apex, lacks a frosted appearance (Figs 9, 10). The region following the postmedial line in *O. altura* is lighter than the rest of the subterminal area. Forewing length: 9.5–13.0 mm.

The genital differences between *O. altura* and *O. sexta* are given in the diagnosis of *O. sexta*.

Distribution and biology. *Ogdoconta altura* has a wider distribution than *O. sexta*. *Ogdoconta altura* was collected in south central and southern Texas as well as in northeastern Mexico. The larva and its food plants are unknown. Adults were collected in April, May, July, August, and September. *Ogdoconta altura* is infrequently collected.

Remarks. *Ogdoconta altura* and *O. sexta* are difficult to separate superficially. Both species are similar size, and the overall coloration is brown with a green-gray cast. When held in the light at the correct angle, the wings appear to be shiny. The hind wing of the female is more heavily suffused with brown than the male, although the amount of dark suffusion is variable among males. Among males, some individuals have a smoother and slightly lighter appearance than others. There is no geographic variation.

Ogdoconta satana Metzler, Knudson & Poole, sp. n.

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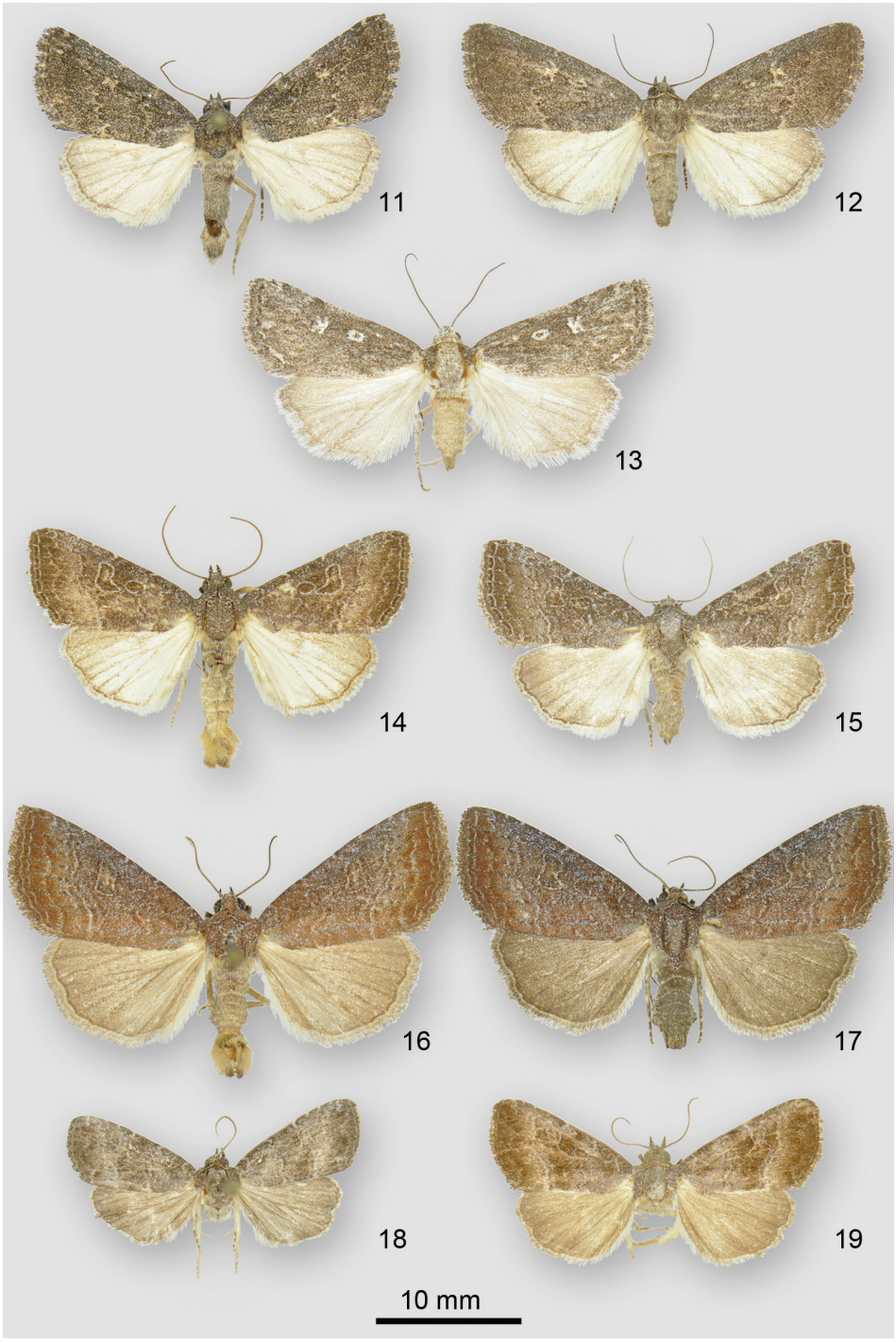
http://species-id.net/wiki/Ogdoconta_satana
Figs 11, 12, 28, 29, 40, 44

Type material. Holotype: Adult male, pinned: USA: NM: Eddy Co. Carlsbad Caverns N[ational]P[ark], arroyo habitat, 104°33.74'W, 32°06.38'N 4,170', 10 July 2010, CCNP5, Eric H. Metzler, uv tr[a]p, Accss #: CAVE - 02263 (USNM). **Paratypes:** 38 males and 20 females: Same data as holotype with dates 10 July 2010, 9 June 2009, 14



Figures 11–19. *Ogdoconta* and *Fotella notalis* adults. **11** *O. satana* male **12** *O. satana* female paratype **13** *F. notalis* dark female **14** *O. tacna* male **15** *O. tacna* female **16** *O. rufipenna* male holotype **17** *O. rufipenna* female paratype **18** *O. fergusoni* male holotype **19** *O. fergusoni* female paratype.

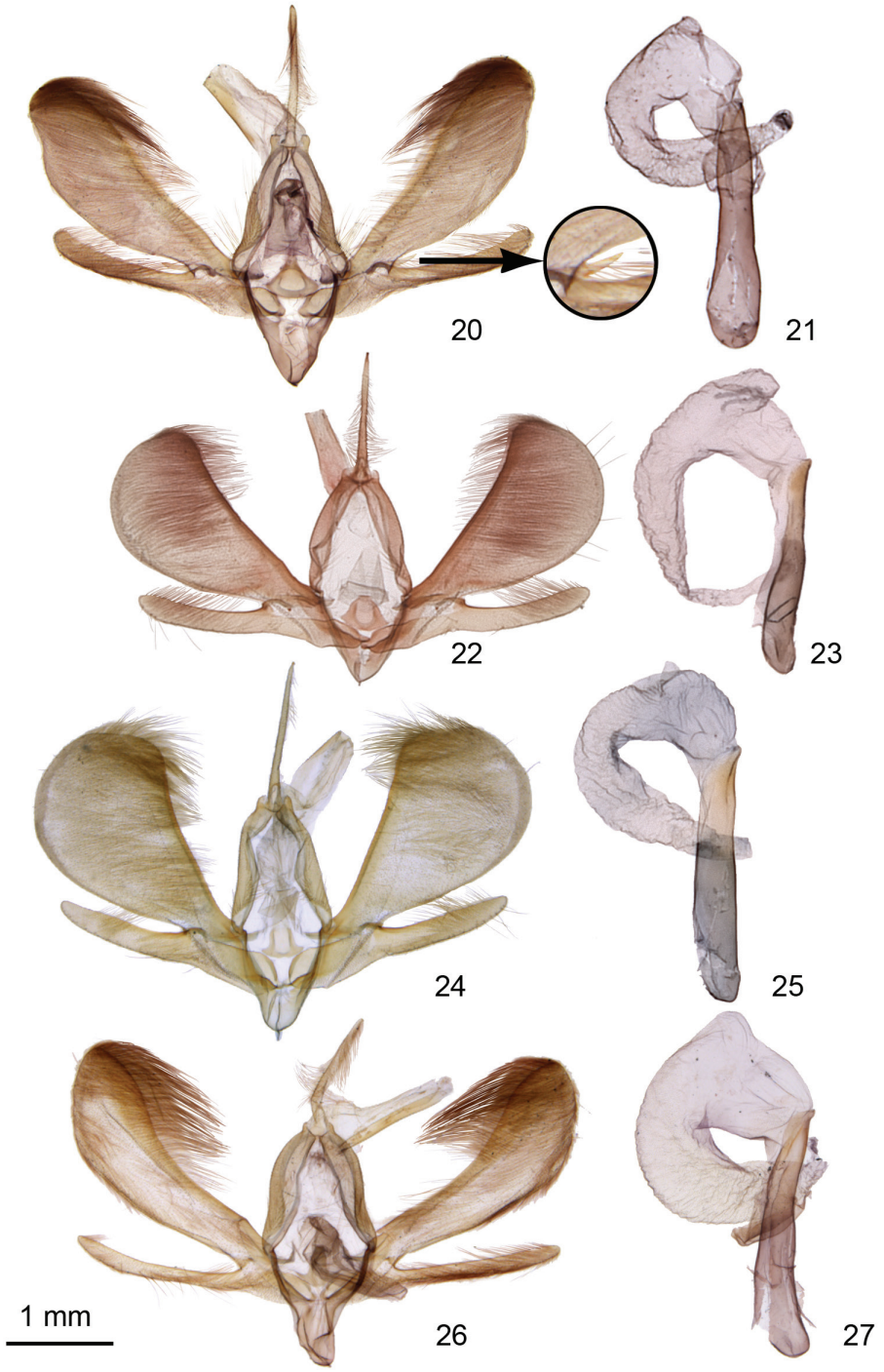
June 2007. USA: NM: Eddy Co. Carlsbad Caverns NP, arroyo habitat, 104°33.569'W, 32°5.976'N 4,100', 9 June 2009, 6 August 2010 CCNP2, Eric H. Metzler, uv trp, Accss #: CAVE - 02263. USA: NM: Eddy Co. Carlsbad Caverns NP, grassland habitat, 32°06.222'N 4160' 104°33.759'W, 29 August 2006, CCNP1, Eric H. Metzler Accss #: CAVE - 02263. TEXAS, Culberson Co., Guadalupe Mts. NP, Williams Ranch, 10,11-VIII-91, leg.E.C.Knudson. TEXAS: Culberson Co. Sierra Diablo WMA, leg. E.C.Knudson, 18-VIII-84. TX: Culberson Co., Guadalupe MtsNP, Ship on Desert, 24-VIII-95, leg.E.Knudson. Texas: Bear Canyon, Guadalupe Mts., Texas, 5700', 4.IX.69, A. & M.E. Blanchard. TX: El Paso Co., Hueco Tanks SP, 23-IX-95/ ECK. TX: Brewster Co., Big Bend NP, Dugout Wells, 8-IX-10 B/K. Shafter, Presidio County, Texas, 9.IX.69, A. & M.E. Blanchard. Sierra Diablo Wildlife Mgt. Area, 6000', Culberson Co., Tex., 12–15.VII.71. (USNM, UNMC, MSUC, EHM, TLSRC).

Etymology. The scientific name *satana* comes from the Marvel comic book fictional character Satana, a child of Satan and sinister character, who taught black magic. The name refers to the black (often equated with evil) color of the adult moth. It is treated as a noun in apposition.

Diagnosis. *Ogdoconta satana* is an easily recognized species within the genus *Ogdoconta*. Forewing is completely suffused with dark ash black, and hind wing is contrastingly pale. Most of the maculation is obscure; scalloped black postmedial line is barely visible. Both orbicular and reniform spots are present as small contrasting light spots or are obscure. Orbicular spot is small and round with an ash-black center, and the reniform spot, filled with ash black, is obscure towards costa and posterior margin. Under low magnification the medial area may appear to be darker. Hind wing is contrastingly pale. There is little or no variation in the appearance of the upperside of *O. satana*; underside, in both males and females, can vary from dirty white with scattered dark-fuscous scales to dark fuscous with scattered dirty-white scales. Orbicular and reniform spots on the underside range from prominent to obscure, and the color may be pale gray, yellow, or dirty white, filled with dark gray, or black. Under low magnification, forewings of some specimens may appear to have a dark-brown tint. No other species of *Ogdoconta* in North America shares these characters.

Females of *O. satana* are superficially similar to very dark females of *Fotella notalis* Grote, 1882 (Noctuidae, Condicinae, Leuconyctini) (Fig. 13). The two species are sympatric in the northern Chihuahuan Desert, and they are easy to distinguish. The front of *F. notalis* has a caldera-like raised ring with a depressed center. Scales between the raised ring and the clypeus are dirty-white, and the antennal scape of *F. notalis* is white. The front of *O. satana* does not have a raised ring. Scales near the clypeus and the antennal scape of *O. satana* are black. Also, *O. satana* has a broader forewing than does *Fotella notalis*.

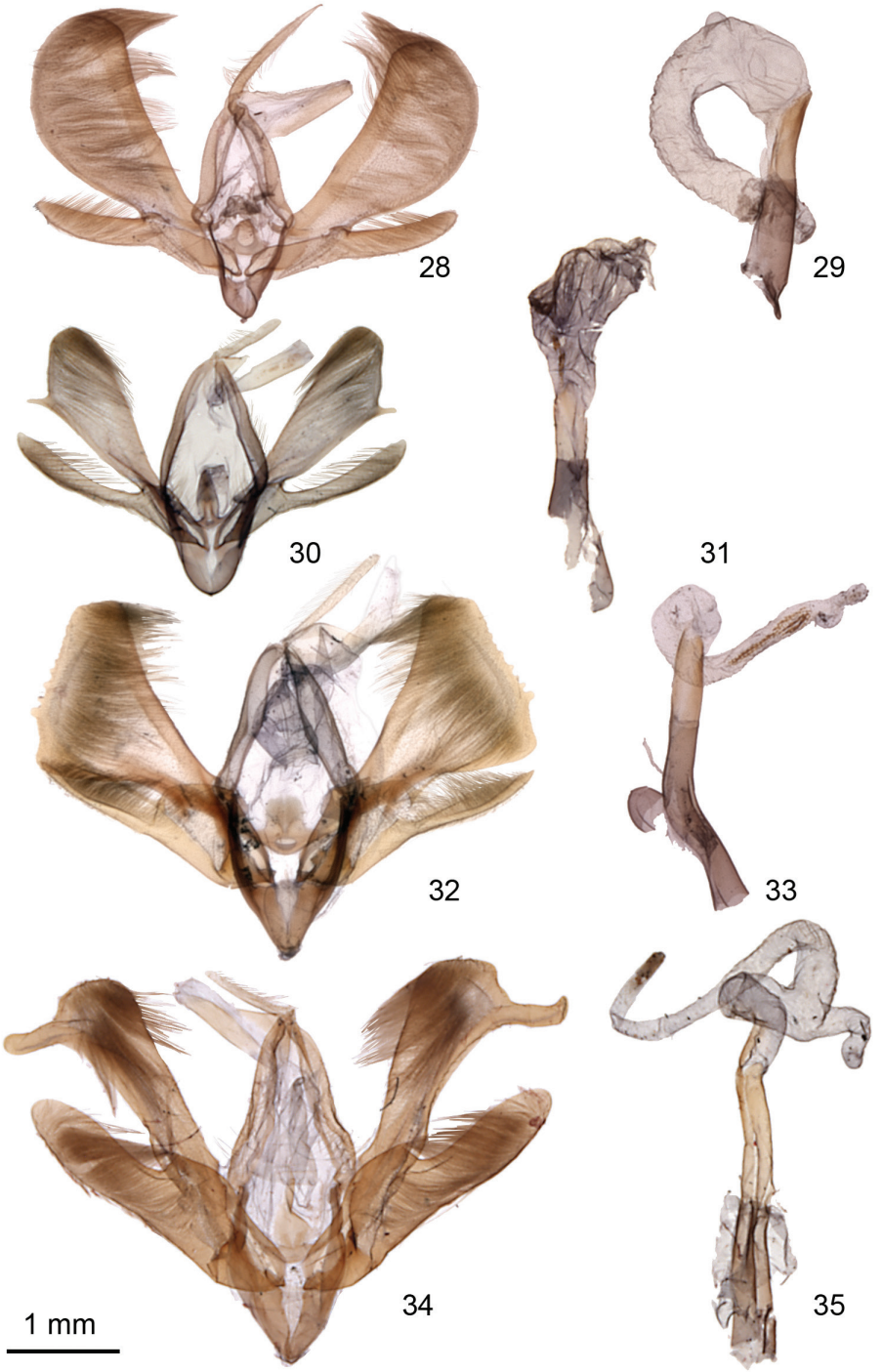
Description. Adult male (Fig. 11). *Head*: Ash black, scales spatulate white tipped, vertex scales erect, front scales smooth. Labial palpus erect, smooth ash black, scattered white scales, scales spatulate, basal segment with ventral tuft of scales, second segment apex mesially white. Haustellum coiled between labial palpi. Antenna filiform, sensory setae inconspicuous, each segment dorsally alternating gray and pale, scales appressed,



Figures 20–27. *Ogdoconta* male genitalia. **20** *O. cinereola* with inserted enlargement showing detail of *O. cinereola* clasper **21** *O. cinereola* aedeagus **22** *O. moreno*. **23** *O. moreno* aedeagus **24** *O. sexta* **25** *O. sexta* aedeagus **26** *O. altura* **27** *O. altura* aedeagus.

ventrally naked, light brown. *Thorax*: Ash black, scales spatulate white tipped; underside dirty white, scales appressed, scattered long hair-like scales. Legs dorsally ash black, ventrally dirty white, smoothly scaled, sparse long hair-like white scales; tarsomeres ash black, white tipped. Forewing: length 10.0–13.0 mm, mean 11.5 mm, n = 37; dorsal surface ground color ash black with scattered gray scales. Basal line obscure, faintly darker; antemedial line obscure, faintly darker; postmedial line dirty white at posterior margin, pointed basally on veins, obscure over cell, disappearing towards costa; subterminal line obscure; terminal line obscure; orbicular spot a round dirty-white ring filled with ash black; reniform spot a kidney-shaped dirty-white ring filled with ash black, obscured towards costa and posterior margin; costa with four or five small dirty-white spots from postmedial line to apex; fringe ash black with occasional pale-gray bars; underside dark gray, whitish-gray towards posterior margin, subcostal basal whitish-gray patch on some specimens, costa ash black, four or five small dirty-white spots from postmedial line to apex; orbicular and reniform spots more or less prominent dark gray. Hind wing dirty white, contrasting with forewing, numerous gray scales, darker in costal and terminal areas, terminal line contrasting dark gray, fringe pale gray; underside pale gray contrasting with forewing, discal spot dark gray, numerous gray scales, darker in dorsal and terminal areas, terminal line contrasting dark gray, fringe pale gray. *Abdomen*: Dorsum dark gray, smoothly scaled; underside dark gray, numerous white-tipped scales, smoothly scaled. *Genitalia* (Fig. 28): Apex of each arm of tegumen produced to tab-shaped lobe, juncture of two arms Y-shaped; uncus straight, drawn out to long point, long hairs sparse, denser basally; juxta widened and rounded anteriorly, laterally thickened, center U-shaped, posteriorly narrowed, drawn out to an obscure terminus; vinculum broadly V-shaped, short; valve divided, saccular region wider for basal one third, dorsal margin bent so apical two thirds narrower, heavier sclerotization at bend, narrowed part slightly curved dorsad, margins parallel, apex rounded, narrowed region densely hairy mesially; cucullar region more than two times length of saccular region, densely hairy mesially, distinctly widened to one-half length, curved dorsad, slightly narrowing towards apex, apex broadly rounded. Aedeagus (Fig. 29) straight; vesica at 90° angle, base wide, narrowing apically, forming loop 270°–360°, apically bent 90°, minute denticules at base, median diverticulum small, thin, plate-like. **Adult female** (Fig. 12): Similar to male; forewing: length 10.0–14.0 mm, mean 13.0 mm, n = 20. *Genitalia* (Fig. 40): Papilla analis lightly sclerotized, apex rounded, setae stout, numerous, conspicuous; posterior apophysis conspicuously widened near base, extending anteriorly to just beyond posterior margin of eighth segment; anterior apophysis equal length, not widened; ostium bursae funnel shaped, trapezoid-shaped plate lightly sclerotized; ductus bursae membranous, gradually narrowing to middle, widening to juncture with corpus bursae, light rugose sclerotization near juncture with corpus bursae; corpus bursae globular, membranous, scattered denticules, narrowed at insertion of ductus bursae; signum, concave, densely covered with elongate denticules.

Remarks. This species is placed in the genus *Ogdoconta* on the basis of the structure of the male and female genitalia. The postmedial line is more complete on some specimens. The loop in the vesica of most specimens examined (n=8) was 270°; how-



Figures 28–35. *Ogdoconta* male genitalia. **28** *O. satana* **29** *O. satana* aedeagus **30** *O. fergusoni* **31** *O. fergusoni* aedeagus with vesica partially everted **32** *O. tacna* **33** *O. tacna* aedeagus **34** *O. rufipenna* **35** *O. rufipenna* aedeagus.

ever the loop in one specimen was nearly 360°. The type locality was selected because it will be protected by the U.S. National Park Service into perpetuity. Metzler, Knudson, and Poole are the sole authors of this species.

Distribution and biology. This species is known from western Texas and Carlsbad Caverns National Park, Eddy County, New Mexico (Fig. 44). Its distribution into Mexico is not known. The larva and its food plant(s) are unknown. *Ogdoconta satana* is common in Carlsbad Caverns National Park, otherwise it is infrequently collected.

tacna species group

***Ogdoconta tacna* (Barnes, 1904)**
http://species-id.net/wiki/Ogdoconta_tacna
Figs 14, 15, 32, 33, 41

Caradrina tacna Barnes, 1904a: 167.

Type material. *Caradrina tacna* is based on an unspecified number of syntypes. The female syntype in the USNM bearing the locality "Kerrville, Texas" is labeled and hereby designated as **Lectotype** to ensure the stability of the name.

Diagnosis. The forewing of *O. tacna* is gray brown with a slight greenish tint. The species is separable from all other species of *Ogdoconta* in North America by a pattern of fine white lines and a light scattering of white scales over a gray-brown forewing. In particular, the orbicular and reniform spots are clearly outlined by fine, dirty-white lines. Postmedial line is mostly straight and oblique from the costa to the posterior margin, although there is a slight outward pointing angulation near the bottom of the reniform spot. Postmedial line is accented with vague dark gray-green rectangles on its inner side. Subterminal area is slightly lighter than the terminal area, and the subterminal line is irregular and dull white. Terminal line consists of a series of dark rectangles accented on their inner sides by white lines. Hind wing of the male is dirty white with dark scales along the fringe and a dusting of dark scales along the costal margin. Female hind wing is more generally suffused with dark scales. White still shows through, particularly basally and along the posterior margin. Forewing length: 11.0–13.5 mm.

The male genitalia are distinctive. The cucullar part of the valve is triangular, not ovate, and there is a series of small knobs along the outer margin. Aedeagus is long, narrow, and slightly sinuous. Vesica is narrow with a tight basal loop followed by a straight region containing a double row of short, stubby spines, not found in the other North American species of *Ogdoconta*. The distal end of the vesica is another tight loop. Female genitalia are distinctive. Ostium is strongly sclerotized and the sclerotization extends the entire length of the ductus bursae. Appendix bursae contains a series of sclerotized rugosities. The distal end of the appendix bursae is not distinguishable from the beginning of the ductus seminalis. The caudal end of the corpus bursae contains the same sclerotized rugosities found in the appendix bursae.

Figures 36–43. *Ogdoconta* female genitalia. **36** *O. cinereola* **37** *O. moreno* **38** *O. sexta* **39** *O. altura* **40** *O. satana* **41** *O. tacna* **42** *O. rufipenna* **43** *O. fergusoni*.

Distribution and biology. In the US, this species is only known from central and southeastern Texas. The distribution of *O. tacna* in Mexico is not known. The larva and its food plants are unknown. Adults were collected in April and May and again in September and October. *Ogdoconta tacna* is infrequently collected.

Remarks. The Lectotype designated here is the specimen illustrated as type female on plate IX, fig. 15 in Barnes and McDunnough (1912).

The shape of the valve and the knob-like projections on the valve can be seen by brushing a few scales from the protruding genitalia of male specimens.

The CNC specimen from Florida reported as *O. tacna* (Kimball 1965, Heppner, 2003) is *O. fergusoni* Metzler & Lafontaine, new species. The specimen from Cassadaga, FL, attributed to Stanley V. Fuller, could not be located amongst Fuller's specimens, now deposited at the McGuire Center for Lepidoptera and Biodiversity, University of Florida, and it could not be located at the Museum of Comparative Zoology, Harvard University, which is where Kimball deposited his specimens. If the Fuller specimen was examined by Kimball it is easy to speculate that the Fuller specimen is *O. fergusoni.* The specimens identified as *"Ogdoconta* species near *tacna*" (Kons and Borth 2006) from six localities in northern and northeast Florida were not available for this study.

***Ogdoconta fergusoni* Metzler & Lafontaine, sp. n.**
urn:lsid:zoobank.org:act:26626E74-FA32-48C5-A502-B91402562695
http://species-id.net/wiki/Ogdoconta_fergusoni
Figs 18, 19, 30, 31, 43, 44

Type material. Holotype: Adult male, pinned: USA, FLORIDA: Hernando County, Brookesville, N28.583, W82.333, 6-V-2002 J. Vargo. Male genitalia on slide 136355 (USNM). **Paratypes**: 3 females: MISS.,Wilkinson Co., Clark Creek Nat[ural]. Area, 31°04'22"N, 91°31'05"W, 12 July 1997, R.L.Brown. Aug-1-1981 Weyanoke, West Feliciana Par. Louisiana USA Coll. V.A. BROU. Florida 14 7[?= 14 July]. Ex Coll. Wolley-Dod. (CNC, MEM, VAB).

Etymology. The scientific name *fergusoni* recognizes the contributions of Douglas Campbell Ferguson to the study of Lepidoptera and his role as a friend and mentor to many people who study Lepidoptera. The name is in the genitive case.

Diagnosis. *Ogdoconta fergusoni* is the smallest North American species of *Ogdoconta*. At first glance it might be overlooked as a species of *Elaphria* Hübner, 1818, especially *E. fuscimacula* (Grote, 1881) or *E. grata* Hübner, 1818. Both species of *Elaphria* are reddish brown and *O. fergusoni* is shades of gray with hints of brown and has fuscous hind wings. Historically (Kimball 1965, Heppner 2003) *O. fergusoni* was confused with *O. tacna. Ogdoconta fergusoni* is dark gray or dark reddish brown like *O. tacna*. When *O. fergusoni* is compared to *O. tacna*, the forewing of *O. tacna* is not noticeably paler in the postmedial area, *O. tacna* is noticeably larger, the maculation of *O. tacna* is more prominently outlined in white, and the base of the hind wings of females of *O. tacna* have at least a few dirty-white scales. The postmedial area of the forewing

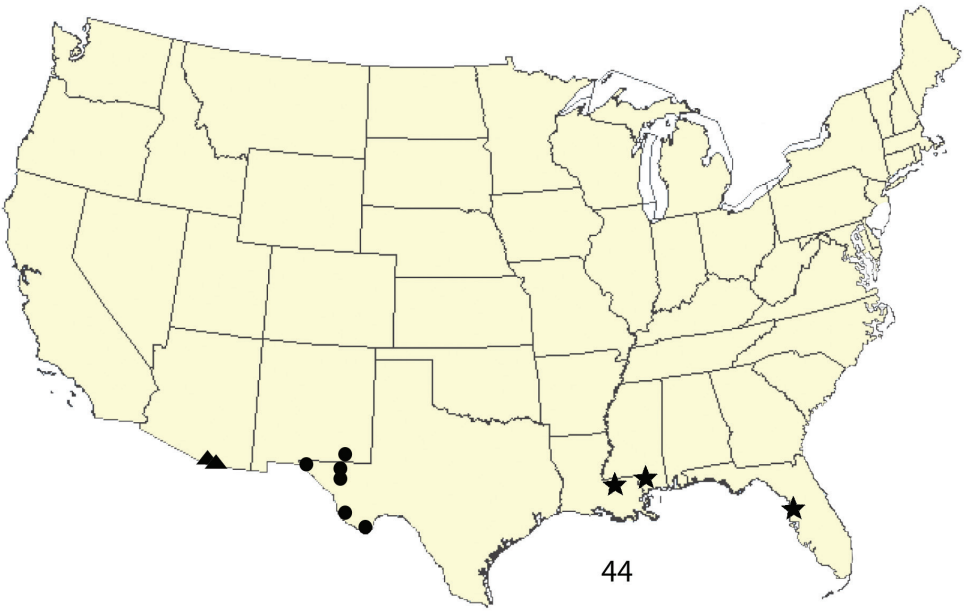


Figure 44. Distribution of new species of *Ogdoconta*: ● = *O. satana*. ▲= *O. rufipenna*. ★= *O. fergusoni*.

of *O. fergusoni* is noticeably paler than the postmedial area of the forewing of *O. tacna*, *O. fergusoni* is smaller than *O. tacna*, and the hind wings of *O. fergusoni* are solidly fuscous. When held obliquely to the light, the forewings of *O. fergusoni* appear shiny.

Description. Adult male (Fig. 18). *Head***:** Front smooth, scales white tipped gray brown; vertex, scales spatulate, 45° erect posteriorly, white tipped gray brown. Labial palpus porrect, reaching top of head; first segment dorsal scales, long, narrow, erect, pale yellow, mesial surface smooth, dirty white, ventral surface scales erect, shaggy tuft, dirty white, lateral surface smooth, scales, gray brown and white; second segment dorsal scales, dark reddish-brown, scattered white scales, smooth, mesial scales dirty white with brown and brown with white tips, ventral surface very slight tuft, scales brown with white tips; third segment scales smooth, gray brown, scattered dirty white, apex dirty white, scales smooth, gray brown, scattered dirty-white scales, apex pointed, dirty white. Haustellum coiled between labial palpi. Antenna filiform, dorsal surface scales alternating dirty white and gray brown, ventral surface naked, sensory setae sparse, setal length = 4/5 segment width. *Thorax*: Scales spatulate, white tipped gray brown, partially erect, disc smooth; underside dirty white, scales rounded, appressed, scattered long hair-like scales. Legs: fore leg dorsal surface brown, scattered dirty-white scales, ventral surface dirty white, scattered gray-brown scales, segments tipped with dirty white, tarsomeres dorsal surface brown, ventral scales dirty white, each tarsomere tipped with dirty white, mid-leg similar, tarsomeres ventral surface dirty white; hind leg dirty white, scattered gray-brown and pale-fuscous scales. Forewing: length 9.0 mm, n = 1; dorsal surface ground color gray brown with dirty-white-tipped scales, hoary. Basal line on costal half, fine, scalloped, white, incomplete; antemedial line

fine, vaguely double, three elements, basal and outer elements brown, defined by white center element, scalloped; medial shade, gray brown, scales without white tips, barely darker; postmedial line not reaching costa, five elements, basal and outer elements vague, frosted, center element mostly white, lateral elements gray brown without white tips, veins brown towards costa; postmedial region contrastingly pale, pale-brown scales without white tips; subterminal line fine, waved, white; terminal line fine, white, straight, interrupted on veins; orbicular spot round, fine white outline, inconspicuous; reniform spot figure 8 shape, fine white outline, inner edge of dorsal loop extended basally to a point, dorsal loop, except basal extension, filled with light-brown scales; costa outer half marked with five white spots; fringe gray brown, white scales mark ends of veins, inconspicuous; underside pale fuscous, costal region scales mixed dirty white and gray brown, scales on veins dark, postmedial line pale gray, broadly excurved, terminal line finely dark brown; gray gradually darkening outwardly, white scales mark ends of veins. Hind wing scales fuscous-tipped pale gray, terminal line finely marked dark brown; fringe inner half dirty-white, outer half fuscous; underside base and posterior margin dirty white, gradually darkening to gray brown towards costa and outer margin; terminal line finely marked dark brown; fringe inner half dirty white, outer half fuscous. *Abdomen*: Dorsal surface pale fuscous, scales appressed, spatulate and hair-like scales mixed; basal tufts on segments one, two, and three, with gray-brown dirty-white-tipped scales, partially erect; ventral surface scales appressed, scales mixed dirty white, pale fuscous, and scattered gray brown. *Genitalia* (Fig. 30): Tegumen, each side straight, narrow, rounded at apex at junction, not modified; uncus straight, setose, slightly shorter than subscaphium, apex not narrowed, bluntly rounded; scaphium lightly sclerotized, fin-like; subscaphium sclerotized, tube-like, sub-apical scobinate patch; juxta narrow, rounded anteriorly, sub-lateral ridges strongly sclerotized, laterally indistinct, posteriorly drawn out to a long indistinct point; vinculum arms broad, broadly U-shaped, length moderate, stout; valve deeply divided, saccular region mesial surface densely hairy, gradually widened from base to one third, basal one third costa thickened, dorsal margin abruptly bent at one third, saccular area abruptly narrowed at one third, distal two thirds slightly directed ventrally, gradually widening and narrowing to bluntly rounded apex; cucullar region, one-fourth longer than saccular region, gradually widening to three-fourths length, apical one-fourth, ventral margin angled dorsally to broadly rounded apex, mesial surface of apical one-half densely hairy, ventral margin at three-fourths drawn out to a prominent finger-like projection. Aedeagus (Fig. 31) stout, straight. Vesica basally wide, broadly curved 180°, outer margin of loop lightly sclerotized with minute scobinations, narrowed apically, basal sclerite, very small, linear, prominent denticular teeth in double row, broad diverticulum before top of loop. **Adult female** (Fig. 19). Similar to male except wing dorsal surface more reddish; forewing: length 9.0–10.5 mm, mean 9.5 mm, n = 3. *Genitalia* (Fig. 43): Papilla analis lightly sclerotized, apex rounded, setae gradually denser towards apex; posterior apophysis extending anteriorly to just beyond posterior margin of eighth segment; eighth segment sclerotized ring, anterior margin extended into base of anterior apophyses; anterior apophysis length = 2× posterior apophysis; la-

mella postvaginalis sclerotized, excurved caudally, shallow concavity mesially, posterior margin with numerous short stiff hair-like tiny projections; surface densely covered with pointed spicules, density of spicules and length of points decreases anteriorly; ductus bursae sclerotized entire length, sclerotization weaker at midpoint, anterior half gradually widening, abruptly narrowing to short membranous section at junction with corpus bursae; corpus bursae posterior end with wide weakly sclerotized rugosities, bulbous, lengthened anteriorly; signum concave, approximately round, covered with pointed spicules, surrounded by bluntly-rounded cobble-like spicules, prominence of rounded spicules decreases as distance from signum increases; appendix bursae at posterior end of corpus bursae, directed laterally, more or less distinct, funnel-shaped, not coiled, narrowed to distinct ductus seminalis.

Remarks. This new species is placed in the genus *Ogdoconta* on the basis of the shape of the male and female genitalia, and the appearance of the adult moth. The medial shade, visible under magnification, is detected by the absence of dirty-white-tipped scales. The female specimen in the CNC from Florida (Wolley-Dod) has a darker postmedial area than the other specimens in the type series; however the genitalia of this specimen leave no doubt that it is *O. fergusoni*.

The hair-like projections on the posterior margin of the lamella postvaginalis and the pointed ends of the spicules are very small. They can be seen with a compound microscope at 60 × or greater magnification. The number of hair-like projections and the number of pointed ends which are visible increases as magnification increases.

This species was misidentified as *O. tacna* (Kimball 1965, Heppner 2003). Metzler & Lafontaine are the sole authors of this species.

Distribution and biology. This species is recorded from Florida, southern Mississippi, and southern Louisiana (Fig. 44). The larva and its food plants are unknown. *Ogdoconta fergusoni* is infrequently collected.

***rufipenna* species group**

***Ogdoconta rufipenna* Metzler, Knudson & Poole, sp. n.**
urn:lsid:zoobank.org:act:C0C5F702-F47C-4078-B995-A2B116A3F4D3
http://species-id.net/wiki/Ogdoconta_rufipenna
Figs 16, 17, 34, 35, 42, 44

Ogdoconta sp. not *O. lilacina* (Druce, 1890), (Lafontaine and Schmidt 2010): 66.

Type material. Holotype: Adult male, pinned: Madera Canyon 5800', Santa Rita Mts., Santa Cruz Co., Ariz., 6 July 1960, J. G. Franclemont. (CUIC). **Paratypes**: 121 males and 50 females: AZ Santa Cruz Co., Sycamore Canyon, 4000', 6 August, 1991, UV light., C. D. Ferris leg. Madera Canyon 4880', Santa Rita Mts., Santa Cruz Co., Ariz., 26 June 1960–24 July 1960, J. G. Franclemont. Madera Canyon 5800', Santa Rita Mts., Santa Cruz Co., Ariz., 27 June 1960–21 July 1960, J. G. Franclemont.

Ariz., Santa Cruz Co., Madera Canyon, Santa Rita Mts., 5100', July 10–26, 1964, D.R. Davis. Ariz., Washington Mts., B.P. Clark Donor. USA:AZ: Cochise Co. Huachuca Mts. 5354 Ash Cyn. Rd., 0.5miW Hwy 92 2.IX.1991 5100' N.McFarland UV light. USA:AZ: Cochise Co. Huachuca Mts. 5354 Ash Cyn. Rd., 0.5miW Hwy 92 20.VII.1988 5100' N.McFarland UV light. Sierra Vista, ARIZ 9-IV-1967 R. F. Sternitzky. Sierra Vista, ARIZ 13.IX.1967 R. F. Sternitzky. Miller Canyon Huachuca Mts., Arizona 23.V.66 R. F. Sternitzky. Miller Canyon Huachuca Mts., Arizona 30.VII.67 R. F. Sternitzky. July 6, 1958, Sunnyside, W. side, Huachuca Mt's., Cochise Co., Arizona Lloyd M. Martin, 15 watt black light. July 7, 1958, Sunnyside, W. side, Huachuca Mt's., Cochise Co., Arizona Lloyd M. Martin, 15 watt black light. July 8, 1958, Sunnyside, W. side, Huachuca Mt's., Cochise Co., Arizona Lloyd M. Martin, 15 watt black light. July 9, 1958, Sunnyside, W. side, Huachuca Mt's., Cochise Co., Arizona Lloyd M. Martin, 15 watt black light. July 11, 1958, Sunnyside, W. side, Huachuca Mt's., Cochise Co., Arizona Lloyd M. Martin, 15 watt black light. July 13, 1958, Sunnyside, W. side, Huachuca Mt's., Cochise Co., Arizona Lloyd M. Martin, 15 watt black light. July 14, 1958, Sunnyside, W. side, Huachuca Mt's., Cochise Co., Arizona Lloyd M. Martin, 15 watt black light. July 16, 1958, Sunnyside, W. side, Huachuca Mt's., Cochise Co., Arizona Lloyd M. Martin, 15 watt black light. July 17, 1958, Sunnyside, W. side, Huachuca Mt's., Cochise Co., Arizona Lloyd M. Martin, 15 watt black light. July 18, 1958, Sunnyside, W. side, Huachuca Mt's., Cochise Co., Arizona Lloyd M. Martin, 15 watt black light. Ramsey Canyon Huachuca Mts., 28.VIII.66 R. F. Sternitzky. Ramsey Canyon Huachuca Mts., 15.IX.67 R. F. Sternitzky. Sept. 6, 1959, Ramsey Canyon, Huachuca Mt's., Cochise Co., Ariz., 15 watt black light, Lloyd M. Martin. July 7–17, 1958, Sunnyside, W. side, Huachuca Mt's., Cochise Co., Arizona Tom W. Davies, 15 watt black light. AZ, Cochise Co, 6050 ft., Huachuca Mts., Copper Canyon, UV/MV lights, Oak woodland habitat, 24 July 2010, B. Walsh leg. Madera Canyon 4880', Santa Rita Mts., Santa Cruz Co., Ariz., 19 June 1960, 25 June 1960, 26 June 1960, 27 June 1960, 1 July 1960, 3 July 1960, 4 July 1960, 5 July 1960, 6 July 1960, 10 July 1960, 20 July 1960, 22 July 1960, 23 July 1960, 24 July 1960, 27 July 1960, 1 August 1960, J. G. Franclemont. Madera Canyon 4880', Santa Rita Mts., Santa Cruz Co., Ariz., 26 June 1959, 1 July 1959, 4 July 1959, 5 July 1959, 7 July 1959, 9 July 1959, 11 July 1959, 12 July 1959, 13 July 1959, 14 July 1959, 16 July 1959, 18 July 1959, 19 July 1959, 20 July 1959, 22 July 1959, 23 July 1959, 24 July 1959, 27 July 1959, 13 August 1959, 15 August 1959, 24 August 1959, 25 August 1959, J. G. Franclemont. Madera Canyon 5800', Santa Rita Mts., Santa Cruz Co., Ariz., 21 June 1960, 26 June 1960, 27 June 1960, 28 June 1960, 1 July 1960, 5 July 1960, 7 July 1960, 8 July 1960, 13 July 1960, 21 July 1960, 22 July 1960, 26 July 1960, 29 July 1960, J. G. Franclemont. ARIZ., Cochise Co., Huachuca Mts. 6550', Carr Canyon Rd. 4.8 mi from jct Ariz. 92, 15 August 1966, at U. V. light, Robert G. Beard. (USNM, CDF, CNC, CUIC, EHM, LACM, JBW).

Etymology. The scientific name *rufipenna* comes from the Latin rufus = reddish and the Latin penna = wing. The name *rufipenna*, red wing, refers to the burgundy (= reddish-brown) color of the adult forewings. It is used as a singular adjective.

Diagnosis. *Ogdoconta rufipenna* is a large North American species of *Ogdoconta*. *Ogdoconta rufipenna* is easily identified by a uniform burgundy-colored forewing with faint fine white lines. Forewing has few distinct markings, although all marks and lines (except the claviform spot) are present as fine white lines. No other North American species of *Ogdoconta* shares these color characteristics. Valve is distinguished by a large thumb-like projection from the lower angle of the apex of the cucullar region of the valve. Cucullar part of the valve is narrower than the other North American species of *Ogdoconta*, and the cucullar part is neither triangular nor ovate. Aedeagus is thin, long, and slightly sinuous, like *O. tacna*. Vesica has a tight basal loop, similar to *O. tacna*, but the vesica of *O. rufipenna* has no spines, whereas the vesica of *O. tacna* has two rows of spines between the first and second loops. Vesica of *O. rufipenna* has a prominent curved diverticulum; the vesica of *O. tacna* does not have a diverticulum. The distal end of the vesica of *O. rufipenna* forms a wide loop. Lamella postvaginalis and the caudal half of the ductus bursae of *O. rufipenna* are strongly sclerotized; there are no sclerotized rugosities in the appendix bursae. In *O. tacna* the lamella postvaginalis is sclerotized, and there are strongly sclerotized rugosities in the appendix bursae. In the other North American species of *Ogdoconta*, the lamella postvaginalis is not strongly sclerotized.

Description. Adult male (Fig. 16). *Head*: scales burgundy, spatulate white tipped, vertex scales erect, front scales smooth. Labial palpus dark reddish-brown, scattered white scales, erect, basal segment with ventral tuft, second segment smooth scaled, ventral mesial margin white, apical segment smooth scaled, white tipped. Haustellum coiled between labial palpi. Antenna filiform, sensory setae inconspicuous, dorsally each segment alternating pale and dark, smooth scaled, ventrally brown. *Thorax*: burgundy, spatulate white-tipped scales; underside dirty white, scales appressed, scattered long hair-like scales. Legs dorsally dark reddish-brown, scattered white scales, ventrally admixture of dirty-white and dark reddish-brown, smoothly scaled, sparse long hair-like whitish scales; tarsomeres white tipped. Forewing: length 10.5–16.0 mm, mean 14.5 mm, n = 117; dorsal surface ground color uniformly burgundy, scattered white scales, hoary. Basal line fine, inconspicuous at costa, dorsally absent, white; antemedial line fine, white from costa to below cell, dorsally absent, sometimes fused to orbicular spot; medial shade absent; postmedial line fine, white from costa to below cell; subterminal line scalloped, obscure, marked with white and dark scales; terminal line fine, white, scalloped; orbicular spot round, finely outlined with white, filled with burgundy; reniform spot kidney shaped, elongated dorsally towards orbicular spot, finely outlined with white, filled with a vague vertical white line and burgundy; costa with five small white spots from antemedial line to postmedial line; fringe dark reddish brown, white tipped; underside dark reddish brown, costa and terminal areas hoary with white scales, subterminal line white, marking edge of terminal area; terminal line dark; fringe basal line pale, two-toned dark reddish brown, white tipped. Hind wing dark reddish brown, hoary, veins lined with dark, terminal line dark, fringe two-toned, basally umber, distally paler, white tipped; underside umber, hoary, subterminal line dark, terminal line dark, fringe basal line pale,

umber, white tipped. *Abdomen*: Dorsum with two basal tufts burgundy, scales white tipped, elsewhere dark reddish brown, hoary, smoothly scaled, valves (if protruding) dark yellow; underside dark reddish brown, hoary, scales appressed. *Genitalia* (Fig. 34): Tegumen, each side rounded at apex, not modified; uncus straight, setose, scarcely shorter than subscaphium, apex slightly down turned, pointed; scaphium basally sclerotized, laterally membranous, subscaphium sclerotization increasing distally, tube-like; juxta rounded anteriorly, laterally indistinct, posteriorly drawn out to a long slightly thickened point, with or without a thin keel; vinculum V-shaped, length moderate, stout; valve deeply divided, saccular region gradually widened from base to one half, dorsal margin abruptly bent at one half, saccular area abruptly narrowed at one half, gradually widening and narrowing to bluntly rounded apex, minute denticules on dorsal half at bend, dense, narrowed apical region densely hairy mesially; cucullar region one fifth longer than saccular region, subtly curved, costal and ventral margins parallel almost to apex, apex swollen, capitate, rounded, densely hairy mesially, large thumb-like projection from the lower angle of apex. Aedeagus (Fig. 35) long, narrow, slightly sinuous, last one fourth densely covered with minute denticules; vesica, gradually narrowing, first loop tight, second loop elongate, median diverticulum elongate, curved, with minute denticules, dense, inside first curve of loop, minute denticules, dense, outside curve of second loop. **Adult female** (Fig. 17). -Similar to male. Forewing: length 10.5–15.5 mm, mean 14.5 mm, n = 47; *Genitalia* (Fig. 42): Papilla analis lightly sclerotized, apex rounded, setae gradually denser towards apex; posterior apophysis extending anteriorly to just beyond posterior margin of eighth segment; anterior apophysis slightly stouter than posterior apophysis but equal in length; lamella postvaginalis rounded, posterior margin slightly concave, strongly sclerotized, covered with minute denticules; ostium bursae strongly sclerotized, inside of opening with numerous minute denticules, narrowing anteriorly; ductus bursae with caudal half sclerotized on ventral side, cephalad half membranous, narrowed anteriorly, inconspicuous S-shaped bend, lightly sclerotized to left; appendix bursae attached where ductus bursae meets corpus bursae, bulbous, not coiled, membranous, surface wrinkled, infrequent indistinct patches of minute denticules; ductus seminalis distinct, directed anteriorly; corpus bursae bulbous, elongate, membranous, surface wrinkled, and patches of minute denticules, scattered, obscure; signa, if present, obscure.

Remarks. This new species is placed in the genus *Ogdoconta* on the basis of the shape of the male and female genitalia. The large thumb-like projection on the valve of the male can be seen by brushing a few scales from the protruding genitalia of male specimens. This species was misidentified as *O. lilacina* on a web site detailing the moths of southeastern Arizona (Walsh 2011). Metzler, Knudson & Poole are the sole authors of this species.

Distribution and biology. This species is recorded from Santa Cruz and Cochise Counties in southeastern Arizona (Fig. 44). Its distribution in Mexico is not known. The larva and its food plants are unknown. *Ogdoconta rufipenna* is moderately common in specific locations in Santa Cruz and Cochise counties, Arizona.

Discussion

In preparation of this document, we examined the types of all species of *Ogdoconta,* which were described from the New World.

The coordinates for latitude and longitude are reported exactly as they are on the specimens. These data are easily converted to any other format by using one of many conversion sites on the World Wide Web, such as CSGNetwork.com (2012).

The specimens from Carlsbad Caverns National Park were collected during a ten-year study of the moths in the Park. This is the fifth in a series of papers (Metzler et al. 2010, Metzler and Knudson 2011, Metzler et al. in press, Metzler and Forbes 2012) detailing the moths of Carlsbad Caverns National Park, and *O. satana* is the fourth species described as a result of the study. Carlsbad Caverns National Park was selected as the type locality of *O. satana* because the site will be protected by the National Park Service into perpetuity.

Acknowledgments

The National Parks Foundation, Washington, DC, the Adopt-A-Bat program, administered by the Carlsbad Caverns-Guadalupe Mountain Association, Carlsbad, NM, and the Chihuahuan Desert Conservation Alliance, Carlsbad, NM all contributed travel funding for the study of Lepidoptera at Carlsbad Caverns National Park. We are grateful for their financial support. Renée West, Supervisory Biologist, Carlsbad Caverns National Park was especially helpful with logistics. Jocelyn Gill provided her special skills in preparation of the figures. Several persons were available for consultation, or made specimens or photographs or data available for study from their institutions or personal collections; Vernon A. Brou, Jr., Richard L. Brown, Charles V. Covell, Jr., Jason J. Dombroskie, Julian P. Donahue, John B. Heppner, E. Richard Hoebeke, Leroy C. Koehn, Jon A. Lewis, James K. Liebherr, Philip D. Perkins, Michele A. Touchet, J. Bruce Walsh, Andrew D. Warren, and Weiping Xie. Martin Honey from the Natural History Museum, London, examined the type of *O. cymographa* Hampson, 1910, and he placed the Lectotype label on the syntype specimen of *Placodes cinereola* Guenée, 1852. Patricia A. Metzler faithfully accompanied Metzler on his many collecting trips to Carlsbad Caverns National Park, and she accompanied him on several long driving trips to Washington, DC and other locations for the purpose of identifying specimens. She contributed financially to the study.

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RESEARCH ARTICLE

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A revision of the genus *Ufeus* Grote with the description of a new species from Arizona (Lepidoptera, Noctuidae, Noctuinae, Xylenini, Ufeina)

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Abstract

The genus *Ufeus* Grote is revised to include five species including *U. felsensteini*, **sp. n.** in southern Arizona. A key to species, descriptions, illustrations of adults and genitalia are included.

Keywords

Taxonomy, Xylenini, Ufeina, *Ufeus*, Arizona

Introduction

The genus *Ufeus* Grote is an isolated genus that was included in the subfamily Noctuinae (s.s.) for almost a century (e.g., Hampson 1903) because of the presence of spiniform setae on the middle and hind tibiae. Crumb (1956) proposed a separate subfamily for the genus based on two peculiarities of the larvae, two L-setae on abdominal segment 9, and prolegs with more than 50 crochets. The Ufeinae were downgraded to

a tribe of the Noctuinae by Franclemont and Todd (1983), raised again to subfamily level by Kitching and Rawlins (1998), and more recently, included within the Xylenini by Mitchell et al. (2006). Following the results of Mitchell (op. cit.) the group was treated as Ufeina, a subtribe of the Xylenini, by Lafontaine and Schmidt (2010) within an expanded concept of Noctuinae. In addition to the molecular results, additional characters that support placement in the Xylenini are: the presence of spiniform setae on the middle and hind tibiae in some genera (e.g., *Rhizagrotis* Smith, *Sutyna* Todd, *Fishia* (Grote), genera also included in the Noctuinae by Hampson 1903); larvae feeding mainly on woody plants; adults overwintering; adults with lashes in front of eye at base of antenna. Recently, Wagner et al. (2011) treated *Ufeus* as a tribe separate from the Xylenini based on the peculiarities of the larvae found by Crumb (op. cit.). However, with *Ufeus* nested within the Xylenini, such a move also would require the other subtribes of the Xylenini to be raised to tribal status, and this would impact on the status of the other tribes of the subfamily Noctuinae. As a result, we retain the *Ufeina* as a subtribe of the Xylenini in order to preserve the phylogenetic associations of the genus.

Materials and methods

Repository abbreviations

Specimens were examined from the following collections:

AMNH	American Museum of Natural History, New York, New York, USA.
BMNH	The Natural History Museum (statutorily, British Museum (Natural History), London, UK.
CNC	Canadian National Collection of Insects, Arachnids, and Nematodes, Ottawa, Ontario, Canada.
CUIC	Cornell University Insect Collection, Ithaca, New York, USA.
FMNH	The Field Museum, Chicago, Illinois, USA.
JBW	Personal collection of J. Bruce Walsh, Tucson, Arizona, USA.
NYSM	New York State Museum, Albany, New York, USA.
USNM	National Museum of Natural History (formerly, United States National Museum), Washington, District of Columbia, USA.

Dissecting methods and genital terminology. Dissection of genitalia and terms for genital structures and wing markings follow Lafontaine (2004).

Ufeus Grote, 1873

http://species-id.net/wiki/Ufeus

Type species. *Ufeus satyricus* Grote, 1873, by original designation.

Diagnosis. Adults. Males typically smaller and paler than females (forewing length 15–20 mm, males, 17–23 mm, females). Vestiture of palpi, head, and thorax of long hair-like scales, without evident tufting. *Head* – Male antenna constricted between segments with long setae tending to form a tuft on each side of each segment (*U. satyricus*) or filiform or very slightly constricted with setae minute in *U. faunus* Strecker, *U. felsensteini*, sp. n., *U. hulstii* Smith, and *U. plicatus* Grote. Female antenna filiform, minutely setose ventrally. Eye slightly reduced, smooth, without surface hair. Labial palpus porrect, apical segment usually about ½ as long as second segment. *Thorax* – *Wings*: Forewing ground color typically gray brown to reddish brown; pattern reduced to small elongated remnants of reniform and orbicular spots, faint dentate postmedial line, and darker shading and wedge-shaped spots in terminal area; an elongated black streak through position of reniform and orbicular spots in most species, especially in females. Hindwing translucent white to dark fuscous, a darker discal spot in most species; a dark postmedial line in *U. satyricus*. *Legs*: a few sclerotized spiniform setae on middle and hind tibiae proximal to apical spurs in most specimens; spurs relatively short with longer spur in each pair about as long as width of tibia. Basitarsus with three ventral rows of spiniform setae, increased to a fourth row near apex; central row of setae tending to duplicate into two or three irregular rows on tarsal segments 2–5. *Abdomen* – Base of abdomen without basal abdominal brushes; abdomen clothed with long hair-like setae overlaying flat broad setae underneath; abdomen dorso-ventrally flattened, especially in females. **Male genitalia** – Uncus typically expanded preapically with apex flattened, tapered, heavily sclerotized, and forked (apex rounded in *U. satyricus*). Tegumen variable, from about as wide as vinculum in *U. satyricus* but much broader than vinculum in *U. felsensteini*. Valve with sacculus usually slightly more than ½ length of valve; valve slightly constricted beyond sacculus, broadly rounded at apex; without corona or digitus; clasper in *U. satyricus* arising on ventral margin of valve at apex of sacculus, gradually widening in oblique angle across valve, then forming a flattened twisted arm above dorsal margin of valve curving posteriorly almost to valve apex; clasper in other four species in middle of valve beyond sacculus with base forked extended to ventral margin of valve and dorsal margin of sacculus; distal to base clasper slightly tapered, but expanded and spatulate apically. Aedeagus about 10 × as long as wide in *U. satyricus* and vesica a slender curving tube about ½ as long as aedeagus; in other species aedeagus 4–6 × as long as wide and vesica about as long as aedeagus and with 1–3 fields of spine-like cornuti on short diverticula. **Female genitalia** – Corpus bursae thin and membranous, rounded or oval, without obvious signa, except in *U. plicatus* and *U. hulstii*; posterior part of corpus bursae tapered directly into ductus bursae (*U. satyricus*), or covered with striated sclerotized bands (other species), giving rise to appendix bursae in three species. Ductus bursae heavily sclerotized, even in width throughout (*U. satyricus*), or expanded into broad posterior pouch (other four species). Anterior apohyses about as long as abdominal segment eight and ½ × as long as posterior apophyses (*U. satyricus*), or ovipositor telescopic with anterior apohyses about 3 × as long as abdominal segment eight and ½ × as long as posterior apophyses. Anal papillae rounded, lightly sclerotized, covered with long hair-like setae.

Larva and habits. The larva is characterized by the large number of crochets (> 50) on each proleg, and the presence of two L setae on abdominal segment 9 (Crumb 1956, Wagner et al. 2011). The larvae are said to hide by day under strips of bark in *U. plicatus* (i.e., Wagner et al. 2011) and *U. faunus* (i.e., Crumb 1956), and adults of *U. satyricus* are reported to do this also (i.e., Forbes 1954). It is likely that all species share this habit and also would explain the tendency for adults to be dorsoventrally flattened. The larvae, where known, feed on poplar and willow and may prefer large trees where there is abundant loose bark near the base of the tree. The large number of crochets in the larvae may be an adaptation to feeding on poplar leaves. The petiole on a poplar leaf is laterally flattened, making it hard to hold on to and causes it to shake – even in a light breeze.

Key to North American species of *Ufeus*

1 Forewing with black intervenal dashes in subterminal area; hindwing with darker postmedial line, especially obvious on underside; male genitalia with clasper above dorsal margin of valve, tapered toward apex; ovipositor short (posterior apophyses 2 × as long as abdominal segment eight) **... *U. satyricus***

– Forewing with subterminal area clear, or with diffuse dark shading; hindwing unicolorous, without darker postmedial line (except occasionally in *U. plicatus*); male genitalia with clasper on inner surface of valve, apically spatulate; ovipositor telescoping (posterior apophyses 4–7 × as long as abdominal segment eight) **..... 2**

2 Hindwing fuscous; uncus in male genitalia with large preapical bulge dorsally giving profile like a duck's head; corpus bursae with two signa**..... 3**

– Hindwing white and translucent, sometimes with a slight smoky or reddish sheen; uncus with at most a slight preapical bulge; corpus bursae without signa **..... 4**

3 Clasper in male genitalia about ½ × as wide as valve; patch of spike-like cornuti on ventral side of vesica much stouter than those on dorsal side; occurring from southern Quebec to Pennsylvania westward to eastern Nebraska**. ..... *U. plicatus***

– Clasper in male genitalia wider, ⅔– ¾ × as wide as valve; patch of spike-like cornuti on ventral side of vesica similar to those on dorsal side; occurring from foothills of Alberta and Colorado westward**..... *U. hulstii***

4 Forewing reddish brown with diffuse dark streak extending from wing base to postmedial line; vesica in male genitalia elongated with three patches of spike-like cornuti; posterior rugose part of corpus bursae as wide as anterior part and lobed **..... *U. felsensteini***

– Forewing buffy brown, sometimes with a narrow black line through reniform and orbicular spots; vesica in male genitalia rounded with two patches of spike-like cornuti; posterior rugose part of corpus bursae long and narrow, about ¼ × as wide as anterior part **..... *U. faunus***

Systematics

***Ufeus satyricus* Grote, 1873**
http://species-id.net/wiki/Ufeus_satyricus
Figs 1–6, 15, 20

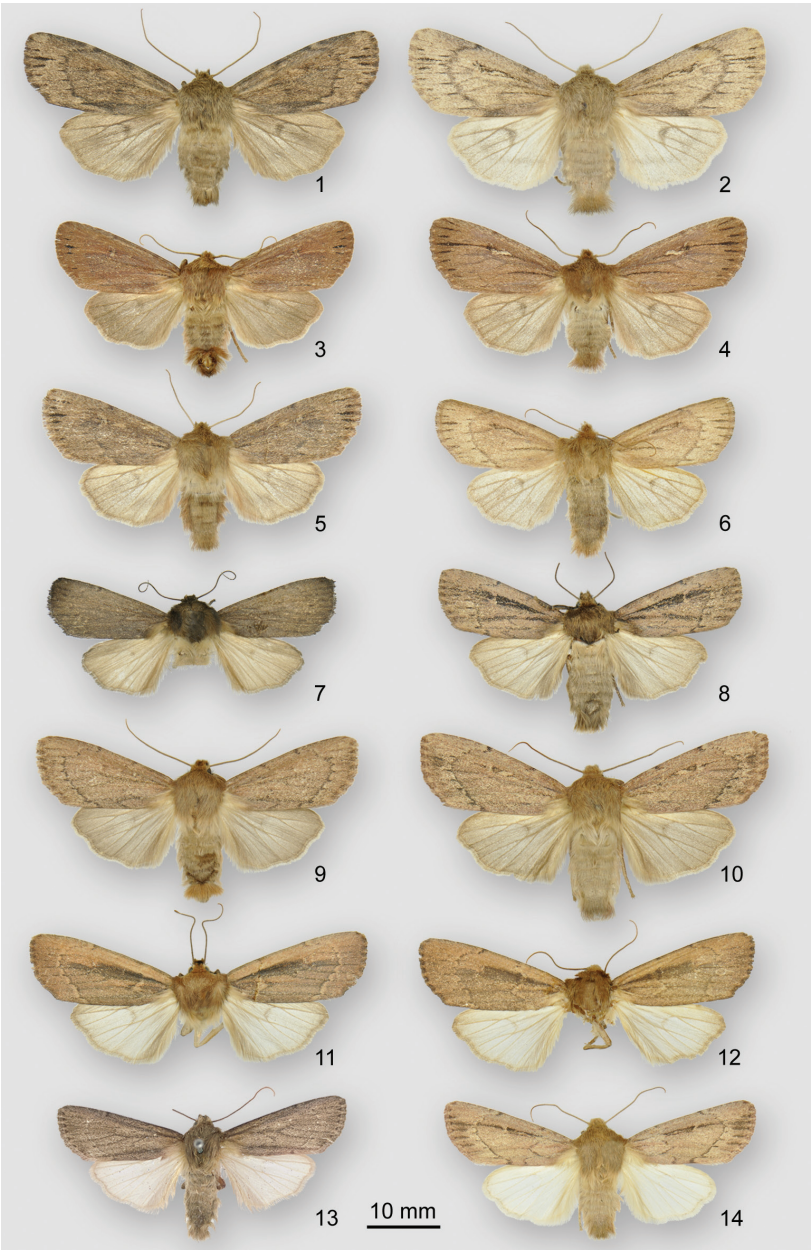
Ufeus satyricus Grote, 1873: 101.
Asterocampus barometricus Goossens, 1881: 380.
Ufeus sagittarius Grote, 1883: 31.
Ufeus electra Smith, 1908: 99.
Ufeus unicolor ab. coloradica Strand, [1916]: 146. Unavailable infrasubspecific name.
Ufeus unicolor ssp. coloradica McDunnough, 1938: 68. Validation of *coloradica*.

Type material. *Ufeus satyricus*: **syntypes** 2 ♀. [London], Ontario, Canada [lost]; Albany New York, NYSM. *Asterocampus barometricus*: Canada [type lost]; original description diagnostic for synonym of *Ufeus satyricus*. *Ufeus sagittarius*: **holotype** ♀. California, USNM. *Ufeus electra*: lectotype ♀, Oregon, AMNH, designated by Todd (1982). *Ufeus unicolor* ssp. *coloradica*: **syntype** ♂. Colorado, BMNH.

Other material examined and distribution. Canada: Alberta, British Columbia, Manitoba, New Brunswick, Nova Scotia, Ontario, Quebec, Saskatchewan. **USA:** Arizona, California, Colorado, Montana, New York, Oregon, Utah, Washington.

Diagnosis. *Ufeus satyricus* is abundantly distinct structurally from all other species in the genus. Superficially, adults in eastern North America can be distinguished from the largely sympatric *U. plicatus* by the pale-brown forewings, extensively dusted with black scales, and the prominent black shading on the veins, discal spot, and postmedial line on the hindwing. Males are smaller and darker than females (forewing length 15–22 mm in males, 19–24 mm in females). Adults from western North America differ from those from the East in having darker reddish-brown forewings with the postmedial line less prominent, and the hind wing in the male is dark fuscous, obscuring the postmedial line on the upper surface of the wing. Western specimens are easily confused with those of *U. hulstii*, which have similar reddish-brown forewings. The black streaks in the subterminal area and the less prominent postmedial line on the forewing, and the postmedial line on the hindwing, at least on the underside of the wing, allow specimens of *U. satyricus* to be distinguished from those of *U. hulstii* without dissection. Western populations of *U. satyricus* are segregated as *U. satyricus* ssp. *sagittarius*. Intermediate populations are in Wyoming and Colorado. The **male genitalia** of *U. satyricus* are characterized by the dorsal clasper and the long slender aedeagus and vesica. In the **female genitalia** the corpus bursae is rounded and extends directly into the long sclerotized ductus bursae. The anterior and posterior apophyses are relatively short (as described in the generic diagnosis), so the ovipositor is not telescoping.

Distribution and biology. *Ufeus satyricus* occurs across central and southern Canada from the Atlantic to the Pacific where large poplar trees occur and as far south in the east as Pennsylvania and Illinois. In the west it occurs as far south as southern Arizona and California. Adults emerge from the pupae in the summer and overwinter



Figures 1–14. *Ufeus* adults **1** *U. s. satyricus* ♂, New Brunswick, Fredericton **2** *U. s. satyricus* ♀, New Brunswick, Fredericton **3** *U. satyricus sagittarius* ♂, California, San Diego Co., Laguna Mts **4** *U. satyricus sagittarius* ♀, California, Plumas Co., Johnsville **5** *U. satyricus sagittarius* ♂, Arizona, Santa Cruz Co., Patagonia Mts **6** *U. satyricus sagittarius* ♀, Montana, Bozeman **7** *U. plicatus* ♂, Nebraska, Omaha **8** *U. plicatus* ♀, Quebec, Laval **9** *U. hulstii* ♂, British Columbia, Watch Peak, 50°29'N, 116°18'W **10** *U. hulstii* ♀, British Columbia, Gott Peak, 50°21'N, 122°08'W **11** *U. felsensteini* holotype ♂, Arizona, Pima Co., Santa Catalina Mts **12** *U. felsensteini* paratype ♀, Arizona, Pima Co., Santa Catalina Mts **13** *U. faunus* holotype ♂, New Mexico **14** *U. faunus* ♀, California, Mojave Desert near Llano.

as adults, but they are mostly collected between late August and early May, even during mild spells in mid-winter. Most records are in October and November in the fall and March and April in the spring. Crumb 1956 reports finding and rearing larvae on cottonwood in western United States. The species is arranged in two subspecies.

***Ufeus satyricus satyricus* Grote, 1873**
http://species-id.net/wiki/Ufeus_satyricus_satyricus
Figs 1, 2, 15

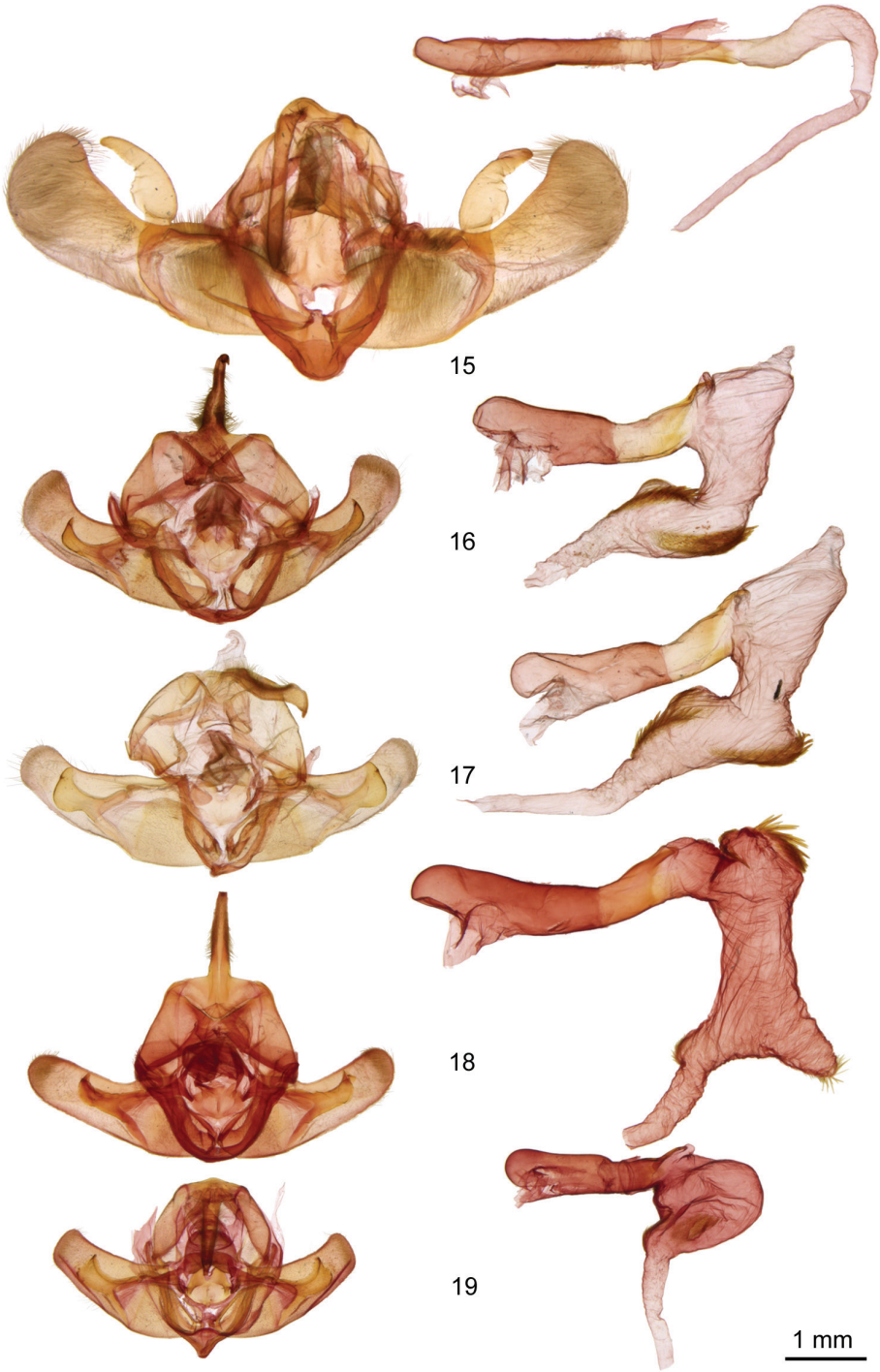
Ufeus satyricus Grote, 1873: 101.
Asterocampus barometricus Goossens, 1881: 380.

Remarks. In *Ufeus satyricus satyricus* the forewing in both sexes is pale brown, heavily speckled with black, and the postmedial line is prominent and dentate. The hindwing in the male is a mottled fuscous with darker fuscous shading on the veins, discal spot, and a diffuse postmedial line. The hindwing in the female is similar to that of the male except the ground color of the wing is pale buffy brown. The nominate subspecies occurs from eastern North America westward to the foothills of the Rocky Mountains.

***Ufeus satyricus sagittarius* Grote, 1883**
http://species-id.net/wiki/Ufeus_satyricus_sagittarius
Figs 3–6, 20

Ufeus sagittarius Grote, 1883: 31.
Ufeus electra Smith, 1908: 99.
Ufeus unicolor ab. coloradica Strand, [1916]: 146. Unavailable infrasubspecific name.
Ufeus unicolor ssp. coloradica McDunnough, 1938: 68. Validation of *coloradica*.

Remarks. In *Ufeus satyricus sagittarius* sexual dimorphism is much more obvious than in the eastern subspecies. In the male the forewing is a shiny dark reddish brown with the maculation obscure except for a trace of pale streaks representing the reniform and orbicular spots and a hint of a darker postmedial line. The hindwing is dark fuscous, usually obscuring the postmedial line and discal spot. In the female the forewing is a paler reddish brown with a black streak between, above, or through the pale streaks representing the reniform and orbicular spots, the postmedial line is prominent, and usually there are numerous black streaks in the subterminal area. The hindwing is pale fuscous with the discal spot and postmedial line contrastingly darker. Unlike subspecies satyricus, the two sexes of *sagittarius* differ markedly in size with forewing length averaging 17. 6 mm (*n*=20) in males and 19.7 mm (*n*=20) in females. The two sexes of this subspecies frequently are sorted as two separate species in collections. Subspecies *sagittarius* occurs from the eastern edge of the Rocky Mountains in Alberta, Montana, and Colorado westward to the Pacific Coast.



Figures 15–19. *Ufeus* male genitalia. **15** *U. satyricus* **16** *U. plicatus* **17** *U. hulstii* **18** *U. felsensteini* **19** *U. faunus*.

***Ufeus plicatus* Grote, 1878**
http://species-id.net/wiki/Ufeus_plicatus
Figs 7, 8, 16, 21

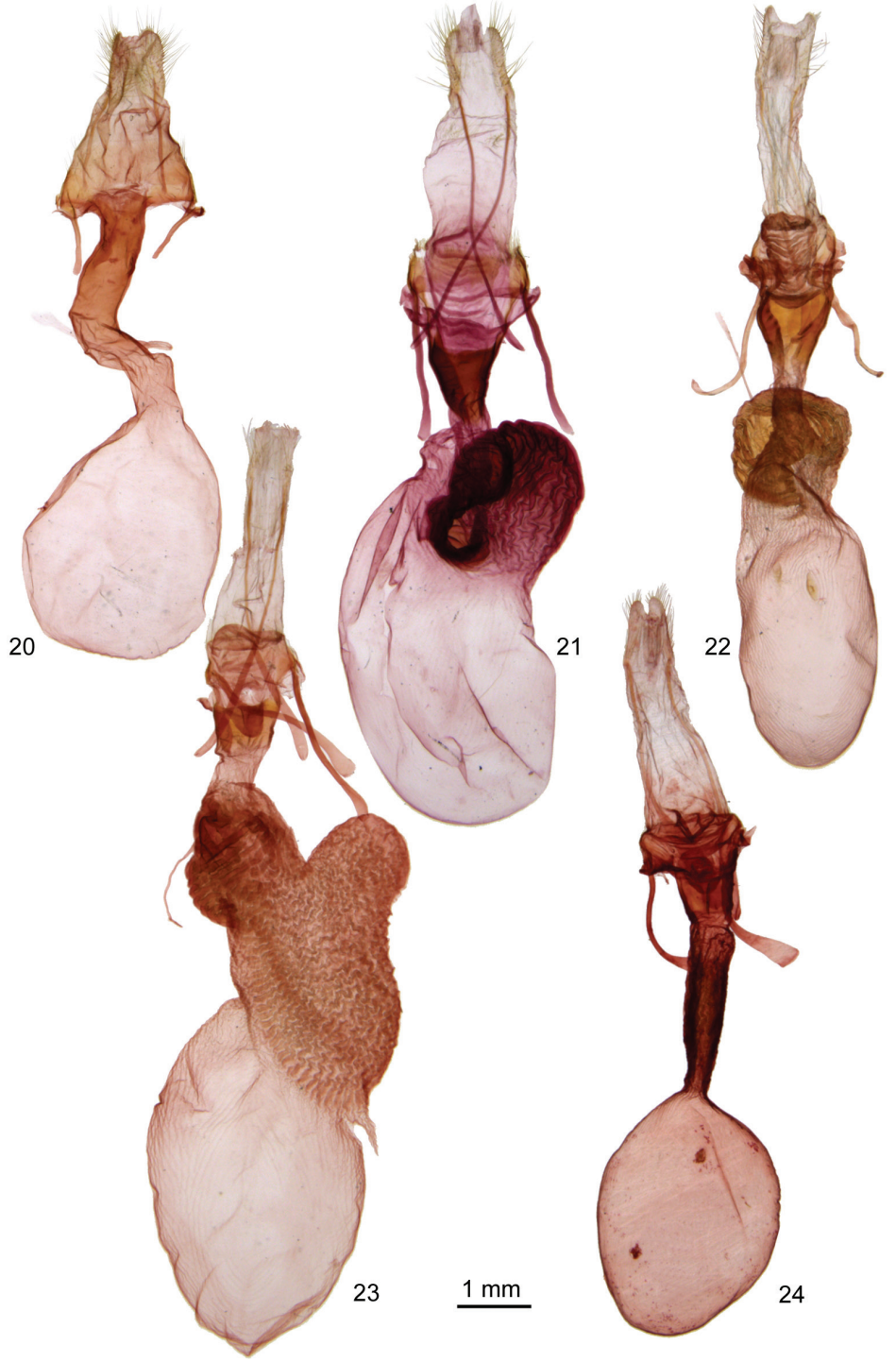
Ufeus plicatus Grote, 1873: 102.
Ufeus unicolor Grote, 1878: 179.

Type material. *Ufeus plicatus*: **holotype** ♂. Illinois [type lost but description diagnostic]. *Ufeus unicolor*: **holotype** ♂. Illinois, BMNH.

Other material examined and distribution. Canada: Ontario, Quebec. **USA**: Illinois, Iowa, Nebraska.

Diagnosis. *Ufeus plicatus* occurs sympatrically with *U. satyricus* in northeastern North America but can be distinguished from it by the darker, more even, somewhat glossy, dark reddish-brown or blackish-brown color of the forewing in males and the reddish-brown color of the forewing with a long blackish streak extending from the wing base through the orbicular and reniform spots into the subterminal area in females. In both sexes the hindwing is evenly colored light fuscous with at most a slight trace of a discal spot and postmedial line. Males average only slightly smaller than females (forewing length 16–19 mm in males, 17–20 mm in females). *Ufeus plicatus* is most closely related to *U. hulstii*, which occurs from the Rocky Mountains westward. In addition to range, adults can superficially be distinguished from those of *U. hulstii* by the darker color of the forewing in males, and the more extensive dark streak through the forewing cell in females. In the **male genitalia** of *U. plicatus* the clasper is positioned on the inner surface of the valve with the expanded apical part about ½ × as wide as the valve (⅔– ¾ × as wide in *U. hulstii*); the vesica has two elongated patches of spike-like setae; the setae in ventral patch (near the aedeagus) are much stouter than those in the dorsal patch (in *U. hulstii* the setae are similar in size in both patches). In the **female genitalia** the corpus bursae is ⅓–½ × as wide as its length, and has a large, rugose sclerotized appendix bursae posteriorly. The sclerotized part of the ductus bursae is wedge shaped, wide posteriorly and evenly tapered anteriorly. The ovipositor is telescoping with the anterior apophyses about 4 × as long as abdominal segment eight and the posterior apophyses about 7 × as long. The corpus bursae is narrower, about 1/3 × as wide as its length, and has a smaller rugose sclerotized appendix bursae posteriorly. The sclerotized part of the ductus bursae is narrow posteriorly, widens anteriorly to ¼ × wider, before tapering anteriorly. The ovipositor is telescoping, as *U. plicatus*.

Distribution and biology. *Ufeus plicatus* is an extremely rarely-collected species. Until recently the few specimens known were only from the mid-west, mostly from Illinois with a few records from Iowa, Minnesota, Missouri, and Nebraska. This led Forbes (1954) to suggest that the type locality of Philadelphia, Pennsylvania, was almost certainly in error for Illinois. Recent collections of the species from southern Quebec (Handfield 2011) and Connecticut (Wagner et al. 2011) suggest that not only is Philadelphia a possibility, but that the species might be widespread in the Northeast as is its highly localized and specialized habitat. The species is associated with large



Figures 20–24. *Ufeus* female genitalia. **20** *U. satyricus* **21** *U. plicatus* **22** *U. hulstii* **23** *U. felsensteini* **24** *U. faunus*.

poplars, especially eastern cottonwood (*Populus deltoides* Bartram ex Marsh.) growing in moist areas along rivers where there is abundant loose rotting strips of bark near the base of the tree. Larvae hide under the strips of bark during the day and the adults likely hide there also during the day and in the winter. According to Wagner et al. (2011) the eggs are laid in the spring with adults emerging in late spring and early summer, but mainly aestivating until the fall before becoming active. Adults have been recorded in all months except June, but most records are from October and November in the fall and March and April in the spring. The scarcity of adults, even in suitable habitats where they are known to occur, suggests they may not be strongly attracted to light.

***Ufeus hulstii* Smith, 1908**
http://species-id.net/wiki/Ufeus_hulstii
Figs 9, 10, 17, 22

Ufeus hulstii Smith, 1908: 99.
Ufeus lura Dyar, 1914: 370, **syn. n.**

Type material. *Ufeus hulstii*: **lectotype** ♂. Stockton, Utah, AMNH, designated by Todd (1982). *Ufeus lura*: **holotype** ♂. Mexico City, Mexico, USNM.

Other material examined and distribution. Canada: Alberta, British Columbia. **Mexico:** Distrito Federal, Durango. **USA**: Alaska, Arizona, California, Colorado, Idaho, Montana, New Mexico, Nevada, Oregon, Utah, Washington.

Remarks. *Ufeus hulstii* is the western counterpart of *Ufeus plicatus* and was treated as a subspecies of it for many years. Differences in external appearance, male and female genitalia, barcodes, and biology led to its recognition as a separate species by Lafontaine and Schmidt (2010), but they used the name *U. electra* for it, a name that had been treated as a synonym of *U. plicatus* by Franclemont and Todd (1983) and Poole (1989). Re-examination of the type material resulted in the name *U. electra* being transferred to the synonymy of *U. satyricus* and *U. hulstii* being used for this species (Lafontaine and Schmidt 2011).

Diagnosis. In *Ufeus hulstii* both sexes have an orange-brown forewing and fuscous hindwing with males averaging slightly darker than females. Most females of *U. hulstii* have a dark streak through the orbicular and reniform spots, but the streak does not normally extend to the postmedial line or into the basal area of the wing. Although occasionally specimens of *U. hulstii* are as small as those of *U. plicatus* (16 mm), they are, on average, much larger with forewing lengths up to 22 mm in males and 23 mm in females. The **male genitalia** of *U. hulstii* differ from those of *U. plicatus* by the characters given in the key and in the diagnosis for *U. plicatus*. The **female genitalia** of *U. hulstii* are similar to those of *U. plicatus.*

Distribution and biology. *Ufeus hulstii* is widely distributed in western North America from central Alaska southward to south-central Mexico and from the Rocky Mountain foothills to the West Coast. The larvae are reported to feed on poplar, aspen,

and willow with adults emerging in early summer (Crumb 1956). Like other species, the adults overwinter, but they also are more frequently collected during the summer months than other species.

***Ufeus felsensteini* Lafontaine & Walsh, sp. n.**
urn:lsid:zoobank.org:act:1BA7C2AE-95F3-4ECE-8579-FBCC525D6A32
http://species-id.net/wiki/Ufeus_felsensteini
Figs 11, 12, 18, 23

Type material. Holotype ♂. Arizona, Pima Co., Santa Catalina Mts, Bear Wallow Road, 8000', uv light trap, 18 May 2003, B. Walsh. CNC. **Paratypes:** 1 ♂, 3 ♀. Arizona, Pima Co., Santa Catalina Mts, Bear Wallow Road, 7800', uv lights, pine forest, 21 May 2005, B. Walsh (1 ♂); USA, Arizona, Pima Co., Santa Catalina Mts, mile 5.5 Mt. Lemmon Hwy, 4400', uv light trap, riparian/blue oak woodland, 16 Jan. 2005, B. Walsh (1 ♀); USA, Arizona, Pima Co., Santa Catalina Mts, Molino Canyon, 4,100', mile 4.5 Mt Lemmon Hwy, uv light trap, riparian habitat, 1 Jan. 2012, B. Walsh (1 ♀); USA, Arizona, O. Bryant (1 ♀). Paratypes deposited in CNC, JBW.

Etymology. The species name is in honor of Professor Joseph Felsenstein, who pioneered modern statistical methods in the reconstruction of phylogenies.

Diagnosis. *Ufeus felsensteini* can be recognized by the reddish-brown forewing with the maculation obscure except for a prominent black dash from the wing base to the reniform spot, then continuing below the reniform spot to, or slightly past, the postmedial line, and by the translucent hindwing with a pearly-pinkish sheen. It is most closely related to *U. hulstii*, both species having similar male and female genitalia, but in *U. felsensteini* there is a cluster of long spike-like setae on the subbasal diverticulum of the vesica, not just on the two subapical diverticula as in *U. hulstii*, and the uncus lacks the preapical dorsal lobe found in *U. hulstii*. The female genitalia of *U. felsensteini* have much more extensive rugose sclerotized banding than in other species, extending over the posterior part of the corpus bursae, appendix bursae, and anterior part of the ductus bursae.

Description. Adults. Male and female similar in size, color, and maculation. Forewing length: 19–21 mm. **Head –** Male and female antennae with individual segments very slightly constricted between segments; minutely setose ventrally. Palpi and head mainly covered with reddish-brown scales, but with blackish-brown scales on frons and scattered blackish-brown scales on palpi. **Thorax –** Covered with reddish-brown scales; without tufting. *Legs*: Covered with pale reddish-brown scales with scattered dark-gray scales, especially on outer side of tibiae. Distal half of middle and hind tibia with 5–8 spiniform setae. Tarsi with three ventral rows of spiniform setae on basal half of basitarsus, increasing to four rows on apical half; 2nd–4th tarsi with four ventral rows of spiniform setae, five rows on 5th segment. *Wings*: Dorsal forewing reddish brown with maculation obscure except for slightly paler antemedial and postmedial lines, the former lined distally with black, and the latter slightly dentate and lined proximally

with black; wing with an increasingly wide black streak extending from wing base to reniform spot, then continuing below reniform spot to, or slightly beyond, postmedial line; reniform and orbicular spots indicated by minute paler spots within dark forewing dash; terminal line concolorous with forewing, or with slight black wedge-shaped spots between veins. Fringe slightly checkered, with dark intervenal spots continuing on to fringe. Hindwing translucent white with a slight pearly-pink sheen; slightly darker fuscous shading on discal spot, wing margin, and fringe. **Male genitalia –** Uncus dorso-ventrally flattened, gradually tapering from base to apex with heavily-sclerotized, downward projecting plate at apex with pointed tip. Valve abruptly tapered from base, then apical half parallel-sided with rounded apex; corona and digitus absent; sacculus extending almost to middle of valve; clasper in middle of valve beyond sacculus with base forked, extending to ventral margin of valve and dorsal margin of sacculus; distal to base of clasper slightly tapered, but expanded and spatulate apically. Aedeagus about 6 × as long as wide with ventral extension at apex; vesica cylindrical with three diverticula each with a cluster of long spine-like cornuti, one subbasally with longest, stoutest cornuti, one preapically on outside with shorter, thinner cornuti, and one on inner side at apex with shortest, thinnest cornuti. **Female genitalia –** Corpus bursae bilobed, shaped like Figure 8, anterior lobe membranous, rounded; posterior lobe with diverticulum to right, and posterior extension leading to ductus bursae rugose, covered with twisted sclerotized bands. Ductus bursae about 0.15 × as long as corpus bursae with slightly tapered sclerotized plate in posterior half of ductus.

Distribution and biology. *Ufeus felsensteini* is known only from the Santa Catalina Mountains of southeastern Arizona. The life history probably is similar to those of the other species of *Ufeus* with larvae associated with large cottonwoods; adults emerge in the spring and overwinter, mainly flying during the winter months.

***Ufeus faunus* Strecker, 1898**
http://species-id.net/wiki/Ufeus_faunus
Figs 13, 14, 19, 24

Ufeus faunus Strecker, 1898: 9.

Type material. Holotype ♂. New Mexico, USA, FMNH.

Other material examined and distribution. USA: Arizona, California.

Diagnosis. *Ufeus faunus* is the smallest and palest species in the genus. Forewing length is 15–17 mm in males and 17–19 mm in females. Both sexes have pale buffy-brown forewings with black defining a zigzagged antemedial line and a toothed postmedial line with dark shading and streaks in the outer half of the terminal area. In females usually there is a thin dark streak extending from the reniform spot to the postmedial line and, in extreme forms, from the antemedial line into the subterminal area. In both sexes the hindwing is translucent white with some buffy-brown shading on the terminal line. The **male genitalia** of *U. faunus* differ from those of *U. plicatus*

and *U. hulstii* in that the apex of the valve is truncated, not rounded, the apex of the clasper is notched, not rounded, and the vesica is globular, not elongated, with a dense patch of short sclerotized preapical cornuti on the right and a patch of longer cornuti at the apex. In the **female genitalia** the corpus bursae is gourd-shaped with a rounded membranous anterior part, and a long, narrow, almost neck-like posterior part with the surface rugose and sclerotized and the ductus seminalis arising dorsally at the posterior end. The ductus bursae is short, only 0.15 × as long as the two parts of the corpus bursae and almost entirely sclerotized. As in other members of the *U. plicatus* group, the ovipositor telescopes.

Distribution and biology. *Ufeus faunus* is known only from southwestern United States in a band extending from southwestern California to southern New Mexico. Crumb 1956 reports finding larvae under bark strips of cottonwood and willow near Superior, Arizona, in late March, with adults emerging in early May.

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Comments on differences in classification of the superfamily Noctuoidea (Insecta, Lepidoptera) between Eurasia and North America

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Abstract

An attempt is made to bring consensus between the classifications of the Noctuoidea in Europe and North America. Twelve points of disagreement between the check lists from the two regions are discussed and solutions recommended.

Keywords

North America, Europe, Ophiusini, Poaphilini, Dilobinae, Raphiinae, Amphipyrinae, Psaphidinae, Oncocnemidini, Athetiina, Xyleninae, Hadeninae, Noctuinae, *Arctia*, *Pararctia*, *Platarctia*, Lymantriinae

Introduction

There has been excellent collaboration among noctuoid specialists in Europe and North America over the past 30 years, highlighted by the collaboration between Michael Fibiger (Denmark) and Don Lafontaine (Canada) in bringing the noctuoid classification used in Europe and North America into harmony. Michael's death on 16

February 2011 was a tragic loss for his family, friends, and the Lepidoptera community. Michael's main research focus for the last 22 years of his life was his initiation, production, and coordination of a massive 13 volume series of books on the noctuid fauna of Europe. The final volume completing the series was finished and published by his colleagues in 2011. This volume included a check list of the four quadrifid families of Noctuoidea (i.e., Noctuidae, sensu lato) of Europe (Fibiger et al. 2011), based on the 13 published volumes, recent phylogenetic work by Zahiri et al. (2011, 2012), and the North American check list (Lafontaine and Schmidt 2010). The 2011 European list departs from the North American list in 12 taxonomic areas. They are discussed below in the taxonomic sequence of Lafontaine and Schmidt (2010).

Results

1. The phylogeny and classification within the subfamily Lymantriinae is still very fragmentary, and attempts at systematic overviews have been limited to regional accounts. Ferguson (1978) recognized two tribes (Orgyini and Lymantriini) within a single subfamily (Lymantriinae) for North American taxa of the Lymantriidae, allowing that African and Asian genera would likely represent additional subfamilies. Under Ferguson's definition, the composition of the subfamily and family were the same, there being only a single subfamily in the family Lymantriidae. Kitching and Rawlins [1998] did not present any subdivisions within the Lymantriidae. Holloway (1999) maintained Ferguson's concept of one subfamily divided into tribes, and recognized three additional tribes based on Indo-Australian genera. Benkhelil (1999) raised Orgyiini and Lymantriini to subfamilies and discussed synapomorphies between European genera and those studied by Ferguson (1978), while transferring *Euproctis* Hübner to Orgyiinae from Lymantriinae. The Indo-Australian genera and tribes proposed by Holloway (1999) were not included by Benkhelil (1999). Most recently, Witt and Ronkay (2011) reconcile existing classifications by arranging the Erebidae: Lymantriinae into two tribes, corresponding to Benkhelil's (1999) concepts of Orgyiinae and Lymantriinae, and further dividing each tribe into subtribes based on the five tribal groups of Holloway (1999): Lymantriini with Lymantriina, Arcornithina, Leucomina, and Orgyiini with Orgyiina and Nygmiina. This classification would result in changes of tribal and subtribal placement for all genera occurring in North America. However, we note that the current concept of Orgyiini (Benkhelil 1999, Witt and Ronkay 2011) appears not to be monophyletic, since molecular data (Mitchell et al. 2006) indicate that *Euproctis* (Orgyiini: Nygmiina) is more closely related to *Lymantria* Hübner (Lymantriini: Lymantriina) than to *Dasychira* Hübner or *Orgyia* Ochsenheimer (Orgyini: Orgyina). Until a more comprehensive systematic study of the Lymantriinae is undertaken and suprageneric taxa are put into a phylogenetic hierarchy, we follow Holloway (1999) and retain the family-group taxa within the Lymantriinae as tribes (Lafontaine and Schmidt 2010, 2011).

2. Witt et al. (2011) synonymized *Platarctia* Packard and *Pararctia* Sotavalta under *Arctia* Schrank. Although a very broad concept of *Arctia* could be justified by including a number of traditionally recognized arctiine genera, the current concept of *Arctia* as defined by Witt et al. renders *Arctia* polyphyletic as neither of these two genera are sister groups to *Arctia* (Schmidt 2007, Dubatolov 2008). We therefore maintain *Pararctia* and *Platarctia* as valid genera.

3. The Boletobiinae, Aventiinae, Eublemminae, and Phytometrinae are treated as subfamilies in Lafontaine and Schmidt (2010), but as tribes of the Boletobiinae by Fibiger et al. (2011). They are downgraded to tribes in Lafontaine and Schmidt (2012) on the basis of the results in Zahiri et al. (2012), resulting in agreement between the two lists.

4. The genus *Colobochyla* Hübner is included in the subfamily Hypeninae in Lafontaine and Schmidt (2010), but in the subfamily Boletobiinae, tribe Phytometrini in Fibiger et al. (2011). The genus was included in the Phytometrinae by Fibiger and Lafontaine (2005) and Beck (1999–2000) in order to restrict the Hypeninae to the genus *Hypena* Schrank, because of its many peculiarities, such as the appendiculate tooth on the larval crochets. The adult and larva are similar in habitus to those of species of *Phytometra* Haworth, but there are no definitive derived characters that associate *Colobochyla* with either the Hypeninae or the Phytometrinae. The genus was included in the Hypeninae because DNA results in Zahiri et al. (2011) indicated a sister-group relationship between *Hypena* and *Colobochyla* (Bootstrap support 68%, Bremer support value 13 [68/13]). Support for the subfamily Boletobiinae, which now includes the Phytometrini as a tribe, is 98/13, suggesting *Colobochyla* is not a phytometrine. More recently, expanded results from Zahiri et al. (2012) place *Colobochyla* as the sister group to the Hypeninae without significant support, but the support for the Boletobiinae is 100/5, clearly excluding *Colobochyla* from the Boletobiinae and Phytometrini. So, until evidence for a better phylogenetic placement for *Colobochyla* is brought forward, we retain it in the Hypeninae.

5. In North America the genera *Achaea* Hübner, *Allotria* Hübner, *Argyrostrotis* Hübner, *Cutina* Walker, *Gondysia* Berio, *Mimophisma* Hampson, *Ophisma* Guenée, and *Parallelia* Hübner are now included in the Erebidae, Erebinae, Poaphilini, the tribal name based on a synonym of *Argyrostrotis*. Three of these genera (*Achaea*, *Mimophisma*, and *Ophisma*) are transferred into the Poaphilini here on the basis of the molecular results of Zahiri et al. (2012). This tribe has not been recognized in Europe, but Goater et al. (2003) treated it as "the *Parallelia* genus-group" of the subtribe Ophiusina, and gave a list of characters that define the group, the most obvious of which is the eversible coremata ballooning out from the outer proximal surface of the valve in most genera. They included the European genera *Grammodes* Guenée and *Dysgonia* Hübner in the group,

as well as the Asian genera *Achaea*, *Bastilla* Swinhoe, *Buzara* Walker, *Euphiusa* Hampson, *Ophisma*, and *Parallelia*. Holloway (2005) also arranged the genera of the Ophiusini into two generic groupings, one being the "*Achaea/Parallelia* complex," which includes many of the same genera as Goater et al., but adds *Chalciope* Hübner, *Macaldenia* Moore, *Pindara* Moore, and provisionally *Oxyodes* Guenée. This segregate of the Ophiusini is recognized as the tribe Poaphilini and sister to the Ophiusini with bootstrap/Bremer support values in Zahiri et al. (2012) of 100/19 and 100/16 respectively and associated as sister taxa with 93/6 support values. As a result, we transfer the European genera *Grammodes* and *Dysgonia* from the Ophiusini to the Poaphilini.

6. The subfamily Raphiinae was synonymized with the Dilobinae by Fibiger et al. (2009) and followed by Lafontaine and Schmidt (2010) in the North American list. The two subfamilies were separated again by Yela and Zahiri (2011) and Fibiger et al. (2011), mainly on larval autapomorphies of each of the two genera comprising these subfamilies. The problem of determining the systematic position of Dilobinae has been that the single constituent species (*Diloba caeruleocephala* (Linnaeus)) exhibits many autapomorphic traits that obscure its relationship to the Raphiinae / Pantheinae group, the most likely closest relatives (Miller 1991, Zahiri et al. 2012). Fibiger et al. (2009) united *Diloba* and *Raphia* on presumed unique synapomorphies in the genitalic structure, but an examination of a broader sampling of global pantheine genera (BCS, unpubl. data) shows these characters to also be present in the Pantheinae. To date, molecular results provide no support for Dilobinae as the sister group to Raphiinae (Mitchell et al. 2006, Zahiri et al. 2012). We therefore follow Yela and Zahiri (2011) and Fibiger et al. (2011) in treating the three taxa, Dilobinae, Raphiinae, and Pantheinae, as separate subfamilies.

7. The European list treats the Amphipyrinae and Psaphidinae as subfamilies with the Feraliini a tribe of the latter following Poole (1995), Fibiger and Lafontaine (2005), and Fibiger and Hacker (2007). In the North American list the subfamily Amphipyrinae includes three tribes, Amphipyrini, Psaphidini (with four subtribes) and Stiriini (with four subtribes). The Amphipyrini is essentially based on the genus *Amphipyra* Ochsenheimer and characterized by its many peculiarities. Many characters form a mosaic in distribution, such as the uniordinal larval crochets in Amphipyrini and Feraliina and biordinal crochets in the Psaphidina and Cucculliinae. Molecular work by Mitchell (2006, Fig. 4) suggests a sister group relationship between the Amphipyrinae and Psaphidini with the Stiriini being the sister group to them. The close relationship between Psaphidini and Amphipyrini is also highlighted by the recent discovery of species exhibiting larval and adult characters clearly associating these lineages (Wagner et al. 2008). Until more molecular work has been done to bring better resolution to the phylogenetic relationships of the

tribes and subtribes of the clade, we feel it is better to treat the whole clade as a single subfamily – the Amphipyrinae.

8. In Europe the situation with *Sympistis* Hübner and *Oncocnemis* Lederer seems relatively simple with four species of *Sympistis* being diurnal arctic-alpine species and five species of *Oncocnemis* being nocturnal and desert loving. In North America, however, *Sympistis* is very large (176 species) and structurally complex and the four *Sympistis* s.s. species are not only nested within the *Sympistis*/*Oncocnemis* complex as a whole, but one species (*Sympistis funebris* Hübner) does not form a monophyletic clade with the other diurnal species that formerly constituted *Sympistis*. *Sympistis funebris* is the sister species to a clade of species formerly considered a separate genus (*Apharetra* Grote), so *Sympistis* s.s. is polyphyletic. The genera of the Oncocnemidini were revised by Troubridge (2008), who treated many former genera as species groups within an expanded concept of *Sympistis*. We follow Troubridge in treating *Oncocnemis* as a synonym of *Sympistis* and including the four species of the former *Sympistis* (in two different species groups).

9. *Sympistis nigrita* (Boisduval), described from the Alps, was treated as a Holarctic species by Ronkay and Ronkay (1995) and Troubridge (2008) by virtue of considering the northern Holarctic taxon *S. zetterstedtii* (Staudinger) as a subspecies of *S. nigrita*. *Sympistis zetterstedtii*, stat. rev., differs from *S. nigrita* in that the fields of cornuti in the male vesica are concentrated into two dense patches, not scattered over the apical half of the vesica as in *S. nigrita*, and the subbasal diverticulum of the vesica in *S. zetterstedtii* is minute, not pouch-like as in *S. nigrita*. In the female genitalia of *S. zetterstedtii* the ductus bursae enters the corpus bursae on the side of the near the posterior end, whereas it enters at the posterior end of the corpus bursae in *S. nigrita*. The barcodes of the two species are 2.8% different (Mutanen et al. 2012). Populations of *Sympistis zetterstedtii* in Yukon and Alaska have dark hindwings, like those from Fennoscandia, however, their barcodes are the same as those from Greenland and the barcodes of North American populations differ from those from northern Europe by more than 1%, so we treat the North American populations as *Sympistis zetterstedtii* ssp. *kolthoffi* (Aurivillius, 1890). We see no structural differences among populations of *Sympistis zetterstedtii*, unlike the situation between *S. zetterstedtii* and *S. nigrita*. As a result of these data, we treat *Sympistis nigrita* as being endemic to the Alps and *S. zetterstedtii* as a northern Holarctic species.

10. *Protoschinia scutosa* ([D. & S.]) is represented in North America by a separate species, *Protoschinia nuchalis* (Grote), which is currently included in the genus *Schinia* Hübner on the basis of synonymy of the genera by Matthews (1991). The status of the two genera will be addressed in an upcoming revision by Michael Pogue, but in the interim we follow the European lead in returning *nuchalis* to *Protoschinia* Hardwick, mainly because the barcodes suggest that *Protoschinia* is more closely related to *Heliothis* Ochsenheimer and *Helicoverpa* Hardwick than it is to *Schinia*.

11. The European check list follows Fibiger and Lafontaine (2005), Fibiger and Hacker (2005) and Lafontaine and Fibiger (2006) in arranging the genera in Noctuinae s.l. of Poole (1995) into three subfamilies, Xyleninae, Hadeninae, and Noctuinae s.s. However, Fibiger and Lafontaine (2005) stated that the Xyleninae cannot be defined on any shared derived character states and is probably a paraphyletic group with respect to some tribes in the Hadeninae. Similarly, Yela and Zahiri (2011) stated there are no derived character states to support the Xyleninae. These results are not surprising because the molecular work of Mitchell et al. (2006) shows that the tribes Pseudeustrotiini, Phosphilini, Prodeniini, Elaphriini, Caradrinini, Dypterygiini, and Actinotiini are external to the [[Apameini + Xylenini] + Hadeninae] + Noctuinae clade, and it appears that the Hadeninae do not form a monophyletic group, with some tribes more closely related to tribes in the Xylenini. The result is that either these tribes need to be combined as tribes of a single subfamily, the Noctuinae s.l., or they need to be arranged in 10 to 20 poorly-defined subfamilies, in order to retain monophyletic taxa. The monophyly of the subfamily Noctuinae s.l. is very well supported by the molecular results of Mitchell et al. (2006), and by morphology (clasper located in middle of valve, larva with dorsally-grooved spinneret), and this clade contains the true cutworms, many of which are significant agricultural pests. As a result, we believe the best option is to arrange the tribes in a single expanded concept of the Noctuinae as was done by Lafontaine and Schmidt (2010) for the North American taxa.

12. The subtribe Athetiina was originally constructed by Fibiger and Lafontaine (2005) by dropping the '*is*' ending from *Athetis* Hübner to create the subtribal name Athetina. Later, when it was revealed that the name was a homonym of the Athetina in Coleoptera, Staphylinidae, based on *Atheta* Thomson, the stem was changed by dropping only the '*s*' to create Athetiina to avoid homonomy.

The subtribe includes several hundred species, mainly Old World, which can be arranged in three distinctive groups: *Athetis* Hübner, with parallel-sided valves, a clasper complex positioned near the apex of the valve on (or near) the ventral margin, and the sacculus is very long; *Hydrillula* Tams is mainly an African group with parallel-sided valves, apically expanded and rounded at the cucullus, and the clasper is spine-like; *Proxenus* Herrich-Schäffer, mainly eastern Asian and North American, valves greatly expanded from a small base to a large rounded apex with the clasper in the middle of the apical area, the sacculus is very small. *Athetis* and *Proxenus* occur in North America and were treated as genera of the Athetiina by Fibiger and Lafontaine (2005), Fibiger and Hacker (2005), and Lafontaine and Schmidt (2010). The three genera were treated as subgenera of *Athetis* by Fibiger and Hacker (2007) and Fibiger et al. (2011). The loss of the uncus makes an easy and reliable character to define this group, and is the main justification for the single genus *Athetis*; however, this same character was the main basis for the subtribal grouping to associate these three genera as a monophyletic group. The structural differences among the three groups are consistent and significant, so it seems pointless to define the genus

Athetis and Athetiina on the same characters and have a subtribe with only one genus. We therefore treat *Athetis* and *Proxenus* as valid genera, not as subgenera of *Athetis*.

Discussion

The purpose of a classification, and resulting check lists, are to organize, store, and communicate information about organisms and their names. In the not so distant past, different classifications were frequently in use on different continents, and even among countries and regions, severely hampering effective communication and transfer of biological information. Consensus in classification is becoming an increasingly important issue with globalization of data-bases and information available on the World Wide Web. There has been a huge amount of progress in the past 20 years in the development of a consensus classification of the superfamily Noctuoidea between North America and Eurasia because of cooperation and collaboration of researchers. Classifications are not static, but will continue to change and adapt as new data and new ways of interpreting data are brought forward. We believe that transparency, communication, and collaboration will aid in the process of maintaining stability while continuing to change. We hope that this contribution will be a step forward in continuing this process.

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Lepidoptera family-group names proposed by Thaddeus William Harris in 1841

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Abstract

In 1841, T. W. Harris published "A Report on the Insects of Massachusetts, Injurious to Vegetation," a seminal work in North American Entomology and one of the first New World publications to describe Lepidoptera species. Although appearing in several subsequent editions, the eight family-group names proposed by Harris were largely overlooked. In summarizing Harris' family-group names, we show that authorship for two Noctuidae names in current usage require changes: Acronictinae Harris, 1841 (originally as Acronyctadae) has priority over Heinemann, 1859, and Agrotini Harris, 1841 (as Agrotitidae) has priority over Rambur, 1848. Mamestradae Harris, 1841 is also a senior synonym of Mamestrinae Hampson, 1902 (Type genus: *Mamestra* Ochsenheimer, 1816), an available name that is currently a junior subjective synonym of Noctuidae: Noctuinae: Hadenini Guenée, 1837 (Type genus: *Hadena* Schrank, 1802). Geometridae: Ennominae: Hyberniini Harris, 1841 (as Hyberniadae), based on *Erranis* Hübner, [1825] (= *Hybernia* Berthold, 1827), has precedence over two family-group names with long-standing usage, Bistonini Stephens, 1850 and Boarmiini Duponchel, 1845, and a reversal of precedence for the latter two names over Hyberniini is proposed under ICZN guidelines.

Keywords

Acronictinae, Agrotini, Bistonini, Boarmiini, Ennominae, Geometridae, Hadenini, Hyberniini, Noctuidae

Introduction

In one of the earliest compendia of North American entomology, Thaddeus William Harris' "A Report on the Insects of Massachusetts, Injurious to Vegetation" describes the life histories of hundreds of insect species, often in extensive detail. Over a dozen Lepidoptera species were described and named by Harris therein, including familiar species such as *Lophocampa maculata*, *Acronicta americana,* and *Euxoa messoria*. First published in 1841, the "Report" was re-printed in 1842 (Harris 1842), and subsequently released in a 2nd (Harris 1852) and 3rd edition (Harris 1862). The 3rd edition was published after Harris' death in 1856, and included the addition of butterfly species based on Harris' manuscripts, including descriptions of 10 new species. Harris described over 50 new taxa, 40 of which are currently valid species names.

Less well-known are the family-group names proposed by Harris in 1841, only two of which are currently attributed to him – Lasiocampidae (Lasiocampoidea) and Ceratocampinae (Bombycoidea: Saturniidae). In an earlier work on sphinx moths (Harris 1839), Harris named the Macroglossiadae, currently Sphingidae: Macroglossinae. The purpose of this paper is to review the eight family-group names proposed by Harris (1841). Authorship for two family-group names in current usage should be attributed to Harris in accordance with publication priority, viz. Acronictinae Harris, 1841 (*nec*. Heinemann, 1859) and Agrotini Harris, 1841 (*nec*. Rambur, 1848). The remaining Harris names are junior homonyms or junior subjective synonyms; one is proposed as a *nomen oblitum*.

Family-group names and ICZN

Harris classified the Lepidoptera similar to the categories proposed by Linnaeus, where the non-sphingid moths were further divided into seven groups, the Bombyces, Noctuae, Geometrae, Pyralides, Tortrices, Tineae and Alucitae. Harris (1841) proposed new family-group names in the Bombyces (Liparidae, Lasiocampadae, Ceratocampadae), Noctuae (Notodontadae, Acronyctadae, Agrotitidae, Mamestradae), and Geometrae (Hyberniadae). He indicated new family-group names by stating each "may be called" or "which I call," and indicated that the name was based on what he considered the corresponding "core genus." This prose was not followed for family names he knew were already named, such as the Lithosiadae (p. 240), and the Nonagriadae (p. 318), both used by Harris in 1833 along with other previously established family-group names. Eight family-group names were proposed by Harris in 1841 (and not included by him in his 1833 work), and we compared these to those summarized by Speidel and Naumann (2005) and Fibiger and Lafontaine (2005) for the Noctuoidea, and Forum Herbulot (2003) for the Geometroidea.

Family-group names proposed by Harris, 1841

Original spelling of family-group names is given in bold, followed by the current taxonomic position and emended spelling in square brackets.

Liparidae (p. 260) [Lymantriidae Hampson, 1893]. A junior synonym of Liparides Boisduval, 1834. Both family-group names are invalid due to homonymy of the type genus, *Liparis* Ochsenheimer, 1810 (= *Liparis* Scopoli, 1777 [Pisces]).

Lasiocampadae (p. 265) [Lasiocampoidea: Lasiocampidae Harris, 1841]. Correctly attributed to Harris in recent publications, e.g., Franclemont (1973: 25), de Freina and Witt (1987: 33).

Ceratocampadae (p. 287) [Saturniidae: Ceratocampinae Harris, 1841]. Correctly attributed to Harris in recent works (e.g., Tuskes et al. 1996), but Ferguson (1971: 18) considered Citheroniinae Neumoegen and Dyar, 1894 to be the valid, although junior, name.

Acronyctadae (p. 316) [Noctuidae: Acronictinae Harris, 1841]. A senior synonym of Acronyctadae Heinemann, 1859.

Agrotitidae (p. 321) [Noctuidae: Noctuinae: Agrotini Harris, 1841]. A senior synonym of Agrotides Rambur, 1848, currently ranked as a tribe (e.g., Lafontaine 2004, Fibiger and Lafontaine 2005).

Mamestradae (p. 329) [Noctuidae: Noctuinae: Hadenini Guenée, 1837]. A senior synonym of Mamestrinae Hampson, 1902. Mamestrini (type genus: *Mamestra* Ochsenheimer, 1816) is currently considered a junior subjective synonym of Hadenini Guenée, 1837 (as Hadenidi), e.g., Fibiger and Lafontaine (2005).

Herminiadae (p. 344) [Erebidae: Herminiinae Leach, [1815]]. A junior synonym of Herminida Leach, [1815].

Hyberniadae (p. 332) [Geometridae: Ennominae: Boarmiini Duponchel, 1845]. *Hybernia* Berthold, 1827 is a junior objective synonym of *Erannis* Hübner, [1825] (Ferguson 1983). Hyberniini Harris has priority over Hyberniini Duponchel, 1845 (as Hibernites), and also over Boarmiini Duponchel, 1845 (as Boarmites) and Bistonini Stephens, 1850 (as Bistonidi). Although mostly treated as a valid tribe prior to Holloway (1994), Bistonini has recently been subsumed within Boarmiini (e.g., Holloway 1994, Sihvonen et al. 2011). Hyberniini was used (as Hybernites) by Bruand (1846), Stephens (1850) and Guenée (1857), but has apparently not been used as a

family-group name after 1899 and therefore meets requirement 23.9.1.1 for "Reversal of Precedence" under ICZN rules. Both Boarmiini and Bistonini have long-standing usage in the literature, summarized in Table 1, and thereby meet the second requirement (23.9.1.2) for "Reversal of Precedence" (ICZN), which states that the name in question should be cited in at least 25 works, published by at least 10 authors in the immediately preceding 50 years and encompassing a span of not less than 10 years. The Geometridae family-group names (Forum Herbulot 2003) in question should therefore be revised as follows:

Boarmiini Duponchel, 1845(Boarmites) *nomen protectum*
= Hyberniini Harris, 1841 (Hyberniadae) *nomen oblitum*
= Hyberniini Duponchel, 1845 (Hibernites) junior synonym of Hyberniadae Harris, 1841
= Bistonini Stephens, 1850 (Bistonidi)

Table 1. Publications citing Boarmiini or Bistonini as a family-group name.

Boarmiini	Bistonini
Brehm and Fiedler 2003, 2004, 2005; Ferguson 1983, 2008; Forbes 1948; Holloway 1994, 2011; Krüger 2007; McGuffin 1977, 1981, 1987; Minet and Scoble 1998; Őunap et al. 2011; Patočka 1986, 1993; Pitkin 2002; Pohl et al. 2010; Rindge 1972, 1976; Riotte 1992; Sihvonen et al. 2011; Stephens and Gibbs 2003; Vargas 2007, 2010; Viidalepp et al. 2007; Wahlberg et al. 2010; Young 2003.	Butler 1986; Ferguson 1983; Ferris 2010; Forbes 1948; Hackray et al. 1984; Holloway 1994; Hunter 1995; McGuffin 1977, 1981, 1987; Miller 1996; Minet and Scoble 1998; Őunap et al. 2011; Patočka 1978; Pellmyr 1980; Pitkin 2002; Pohl et al. 2010; Powell and Opler 2009; Rindge 1975, 1985; Riotte 1992; Rose 1985; Viidalepp 1989; Viidalepp et al. 2007; Wahlberg et al. 2010.

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Brehm G, Fiedler K (2005) Diversity and community structure of geometrid moths of disturbed habitat in a montane area in the Ecuadorian Andes. Journal of Research on the Lepidoptera 38: 1–14.

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RESEARCH ARTICLE

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Additions and corrections to the check list of the Noctuoidea (Insecta, Lepidoptera) of North America north of Mexico

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Abstract

A total of 64 additions and corrections are listed and discussed for the check list of the Noctuoidea of North America north of Mexico published in 2010. One family-group name is inserted, four are changed in rank, one is deleted, one is changed in name, and three are changed in authorship. Taxonomic changes to species are six new or revised synonymies, one new combination, and one revision in status from species to subspecies.

Keywords

Canada, United States, Erebidae, Noctuidae, Nolidae, Boletobiinae, Eligminae, Diphtherinae, Eulepidotinae, Omopterinae, Toxocampinae, Boletobiini, Aventiini, Eublemmini, Phytometrini

Introduction

Continuing work on the taxonomy and systematics of New World Noctuoidea has resulted in an additional 64 changes to the check list North American Noctuoidea (Lafontaine and Schmidt 2010), these in addition to the 96 changes published in 2011 (Lafontaine and Schmidt 2011). Eighteen species are added to the fauna, eight are removed through synonymy, and eight are name changes due to synonymy. The new total for Noctuoidea in North America north of Mexico is 3689.

Materials and methods

Repository abbreviations

Taxonomic changes are based on examination of material, especially type specimens, in the following collections:

BMNH The Natural History Museum [statutorialy: British Museum (Natural History)], London, UK
CNC Canadian National Collection of Insects, Arachnids, and Nematodes, Ottawa, Ontario, Canada
DFC David Fine Collection, Coconut Creek, Florida, USA
JKAC James K. Adams Collection, Calhoun, Georgia, USA
JTTC James T. Troubridge Collection, Selkirk, Ontario, Canada
MNHN Muséum National d' Histoire Naturelle, Paris, France
TLSRC Texas Lepidoptera Survey Research Collection, Houston, Texas, USA
TSDC Terhune S. Dickel Collection, Anthony, Florida, USA
USNM National Museum of Natural History [formerly, United States National Museum], Washington, District of Columbia, USA

Results

Corrections, additions, and changes (highlighted in **bold**)

p. 3 **Tribe Boletobiini** [insert after Subfamily Boletobiinae]
p. 3 **Subfamily Eligminae Mell, 1943** [insert before subfamily Risobinae]
p. 3 **Subfamily Diphtherinae** [insert before subfamily Nolinae]
p. 3 & p. 28 **Tribe Aventiini** [lower subfamily name to tribal name]
p. 3 & p. 28 **Tribe Eublemmini** [lower subfamily name to tribal name]
p. 3 & p. 29 **Tribe Phytometrini** [lower subfamily name to tribal name]
p. 3 & p. 30 **Subfamily Toxocampinae** [raise tribal name to subfamily name]

p. 3 & p. 37 **Tribe Omopterini Boisduval, 1833** [change Tribe Ophiusini Guenée, 1837 to Omopterini]
p. 3 & p. 39 **Tribe Eulepidotini** and **Tribe Panopodini** [delete tribal names]
p. 3 & p. 42 Collomeninae **Zahiri, Lafontaine, & Schmidt, 2012** [correct authorship from Kitching and Rawlins, [1998]]
p. 3 & p. 49 **Subfamily Raphiinae Beck, 1996 [**change Subfamily Dilobinae to Subfamily Raphiinae]
p. 4 & p. 50 Acronictinae **Harris, 1841** [correct authorship from Heinemann, 1859]
p. 5 & p. 99 Agrotina **Harris, 1841** [correct authorship from Rambur, 1848]
p. 28 **Tribe Boletobiini** [insert to include species 930673 to 930692]
p. 41 **Subfamily Diphtherinae and 931410 *Diphthera festiva* (Fabricius, 1775)** [insert before Subfamily Nolinae and renumber species as **931120.1**]
p. 42 **Subfamily Eligminae Mell, 1943** [insert before 931147 *Iscadia aperta* Walker]
p. 49 **Delete** Subfamily Diphtherinae and 931410 *Diphthera festiva* (Fabricius, 1775)
930356.1 *Xenosoma flaviceps* (Walker, 1865)
930405 *Cycnia oregonensis* (Stretch [1874])
ssp. *C. o. oregonensis* (Stretch [1874])
ssp. *C. o. tristis* Crabo, 2013
930447.1 *Aclytia heber* (Cramer, [1780])
930500 *Zanclognatha jacchusalis* (Walker, 1859)
ssp. *Z. j. jacchusalis* (Walker, 1859)
syn. *Z. ochreipennis* (Grote, 1872)
ssp. *Z. j. lutalba* (Smith, 1906)
ssp. *Z. j. bryanti* Barnes, 1928
930501 Delete. Moved to synonymy of 930500
930502 *Chytolita morbidalis* (Guenée, 1854)
syn. *C. petrealis* Grote, 1880
syn. *C. punctiformis* (Smith, 1895)
syn. *C. fulicalis* Smith, 1907
930503 Delete. Moved to synonymy of **93**0502
930579 ***Hypena lividalis* (Hübner, 1796)**
syn. *H. abjuralis* Walker, [1859]
930608 *Anomis illita* Guenée, 1852
syn. *A. conducta* Walker, [1858]
syn. *A. hostia* (Harvey, 1876)
930609 ***Anomis gentilis* Schaus, 1912**
syn. *A. exacta* of authors, not Hübner, 1822
930611.1 *Dinumma deponens* Walker, 1858
930621.1 *Gonodontodes dispar* Hampson, 1913
930702 Delete. Moved to synonymy of 930705
930705 *Hemeroplanis historialis* (Grote, 1882)
syn. *H. finitima* (Smith, 1893)

syn. *H. secundalis* (Smith, 1907)
930706 Delete. Moved to synonymy of 930705
930755.1 *Hemeroblemma mexicana* (Guenée, 1852)
930884 *Forsebia cinis* (Guenée, 1852)
syn. *F. perlaeta* (H. Edwards, 1882)
930903.1 *Drasteria parallela* Crabo & Mustelin, 2013
930968.1 *Ophisma tropicalis* (Guenée, 1852)
930968.2 *Mimophisma delunaris* (Guenée, 1852)
930968.3 *Achaea ablunaris* (Guenée, 1852)
931057 Delete. Moved to **930968.1**
931058 Delete. Moved to **930968.2**
931059 Delete. Moved to **930968.3**
931109 Delete. Moved to synonymy of 931117
931113.1 *Paectes fuscescens* (Walker, 1855)
931116 Delete. North American concept moved to synonymy of 931117.1
931117 Delete. North American concept moved to synonymy of 931117
931117 *Paectes nana* (Walker, 1865)
syn. *P. arcigera* of authors, not (Guenée, 1852)
syn. *P. burserae* (Dyar, 1901)
931117.1 *Paectes asper* Pogue, 2013
syn. *P. obrotunda* of authors, not (Guenée, 1852)
931167.1 *Enigmogramma antillea* Becker, 2001
931171.1 *Chrysodeixis chalcites* (Esper, 1789)
syn. *C. eriosoma* of Lafontaine & Schmidt (2010), not (Doubleday, 1843)
931253.1 *Amyna amplificans* (Walker, 1858)
931260.1 *Tripudia paraplesia* Pogue, 2009
931931 *Sympistis zetterstedtii* (Staudinger, 1857)
ssp. *S. **z.** kolthoffi* (Aurivillius, 1890)
931965 *Eudryas brevipennis bonneville* Shepard & Crabo, 2013
931988.1 *Perigea bahamica* Hampson, 1908
932006 *Condica charada* (Schaus, 1906)
932021.1 *Ogdoconta satana* Metzler, Knudson & Poole, 2013
932023 *Ogdoconta rufipenna* Metzler, Knudson & Poole, 2013
syn. *Ogdoconta* sp. not *O. lilacina* (Druce, 1890) (Lafontaine and Schmidt 2010).
932023.1 *Ogdoconta fergusoni* Metzler & Lafontaine, 2013
932061 *Protoschinia* *nuchalis* (Grote, 1878)
932368.1 *Resapamea diluvius* Crabo, 2013
932368.2 *Resapamea angelika* Crabo, 2013
932368.3 *Resapamea mammuthus* Crabo, 2013
932454 Delete. Moved to synonymy of 932455
932455 *Hydraecia medialis* Smith, 1892
syn. *H. pallescens* Smith, 1899
932456 *Hydraecia obliqua* **(Harvey)**, 1876

syn. *H. ximena* (Barnes & Benjamin, 1924)
syn. *H. columbia* (Barnes & Benjamin, 1924)
932462 Delete. Moved to synonymy of 932456
932463 Delete. Moved to synonymy of 932456
932631 *Aseptis* ***fanatica*** Mustelin, 2006
932693.1 *Fishia nigrescens* Hammond & Crabo, 2013
932711.1 *Ufeus felsensteini* Lafontaine & Walsh, 2013
933606 *Xestia perquiritata orca* Crabo & Hammond, 2013

Notes

p. 3 & p. 28–29 subfamily Boletobiinae – The phylogenetic studies of the Erebidae by Zahiri et al. (2012a) showed that the subfamilies Aventiinae, Eublemminae, and Phytometrinae should be included within the subfamily Boletobiinae as tribes.

p. 3 & p. 30 Subfamily Toxocampinae – phylogenetic studies of the Erebidae by Zahiri et al. (2012a) showed that the Toxocampini should be treated as a subfamily of the Erebidae, rather than as a tribe of the Erebinae.

p. 3 & p. 37 Tribe Omopterini – phylogenetic studies of the Erebidae by Zahiri et al. (2012a) showed that the tribe Ophiusini Guenée is confined to the Old World, so the tribal name for most of the New World representatives related to *Zale* Hübner should be changed to tribe Omopterini. Three genera (*Ophisma* Guenée, *Mimophisma* Hampson, *Achaea* Hübner) should be transferred to the Poaphilini.

p. 3 & p. 39 Subfamily Eulepidotinae – The nuclear DNA results in Zahiri et al. (2012a) showed that genera *Eulepidotis* and *Panopoda* are closely related, so the tribes Eulepidotini and Panopodini are unnecessary. The date of the Eulepidotinae was corrected from 1985 to 1895 by Lafontaine and Schmidt (2011).

p. 3 & p. 41 Subfamily Diphtherinae – The molecular results of Zahiri et al. (2012b) show that the subfamily Diphtherinae is the basal lineage of the Nolidae and so it is moved to a position as the first subfamily of the Nolidae. These results show very strong support for the monophyly of the subfamilies of the Nolidae but virtually no support for phylogenetic associations among the subfamilies, other than Diphtherinae being sister to the other subfamilies. So, we suggest no change in subfamily sequence at this time.

p. 3 & p. 42 Subfamily Eligminae – The molecular results of Zahiri et al. (2012b) showed that the genus *Iscadia* Walker, and related Neotropical genera (e.g., *Elaeognatha* Hampson) belong to the Eligminae and not to the Chloephorinae: Sarrothropini as previously supposed. Previous to these results the Eligminae were thought to be restricted to Asia and Australia.

p. 3 & p. 49 Subfamily Raphiinae – Change subfamily name from Dilobinae (see Lafontaine and Schmidt 2013).

p. 4 & p. 50 Acronictinae – Change in authorship from Schmidt and Lafontaine 2013.

p. 5 & p. 99 Agrotina – Change in authorship from Schmidt and Lafontaine 2013.

p. 42 Subfamily Collomeninae – The subfamily name was first used in a North American check list (Franclemont and Todd 1983), but without a description. This was discussed in more detail by Kitching and Rawlins [1998], but mostly from a distributional perspective and still no diagnostic characters were given that would validate the subfamily name by the rules of the International Commission on Zoological Nomenclature. A formal description was given by Zahiri, Lafontaine and Schmidt (2012c).

p. 49 Subfamily Diphtherinae – Moved to Nolidae.

930356.1 *Xenosoma flaviceps* – This species occurs in northern Mexico (State of San Luis Potosi), and in southern Mexico from at least Chiapas to Guatemala and Costa Rica. A single specimen was collected at Alamo, Texas on 5 December 2012. Contributed by E. Knudson and C. Bordelon. Voucher in TLSRC, photograph examined.

930405 *Cycnia oregonensis tristis* – New subspecies (see Crabo et al. 2013).

930447.1 *Aclytia heber* – A single specimen was collected at Alamo, Texas in November of 2012. Contributed by E. Knudson and C. Bordelon. Voucher in TLSRC, photograph examined.

930500 *Zanclognatha jacchusalis* – The species is widely distributed in eastern United States and occurs as far west as Arizona. It is characterized by the burnt-orange forewing ground color that is heavily speckled with black scales. It is replaced in Canada by a form that has paler buffy-brown or gray-brown forewings with little black speckling. This northern form is currently treated as *Zanclognatha lutalba* (Smith), occurring from Nova Scotia to Alberta, and as *Zanclognatha lutalba* ssp. *bryanti* Barnes in British Columbia and Washington. However, there is a broad area in southern Ontario and Quebec, northern New York, and New England, where most specimens are intermediate between typical *Zanclognatha jacchusalis* and *Z. lutalba* and occasionally *Z. lutalba*-like forms are found as far south as the Appalachians of North Carolina. There are no external structural or genital characters to distinguish the two taxa and barcodes do not separate them either, so we synonymize *Z. lutalba*, **syn. n.**, but retain the name as a northern subspecies as *Z. jaccusalis* ssp. *lutalba*, **stat. n.**, and move subspecies *bryanti* to *Z. jaccusalis* ssp. *bryanti*, **stat. rev.**

930502 *Chytolita morbidalis* – New and revised synonymy from Crabo et al. 2013.

930579 *Hypena lividalis* – The species, which occurs in Africa and southern Europe, is now believed to be a Pan-tropical species with *Hypena abjuralis* (Walker, [1859]), **syn. rev.**, as a synonym. The external characters, genitalia, and barcodes are the same from each region. It is possible that the spread of the species to the New World was aided by man.

930608 *Anomis illita* – Examination of type material and barcodes shows that *Anomis conducta* Walker, [1858], **syn. n.**, and *Aletia hostia* Harvey, 1876, **syn. n.**, are synonyms of *Anomis illita*, and not synonyms of *Anomis exacta* Hübner, 1822. The barcodes also show that *Anomis illita* is widely distributed from Florida and Texas southward through the Caribbean and Central and South America to Brazil, the latter being the type locality.

930608 *Anomis gentilis* – Examination of the type material associated with the name *Anomis exacta* and *A. gentilis* Schaus, shows that the species that occurs in Texas is

A. gentilis. The type material of *Anomis exacta* is lost, but the illustration in Hübner (1822), and material associated with it in the Natural History Museum, London (BMNH), do not match the taxon occurring in Texas, or any North American species of *Anomis*. Further, the two names currently associated with the *Anomis exacta* as synonyms, one of which (*A. hostia* (Harvey)) was described from Texas, are synonyms of *Anomis illita* and are transferred to its synonymy above.

930611.1 *Dinumma deponens* – A fresh female specimen of *Dinumma deponens* Walker, 1858 was taken at gas station lights in Morganton, Fannin Co., in north Georgia on June 15, 2012 by Paul Dennehy and James Adams. This location is quite rural, along a state highway about 100 miles north of Atlanta. The species' home range is "from India across E China to Japan, Korea and to Thailand" (Alberto Zilli, pers. comm.), though not Borneo. The larval food plants of *Dinumma* Walker, and the species *D. deponens*, are members of the genus *Albizia* Durazz. (Mimosa). Mimosa is extensively planted and naturalized throughout north Georgia. As such, it is certainly plausible that this single specimen represents a member of an established population of the moth in the U.S. It is tentatively included in the Anomini following Holloway (2005). The specimen is in the JKAC. Contributed by James Adams.

930621.1 *Gonodontodes dispar* – A male of this species was collected at Mile Marker 36, US A1A, Key Largo, Monroe Co., Florida, 2 May 2009 by David Fine. The specimen is in DFC. Contributed by Leroy Koehn.

930705 *Hemeroplanis historialis* – Examination of genitalia and barcodes shows that the names *H. finitima*, **syn. n.**, and *H. secundalis*, **syn. n.**, are color forms of *H. historialis*. The species is mainly distinguished from *H. incusalis*, which occurs with it in parts of Arizona and California, by the more parallel transverse lines on the forewing with black wedge-shaped spots on the costa in *H. historialis*, and usually the reniform spot is black.

930755.1 *Hemeroblemma mexicana* – A female of this species was collected 6 June 2012 at Falcon Heights, Starr Co., Texas by Barry Nall. The specimen is in the TLSRC.

930884 *Forsebia cinis* – The male lectotype of *Bolina cinis* Guenée, 1852, in the MNHN, Paris, is a senior synonym of *Forsebia perlaeta* (H. Edwards, 1882), **syn. n.**, and not a synonym of *Melipotis jucunda* Hübner, 1818, as previously supposed. *Forsebia cinis* is a **new combination.** Contributed by Robert Poole.

930903.1 *Drasteria parallela* – Addition (see Crabo et al. 2013).

930961.1 *Ophisma tropicalis* – The molecular results in Zahiri et al. (2012a) show that *Ophisma*, and the two genera below (*Mimophisma* Hampson and *Achaea* Hübner), should be in the Poaphilini, so the species is moved here from 931057.

930961.2 *Mimophisma delunaris* – moved from 931058.

930961.3 *Achaea ablunaris* – moved from 931059.

931113.1 *Paectes fuscescens* – A single specimen from Florida was found in unidentified material in the USNM by Mike Pogue while sorting specimens for a revision of the *Paectes arcigera* group. The specimen was reared but the data do not include host plant information. Terhune Dickel and Jim Troubridge have

both collected this species in southern Florida (Homestead and Key Largo). Some specimens have previously been identified as *Paectes burserae*. Vouchers in CNC, JTTC, TSDC, and USNM.

931117 *Paectes nana* – This taxon, formerly considered to be a synonym of *Paectes arcigera*, is widely distributed in Florida, the Caribbean, Mexico, Central America, and northern South America. The taxonomic status and distribution are based on Pogue (2013). *Paectes arcigera* is found in the Lesser Antilles and Puerto Rico and would not be expected to occur in Florida. *Paectes burserae* (931109 in Lafontaine & Schmidt 2010) is placed in synonymy with *P. nana* by Pogue 2013.

931117.1 *Paectes asper* – Addition (see Pogue 2013). This is the species formerly identified as *Paectes obrotunda* (Guenée, 1852) in Florida. It is widely distributed in southern Florida and the Caribbean, whereas *P. obrotunda* is confined to Brazil (Pogue 2013).

931167.1 *Enigmogramma antillea* – This species was described by Becker (2001). A specimen was collected in Collier County, Florida, in 2012 by Jim Troubridge. Voucher in CNC.

931171.1 *Chrysodeixis chalcites* – This species occurs mainly in Africa and western Eurasia with *C. eriosoma* mainly in eastern Asia, but occasionally found in Europe in greenhouses. The two species are very difficult to identify other than by geographic range, DNA, and pheromones. When populations of this complex were discovered in greenhouses in British Columbia in 2006, it was assumed they would have an eastern Eurasian origin, like most recent introductions into the Vancouver area. More recently, barcode results show that these populations, and recently discovered populations in southern Ontario and Michigan, are referable *Chrysodeixis chalcites* and not to *C. eriosoma* (Murillo et al. in press).

931253.1 *Amyna amplificans* – A single specimen of this species was collected by Bruce Walsh in the Huachuca Mountains in southeastern Arizona. Voucher in JBWC.

931260.1 *Tripudia paraplesia* – A single specimen of this species was collected by Vernon Brou in Louisiana in 1994. Previously, the species was recorded only as far north as northeastern Mexico (Pogue 2009). It is distinguishable from *T. quadrifera* (Zeller) and *T. rectangula* Pogue only by genital characters. Voucher in CNC.

931931 *Sympistis zetterstedtii* – Reinstated as a full species, not a subspecies of *Sympistis nigrita* (Boisduval, 1840) from the Alps, following Lafontaine and Schmidt (2013).

931965 *Eudryas brevipennis bonneville* – New subspecies (see Crabo et al. 2013).

931988.1 *Perigea bahamica* – The species was collected in Monroe County, Florida, in 2012 by Jim Troubridge. Voucher in CNC.

932006 *Condica charada* – The species name was misspelled as *chardra* in Lafontaine & Schmidt (2011).

932021.1 *Ogdoconta satana* – Addition (see Metzler et al. 2013).

932023 *Ogdoconta rufipenna* – Addition (see Metzler et al. 2013). This species had been listed in numerous lists and season summaries and was treated in Lafontaine & Schmidt (2010) as *Ogdoconta* sp. not *O. lilacina* (Druce, 1890).

932023.1 *Ogdoconta fergusoni* – Addition (see Metzler et al. 2013).

932061 ***Protoschinia nuchalis*** **–** Change in combination from Lafontaine and Schmidt (2013).

932368.1 ***Resapamea diluvius*** **–** Addition (see Crabo et al. 2013).

932368.2 ***Resapamea angelika*** **–** Addition (see Crabo et al. 2013).

932368.3 ***Resapamea mammuthus*** **–** Addition (see Crabo et al. 2013).

932455 ***Hydraecia medialis*** **–**New synonymy from Crabo et al. 2013.

932456 ***Hydraecia obliqua*** **–** The author's name, Harvey, should be in parentheses because the original combination was *Gortyna obliqua* Harvey. New synonymy from Crabo et al. 2013.

932631 ***Aseptis fanatica*** **–** The species name was misspelled as *fannatica* in Lafontaine & Schmidt (2010).

932693.1 ***Fishia nigrescens*** **–** Addition (see Crabo et al. 2013).

932711.1 ***Ufeus felsensteini*** **–** Addition (see Lafontaine and Walsh 2013).

933606 ***Xestia perquiritata orca*** **–** New subspecies (see Crabo et al. 2013).

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Gondysia preceeded *Neadysgonia* (Lepidoptera, Erebidae, Erebinae), a new generic synonymy from Southeastern United States – Corrigendum

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In the paper cited, a list of taxa was included to summarize the taxonomic changes resulting in the synonymy of *Neadysgonia* Sullivan, 2010, with *Gondysia* Berio, 1965. A formatting change in the taxonomic changes on the list in page proof stage resulting in all the changes being shown as new synonymies instead of both new synonymies. The corrected list is given below:

Gondysia Berio, 1955
Parallelia, Auct. *nec* Hb., 1818
Neadysgonia Sullivan, 2010, **syn. n.**

consobrina (Gn., 1852), **comb. n.**
redditura (Walker, 1858)
pertorrida Berio, 1955, **syn. n.**

similis (Gn., 1852), **comb. n.**
apicalis (Gn., 1852)
concolor (Grt., 1893)

smithii (Gn., 1852), **comb. n.**

telma (Sullivan, 2010), **comb. n.**

Reference

Sullivan JB, Legrain A (2011) *Gondysia* preceeded *Neadysgonia* (Lepidoptera: Erebidae: Erebinae), a new generic synonymy from Southeastern United States. ZooKeys 149: 103–106. doi: 10.3897/zookeys.149.1747