

# **Contributions to the systematics of New World macro-moths II**

Editted by

B. Christian Schmidt & J. Donald Lafontaine



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CONTRIBUTIONS TO THE SYSTEMATICS OF NEW WORLD MACRO-MOTHS II

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## Contents

- I Editorial**  
*B. Christian Schmidt, J. Donald Lafontaine*
- 3 A review of the subfamily Anobinae with the description of a new species of *Baniana* Walker from North and Central America (Lepidoptera, Erebidae, Anobinae)**  
*J. Donald Lafontaine, J. Bruce Walsh*
- 13 Review of the *Catocala delilah* species complex (Lepidoptera, Erebidae)**  
*David C. Hawks*
- 37 Systematics of moths in the genus *Catocala* (Lepidoptera, Erebidae) IV. Nomenclatorial stabilization of the Nearctic fauna, with a revised synonymic check list**  
*Lawrence F. Gall, David C. Hawks*
- 85 A new genus and species for *Dysgonia* (Lepidoptera, Erebidae, rebinae) from Southeastern United States**  
*J. Bolling Sullivan*
- 99 Taxonomic reassessment of *Zale lunifera* (Hübner) (Erebidae, Erebiniae)**  
*B. Christian Schmidt*
- 107 Larva and pupa of *Amyna axis* (Guenée, 1852) and affirmation of its taxonomic placement in Bagisarinae (Lepidoptera, Noctuidae)**  
*David L. Wagner, Shawn Binns*
- 117 Review of the North American species of *Marimatha* Walker with descriptions of three new species (Lepidoptera, Noctuidae, Eustrotiinae) and the description of *Pseudomarimatha flava* (Noctuidae, Noctuinae, Elaphriini), a new genus and species confused with *Marimatha***  
*Clifford D. Ferris, J. Donald Lafontaine*
- 137 Review of the New World genera of the subfamily Acontiinae (Lepidoptera, Noctuidae)**  
*J. Donald Lafontaine, Robert W. Poole*

- 161 The North American species of *Charadra* Walker, with a revision of the *Charadra pata* (Druce) group (Noctuidae, Pantheinae)**  
*B. Christian Schmidt, Gary G. Anweiler*
- 183 *Cucullia umbratica* (Lepidoptera, Noctuidae), a new European noctuid in North America**  
*Louis Handfield, Daniel Handfield*
- 187 A revision of the genus *Bryolymnia* Hampson in North America with descriptions of three new species (Lepidoptera, Noctuidae, Noctuinae, Elaphriini)**  
*J. Donald Lafontaine, J. Bruce Walsh, Richard W. Holland*
- 205 Review of the Nearctic species of *Enargia* Hübner, [1821] (Noctuidae, Noctuinae, Xylenini)**  
*B. Christian Schmidt*
- 225 A revision of the genus *Hypotrix* Guenée in North America with descriptions of four new species and a new genus (Lepidoptera, Noctuidae, Noctuinae, Eriopygini)**  
*J. Donald Lafontaine, Clifford D. Ferris, J. Bruce Walsh*
- 255 Two new species of the *Euxoa westermanni* species-group from Canada (Lepidoptera, Noctuidae, Noctuinae)**  
*J. Donald Lafontaine, James T. Troubridge*
- 263 New species of the Neotropical genus *Camptonema* Jones (Geometridae, Ennominae) with the first description of the female**  
*J. Bolling Sullivan*

## Contributions to the systematics of New World macro-moths II

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This special issue of ZooKeys, “Contributions to the systematics of New World macro-moths II” marks the second volume in this series that was initiated in May 2009 (Schmidt and Lafontaine 2009). As in the previous volume, the focus here is on the North American Noctuoidea with the goal of having as complete and updated a classification of this fauna as possible for a new check list of the Noctuoidea of North America (Lafontaine and Schmidt 2010). Fifteen authors contributed 15 manuscripts for this volume, which includes the description of three new genera, 23 new species, and four new subspecies. Also, 64 new or revised synonyms, 13 new or revised statuses, and 125 new or revised generic combinations are proposed herein.

A total of 22 authors contributed to the first two volumes of “Contributions” and the list of areas needing taxonomic revision continues to grow, so plans for a third volume are already underway. Expansion of coverage to other taxonomic groups and the Neotropics is anticipated in subsequent volumes. Interested authors are encouraged to contact us.

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

# A review of the subfamily Anobinae with the description of a new species of *Baniana* Walker from North and Central America (Lepidoptera, Erebidae, Anobinae)

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## Abstract

A new species of *Baniana* Walker related to *B. gobar* Druce is described from Arizona and Costa Rica and the status of *Baniana*, *Anoba* Walker, and the Anobinae are discussed. Adults and/or genitalia of *Anoba trigonoides* Walker, *Anoba* sp. *trigonoides* group, *Baniana significans* Walker, *B. minor* sp. n., *B. gobar*, and *Deinopa delinquens* (Walker) are illustrated.

## Keywords

Taxonomy, Anobinae, *Anoba trigonoides*, *Baniana minor*, *Baniana gobar*, *Baniana significans*, *Deinopa*, Arizona, Costa Rica, Dominican Republic, Mexico, Venezuela

## Introduction

The Anobini was proposed by Holloway (2005) for *Anoba* Walker and related genera that share various features of habitus and genital structure. Several genera are sexually dimorphic, so the males and females were sometimes described as separate species. An undescribed species of *Baniana* Walker occurs from Arizona to Costa Rica, so the subfamily and associated genera are briefly diagnosed in order to include the Anobinae and the genera *Baniana* and *Deinopa* Walker in the North American check list (Lafontaine and Schmidt 2010).

## Materials and methods

### Repository abbreviations

Specimens were examined from the following collections:

- BMNH** The Natural History Museum (statutorily, British Museum (Natural History)), London, UK
- CDF** Personal Collection of Clifford D. Ferris, Laramie, Wyoming, USA.
- CNC** Canadian National Collection of Insects, Arachnids, and Nematodes, Ottawa, Ontario, Canada.
- JBS** Personal collection of J. Bolling Sullivan, Beaufort, North Carolina, USA.
- JBW** Personal collection of J. Bruce Walsh, Tucson, Arizona, 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).

### Subfamily Anobinae Holloway, 2005, stat. rev.

Type genus: *Anoba* Walker, 1858

The classification of the recently proposed subfamily Anobinae (Holloway 2005) is poorly understood. It appears that none of the genera is shared by the New World and Old World faunas, in spite of strikingly similar appearances among some species and current generic assignments. In the New World the generic classification is very confused. Four genera are associated with Anobinae in the New World: *Anoba* Walker, *Baniana* Walker, *Deinopa* Walker, and *Lephana* Walker. In all genera of Anobinae the head and prothoracic collar are dark and contrast with the color of the thorax, and the middle of the male valva has a lightly sclerotized “window,” usually in the same area as the clasper. Males have bipectinate antennae, or the seta on each side of the flagellomeres is enlarged giving the impression that the antenna is narrowly bipectinate.

Of 41 species associated with the genus *Anoba* by Poole (1989), only seven occur in the New World and only three of these are referable to *Anoba* (*A. pohli* (Felder & Rogenhofer), *A. trigonoides* Walker [the type species of *Anoba*], and *A. uncifera* Hampson). Two others belong to *Baniana* (*B. crucilla* (Schaus) comb. n. and *B. firmalis* (Guenée), comb. n.), with the remainder belonging elsewhere. All of the Old World species need to be relegated to Old World genera.

Of 44 species listed in *Baniana* by Poole, 34 occur in the New World, but only five of these are referable to *Baniana* (*B. gobar* Druce, *B. haga* Schaus, *B. inaequalis* Walker, *B. significans* Walker [the type species of *Baniana*], and *B. triangulifera* Dognin). Most of the remaining 29 New World species belong to the *Deinopa* generic complex.

Poole lists 17 species of *Deinopa* of which 13 occur in the New World. These 13, together with most of the 29 species currently misplaced in *Baniana*, form a generic complex that has not yet been resolved. As an example of the structural heterogeneity of the group, the male genitalia of *Deinopa delinquens* Walker, type species of the generic "synonym" *Poesula* Walker, is illustrated (Fig. 10).

Poole lists six species of *Lephana*, although additional species are misplaced in other genera. *Lephana* is characterized by the prominently falcate forewing apex, and a triangular patch of scales projecting below the hind margin of the forewing wing at the antemedial line.

Among the New World Anobinae, species in the genus *Baniana* are likely to be confused only with those in *Anoba*. In both genera the male antenna is bipectinate, the forewing is broadly triangular with a slightly falcate apex, there is a velvety-black patch on the outer margin of the antemedial (am) line. The two genera are most easily separated according to sex, because *Anoba* is sexually dimorphic.

In *Baniana* males (Figs 3, 4, 6, 7) the black patch on the outer side of the antemedial line is largest near the middle of the line, and the postmedial (pm) line is deeply incurved near the middle of the wing to a position below the reniform spot with dark shading along the outer margin of the line. The female (Figs 5, 8) is similar in pattern to the male, but the antennal flagellomeres are bead-like, not bifasciculate.

In the male of *Anoba* (Fig. 1) the black patch in the medial area forms a triangle (one side on the am line, one on the posterior margin of wing, and one from the am line to the pm line); the pm line is similar to those of *Baniana* males. In the female of *Anoba* (Fig. 2) the black patch on the am line is similar to that in *Baniana* males, but the pm line is straight or slightly sinuate and without dark shading in subterminal area.

### ***Baniana* Walker, 1858**

Type species. *Baniana significans* Walker, 1858 by monotypy.

**Diagnosis. Adults.** Males and females of similar size and pattern; forewing length 7–15 mm. *Head* – Labial palpus with third segment short and rounded, 0.20–0.25 × as long as second segment. Lower frons usually denuded of scales. Male antenna bipec-

minate; female antenna bead-like, appearing slightly biserrate dorsally because scales on shaft flare out anteriorly over base of flagellomeres. Head and prothoracic collar black, dark brown, or reddish brown, contrasting with brown or gray color of thorax. *Thorax* – Tibia without spiniform setae; tibia smoothly scaled with longer hair-like scales but without hair pencils. Forewing broad and triangular, apex slightly falcate; antemedial line with black lobe or enlargement near middle of outer side; postmedial line curved inward and upward to touch bottom of reniform spot; reniform spot reduced to two black dots, sometimes connected; orbicular spot, if present, a small black dot. Hindwing fuscous. *Male genitalia* – Upper part of tegumen enlarged into hood-like posterior projection; uncus elongate, with projecting flanges or processes. Valva with heavily sclerotized plates, flanges, or processes on costal and/or ventral margin of valve; central part of valva with lightly sclerotized translucent “window;” valve tapered from base to apex and arching downward; clasper vestigial, a sclerotized plate in middle of valve distal to sacculus. Aedeagus varies from short and stout to slender and curved; vesica with numerous spinulose diverticula. *Female genitalia* – Corpus bursae very long with narrow posterior  $3/4$  resembling a ductus bursae; ductus seminalis at posterior end of ductus bursae on short appendix bursae; posterior part of ductus bursae sclerotized or with longitudinal sclerotized ridges; ostium and ductus bursae sclerotized; ostial opening on anterior margin of abdominal segment 8 (A8). A8 lightly sclerotized except for two postvaginal sclerotized plates in ventral wall of A8. Anterior apophyses slightly shorter than A8; posterior apophyses slightly longer than A8. Anal papillae as long as lateral width, truncated posteriorly, covered with short setae.

**Included species.** *Baniana firmalis* (Guenée), *B. gobar* Druce, *B. haga* Schaus, *B. inaequalis* Walker [= *B. crucilla* (Schaus), syn. n.], *B. minor* Lafontaine & Walsh, sp. n., *B. significans* Walker, and *B. triangulifera* Dognin.

### Key to species of *Baniana*

1. Postmedial line only slightly incurved below reniform spot; French Guiana, Brazil ..... ***B. inaequalis***
- Postmedial line markedly incurved below reniform spot and bending upward toward reniform spot ..... **2**
2. Black shading on antemedial line merely an enlarged dark area tapered slightly to posterior margin of wing ..... **3**
- Black shading on antemedial line forming large rounded or wedge-shaped lobe extending into medial area from middle of antemedial line ..... **4**
3. Black shading on antemedial line prominent from costal margin of wing to posterior margin; ground color of forewing brown; French Guiana ..... ***B. firmalis***
- Black shading on antemedial line tapered to thin line toward costal margin of wing; ground color of forewing gray; Costa Rica ..... ***B. haga***
4. Postmedial line covering reniform spot (i.e., no black dots above pm line); Argentina ..... ***B. triangulifera***
- One or two black dots above postmedial line at position of reniform spot ..... **5**



5. Two black dots representing reniform spot (Fig. 3); forewing length: 12–14 mm; Dominican Republic ..... ***B. significans***
- One black dot representing reniform spot; forewing length: 8–10 mm ..... **6**
6. Black lobe on antemedial line extending about 1/2 distance to postmedial line (Figs 7, 8); uncus with dorsal crest-like ridge at 1/4 from base (Fig. 12); posterior part of corpus bursae with longitudinally sclerotized ridges (Fig. 14); Durango, Mexico to Guanacaste, Costa Rica ..... ***B. gobar***
- Black lobe on antemedial line extending about 1/4 distance to postmedial line (Figs 4–6); uncus with finger-like process ventrally at 1/3 from base (Fig. 11); posterior part of corpus bursae evenly sclerotized (Fig. 13); south-eastern Arizona to Costa Rica..... ***B. minor***

## Systematics

### *Baniana minor* Lafontaine & Walsh, sp. n.

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Figs 4–6, 11, 13

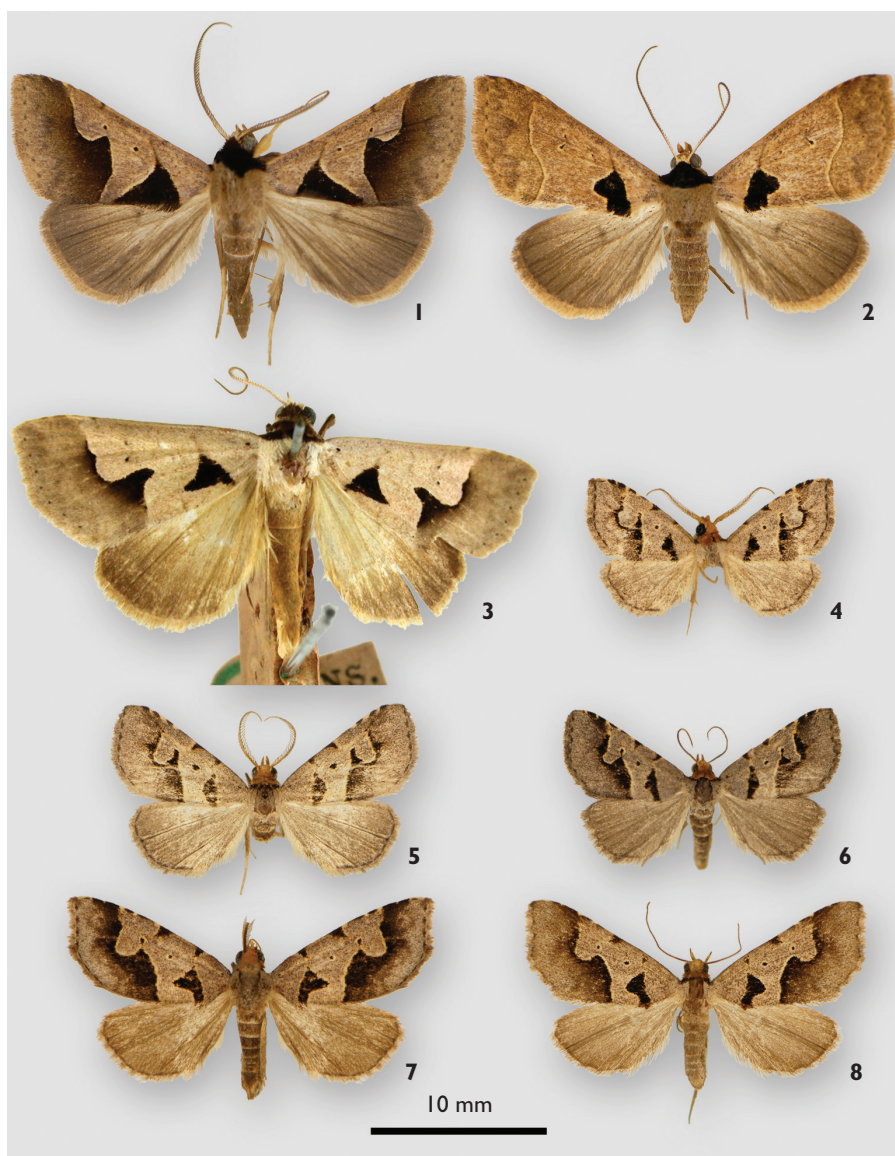
**Type material.** **Holotype** male. Arizona, Santa Cruz Co., 4900', Patagonia Mts., Harshaw, UV/MV light, oak and mesquite grassland habitat, 29 Aug. 2006, B. Walsh leg., CNC Noctuoidea slide 15866, Barcode of Life voucher CNC Noctuoidea NOC14005. CNC. **Paratypes:** 2 ♂, 4 ♀. **USA, Arizona.** Same locality and collector as for holotype, 27, 28 Aug. 2007 (2 ♂), 13 July 2008 (3 ♀), J. B. Walsh leg.; Santa Cruz Co., Patagonia Mts., Harshaw area, 30 Aug. 2005, H. Grisham (1 ♀). Paratypes deposited in CDF, CNC, JBW.

**Other material examined:** Costa Rica, Guanacaste Prov., Santa Rosa National Park, 29–30 April 1980, D.H. Janzen & W. Hallwachs (1 ♂). Costa Rica, Area de Conservacion de Guanacaste: Hotel Borinquen, 22 Sept. 2006, F. Quesada & H. Cambronero (1 ♀); Sector Santa Rosa, 25 May 2007 (1 ♀); Sector Mundo Nuevo, 13 Nov. & 9 Dec. 2007 (2 ♀), R. Franco & H. Cambronero.

**Etymology.** The species name *minor* refers to the small size of this species of *Baniana*.

**Diagnosis.** *Baniana minor* can be recognized by its small size (forewing length: 8–9 mm), the relatively short bulging black area near the middle of the antemedial line, and by the ventral subbasal process on the ventral margin of the uncus. Other differences in *B. gobar* are given in brackets in the description of *B. minor*.

**Description. Adults.** Male and female similar in size, color, and maculation. Forewing length: 8–9 mm. **Head** – Male antenna bipectinate, with longest rami 4 × as wide as central shaft; apical seta long, 2 × as long as central shaft and 1/2 as long as rami. Female antenna bead-like, constricted between segments. Palpi appearing laterally flattened and blade-like with scale row ventrally and dorsally; apical segment short and rounded, 0.20–0.25 × length of second segment. Scales narrow and strap-like,

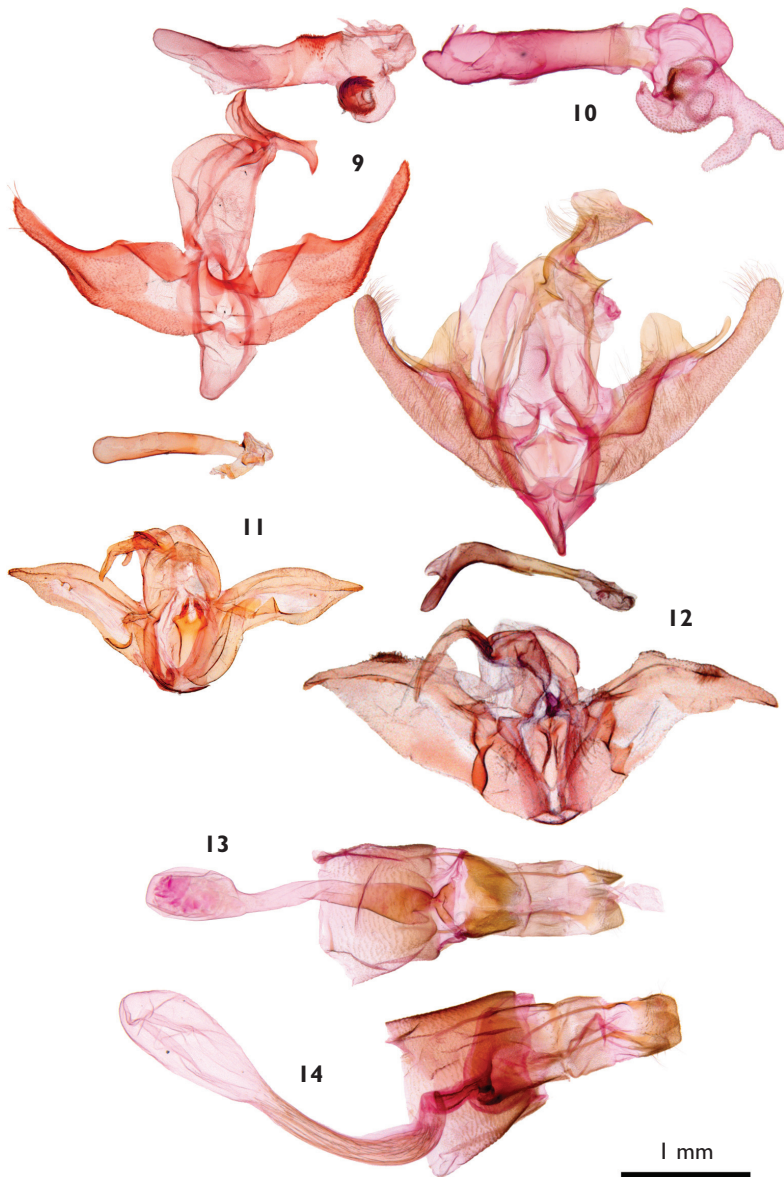


**Figures 1–8.** Adults of Anobinae. **1** *Anoba* sp. *trigonoides* species complex, male (Paraguari, Paraguay) **2** *Anoba* sp. *trigonoides* species complex, female (Itapua, Paraguay) **3** *Baniana significans* male holotype (Santo Domingo, Dominican Republic) **4** *Baniana minor* male (Guanacaste, Costa Rica) **5** *Baniana minor* male paratype (Santa Cruz Co., Arizona, USA) **6** *Baniana minor* female paratype (Santa Cruz Co., Arizona, USA) **7** *Baniana gobar* male (Puebla, Mexico) **8** *Baniana gobar* female (Puebla, Mexico).

yellow brown on labial palpi and head, and reddish orange on prothoracic collar. *Thorax* – Covered with narrow strap-like scales, forming black transverse band posterior to prothoracic collar, pale gray brown elsewhere. *Legs*: Foretibia covered with pale reddish-brown scales; scales on middle and hind tibiae and tarsi with pale gray-brown scales

with scattered dark-brown scales. Tibia without spiniform setae and without long tufts of scales. *Wings*: Dorsal forewing mainly gray with scattered brown scales; basal line absent; antemedial line with straight inner margin, outer margin bulging into medial area between anal and cubital vein, line obsolete in upper part of cell but reappearing as dark wedge on costa; second wedge-shaped spot on costa at position of medial line; orbicular spot a black dot in cell between two wedges on costa; reniform spot a black dot or teardrop-shaped spot above curve in postmedial line; postmedial line extending down from costa, parallel to outer margin of wing, curving abruptly inward at vein M3, then upward to touch or almost touch reniform spot, then extending down to posterior margin of wing slightly beyond middle of hind margin; postmedial line black with sharply-defined inner margin but diffuse outwardly with black and brown scales fading to mainly pale-gray scales in most of subterminal and terminal area; terminal line black, slightly enlarged between veins, broken at position of veins; fringe a mixture of pale-gray and dark-gray scales. Hindwing fuscous, slightly paler toward wing base in males; terminal line dark gray; fringe fuscous. *Male genitalia* – Uncus: basal  $2/3$  cylindrical with low, sclerotized mid-dorsal ridge [basally “winged” with lateral carinae in *B. gobar*]; a curved finger-like lobe projecting from ventral surface at  $1/3$  from base [absent in *B. gobar*]; apical  $1/3$  of uncus abruptly bent downward with apex dorsoventrally flat [evenly curved in *B. gobar*]. Tegumen broad, hood-like, projecting posteriorly. Saccus very short, with pointed anterior process. Juxta elongated, somewhat V-shaped with lower (anterior) extension tapered and lightly sclerotized; upper (posterior) extension divided into two heavily sclerotized processes covered with spines [spines absent in *B. gobar*]. Valve broad basally, evenly tapered and down-curved to apex; setose clavi-like process at base of costal margin of valve projecting  $1/2$  distance across valve [projecting  $1/4$  distance in *B. gobar*]; curved carina at apex of sacculus on left valve, angled and near middle of valve on right side [carinae at apex of sacculi on both valves but asymmetrical in *B. gobar*]; costal margin of valve evenly convex [costal margin with serrated fin-like process near middle and setose lobe at  $3/4$  in *B. gobar*]. Aedeagus cylindrical and straight [curved through 90 degree angle at  $1/3$  from base and tapered to apex in *B. gobar*]. *Female genitalia* – Corpus bursae very long,  $8 \times$  long as ductus bursae, but posterior  $3/4$  long and narrow, resembling a ductus bursae; ductus seminalis at posterior end of corpus bursae on a small appendix bursae; ductus bursae constricted to  $1/2$  width immediately posterior to ostium bursae; ostium bursae, ductus bursae, and posterior  $1/4$  of corpus bursae sclerotized. Abdominal segment eight (A8) lightly sclerotized except for two large triangular heavily-sclerotized postvaginal plates, tapered posteriorly and partially fused where they meet. Posterior apophyses  $2 \times$  as long as lateral length of A8 and  $1.5 \times$  as long as anterior apophyses. Anal papillae as long as lateral width, truncated posteriorly, covered with short setae.

**Distribution and biology.** *Baniana minor* occurs in open woodland/grassland scrub habitat in southeastern Arizona and also occurs, probably in similar habitat in Guanacaste Province, Costa Rica. Adults have been collected between mid-July and late August in Arizona. Costa Rican records are from April, May, September, November, and December.



**Figures 9–14.** Genitalia of Anobinae. **9** *Anoba trigonoides*, male genitalia (Lara, Venezuela) **10** *Deinopa delinquens*, male genitalia (Amazonas, Brazil) **11** *Baniana minor*, male genitalia (Santa Cruz Co., Arizona, USA) **12** *Baniana gobar*, male genitalia (Sinaloa, Mexico) **13** *Baniana minor* female genitalia (Santa Cruz Co., Arizona, USA) **14** *Baniana gobar*, female genitalia. (Sinaloa, Mexico)

**Remarks.** Singleton specimens of undescribed species from Veracruz, Mexico and Guanacaste, Costa Rica, indicate that there are several additional undescribed species of *Baniana* in southern Mexico and Central America.

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# Review of the *Catocala delilah* species complex (Lepidoptera, Erebidae)

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## Abstract

The members of the Nearctic *Catocala delilah* species complex are reviewed. One new species (*C. caesia*) and four new subspecies are described, one subspecies is reinstated to specific rank (*C. desdemona*), and one species and three subspecies are placed into synonymy. A neotype is designated for *C. calphurnia* and a lectotype is designated for *C. desdemona*.

## Keywords

Lepidoptera, Erebidae, *Catocala*, southwestern USA, California, Arizona, *Quercus*, oaks

## Introduction

In their monograph of the North American *Catocala*, Barnes and McDunnough (1918) subdivided the genus into 20 “Groups” based on morphological characteristics. They included four species with primarily southwestern geographical distributions in their Group XII (the *Catocala delilah* species complex), acknowledging that little information was known of the species and that the placement was provisional. Four additional species in the *delilah* complex were described subsequent to Barnes and McDunnough’s time, and the monophyly of the complex, species’ boundaries, relationships, and life histories of these taxa were examined by Hawks (1986).

This paper summarizes recent taxonomic work on the *delilah* complex, with descriptions of one new species and four new subspecies: *Catocala caesia* Hawks sp. n., *C. benjamini jumpi* Hawks ssp. n., *C. benjamini mayhewi* Hawks ssp. n., *C. chelidonia occidentalis* Hawks ssp. n., and *C. chelidonia uniforma* Hawks ssp. n. Also, *Catocala desdemona* is reinstated to species status, *C. delilah utahensis* and *C. ixion* are placed in synonymy with *C. desdemona*, *C. andromache wellsi* is placed in synonymy with *C. andromache*, and *C. mcdunnoughi browerorum* is placed in synonymy with *C. mcdunnoughi*.

Institutional acronyms follow Arnett et al. (1993): AMNH = American Museum of Natural History, New York; BMNH = The Natural History Museum, London; CMNH = Carnegie Museum of Natural History, Pittsburgh; CNC = Canadian National Collection of Insects, Ottawa; FMNH = Field Museum of Natural History, Chicago; MCZ = Museum of Comparative Zoology, Cambridge (USA); PMNH = Peabody Museum of Natural History, New Haven; USNM = United States National Collection, Smithsonian Institution, Washington; ZMHU = Museum für Naturkunde, Humboldt University, Berlin.

### Checklist of the *Catocala delilah* species complex

- C. delilah*** Strecker, 1874
  - adoptiva* Grote, 1874
  - calphurnia* H. Edwards, 1880
  - umbella* Barnes & Benjamin, 1927
- C. desdemona*** H. Edwards, 1882, **stat. rev.**
  - ixion* Druce, 1890, **syn. n**
  - utahensis* Cassino, 1918, **syn. n**
  - swetti* Barnes & Benjamin, 1927
  - umbra* Barnes & Benjamin, 1927
- C. caesia*** Hawks, 2010, **sp. n.**
- C. frederici*** Grote, 1872
- C. benjamini*** Brower, 1937
  - a. *benjamini* Brower, 1937
  - b. *ute* Peacock & Wagner, 2009
  - c. *jumpi* Hawks, 2010, **ssp. n.**
  - d. *mayhewi* Hawks, 2010, **ssp. n.**
- C. andromache*** H. Edwards, 1885
  - wellsi* Johnson, 1983, **syn. n.**
- C. californiensis*** Brower, 1976
- C. johnsoniana*** Brower, 1976
- C. mcdunnoughi*** Brower, 1937
  - browerorum* Johnson, 1983, **syn. n.**
- C. chelidonia*** Grote, 1881
  - a. *chelidonia* Grote, 1881



b. *occidentalis* Hawks, 2010, **ssp. n.**

c. *uniforma* Hawks, 2010, **ssp. n.**

### Key to adults of the *Catocala delilah* species complex

1. Forewing with conspicuous basal dash; subreniform open..... *johnsoniana*
- Basal dash absent, or small and inconspicuous; subreniform usually closed 2
2. Dorsal hindwing with thin black line along margin between M1 and ScR1 dividing apical spot; ventral hindwing apical area invaded by black..... 3
- Apical areas not as above ..... 4
3. Dorsal forewing even charcoal or ashy gray ..... *chelidonia*
- Dorsal forewing mostly brown, mottled with dark patches..... *mcdunnoughi*
4. Two teeth of PM line pointing outward near M1 and M2, third tooth pointing inward near 2A at least twice as long as other teeth; generally large species, forewing costal margin length circa 28–31 mm..... 5
- All teeth of PM line similar in size, none conspicuously longer than others; smaller species, forewing costal margin circa 19–26 mm ..... 6
5. AM line thick at costa, gradually becoming thin toward inner margin, or appearing “beaded” due to alternating thick and thin areas; dorsal forewing surface usually evenly brown; dorsal hindwing with bands brownish orange; edges of apical spot on ventral hindwing usually not well defined ..... *delilah*
- AM line thick at costa, abruptly becoming thin near radial vein and near inner margin, not conspicuously “beaded;” dorsal forewing highly variable, usually mottled grayish brown; bands of dorsal hindwing yellowish orange; edges of apical spot on ventral hindwing usually well defined..... *desdemona*
6. Undersides of forewings and hindwings boldly marked with yellow and black; apex and fringe of ventral forewing yellowish gray with few dark scales; apical hindwing spot yellow, sharply defined; fringes mostly yellow ..... 7
- Yellow areas of ventral wings often smeared with dark scales; apex of ventral forewing infused with dark scales; apical hindwing spot not sharply defined, ventral fringes conspicuously checkered ..... 8
7. Dorsal forewing even green to blue gray, black scales nearly absent .... *frederici*
- Dorsal forewing mottled blue, gray, brown, and black..... *caesia*
8. Dorsal forewing even ashy gray with black lines; AM line thick; dark patch between reniform, subreniform, and PM line usually conspicuous ..... *californiensis*
- Dorsal forewing mottled with brown, lines indistinct; AM line usually thin, indistinct; dark patch usually not conspicuous ..... 9
9. Dorsal forewing varies from mottled to even brown or gray brown, not speckled with green or bluish-gray scales; ventral hindwing yellowish tan with narrow (1–2 mm) black inner band; few dark scales at hindwing base ..... *benjamini*
- Dorsal forewing often blackish-gray, variably speckled with green or bluish-gray scales; ventral hindwing yellow to yellow orange with wide (2–4 mm) black inner band; dark scales usually present at hindwing base.... *andromache*

## Taxonomic accounts

### *Catocala delilah* Strecker

Figs 1, 3

*Catocala delilah* Strecker, 1874: 96, fig. 7, pl. XI.

*Catocala adoptiva* Grote, 1874: 96.

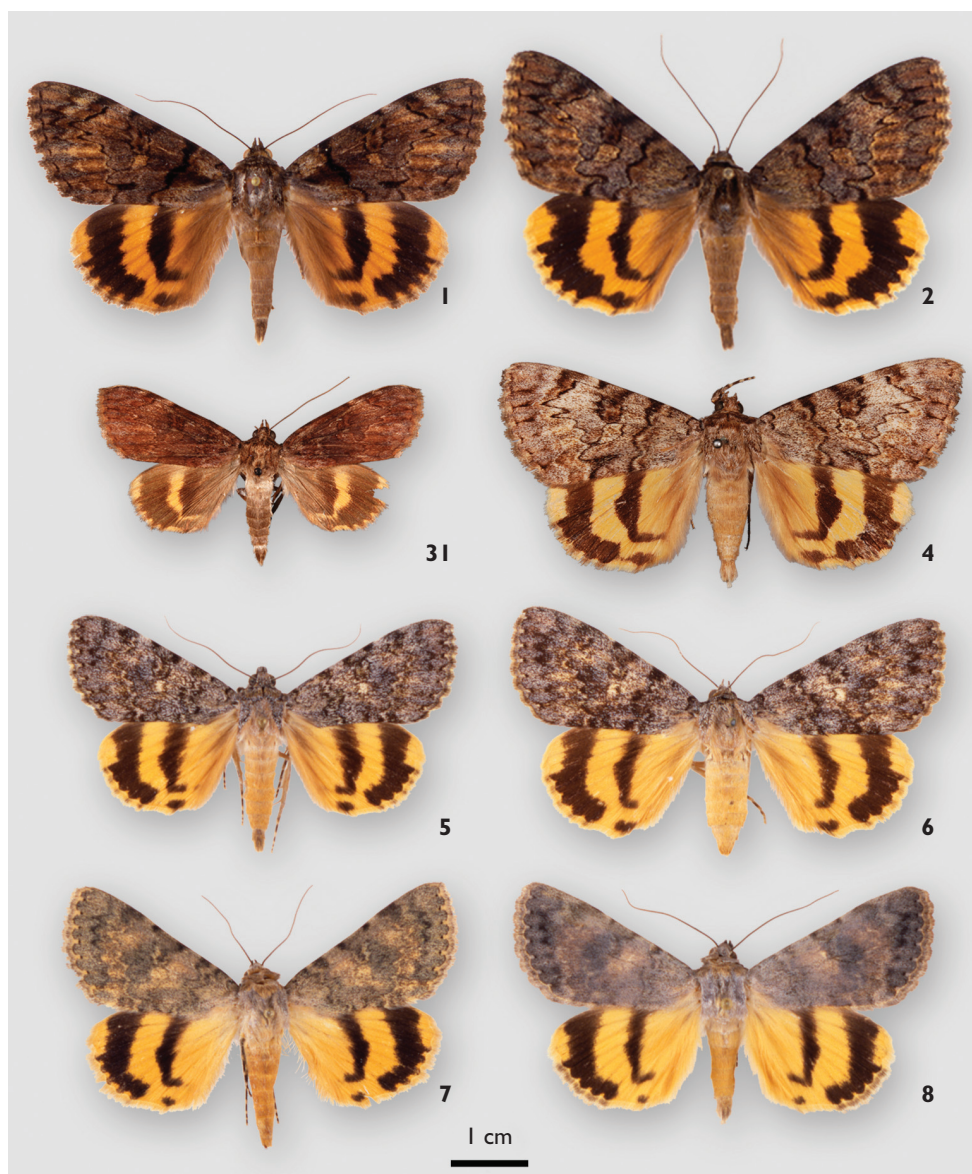
*Catocala calphurnia* H. Edwards, 1880: 59.

*Catocala delilah* form *umbella* Barnes & Benjamin, 1927: 7

**Type material.** *Catocala delilah*: lectotype ♂ [FMNH, examined], designated by Gall and Hawks (1990: 8). Type locality: [Dallas], Texas, [USA]. *Catocala adoptiva*: lectotype ♂ [MCZ, examined], designated by Gall (1990: 121). Type locality: Dallas Co[unty], Texas, [USA]. *Catocala calphurnia*: **neotype** ♂ [PMNH specimen #ENT 718629, examined], hereby designated to promote taxonomic stability (Fig. 3). Type locality: Burnet Co[unty], Texas, [USA]. The neotype bears the labels “Burnett [sic] Co. / Texas”, “Presented by / HERMAN PAUL WILHELM / October 1970”, “*Catocala / delilah* / Stkr. / det. / D.C.Hawks 1986.” *Catocala delilah* form *umbella*: holotype ♂ [USNM, examined], unavailable infra-specific name proposed as a color form. Type locality: Kerrville, Texas, [USA].

**Taxonomic remarks.** The original description of *Catocala calphurnia* states “the primaries are of a wholly greenish tinge, and not bright brown... secondaries are wholly black, with the exception of a small central cloud... Exp. wings, 2.10 inch. Kansas. Type, coll. Dr. James S. Bailey.” Beutenmüller stated (1907: 149): “The type of this form [*calphurnia*] is a female in the collection of the late Dr. James Bailey, Albany, New York, and was examined by me. The specimen looks suspiciously like an exotic species allied to the European *nymphaea* Esper or it is an undersized aberration of *Catocala delilah*. The fore wings are almost completely uniform dark brown...” Barnes and McDunnough (1918: 33) stated: “We know nothing regarding *calphurnia* Hy. Edwards, described from a single specimen in the Bailey Collection ostensibly from Kansas; according to Beutenmüller, the species may be either European or an aberration of *delilah*; we leave it as the latter for the present.” The type of *calphurnia* has not been located, and the Bailey collection has apparently been lost. The potential confusion with Palearctic *Catocala* threatens nomenclatorial stability, hence the neotype designation. The neotype is one of three dwarfed and perhaps reared *Catocala delilah* specimens from the Wilhelm collection, with uniformly dark forewings and the yellowish basal area of the hindwing suffused with dark brown. The neotype thus agrees closely with Henry Edwards’ original description as well as with Beutenmüller’s assessment. The type locality is hereby amended from the original Kanss, [USA] on the basis of the neotype labels.

**Diagnosis.** One of the two largest species in the complex, with mean forewing costal margin length 27.1 mm (♂), 30.5 mm (♀). The only species similar to *C. delilah* is *C. desdemona*. Both are similar in size, with a brown thorax, but *C. desdemona* has a paler and more yellowish abdomen that contrasts with the thorax. The forewing antemedial line is wide (ca. 2 mm) at the costa in both species, but in *C.*



**Figures 1–8.** Adults of *Catocala*. **1** *C. delilah* Strecker **2** *C. desdemona* H. Edwards **3** neotype, *C. calphurnia* H. Edwards **4** lectotype, *C. desdemona* H. Edwards **5** holotype, *C. caesia* Hawks **6** allotype, *C. caesia* Hawks **7, 8** *C. frederici* Grote.

*desdemona* it abruptly becomes thin just past the radial vein; in *delilah* the line becomes thinner gradually. The brown line just basal to the antemedial line is usually less conspicuous in *C. delilah*. In contrast to *C. delilah*, the forewings of almost all specimens of *C. desdemona* are speckled with white or yellow scales, which gives the wings a distinctly gray cast.

**Distribution and biology.** Southern USA from south-central Texas to Kansas, and eastward (mostly coastally) to Florida. County records for USA are as follows. ARKANSAS: Washington; KANSAS: Douglas, Leavenworth; OKLAHOMA: Comanche, Carter, Creek, Mays, Oklahoma, Pittsburg, Pottawattamie, Payne; NEBRASKA: Gage; TEXAS: Anderson, Bastrop, Bee, Bexar, Blanco, Brazos, Burnet, Comal, Dallas, Erath, Harris, Hays, Kerr, Kimble, Medina, Montague, Robertson, San Patricio, Washington; MISSOURI: Greene, Organ; ILLINOIS: Adams, Jackson, Union; TENNESSEE: Morgan; MISSISSIPPI: Oktibbeha; GEORGIA: Macintosh; FLORIDA: Citrus, Dixie, Hernando, Hillsborough, Jackson, Lake, Lane, Levy, Orange, Putnam, Seminole; KENTUCKY: (no county). Adults fly from May to July, with most records from May and June. Larvae of *C. delilah* have been collected from *Quercus virginiana* Mill. (in Texas and Florida), *Q. fusiformis* Small (Texas), and *Q. laurifolia* Michx. (Texas).

***Catocala desdemona* H. Edwards, stat. rev.**

Figs 2, 4

*Catocala desdemona* H. Edwards, 1882: 15.

*Catocala ixion* Druce, 1890: 360, **syn. n.**

*Catocala delilah* form *utahensis* Cassino, 1918: 14, **syn. n.**

*Catocala delilah utahensis* form *swetti* Barnes and Benjamin, 1927: 8

*Catocala delilah desdemona* form *umbra* Barnes and Benjamin, 1927: 8

**Type material.** *Catocala desdemona*: **lectotype** ♂ [USNM, examined], hereby designated to promote taxonomic stability (Fig. 4). Type locality: Prescott, Arizona, [USA]. The original description states “Four examples. Prescott, Arizona. I. Doll. Type. Coll. B. Neumoegen.” The lectotype bears the labels “Prescott. / Ariz.”, “Col. / B. Neumoegen.”, “Type / No. / 33991 / U.S.N.M.”, “Catocala / desdemona / Type Hy. Edw.” *Catocala ixion*: holotype ♂ [BMNH, examined]. Type locality: Xucumanatlan, Guerrero, Mexico. *Catocala delilah* form *utahensis*: holotype ♂ [USNM, examined]. Type locality: Provo, Utah, [USA]. *Catocala delilah desdemona* form *umbra*: holotype ♂ [USNM, examined], unavailable infrasubspecific name proposed as a color form. Type locality: Hereford, Arizona, [USA]. *Catocala delilah utahensis* form *swetti*: holotype ♀ [USNM, examined], unavailable infrasubspecific name proposed as a color form. Type locality: Vineyard, Utah, [USA].

**Taxonomic remarks.** The name *ixion* has apparently not been previously tabulated in the Nearctic *Catocala* literature. Druce’s illustration is a good representation of the BMNH holotype, which is a typical specimen of *Catocala desdemona* H. Edwards. Regarding the name *utahensis*, Cassino used the term “race” in the body of the original description, and offered a restricted geographic distribution (Utah), and hence the name has been treated as subspecific (McDunnough 1938; Franclemont and Todd 1983). However, the name *utahensis* refers to a lighter infrapopulational variant of *C. desdemona* with no definable geographic basis.



**Diagnosis.** *Catocala desdemona* has been treated as a subspecies of *C. delilah* since early in the twentieth century. However, *C. delilah* and *C. desdemona* breed true ex ovis, and remain morphologically distinct in a broad area of sympatry in central Texas and Oklahoma. Besides *C. delilah*, no other species is similar to *C. desdemona*. Mean forewing costal margin length 27.2 mm (♂), 29.5 mm (♂); see the species account for *C. delilah* above for points of separation. *C. desdemona* is much more variable in maculation than *C. delilah*, especially in the southern part of its range. The variation is continuous, with the form “umbra” (dark brown patch nearly filling the area between the antemedial and postmedial lines) being just one extreme example.

**Distribution and biology.** *Catocala desdemona* occurs from central Oklahoma and central Texas westward to central Utah, and southward through Mexico to Guatemala and Honduras. It is sympatric with *C. delilah* in central Texas and central Oklahoma. County records for the USA are as follows: OKLAHOMA: Comanche, Carter, Oklahoma, Pittsburg, Pottawattamie, Woods; TEXAS: Bexar, Blanco, Brewster, Brown, Burnet, Coleman, Culberson, El Paso, Hays, Hudspeth, Jeff Davis, Kaufman, Kerr, Kimble, Montague, Real, San Patricio, Taylor, Uvalde, Val Verde, Wise; NEW MEXICO: Bernalillo, Colfax, Dona Ana, Grant, Hidalgo, Lincoln, Sandoval, San Miguel, Sierra, Torrance, Union; UTAH: Davis, Garfield, Grand, Kane, Utah, Washington; COLORADO: Montezuma; ARIZONA: Cochise, Greenlee, Maricopa, Pima, Pinal, Santa Cruz, Yavapai. Records for MEXICO are as follows: SONORA: 3 km S of Mina Trinidad, 9 km W of Yecora, Rancho Tres Rios, km 60 Colonia Mesa Tres Rios to Huachinera; CHIHUAHUA: 4 km S of Temoresi-Cuiteco, Creel; NUEVO LEON: 22 km W. Linares, 6 km W of Iturbide; SINALOA: 11 km W of El Palmito; BAJA CALIFORNIA SUR: 25 km SE of San Antonio, Sierra de La Laguna, Rancho San Antonio de La Sierra; SAN LUIS POTOSI; GUERRERO: Xucumanatlan; MEXICO DF: Zacualpan. Records for GUATEMALA are as follows: Guatemala City. Records for HONDURAS are as follows: CORTÉS, YORO, and OLANCHO departments. Adults emerge from May to November, with peaks of abundance in June and September, at least in the southwestern United States and northern Mexico). This long flight period, especially evident in southeastern Arizona, is apparently due to some eggs hatching in response to the spring growth period of the oaks, while other eggs wait until the summer growth period to hatch. There is no evidence that *C. desdemona* is ever double brooded. Larvae of *C. desdemona* undoubtedly feed on several species of oaks in nature, but so far have only been recorded on *Quercus oblongifolia* Torr. (Huachuca Mountains, Arizona).

***Catocala caesia* Hawks, sp. n.**

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Figs 5, 6

**Type material.** **Holotype** ♂ (Fig. 5, PMNH specimen #ENT 721045): South Fork of Cave Creek, Chiricahua Mountains, Cochise County, Arizona, 28 May 1985, leg. D.

C. Hawks (FW length 23 mm). **Allotype** ♀ (Fig. 6, PMNH specimen #ENT 721046): same locality as holotype, 21 May 1962, leg. L. M. Martin (FW length 25 mm). **Paratypes** (35 ♂ 34 ♀): 6 ♂ 15 ♀ from same locality as holotype late May to mid June, various years and collectors; other localities: ARIZONA: Cochise County: Chiricahua Mountains, 7 km W of Portal (6 ♂ 4 ♀; early to mid-June); Chiricahua Mountains, Southwestern Research Station, 8 km W of Portal (3 ♂ 2 ♀; mid-June and early Sept.); Cochise County: Chiricahua Mountains, Sunny Flat Campground, 11–12 June 2007, M.L. Raschko (2 ♂); Dragoon Mountains, Cochise Stronghold (1 ♂; 8 June 1967); Huachuca Mountains, Ash Canyon (2 ♂; 13 Aug. 1967, 7 Oct. 1968); Huachuca Mountains, Carr Canyon (1 ♂; 27 Sept. 1967); Huachuca Mountains, Miller Canyon (1 ♂; 13 Oct. 1967); Huachuca Mountains, Ramsey Canyon (3 ♂; 15 July 1968, 25 July 1967, 13 Oct. 1967); Peloncillo Mountains, Cottonwood Canyon (2 ♂ 2 ♀; 31 May 1979; leg. P. M. Jump); Pima County: Santa Rita Mountains (1 ♂; June). NEW MEXICO: Hidalgo County: Peloncillo Mountains, Clanton Draw (1 ♀; 6 June 1979, leg. P. M. Jump). MEXICO: CHIHUAHUA: Creel (7 ♂ 6 ♀; mid-July to late-August); Sierra del Nido, Arroyo del Mesteno (1 ♀; 21 July 1959); Madera, Cerro de la Concha, 29 July 2009, D.L. Wikle (3 ♀). Holotype and allotype deposited at PMNH, paratypes deposited at LACM and other USA museums as well as in private collections.

**Diagnosis.** Most closely related to *C. frederici*. The ventral surface of the forewing and both surfaces of the hindwing are nearly identical in *C. caesia* and *C. frederici*, although *C. frederici* tends to have paler yellow-orange scales and slightly narrower black bands. However, the upper surface of the forewing of *C. frederici* is an even grayish to nearly off-white color, and there are almost no black scales present; all lines are less distinct in *C. frederici* than in *C. caesia*. The forewings are usually browner in *C. benjamini* than in *C. caesia*, although the former also may have a bluish cast; the antemedial and postmedial lines are also more distinct in *C. benjamini*, and the subreniform is sometimes open. The hindwing upperside of *C. benjamini* is a duller orange and more brown scales are present at the base. On the wing undersides, *C. benjamini* always has substantial dusky suffusion, especially on the forewing, and the apex of the forewing is brown. The general appearance of *C. caesia* is also like *C. desdemona*, although *C. caesia* is smaller and can always be separated from *C. desdemona* by the uniform size of the teeth of the postmedial band, and by the pure pale yellowish-tan color of the ventral surfaces (*C. desdemona* has a whitish shade along the costa of the forewing, and usually more dusky suffusion at the apex of the forewing underside).

**Description.** *Head*: eye dark brown; vertex and palpi covered with dark-brown and white scales; antenna 26–28 mm, brown dorsally, reddish brown ventrally. *Thorax*: patagia and tegulae mottled with white, tan, and dark-brown scales, patagia slightly darker; remainder of thorax covered dorsally by tan scales, especially posteriorly; ventrally covered by long thin off-white scales; tibiae clothed mainly with short, pale-tan scales, speckled with brown scales; mid-section of tibiae with brush of medium to long, straight, off-white and tan scales; tarsi pale tan, banded with dark brown. *Abdomen*: mostly orange, clothed with sparse, long, pale-tan scales, especially anteriorly; ventrally, pale, yellowish tan. *Forewing*: mean FW length 22.4 mm (males), 25.0 mm (females).

Dorsal surface: patterns composed of black, dark brown, tan, and white scales, some scales iridescent bluish gray; basal line black, ending before meeting 2A; no basal dash; antemedial line and line basal to antemedial line black, blurred; reniform bluish gray and tan outlined indistinctly with black; subreniform closed, whitish or tan, to indistinct, narrowly outlined with black; postmedial line black, indistinct, all teeth between M1 and inner margin subequal in length; area between postmedial and subterminal lines more brownish especially between M2 and inner margin; subterminal line black, blurred, often only teeth near M1 and M2 obvious; terminal line inconspicuous, usually present only as a series of black dots mid-way between ends of veins; fringe brown. Overall appearance of the dorsal forewing is mottled bluish gray and black. Ventral surface: base of wing pale yellowish tan, blending with indistinct postbasal band of yellow and brown scales; antemedial band pale yellowish tan, edges indistinct; medial band black, widest between M2 and Cul, narrowing markedly between Cu and inner margin, occasionally disappearing before reaching inner margin; postmedial band pale yellowish tan; outer band black, often interrupted by pale yellowish tan along a fold between Cu and 2A. Apex pale yellowish tan, blending smoothly with pale yellowish-tan marginal band; fringe pale yellowish tan with a few black scales at end of each vein. *Hindwing*: dorsal surface: basal area, postmedial band, apical spot, and fringe yellow orange; basal area with a few brown scales; inner band black, usually thin (3–4 mm at widest point); short hook usually apparent just anterior to anal spot; outer band black; anal spot nearly always separated from outer band by 2–3 mm; apical spot large, squared; fringe varyingly checkered with black scales originating from near ends of M1 to 2A. Ventral surface: basal area, postmedial band, apical spot, and fringe pale yellowish tan, a little brighter than ventral forewing; inner band black, distinctly narrower than on dorsal surface; outer band black, often connected with anal spot by thin array of black scales; apical spot sharply defined, squared, although occasionally blending with pale yellowish-tan marginal band when band wider than just width of fringe; fringe usually pure pale yellowish tan. Overall, there is no pronounced sexual dimorphism in *C. caesia*.

**Etymology.** The adjectival name *caesia* is based on the Latin root *caesi*, referring to the bluish-gray color of the forewing. The “Bluish-gray Underwing” is suggested as a vernacular name.

**Distribution and biology.** The range of *C. caesia* is limited to the mountains of southeastern Arizona and southwestern New Mexico, and southward through the Sierra Madre Occidental in Chihuahua. *Catocala caesia* is sympatric with its closest relative, *C. frederici*, in the Chiricahua and Huachuca Mountains of Cochise County, Arizona. In collections, *C. caesia* has usually been identified as *C. benjamini*, and these two species have likely also been conflated in the literature. Some paratypes of *C. benjamini* may actually be *C. caesia* because Brower’s (1937) original description of *C. benjamini* lists paratypes from the Huachuca Mountains (the author has seen more specimens of *C. caesia* than *C. benjamini* in the Huachuca Mountains). Fortunately, the type locality of *C. benjamini* is Mojave County, Arizona, which is not within the range of *C. caesia*. Adults fly from late May to October, although late emerging individuals are much less common than are those from May to July. Several species of oaks are present at each of the known collecting localities.

***Catocala frederici* Grote**

Figs 7, 8

*Catocala frederici* Grote, 1872: 14.

**Type material.** *Catocala frederici*: lectotype ♀ [ZMHU, examined], designated by Gall and Hawks (2002: 246). Type locality: Texas, [USA].

**Diagnosis.** The ventral surface of the forewing and both surfaces of the hindwing are similar in both *C. frederici* and *C. caesia*, although the patterning is less distinct in *C. frederici* compared to *C. caesia*. However, the even, generally pale-gray appearance of the forewing upperside in *C. frederici* is distinctive. The black hindwing bands tend to be narrower in *C. frederici* than in *C. caesia*.

**Distribution and biology.** Southwestern USA, from east-central Kansas and western Texas, westward to southeastern Arizona. County records for USA are as follows. ARIZONA: Cochise; KANSAS: Douglas, Riley; NEW MEXICO: Bernalillo, Dona Ana, Eddy, Lincoln, Otero, Sandoval, San Miguel; COLORADO: Baca; OKLAHOMA: Cimarron, Kiowa; TEXAS: Blanco, Bosque, Brewster, Burnet, Coke, Coleman, Culberson, Dallas, Dickens, El Paso, Hudspeth, Jeff Davis, Kerr, Kimble, Lubbock, Randall, Uvalde, Vale Verde.

**Biological notes.** Adults have been collected from May to September. Several species of oaks are present at most of the known collecting localities. *C. frederici* tends to inhabit hotter and drier desert mountain ranges than do *C. delilah*, *C. desdemona* and *C. caesia*.

***Catocala benjamini* Brower**

Figs 9–14

*Catocala andromache* race *benjamini* Brower, 1937: 185

*Catocala benjamini ute* Peacock & Wagner, 2009: 89

*Catocala benjamini jumpi* Hawks, **ssp. n.**

*Catocala benjamini mayhewi* Hawks, **ssp. n.**

***Catocala benjamini benjamini* Brower**

Fig. 9

**Type material.** *Catocala andromache* race *benjamini*: holotype ♂ [USNM, examined]. Type locality: Mohave County, Arizona, [USA].

**Diagnosis.** *Catocala b. benjamini* is similar to *C. caesia* on the upperside, but the undersides differ (see account for *C. caesia* above for points of distinction). Nominate *C. benjamini* is also similar to *C. andromache* and the only fairly reliable difference in color pattern is that the dorsal forewing of *C. andromache* tends to have a distinctly greenish cast due to iridescent scales. Most populations of *C. benjamini* and *C. an-*





**Figures 9–16.** Adults of *Catocala*. **9** *C. benjamini benjamini* Brower **10** *C. benjamini ute* Peacock & Wagner **11** holotype, *C. benjamini jumpi* Hawks **12** allotype, *C. benjamini jumpi* Hawks **13** holotype, *C. benjamini mayhewi* Hawks **14** allotype, *C. benjamini mayhewi* Hawks.

*dromache* are allopatric, although *C. benjamini mayhewi* and *C. andromache* occur in sympatry in southern California. Differences between the larvae of *C. benjamini* and *C. andromache* were reported by Johnson (1985).

**Distribution and biology.** Southeastern California, Arizona, southern Nevada, and southwestern Utah. County records for USA are as follows. ARIZONA: Apache, Cochise, Coconino, Gila, Graham, Mohave, Maricopa, Navajo, Pima, Yavapai; CALIFORNIA: San Bernardino; NEVADA: Clark, Lincoln; UTAH: Washington. Adults have been collected from May to September with most from June and July. The immature stages of the nominate subspecies are unknown. However, at several of the known collecting localities (e.g., Hualapai and Pinal Mountains) *Quercus turbinella* Greene is the only species of oak. Additionally, the known distribution of *C. b. benjamini* closely coincides with the distribution of *Q. turbinella*. Like *C. frederici*, *C. b. benjamini* primarily inhabits dry desert mountain ranges.

***Catocala benjamini ute* Peacock & Wagner**

Fig. 10

**Type material.** *Catocala benjamini ute*: holotype ♂ [PMNH, examined]. Type locality: USA, Utah, Grand Co[unty], Arches National Park, Balanced Rock Area, 1610 m.

**Diagnosis.** Similar to other subspecies, although slightly larger in size and with an orange-brown ground color, and yellow orange usually infusing other aspects of the maculation; underside with reduced black scaling in both basal and adterminal areas; adterminal not as checkered as in other subspecies.

**Distribution and biology.** Known only from Grand and San Juan counties in southeastern Utah, in the most northeastern part of the species' overall range. Adults have been taken in early June. The immature stages are unknown. Peacock and Wagner (2009) indicate *Quercus* × *pauciloba* Rydb. (= *Q. undulata* Torr.; a hybrid from *Q. gambelii* Nutt. and *Q. turbinella*) is the most prevalent and sometimes only oak species at the known collecting localities; they report the absence of *C. benjamini ute* from nearby stands of *Q. gambelii*.

***Catocala benjamini jumpi* Hawks, ssp. n.**

urn:lsid:zoobank.org:act:EA01B04C-27EE-4604-83C5-7AF5696A3A6F

Figs 11, 12

**Type material.** **Holotype** ♂ (Fig. 11, PMNH specimen #ENT 721047; FW length 21 mm), **allotype** ♀ (Fig. 12, PMNH specimen #ENT 721048; FW length 23 mm): Kofa Queen Canyon, 900 m, Kofa Mountains, Yuma County, Arizona, 27 May 1989, leg. D. C. Hawks. **Paratypes** (14 ♂ 16 ♀): 1 ♂ 6 ♀ from type locality, 29 May 1981, P.M. Jump; 13 ♂ 10 ♀ from type locality, 27 May 1989, D.C. Hawks. The remainder are from Palm Canyon, Kofa Mountains (6 ♂ 1 ♀, leg. G. Butler & D. Tuttle, 29 May 1955; 1 ♂ 1 ♀, leg. D. C. Hawks, 3 June 1985). Holotype and allotype deposited at PMNH, paratypes deposited at LACM and other USA museums as well as in private collections.

**Diagnosis.** *C. benjamini jumpi* differs from other *C. benjamini* subspecies in having pale dusky-yellow hindwing bands; forewings distinctly narrower and more pointed; lines less distinct; ventral surface yellow areas paler; black hindwing bands tend to be wider; inner band, outer band, and anal spot sometimes fused.

**Description.** *Forewing*: narrow and pointed; dorsal surface with black, dark-brown, tan, and beige scales, few scales iridescent bluish or purplish; antemedial line black, edges indistinct; reniform black, subreniform usually beige, variable in size; apical yellowish area suffused with black; fringes gray, checkered with black. *Hindwing*: dorsal surface with pale-brown scales suffusing much of basal area; medial band dull pale yellowish; fringe yellowish tan with black checkering; bands black; ventral surface pale dusky yellow; fringe pale yellowish beige checkered with black; inner band usually only slightly narrower than on dorsal surface.

**Etymology.** The subspecies is named in honor of Peter M. Jump, who introduced the author to this unique population of *C. benjamini*, and who collected seven of the type specimens.

**Distribution and biology.** *Catocala benjamini jumpi* is known only from the Kofa Mountains of southwestern Arizona. The Kofa Mountains and the nearby Castle Dome Mountains are separated from the nearest known suitable locality for *C. benjamini* by about 140 km. The oaks (*Q. turbinella*) occurring in these two mountain ranges are notably disjunct in the overall range of this oak. Adults have been collected only in late May and early June. Larvae likely feed exclusively on *Quercus turbinella* since this is the only oak occurring in the area.

***Catocala benjamini mayhewi* Hawks, ssp. n.**

urn:lsid:zoobank.org:act:8E8508F4-153B-4CFC-B015-CDF6374BFC4F

Figs 13, 14

**Type material.** **Holotype** ♂ (Fig. 13, PMNH specimen #ENT 721049; FW length 19.5 mm), **allotype** ♀ (Fig. 14, PMNH specimen #ENT 721050; FW length 21 mm): Pinyon Flat, 1500 m, Santa Rosa Mountains, Riverside County, California, 22 June 1987 leg. D. C. Hawks. **Paratypes** (70 ♂ 68 ♀): 62 ♂ 59 ♀ from the type locality, collected between 1 June and 2 August over several decades by J. W. Johnson, E. Walter, R. H. Leuschner, and D. C. Hawks. Remaining paratypes: Los Angeles County: San Gabriel Mountains near Valyermo (4 ♀); San Gabriel Mountains, Big Rock Creek (1 ♂); Riverside County: San Jacinto Mountains, Chino Canyon near Palm Springs (4 ♂ 1 ♀); San Bernardino County: Joshua Tree (1 ♂); San Diego County: Anza Borrego State Park, Tub Springs (1 ♀); Jacumba (1 ♂); Sentenac Canyon (3 ♀). Holotype and allotype deposited at PMNH, paratypes deposited at LACM and other USA museums as well as in private collections.

**Diagnosis.** *Catocala benjamini mayhewi* is similar to *C. b. benjamini*, but differs as follows: dorsal forewing surface slightly paler grayish brown; yellowish areas on hindwing dorsal surface slightly paler; inner band almost always thin, occasionally absent. Mean forewing length of *C. b. mayhewi* (19.0 mm, males; 21.5 mm, females) consistently smaller than all other *C. benjamini* subspecies. *C. b. mayhewi* is sympatric with *C. andromache* throughout most of its range (this fact led Brower (1982) to elevate *C. benjamini* to a full species).

**Description.** *Forewing*: dorsal surface with black, dark-brown, tan, and beige scales, few scales iridescent bluish or purplish; overall appearance pale grayish brown; antemedial line black, edges indistinct; reniform black, subreniform usually beige, variable in size; apical yellowish area suffused with black; fringes gray, checkered with black; ventral surface pale whitish yellow with relatively narrow black medial band. *Hindwing*: dorsal surface with pale-brown scales suffusing much of basal area; medial band dull pale orange; fringe yellowish tan with black checkering; bands black; ventral surface pale yellow; fringe pale yellowish beige checkered with black; inner band quite thin and narrow on both surfaces.

**Etymology.** The subspecies is named in honor of W. W. Mayhew, the author's MS thesis advisor. A portion of the type locality (Pinyon Flat) has been protected from encroaching development thanks to Mayhew's foresight and persistence.

**Distribution and biology.** *Catocala benjamini mayhewi* occurs along the desert-facing slopes of the Laguna, Santa Rosa, San Jacinto, San Bernardino, San Gabriel Mountains, and Little San Bernardino Mountains in southern California. It also occurs in northern Baja California, Mexico. Adults have been collected from early June to early August. The immature stages of *C. b. mayhewi* have been described and the larva figured by Johnson (1985). The larvae feed on *Quercus cornelius-mulleri* Nixon & Steele at the San Bernardino, Riverside, and San Diego County localities.

### ***Catocala andromache* H. Edwards**

Figs 15, 16

*Catocala andromache* H. Edwards, 1885: 50

*Catocala andromache wellsi* Johnson, 1983: 245, **syn. n.**

**Type material.** *Catocala andromache*: holotype ♂ [AMNH, examined]. Type locality: San Bernardino, Cal[ifornia, USA].

**Diagnosis.** The only closely similar taxon to *C. andromache* is *C. b. benjamini*. The dorsal forewing of *C. andromache* is usually liberally speckled with greenish scales (in many freshly eclosed specimens the wings are a mottled moss green), whereas the dorsal forewing of *C. b. benjamini* is sparsely speckled with bluish scales. This distinction breaks down for worn specimens, and for many specimens from desert edge mountains in southern California. However, *C. andromache* is not sympatric with *C. b. benjamini*. *Catocala andromache* is sympatric with *C. b. mayhewi* along the desert slopes of the mountains of southern California, and there the two species are consistently separated by the larger size, darker forewings, darker yellowish bands, and wider black bands of *C. andromache*. The name *wellsi* was proposed for specimens with more blackish, unmottled forewings from the central Sierran foothills, but these characteristics break down in larger series and there seems little merit in retaining the name at subspecific rank.

**Distribution and biology.** *Catocala andromache* occurs in the mountains of San Diego, Riverside, San Bernardino, and Los Angeles counties, and northward through the southern Coast Ranges and the Sierra Nevada of California. County records for USA are as follows. CALIFORNIA: Amador, Butte, Calaveras, Kern, Lake, Los Angeles, Mariposa, Nevada, Riverside, San Bernardino, San Diego, Santa Barbara, Solano, Ventura, Yolo. Larvae of *C. andromache* have been collected from *Quercus chrysolepis* Liebm. They also probably feed on *Quercus cornelius-mulleri*, *Q. dumosa* Nutt., and *Q. wislizenii* A. de Candolle, among others. Adults have been collected from mid-June through August, and fly mostly below 2000 m.





**Figures 15–20.** Adults of *Catocala*. **15, 16** *C. andromache* H. Edwards **17** *C. californiensis* Brower **18** *C. johnsoniana* Brower **19, 20** *C. mcdunnoughi* Brower.

***Catocala californiensis* Brower**

Fig. 17

*Catocala californiensis* Brower, 1976: 30

**Type material.** *Catocala californiensis*: holotype ♂ [USNM, examined]. Type locality: Ranch two and one half miles south-southwest of Valyermo, Los Angeles Co[unty], Calif[ornia, USA].

**Diagnosis.** *Catocala californiensis* is most similar to *C. johnsoniana* in forewing coloration, and to *C. benjamini mayhewi* in hindwing coloration. However, on the forewing, *C. johnsoniana* has a conspicuous basal dash (lacking or very small in *C. californiensis*), and longer teeth in the postmedial line with a shorter and wider inner hindwing black band than in *C. californiensis*.

**Etymology.** I suggest the common name “Ashy-gray Underwing” for *C. californiensis* based on Brower’s description of the forewing ground color. The “California Underwing” is probably best applied to *C. californica* W. H. Edwards (1864).

**Distribution and biology.** *Catocala californiensis* occurs in southern California along the desert-facing slopes of the Peninsular and Transverse Ranges to the southeastern edge of the Coast Ranges in Santa Barbara County. County records for USA are as follows. CALIFORNIA: Kern, Los Angeles, Riverside, San Bernardino, San Diego, Santa Barbara, Ventura. The immature stages of *C. californiensis* have been described and the larva figured by Johnson (1985). Larvae feed on *Quercus cornelius-mulleri* at the San Bernardino, Riverside, and San Diego County localities, and they probably feed on *Q. turbinella* at the Los Angeles, Kern, Santa Barbara, and Ventura county localities. Adults have been collected from mid-June to late August. The northwestern-most populations represent a distinctive new subspecies (Hawks, in prep.).

### *Catocala johnsoniana* Brower

Fig. 18

*Catocala johnsoniana* Brower, 1976: 30

**Type material.** *Catocala johnsoniana*: holotype ♂ [USNM, examined]. Type locality: Kernville, Kern Co[unty], Calif[ornia, USA].

**Diagnosis.** *Catocala johnsoniana* is most similar to *C. californiensis* but the forewing has a distinct basal dash, the subreniform is always widely open, and the teeth of the postmedial line are longer. Also, the hindwing black inner band is relatively short and thick, while the postmedial yellow band is proportionately wider than in most specimens of all other species in the *C. delilah* complex.

**Distribution and biology.** *Catocala johnsoniana* occurs mostly in the northern, eastern and southern foothills edging the Central Valley of California, mostly at slightly lower elevations than the other five species found in California. County records for USA are as follows. CALIFORNIA: Butte, Colusa, Kern, Lake, Los Angeles, Madera, Solano, Tuolumne, Yolo. The immature stages of *C. johnsoniana* have been described and the larva figured by Johnson (1985). Moths are always collected in areas dominated by *Quercus douglasii* Hook. & Arn., and this is probably the primary or only host plant. Adults have been collected from late May to early July.

***Catocala mcdunnoughi* Brower**

Figs 19, 20

*Catocala mcdunnoughi* Brower, 1937: 32*Catocala mcdunnoughi browerorum* Johnson, 1983: 247, **syn. n.**

**Type material.** *Catocala mcdunnoughi*: holotype ♂ [MCZ, examined]. Type locality: [Mount Wilson], southwestern California, [USA]. *Catocala mcdunnoughi browerorum*: holotype ♀ [USNM, examined]. Type locality: Moore Creek Forest Service Camp-ground, Amador-Calaveras Co[unties], California, [USA].

**Taxonomic remarks.** *Catocala mcdunnoughi browerorum* Johnson was described from four darker and more greenish specimens from Amador County, California. However, other topotypical *browerorum* material does not differ from nominate material and variation is not consistent geographically (e.g., many Plumas and Butte county specimens are more evenly greenish brown), so there seems little reason to retain the name.

**Diagnosis.** *Catocala mcdunnoughi* is most similar to *C. chelidonia*, but the more brownish and mottled ground color of *C. mcdunnoughi* will usually separate these species. No other small *Catocala* species in the region has postmedial lines with two large teeth only at M1 and M2.

**Distribution and biology.** *Catocala mcdunnoughi* occurs from the Laguna Mountains of San Diego County, California, northward to southern Oregon. County records for USA are as follows. CALIFORNIA: Amador, Butte, Calaveras, Inyo, Kern, Los Angeles, Mariposa, Orange, Plumas, Riverside, San Bernardino, San Diego; OREGON: Josephine. The immature stages of *C. mcdunnoughi* have been described and the larva figured by Johnson (1985). Larvae have been collected on *Quercus chrysolepis* Liebm. in the San Gabriel Mountains of Los Angeles County, California, and this is likely the major (or only) host of *C. mcdunnoughi*. In southern California, *C. mcdunnoughi* flies at somewhat higher elevations than the other five species. It also flies later in the year, usually emerging from mid-July to mid-August. At lower elevations in northern California it begins to fly in late June.

***Catocala chelidonia* Grote**

Figs 21–26

*Catocala chelidonia* Grote, 1881: 159.*Catocala chelidonia occidentalis* Hawks, **ssp. n.***Catocala chelidonia uniforma* Hawks, **ssp. n.*****Catocala chelidonia chelidonia* Grote**

Figs 21, 22

**Type material.** *Catocala chelidonia*: lectotype ♂ [USNM, examined], designated by Gall and Hawks (2002: 244). Type locality: Prescott, Arizona, [USA].



**Figures 21–26.** Adults of *Catocala*. **21, 22** *C. chelidonia chelidonia* Grote **23** holotype, *C. chelidonia occidentalis* Hawks **24** allotype, *C. chelidonia occidentalis* Hawks **25** holotype, *C. chelidonia uniforma* Hawks **26** allotype, *C. chelidonia uniforma* Hawks.

**Diagnosis.** *Catocala chelidonia chelidonia* is similar only to *C. mcdunnoughi*. The more brownish and mottled ground color in *mcdunnoughi* will usually separate these species. Also, in *chelidonia*, the teeth of the postmedial line at M1 and M2 are usually longer than other teeth, but usually not as conspicuous as in *mcdunnoughi*.

**Distribution and biology.** *Catocala c. chelidonia* occurs from southern Nevada and south-central Utah southward and eastward through Arizona to New Mexico. County records for USA are as follows. ARIZONA: Apache, Coconino, Gila, Maricopa, Mohave, Pinal, Yavapai; CALIFORNIA: San Bernardino; NEVADA: Clark, Lincoln; NEW MEXICO: Bernalillo, Grant, Sandoval, Sierra; UTAH: Garfield, Washington. Crumb (1956) described larvae of *C. c. chelidonia* from Cave Creek, Maricopa County, Arizona. The larvae of this subspecies probably feed mostly, if not exclusively, on *Quercus turbinella*. Adults have been collected from mid-June to late July.



***Catocala chelidonia occidentalis* Hawks, ssp. n.**

urn:lsid:zoobank.org:act:F24788C7-BB3D-40B9-BFC7-6BA5D4370601

Figs 23, 24

**Type material.** **Holotype** ♂ (Fig. 23, PMNH specimen #ENT 721051; FW length 20 mm), **allotype** ♀ (Fig. 24, PMNH specimen #ENT 721052; FW length 21 mm): Pinyon Flat, Santa Rosa Mountains, Riverside County, California, leg. D. C. Hawks; holotype 15 June 1987, allotype 22 June 1987. **Paratypes** (25 ♂ 53 ♀): 23 ♂ 46 ♀ from the type locality, various dates and collectors. Remaining paratypes: Kern County: 10 km NW of Frazier Park (1 ♀); Los Angeles County: San Gabriel Mountains, 4 km SSW of Valyermo (1 ♂ 4 ♀); Juniper Hills, 3 km S of Pearblossom (1 ♀); San Gabriel Mountains, Ridge Route, Halfway House (1 ♂); San Diego County: 6 km S of Oak Grove (1 ♀). Holotype and allotype deposited at PMNH, paratypes deposited at LACM and other USA museums as well as in private collections.

**Diagnosis.** The forewings of *C. c. occidentalis* are similar to those of other subspecies. Distinguishing hindwing characters include: dorsal surface has many black scales at the base; wider inner band; narrower postmedial band; yellowish color of the dorsal surface consistently darker. About 5 percent of the specimens of *C. c. occidentalis* examined could be confused with specimens of the nominate subspecies.

**Description.** *Forewing:* dorsal surface ground color charcoal to brownish gray, mottled with hoary scales; antemedial and postmedial lines black, modestly apparent; subreniform whitish to yellow, usually visible. *Hindwing:* pale areas dull yellow orange; bands black, apical spot dull yellow orange; anal spot separated from outer band; conspicuously narrow postmedial band (usually only 1–2 mm near vein M2); anterior half of outer band wide with conspicuous rounded indentation in inner edge of outer band between M2 and Cu1; many dark scales at base.

**Distribution and biology.** *Catocala c. occidentalis* occurs along the western desert edge in southern California and northward to at least Trinity County. County records for USA are as follows. CALIFORNIA: Kern, Lake, Los Angeles, Madera, Napa, Riverside, San Bernardino, San Diego, Santa Clara, Solano, Trinity.. The immature stages of *C. c. occidentalis* have been described and the larva figured by Johnson (1985). At the San Diego, Riverside, and San Bernardino County localities the larvae feed on *Quercus cornelius-mulleri*. Adults have been collected from early June to late August, with the peak flight period in late June at Pinyon Flat.

***Catocala chelidonia uniforma* Hawks, ssp. n.**

urn:lsid:zoobank.org:act:85959B2B-9561-4B4F-9070-4E7906F0AA72

Figs 25, 26

**Type material.** **Holotype** ♂ (Fig. 25, PMNH specimen #ENT 721053; FW length 20.0 mm), **allotype** ♀ (Fig. 26, PMNH specimen #ENT 721054; FW length 19.5 mm): Ash Canyon, Huachuca Mountains, Cochise County, Arizona, 1700 m, leg. N.

McFarland; holotype 2 June 1981, allotype 15 June 1983. **Paratypes** (13 ♂ 26 ♀): 8 ♂ 12 ♀ from the type locality, varying dates and collectors; Sierra Vista, Cochise County, Arizona (1 ♀); Miller Canyon, Huachuca Mountains, Cochise County, Arizona (1 ♀); Cochise County: Chiricahua Mountains, Sunny Flat Campground, 11–12 June 2007, M.L. Raschko (1 ♂, 1 ♀); Chiricahua Mountains, South Fork Cave Creek (2 ♀); Chiricahua Mountains, vicinity of Southwestern Research Station (3 ♂, 5 ♀); Chiricahua Mountains (1 ♀); New Mexico: Hidalgo County, Peloncillo Mountains, Clanton Draw (3 ♀); Animas Mountains, Bear Canyon (1 ♂). Holotype and allotype deposited at PMNH, paratypes deposited at LACM and other USA museums as well as in private collections.

**Diagnosis.** This subspecies has uniform gray forewings with substantially reduced hoary mottling. The antemedial and postmedial forewing lines vary from inconspicuous to very distinct. Hindwing as in the nominate subspecies.

**Description.** *Forewing*: dorsal surface ground color charcoal gray, concolorous, with few hoary scales; antemedial and postmedial lines black; antemedial line fades away toward the inner margin; subreniform whitish to yellow, usually visible. *Hindwing*: pale areas dull yellow orange; bands black, apical spot dull yellow orange; anal spot separated from outer band; few dark scales at base.

**Distribution and biology.** *Catocala chelidonia uniforma* is known from mountains of southeastern Arizona and southwestern New Mexico. Nothing is known of the early stages of this subspecies. Adults have been collected from late May to mid-July, with peak abundance in mid-June (N. McFarland, pers. comm.).

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## Appendix: Synopsis of actions taken in this paper regarding Nearctic names in the genus *Catocala* Schrank

Name	Author	Year	Assigned to taxon	Typification	Status change
<i>browenarum</i>	Johnson	1983	synonym of <i>C. mcdunnoughi</i> Brower, 1937		new synonymy
<i>caesia</i>	Hawks	2010	full species	holotype	new species
<i>calphurnia</i>	H. Edwards	1880	synonym of <i>C. delilah</i> Strecker, 1874	neotype	
<i>desdemona</i>	H. Edwards	1882	full species	lectotype	revised status
<i>ixion</i>	Druce	1890	synonym of <i>C. desdemona</i> H. Edwards, 1882		new synonymy
<i>jumpi</i>	Hawks	2010	subspecies of <i>C. benjamini</i> Brower, 1937	holotype	new subspecies
<i>mayhewi</i>	Hawks	2010	subspecies of <i>C. benjamini</i> Brower, 1937	holotype	new subspecies
<i>occidentalis</i>	Hawks	2010	subspecies of <i>C. chelidonia</i> Grote, 1881	holotype	new subspecies
<i>uniforma</i>	Hawks	2010	subspecies of <i>C. chelidonia</i> Grote, 1881	holotype	new subspecies
<i>utahensis</i>	Cassino	1918	synonym of <i>C. desdemona</i> H. Edwards, 1882		new synonymy
<i>wellsi</i>	Johnson	1983	synonym of <i>C. andromache</i> H. Edwards, 1885		new synonymy



# Systematics of moths in the genus *Catocala* (Lepidoptera, Erebiidae) IV. Nomenclatorial stabilization of the Nearctic fauna, with a revised synonymic check list

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## Abstract

The taxonomy of the Nearctic species in the genus *Catocala* is reviewed, and a revised check list presented. A total of 101 species is recognized, with a synonymy comprising 357 names. The status of 61 available names is assessed, with designation and illustration of 41 lectotypes and 5 neotypes. Taxonomic changes include 23 new synonymies, 3 revised synonymies, 8 new statuses and 1 revised status. Two subspecies are elevated to species rank (*Catocala carissima* Hulst, 1884 and *Catocala luctuosa* Hulst, 1884), 15 subspecies are synonymized, and another 15 species are either downgraded to subspecies or synonymized.

## Keywords

Lepidoptera, Erebiidae, *Catocala*, taxonomy, nomenclature, lectotypes, neotypes, Nearctic region

## Introduction

The holarctic genus *Catocala* Schrank (1802) in the family Erebiidae (treatment sensu Zahiri et al. 2010) contains more than 200 species worldwide. The most recent revision of the North American species was Barnes and McDunnough's (1918) monograph, and the Nearctic faunal list has subsequently grown to encompass 357 available

and/or infrasubspecific names. The present paper is the fourth in a series on Nearctic *Catocala* taxonomy. The previous papers addressed 116 available and 15 infrasubspecific names, with designation of 78 lectotypes and 3 neotypes, and 6 changes in status (Gall 1990; Gall and Hawks 1990, 2002b). Here we discuss in further detail 61 of the other 147 available names that warrant nomenclatorial action to promote stability, and present a revised check list for the Nearctic fauna.

## Materials and methods

Nomenclatorial protocol follows Gall and Hawks (2002b: 234–235). To paraphrase, the early *Catocala* workers used the terms “type” and “types” loosely, and a priori we presume there may be syntypes even when original descriptions use the singular. In addition, the terms “form” and “variety” were used in both subspecific and infrasubspecific manners, and different authors had varying and potentially confusing, inconsistent customs. Determining infrasubspecific intent often requires tracing context for a name through the early literature until the publication of Barnes and McDunnough’s (1918) definitive monograph, and may not be evident simply by reading the original description (many of which are brief). For example, G. D. Hulst used the term “var.” for *Catocala* names in potentially subspecific and/or infrasubspecific manners, sometimes within a single publication, e.g.: “I use the word variety to mean a local form, which breeds true to itself, but is yet known by intergrades, or breeding elsewhere, to be connected to the stem form of the species... I also give variety standing to marked accidental variations among the *Catocalae*, which do not breed true to themselves...” (Hulst 1884: 28).

Institutional acronyms follow Arnett et al. (1993): AMNH = American Museum of Natural History, New York; ANSP = Academy of Natural Sciences, Philadelphia; BMNH = The Natural History Museum, London; CMNH = Carnegie Museum of Natural History, Pittsburgh; CNC = Canadian National Collection of Insects, Ottawa; CUIC = Cornell University, Ithaca; FMNH = Field Museum of Natural History, Chicago; MCZ = Museum of Comparative Zoology, Cambridge (USA); PMNH = Peabody Museum of Natural History, New Haven; USNM = United States National Collection, Smithsonian Institution, Washington.

## Results

Type specimens for the 357 Nearctic *Catocala* names are scattered widely in dozens of institutional collections throughout North America and Europe. We have located and examined what we consider to be suitable type material for all but 19 of the 357 names - 6 available, and 13 infrasubspecific. Types are presumed lost for another 8 available names authored by J. E. Smith, D. Drury, P. Cramer, and J. Hübner. However, application of these 14 available and 13 infrasubspecific names has remained stable since Barnes and McDunnough (1918).



For the 61 available names treated below in the “Taxonomic Assessments” section, 41 lectotypes are designated. In addition, 5 neotypes are designated for names in taxonomically difficult western Nearctic species complexes (notably the species whose larvae feed on willows and poplars) for which unequivocal type material is lacking, since these taxa can not be adequately stabilized in the absence of types (see further elaboration in Gall and Hawks 2002b: 235). In addition, 23 new synonymies (8 species and 15 subspecies downgraded to synonyms), 3 revised synonymies, 8 new statuses (7 species downgraded to subspecies, one subspecies elevated to species), and one revised status (subspecies elevated to species) are established.

The ranks and statuses for the remaining 86 available names in the Nearctic fauna have either been long since established in the literature, or recently reexamined (Gall 1992, 2002, Gall and Hawks 2002b; Hawks 2010; Brou 2002a, 2002b). Another 3 previously available names have been formally excluded here: *Phalaena amasia* (J. E. Smith, 1797) (suppressed in Opinion 1774; ICZN 1994); *Catocala polygama* Guenée, 1852 (suppressed in Opinion 2068; ICZN 2004); and *Catocala protonympha* Boisduval, 1840 (a *nomen oblitum*, the corresponding *nomen protectum* being *Catocala louiseae* Bauer, 1965; Gall and Hawks [2002a]).

The Nearctic *Catocala* fauna comprises 101 species. In the Check List and Taxonomic Assessments sections below, names for the taxa are presented in alphabetical order. Actions taken in the Taxonomic Assessments section are summarized in Table 1. An alphabetical checklist of the Nearctic *Catocala* is given in Appendix 1, and a phylogenetic list of the species and subspecies is given in Appendix 2.

**Table 1.** Synopsis of actions taken in this paper regarding Nearctic names in the genus *Catocala* Schrank.

Name	Author	Year	Assigned To Taxon	Typification	Status Change
<i>allusa</i>	Hulst	1884	subspecies of <i>C. faustina</i> Strecker, 1874	lectotype	new status
<i>augusta</i>	H. Edwards	1875	synonym of <i>C. junctura</i> Walker, [1858]	lectotype	new synonymy
<i>barnesii</i>	French	1900	synonym of <i>C. agrippina</i> Strecker, 1874	lectotype	none
<i>beutenmuelleri</i>	Barnes & McDunnough	1910	synonym of <i>C. verrilliana</i> Grote, 1875	lectotype	new synonymy
<i>blandula</i>	Hulst	1884	full species	lectotype	none
<i>caerulea</i>	Beutenmüller	1907	synonym of <i>C. faustina</i> <i>cleopatra</i> Strecker, 1874	lectotype	new synonymy
<i>carissima</i>	Hulst	1880	full species	lectotype	new status
<i>cassandra</i>	H. Edwards	1875	synonym of <i>C. electilis</i> Walker, [1858]	lectotype	none
<i>charlottae</i>	Brou	1988	subspecies of <i>C. praeclara</i> Grote & Robinson, 1866		new status
<i>concumbens</i>	Walker	[1858]	full species	lectotype	none
<i>cordelia</i>	H. Edwards	1880	synonym of <i>C. connubialis</i> Guenée, 1852	lectotype	none
<i>crataegi</i>	Saunders	1876	full species	lectotype	none
<i>dana</i>	Cassino	1918	synonym of <i>C. mira</i> Grote, 1918		new synonymy

Name	Author	Year	Assigned To Taxon	Typification	Status Change
<i>denussa</i>	Ehrman	1893	synonym of <i>C. habilis</i> Grote, 1872		revised synonymy
<i>diantha</i>	Beutenmüller	1907	synonym of <i>C. hermia hermia</i> H. Edwards, 1880	lectotype	none
<i>dionyza</i>	H. Edwards	1885	subspecies of <i>C. piatrix</i> Grote, 1864	lectotype	none
<i>dollii</i>	Beutenmüller	1907	synonym of <i>C. ophelia</i> H. Edwards, 1880	neotype	none
<i>edwardsi</i>	Kusnezov	1903	synonym of <i>C. californica</i> W.H. Edwards, 1864		new synonymy
<i>elda</i>	Behrens	1887	synonym of <i>C. relictata</i> Walker, [1858]	lectotype	new synonymy
<i>elizabeth</i>	Cassino	1918	synonym of <i>C. californica</i> W.H. Edwards, 1864		new synonymy
<i>elsa</i>	Beutenmüller	1918	synonym of <i>C. junctura</i> Walker, [1858]		new synonymy
<i>erichi</i>	Brower	1976	synonym of <i>C. californica</i> W.H. Edwards, 1864		new synonymy
<i>euphemia</i>	Beutenmüller	1907	subspecies of <i>C. neogama</i> (J.E. Smith, 1797)	lectotype	new status
<i>francisca</i>	H. Edwards	1880	subspecies of <i>C. hermia</i> H. Edwards, 1880	lectotype	new status
<i>frenchii</i>	Poling	1901	synonym of <i>C. faustina allusa</i> Hulst, 1884	lectotype	revised synonymy
<i>gisela</i>	Meyer	1880	synonym of <i>C. micronympha</i> Guenée, 1852	lectotype	none
<i>grotiana</i>	Bailey	1879	full species	neotype	none
<i>hippolyta</i>	Strecker	1874	subspecies of <i>C. semirelictata</i> Grote, 1874		new status
<i>irene</i>	Behr	1870	full species	neotype	none
<i>jessica</i>	Strecker	1877	full species	lectotype	none
<i>loretta</i>	Barnes & McDunnough	1918	synonym of <i>C. neogama neogama</i> (J.E. Smith, 1797)	lectotype	new synonymy
<i>luctuosa</i>	Hulst	1884	full species	lectotype	revised status
<i>maestosa</i>	Hulst	1884	full species	lectotype	none
<i>manitoba</i>	Beutenmüller	1908	subspecies of <i>C. praeclara</i> Grote & Robinson, 1866	lectotype	new status
<i>manitobensis</i>	Cassino	1918	synonym of <i>C. blandula</i> Hulst, 1885		new synonymy
<i>margherita</i>	Beutenmüller	1918	synonym of <i>C. junctura</i> Walker, [1858]		new synonymy
<i>minerva</i>	Cassino	1917	synonym of <i>C. briseis</i> W.H. Edwards, 1864		new synonymy
<i>miranda</i>	H. Edwards	1881	full species	lectotype	none
<i>nebraskae</i>	Dodge	1875	synonym of <i>C. luciana</i> Strecker, 1874	lectotype	none
<i>nerissa</i>	H. Edwards	1880	synonym of <i>C. lineella</i> Grote, 1872	lectotype	revised synonymy
<i>nevadensis</i>	Beutenmüller	1907	synonym of <i>C. semirelictata semirelictata</i> Grote, 1874	lectotype	new synonymy
<i>nuptula</i>	Walker	[1858]	synonym of <i>C. grynea</i> (Cramer, 1780)	lectotype	none

Name	Author	Year	Assigned To Taxon	Typification	Status Change
<i>nurus</i>	Walker	[1858]	synonym of <i>C. amatrix</i> (Hübner, [1813])	lectotype	none
<i>olivia</i>	H. Edwards	1880	synonym of <i>C. alabamiae</i> Grote, 1875		new synonymy
<i>orion</i>	McDunnough	1922	synonym of <i>C. meskei</i> Grote, 1873		new synonymy
<i>phoebe</i>	Hulst	1884	synonym of <i>C. badia coelebs</i> Grote, 1874	lectotype	none
<i>phoebe</i>	H. Edwards	1885	synonym of <i>C. badia coelebs</i> Grote, 1874	lectotype	none
<i>pura</i>	Hulst	1880	synonym of <i>C. semirelecta semirelecta</i> Grote, 1874	lectotype	new synonymy
<i>rosalinda</i>	H. Edwards	1880	synonym of <i>C. meskei</i> Grote, 1873	lectotype	none
<i>sancta</i>	Hulst	1884	synonym of <i>C. connubialis</i> Guenée, 1852	lectotype	none
<i>sheba</i>	Cassino	1919	synonym of <i>C. hermia hermia</i> H. Edwards, 1880	lectotype	new synonymy
<i>sorsconi</i>	Barnes & Benjamin	1924	synonym of <i>C. consors</i> (J.E. Smith, 1797)		new synonymy
<i>stretchii</i>	Behr	1870	synonym of <i>C. junctura</i> Walker, [1858]	neotype	new synonymy
<i>texanae</i>	French	1902	full species	neotype	none
<i>texarkana</i>	Brower	1976	subspecies of <i>C. pretiosa</i> Lintner, 1876		new status
<i>titania</i>	Dodge	1900	synonym of <i>C. alabamiae</i> Grote, 1876	lectotype	new synonymy
<i>unijuga</i>	Walker	[1858]	full species	lectotype	none
<i>valeria</i>	H. Edwards	1880	synonym of <i>C. irene</i> Behr, 1870	lectotype	new synonymy
<i>verecunda</i>	Hulst	1884	synonym of <i>C. hermia hermia</i> H. Edwards, 1880	lectotype	new synonymy
<i>violenta</i>	H. Edwards	1880	full species	lectotype	none
<i>wernerii</i>	Biederman	1909	synonym of <i>C. verrilliana</i> Grote, 1875	lectotype	none

## Taxonomic Assessments

### *Catocala faustina* ssp. *allusa* Hulst, stat. n.

Fig. 1 (lectotype)

*Catocala allusa* Hulst, 1884: 45

*Catocala allusa*; Barnes and McDunnough 1918: 22

*Catocala allusa*; McDunnough 1938: 116

*Catocala allusa*; Franclemont and Todd 1983: 128

**Type material.** *Catocala allusa*: the original description does not state the number of types. A female type is at the USNM, and is designated as **lectotype** to clarify applica-

tion of the name *allusa*. The lectotype bears the labels “Was. T.”, “Catocala / allusa / Orig. Type. Hulst”, “Type No. / 33992 / U.S.N.M.” The geographic distribution of *Catocala allusa* is broadly parapatric with that of *Catocala faustina* Strecker, 1873 in northwestern North America; *C. allusa* blends with *C. faustina cleopatra* Strecker, 1874 in northwestern California, and with *C. faustina faustina* in the Rocky Mountains of Idaho, Wyoming and Montana. The larvae of *C. allusa* and *C. faustina* also do not differ appreciably, and so we place *C. allusa* as a subspecies of *Catocala faustina* Strecker, 1873. We refer material from the coastal areas of northern California, Oregon, Washington and British Columbia to *C. faustina allusa*. Type Locality: Was[hington] T[erritory, USA].

***Catocala junctura* syn. *augusta* H. Edwards, syn. n.**

Fig. 2 (lectotype)

*Catocala augusta* H. Edwards, 1875a: 1

*Catocala aspasia* form *augusta*; Barnes and McDunnough 1918: 31

*Catocala arizonae* ssp. *augusta*; McDunnough 1938: 117

*Catocala arizonae* ssp. *augusta*; Franclemont and Todd 1983: 129

**Type material.** *Catocala augusta*: the original description states “Mrs. Behrens took two specimens of this charming insect in August last.” A female type is at the AMNH, and is designated as **lectotype** to clarify application of the name *augusta*. The lectotype bears the labels “6035 / S. Diego / Califor.”, “No. 12654 / Collection / Hy. Edwards”, “Type / No. / A.M.N.H.”, “Type. / augusta / Hy. Edws.” The lectotype of *C. augusta* is a typical specimen of the widespread and morphologically variable *C. junctura* Walker [1858]. Type Locality: San Diego, Califor[nia, USA].

***Catocala agrippina* syn. *barnesii* French**

Fig. 3 (lectotype)

*Catocala barnesii* French, 1900: 190

*Catocala agrippina* syn. *barnesi*; Barnes and McDunnough 1918: 12

*Catocala agrippina* syn. *barnesi*; McDunnough 1938: 115

*Catocala agrippina* syn. *barnesi*; Franclemont and Todd 1983: 128

**Type material.** *Catocala barnesii*: the original description states “two examples from San Antonio, Texas; in the cabinet of Dr. Wm. Barnes, Decatur Ill.” These syntypes are at the USNM, and a male is designated as **lectotype** to clarify application of the name *barnesii*. The lectotype bears the labels “San Antonio / Texas”, “barnesii [sic] / Type”, “Barnes / Collection.” Type Locality: San Antonio, Texas, [USA].



**Figures 1–8.** Type specimens of *Catocala*. **1** lectotype, *C. allusa* Hulst, 1884 **2** lectotype, *C. augusta* H. Edwards, 1875 **3** lectotype *C. barnesii* French, 1900 **4** lectotype, *C. beutenmuelleri* Barnes & McDunnough, 1910 **5** lectotype, *C. blandula* Hulst, 1884 **6** lectotype, *C. caerulea* Beutenmüller, 1907 **7** lectotype, *C. carissima* Hulst, 1880 **8** lectotype, *C. cassandra* H. Edwards, 1875.

***Catocala verrilliana* syn. *beutenmuelleri* Barnes & McDunnough, syn. n.**

Fig. 4 (lectotype)

*Catocala beutenmuelleri* Barnes & McDunnough, 1910: 251*Catocala verrilliana* race *beutenmuelleri*; Barnes and McDunnough 1918: 37*Catocala verrilliana* ssp. *beutenmulleri*; McDunnough 1938: 117*Catocala verrilliana* ssp. *beutenmulleri*; Franclemont and Todd 1983: 129

**Type material.** *Catocala beutenmuelleri*: the original description states “Provo Ut. (Spalding), 3 ♂, 1 ♀. Type, coll. Barnes.” A male type is at the USNM, and is designated as **lectotype** to clarify application of the name *beutenmuelleri*. The lectotype bears the labels “Tom Spalding / VIII-2-9 / Provo Utah”, “Catocala / beutenmuelleri / B+McD / Type ♂.” The name *beutenmuelleri* has been retained since Barnes and McDunnough (1918) as a western subspecies of *C. verrilliana* Grote, 1875. However, specimens referable to *C. beutenmuelleri* are part of the normal infrapopulational variation seen throughout the geographic range of *C. verrilliana*. Type Locality: Provo, Ut[ah, USA].

***Catocala blandula* Hulst**

Fig. 5 (lectotype)

*Catocala blandula* Hulst, 1884: 38*Catocala blandula*; Barnes and McDunnough 1918: 41*Catocala blandula*; McDunnough 1938: 118*Catocala blandula*; Franclemont and Todd 1983: 129

**Type material.** *Catocala blandula*: the original description does not state the number of types. A male and female type are at the AMNH, and the male is designated as **lectotype** to clarify application of the name *blandula*. The lectotype bears the labels “♂”, “Vt.”, “Collection / GDHulst”, “Catocala / blandula / Type Hulst.” Type Locality: hereby restricted to V[ermon]t, [USA] on the basis of the lectotype label.

***Catocala faustina* ssp. *allusa* syn. *caerulea* Beutenmüller, syn. n.**

Fig. 6 (lectotype)

*Catocala caerulea* Beutenmüller, 1903: 939*Catocala faustina* race *caerulea*; Barnes and McDunnough 1918: 23*Catocala cleopatra* ssp. *caerulea*; McDunnough 1938: 116*Catocala cleopatra* ssp. *caerulea*; Franclemont and Todd 1983: 128

**Type material.** *Catocala caerulea*: the original description does not state the number of types. There are two male types at the AMNH, and one is designated as **lectotype**



to clarify application of the name *caerulea*. The lectotype bears the labels “Oregon”, “Type / No. / A.M.N.H.”, “*Catocala* / *caerulea* / Beut.” The name *caerulea* has been treated since Barnes and McDunnough (1917) as a subspecies of nominate *C. faustina*, but the name *allusa* Hulst, 1884 has priority over the name *caerulea* for the coastal northwestern subspecies. Type Locality: Oregon, [USA].

***Catocala carissima* Hulst, stat. n.**

Fig. 7 (lectotype)

*Catocala carissima* Hulst, 1880: 97

*Catocala cara* race *carissima*; Barnes and McDunnough 1918: 31

*Catocala cara* ssp. *carissima*; McDunnough 1938: 117

*Catocala cara* ssp. *carissima*; Franclemont and Todd 1983: 129

**Type material.** *Catocala carissima*: The original description does not state the number of types. Several types are at the AMNH, and a male is designated as **lectotype** to clarify application of the name *carissima*. The lectotype bears the labels “Fla.”, “Collection / GDHulst”, “*Catocala* / *cara* / var. *carissima* / Type Hulst.” Hulst (1880: 97) stated “We have a form of *Catocala cara* which is not found in the North and which seems to be the constant form in the South.” Specimens of *C. cara* and *C. carissima* are readily separable, and despite the fact that *C. cara* is principally northern and *C. carissima* principally southern, a zone of sympatry extends across much of the southern United States. The egg of *C. carissima* is consistently smaller than that of *C. cara* (eggs from several females of each taxon have been examined; this size difference is unusual among related species of *Catocala*). We have never reared *C. carissima* from *C. cara* females, out of a half dozen broods from differing locations in the USA, and hence elevate *C. carissima* to species rank. Type Locality: hereby restricted to Fl[orid]a, [USA] on the basis of the lectotype locality label.

***Catocala electilis* syn. *cassandra* H. Edwards**

Fig. 8 (lectotype)

*Catocala cassandra* H. Edwards, 1875b: 214

*Catocala electilis* syn. *cassandra*; Barnes and McDunnough 1918: 30

*Catocala electilis* syn. *cassandra*; McDunnough 1938: 117

*Catocala electilis* syn. *cassandra*; Franclemont and Todd 1983: 129

**Type material.** *Catocala cassandra*: the original description states “Guadalajara, Mexico, Baron Terloo. (Coll. Hy. Edw.).” A male type is at the AMNH, and is designated as **lectotype** to clarify application of the name *cassandra*. The lectotype bears the labels “6034 / Mexico”, “Type / No. / A.M.N.H.”, “No. 11763 / Collection / Hy. Edwards.”, “*Catocala* type / *cassandra* Hy. Ed. / Guadalajara. Mex.”, “*C. electilis* /

v. cassandra / Hy. Edw.”, “in coll. as / Catocala / electilis / Walker.” Type Locality: Guadalajara, Mexico.

***Catocala praeclara* ssp. *charlottae* Brou, stat. n.**

*Catocala charlottae* Brou, 1988: 116

**Type material.** *Catocala charlottae*: holotype ♂ [USNM, examined]. The original description inexplicably compared *C. charlottae* only to the sympatric *C. alabamae* Grote, 1875, and not to the more similar and widespread *C. praeclara* Grote & Robinson, 1866. Specimens of *C. charlottae* have been reported from a scattering of counties abutting or near the Gulf of Mexico in Louisiana, Mississippi, and Florida; although several hundred specimens have been collected from the type locality (Abita Springs) only a few dozen specimens exist from all other localities combined. The type locality of *C. charlottae* is also the most southwesterly population known for *praeclara*, and appears to be somewhat isolated geographically from other Gulf Coast populations, although we suspect this may be an artifact of limited sampling. We have examined a series of over one hundred topotypes of *C. charlottae*, and although these are fairly homogeneous (forewings largely lacking both the lustrous blue-green scaling and prominent basal dash, and with an overshadowing of brown), about five percent of the topotypes are like *C. praeclara* from other localities in North America. Baggett (1989) reported that “*charlottae* and a *praeclara*-like morph were reared from the same batch of eggs,” and J. Slotten (in litt.) has reared specimens both with and without the basal dash from the same female. The larva of *C. charlottae* is similar to nominate *C. praeclara*, and unlike the larva of *C. alabamae*. Given these rearing results, and the broad overlap in morphological variation of adult *C. charlottae* and *C. praeclara*, we consider *C. charlottae* to be best treated as a subspecies of *C. praeclara* Grote & Robinson, 1866. Additional collecting and ex ovis rearing are desirable from the southern United States, notably in the apparent sampling gap in Mississippi and Alabama. See the account for *C. manitoba* Beutenmüller, 1908 below for further discussion of geographic variability in *C. praeclara*. Type Locality: 4.2 mi. NE Abita Springs, Saint Tammany Parish, Louisiana, [USA].

***Catocala concumbens* Walker**

Fig. 9 (lectotype)

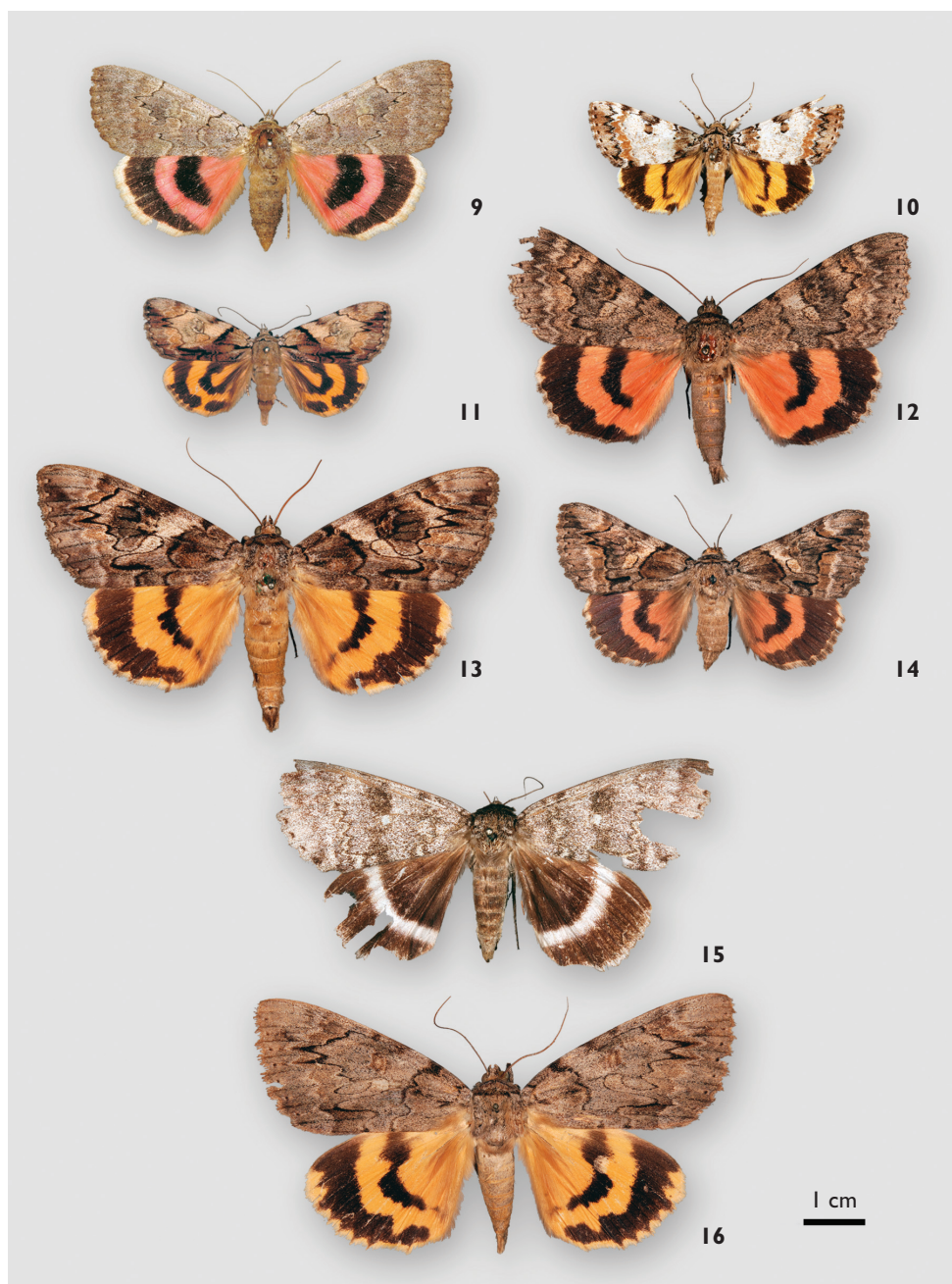
*Catocala concumbens* Walker, [1858]: 1198

*Catocala concumbens*; Barnes and McDunnough 1918: 32

*Catocala concumbens*; McDunnough 1938: 117

*Catocala concumbens*; Franclemont and Todd 1983: 129

**Type material.** *Catocala concumbens*: the original description states “a. Orilla [sic], West Canada. From Mr. Bush’s collection. b. North America.” A female type is at



**Figures 9–16.** Type specimens of *Catocala*. **9** lectotype, *C. concumbens* Walker, [1858] **10** lectotype, *C. cordelia* H. Edwards, 1880 **11** lectotype, *C. crataegi* Saunders, 1876 **12** lectotype, *C. diantha* Beutenmüller, 1907 **13** lectotype, *C. dionyza* H. Edwards, 1885 **14** neotype, *C. dollii* Beutenmüller, 1907 **15** lectotype, *C. elda* Behrens, 1887 **16** lectotype, *C. euphemia* Beutenmüller, 1907.

the BMNH, and is designated as **lectotype** to clarify application of the name *con-cumbens*. The lectotype bears the labels “Canada / Ontario / Orilla / Bush. / 56-13”, “Canada W. / 56-13 [and on the reverse:] Catocala / concumbens / Walker Type.” Type Locality: hereby restricted to Orillia, [Ontario,] Canada on the basis of the lectotype label.

***Catocala connubialis* syn. *cordelia* H. Edwards**

Fig. 10 (lectotype)

*Catocala cordelia* H. Edwards, 1880b: 59

*Catocala cordelia*; Barnes and McDunnough 1918: 44

*Catocala connubialis* syn. *cordelia*; McDunnough 1938: 118

*Catocala connubialis* syn. *cordelia*; Franclemont and Todd 1983: 129

**Type material.** *Catocala cordelia*: the original description states “five specimens... Types, coll. Dr. James S. Bailey, Hy. Edwards.” A male type is at the AMNH, and is designated as **lectotype** to clarify application of the name *cordelia*. The lectotype bears the labels “Tallahassee / Florida.”, “Type / No. / A.M.N.H.”, “No. 11793 / Collection / Hy. Edwards.”, “Catocala / cordelia / Type / Hy. Ed.” Type Locality: Tallahassee, Florida, [USA].

***Catocala crataegi* Saunders**

Fig. 11 (lectotype)

*Catocala crataegi* Saunders, 1876: 72

*Catocala crataegi*; Barnes and McDunnough 1918: 39

*Catocala crataegi*; McDunnough 1938: 118

*Catocala crataegi*; Franclemont and Todd 1983: 129

**Type material.** *Catocala crataegi*: the original description cites “[adult] specimens [reared from larvae] taken by bush beating about the middle of June.” Barnes and McDunnough (1918: 39) referred to a male type at the BMNH, and it is designated as **lectotype** to clarify application of the name *crataegi*. The lectotype bears the labels “Grote Coll. / 81-116”, “Canada / Saunders”, “Canada / 81-116 [and on the reverse:] Catocala / crataegi / Type Saunders.” Type Locality: [London, Ontario, Canada].

***Catocala mira* syn. *dana* Cassino, syn. n.**

*Catocala mira* var. *dana* Cassino, 1918a: 54

*Catocala mira* ssp. *dana*; McDunnough 1938: 118

*Catocala mira* ssp. *dana*; Franclemont and Todd 1983: 129

**Type material.** *Catocala mira* var. *dana*: the original description states a “Holotype ♂ in the collection of the author.” There is a female at the USNM [Type No. 44533, examined] with a Cassino type label and appropriate locality data, and because Cassino often missexed his material, we consider this female to be his holotype. The name *dana* has in the past been treated as a subspecies of *C. mira* Grote, 1876, probably based on small sample sizes and limited knowledge of geographic variation in this species. We have examined large numbers of *C. mira* from throughout North America, and find the name *dana* to be neither distinctive nor geographically definable. Type Locality: Springfield, Texas, [USA].

***Catocala habilis* syn. *denussa* Ehrman, syn. rev.**

*Catocala denussa* Ehrman, 1893: 152

*Catocala denussa*; Beutenmüller 1913: 97

*Catocala denussa*; Barnes and McDunnough 1918: 9

*Catocala palaeogama* syn. *denussa*; McDunnough 1938: 115

*Catocala palaeogama* syn. *denussa*; Franclemont and Todd 1983: 128

**Type material.** *Catocala denussa*: the holotype male [CMNH, examined] is a melanic aberrant of *C. habilis* Grote, 1872 as originally suggested by Ehrman and Beutenmüller (1913). The name was incorrectly placed as a synonym of *C. palaeogama* Guenée, 1852 in McDunnough (1938). Type Locality: [Browns Hills, Pittsburgh], Allegheny County, Penn[sylvania, USA].

***Catocala hermia* ssp. *hermia* syn. *diantha* Beutenmüller**

Fig. 12 (lectotype)

*Catocala diantha* Beutenmüller, 1907: 937

*Catocala verecunda* syn. *diantha*; Barnes and McDunnough 1918: 21

*Catocala hermia* ssp. *verecunda* syn. *diantha*; McDunnough 1938: 116

*Catocala hermia* ssp. *verecunda* syn. *diantha*; Franclemont and Todd 1983: 128

**Type material.** *Catocala diantha*: the original description states “Collections, William Barnes, Jacob Doll, American Entomological Society, American Museum of Natural History, and United States National Museum.” Three types are at the AMNH, and a male is designated as **lectotype** to clarify application of the name *diantha*. The lectotype bears the labels “Denver, Col. / 9-3-02.”, “No. 22374 / Museum Coll.”, “Type / No. / A.M.N.H.”, “Catocala / diantha / Beuten.” Type Locality: hereby restricted to Denver, Colorado [USA] on the basis of the lectotype locality label.

***Catocala piatrix* ssp. *dionyza* H. Edwards**

Fig. 13 (lectotype)

*Catocala dionyza* H. Edwards, 1885: 124*Catocala piatrix* syn. *dionyza*; Barnes and McDunnough 1918: 5*Catocala piatrix* ssp. *dionyza*; McDunnough 1938: 115*Catocala piatrix* ssp. *dionyza*; Franclemont and Todd 1983: 128

**Type material.** *Catocala dionyza*: the original description states “2 ♂... Arizona. Coll. B. Neumoegen.” A male type is at the USNM, and is designated as **lectotype** to clarify application of the name *dionyza*. The lectotype bears the labels “Arizona” “Type No. / 33996 / U.S.N.M.” Col. / B. Neumogen” “Catocala / Type / dionyza. Hy. Edw.” Type Locality: Arizona, [USA].

***Catocala ophelia* syn. *dollii* Beutenmüller, syn. n.**

Fig. 14 (neotype)

*Catocala ophelia* var. *dollii* Beutenmüller, 1907: 940*Catocala ophelia* form *dollii*; Barnes and McDunnough 1918: 38*Catocala ophelia* ssp. *dollii*; McDunnough 1938: 117*Catocala ophelia* ssp. *dollii*; Franclemont and Todd 1983: 129

**Type material.** *Catocala ophelia* var. *dollii*: the original description states “Male... Habitat – Colorado. A single specimen of this odd variety is in the collection of Mr. Jacob Doll.” Barnes and McDunnough (1918) claimed to have figured the holotype by monotypy, but the specimen from Doll’s collection marked as type at the USNM is a female from Arizona and bears a label written in 1932 by F. H. Benjamin stating “prob. spurious type.” Benjamin apparently worked on but never resolved this issue, as several other specimens of *C. dollii* in the USNM and AMNH collections bear notes by him inquiring as to the status of the holotype. Given Benjamin’s difficulties and the fact that the name refers to one of the taxonomically difficult western Nearctic species, we designate the USNM female noted above as **neotype** to clarify application of the name *dollii*. The neotype bears the labels “Prescott / VII. 21 Ariz.”, “Col. / Jacob Doll”, “Type / No. / A.M.N.H.”, “Type No. / 44535 / U.S.N.M.”, “Prob. spurious type. / Should be a ♂ from / Colorado (Doll Coll.) / FHB. 1932.” Type Locality: hereby amended to Prescott, Ariz[ona, USA] on the basis of the neotype labels.

***Catocala californica* syn. *edwardsi* Kusnezov, syn. n.***Catocala edwardsi* Kusnezov, 1903: 75*Catocala edwardsi*; Barnes and McDunnough 1918: 24



*Catocala californica* ssp. *edwardsi*; McDunnough 1938: 116

*Catocala californica* ssp. *edwardsi*; Franclemont and Todd 1983: 128

**Type material.** *Catocala edwardsi*: the name *edwardsi* is a replacement name for *C. mariana* Strecker, 1874, with the same type specimen and type locality [FMNH, examined], and *C. mariana* Strecker is a primary junior homonym of *C. mariana* Rambur, 1866 (see Gall and Hawks 1990). Although *C. edwardsi* has been treated since McDunnough (1938) as a subspecies of *C. californica* Edwards, *C. edwardsi* falls within the normal range of geographic variation of *C. californica*. Type Locality: Vancouver Island, [British Columbia, Canada].

***Catocala relictata* syn. *elda* Behrens, syn. n.**

Fig. 15 (lectotype)

*Catocala elda* Behrens, 1887: 199

*Catocala relictata* race *elda*; Barnes and McDunnough 1918: 20

*Catocala relictata* ssp. *elda*; McDunnough 1938: 116

*Catocala relictata* ssp. *elda*; Franclemont and Todd 1983: 128

**Type material.** *Catocala elda*: the original description states “Three examples. Portland, Oregon.” A female type is at the AMNH, and is designated as **lectotype** to clarify application of the name *elda*. The lectotype bears the labels “No. 11745 / Collection / Hy. Edwards.”, “Type / No. / A.M.N.H.”, “Catocala / elda Hy. Edw. / Type”, “Beutenmuller – Edwards / types A.M.N.H. Bulletin / IV p. 192. – 1892 / gives: *C. elda* Behrens / 1 ♀, Portland Oregon. / This is presumably one / of three spec. referred to in O.D. / 14.VIII.41 W. P. Comstock.” Beutenmüller (1897: 17) noted “last summer Mr. Doll raised a single specimen [of *elda*] from a larva found on Long Island, N.Y. It is, without doubt, nothing more than a gray variety of *C. relictata*. Mr. Palm already called attention to this fact (Journ. N. Y. Entomological Soc., I, p. 21.).” Barnes and McDunnough stated (1918: 20) that *elda* was “at best a mere geographical race found on the Pacific Coast from British Columbia to Oregon... it is apparently best defined on Vancouver Island, B.C., for specimens before us from the interior of Washington State can scarcely be separated from *phrynia*.” Since we have also seen specimens referable to *elda* from other eastern North American localities, we place *C. elda* as a synonym of *C. relictata* Walker, [1858]. Type Locality: Portland, Oregon, [USA].

***Catocala californica* syn. *elizabeth* Cassino, syn. n.**

*Catocala elizabeth* Cassino, 1918a: 53

*Catocala californica* ssp. *elizabeth*; McDunnough 1938: 116

*Catocala californica* ssp. *elizabeth*; Franclemont and Todd 1983: 128

**Type material.** *Catocala elizabeth*: holotype ♀ [USNM, examined]. The name *elizabeth* has been treated since McDunnough (1938) as a subspecies of *C. californica* Edwards, 1864. However, the type of *C. elizabeth* falls within the normal range of geographic variation of *C. californica*. Type Locality: Truckee, Calif[ornia, USA].

***Catocala junctura* syn. *elsa* Beutenmüller, syn. n.**

*Catocala elsa* Beutenmüller, 1918: 62

*Catocala elsa*; McDunnough 1938: 116

*Catocala elsa*; Franclemont and Todd 1983: 129

**Type material.** *Catocala elsa*: holotype ♀ [USNM, examined]. The name *elsa* has been treated since McDunnough (1938) as a full species. However, the type of *C. elsa* is a typical specimen of the widespread and morphologically variable *C. junctura* Walker, [1858]. Type Locality: Prescott, Arizona, [USA].

***Catocala californica* syn. *erichi* Brower, syn. n.**

*Catocala erichi* Brower, 1976

*Catocala erichi*; Franclemont and Todd 1983: 129

**Type material.** *Catocala erichi*: holotype ♂ [USNM, examined]. Brower's (1976: 37) brief diagnosis stated that *C. erichi* was "well separated from *francisca* Hy. Edwards, and from the more northern complex of *mariana*, Hy. Edwards, *edwardsi* Kuznesov and *eldoradensis* Beutenmüller. Larvae of *erichi* (named for the chief collector), two broods, lost in the last instar the dark brown patch on the abdominal hump, while larvae of *francisca* kept their patch." Our rearing work and comparison of types indicate that *C. francisca* H. Edwards, 1880 is conspecific with *C. hermia* H. Edwards, 1880, not *C. californica* Edwards, 1864; and that *C. erichi* is an infrapopulational form of *C. californica*. Specimens referable to *C. erichi* occur sporadically throughout the geographic range of *C. californica*, but are most prevalent in the mountains of southern California. The larval character cited by Brower varies both geographically as well as within single broods of *C. hermia* and *C. californica*, and as Johnson and Walter (1984) more accurately reported, "[the] oblique, lateral patch on A5 and A6 [in *erichi* is] inconspicuous" i.e., not "lost" as stated by Brower. Type Locality: Green Valley Creek, San Bernardino M[oun]t[ain]s, Calif[ornia, USA].

***Catocala neogama* ssp. *euphemia* Beutenmüller, stat. n.**

Fig. 16 (lectotype)

*Catocala euphemia* Beutenmüller, 1907: 938*Catocala euphemia*; Barnes and McDunnough 1918: 16*Catocala euphemia*; McDunnough 1938: 115*Catocala euphemia*; Franclemont and Todd 1983: 128

**Type material.** *Catocala euphemia*: the original description indicates types at the “American Entomological Society, American Museum of Natural History, and Brooklyn Institute of Art and Science.” A male type is at the AMNH, and is designated as **lectotype** to clarify application of the name *euphemia*. The lectotype bears the labels “Carr Canyon / Huachuca Mts. / Cochise Co. Ariz.,” “H. Skinner / August 1905,” “Type / No. / A.M.N.H.,” “Catocala / euphemia / Type Beuten.” Barnes and McDunnough (1918:16) noted that *C. euphemia* could “be merely a southwestern race of *neogama* (J. E. Smith, 1797) but as there is some slight difference shown in the male claspers, we treat it as a species until the larval history is known.” At the same time, they described *C. loretta* from south-central Texas as a new race that “would appear to be intermediate between *neogama* and *euphemia*,” and suggested that the name *euphemia* be limited to the material from the Huachuca Mountains, Arizona, as has been done above. Although specimens of *C. euphemia* from Arizona and New Mexico are normally separable from specimens of *C. neogama* from the midwest and eastern United States, these two blend in the southcentral United States, particularly in Oklahoma and Texas; specimens referable to *loretta* mostly manifest toward the southern end of this blend. We have successfully reared larvae ex ovis from several broods of Arizona *C. euphemia* and eastern *C. neogama*, and have collected and reared many wild larvae of both taxa from various species of *Juglans*; we have found no substantial differences between these larvae. Three fluid preserved larvae of *C. loretta* at PMNH, collected by R. Kendall on *Juglans microcarpa* Berl. in Uvalde County, Texas, are likewise indistinguishable from larvae of *C. neogama* and *C. euphemia*. Accordingly, we treat *C. euphemia* as a subspecies of *C. neogama* (J. E. Smith, 1797). We refer material from Arizona, New Mexico, and extreme western Texas to *C. neogama euphemia*, and all other material to *C. n. neogama* (for analysis of *C. loretta* Barnes & McDunnough, 1918 see its entry below). Type Locality: hereby restricted to Carr Canyon, Huachuca M[oun]t[ain]s, Cochise Co[unty], Arizona [USA] on the basis of the lectotype labels.

***Catocala hermia* ssp. *francisca* H. Edwards, stat. n.**

Fig. 17 (lectotype)

*Catocala mariana* var. *francisca* H. Edwards, 1880b: 57*Catocala francisca*; Barnes and McDunnough 1918: 25

*Catocala francisca*; McDunnough 1938: 116

*Catocala francisca*; Franclemont and Todd 1983: 128

**Type material.** *Catocala mariana* var. *francisca*: The original description states “Humboldt Co., Cal. 2 ♂. Type, coll. Hy. Edwards.” Beutenmüller (1892: 191) lists the *C. francisca* types as being at the AMNH, and a male type is there but bears Mendocino County, California locality labels. At the USNM is a male labeled “Type 2” [examined], also from Mendocino County. Although the county on these labels conflicts with the original description, Barnes and McDunnough (1918: 24–25) have already noted that errors in locality data do occur with type specimens of the dark-forewinged western *Catocala*. Mendocino and Humboldt counties are adjacent to one another, and the county indicated on the label is the only information we have that might otherwise disqualify the two aforementioned *C. francisca* males as syntypes. With deference to Beutenmüller and Barnes and McDunnough’s judgments, we consider it likely that a mislabeling occurred, and designate the AMNH male as **lectotype** to clarify application of the name *francisca*. The lectotype bears the labels “Mendocino Co./California”, “7299”, “No. 11889 / Collection / Hy. Edwards.”, “Type / No. / A.M.N.H.”, “Cat. mariana / v. francisca / Type. Hy. Edw.” From rearing work and analysis of museum specimens, we have concluded that *C. francisca* is neither a full species nor conspecific with *C. californica* Edwards, 1864 (= *C. mariana* Strecker, 1874), but rather is a coastal Californian subspecies of *C. hermia* H. Edwards, 1880 with uniform, dark greenish-black forewings. Type Locality: hereby amended to Mendocino Co[unty], California, [USA] on the basis of the lectotype label.

*Catocala faustina* ssp. *allusa* syn. *frenchii* Poling, syn. rev.

Fig. 18 (lectotype)

*Catocala frenchii* Poling, 1901: 125

*Catocala allusa* syn. *frenchii*; Barnes and McDunnough 1918: 22

*Catocala allusa* syn. *frenchii*; McDunnough 1938: 116

*Catocala allusa* syn. *frenchii*; Franclemont and Todd 1983: 128

**Type material.** *Catocala frenchii*: the original description states “two examples, one in collection of G. H. French, the other in the collection of O. C. Poling.” A male type is at the USNM, and is designated as **lectotype** to clarify application of the name *frenchii*. The lectotype bears the labels “N. Westminster, / 1900 B.C. / Poling.”, “Frenchii / Type”, “Catocala / frenchii / Poling / Type.”, “Barnes / Collection.” Type Locality: New Westminster, B[ritish] C[olumbia], Canada.



**Figures 17–24.** Type specimens of *Catocala*. **17** lectotype, *C. francisca* H. Edwards, 1880 **18** lectotype, *C. frenchii* Poling, 1901 **19** lectotype, *C. gisela* Meyer, 1880 **20** neotype, *C. grotiana* Bailey, 1879 **21** neotype, *C. irene* Behr, 1870 **22** lectotype, *C. jessica* Strecker, 1877 **23** lectotype, *C. loretta* Barnes & McDunnough, 1918 **24** lectotype, *C. luctuosa* Hulst, 1884.



***Catocala micronympha* syn. *gisela* Meyer**

Fig. 19 (lectotype)

*Catocala gisela* Meyer, 1880: 96*Catocala micronympha* syn. *gisela*; Barnes and McDunnough 1918: 43*Catocala micronympha* syn. *gisela*; McDunnough 1938: 118*Catocala micronympha* syn. *gisela*; Franclemont and Todd 1983: 129

**Type material.** *Catocala gisela*: the original description states “One specimen in my collection, and another in Mr. Fr. Tepper’s of Brooklyn.” A female type is at the BMNH, and is designated as **lectotype** to clarify application of the name *gisela*. The lectotype bears the labels “*Catocala* / *gisela* ♂ / Type”, “*Catocala* / *gisela* ♀.” Type Locality: Georgia, [USA].

***Catocala grotiana* Bailey**

Fig. 20 (neotype)

*Catocala grotiana* Bailey, 1879: 21*Catocala grotiana*; Barnes and McDunnough 1918: 26*Catocala grotiana*; McDunnough 1938: 116*Catocala grotiana*; Franclemont and Todd 1983: 129

**Type material.** *Catocala grotiana*: the original description states “My specimen is a ♂ in good condition, and was taken in Colorado.” We have been unable to locate a specimen labeled as type, and the Bailey collection is apparently lost. Although usage of the name *grotiana* has been largely consistent during the last century, since the name refers to a member of the taxonomically difficult and variable western Nearctic species, we designate a female from the AMNH as **neotype** to clarify application of the name *grotiana*. The neotype bears the labels “Colorado.”, “No. 12652 / Collection / Hy. Edwards.”, “Edw. Coll.”, “*Catoc.* / *grotiana* / Bailey.” Type Locality: remains Colorado, [USA] on the basis of the neotype labels.

***Catocala semirelecta* ssp. *hippolyta* Strecker, stat. n.***Catocala hippolyta* Strecker, 1874: 99*Catocala hippolyta*; Barnes and McDunnough 1918: 30*Catocala hippolyta*; McDunnough 1938: 116*Catocala hippolyta*; Franclemont and Todd 1983: 129

**Type material.** *Catocala hippolyta*: lectotype ♂ [FMNH, examined], designated by Gall and Hawks (1990: 10). Barnes and McDunnough (1918: 30) stated “the species is only



known from the Coast Range of California extending from Sonoma County to Los Angeles County.” Although *C. hippolyta* has been treated as an endemic coastal Californian species, it in fact comes into contact with *C. semirelecta* Grote, 1874 along the eastern and northern edges of its geographic range in the Sierra Nevada mountains, where the two blend into one another. Moreover, during the past several decades, Paul and Sandy Russell have collected from one locality in the Santa Barbara foothills a series of *C. hippolyta* that contains specimens indistinguishable from typical *C. semirelecta*. We thus feel the observed geographic variation in *C. hippolyta* and *C. semirelecta* is more indicative of two subspecies. Type Locality: San Mateo County, California, [USA].

### ***Catocala irene* Behr**

Fig. 21 (neotype)

*Catocala irene* Behr, 1870: 24

*Catocala irene*; Barnes and McDunnough 1918: 22

*Catocala irene*; McDunnough 1938: 116

*Catocala irene*; Franclemont and Todd 1983: 128

**Type material.** *Catocala irene*: the original description states “Ft. Tejon, one specimen.” Smith (1893: 343) indicated the *irene* type was in Henry Edwards’ collection, and Barnes and McDunnough stated (1918: 22): “According to Hy. Edwards, who had opportunities of examining the type specimen (since destroyed)...; a specimen of this form, marked ‘true to type’ exists in the Hy. Edwards’ Collection...” Reiff (1920: 64) added: “Without making any comments I may mention that I have from the old Worthington collection a specimen without locality label and marked ‘Irene type’ in apparently Strecker’s handwriting.” Henry Edwards’ specimen is at the AMNH, and Reiff’s specimen is at the MCZ. We have not been able to locate another specimen that is unquestionably the *C. irene* holotype. Reiff’s MCZ specimen could be the holotype, since what we consider to be the holotype of *C. zoe* Behr, 1870 is in the Strecker collection at the FMNH, and it seems likely that Behr’s *Catocala* types resided at some juncture with Strecker (see Gall and Hawks 1990). However, since we cannot prove the MCZ specimen is the holotype, and the name refers to a member of the taxonomically difficult and variable western Nearctic species, we give precedence to the AMNH specimen compared to the type, and designate it as **neotype** to clarify application of the name *irene*. The neotype bears the labels “Mendocino / California.”, “3477”, “No. 11896 / Collection / Hy. Edwards.”, “True to type. / irene / Behr.” Type Locality: hereby amended to Mendocino, California, [USA] on the basis of the neotype locality label.

### ***Catocala jessica* H. Edwards**

Fig. 22 (lectotype)

*Catocala jessica* H. Edwards, 1877: 23

*Catocala jessica*; Barnes and McDunnough 1918: 29

*Catocala jessica*; McDunnough 1938: 116

*Catocala jessica*; Franclemont and Todd 1983: 129

**Type material.** *Catocala jessica*: the original description states “1 ♀, 1 ♂, Havilah, Kern Co., Mr. R. H. Stretch. (Coll. Hy. Edw., No. 6,648).” These two types are at the AMNH, the female being a specimen of *C. jessica* and the male a specimen of *C. junctura* Walker [1858]. The female is designated as **lectotype** to clarify application of the name *jessica*. The lectotype bears the labels “Havilah / California.”, “6648”, “No. 12651 / Collection / Hy. Edwards.”, “Type / No. / A.M.N.H.”, “Cat. / var. *jessica*. Type. / Hy. Edw.”, “Catocala / *jessica* / Hy. Edws.” Type Locality: Havilah, Kern Co[unty], California, [USA].

***Catocala neogama* syn. *loretta* Barnes & McDunnough, syn. n.**

Fig. 23 (lectotype)

*Catocala neogama* race *loretta* Barnes & McDunnough, 1918: 16

*Catocala neogama* ssp. *loretta*; McDunnough 1938: 115

*Catocala neogama* ssp. *loretta*; Franclemont and Todd 1983: 128

**Type material.** *Catocala neogama* race *loretta*: the original description lists 4 males and 3 females from several Texas localities, and a male from the USNM is designated as **lectotype** to clarify application of the name *loretta*. The lectotype bears the labels “Black Jack / Spgs, Texas”, “*C. neogama* / v. *lucetta* [sic] / Type B+McD”, “Barnes / Collection.” We noted above under the entry for the name *euphemia* that the larvae of *C. loretta* do not differ appreciably from those of both *C. n. neogama* and *C. n. euphemia*. A broad blend zone between *C. n. neogama* and *C. n. euphemia* exists in the southcentral United States, and specimens matching *C. loretta* occur throughout this zone, mostly in Texas. We therefore place *C. loretta* as a synonym of *C. n. neogama* (J. E. Smith, 1797). Type Locality: hereby restricted to Black Jack Sp[ri]ngs, Texas, [USA] on the basis of the lectotype labels.

***Catocala luctuosa* Hulst, stat. rev.**

Fig. 24 (lectotype)

*Catocala luctuosa* Hulst, 1884: 53

*Catocala resecta* syn. *luctuosa*; Barnes and McDunnough 1918: 13

*Catocala resecta* ssp. *luctuosa*; McDunnough 1938: 115

*Catocala resecta* ssp. *luctuosa*; Franclemont and Todd 1983: 128

**Type material.** *Catocala luctuosa*: the original description does not state the number of types. Four types are at the AMNH, and a male is designated as **lectotype** to clarify ap-

plication of the name *luctuosa*. The lectotype bears the labels “Ind.”, “Collection / GD-Hulst”, “*Catocala* / *luctuosa* / Type Hulst.” Although Hulst described *C. luctuosa* as a distinct species, the name has been treated in the literature as a synonym or subspecies of *C. resecta* Grote, 1872. Gall (1991) established that *C. luctuosa* and *C. resecta* breed true, and that the adult morphologies are consistently distinct. Although *C. luctuosa* is encountered more commonly than *C. resecta* in the southcentral United States, the area of sympatry between the two is extensive and includes most of the geographic range of *C. luctuosa*. Accordingly, we reinstate *C. luctuosa* to the rank of species. Type Locality: hereby restricted to Ind[iana, USA] on the basis of the lectotype labels.

### ***Catocala maestosa* Hulst**

Fig. 25 (lectotype)

*Catocala maestosa* Hulst, 1884: 53

*Catocala maestosa*; Barnes and McDunnough 1918: 14

*Catocala maestosa*; McDunnough 1938: 115

*Catocala maestosa*; Franclemont and Todd 1983: 128

**Type material.** *Catocala maestosa*: the name *maestosa* was proposed as a replacement name for *C. viduata* Guenée, 1852, which was based on a misidentification of *Phalaena vidua* J. E. Smith 1797. Two of Hulst’s types are at the AMNH, and a male is designated **lectotype** to clarify application of the name *maestosa*. The lectotype bears the labels “Tex.”, “Collection / GDHulst”, “*Catocala* / *maestosa* / Type Hulst.” Type Locality: Tex[as, USA].

### ***Catocala praeclara* ssp. *manitoba* Beutenmüller, stat. n.**

Fig. 26 (lectotype)

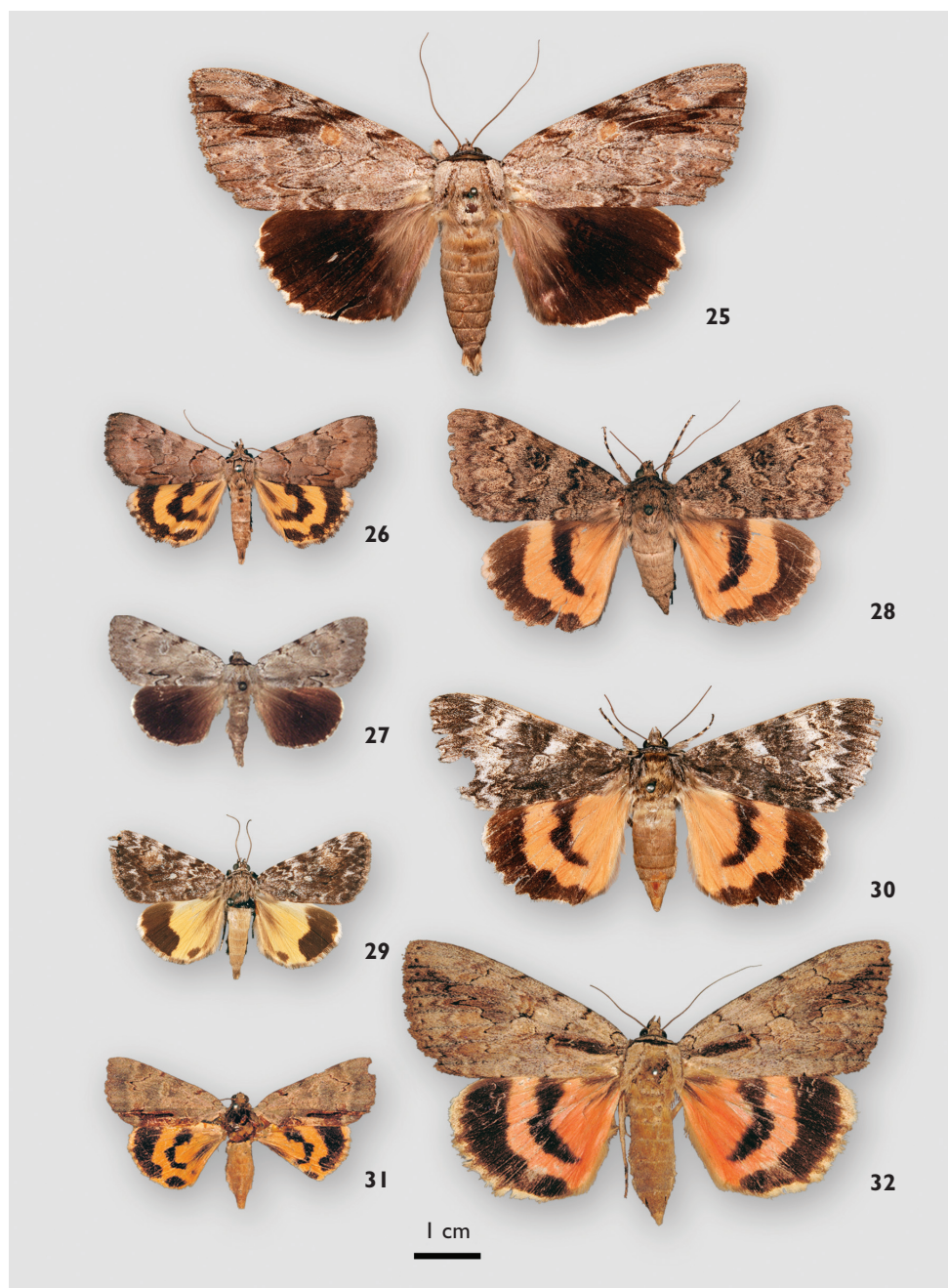
*Catocala manitoba* Beutenmüller, 1908: 54

*Catocala manitoba*; Barnes and McDunnough 1918: 41

*Catocala manitoba*; McDunnough 1938: 118

*Catocala manitoba*; Franclemont and Todd 1983: 129

**Type material.** *Catocala manitoba*: the original description states “Types. -- Collections: American Museum of Natural History, Rutgers College, and George J. Keller.” There are seven types at the AMNH, and a male is designated as **lectotype** to clarify application of the name *manitoba*. The lectotype bears the labels “Cartwright / Manitoba, Canadian / E. F. Heath / VIII 22 07”, “Type / No. / A.M.N.H.”, “*Catocala* / *manitoba* / Beuten.” Beutenmüller considered *C. manitoba* closely related to *C. praeclara* Grote & Robinson, 1866, and Barnes and McDunnough (1918: 41) felt this “duller and darker-colored form” might “merely be a geographical race” of *praeclara*.



**Figures 25–32.** Type specimens of *Catocala*. **25** lectotype, *C. maestosa* Hulst, 1884 **26** lectotype, *C. manitoba* Beutenmüller, 1908 **27** lectotype, *C. miranda* H. Edwards, 1881 **28** lectotype, *C. nebraskae* Dodge, 1875 **29** lectotype, *C. nerissa* H. Edwards, 1880 **30** lectotype, *C. nevadensis* Beutenmüller, 1907 **31** lectotype, *C. nuptula* Walker, [1858] **32** lectotype, *C. nurus* Walker, [1858].

Beutenmüller described the forewings of *C. manitoba* as generally more concolorous and less lustrous than *C. praeclara*, with a reduced basal dash “scarcely extending to the middle of the basal area, sometimes absent” (a basal dash is a prominent characteristic of eastern *C. praeclara* populations). At that time, there was an apparent geographic disjunction between *C. manitoba*, which had only been recorded from Manitoba, and *C. praeclara*, which was known from the eastern coast of the USA and maritime Canada. Specimens referable to *C. manitoba* are now known from over forty localities in Alberta, Saskatchewan, Manitoba, Wisconsin, Minnesota, North Dakota, northern South Dakota and northern Wyoming. Similarly, populations of *praeclara* are now known from throughout the Great Lakes region, and then eastward to the seacoast. Individuals lacking a basal dash occur sporadically throughout the entire range of *C. praeclara* (more frequently in Michigan, Wisconsin and Minnesota, and the southern USA; see above under account for *C. charlottae* Brou, 1988), and the same individuals that lack the basal dash often have less iridescent and/or more concolorous forewings. A paratype of *C. manitoba* in the ANSP has a prominent basal dash and markings otherwise consistent with nominate *C. praeclara*, lacking only the lustrous scaling. Beutenmüller also stated that the two medial teeth of the postmedian forewing line were of nearly equal size in *C. praeclara*, and unequal in *C. manitoba*, but this distinction does not hold over the broader distributions now known. Because these several traits vary inconsistently over a widespread area, and covary to a certain extent, particularly in the geographic sampling gap of Beutenmüller’s time, we treat *C. manitoba* as a subspecies of *C. praeclara* Grote & Robinson, 1866 Populations to the west and north of Minnesota most consistently and uniformly display the characteristics ascribed to *C. p. manitoba*. Type Locality: restricted to Cartwright, Manitoba, [Canada] on the basis of the lectotype labels.

***Catocala blandula* syn. *manitobensis* Cassino, syn. n.**

*Catocala blandula* var. *manitobensis* Cassino, 1918b: 81

*Catocala blandula* ssp. *manitobensis*; McDunnough 1938: 118

*Catocala blandula* ssp. *manitobensis*; Franclemont and Todd 1983: 129

**Type material.** *Catocala manitobensis*: the original description states “Holotype 1 ♂, 6 paratypes, in the collection of the author, Cartwright, Manitoba, July 17.” A female at the USNM (USNM Type No. 44528) bears a label stating “manitobensis / Cass. / Type fide / Buchholz.” Because Cassino often missexed his material, we see no reason to challenge Buchholz’s judgment, and accept this specimen as the holotype by original designation. Cassino tabulated several characteristics supposedly distinguishing *C. m. manitobensis* from nominate *C. blandula* Hulst, 1884. On the dorsal forewing these included: a darker and more distinct postmedian band; a light to absent brown scaling distad from the postmedian band; and a lighter and bluish ground color, such that “the whole effect of the superiors is a bluish tint quite unlike that of *blandula*, the scales of



which are more brownish.” We have examined specimens of *C. m. manitobensis* (including paratypes) and nominate *C. blandula* from across the Nearctic, and find that the characteristics ascribed to *C. m. manitobensis* occur sporadically throughout the species’ entire geographic range, especially in females, and see little merit in retaining the name *manitobensis*. Exemplary localities where specimens often show *manitobensis* characteristics include the vicinity of Chicago, Illinois, and the eastern seaboard of Maine and maritime Canada; the same characteristics also appear regularly in what we presently consider to be *C. blandula* populations from lowland coastal areas in the southeastern USA (e.g., notably around Gainesville, Florida). These lowland *C. blandula* populations are among the most morphologically variable known: some Floridian specimens (especially females) are nearly identical to types of *C. manitobensis*, whereas others have the entire forewing pattern obscured by brownish black, and numerous intergrades occur. In many respects, the extreme variation in these southeastern *C. blandula* populations is analogous to the extreme intrapopulational forms of both *C. connubialis* Guenée, 1852 and *C. crataegi* Saunders, 1876 seen from the same geographic region. Type Locality: Cartwright, Manitoba, [Canada].

***Catocala junctura* syn. *margherita* Beutenmüller, syn. n.**

*Catocala stretchii* var. *margherita* Beutenmüller, 1918: 65

*Catocala stretchii* var. *margherita*; McDunnough 1938: 116

*Catocala stretchii* var. *margherita*; Franclemont and Todd 1983: 129

**Type material.** *Catocala margherita*: holotype ♂ [USNM, examined]. The holotype of *margherita* is a specimen of *junctura* Walker, [1858] with a thin black median hindwing band that is prominently curved basally. The name *margherita* has no definable geographic basis, as similar specimens occur in differing frequencies within populations of *C. junctura* throughout the western USA. Type Locality: Mendocino Co[unty], California, [USA].

***Catocala briseis* syn. *minerva* Cassino, syn. n.**

*Catocala minerva* Cassino, 1917: 63

*Catocala briseis* ssp. *minerva*; Barnes and McDunnough 1918: 26

*Catocala briseis* ssp. *minerva*; McDunnough 1938: 116

*Catocala briseis* ssp. *minerva*; Franclemont and Todd 1983: 129

**Type material.** *Catocala minerva*: holotype ♂ [USNM, examined]. The name *minerva* has been treated for many years as a subspecies of *C. briseis* Edwards, 1864, but *C. minerva* is a lighter color form of *C. briseis* that occurs regularly throughout much of the western geographic range of the species. Type Locality: Deer Creek, Provo Canyon, Utah, [USA].



***Catocala miranda* H. Edwards**

Fig. 27 (lectotype)

*Catocala miranda* H. Edwards, 1881: 118

*Catocala miranda*; Barnes and McDunnough 1918: 39

*Catocala miranda*; McDunnough 1938: 117

*Catocala miranda*; Franclemont and Todd 1983: 129

**Type material.** *Catocala miranda*: the original description states “Washington, D. C. Type. Coll. Hy. Edwards.” A male type is at the AMNH, and is designated as **lectotype** to clarify application of the name *miranda*. The lectotype bears the labels “Washington / D.C.” “No. 11725 / Collection / Hy. Edwards” “Type / No. / A.M.N.H.” “Catocala / miranda / Type. Hy. Edw.” Type Locality: Washington, D[istrict of] C[olumbia, USA].

***Catocala luciana* syn. *nebraskae* Dodge**

Fig. 28 (lectotype)

*Catocala nebraskae* Dodge, 1875: 2

*Catocala luciana* syn. *nebraskae*; Barnes and McDunnough 1918: 21

*Catocala luciana* syn. *nebraskae*; McDunnough 1938: 116

*Catocala luciana* syn. *nebraskae*; Franclemont and Todd 1983: 128

**Type material.** *Catocala nebraskae*: the original description does not specify the number of types. A female type is at the USNM, and is designated as **lectotype** to clarify application of the name *nebraskae*. The lectotype bears the labels “36212”, “Type / No. 4698 / U.S.N.M.”, “Catocala nebraskae. Type Spec.m / Glencoe, Dodge Co. Nebr. / Coll. G. M. Dodge.” Type Locality: Glencoe, Dodge County, Nebraska, [USA].

***Catocala lineella* syn. *nerissa* H. Edwards, syn. rev.**

Fig. 29 (lectotype)

*Catocala nerissa* H. Edwards, 1880: 61

*Catocala amica* form *nerissa*; Barnes and McDunnough 1918: 45

*Catocala amica* syn. *nerissa*; McDunnough 1938: 118

*Catocala amica* syn. *nerissa*; Franclemont and Todd 1983: 129

**Type material.** *Catocala nerissa*: the original description states “Type, coll. B. Neumoegen.” At the AMNH is a *nerissa* labeled “Type” and at the USNM is another *nerissa* labeled “Type 2.” The AMNH type is a specimen of *C. lineella*

Grote, 1872 and the USNM type is a specimen of *C. jair* Strecker, 1897. The AMNH male is designated as **lectotype** to clarify application of the name *nerissa*. The name *nerissa* thereby attaches to *C. lineella*, which itself was reinstated to species status by Gall (1990). The lectotype bears the labels “S. West / Texas.”, “No. 11784 / Collection / Hy. Edwards.”, “Cat. amica / var. nerissa. / Type Hy. Edw.” Type Locality: hereby restricted to S[outh] West Texas, [USA] on the basis of the lectotype labels.

***Catocala semirelictica* ssp. *semirelictica* syn. *nevadensis* Beutenmüller, syn. n.**

Fig. 30 (lectotype)

*Catocala nevadensis* Beutenmüller, 1907: 935

*Catocala nevadensis*; Barnes and McDunnough 1918: 28

*Catocala nevadensis*; McDunnough 1938: 116

*Catocala nevadensis*; Franclemont and Todd 1983: 129

**Type material.** *Catocala nevadensis*: the original description states “Three males and five females, American Museum of Natural History.” Two types are at the AMNH, and a female is designated as **lectotype** to clarify application of the name *nevadensis*. The lectotype bears the labels “27”, “Type / No. / A.M.N.H.”, “nevadensis from / which ♀ plate / was drawn / for mono.”, “Catocala / nevadensis / Beut.” The lectotype of *C. nevadensis* is a specimen of the widespread and morphologically variable *C. semirelictica* Grote, 1874 with strong black markings on the forewing. Such specimens occur more commonly in the western USA, but have no definable geographic basis. Type Locality: hereby restricted to Lake Tahoe, Sierra Nevada [Mountains], California, [USA] on the basis of the lectotype labels.

***Catocala grynea* syn. *nuptula* Walker**

Fig. 31 (lectotype)

*Catocala nuptula* Walker, [1858]: 1205

*Catocala grynea* syn. *nuptula*; Barnes and McDunnough 1918: 40

*Catocala grynea* syn. *nuptula*; McDunnough 1938: 118

*Catocala grynea* syn. *nuptula*; Franclemont and Todd 1983: 129

**Type material.** *Catocala nuptula*: the original description states “a,b. North America. From Mr. Milne’s collection.” A female type is at the BMNH, and is designated as **lectotype** to clarify application of the name *nuptula*. The lectotype bears the labels “N. America / 39.-6.-19. / 1595”, “N. America / 39.-6.-19.-1595”, “Catocala / nuptula / Walk. Type.” Type Locality: North America.

***Catocala amatrix* syn. *nurus* Walker**

Fig. 32 (lectotype)

*Catocala nurus* Walker, [1858]: 1195

*Catocala amatrix* syn. *nurus*; Barnes and McDunnough 1918: 32

*Catocala amatrix* syn. *nurus*; McDunnough 1938: 117

*Catocala amatrix* syn. *nurus*; Franclemont and Todd 1983: 129

**Type material.** *Catocala nurus*: the original description states “a-c. United States. Presented by E. Doubleday, Esq.” A female type is at the BMNH, and is designated **lectotype** to clarify application of the name *nurus*. The lectotype bears the labels “New York / Doubleday / 46-110”, “New York / 46-110 [and on the reverse:] *Catocala* / *nurus* ♀ / Walker Type.” The name *nurus* Walker is a synonym of *C. amatrix* Hübner, [1813] and a homonym of *Noctua nurus* Hübner, 1822, which is itself a synonym of the Palearctic *C. elocata* (Esper, 1787). Type Locality: United States.

***Catocala alabamae* syn. *olivia* H. Edwards, syn. n.**

*Catocala olivia* H. Edwards, 1880a: 95

*Catocala olivia*; Barnes and McDunnough 1918: 41

*Catocala olivia*; McDunnough 1938: 118

*Catocala olivia*; Franclemont and Todd 1983: 129

**Type material.** *Catocala olivia*: holotype ♂ [USNM, examined]. *Catocala olivia* has previously been treated as a full species, but, as suggested by Barnes and McDunnough (1918: 41), it is an extreme infrapopulational variant of *C. alabamae* Grote, 1875 with a large black basal forewing patch. We have seen intergrades between *C. olivia* and typical *C. alabamae* from several localities in Texas, Arkansas and Oklahoma, and J. Slotten (in litt.) has reared both *C. olivia* and typical *C. alabamae* ex ovis from a female from eastern Texas. The color form *parvula* W. H. Edwards, 1864 of *C. minuta* Edwards, 1864 is a parallel to the color form *olivia* of *C. alabamae*. Type Locality: S[outh] W[est] Texas, [USA].

***Catocala meskei* syn. *orion* McDunnough, syn. n.**

*Catocala orion* McDunnough, 1922: 288

*Catocala meskei* ssp. *orion*; McDunnough 1938: 116

*Catocala meskei* ssp. *orion*; Franclemont and Todd 1983: 129

**Type material.** *Catocala orion*: holotype ♂ [CNC, examined]. McDunnough (1922: 288) considered that specimens of *C. orion* “approach closest to *meskei* Grt., and may

eventually prove to be a race of this species.” We have examined the type series at the CNC, and consider that *C. orion* falls within the normal range of geographic variation of *C. meskei* Grote, 1873. Type Locality: Lethbridge, Al[ber]ta, [Canada].

***Catocala badia* ssp. *coelebs* syn. *phoebe* Hulst**

Fig. 33 (lectotype)

*Catocala badia* var. *phoebe* Hulst, 1884: 50

*Catocala badia* var. *phoebe*; Barnes and McDunnough 1918: 8

*Catocala badia* syn. *phoebe*; McDunnough 1938: 115

*Catocala coelebs* syn. *phoebe*; Franclemont and Todd 1983: 128

**Type material.** *Catocala phoebe*: the name *phoebe* was proposed by Hulst as “A form intermediate between *coelebs* and *badia*... Found in Mass. and N. Hampshire.” Since Hulst gave distinguishing characters and non-overlapping geographic localities for each of *C. badia* Grote & Robinson, 1866, *C. coelebs* Grote, 1874 and *C. phoebe*, the name *phoebe* was proposed in a subspecific context and is available. Hulst cited the name *phoebe* to “Hy. Edw. MSS,” but Hulst’s paper was published before Edwards’ description appeared. Two females from Hy. Edwards’ type lot are at the AMNH, and one is designated **lectotype** to clarify application of the name *phoebe* Hulst. The lectotype bears the labels “New Hampshire”, “No. 11779 / Collection / Hy. Edwards.”, “Type / No. / A.M.N.H.” Type Locality: hereby restricted to New Hampshire, [USA] on the basis of the lectotype labels.

***Catocala badia* ssp. *coelebs* syn. *phoebe* H. Edwards**

Fig. 33 (lectotype)

*Catocala phoebe* n. var. H. Edwards, 1885: 125

*Catocala badia* var. *phoebe*; Barnes and McDunnough 1918: 8

*Catocala badia* syn. *phoebe*; McDunnough 1938: 115

*Catocala coelebs* syn. *phoebe* Franclemont and Todd 1983: 128

**Type material.** *Catocala phoebe*: H. Edwards listed seven specimens from New Hampshire in his description of *C. phoebe*. To clarify application of the name, the female lectotype of *C. phoebe* Hulst is also designated as **lectotype** of *C. phoebe* H. Edwards. The name *phoebe* H. Edwards, 1885 is a homonym of *C. phoebe* Hulst, 1884. Type Locality: New Hampshire, [USA].

***Catocala semirelictata* ssp. *semirelictata* syn. *pura* Hulst, syn. n.**

Fig. 34 (lectotype)

*Catocala pura* Hulst, 1880: 96



**Figures 33–40.** Type specimens of *Catocala*. **33** lectotype, *C. phoebe* Hulst, 1884 and *C. phoebe* H. Edwards, 1885 **34** lectotype, *C. pura* Hulst, 1880 **35** lectotype, *C. rosalia* H. Edwards, 1880 **36** lectotype, *C. sancta* Hulst, 1884 **37** lectotype, *C. sheba* Cassino, 1919 **38** neotype, *C. stretchii* Behr, 1870 **39** neotype, *C. texanae* French, 1902 **40** lectotype, *C. titania* Dodge, 1900.

*Catocala pura*; Barnes and McDunnough 1918: 28

*Catocala pura*; McDunnough 1938: 116

*Catocala pura*; Franclemont and Todd 1983: 129

**Type material.** *Catocala pura*: the original description does not state the number of types. A male type is at the AMNH, and is designated **lectotype** to clarify application of the name *pura*. The lectotype bears the labels “♂”, “Col.”, “Collection / GDHulst”, “Catocala

/ pura / Type Hulst.” The lectotype of *C. pura* is a typical specimen of the widespread and morphologically variable *C. semirelictica* Grote, 1874.. Type Locality: Colorado, [USA].

***Catocala meskei* syn. *rosalinda* H. Edwards**

Fig. 35 (lectotype)

*Catocala rosalinda* H. Edwards, 1880b: 55

*Catocala meskei* syn. *rosalinda*; Barnes and McDunnough 1918: 26

*Catocala meskei* syn. *rosalinda*; McDunnough 1938: 116

*Catocala meskei* syn. *rosalinda*; Franclemont and Todd 1983: 129

**Type material.** *Catocala rosalinda*: the original description states “Type, coll. Dr. James S. Bailey.” A male at the AMNH is labelled “Type 2.” Beutenmüller (1892: 192) stated that the type of *C. rosalinda* was at the AMNH, and we presume this male to be the specimen to which he referred, since we have been unable to locate a specimen of *C. rosalinda* bearing simply a “Type” label. The AMNH male is designated as **lectotype** to clarify application of the name *rosalinda*. The lectotype bears the labels “New York. / Albany”, “No. 11836 / Collection / Hy. Edwards.”, “Type / No. / A.M.N.H.”, “Catoc. Type 2 / rosalinda. / Hy. Edw.” Type Locality: Albany, [New York, USA].

***Catocala connubialis* syn. *sancta* Hulst**

Fig. 36 (lectotype)

*Catocala sancta* Hulst, 1884: 38

*Catocala connubialis* syn. *sancta*; Barnes and McDunnough 1918: 44

*Catocala connubialis* syn. *sancta*; McDunnough 1938: 118

*Catocala connubialis* syn. *sancta*; Franclemont and Todd 1983: 129

**Type material.** *Catocala sancta*: the original description does not state the number of types. A male type is at the AMNH, and is designated as **lectotype** to clarify application of the name *sancta*. The lectotype bears the labels “Collection / GDHulst”, “Catocala / sancta / Type Hulst.” The name *sancta* was proposed as a replacement name for *C. connubialis* Guenée, 1852, which Hulst mistakenly thought was unavailable (see Gall and Hawks 2002b: 257–259 for detailed analysis of the name *connubialis*). Type Locality: East and South East [southeastern USA].

***Catocala hermia* ssp. *hermia* syn. *sheba* Cassino, syn. n.**

Fig. 37 (lectotype)

*Catocala sheba* Cassino, 1919: 99



*Catocala sheba*; McDunnough 1938: 116

*Catocala sheba*; Franclemont and Todd 1983: 128

**Type material.** *Catocala sheba*: the original description states “Types: 1 ♂, one ♀, paratypes 8 ♂s, 7 ♀s in the author’s collection.” A male is at the USNM, with correct locality and date information, and a label “C. new= / muni / Cassino.” It also bears the following label by F. H. Benjamin: “Think this ♂ type / of sheba Cass. / ...who says descr. / under diff. name / from that on / Type label / FHB.” This male is designated **lectotype** to clarify application of the name *sheba*. In addition to the above two labels, the lectotype bears the labels “Jemez Springs / New Mex”, “Sept 3”, “Barnes / Collection.” The lectotype of *C. sheba* is a typical specimen of the widespread and morphologically variable *C. hermia* H. Edwards, 1880. Type Locality: Jemez Springs, New Mexico, [USA].

***Catocala consors* syn. *sorsconi* Barnes & Benjamin, syn. n.**

*Catocala consors* race *sorsconi* Barnes & Benjamin, 1924: 174

*Catocala consors* ssp. *sorsconi*; McDunnough 1938: 115

*Catocala consors* ssp. *sorsconi*; Franclemont and Todd 1983: 128

**Type material.** *Catocala sorsconi*: holotype ♂ [USNM, examined]. Although Barnes and Benjamin discussed wing pattern characters supposedly differentiating *C. c. consors* (J. E. Smith, 1797) from their northern subspecies *C. s. sorsconi* (which they had named “mainly to correct... [Reiff’s] error [in naming *pensacola*]”), these characters vary widely in large series of specimens from Texas through Florida. Because the variation is geographically inconsistent, we see little merit in retaining the name *sorsconi*. Type Locality: Maine, [USA].

***Catocala junctura* syn. *stretchii* Behr, syn. n.**

Fig. 38 (neotype)

*Catocala stretchii* Behr, 1870: 24

*Catocala stretchii*; Barnes and McDunnough 1918: 30

*Catocala stretchii*; McDunnough 1938: 116

*Catocala stretchii*; Franclemont and Todd 1983: 129

**Type material.** *Catocala stretchii*: the original description states “One specimen, collected by Mr. Stretch, at Virginia City.” Barnes and McDunnough (1918: 30) stated: “The type of *stretchii* being lost, there only remains a specimen in the H. Edwards collection marked ‘true to type’; this, however is from Havilah, Kern County.” They compared this H. Edwards specimen to what they considered *C. stretchii* from Truckee, *C. portia*

H. Edwards, 1880 and *C. sierrae* Beutenmüller, 1897 and concluded that these three names referred to the same species (viz. *C. junctura* Walker [1858]). We have not been able to locate the *C. stretchii* type. Since the name refers to a member of the taxonomically difficult western Nearctic species, the female in the AMNH labeled true to type is designated as **neotype** to clarify application of the name *stretchii*. The neotype bears the labels “Havilah / California.”, “7300”, “No. 12646 / Collection / Hy. Edwards.”, “Stretchii, / Behr. / True to type.” The neotype of *C. stretchii* is a typical specimen of the widespread and morphologically variable *C. junctura* Walker, [1858]. Type Locality: hereby amended to Havilah, California, [USA] on the basis of the neotype labels.

### ***Catocala texanae* French**

Fig. 39 (neotype)

*Catocala texanae* French, 1902: 98

*Catocala texanae*; Barnes and McDunnough 1918: 29

*Catocala texanae*; McDunnough 1938: 117

*Catocala texanae*; Franclemont and Todd 1983: 129

**Type material.** *Catocala texanae*: French’s original description states “Before closing this I want to speak of the *Junctura* group. The more I see of the Arizona specimens, the more satisfied I am that the Texan form is separate from both that occur in Arizona... The Texan form is a larger insect than either of the Arizona forms, of an even greenish gray, and may be known as *Texanae*.” No types of *C. texanae* have been located in institutional collections, and French may never have labeled any specimens as such. Since the name refers to a member of the taxonomically difficult western Nearctic species, a female from PMNH (specimen #ENT 719311) is designated as **neotype** in order to clarify application of the name *texanae*. The neotype bears the labels “Uvalde Co / Texas / Stallings & Turner” “*Catocala / texanae* / French / Det. / A.E. Brower 1941.” Type Locality: hereby amended to Uvalde Co[unty, Texas, USA] on the basis of the lectotype label.

### ***Catocala pretiosa* ssp. *texarkana* Brower, stat. n.**

*Catocala texarkana* Brower, 1976: 33

*Catocala texarkana*; Franclemont and Todd 1983: 129

**Type material.** *Catocala texarkana*: holotype ♂ [USNM, examined]. When he designated the lectotype for *C. pretiosa* Lintner, 1876, Schweitzer (1982) aptly noted “separation of *Catocala texarkana* from *C. pretiosa* is extremely difficult. At present, some specimens cannot be determined with certainty. The original description of *C. texarkana* does not contain explicit comparisons with related taxa, and I can find no constant differences between these two taxa.” Even though Schweitzer had rather

limited specimen material available to him, especially from the southern Appalachians, he was able to find at least one specimen of *C. pretiosa* (from Massachusetts) that was indistinguishable from three topotypical *C. texarkana*. We have subsequently examined hundreds of specimens of *C. texarkana* from over fifty localities from Texas and Oklahoma through the midatlantic states (including Brower's types, and a morphologically variable series of several dozen topotypes in the CUIIC), and find the minor differences between *C. pretiosa* and *C. texarkana* to be essentially as stated by Schweitzer, but with greater overlap and variability. These differences are best reflected by placing *C. texarkana* as a subspecies of *C. pretiosa* Lintner, 1876. Type Locality: Forestburg, Texas, [USA].

***Catocala alabamae* syn. *titania* Dodge, syn. n.**

Fig. 40 (lectotype)

*Catocala titania* Dodge, 1900: 472

*Catocala titania*; Barnes and McDunnough 1918: 42

*Catocala titania*; McDunnough 1938: 118

*Catocala titania*; Franclemont and Todd 1983: 129

**Type material.** *Catocala titania*: the original description does not state the number of types. A male type is at the USNM, and is designated as **lectotype** to clarify application of the name *titania*. The lectotype bears the labels "Bred. 6.8.99 / La Mo", "type C. TITANIA, Dodge", "C. titania. Dodge / Type. Feb. 1 1900 / G. M. Dodge", "Barnes / Collection." Barnes and McDunnough (1918: 42) felt that *C. titania* "may be merely a poorly marked race of *alabamae*." Although most specimens from Illinois and Missouri are referable to *C. titania* (even gray forewings with reduced maculation), both *C. titania* and *C. alabamae* and a wide range of intergrades (including its form *olivia*) occur in populations in Oklahoma, Arkansas and Texas. Specimens referable to *C. titania* are in the minority in populations along the Gulf Coast, and are apparently lacking in peninsular Floridian specimens, which are even larger and more strongly marked than typical *C. alabamae*. Because *C. titania* and *C. alabamae* can be found on an intrapopulational basis over a broad geographic area, we place *C. titania* as a synonym of *C. alabamae* Grote, 1875. Type Locality: Louisiana, Missouri, [USA].

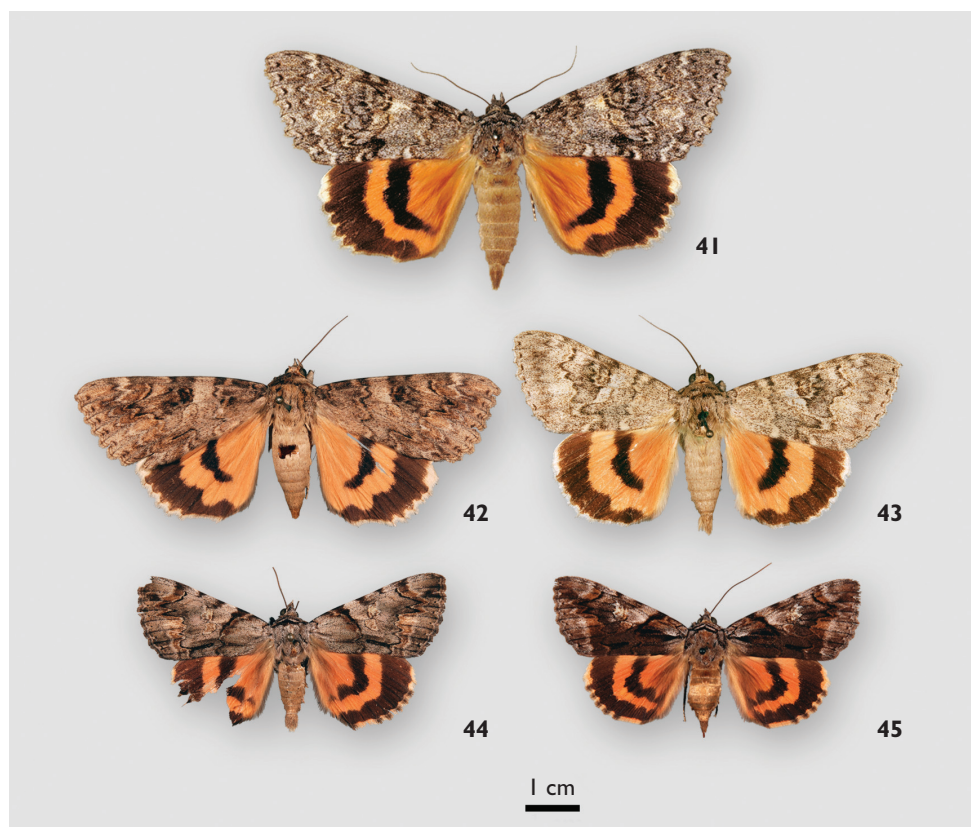
***Catocala unijuga* Walker**

Fig. 41 (lectotype)

*Catocala unijuga* Walker, [1858]: 1194

*Catocala unijuga*; Barnes and McDunnough 1918: 27

*Catocala unijuga*; McDunnough 1938: 116



**Figures 41–45.** Type specimens of *Catocala*. **41** lectotype, *C. unijuga* Walker, [1858] **42** lectotype, *C. valeria* H. Edwards, 1880 **43** lectotype, *C. verecunda* Hulst, 1884 **44** lectotype, *C. violenta* H. Edwards, 1880 **45** lectotype, *C. wernerii* Biederman, 1909.

*Catocala unijuga*; Franclemont and Todd 1983: 128

**Type material.** *Catocala unijuga*: the original description states “a. St. Martin’s Falls, Albany River, Hudson’s Bay. Presented by Dr. Barnston. b. United States. Presented by E. Doubleday, Esq. c. Canada. Presented by E. Doubleday, Esq.” A male type is at the BMNH, and is designated **lectotype** to clarify application of the name *unijuga*. The lectotype bears the labels “New York / Doubleday / 46-110.”, “New York / 46-110 [and on the reverse:] *Catocala* / *unijuga* / Type Walker.” Type Locality: [North America].

*Catocala irene* syn. *valeria* H. Edwards, syn. n.

Fig. 42 (lectotype)

*Catocala irene* var. *valeria* H. Edwards, 1880b: 56

*Catocala irene* race *valeria*; Barnes and McDunnough 1918: 22

*Catocala irene* ssp. *valeria*; McDunnough 1938: 116

*Catocala irene* ssp. *valeria*; Franclemont and Todd 1983: 128

**Type material.** *Catocala valeria*: the original description states “Types, coll. B. Neumoegen, Hy. Edwards.” A female type is at the AMNH, and is designated **lectotype** to clarify application of the name *valeria*. The lectotype bears the labels “Arizona.”, “7304”, “No. 11897 / Collection / Hy. Edwards.”, “Type / No. / A.M.N.H.”, “Cat. irene. / var. valeria. / Type. Hy. Edw.” The name *valeria* represents specimens of *C. irene* Behr, 1870 with light brown forewings with distinctive markings, and has no definable geographic basis. Type Locality: Arizona, [USA].

*Catocala hermia* ssp. *hermia* syn. *verecunda* Hulst, syn. n.

Fig. 43 (lectotype)

*Catocala verecunda* Hulst, 1884: 45

*Catocala verecunda*; Barnes and McDunnough 1918: 21

*Catocala hermia* ssp. *verecunda*; McDunnough 1938: 116

*Catocala hermia* ssp. *verecunda*; Franclemont and Todd 1983: 128

**Type material.** *Catocala verecunda*: the original description states “Habitat, Montana. Taken in numbers by H. K. Morrison.” Two female types are at the AMNH, and one is designated as **lectotype** to clarify application of the name *verecunda*. The lectotype bears the labels “♀”, “Mon.”, “Collection / GDHulst”, “Catocala / verecunda / Type Hulst.” The name *verecunda* has been treated as a subspecies of *C. hermia* H. Edwards, 1880 but *C. verecunda* falls within the normal pattern of variation seen in nominate *C. hermia*. Type Locality: Montana, [USA].

*Catocala violenta* H. Edwards

Fig. 44 (lectotype)

*Catocala violenta* H. Edwards, 1880b: 58

*Catocala violenta*; Barnes and McDunnough 1918: 37

*Catocala violenta*; McDunnough 1938: 117

*Catocala violenta*; Franclemont and Todd 1983: 129

**Type material.** *Catocala violenta*: the original description states “M. B. Neumoegen, 6 examples, ♂, ♀. Type, coll. B. Neumoegen.” A male type is at the AMNH, and is designated **lectotype** to clarify application of the name *violenta*. The lectotype bears the labels “South / Colorado”, “7327”, “No. 11846 / Collection / Hy. Edwards.”, “Type / No. / A.M.N.H.”, “Catocala / violenta Hy. Edw. / Type.” Type Locality: southern Colorado, [USA].

***Catocala verrilliana* syn. *weneri* Biederman**

Fig. 45 (lectotype)

*Catocala weneri* Biederman, 1909: 76

*Catocala verrilliana* syn. *weneri*; Barnes and McDunnough 1918: 37

*Catocala verrilliana* syn. *weneri*; McDunnough 1938: 117

*Catocala verrilliana* syn. *weneri*; Franclemont and Todd 1983: 129

**Type material.** *Catocala weneri*: the original description does not state the number of types. A female type is at the USNM, and is designated as **lectotype** to clarify application of the name *weneri*. The lectotype bears the labels “Palmerlee / Ariz.”, “*Catocala* / *weneri* / Type Biederman”, “Photograph / Pl. X No. 1.” Type Locality: Palmerlee, Huachuca Mountains, Arizona, [USA].

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## Appendix I: Check List of the Nearctic *Catocala* Schrank, 1802

- C. abbreviatella* Grote, 1872
- C. agrippina* Strecker, 1874  
*barnesii* French, 1900
- C. abolibab* Strecker, 1874  
*coloradensis* Beutenmüller, 1903  
*ellenensis* Reiff, 1920
- C. alabamiae* Grote, 1875  
*distincta* Schwarz, 1919  
*olivia* H. Edwards, 1880, **syn. n.**  
*titania* Dodge, 1900, **syn. n.**
- C. amatrix* (Hübner, [1813])  
*editha* W.H. Edwards, 1874  
*hesseli* Sargent, 1976  
*nurus* Walker, [1858] (preocc.)  
*pallida* Barnes & McDunnough, 1918 (preocc.)  
*selecta* Walker, [1858] (preocc.)
- C. amestris* Strecker, 1874  
*anna* Grote, 1874  
*westcottii* Grote, 1878
- C. amica* (Hübner, 1818)  
*androphila* Guenée, 1852  
*curvifascia* Brower, 1936  
*melanotica* Reiff, 1916  
*suffusa* Beutenmüller, 1903
- C. andromache* H. Edwards, 1885  
*wellsi* Johnson, 1983
- C. andromedae* Guenée, 1852  
*tristis* W.H. Edwards, 1864
- C. angusi* Grote, 1876  
*edna* Beutenmüller, 1907  
*lucetta* French, 1882
- C. antinympha* (Hübner, [1823])  
*affinis* Westwood, 1837  
*melanympha* Guenée, 1852  
*multoconspicua* Reiff, 1919  
*paranympha* (Drury, 1773) (preocc.)
- C. atocala* Brou, 1985
- C. badia* Grote & Robinson, 1866  
a. *badia* Grote & Robinson, 1866  
b. *coelebs* Grote, 1874  
*phoebe* Hulst, 1884  
*phoebe* H. Edwards, 1885 (preocc.)
- C. benjamini* Brower, 1937  
a. *benjamini* Brower, 1937  
b. *ute* Peacock & Wagner, 2009  
c. *jumpi* Hawks, 2010  
d. *maybewi* Hawks, 2010
- C. blandula* Hulst, 1884  
*manitobensis* Cassino, 1918, **syn. n.**
- C. briseis* W.H. Edwards, 1864  
*albida* Beutenmüller, 1907  
*briseana* (Strand, 1913)  
*clarissima* Beutenmüller, 1918  
*minerva* Cassino, 1917, **syn. n.**
- C. caesia* Hawks, 2010
- C. californica* W.H. Edwards, 1864  
*edwardsi* Kusnezov, 1903, **syn. n.**  
*eldoradensis* Beutenmüller, 1907  
*elizabeth* Cassino, 1918, **syn. n.**  
*erichi* Brower, 1976, **syn. n.**  
*mariana* Strecker, 1874 (preocc.)  
*mariana* H. Edwards, 1875 (preocc.)
- C. californiensis* Brower, 1976
- C. cara* Guenée, 1852
- C. carissima* Hulst, 1880, **stat. n.**  
*sylvia* H. Edwards, 1880
- C. cerogama* Guenée, 1852  
*aurella* Fischer, 1885  
*bunkeri* Grote, 1876  
*eliza* Fischer, 1885  
*ruperti* Franclemont, 1938
- C. chelidonia* Grote, 1881  
a. *chelidonia* Grote, 1881  
b. *occidentalis* Hawks, 2010  
c. *uniforma* Hawks, 2010
- C. clintonii* Grote, 1864
- C. coccinata* Grote, 1872  
*chiquita* Bartsch, 1916  
*circe* Strecker, 1876  
*sinuosa* Grote, 1879
- C. concumbens* Walker, [1858]  
*diana* H. Edwards, 1880  
*hillii* Grote, 1883
- C. connubialis* Guenée, 1852  
*broweri* J. Muller, 1960  
*cordelia* H. Edwards, 1880  
*pulverulenta* Brower, 1940  
*sancta* Hulst, 1884  
*virens* French, 1886
- C. consors* (J.E. Smith, 1797)  
*pensacola* Reiff, 1919  
*sorsconi* Barnes & Benjamin, 1924, **syn. n.**
- C. crataegi* Saunders, 1876
- C. dejecta* Strecker, 1880
- C. delilah* Strecker, 1874  
*adoptiva* Grote, 1874  
*calphurnia* H. Edwards, 1880

- umbella* Barnes & Benjamin, 1927
- C. *desdemona*** H. Edwards, 1882
- ixion* Druce, 1890
- swetti* Barnes & Benjamin, 1927
- umbra* Barnes & Benjamin, 1927
- utahensis* Cassino, 1918
- C. *dulciola*** Grote, 1881
- C. *electilis*** Walker, [1858]
- cassandra* H. Edwards, 1875
- electilella* (Strand, 1913)
- C. *epione*** (Drury, 1773)
- marginata* (Fabricius, 1775)
- marginella* (Fabricius, 1794)
- C. *faustina*** Strecker, 1873
- a. *faustina* Strecker, 1873
- carlota* Beutenmüller, 1897
- lydia* Beutenmüller, 1907
- rubra* Cassino, 1918
- zillah* Strecker, 1878
- b. **C. *cleopatra*** Strecker, 1874
- barbara* Cassino, 1918
- caerulea* Beutenmüller, 1907, **syn. n.**
- cleopatra* H. Edwards, 1875 (preocc.)
- perdita* Strecker, 1874
- perdita* H. Edwards, 1875 (preocc.)
- c. **C. *allusa*** Hulst, 1884, **stat. n.**
- frenchii* Poling, 1901, **syn. rev.**
- C. *flebilis*** Grote, 1872
- carolina* Holland, 1903
- C. *frederici*** Grote, 1872
- C. *gracilis*** W.H. Edwards, 1864
- cinerea* Mayfield, 1922
- hesperis* Sargent, 1976
- lemmeri* Mayfield, 1923
- tela* (Strand, 1913)
- C. *grisatra*** Brower, 1936
- C. *grotiana*** Bailey, 1879
- georgeana* Beutenmüller, 1918
- C. *grynea*** (Cramer, 1780)
- constans* Hulst, 1884
- nuptula* Walker, [1858]
- C. *habilis*** Grote, 1872
- basalis* Grote, 1876
- denussa* Ehrman, 1893, **syn. rev.**
- depressans* Sargent, 1976
- C. *hermia*** H. Edwards, 1880
- a. *hermia* H. Edwards, 1880
- diantha* Beutenmüller, 1907
- ritana* Beutenmüller, 1918
- rosa* Beutenmüller, 1918
- sheba* Cassino, 1919, **syn. n.**
- verecunda* Hulst, 1884, **syn. n.**
- vesta* Barnes & McDunnough, 1918
- b. **C. *francisca*** H. Edwards, 1880, **stat. n.**
- C. *herodias*** Strecker, 1876
- a. *herodias* Strecker, 1876
- b. *gerhardi* Barnes & Benjamin, 1927
- C. *ilia*** (Cramer, 1776)
- a. *ilia* (Cramer, 1776)
- albomacula* Butler, 1892
- conspicua* Worthington, 1883
- decorata* Worthington, 1883
- duplicata* Worthington, 1883
- hulsti* Reiff, 1920
- iliana* (Strand, 1913)
- normani* Bartsch, 1916
- obsoleta* Worthington, 1883
- satanas* Reiff, 1920
- uxor* Guenée, 1852 (preocc.)
- b. **C. *zoe*** Behr, 1870
- osculata* Hulst, 1884
- reiffi* Cassino, 1917
- C. *illecta*** Walker, [1858]
- magdalena* Strecker, 1874
- C. *innubens*** Guenée, 1852
- flavidalis* Grote, 1874
- hinda* French, 1881
- innubenta* (Strand, 1913)
- scintillans* Grote & Robinson, 1866
- C. *insolabilis*** Guenée, 1852
- insolabilella* (Strand, 1913)
- C. *irene*** Behr, 1870
- valeria* H. Edwards, 1880, **syn. n.**
- virgilia* H. Edwards, 1880
- volumnia* H. Edwards, 1880
- C. *jair*** Strecker, 1897
- C. *jessica*** H. Edwards, 1877
- babayaga* Strecker, 1884
- C. *johnsoniana*** Brower, 1976
- C. *judith*** Strecker, 1874
- levettei* Grote, 1874
- C. *junctura*** Walker, [1858]
- arizonae* Grote, 1873
- arizonensis* (Strand, 1913)
- aspasia* Strecker, 1874
- augusta* H. Edwards, 1875, **syn. n.**
- elsa* Beutenmüller, 1918, **syn. n.**
- huachuca* Beutenmüller, 1918
- julietta* French, 1916
- juncturana* (Strand, 1913)
- juncturella* (Strand, 1913)
- juncturelloides* (Strand, 1913)
- margherita* Beutenmüller, 1918, **syn. n.**
- portia* H. Edwards, 1880

- roseata* Cassino, 1919  
*sara* French, 1883  
*sierrae* Beutenmüller, 1897  
*stretchii* Behr, 1870, **syn. n.**  
*walshii* W.H. Edwards, 1864
- C. lacrymosa** Guenée, 1852  
*albomarginata* Cassino, 1917  
*emelia* H. Edwards, 1881  
*evelina* French, 1881  
*paulina* H. Edwards, 1880  
*subviridis* Harvey, 1877  
*zelica* French, 1881
- C. lincolnana** Brower, 1976
- C. lineella** Grote, 1872  
*aurantiaca* Reiff, 1916  
*nerissa* H. Edwards, 1880, **syn. rev.**  
*novangliae* Reiff, 1916
- C. louisae** Bauer, 1965
- C. luciana** Strecker, 1874  
*luciana* H. Edwards, 1875 (preocc.)  
*nebraskae* Dodge, 1875  
*somnus* Dodge, 1881
- C. luctuosa** Hulst, 1884, **stat. rev.**
- C. maestosa** Hulst, 1884  
*guenei* Grote, 1887  
*moderna* Grote, 1900  
*viduata* Guenée, 1852 missp.
- C. marmorata** W.H. Edwards, 1864
- C. mcdunnoughi** Brower, 1937  
*browerorum* Johnson, 1983
- C. meskei** Grote, 1873  
*beaniana* Grote, 1878  
*concolorata* McDunnough, 1922  
*krombeini* Franclemont, 1938  
*mescei* Hampson, 1913 missp.  
*orion* McDunnough, 1922, **syn. n.**  
*rosalinda* H. Edwards, 1880
- C. messalina** Guenée, 1852  
*belfragiana* Harvey, 1875  
*jocasta* Strecker, 1875
- C. micronympha** Guenée, 1852  
*atarah* Strecker, 1874  
*fratercula* Grote & Robinson, 1866  
*gisela* J. Meyer, 1880  
*helene* Pilate, 1882  
*hero* Hulst, 1884  
*hero* H. Edwards, 1884 (preocc.)  
*jacquetta* H. Edwards, 1880  
*jacquetta* McDunnough, 1938 missp.  
*lolita* Sargent, 1976  
*ouwah* Poling, 1901  
*sargenti* Covell, 1978
- timandra* H. Edwards, 1880
- C. minuta** W.H. Edwards, 1864  
*eureka* Schwarz, 1919  
*hiseri* Cassino, 1918  
*mellitula* Hulst, 1884  
*obliterata* Schwarz, 1919 (preocc.)  
*parvula* W.H. Edwards, 1864
- C. mira** Grote, 1876  
*dana* Cassino, 1918, **syn. n.**
- C. miranda** H. Edwards, 1881
- C. muliercula** Guenée, 1852  
*peramans* Hulst, 1884
- C. nebulosa** W.H. Edwards, 1864  
*ponderosa* Grote & Robinson, 1866
- C. neogama** (J.E. Smith, 1797)  
 a. *neogama* (J.E. Smith, 1797)  
*communis* Grote, 1872  
*loretta* Barnes & McDunnough, 1918, **syn. n.**  
*mildredae* Franclemont, 1938  
 b. *euphemia* Beutenmüller, 1907, **stat. n.**  
*arizonae* (Strand, 1913) (preocc.)
- C. nuptialis** Walker, [1858]  
*myrrha* Strecker, 1874
- C. obscura** Strecker, 1873  
*obvia* Schwarz, 1919  
*simulatis* Grote, 1874
- C. ophelia** H. Edwards, 1880  
*dollii* Beutenmüller, 1907
- C. orba** Kusnezov, 1903
- C. palaeogama** Guenée, 1852  
*annida* Fager, 1882  
*phalanga* Grote, 1864  
*snowiana* Grote, 1876
- C. parta** Guenée, 1852  
*forbesi* Franclemont, 1938  
*perplexa* Strecker, 1873  
*petulans* Hulst, 1884
- C. piatrix** Grote, 1864  
 a. *piatrix* Grote, 1864  
 b. *dionyza* H. Edwards, 1885
- C. praeclara** Grote & Robinson, 1866  
 a. *praeclara* Grote & Robinson, 1866  
 b. *charlottae* Brou, 1988, **stat. n.**  
 c. *manitoba* Beutenmüller, 1908, **stat. n.**
- C. pretiosa** Lintner, 1876  
 a. *pretiosa* Lintner, 1876  
 b. *texarkana* Brower, 1976, **stat. n.**  
*bridwelli* Brower, 1976
- C. relictia** Walker, [1858]  
*bianca* H. Edwards, 1880  
*clara* Beutenmüller, 1903  
*elda* Behrens, 1887, **syn. n.**



- fischeri* H. Meyer, 1952  
*phrynia* H. Edwards, 1880  
**C. *residua*** Grote, 1874  
**C. *retracta*** Grote, 1872  
**C. *robinsonii*** Grote, 1872  
*curvata* French, 1881  
*missouriensis* Schwarz, 1915  
**C. *sappho*** Strecker, 1874  
*cleis* Cassino, 1918  
**C. *semirelecta*** Grote, 1874  
a. *semirelecta* Grote, 1874  
*atala* Cassino, 1918  
*montana* Beutenmüller, 1907  
*nevadensis* Beutenmüller, 1907, **syn. n.**  
*nigra* Eastman, 1916 (preocc.)  
*pura* Hulst, 1880, **syn. n.**  
b. *hippolyta* Strecker, 1874, **stat. n.**  
*hippolyta* H. Edwards, 1875 (preocc.)  
*walteri* Schwarz, 1923  
**C. *serena*** W.H. Edwards, 1864  
**C. *similis*** W.H. Edwards, 1864  
*aholah* Strecker, 1874  
*formula* Grote & Robinson, 1866  
*isabella* H. Edwards, 1880  
**C. *sordida*** Grote, 1877  
*engelhardti* Lemmer, 1937  
*metalomus* Mayfield, 1922  
**C. *subnata*** Grote, 1864  
*subnatana* (Strand, 1913)  
**C. *texanae*** French, 1902  
**C. *ulalume*** Strecker, 1878  
**C. *ultronia*** (Hübner, 1823)  
*adriana* H. Edwards, 1880  
*celia* H. Edwards, 1880  
*lucinda* Beutenmüller, 1907  
*mopsa* H. Edwards, 1880  
*nigrescens* Cassino, 1917  
**C. *umbrosa*** Brou, 2002  
*confusa* Worthington, 1883  
**C. *unijuga*** Walker, [1858]  
*agatha* Beutenmüller, 1907  
*cassinoi* Beutenmüller, 1918  
*fletcherii* Beutenmüller, 1903  
*helena* Cassino, 1917 (preocc.)  
*lucilla* Worthington, 1883  
*patricia* Cassino, 1917  
**C. *verrilliana*** Grote, 1875  
*beutenmuelleri* Barnes & McDunnough, 1910, **syn. n.**  
*verneri* Hampson, 1913 missp.  
*votiva* Hulst, 1884  
*wernerii* Biederman, 1909  
**C. *vidua*** (J.E. Smith, 1797)
- desperata* Guenée, 1852  
*viduata* Guenée, 1852 missp.  
**C. *violenta*** H. Edwards, 1880  
*chiracahua* McDunnough, 1938 missp.  
*chiracahua* Poling, 1901  
**C. *whitneyi*** Dodge, 1874  
*obscura* Draudt, 1939 (preocc.)  
*whitneyi* Hampson, 1912 missp.

## Appendix 2: Phylogenetic list of North American species of *Catocala*

*Catocala* Schrank, 1802

*innubens* Guenée, 1852

*piatrix* Grote, 1864

a. *piatrix* Grote, 1864

b. *dionyza* H. Edwards, 1885

*consors* (J.E. Smith, 1797)

*epione* (Drury, 1773)

*muliercula* Guenée, 1852

*antinympa* (Hübner, [1823])

*badia* Grote & Robinson, 1866

a. *badia* Grote & Robinson, 1866

b. *coelebs* Grote, 1874

*habilis* Grote, 1872

*robinsonii* Grote, 1872

*angusi* Grote, 1876

*judith* Strecker, 1874

*serena* W.H. Edwards, 1864

*obscura* Strecker, 1873

*residua* Grote, 1874

*flebilis* Grote, 1872

*sappho* Strecker, 1874

*resecta* Grote, 1872

*luctuosa* Hulst, 1884

*ulalume* Strecker, 1878

*dejecta* Strecker, 1880

*insolabilis* Guenée, 1852

*vidua* (J.E. Smith, 1797)

*lacrymosa* Guenée, 1852

*palaeogama* Guenée, 1852

*agrippina* Strecker, 1874

*atocala* Brou, 1985

*nebulosa* W.H. Edwards, 1864

*subnata* Grote, 1864

*maestosa* Hulst, 1884

*neogama* (J.E. Smith, 1797)

a. *neogama* (J.E. Smith, 1797)

b. *euphemia* Beutenmüller, 1907

*aholibah* Strecker, 1874

*ilia* (Cramer, 1776)

a. *ilia* (Cramer, 1776)

b. *zoe* Behr, 1870

*umbrosa* Brou, 2002

*cerogama* Guenée, 1852

*relicta* Walker, [1858]

*marmorata* W.H. Edwards, 1864

*unijuga* Walker, [1858]

*parta* Guenée, 1852

*irene* Behr, 1870

*luciana* Strecker, 1874

*faustina* Strecker, 1873

a. *faustina* Strecker, 1873

b. *cleopatra* Strecker, 1874

c. *allusa* Hulst, 1884

*hermia* H. Edwards, 1880

a. *hermia* H. Edwards, 1880

b. *francisca* H. Edwards, 1880

*californica* W.H. Edwards, 1864

*briseis* W.H. Edwards, 1864

*grotiana* Bailey, 1879

*semirelicta* Grote, 1874

a. *semirelicta* Grote, 1874

b. *hippolyta* Strecker, 1874

*meskei* Grote, 1873

*jessica* H. Edwards, 1877

*junctura* Walker, [1858]

*texanae* French, 1902

*electilis* Walker, [1858]

*cara* Guenée, 1852

*carissima* Hulst, 1880

*concumbens* Walker, [1858]

*amatrix* (Hübner, [1813])

*delilah* Strecker, 1874

*desdemona* H. Edwards, 1882

*caesia* Hawks, 2010

*frederici* Grote, 1872

*benjamini* Brower, 1937

a. *benjamini* Brower, 1937

b. *ute* Peacock & Wagner, 2009

- c. *jumpi* Hawks, 2010
- d. *maybawi* Hawks, 2010
- andromache* H. Edwards, 1885
- californiensis* Brower, 1976
- johnsoniana* Brower, 1976
- mcdunnoughi* Brower, 1937
- chelidonia* Grote, 1881
  - a. *chelidonia* Grote, 1881
  - b. *occidentalis* Hawks, 2010
  - c. *uniforma* Hawks, 2010
- illecta* Walker, [1858]
- abbreviatella* Grote, 1872
- nuptialis* Walker, [1858]
- whitneyi* Dodge, 1874
- amestris* Strecker, 1874
- messalina* Guenée, 1852
- sordida* Grote, 1877
- gracilis* W.H. Edwards, 1864
- louiseae* Bauer, 1965
- andromedae* Guenée, 1852
- herodias* Strecker, 1876
  - a. *herodias* Strecker, 1876
  - b. *gerhardi* Barnes & Benjamin, 1927
- coccinata* Grote, 1872
- verrilliana* Grote, 1875
- violenta* H. Edwards, 1880
- ophelia* H. Edwards, 1880
- ultronia* (Hübner, 1823)
- miranda* H. Edwards, 1881
- orba* Kusnezov, 1903
- mira* Grote, 1876
- grynea* (Cramer, 1780)
- crataegi* Saunders, 1876
- praeclara* Grote & Robinson, 1866
  - a. *praeclara* Grote & Robinson, 1866
  - b. *manitoba* Beutenmüller, 1908
  - c. *charlottae* Brou, 1988
- alabamae* Grote, 1875
- pretiosa* Lintner, 1876
  - a. *pretiosa* Lintner, 1876
  - b. *texarkana* Brower, 1976
- lincolnana* Brower, 1976
- blandula* Hulst, 1884
- dulciola* Grote, 1881
- clintonii* Grote, 1864
- grisatra* Brower, 1936
- similis* W.H. Edwards, 1864
- minuta* W.H. Edwards, 1864
- micronympha* Guenée, 1852
- connubialis* Guenée, 1852
- amica* (Hübner, 1818)
- lineella* Grote, 1872
- jair* Strecker, 1897



# A new genus and species for *Dysgonia* (Lepidoptera, Erebidae, Erebiniae) from Southeastern United States

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## Abstract

Three North American species currently placed in the genus *Dysgonia* Hübner are moved to *Neadysgonia* **gen. n.** A fourth species, *N. telma*, is described from southeastern United States and a neotype is designated for closely related species *N. smithii*. The generic placement of the new genus is discussed.

## Keywords

Taxonomy, *Dysgonia*, *Neadysgonia*, *Argyrostromis*, United States

## Introduction

The genus *Dysgonia* Hübner as herein restricted currently includes species ranging through the Mediterranean Region and possibly as far east as Australia (Berio 1965). Poole (1989) included species in *Dysgonia* that give it a world wide distribution, however, the genus as delimited by him is clearly polyphyletic (Holloway and Miller 2003). The three species of *Dysgonia* that occur in the United States form a distinct but related group that requires a new generic name. A fourth undescribed species was revealed

by DNA barcoding and confirmed by characters of the genitalia. The purpose of this paper is to propose a new genus for species found in southeastern United States and describe the new species.

## Materials and methods

### Repository abbreviations

<b>BMNH</b>	Natural History Museum, London, UK
<b>CNC</b>	Canadian National Collection of Insects, Arachnids, and Nematodes, Ottawa, Ontario, Canada
<b>JBS</b>	J. Bolling Sullivan, Beaufort, North Carolina, USA
<b>MEM</b>	Mississippi Entomological Museum, Mississippi State, Mississippi, USA
<b>MNHN</b>	Muséum national d'Histoire naturelle, Paris, France
<b>USNM</b>	National Museum of Natural History, Washington, District of Columbia, USA
<b>VAB</b>	Vernon A. Brou, Jr., Abita Springs, Louisiana, USA

Genitalia were prepared by digestion in 10% potassium hydroxide, dissected in water, stained with chlorocresol black or eosin, and slide mounted. Barcoding of 658 base-pairs of the cytochrome oxidase mitochondrial gene (COI) was done by Paul Hebert and his colleagues at the University of Guelph and compared by nearest neighbor analyses (Ratnasingham and Hebert 2007).

### *Neadysgonia* Sullivan, gen. n.

urn:lsid:zoobank.org:act:09B7F994-7059-4CC1-9AEA-9E0CD1722DEE

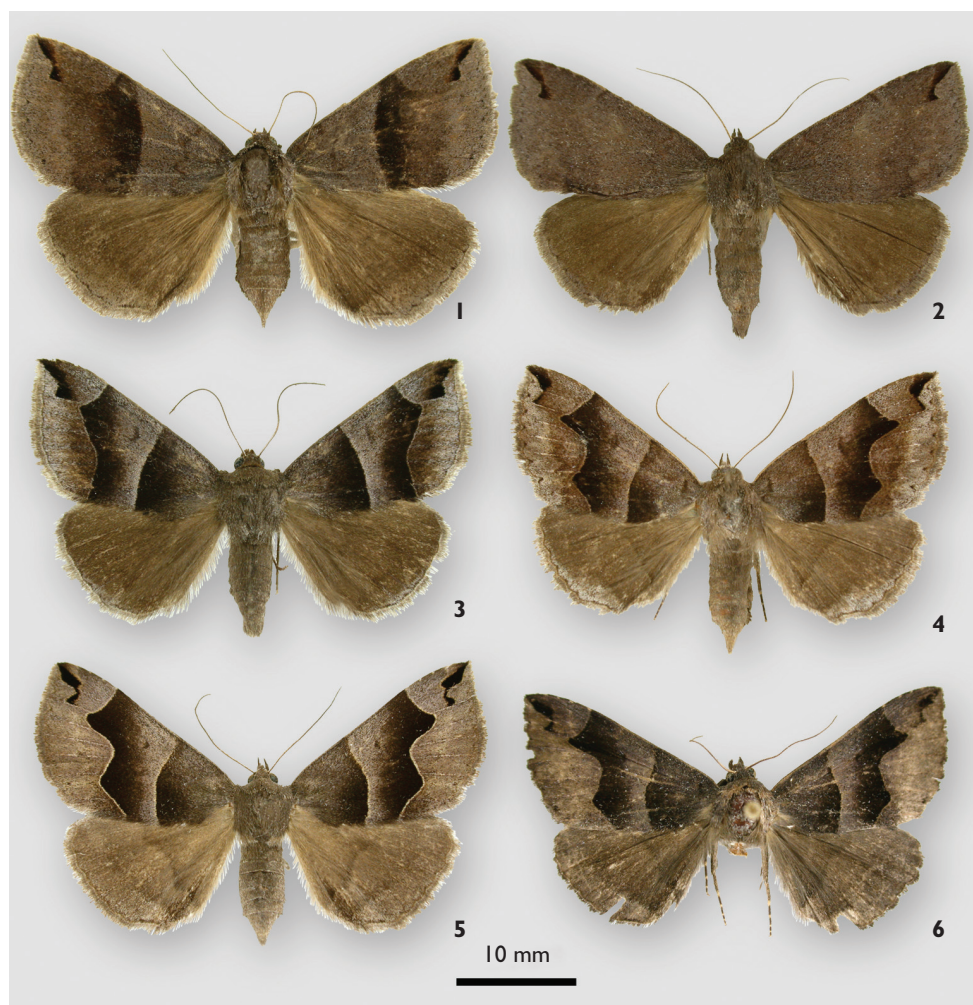
### Type species. *Ophiusa smithii* Guenée, 1852

**Etymology.** The name is a combination of Nearctic and *Dysgonia*.

**Diagnosis.** The European species *Dysgonia algira* (L.) is the type-species for the genus *Dysgonia*. The male genitalia have a single coremata, as does *Neadysgonia*, but have three not two projections from the base of the valva. The tegumen lacks the lateral projection that is so characteristic of *Neadysgonia*. The dorsal tuft of the uncus in *Dysgonia* is composed of two kinds of hairs, one short, one long, whereas in *Neadysgonia* only the single longer hairs are present. The tip of the uncus is slightly bifurcate in *Neadysgonia* but strongly so in *Dysgonia*. The two genera occupy completely different geographical ranges.

Superficially, the species of *Neadysgonia* found in the southeastern United States form a compact group. They are similar in size and maculation (Figs 1–6), particularly the apical trapezoidal mark that often appears to be in the form of a comma, and the course of the postmedial line. The species *Neadysgonia similis* (Guenée, 1852) (Figs 1–2) occurs in two forms, one immaculate, another showing the pattern elements similar to those of the other species.





**Figures 1–6.** Adults of *Neadysgonia*. **1** *Neadysgonia similis* (Gn.) female, Holly Shelter Gamelands, Pender Co., North Carolina, 23 April 1995, J. Bolling Sullivan **2** *Neadysgonia similis* (Gn.) female, Croatan National Forest Road 147, Craven Co., North Carolina, 22 April 1998, J. Bolling Sullivan **3** *Neadysgonia consobrina* (Gn.) male, 4.2 mi. N. Abita Springs, St. Tammany Parish, Louisiana, 14 March 2008, V. A. Brou **4** *Neadysgonia smithii* (Gn.) female, Greenbank Bluff, Brunswick Co., North Carolina, 27 August 1995, J. Bolling Sullivan **5** *Neadysgonia telma* Sullivan female, 3 mi. N. Lucedale, George Co., Mississippi, 19–31 March 1996, R. Kergosien **6** *Neadysgonia telma* Sullivan Holotype male, Lake Waccamaw State Park, Columbus Co., North Carolina, 21 June 2009, J. Bolling Sullivan.

Three species, *N. consobrina* (Guenée, 1852), *N. similis* (Guenée, 1852) and *N. smithii* (Guenée, 1852), currently placed in *Dysgonia* are transferred to *Neadysgonia*.

Four species that occur in Central and South America were included in *Dysgonia* Poole (1989), and there are several undescribed species. They have two coremata and male genitalic characters that place them closer to some of the genera removed from *Dysgonia* by Holloway and Miller (2003).

**Description.** Palpi short, upcurved. Antennae filiform. Head and frons brown, vestiture hairy, some scales slightly spatulate. Legs brownish, joints cream, two pairs of tibial spurs on hind tibia. Forewing with postmedial line (PM) cream or white with one or two points directed toward margin. Darkened area proximal to PM line fades basally, except in *N. similis* where PM line is most distinct proximally and fades distally. Medial area matches ground color and stops abruptly at antemedial line (AM). AM line thin, cream or white with darkened area proximally that fades toward base of wing. In *N. similis* AM line wavy distally and ground color extends to base of wing. Hindwing brown with only trace of PM line. Underside brown with medial line visible as dark line. Wing venation typical for erebines. *Male genitalia* – Uncus variable, either spatulate and expanded medially, or tapered to a point or points. No superuncus. Tegumen with outward pointing medial projection. In *N. similis* tegumen forms a right angle at rounded projection. Valva moderate, often tapering gradually to a point. Costal and anal projections from valva base near vinculum. Costal projection very large in *N. similis*. Anal projections on anal edge of valva often extending upward toward coastal region. Single coremata arising from basal, dorsal area of valva. Juxta broad, two fused plates, medially with indentation of varying size. Annella variable but rarely expanded medially. Saccus slightly pointed anteriorly, rounded in *N. similis*. Aedeagus sclerotized for posterior 2/3, broad and shortened with basal end swollen and unsclerotized, often upturned at tip. Ductus subterminal. Vesica a complex series of evaginations. No cornuti but surface granulated. *Female genitalia* – Anal papillae tapered and slightly pointed dorsally. Posterior apophyses longer than anterior apophyses. Lodix (sclerotized central plate on the 7<sup>th</sup> sternite that arises from the anterior displacement of the ostial opening, leaving a plate derived from the sternite over the ostium) shape species specific, often expanded over ostial opening. Bursa attached to base of seventh sternite. Ductus bursae short, sclerotized for at least half its length (posterior end). Bursa ovate, variable but with well-differentiated bursa appendix arising posterior and ventral to bursa. Signa absent.

#### Key to the species of *Neadysgonia*

1. Forewing with postmedial line well defined and with one or two points directed to wing margin ..... **2**
- Forewing with postmedial line not well defined, broad, with at most a vague point directed to base of apical mark..... *N. similis*
2. Single point on well defined postmedial line directed to base of apical spot.. ..... *N. consobrina*
- Two well defined, well separated points on postmedial line ..... **3**
3. Male ..... **4**
- Female ..... **5**
4. Medial projection of tegumen at least 1/2 length of costal margin of valva... ..... *N. smithii*
- Medial projection of tegumen less than 1/2 length of costal margin of valva.... ..... *N. telma*

5. Lateral edge of lodix separated from main plate by less than width of base of lateral projection of lodix ..... *N. smithii*
- Lateral edge of lodix separated from main plate by distance greater than width of base of lateral projection of lodix ..... *N. telma*

***Neadysgonia similis* (Guenée), comb. n.**

Figs 1, 2, 7a, b, 11

*Ophiusa smithii* Guenée in Boisduval and Guenée, 1852: 267.

**Type material.** This species was described from an unknown number of specimens from an unknown locality. The short description is adequate to distinguish the species. The location of any types is unknown (not in BMNH, MNHN, or USNM).

**Diagnosis.** *Neadysgonia similis* can be recognized by the lack of well-defined triangles from the PM line and no dark shading basal of the AM line. Two forms occur, one devoid of any well-defined pattern between the AM and PM lines. In the male genitalia the projection from the tegumen creates a square shape and the costal projection of the valva ends in a hammerhead. In the female the lodix is rectangular.

**Distribution and biology.** *Neadysgonia similis* has been recorded from North Carolina to Florida. The food plant occurs in Alabama and Mississippi and the moth could be expected from these areas as well.

A larva of *N. similis* was collected from Loblolly Bay (*Gordonia lasianthus* (L.) (Theaceae)) by Richard Broadwell during the course of a study to determine the non-target effects of *Bacillus* treatments to eradicate a Gypsy moth infestation near Wilmington, N.C. (Hall et al. 1999). I identified the emergent moth as *Neadysgonia similis* and have subsequently found additional larvae and reared larvae from eggs from a captive female; all readily fed to maturity on Loblolly Bay. It is a common plant on the frequently burned coastal plain savannas, but both the adults and larvae are relatively uncommon. The moth is multiple brooded (April to September).

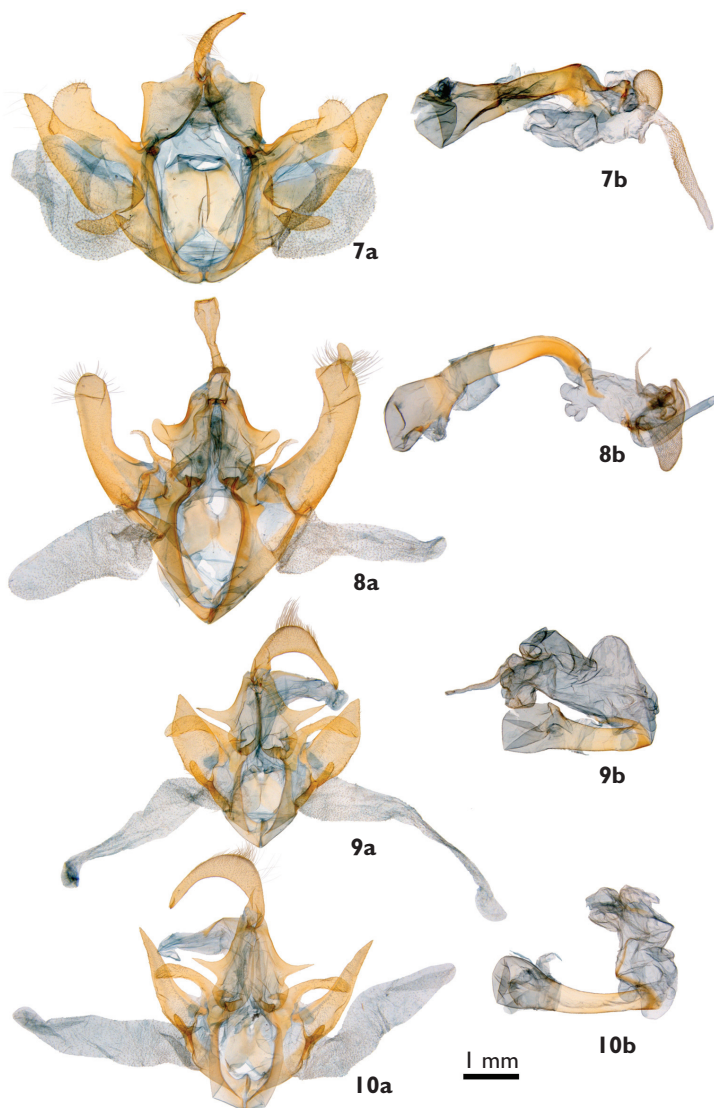
***Neadysgonia consobrina* (Guenée), comb. n.**

Figs 3, 8a, b, 12

*Ophiusa consobrina* Guenée in Boisduval and Guenée, 1852: 267.

**Type material.** *Neadysgonia consobrina*, like *N. similis*, was described from an unknown number of specimens from an unknown locality. The brief description allows identification of the species and the material probably originated from near Savannah, Georgia. No type has ever been located.

**Diagnosis.** This species is distinguished by a single triangular outward projection on the PM line. In the male genitalia the uncus is spatulate and the projection from the



**Figures 7–10.** Male genitalia of *Neadysgonia*. **a** valva **b** aedeagus. **7a,b** *Neadysgonia similis* (Gn.). Carteret Co., North Carolina (JBS 2750) **8a,b** *Neadysgonia consobrina* (Gn.). St. Tammany Parish, Louisiana (JBS 2754) **9a,b** *Neadysgonia smithii* (Gn.). Jones Co., North Carolina (JBS 2749). Same data as male valves **10a,b** *Neadysgonia telma* Sullivan. Holotype. Columbus Co., North Carolina (JBS 2752).

tegumen is rounded. In females the lodix is trapezoidal and the ostial opening forms a horizontal concave line, i.e. smile.

**Distribution and biology.** *Neadysgonia consobrina* occurs from North Carolina to Louisiana. Specimens have been recorded from all of the southeastern states in the range except Alabama and Tennessee. The food plant of the species is unknown. The species is multiple brooded.

***Neadysgonia smithii* (Guenée), comb. n.**

Figs 4, 9a, b, 13

*Ophiusa smithii* Guenée in Boisduval and Guenée, 1852: 266, pl. 22, fig. 4.

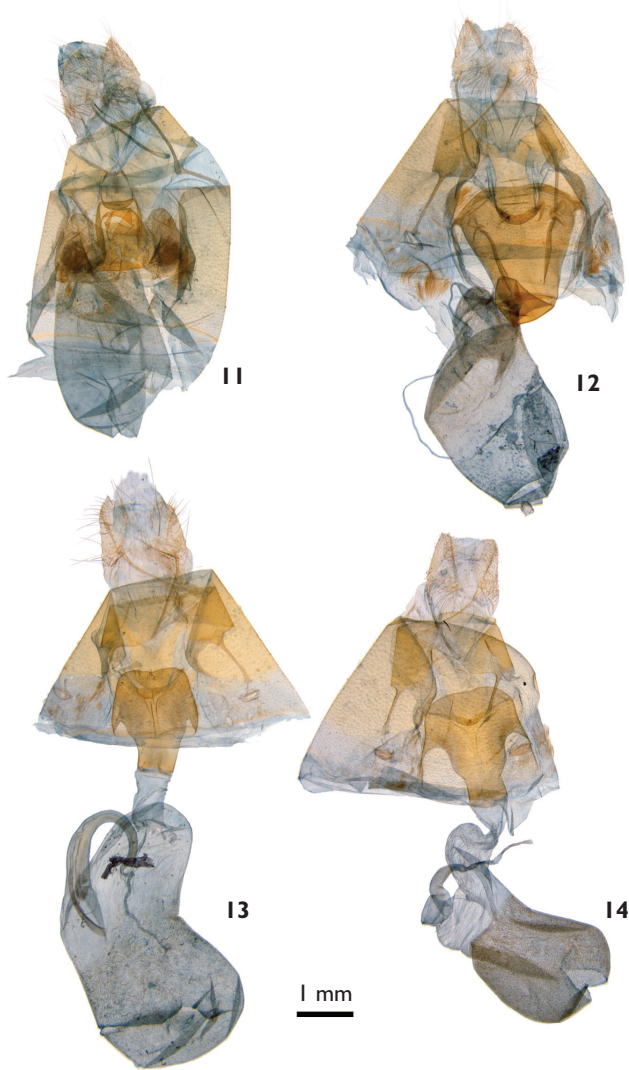
**Type material.** *Neadysgonia smithii* was either described from an unknown number of specimens from an unknown locality, or it may have been described from a painting by John Abbot and sent to his colleague at the British Museum, J. E. Smith who in turn sent it to Guenée. As stated above, the type locality was probably near Savannah, Georgia. The location of any type material is unknown. The identity of *Ophiusa smithii* Guenée can not be determined from the published illustration, or from the original description, so a **neotype** is hereby designated: male, "April 24, 1974, Wedge Plantation, McClellensville, S. C., D. C. Ferguson," so labeled and located in USNM. I have dissected it and the slide number is USNM 50786.

**Material dissected and/or barcoded. USA.** Alabama: Munroe Co.; Georgia: no location (USNM 50787); Mississippi: Forest, Franklin, Grenada, Hinds, Rankin, Tishomingo, and Warren Counties; Missouri: Greene Co.; North Carolina: Brunswick, Carteret, Craven, Jones Counties; South Carolina: Charleston Co.; Texas: Jasper Co.

**Note.** This species as well as *N. similis* and *N. consobrina* were all described by Guenée at the same time in the genus *Ophiusa* and probably from specimens or paintings he received from Abbot via Smith. They probably originated from eastern Georgia or South Carolina in the vicinity of Savannah, where Abbot lived. The brief description of *N. smithii* by Guenée and accompanying painting could refer to one of two externally similar species, one of which is described as new below. Neither the description nor the painting of the species that served as a model for the description can be identified as to species. However, Abbot also painted the caterpillar and Guenée included a brief description of it as well. Most importantly, the food plant was identified as *Fagus ferruginea* Aiton (now *Fagus grandifolia* Ehrhart) and the pupae was said to be covered with a thick efflorescence of white purple. A white, waxy bloom on the pupa is characteristic of *N. similis* as well as species of *Argyrostromis* Hübner and *Catocala* Schrank. Apparently *N. smithii* has not been reared again but beech trees are characteristic of mesic forests in the coastal plain and do not occur in the swamp forests where the new species *N. telma* has been collected.

**Diagnosis.** Adults of *N. smithii* are readily distinguished from *N. consobrina* and *N. similis* by the two triangular outward projections of the PM line. However, there is no reliable external character to distinguish it from the newly described species, *N. telma*. Upon dissection of the male genitalia *N. smithii* has a shorter and broader valva and the medial projection on the tegumen is more than half the length of the valva. In *N. telma* the valva is much narrower and longer and the medial projection of the tegumen is rarely as long as half the length of the valva. In females of *N. smithii* the distance between the lateral edges of the lodix and the main plate is less than the thickness of the lateral edge at its base. In *N. telma* this distance is much greater than the width of the base of the lateral edge.





**Figures 11–14.** *Neadysgonia* female genitalia. **11** *Neadysgonia similis* (Gn.). Craven Co., North Carolina (JBS 2863) **12** *Neadysgonia consobrina* (Gn.). St. Tammany Parish, Louisiana (JBS 2755) **13** *Neadysgonia smithii* (Gn.). Brunswick Co., North Carolina (JBS 2756) **14** *Neadysgonia telma* Sullivan. St. Tammany Parish, Louisiana (JBS 2784).

**Distribution and biology.** *Neadysgonia smithii* occurs throughout North Carolina and southward to Georgia and westward to Texas northward in the Mississippi Valley to Missouri. It is not yet recorded from Virginia, Florida, Louisiana or Arkansas, although it does occur close by and would be expected in those states as well. *Neadysgonia smithii* occurs in open savanna and mesic woodland habitats. The adults are multiple brooded.



***Neadysgonia telma* Sullivan, sp. n.**

urn:lsid:zoobank.org:act:2C1288EE-74E4-45D8-BE9C-E8E4E0AD79E5

Figs 5–6, 10a, b, 14

**Type material.** Holotype male: USA, North Carolina: Columbus Co., Lake Waccamaw State Park, Standing water swamp forest, June 21, 2009, uv trap, J. B. Sullivan. USNM. Paratypes: 4 ♂, 5 ♀: USA, North Carolina: Cumberland Co., Ft. Bragg, McPherson Creek at FB1, May 16, 2002, ♂; Robeson Co., Lumber River St. Pk., river bottomland, Sept. 18, 2009, ♂; Craven Co., Croatan Natl. For. Rd. 167, July 21, 1993, ♀; Columbus Co., Lake Waccamaw St. Pk., Standing water swamp forest, Sept. 19, 2009, ♀, all collected by J. B. Sullivan. Louisiana: St. Tammany Parish, 4.2 mi. NE Abita prings, V. A. Brou, ♀ (BMNH, CNC, JBS). Mississippi: Oktibbeha Co., Doraen Lake, April 16, 1990, Pat Porter, ♂; George Co., 3 mi. N. Lucedale, March 19–31, 1996, R. Kergosien, ♀; Franklin Co., Porter Creek, April 8, 1992, J. MacGown, T. Schiefer, ♀; Washington Co., Stoneville Exp. Sta. May 18–31, 1986, R. E. Furr, Jr., ♀ (MEM).

**Dissected or Bar Coded Specimens.** Florida: Liberty Co.; Georgia: DeKalb Co.; Indiana: Posey Co.; Louisiana: Bossier, St. Tammany Counties; Mississippi: Franklin, George, Harrison, Hinds, Oktibbeha, Pike, Tishomingo, Warren, Washington Counties; North Carolina: Carteret, Columbus, Cumberland, Robeson Counties; South Carolina: Charleston Co.; Texas: no location (USNM 40345), Jasper Co.

**Etymology.** The Greek word *telma* refers to standing water. Specimens from North Carolina and Florida are associated with hydric forests in the Coastal Plain.

**Diagnosis.** Wing length 19–20 mm. *Neadysgonia telma* is very similar in maculation to *Neadysgonia smithii*. In some populations it is possible to differentiate most specimens of the two species by wing pattern but certain identification requires dissection or barcoding. The two species can be identified by DNA barcoding and by differences in the male and female genitalia. Male genitalia differ slightly if at all from those of *N. smithii* in many genital characters, but the valvae and the lateral process of the tegumen allow the two species to readily be distinguished. In *N. telma* the valva is much thinner and tapers to a sharp point. In *N. smithii* the valva is broad and tapers gradually to a somewhat broad point. The lateral process of the tegumen is less than half the length of the costal edge of the valva in *N. telma*, but more than half the valva length in *N. smithii*. The anal projection at the base of the valva of *N. telma* is shorter and more sclerotized than that of *N. smithii*. Both species have a medially enlarged uncus with a slightly bifurcate tip, the tegumen has a pronounced lateral projection and both species have similar coremata arising from the dorsal base of the valva. The ranges of the two species appear to overlap substantially, the exact details of which will only be determined by dissection and barcoding of additional specimens.

**Description.** *Head*—Tongue normal, palps slightly porrect, second segment 2.5 × as long as first and third segments. Palps brown scaled with cream scales interspersed throughout, inner faces cream. Frons denuded basally, scales of head projecting forward, brown with cream scales, scape cream, antenna fasciculate with encircling rows

of tan with cream scales laterally. *Thorax* – Collar and vestiture covered with brown hairlike scales interspersed with cream-colored scales; tegulae similarly scaled but with some scales spatulate; abdomen brown with some cream scales dorsally, cream ventrally. Legs brown with cream scaling interspersed and forming cream bands at distal ends of tarsal joints. Tibial segments normal, not swollen. Two pairs of tibial spines on hind leg, single pair on middle leg twice as long as those on hind leg. Forewing pattern with ground brown with dark-purplish scaling. Apical trapezoidal spot distinct, post medial line with two major triangular points directed toward wing margin. Line light but inwardly bordered by a broad purple-brown band that fades toward medial line, which is slightly sinuous or straight, light colored but with darker scaling inward fading to wing base. Wing margin with two bands, inner one gray speckled with brown, outer band tan. Scaling distal to postmedial line gray with purple scales interspersed, becoming lighter toward margin. Hindwing fuscous with two marginal bands like those on forewing. Underside of hindwing fuscous with traces of lines visible, medial most prominent, discal spot faint. *Male genitalia* – (Figs 10a, b). Uncus broad at base, expanding medially and curving 180 degrees and tapering to tip, which is bifurcate. Dorsal setae shorter than medial width. Tegumen moderately broad with outward lateral triangular projection, tapering to sharp point, length less than  $\frac{1}{2}$  length of valva. Base of tegumen with sclerite that joins vinculum. Paired sclerites extend from junction with vinculum to base of uncus. Vinculum moderately broad, oval shaped forming a slight posterior projection where vincula arms meet anteriorly. No differentiated saccus. Juxta broad, paired plates lightly sclerotized and forming dorsal and ventral intrusions at junction. Valva triangular, extending to a point with projections dorsally and ventrally. Dorsal projection broad, finger shaped curving anteriorly and only slightly shorter than valva. Ventral projection finger shaped, straight, sclerotized and  $\frac{1}{4}$  length of valva with slightly raised ridge along ventral margin of valva. Aedeagus approximately length of valva, bulbous anteriorly and tapering toward tip. Basal third of aedeagus unsclerotized; ductus entering subterminally. Tip of aedeagus rounded, striated and continuing as a sclerotized ribbon onto vesica for half its length. Everted vesica moderately broad with numerous short, broad evaginations that are granulated toward distal end of vesica. Small patch of sclerotization on distal end of vesica. Pelt lacks distinct structures. *Female genitalia* – (Figs 14a, b): Anal papillae small, lightly sclerotized with setae from raised pimple-like bases. Posterior apophyses with spatulate tips, slightly longer and thinner than anterior apophyses. Genital plate trapezoidal with broad ostial opening that is lightly attached to 7<sup>th</sup> sclerite. Plate tapers anteriorly on both lateral sides to a thread-like tip, which is broadly separated from base of plate. Medial genital plate tapers to join ductus. Distance between lateral thread-like anterior extensions and lodix will allow *N. telmus* to be differentiated from *N. smithii*. Ductus bursae sclerotized posteriorly, short and tapering slightly to corpus bursa. Posterior end of corpus bursa wrinkled, unsclerotized and expanding to granulated body of corpus bursa. Appendix bursae to right and ventral to corpus bursae and tapering to the ductus. Appendix bursae and ductus unsclerotized. Signum absent. No unusual structural features on pelt.

**Distribution and biology.** *Neadysgonia telma* occurs from North Carolina southward at least to the Florida Panhandle and westward to Texas, with one record farther north from Indiana. The impression from localities where it has been collected is that *Neadysgonia telma* occurs in swamp forests where there is standing water. In this habitat red maples tend to dominate emergent forests whereas mature forests are more mixed with cypress often the dominant large tree. Moth multiple brooded throughout its range with dates from April through September.

## Discussion

The three original species of *Neadysgonia* were described in the genus *Ophiusa* Ochsenheimer. Hampson placed them in *Parallelia* Hübner and Poole (1989) moved them to *Dysgonia*. *Dysgonia* was placed in the tribe *Ophiusini* by Fibiger and Lafontaine (2005) before being moved to the *Poaphilini* by Lafontaine and Schmidt (2010) along with *Argyrostromis* Hübner and *Parallelia* Hübner. Barcoding and morphological characters of the genitalia place them with members of the genus *Argyrostromis* and nearest neighbor analyses place the species *A. anilis* with *Neadysgonia*. *Argyrostromis* and *Neadysgonia* share many characters in the larvae and the adult and they occur in the same kinds of habitats (for the most part, coastal plain savannas and wetlands). *N. smithii* and *A. anilis* occur in a broader array of habitats. In comparing *Argyrostromis* species, the basal projections of the valvae are enhanced whereas in *Neadysgonia* species the tegumens are frequently modified as well. Both genera have a lodix in the female genitalia, both genera have strongly spined tibiae but adults differ considerably in size. Until more is known about the life histories, it seems best to treat them as separate genera.

There are four neotropical species currently placed in *Dysgonia* (Poole, 1989). The male genitalia of these species have two coremata and a superuncus, thus placing them closer to *Ophiusa* Ochsenheimer and its allies. They will be dealt with separately.

The discovery of *N. telma* is a good example of barcoding revealing a cryptic species complex. Hugo Kons, Jr. and Robert Borth had barcoded presumed *N. smithii* from Florida, Texas, and Indiana. They were conspecific. I had barcoded numerous *N. smithii* as well, but it was not until I collected and barcoded an apparent *N. smithii* from Waccamaw Lake State Park in Columbus Co., North Carolina, that I realized two species were present under the name *N. smithii*. When our data were combined, two well-differentiated groups were obvious, true *N. smithii* from eastern North Carolina and *N. telma* from North Carolina, Florida, Texas and Indiana. Further study of barcoded specimens from the two groups revealed obvious genitalic differences. Dissection of over 50 specimens from throughout the ranges showed distribution patterns which were largely overlapping. A single specimen collected by Kohns and Borth from Medina County in the hill country of Texas west of San Antonio could not be placed with certainty. It has been barcoded and pictures of the adult and its genitalia were sent by Hugo Kons, Jr. and are most similar to *N. smithii*, but not clearly identical. Additional specimens may be needed to determine whether this population is *N. smithii*

or perhaps an undescribed species but its barcode differed from *N. smithii* from North Carolina by less than 1%, not an unexpected number for members from the extremities of a species' range.

Although the distribution of the two species by county shows numerous examples of both species occurring in the same county throughout their ranges, both Kons and Borth (2006) and I noticed that *N. telma* is most often found in or near swamps with standing water. *N. smithii* occurs in more upland habitats and has been taken above 2500' in the mountains of North Carolina (based on fascies but not dissected). Abbot's rearing of a larva on *Fagus* is consistent with the capture of *N. smithii* in the mountains, piedmont, and upland coastal plain habitats. Additional life history data for both species should reveal how they coexist over most of their ranges.

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# Taxonomic reassessment of *Zale lunifera* (Hübner) (Erebidae, Erebininae)

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## Abstract

In light of the recent discovery of an unrecognized species within nominal *Zale lunifera* (Hübner), the taxonomy of *Z. lunifera* is reassessed. *Zale intenta* (Walker), **stat. rev.** is the name that applies to the widespread species previously called *Z. lunifera*. *Zale lunifera* sensu stricto is the species previously thought to be undescribed; it occurs from the southern Atlantic coastal plain northward to the pine barrens of north-eastern United States. A differential diagnosis and adult illustrations of the two species are given.

## Keywords

*Zale intenta*, Ophiuini, conservation, Atlantic coastal plain, Pine Barrens

## Introduction

While curating *Zale* specimens collected on a field trip to south-eastern Georgia, I became aware of two similar but apparently different species collected on the same night. Further comparison to other specimens revealed that both species had traditionally been going under the name *Zale lunifera* (Hübner), but a second, apparently unnamed taxon had recently been flagged as one of conservation concern in the north-eastern United States (Wagner et al. 2003, NatureServe 2009). Comparisons of genitalic struc-

ture, phenotype, DNA barcodes of the putative species, and examination of the name-bearing types of the subjective synonyms of *Z. lunifera* show that names are available for both taxa. The purpose of this paper is to clarify the taxonomy and provide a diagnosis of these species.

## Methods and materials

Adult genitalia were prepared following the methods detailed by Lafontaine (2004).

Molecular variation was assessed based on the 658 base-pair ‘barcode’ region of the first subunit of the cytochrome oxidase (*cox1*) gene (Hebert et al. 2003). DNA was extracted from one leg removed from a dried specimen, and processed at the Canadian Centre for DNA Barcoding, Guelph, Ontario. DNA extraction, amplification and sequencing protocols for the Barcode of Life initiative are given in Hebert et al. (2003). Barcode haplotypes were compared with phylograms constructed using the neighbour-joining method as implemented on the Barcoding of Life Data Systems (BOLD) website (<http://barcodinglife.org>; Ratnasingham and Hebert 2007). Phyletic distances were calculated using the Kimura-2-Parameter (K2P) distance model. Data for molecular voucher specimens, including trace files and photographs, are available at the BOLD website under the project: Lepidoptera of NA Phase II: “*Zale lunifera*” under the “Published Projects” tab).

## Abbreviations of collections referred to herein are as follows:

- AMNH** American Museum of Natural History, New York, New York, USA  
**BMNH** The Natural History Museum (formerly British Museum [Natural History]), London, UK.  
**CNC** Canadian National Collection of Insects, Arachnids, and Nematodes, Ottawa, Ontario, Canada  
**USNM** National Museum of Natural History (formerly United States National Museum), Washington, D.C., USA.

## Systematics

### *Zale intenta* (Walker), stat. rev.

Figs 1–4

*Homoptera intenta* Walker, [1858]: 1070.

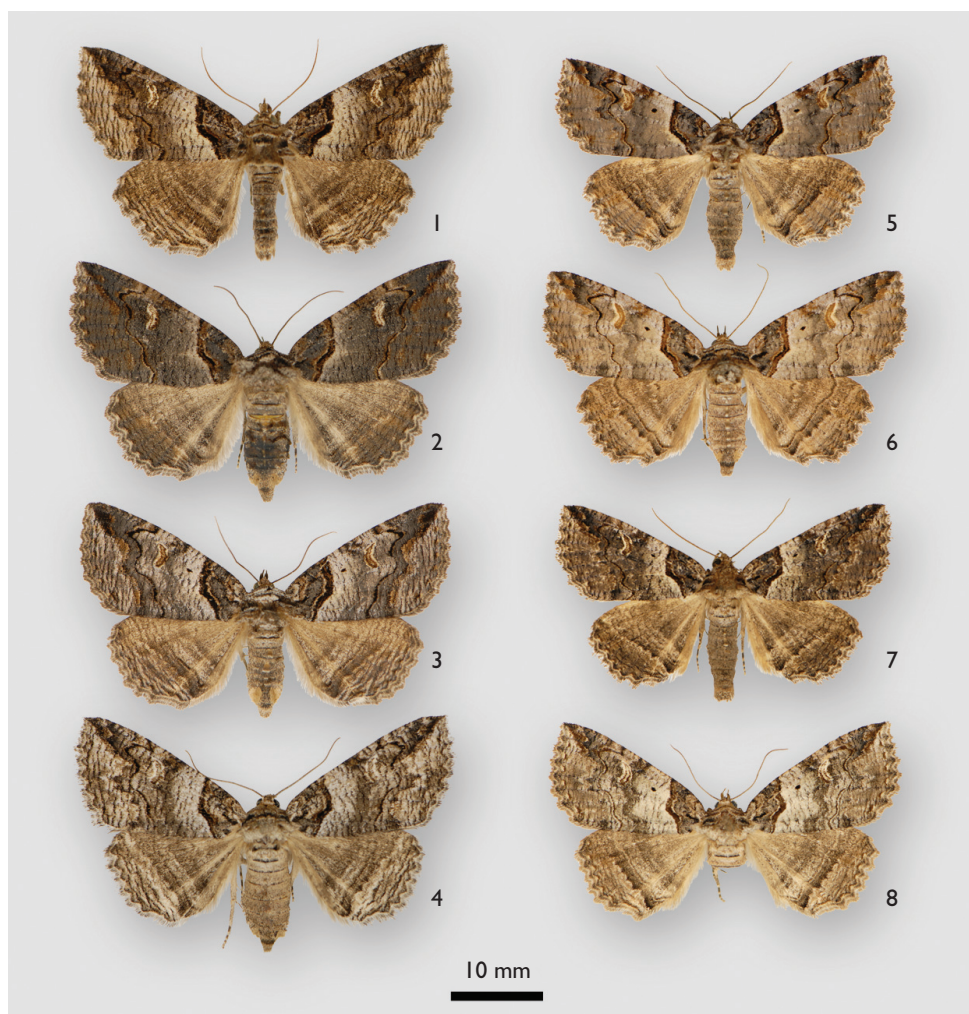
*Homoptera woodii* Grote, 1877: 88.

‡ *Zale calycanthata* ab. *dealbata* Strand, 1916. unavailable.

*Zale lunifera* of authors, not (Hübner, 1818).

*Homoptera cingulifera*; Holland 1913: pl. XXXVII f. 17.

*Zale lunifera*; Handfield 1999: p. 71 f. 8713; Rockburn & Lafontaine 1976: 144, fig. 551.



**Figures 1–8.** Comparison of adult *Zale intenta* and *Zale lunifera*. **1** *Z. intenta*, Edmunston, NB **2** *Z. intenta*, Stony Swamp, Ottawa, ON **3** *Z. intenta*, Ithaca, NY **4** *Z. intenta*, Ludowici, GA **5** *Z. lunifera*, Dwarf Pine Plains, Suffolk Co., NY **6** *Z. lunifera*, Lakehurst, NJ **7** *Z. lunifera*, neotype, Ludowici, GA **8** *Z. lunifera*, Anthony, Marion Co., Anthony, FL.

**Type material.** *Homoptera intenta* - type locality St. Vincent [Florida?] acc. to type label.; holotype in BMNH [photograph examined]. The wing pattern of the holotype is closest to that of southeastern United States populations of this species, which have a more greyish, contrasting pattern (particularly the hindwing) and more contrastingly pale subterminal forewing area than more northern specimens of this species and of *Z. lunifera*. *Homoptera woodii* - Type locality “[USA:] N[ew] Y[ork], Center.” Holotype in BMNH [photograph examined]. *Zale calycanthata* ab. *deallbata* – unavailable infrasubspecific name. Although some of Strand’s infrasubspecific names have subsequently

been validated (most of them inadvertently), I have found no evidence of this for *dealbata*. McDunnough (1938) listed it as a “form” (of *Z. calycanthata* (Smith)), not as a subspecies or subjective synonym. This name is not included in Franclemont and Todd (1983) or Poole (1989), presumably because it was deemed to be unavailable.

**Other material examined.** **New Brunswick:** Edmunston; St.-Basile; **Québec:** Temiscouata Co.; Ste. Flore, Lac Mondor; St-Mathieu de Beloeil; Manseau; Harrington Lake, Gatineau; Aylmer; Kirks Ferry **Ontario:** Ottawa, Pinhey Forest; Carp; Pike Lake, Manitoulin Island. **Tennessee:** Sevier Co., Great Smoky Mountains National Park. **Georgia:** Long Co., Ludowici, Griffin Ridge. **Maryland:** Beltsville. **Massachusetts:** Forest Hills. **Pennsylvania:** Indiana; Berks Co., Sinking Spring. **South Carolina:** McClellanville, Wedge Plantation. **New York:** Ithaca. **Louisiana:** Caddo Parish.

**Diagnosis.** This species has long been confused with *Z. lunifera*, from which it differs by its larger size, more elongate forewing shape, the poorly defined or absent black orbicular spot, and the less sinuate black antemedial line on the forewing. *Zale intenta* also has a tendency to develop an overall striate pattern that is very poorly or not at all developed in *Z. lunifera*, particularly well developed in south-eastern populations (Fig. 4). Male genitalic differences are slight; the valves are more elongate and the aedeagus is longer with a slightly greater twist in *Z. intenta* than in *Z. lunifera*. In females, the distance between the ostium and the caudal margin of the antevaginal plate is equal to the diameter of the ostium; in *Z. lunifera*, this distance is 2.0–2.5 × the diameter of the ostium.

**Redescription.** *Head* – antenna ciliate in both sexes; palpi and head dark brown. *Thorax* – thoracic collar dark brown with a fine black basal line and light-grey distal border; middorsal area with a brown anterior and posterior tuft, scales prominently light grey distally bordered basad by fine black line; tegulae patterned similarly, but with a broad black basal patch; thorax fuscous grey brown ventrally. *Abdomen* – dorsum and ventrum brown grey; dorsum of segments four to seven with pale-tipped hair tufts; sexes similar. *Forewing* – length averaging 19.7 mm (n = 6) in males, 20.1 mm (n = 3) in females; ground colour greyish brown to dark chocolate brown, with a slight dark-purple tinge in fresh specimens; entire wing covered in fine, black striae (particularly developed in southern populations); basal area (basad of antemedial line) dark brown, contrasting with remainder of wing, with small paler brown patch at base of costa; antemedial line dark brown to black, sometimes paler brown medially; bordered distally by pale grey-brown shading; orbicular absent or small and black; reniform spot rust brown centrally with a fine black border and a broader pale-tan outer border; postmedial line fine, black and sinuate; subterminal area variously concolorous with postmedial area (usually) or paler grey-brown, particularly in south-eastern populations; ventrum even fuscous brown with slightly darker indistinct reniform and costal part of postmedial line; dark striae less distinct than on dorsum; sexes similar. *Hindwing* – ground colour greyish brown to dark chocolate brown, grading to lighter fuscous brown toward costal margin; entire wing covered in fine black striae; medial area with or without an indistinct double medial line; postmedial line absent or indistinct; ventrum even fuscous brown with slightly darker, indistinct, dark discal spot;

dark striae less distinct than on dorsum; sexes similar. *Male genitalia* – valves symmetrical, apex (cucullus) distinctly lanceolate and curving about 90 degrees inward; saccular extension consisting of a low triangular process; saccular process an indistinct ridge; uncus long and cylindrical, approximately half length of base of valve, apex pointed and down curved; juxta slightly asymmetrical, with left caudal margin developed into a slight lobe; aedeagus curving dorsad and to right by approximately 90 degrees; aedeagus with a lobe-like process at distal margin; vesica roughly globose with numerous diverticula, very finely scobinate. *Female genitalia* – papillae anales bluntly triangular, lightly sclerotized; posterior apophysis  $2.2 \times$  length of papillae; anterior apophysis  $1.0 \times$  length of papillae; antevaginal plate deeply divided by a medial notch, forming a quadrate flange on each side; ostium originating near proximal margin of antevaginal plate, separated from caudal margin of plate by  $2.0\text{--}2.5 \times$  diameter of plate; ductus bursae short,  $2.0\text{--}2.5 \times$  as long as diameter of ostium; corpus bursae pear shaped, proximal, larger chamber with minute, internal spicules.

**Distribution and biology.** Distributed from Nova Scotia (Ferguson 1954) westward to Wisconsin (Forbes 1954) and Missouri and southward to Georgia. Likely also occurs in northern Florida, but literature records may apply to *Z. lunifera*. The southwestern range limit is not known. Larvae feed on *Prunus* species, including black cherry (Forbes 1954), beach plum and “cherry” (Wagner 2005). The flight period is from March to June depending on latitude and elevation.

### *Zale lunifera* (Hübner)

Figs 5–8

*Phaeocyma lunifera* Hübner, 1818: 19, pl. XX.

*Homoptera cingulifera* Walker, [1858]: 1056.

*Zale lunifera*; Covell 1984: pl. 38 f. 21.

**Type material.** *Phaeocyma lunifera* – Type locality: “Georgien” [USA: Georgia]; the type is apparently lost, but the illustration in the original description is most similar to the oak-feeding species, with a more brownish colouration, distinct orbicular spot, indistinct striations and even, slightly violaceous submedial forewing area. In contrast, specimens of *Z. intenta* from coastal Georgia tend to be heavily striate, greyish rather than brown, and with a contrastingly pale subterminal forewing area. To ensure the stability of the name, the following specimen is designated as **neotype**: “USA: GA [Georgia] Long Co., Ludowici, / 3 mi SW, Griffin Ridge / WMA. [Wildlife Management Area] 31.694N -81.796W / 6-iii-08 C.Schmidt & J.Adams”; “NEOTYPE / *Phaeocyma* / *lunifera* Hübner / desig. Schmidt 2010”. *Homoptera cingulifera* – Type locality: [USA:] East Florida; holotype in BMNH [photograph examined].

**Other material examined.** **Florida:** Marion Co., Anthony; Putnam Co., Ocala National Forest. **North Carolina:** Craven Co., Croatan National Forest. **New York:** Suffolk Co., Dwarf Pine Plains. **New Jersey:** Lakehurst. **Georgia:** Long Co., Ludowici,



Griffin Ridge. **Massachusetts:** Plymouth Co., Myles Standish State Forest. **Alabama:** Ozark, Camp Rucker.

**Diagnosis.** Similar to *Z. intenta*; see diagnosis under that species.

**Redescription.** Markings, colouration and genitalic structure as for *Z. intenta*, but differing in the following characters. *Forewing* – length averaging 17.4 mm ( $n = 4$ ) in males, 18.9 mm ( $n = 3$ ) in females; ground colour greyish brown to dark chocolate brown with a slight violaceous tinge; entire wing covered in fine black striae, less developed and thinner than in *Z. intenta*; antemedial line with more pronounced medial angle than in *Z. intenta*; orbicular small and black, sharply contrasting; subterminal area concolourous with medial area, never contrastingly paler with strong striae. *Hindwing* – as for *Z. intenta*, but without variation toward more contrasting hindwing markings seen in pale specimens. *Male genitalia* – valves slightly more elongate compared to *Z. intenta*; aedeagus slightly shorter and less twisted than in *Z. intenta*. *Female genitalia* – ostium separated from caudal margin of antevaginal plate by diameter of ostium; proximal chamber of corpus bursae  $1.9 \times$  diameter of distal chamber.

**Distribution and biology.** *Zale lunifera* occurs primarily east and south of the Appalachian Mountains. Examined material and reliable records indicate a range from southern Maine (Wagner et al. 2003) south to Lee Co., Mississippi (D. Schweitzer, pers. comm.) and Florida. Not known from south-eastern Virginia or South Carolina, but the species may occur in these regions. Lack of suitable habitat in Maryland and Delaware make occurrence in these states unlikely (D. Schweitzer, pers. comm.). Occurs inland to the mountains of Virginia and Lebanon County, Pennsylvania (NatureServe 2009).

In southeastern Georgia this species inhabits open, sandy pine-oak forest. Wagner et al. (2003) record it from sand plain pitch pine / scrub oak barrens in northeastern United States. Larvae feed on Bear Oak (*Quercus ilicifolia* Wangenh.) (Wagner et al. 2003), and other scrub oak species (NatureServe 2009). Additional life history data are given by NatureServe (2009).

**Remarks.** DNA analysis of seven *Z. lunifera* specimens (New York, North Carolina, Florida) exhibited two ‘barcode’ haplotypes differing by one base-pair. Minimum divergence from *Z. intenta* haplotypes (five specimens from Quebec and Tennessee) was 1.2 %.

## Discussion

The taxonomy of *Zale lunifera* (in the broad sense) has not been clear. Forbes (1954) recognized one valid species, but correctly diagnosed “southern specimens of *Z. cingulifera*”, i.e., *Z. lunifera*, as differing from *Z. intenta* in the more irregular forewing lines, stronger and more dentate subterminal line, and less striate pattern. All *Z. lunifera* group names were treated as synonyms of *Z. lunifera* in Franclemont and Todd (1983). Subsequently, Wagner et al. (2003) treated *Z. lunifera* as “*Zale* sp. 1 near *lunifera*,” as it was thought that nominate *Z. lunifera* was the more common and widespread spe-



cies. As discussed above, the name *Z. intenta* applies to the widespread species, whereas true *Z. lunifera* is the species with a more restricted occurrence east and south of the Appalachians.

The global conservation rank currently assigned to *Z. lunifera* is G3G4, or “Vulnerable” to “Apparently Secure” (NatureServe 2009). Additional surveys for this species should be carried out in the Appalachian Mountains (particularly the eastern portion), sand hills and coastal plain south of New Jersey, which would probably show this species to be more widespread than currently known.

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# Larva and pupa of *Amyna axis* (Guenée, 1852) and affirmation of its taxonomic placement in Bagisarinae (Lepidoptera, Noctuidae)

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## Abstract

The larva and pupa of *Amyna axis* (Guenée, 1852) are described and illustrated, and observations are provided on the insect's life history and larval biology. Larval, adult, and life history characters support the transfer of *Amyna* Guenée from Acontiinae Guenée, 1841 to Bagisarinae Crumb, 1956. The phylogenetic placement of the Bagisarinae is enigmatic; some adult and larval features indicate that the subfamily is a basal trifold proximate to Acontiinae, whereas other larval and life history characters suggest an association with Scoliopteryginae, a basal quadrifid group. Larvae exhibit a green-to-black color polyphenism presumably linked to larval density, with darker phenotypes occurring during outbreak densities. Parallel color shifts that occur in other Lepidoptera are briefly discussed.

## Keywords

Larval polyphenism, larval melanism, thrashing behavior, frass flicking, Acontiinae, *Anomis*, *Amyna axis*, Bagisarinae

## Introduction

The genus *Amyna* Guenée, 1852, contains about 35 recognized species distributed worldwide (Savelle 2009). The majority of the species occur in Asia. Only three are known from the New World; the pan-tropical *Amyna axis* Guenée, 1852 [= *A. octo*

(Guenée, 1852)], *A. bullula* (Grote, 1873), and *A. amplificans* (Walker, 1858). Forbes (1954) placed *Amyna* in his concept of the Acontiinae, but noted that it was “A curious genus, probably not really Acontiine though with proper M of hindwing....” He also mentioned the presence of a blunt appendiculate tooth on the larval crochets (Fig. 7) that suggested the genus was related to “the Malvaceous group” of his Acontiine [*Bagisara* presumably]. Franclemont and Todd (1983) left *Amyna* in the Acontiinae, grouping it in their concept of the Eustrotiini, a heterogeneous assemblage of taxa that includes genera now classified in the Acontiinae, Acronictinae, Condicinae, Eubleminae, Plusiinae, Xyleninae, etc. (Kitching and Rawlins 1998, Fibiger and Lafontaine 2005, Lafontaine and Schmidt (in press). Poole (1989) left *Amyna* in the Acontiinae. Kitching and Rawlins (1998) mentioned *Amyna* in their synopses of both Eustrotiinae and Bagisarinae, noting that the studies of Jeremy Holloway indicated the genus was better placed in the latter subfamily. Holloway (2009) tentatively moved the genus into Bagisarinae in his latest volume on the Moths of Borneo.

*Amyna axis*, the type-species for Guenée’s genus, is the focus of this paper and the basis for the placement of the genus in Bagisarinae. Below we describe the larva and pupa, extending the efforts of Gardner (1941, 1946) and provide information on *Amyna*’s larval biology. We discuss morphological, behavioral, and biological data that support the taxonomic assignment of *Amyna* in Bagisarinae, and conclude the paper with a discussion of the green-to-black color polyphenism that occurs in *Amyna* and other Lepidoptera.

## Materials examined and methods

Larvae of *Amyna axis* were obtained from *Amaranthus* L. in Scissors, Hidalgo County Texas in October 2006 (DLW) and October 2009 (Berry Nall), and *Croton* L. in Starr County, Texas in October 2008 (DLW and Henning von Schmeling).

One larva from Scissors was prepared for SEM study by running it through a series of ethanol baths (70%, 80%, 90%, 95%, 100%) before it was dehydrated with hexamethyldisilazane. The caterpillar was then coated with gold palladium for three minutes in a Polaron E 5100 sputter coater. Images were obtained with a Zeiss DSM-982 Gemini FE SEM at 3 kV. Larval, pupal, adult, film, and digital vouchers have been deposited at the University of Connecticut.

## Descriptions

**Description of living last instar** (Figs 8–10, 12). Elongate, approximately 10 × longer than wide, shallowly constricted between segments, especially rearward. Ground color glaucous green, sea green, or emerald green to nearly black, often with black supraspiracular spots. Thin, white, broken addorsal, subdorsal, and supraspiracular stripes run length of body. Spiracular stripe continuous and roughly 2 × thickness of others,

weakening rearward of A8. Caudal segments somewhat flattened with anal prolegs elongated, splayed outward and held nearly horizontal behind body. Head shiny, pale green to orange, with setae borne from dark spots.

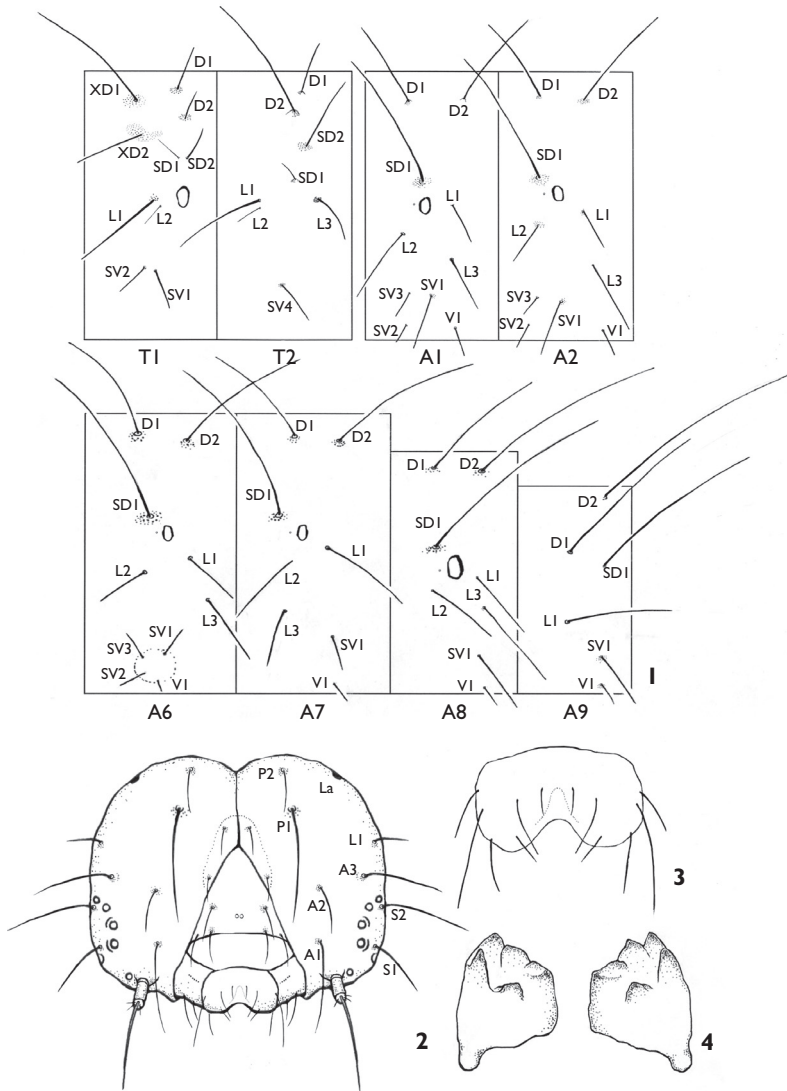
**Description of preserved last instar** (Figs 1–4). Length: 27–30 mm (n=15), body tapered caudad. Essentially unpigmented except for dark areas in melanistic individuals and darkened spots about some pinacula. Setae long, often blackened, frequently broken. **Head** – Primary setae above level of stemmata from blackened spots. P1 darkened, thick, extremely long, curving forward, reaching to clypeus; A3 darkened, thick, long,  $>2 \times$  length of L1. La from darkened spot. Second segment of labial palpus long,  $>5 \times$  basal diameter. Spinneret long and slender with apical pore (Fig. 6). **Thorax** – Prothorax with well-developed cervical gland (Fig. 6); XD1 long, reaching well forward; SD1 and SD2 approximate, at same level, SD1 fine, circa  $1/5$  diameter of SD2; L1 second longest seta on segment reaching to stemmata; L2 fine, approximately  $1/2$  length and  $1/4$  diameter of L1; SV setae at same level, SV1  $2 \times$  length of SV2. T2 and T3 with D1, D2, SD2, and SD1, well separated, nearly in line; D2 seta longest; SD1 fine; L1 and L2 insertions approximate, but not sharing same pinaculum. **Abdomen** – A1–A9 with long setae; D2 and SD1 subequal to segment that bears them; D1, and especially D2, on raised warts that increase in size caudad to A9; D2 and SD1 on A9 longest setae on body, both exceeding length of A8 and A9; SD2 minute. L3 on A7 shifted anteriorad, below L2. A1 and A2 with three SV setae; SV1  $3 \times$  SV2 and SV3 on both segments; SV2 distant, shifted ventrad on A1, nearly in line with V seta. Spiracle height on A1  $1.2 \times$  than those on A2–A7; that on A8  $>2 \times$  that on A7; spiracles on A2–A4 shifted dorsad. Prolegs on A3 and A4 reduced to minute nib; those on A5 and A6 elongate, with 19–21 crochets. Crochets with blunt appendicular tooth (Fig. 7). A7–A9 with 3, 3, and 1 L setae, respectively. Anal plate with long setae; SD1 thickened and elongate.

**Pupa** (Figs 15–17). Length: 11.3–13.0 mm (n=3). Color as in Fig. 15. Deep incisures bounding two fully articulating segments A5–A6. Smooth except for darkened band of shallow pitting anterior to spiracles on A5–A7. Head structures poorly differentiated; only labrum and antennae fully delimited; labial palpus not visible. Prothoracic leg ending at about level of spiracle on A2.

Proboscis, meso- and metatarsi, and antennae all ending together between wing tips. Antennal segmentation vague. Small black pimplelike spot anterodorsal to spiracle on A5–A7. Cremaster consisting of single pair of spines, each shallowly hooked and slightly sinuate at apex.

## Life history

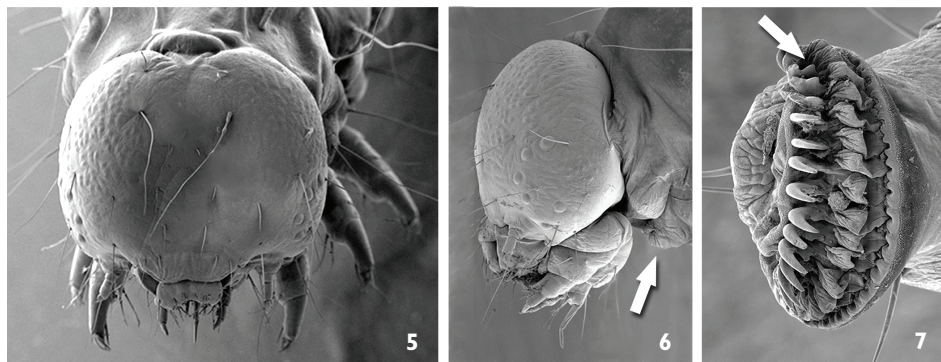
Host records include *Amaranthus* L., *Celosia* L., and *Digera* Forssk. (all Amaranthaceae); *Helianthus* L. (Asteraceae); *Chenopodium* L. and *Spinacia* L. (both Chenopodiaceae); *Ipomoea* L. (Convolvulaceae), *Ricinus* L. (Euphorbiaceae); *Arachis* L., *Crotalaria* L., *Medicago* L., *Phaseolus* L., and *Vigna* Savi (all Fabiaceae); *Hibiscus* L. (Malvaceae); *Car-*



**Figures 1–4.** *Amyna axis* last instar. **1** Chaetotaxy. SD2 on abdomen represented only by its pinaculum (forward of spiracle) **2** Head, frontal **3** Labrum, frontal **4** Mandibles, mesal surfaces.

*diospermum* L. (Sapindaceae); *Solanum* L. (Solanaceae); *Corchorus* L. (Tiliaceae); and *Parasponia* Miq. (Cannabaceae) (Ferguson et al. 1991, Robinson et al. 2001, 2002). Our southern Texas collections came from *Amaranthus* and *Croton* L., but not from any of the dozen or more other forbs and low-growing plants (e.g., *Abutilon* Mill., *Ambrosia* L., *Eupatorium* L., *Helianthus* L., *Heterotheca* Cass., *Lantana* L., *Malvastrum* A. Gray, *Melolochia* L., *Parthenium* L., *Physalis* L., *Sida* L., etc.) sampled with a beating sheet over the course of general (larval) collecting efforts in October 2006, 2007, and 2008. Nearly all of our *Amyna* caterpillars were collected from mature amaranth





**Figures 5–7.** *Amyna axis* last instar. **5** Head, frontal **6** Head, lateral, with prothoracic gland (adenosma) indicated **7** Crochets, with subapical tooth indicated.

plants, especially those that were into seed-set, turning red, and senescing. None came from lush, actively growing pre-flowering plants. *Amyna* caterpillars were so abundant in stands of amaranthus at Scissors, Texas in October 2006 that they had conspicuously damaged the plants.

Larvae perch on the undersides of leaves and along stems and petioles. At rest, the abdominal segments are often looped upward (Fig. 9). When alarmed the larva essentially jumps from the host and continues to writhe and wriggle wildly. A QuickTime® movie of the alarm response of *Amyna* is mounted with this paper on <http://www.eeb.uconn.edu/people/wagner/>.

Prepupal larvae take on a pinkish cast (Fig. 14). Pupation occurs in a silken cocoon below (usually) or at the soil surface; sand and/or plant debris are interwoven into the cocoon wall. Adults occur throughout the growing season in southern Texas, but numbers peak in September and October during the wet season (Ed Knudson, personal communication).

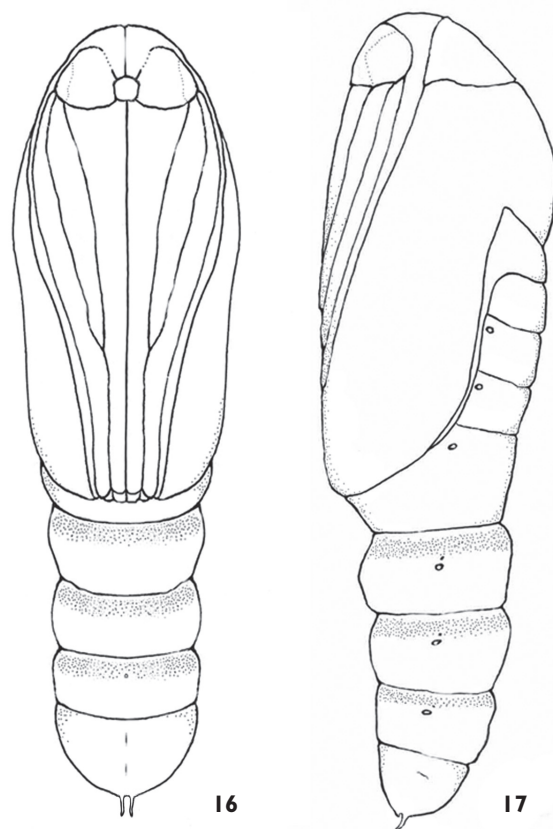
At low densities caterpillars are pale green ( $n > 20$ ). Where we encountered caterpillars in high density and in our rearing containers, we saw higher frequencies of melanistic phenotypes. The degree of blackening varied widely, ranging from individuals with simple subdorsal-lateral patches (Fig. 9) to those that were mostly black (Fig. 10). In the field, melanized individuals (common in 2006) were visible from many meters away.

## Discussion

**Taxonomic matters.** Crumb (1956) was so perplexed by the taxonomic affinities of *Bagisara* that he placed the genus into its own subfamily in his monograph, noting that “All of the principal characters of the larvae are primitive but the moths are rather stout and stubby winged, showing none of the superficial characters students of the moths have come to associate with lower Phalaenidae [Quadrifinae].” Kitching and Rawlins (1998) concurred with Crumb’s assessment and recognized Bagisarinae as a distinct



**Figures 8–15.** *Amyna axis* and *Bagisara repanda* last instar and pupa. **8–10** *Amyna axis* **11** *Bagisara repanda* **12** *Amyna axis* caudal segments **13** *Bagisara repanda* caudal segments; with D2 setae indicated by white arrow **14** *Amyna axis* prepupa **15** *Amyna axis* pupae and cocoon.



**Figures 16–17.** Pupa of *Amyna axis*. **16** ventral **17** lateral.

subfamily of trifine noctuids. The subfamily's position remains essentially unchanged in Fibiger and Lafontaine (2005), Lafontaine and Fibiger (2006), and Lafontaine and Schmidt (in press), i.e., at the base of the trifines in the vicinity Plusiinae, Eustrotiinae, and Acontiinae.

Character evidence that argues for a close phylogenetic association between *Amyna* and *Bagisara* include the (1) elongate body, with shallow incisures between segments and tapered caudal segments (Figs 8–13); (2) prolegs absent or greatly reduced on A3 and A4; (3) at least some crochets with a subapical tooth (Fig. 7); (4) spiracle on A1  $1.2 \times$  that on A2 and that on A8  $2 \times$  height of spiracle on A7, yellowish; (5) spiracles on A2–A4 shifted dorsad; (6) L3 shifted anteriorad below L2 on A7; (7) setae long, especially those on T1 and A8–A10 (Figs 12, 13); (8) SD1 on A10 elongate and thickened; (9) long labial palpus,  $>3 \times$  basal diameter; and (10) pink to reddish prepupae (Fig. 14). Behavioral characters suggesting that *Amyna* is a bagisarine include (11) a resting posture with the mid-abdomen looped above the substrate (Figs 9, 11); (12) an animated and prolonged alarm response (QuickTime® movies of the alarm response



of both genera are mounted on <http://www.eeb.uconn.edu/people/wagner/>; and (13) the flicking of the excreta. The appendiculate crochets and shared spiracular “formula” (i.e., with the height of the spiracle on A1 being  $1.2 \times$  than that of those on A2–A7, that on A8 being  $>2 \times$  that on A7, as well as the dorsal shift of the spiracles on segments A2–A4), strike us as compelling evidence of (recent) common ancestry, and support Holloway’s (2009) suggestion that *Amyna* should be transferred to Bagisarinae.

Conversely, numerous structural differences separate the two genera. *Bagisara* (and some *Xanthodes* Guenée) are unusual among noctuids in their possession of two SV setae on A7 (Crumb 1956, Kitching and Rawlins 1998), whereas *Amyna axis* has only a single SV seta on A7. The prolegs are represented on A3 and A4 in *Amyna axis* by minute nibs; there is no evidence of the prolegs on these segments in the *Bagisara* that we examined. The basal tooth on the crochet of *Amyna* is much less developed than that seen in *Bagisara* species, although some Indian members of the genus evidently have a well-developed subapical tooth (Gardener 1946). *Bagisara* possess short, stout, upcurved D2 setae on A10 (Fig. 13) that presumably play an important role in fecal flicking (see Weiss 2006); the D2 setae are straight and much longer in *Amyna*. *Bagisara* are dietary specialists with much of their species radiation tied to the Malvaceae, whereas *Amyna axis* has been reared from a wide array of forbs.

Like Crumb (1956), we confess to being confused about the phylogenetic affinities of the Bagisarinae. *Bagisara* was long classified in the Acontiinae (e.g., Forbes 1954, Franclemont and Todd 1983) and most recently in its own subfamily proximate to the Acontiinae and Eustrotinae (e.g., Kitching and Rawlins 1998, Fibiger and Lafontaine 2005, Lafontaine and Fibiger 2006, Holloway 2009). In form and habit, the larvae of *Bagisara* (with *Amyna*) share similarities with Acontiinae (such as *Tarachidia* Hampson): e.g., trifold venation in adults, frass flicking habit, absence of prolegs on A3 and A4, and a simple cremaster. But other features, especially in the larvae, suggest linkages with erebids and especially the genus *Anomis* Hübner (Scoliopteryginae): in both the SV group is trisetose on A1 and A2 and the crochets are appendiculate. In addition, *Anomis* and *Bagisara* are Malvaceae specialists. Still other traits are shared with the Hypeninae and Scoliopteryginae taken together: all have some reduction of the prolegs on A3 and A4, flick their frass, have a sustained thrashing response when alarmed, and a spiracular stripe that continues on to the anal plate.

**Melanism matters.** *Amyna axis* larvae are green at low densities in the wild, but at high larval densities — several per sq. m — we encountered larvae with varying amounts of dark pigmentation (Fig. 10). We have also induced blackening in our rearing containers; green, unmarked larvae reared together usually darken within days of their collection. Homologous green-to-black polymorphism occurs in more than two dozen other lepidopteran lineages (Wagner in prep.). In a fashion similar to that seen in *Amyna*, caterpillars of the elm spanworm, *Ennomos subsignarius* (Hübner), darken as a result of physical contact with other larvae (Drooz 1966). Green-to-black color changes have also been linked to crowding in other noctuids: e.g., *Plusia gamma* L. (Long 1953) and *Mamestra brassicae* (L.) (Goulson 1994). In addition to crowding, temperature can induce color polyphenisms in caterpillars. Arizona populations of

*Battus philenor* (L.) raised in high temperatures display a red (cooler core) larval phenotype, whereas those raised at lower temperatures displayed a black (warmer core) phenotype, suggesting that color changes could be a way of “beating the heat” (Nice and Fordyce 2005). The eastern black swallowtail, *Papilio polyxenes* (Stoll), has a dark, cool-season phenotype that has thermoregulatory advantages over the lighter mid-summer morphs (Hazel 2002). Long (1953) reported that the degree of blackening in *Plusia gamma* was also influenced by a caterpillar’s diet. In *Amyna*, the production of dark forms appears to be linked to crowding as such were observed at high field densities and were induced in rearing containers with multiple larvae. Whether or not the green-to-black shift in *Amyna* and other caterpillars represents an adaptive response and the selective consequences of a shift to darker coloration change remain to be elucidated.

## Acknowledgments

We thank Berry Nall for sending us collections of *Amyna axis* from south Texas. Marie Cantino assisted with the scanning electron microscopy and Amy Fernald prepared the artwork and color plates. Herbert Beck, Don Lafontaine, and Dale Schweitzer provided suggestions on drafts of the manuscript.

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# Review of the North American species of *Marimatha* Walker with descriptions of three new species (Lepidoptera, Noctuidae, Eustrotiinae) and the description of *Pseudomarimatha flava* (Noctuidae, Noctuinae, Elaphriini), a new genus and species confused with *Marimatha*

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## Abstract

Seven species of *Marimatha* Walker are examined, five of which occur in North America. In addition to the existing species *M. nigrofimbria* (Guenée), *M. tripuncta* (Möschler) is reported from North America for the first time and three new species are described from southwestern North America: *M. piscimala*, *M. squala*, and *M. quadrata*. *Marimatha alboflava* (Walker), *M. botryoides* (Guenée), and *M. dinumeratalis* (Walker) are discussed in terms of the generic name *Marimatha*, and *M. aurifera* (Walker) is discussed in

relation to the identity of *M. tripuncta*. A generic diagnosis, key to species, descriptions, and illustrations of adults and genitalia are included. A new genus and species is proposed for a species currently placed as an undescribed species of *Marimatha*, but tympanal and genital characters and *mtDNA* suggest an association with the subfamily Noctuidae, tribe Elaphriini.

### Keywords

Taxonomy, *Elaphria*, *Marimatha alboflava*, *Marimatha aurifera*, *Marimatha botyoides*, *Marimatha dinumeratalis*, *Marimatha nigrofimbria*, *Marimatha tripuncta*, *Marimatha piscimala*, *Marimatha squala*, *Marimatha quadrata*, *Thioptera*, *Pseudomarimatha flava*, *Xanthoptera*, Arizona, Brazil, Florida, Honduras, Mexico, New Mexico, Puerto Rico, Texas

### Introduction

The species discussed herein were originally placed in *Xanthoptera* Guenée 1852, which is a junior homonym of *Xanthoptera* Sodoffsky, 1837. Franclemont (1950) proposed the objective replacement name *Thioptera*. Berio (1966) proposed the objective replacement name *Flavula*, apparently unaware of Franclemont's replacement name. Based upon examination of the genitalia of *Marimatha dinumeratalis* Walker, [1866] (TL: Honduras), it is evident to us that *Thioptera* should become a junior synonym of *Marimatha* Walker, [1866]. The type species of *Marimatha* is *M. dinumeratalis* Walker, [1866] (TL: Honduras) by subsequent designation by Hampson (1894: 324). *Marimatha dinumeratalis* and *M. alboflava* (Walker, 1862) (TL: Honduras) are junior subjective synonyms of *M. botyoides* (Guenée, 1852) (Fig. 17) (Nye 1975; Poole 1989). Although there are several undescribed species related to *M. botyoides* in Central America, the reddish-brown shading in the subterminal area and distinct black terminal line are diagnostic for the type specimens of the three names referable to *M. botyoides*. *Marimatha aurifera* (Walker, [1858]) [TL: Brazil] has been listed erroneously in the literature as occurring in the Caribbean and in North America in Florida and Texas. Adults of *M. aurifera* lack the frontal protuberance that occurs in four of the five North American species. Examination of the genitalia separates *M. aurifera* (Fig. 16) from *M. nigrofimbria* (Guenée) (Fig. 11), the only North American species that also lacks a frontal protuberance.

A small noctuid from Arizona has been generally assumed to be another undescribed species of *Marimatha* because of similar size and build, lemon-yellow forewing with a dark fringe. However, the genital characters and DNA associate it with the subfamily Noctuidae: tribe Elaphriini rather than with *Marimatha* in the Eustrotiinae. It is described after the revision of *Marimatha*.

## Materials and methods

### Repository abbreviations

#### Specimens were examined from the following collections:

- AMNH** American Museum of Natural History, New York, NY, USA.  
**BMNH** The Natural History Museum [statutorially: British Museum (Natural History)], London, UK.  
**CMNH** Carnegie Museum of Natural History, Pittsburgh, Pennsylvania, USA  
**CNC** Canadian National Collection of Insects, Arachnids, and Nematodes, Ottawa, Ontario, Canada.  
**CDF** Personal Collection of Clifford D. Ferris, Laramie, Wyoming, USA.  
**CUIC** Cornell University Insect Collection, Ithaca, New York, USA.  
**FSCA** Florida State Collection of Arthropods, McGuire Center for Lepidoptera and Biodiversity, Florida Museum of Natural History, University of Florida, Gainesville, Florida, USA.  
**JBW** Personal collection of J. Bruce Walsh, Tucson, Arizona, USA.  
**OUMNH** Oxford University Museum of Natural History, Oxford, UK.  
**TLSC** Texas Lepidoptera Survey Collection, Houston, Texas, USA.  
**TSD** Personal Collection of Terhune S. Dickel, Anthony, Florida, USA.  
**USNM** National Museum of Natural History [formerly, United States National Museum], Washington, District of Columbia, USA.  
**ZMHB** Museum für Naturkunde der Humboldt-Universität, Berlin, Germany.

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

#### Description abbreviations

- DFW** Dorsal forewing.  
**DHW** Dorsal hindwing.  
**TL** Type locality.  
**VFW** Ventral forewing.  
**VHW** Ventral hindwing.

### *Marimatha* Walker, [1866]

Type species: *Marimatha dinumeratalis* Walker, [1866].

**Note.** *Marimatha dinumeratalis* is a junior subjective synonym of *M. botyoides* (Guenée, 1852) as is *Marimatha alboflava* (Walker, 1862). All three type specimens were examined. The types were not dissected (that of *M. dinumeratalis* lacks an abdomen), but specimens comparable with the types in appearance and locality were.

*Xanthoptera* Guenée, 1852, **syn. n.**

Type species: *Xanthoptera nigrofimbria* Guenée, 1852.

Preoccupied by *Xanthoptera* Sodoffsky, 1837.

*Thioptera* Franclemont, 1950, **syn. n.**

Type species: *Xanthoptera nigrofimbria* Guenée, 1852.

Objective replacement name for *Xanthoptera* Guenée, 1852

*Flavula* Berio, 1966, **syn. n.**

Type species: *Xanthoptera nigrofimbria* Guenée, 1852.

Unnecessary replacement name for *Xanthoptera* Guenée, 1852

**Diagnosis. Adults.** Males and females of similar size (FWL: 8.5–11 mm), similar in range for all species. *Head* – male antenna almost filiform, but very slightly swollen between segments, ventrally minutely setose; female antenna filiform, ventrally minutely setose; head yellow with brown spot in front of eye; palpus upturned, outer surface brown speckled with yellow, inner surface yellowish speckled with brown, terminal segment yellow tipped; frons brown, rounded in some species (only *M. nigrofimbria* in North America), or bulging into transverse ridge with flat tubercle-like surface on lower side of ridge (four species in North America). *Thorax* – bright yellow. *Wings*: DFW with lustrous or glossy aspect, usually bright yellow with dark blackish brown shading on wing margin and fringe and on three dark-brown spots, one at position of reniform and two at position of antemedial line (a small one below costa and a larger one below cubital vein), and usually with some dark shading on postmedial line; DHW pale fuscous to dark fuscous, usually darker on veins and toward wing margin. *Male genitalia* – tegumen triangular when viewed laterally, wider dorsally and tapered to point at junction with vinculum; uncus cylindrical,  $1/3$ – $1/2$   $\times$  length of valva, blunt at apex or with short sclerotized hook; saccus elongate, tapered anteriorly,  $1/3$ – $2/3$   $\times$  length of valva; valva somewhat triangular, broad at base and narrow toward blunt or spine-tipped apex; valva with large, dorsally rounded sacculus, right sacculus larger than left one in some species; clasper a thickened area on ventral margin of valva distal to sacculus, with triangular ampulla-like process near base of clasper in most species; pollex a costal process  $1/4$ – $1/3$  distance from apex; aedeagus  $1$ – $2$   $\times$  length of valva, usually ending in blunt spine at apex ventrally; vesica tubular or slightly inflated, basal part more rigid in some species because of longitudinal sclerotized ridges, apical part membranous with one to several clusters of heavily sclerotized cornuti in most species. *Female genitalia* – corpus bursae without signa, irregularly oval and tapered posteriorly in most species; ductus seminalis on left side of corpus bursae, toward posterior end in most species but anterior to middle in *M. tripuncta* group; ductus bursae long and sinuate, lightly to heavily and irregularly sclerotized; ostium bursae heavily sclerotized with ventral plate projecting posteriorly over opening of ostium in most species; abdominal segment eight (A8) short and weakly sclerotized, especially dorsally; anterior apophyses thin, moderately sclerotized, about as long as A8 and  $1/2$  as long as posterior apophyses; anal papillae lightly sclerotized and setose, quadrangular in lateral profile.

## Key to North American species of *Marimatha*

1. Head without frontal protuberance; forewing usually with no trace of post-medial line; eastern United States..... ***M. nigrofimbria***
- Head with frontal protuberance with raised transverse ridge; postmedial line usually indicated by dark scales; southern Florida and southern Texas westward to Arizona and southward to Costa Rica..... **2**
2. Male genitalia ..... **3**
- Female genitalia ..... **6**
3. Prominent single projection arising about mid-length from dorsal margin of valva; postmedial line evenly curved around position of reniform spot ..... **4**
- Multiple narrow dentate projections along dorsal margin of valva; postmedial line deeply curved around position of reniform spot ..... **5**
4. Projection truncated apically to form squarish process ..... ***M. quadrata***
- Projection sharply pointed and triangular ..... ***M. squala***
5. Preapical diverticulum in vesica with several large cornuti with basal tooth; Caribbean and southern Florida ..... ***M. tripuncta***
- Preapical diverticulum in vesica with several smaller tapered cornuti; Texas and Arizona to Costa Rica..... ***M. piscimala***
6. Ostial plate minute, slightly concave mesially; ductus bursae with 360 degree loop ..... ***M. quadrata***
- Ostial plate prominent, cleft mesially; ductus bursae slightly sinuate..... **7**
7. Ostial plate wedge-shaped with concave sides and small u-shaped notch; ductus seminalis near posterior end of corpus bursae ..... ***M. squala***
- Ostial plate heart-shaped and deeply incised; ductus seminalis anterior to middle of corpus bursae ..... **8**
8. Corpus bursae with shallow, angled diverticulum posteriorly on right; Caribbean and southern Florida ..... ***M. tripuncta***
- Corpus bursae evenly tapered posteriorly; Texas and Arizona to Costa Rica ..... ***M. piscimala***

## Descriptions

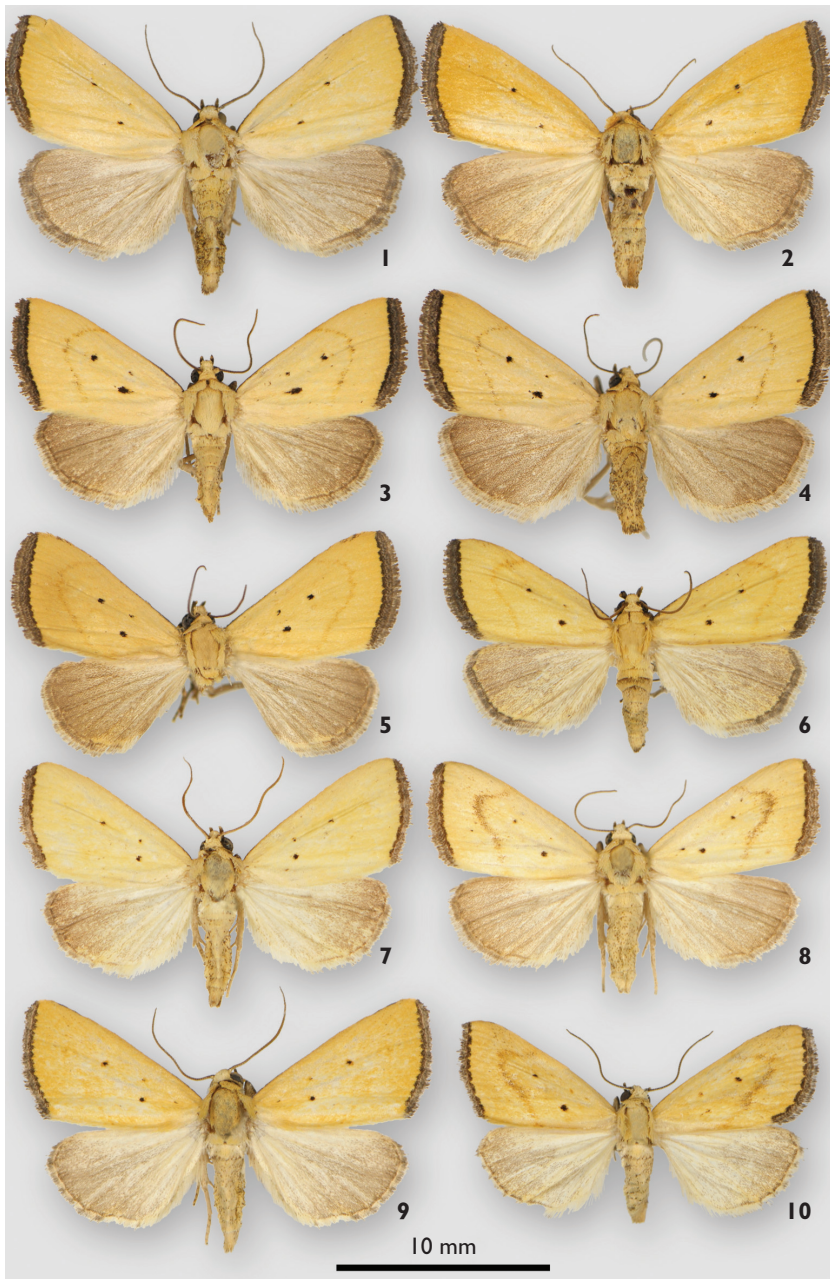
### ***Marimatha nigrofimbria* (Guenée 1852), comb. n.**

Figs 1, 2, 11, 18

*Xanthoptera nigrofimbria* Guenée in Boisduval and Guenée, 1852: 241, pl. 10, Fig. 12.  
*Thioptera nigrofimbria* (Franclemont, 1950).

**Type material.** North America: lost. **Neotype:** Florida. USNM, here designated. There are two superficially similar species in eastern North America, so to ensure the stability of the name we designated a male labeled “USA, Florida, Marion Co., W Anthony





**Figures 1–10.** *Marimatha* adults. **1** *M. nigrofimbria* ♂, 1.4 mi WSW Anthony, Marion Co., Florida **2** *M. nigrofimbria* ♀, Big Cypress Natute Preserve, Collier Co., Florida **3** *M. squala* ♂, Madera Canyon 4880', Santa Rita Mts., Santa Cruz Co., Arizona **4** *M. squala* ♀, Madera Canyon 4880', Santa Rita Mts., Santa Cruz Co., Arizona **5** *M. quadrata* ♂, Madera Canyon 3800', Santa Rita Mts., Pima Co., Arizona **6** *M. quadrata* ♀, Concan, Uvalde Co., Texas **7** *M. tripuncta* ♂, Fuchs Hammock near Homestead, Dade Co., Florida **8** *M. tripuncta* ♀, Fuchs Hammock near Homestead, Dade Co., Florida **9** *M. piscimala* ♂, Brown Canyon, Baboquivari Mts., Pima Co., Arizona **10** *M. piscimala* ♀, Mission, Hidalgo Co., Texas.



Rd, 1.4 mi W Anthony, 29°17'N, 82°08'W, 4 May 2000, T. S. Dickel" as neotype for *Xanthoptera nigrofimbria* Guenée, 1852.

**Other material examined and distribution.** Approximately 2,400 specimens examined from the following states: Alabama, Arkansas, District of Columbia, Florida, Georgia, Illinois, Indiana, Kentucky, Louisiana, Massachusetts, Mississippi, Missouri, New Jersey, North Carolina, Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas, Virginia.

**Diagnosis.** Head with rounded frons. Male genitalia: valva with sharp apical point, irregular dorsal margin with large, tapered process at about 1/3 from apex; aedeagus with three clusters of cornuti, one toward base, one near apex, and a tight bundle of cornuti at apex. Female genitalia: ostial plate of female genitalia lyre-shaped with even slightly concave margin.

**Description. Adult:** *Head* – Front rounded without protuberance. *Thorax* – Yellow with brown flecks. *Legs*: Foreleg and middle leg, brown flecked with paler scales; hindleg yellow-tan flecked with brown scales. *Wings*: DFW lemon yellow with dark discal dot and usually a second dark spot in fold at 1/4 from wing base; occasionally a third spot below costa at 1/4 from base; some pale orange shading may be present toward outer margin and on costa; terminal line and fringe blackish brown; DHW yellowish white with fuscous scaling toward wing margin and on terminal line; VFW yellowish buff, heavily infuscated with dark scales, except on well-defined pale band on inner margin; VHW pale buff, heavily flecked with brown scales, especially along anterior margin of wing. Female similar to male, but wings usually darker, especially hindwing. *Male genitalia* – *Uncus*: decurved, slender, expanded toward apex with acute tip. *Valvae*: symmetrical, basally broad, tapering to mid-length (at apex of sacculus), then narrowing to a pointed apex, without corona; dorsal margin irregular with triangular process at approximately 1/3 from apex; sacculus with blunt apex and uneven dorsal margin. *Aedeagus*: smoothly sclerotized; everted vesica tubular with a short stout spine at base, then patch of 5 robust spines near base, a distal patch of 6 large robust spines adjacent to a smaller patch of approximately 6 smaller spines of varying length. *Female genitalia* – Corpus bursae oval, tapered posteriorly with ductus seminalis at posterior end and ductus bursae entering corpus bursae on right near posterior end. Ductus bursae sinuate, with sclerotized longitudinal ridges, posterior 1/3 narrower than anterior 2/3 and gradually widening toward corpus bursae. Ostium bursae heavily sclerotized, lyre shaped, with sides constricted toward posterior end and with short ostial plate with slightly concave posterior margin.

**Distribution and biology.** Massachusetts westward through northern Ohio to Illinois and Oklahoma and southward to southern Florida and southernmost Texas. Flight season is from May to September in the northern part of the range and from March to November in the South. Reported larval hosts are *Digitaria ischaemum* (Schreb.) Shreb. ex Muhl. (Poaceae), and *Ipomoea sagittata* Poir. (Convolvulaceae).

**Remarks.** *Marimatha nigrofimbria* is replaced by a closely related undescribed species that occurs from southern Mexico (Chiapas) southward to Colombia. It will be treated in a revision of the genus *Marimatha* in Central America in preparation by J. B. Sullivan.

***Marimatha squala* Ferris & Lafontaine, sp. n.**

urn:lsid:zoobank.org:act:9D012295-1CCF-4AE8-8943-283CFC9DC278

Figs 3, 4, 12, 19

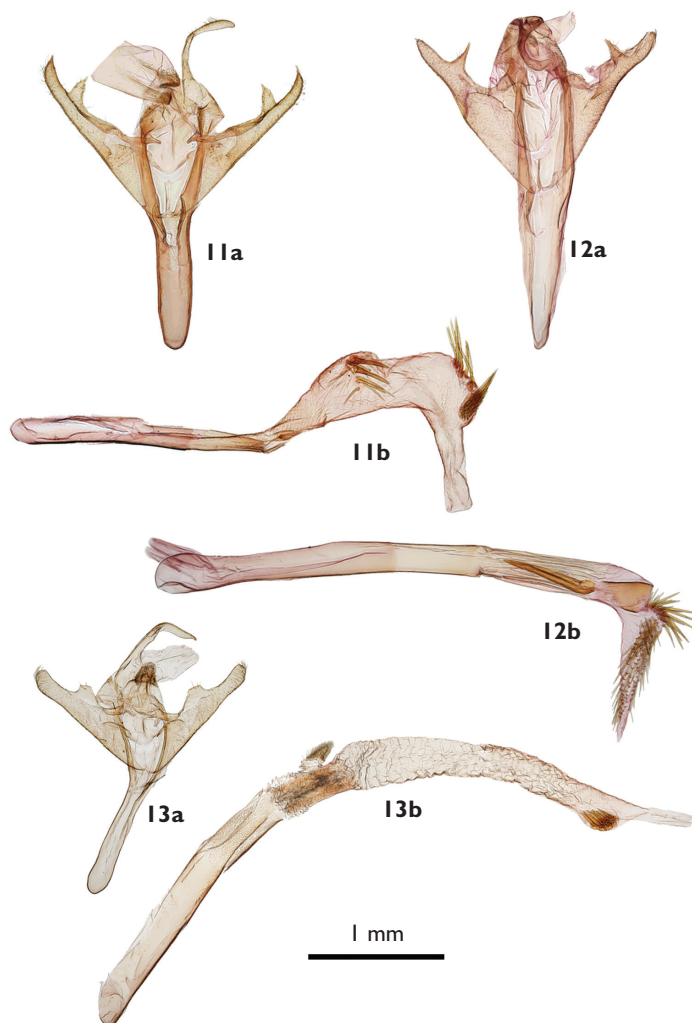
**Type material.** **Holotype** ♂: **Arizona**, Cochise Co., Peloncillo Mts., Guadalupe Cyn., 30 July 1989, B. & J.F. Landry; Genitalia CNC slide # 14892 m. CNC. **Paratypes** 29 ♂, 23 ♀: **Arizona**. Santa Cruz Co., Madera Canyon 4880', 10 July – 28 Aug. 1959 (16 ♂, 11 ♀), 24 June – 20 July 1960 (4 ♂, 1 ♀), J. G. Franclemont; Santa Cruz Co., Peña Blanca 3950', 14 July 1960 (7 ♂), 2–5 Aug. 1960 (1 ♂, 2 ♀), J. G. Franclemont; Santa Cruz Co., Atascosa Mts., Peña Blanca Canyon 3900', 31°38'N, 111°09'W, 3 Aug. 2008, C. Schmidt & B. Walsh (3 ♀); Santa Cruz Co., Oro Blanca Mts., Peña Blanca Lake 3700', 10 mi WNW Nogales, 25 July 1971, L. M. Martin (1 ♂, 1 ♀). **Mexico**. Guerrero, 33 mi S Iguala, 1450', 5 Aug. 1954, J. G. Chillcott (5 ♀). Paratypes deposited in CDF, CNC, CUIC, JBW, and USNM.

**Other material examined and distribution.** **USA. Arizona.** Cochise Co. Carr Canyon, Huachuca Mts, 31°26.38'N 110°15.87'W, 5600', 6 August 2009, C. D. Ferris; Cochise Co., Brushy Canyon, Chiricahua Mts, 31°44.19'N 109°14.16'W, 5470', 31 July 2009, C. D. Ferris; Cochise Co., Banning Creek, Mule Mts, 31°27.78'N 109°52.22'W, 5700', 2 August 2009, C. D. Ferris. Santa Cruz Co., Peña Blanca, 5 July 2009, Nate Gibson; Santa Cruz Co., Patagonia (in town), 31°32.62' N 110°45.31' W, 4050', 7–8 August 2009, C. D. Ferris. **Costa Rica. Guanacaste**, Area de Conservacion Guanacaste, Sector Santa Elena, La Angostura, 25 May 2006, F. Quesada & R. Franco.

**Etymology.** The species name is derived from the shark genus *Squalus* in reference to the sharkfin-like process on the dorsal margin of the male valva.

**Diagnosis.** Head with frontal protuberance. Male genitalia: dorsal margin of valva smooth with sharply pointed triangular process at about 1/4 from apex; vesica with single large subbasal cornutus and a spine-covered diverticulum near apex. Female genitalia: ostial plate protruding, wedge shaped with convex sides, posterior margin cleft in middle 1/3 to base.

**Description. Adult:** *Head* – Frontal protuberance crater-like, nearly circular, flattened above haustellum. *Thorax* – Yellow with brown flecks. *Legs*: yellow, flecked with brown scales, more heavily on forelegs and middle legs, and in females. *Wings* (both sexes): DFW lemon yellow with dark discal spot and additional dark spot in fold at 1/4 from wing base; usually a smaller third spot below costa at 1/4 from base; a thin orange-brown postmedial line evenly curving around discal spot in most specimens. DHW fuscous. VFW yellowish buff, heavily infused with brown scales with well-defined pale band along inner margin. VHW yellowish, moderately flecked with brown scales, indistinct brown marginal line; in some specimens a suggestion of a brown discal spot and postmedian line. *Male genitalia* – *Uncus*: decurved, slender, expanded slightly apically with blunt rounded tip. *Valvae*: symmetrical, basally broad tapering to approximately middle (at apex of sacculus), then narrowing to a rounded apex, without corona; dorsal margin with prominent, sharply-pointed, triangular process at about 1/4 from apex; sacculus broad with slightly pointed rounded apex and with



**Figures 11–13.** *Marimatha* male genitalia. 11 *M. nigrofimbria* 12 *M. squala* 13 *M. quadrata*.

small spines sparsely distributed along dorsal margin. *Aedeagus*: smoothly sclerotized; vesica with single large dorsal cornutus projecting anteriorly, a flat sclerotized plate by opening into ductus ejaculatorius, and with long, tapered, spine-covered diverticulum to left of ductus ejaculatorius. *Female genitalia* – Corpus bursae ovoid without surface features, tapered posteriorly; ductus seminalis arising on left near junction with ductus bursae. Anterior 1/2 of ductus bursae lightly sclerotized, narrow at opening to corpus bursae, then expanded to sclerotized posterior part; a thumb-like diverticulum on ductus bursae on right just posterior to constriction at corpus bursae; posterior 1/2 of ductus bursae well sclerotized with a pleated-like (corrugated) section. Ostial plate an elongate wedge with concave sides, convex posterior margin cleft in middle 1/3 to base.

**Distribution and biology.** Arizona and southward to Costa Rica. Flight season is from mid-July to mid-August in Arizona and from late May in Costa Rica.

***Marimatha quadrata* Ferris & Lafontaine, sp. n.**

urn:lsid:zoobank.org:act:E2CD3094-DB83-4006-8B25-0C13E570B94F

Figs 5, 6, 13, 20

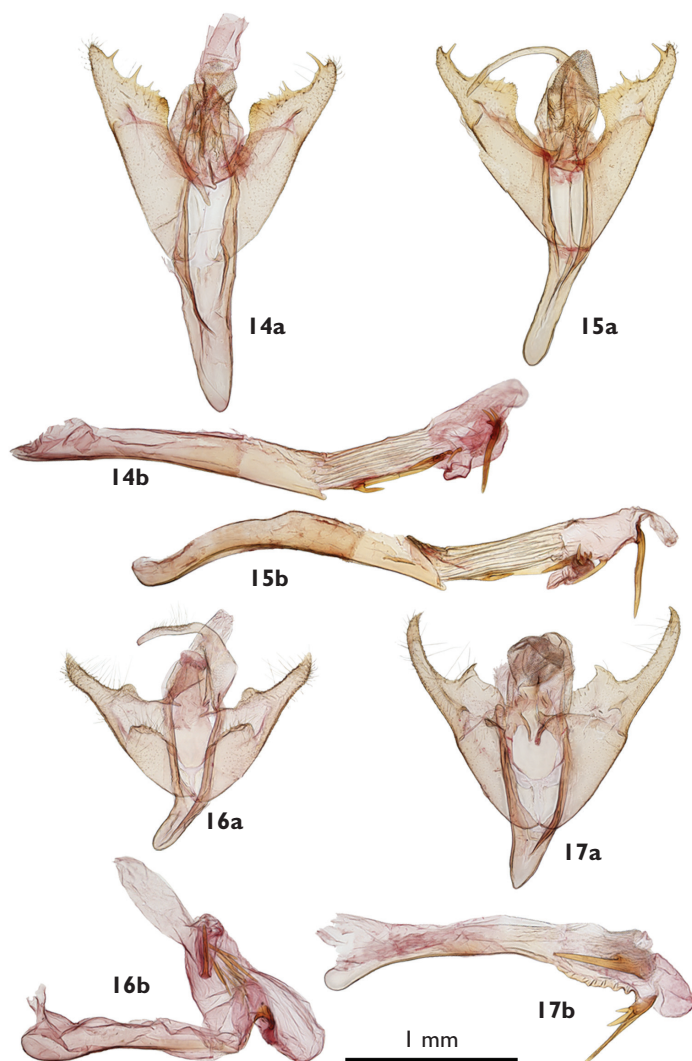
**Type material** **Holotype** ♂. Texas, Reeves Co., Texas, 18 May 1950, E. C. Johnson; Genitalia CNC slide # 14263 m. CNC. Paratypes 5 ♂, 4 ♀: **Arizona:** Santa Cruz Co., Madera Canyon 4880', 9 – 28 Aug. 1959, J. G. Franclemont (1 ♂, 2 ♀); Santa Cruz Co., Atascosa Mts., Peña Blanca Canyon 3900', 31°38'N, 111°09'W, 3 Aug. 2008, C. Schmidt & B. Walsh (1 ♀). **Texas:** Brewster Co., Big Bend Nat. Pk., Chisos Basin, 8–10 Sept. 2008, Bordelon/Knudson (2 ♂); Terrell Co., Sanderson, 5, 14 Sept. 2008, Bordelon/Knudson (1 ♂); Uvalde Co., Concan, 3, 16 Sept. 2008, Bordelon/Knudson (1 ♂). **Mexico:** Sinaloa, 5 mi N Mazatlan, 30 July 1964 (1 ♂), 5–7 Aug. 1964, J. E. H. Martin (1 ♀). Paratypes deposited in CNC, CUIC, and TLSC.

**Other material examined and distribution. USA. Arizona.** Pima Co., Rincon Mts, 32°02.24'N 110°39.90'W, 3370', 13 August 2009, C. D. Ferris; Santa Cruz Co., Patagonia (in town), 31°32.62'N 110°45.31'W, 4050', 7 August 2009, C. D. Ferris.

**Etymology.** The species name is derived from *quadratus* (four-cornered) in reference to the quadrangular process on the dorsal margin of the male valva.

**Diagnosis.** Head with nearly circular crater-like frontal protuberance. Male genitalia: dorsal margin of valva with large squared-off projection near mid-length. Female genitalia: with slightly protruding ostial plate with concave posterior margin; posterior sclerotized part of ductus bursae curved in a 360° loop.

**Description. Adult:** *Head* – Frontal protuberance crater-like, nearly circular, with well defined rim and deep central depression. *Thorax* – Yellow with brown flecks. *Legs:* Forelegs and middle legs brown flecked with paler scales; hindlegs yellow flecked with brown scales. *Wings* (both sexes): DFW lemon yellow with dark discal spot and additional dark spot in fold at 1/4 from wing base; usually a smaller third spot below costa at 1/4 from base; a thin orange-brown postmedial line evenly curving around discal spot in most specimens. DHW pale yellow. VFW yellow, moderately infused with brown scales with pale band along inner margin. VHW yellow, moderately flecked with brown scales, indistinct brown marginal line; in some specimens a suggestion of a brown discal spot and postmedial line. *Male genitalia* – *Uncus:* decurved, slender, spatulate tip. *Valvae:* symmetrical, basally broad, tapering to approximately middle (at apex of sacculus), then narrowing to rounded apex, without corona; ventral margin even, dorsal margin with large squared-off process near middle; sacculus broad with rounded apex. *Aedeagus:* everted vesica an extremely long tube (length of aedeagus and everted vesica about 5 mm) with a small spinulose conical sac at base and 6 robust spines on small diverticulum at distal end. *Female genitalia* – Corpus bursae heart-shaped, tapered to blunt point



**Figures 14–17.** *Marimatha* male genitalia. **14** *M. tripuncta* **15** *M. piscimala* **16** *M. aurifera* **17** *M. botyoides*.

at anterior end; ductus seminalis arising on left near junction with ductus bursae. Ductus bursae arising from posterior end of right lobe of corpus bursae; long and evenly curved through anterior 1/2, with longitudinal sclerotized ridges; posterior 1/2 of ductus narrowed and forming a 360° loop. Ostium bursae a semicircular lightly sclerotized sac with slightly protruding ostial plate with concave posterior margin.

**Distribution and biology.** Western Texas and Arizona and southward to southern Mexico (Sinaloa). Flight season is from mid-May to mid-September.

***Marimatha tripuncta* (Möschler, 1890), comb. n.**

Figs 7, 8, 14, 21

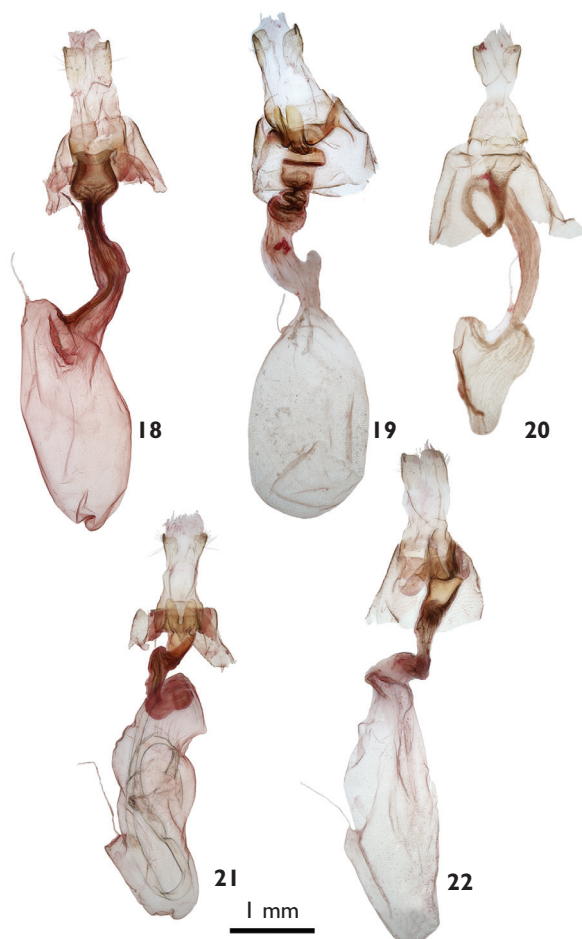
*Xanthoptera tripuncta* Möschler, 1890:158*Thioptera aurifera* of authors, not (Walker, [1858])**Type material.** Three female syntypes. Puerto Rico. MNHU, Berlin, examined.**Other material examined.** Southern Florida; Cuba; Dominican Republic; Haiti; Puerto Rico; St Croix, Virgin Islands; Trinidad.**Diagnosis.** Separated from other species in its North American range by the tuberculate frons, the dark transverse smudge on the DFW, and the deeply curved postmedial line. Some specimens of *piscimala* from Texas are superficially similar. Male genitalia with large apical cornutus with basal process and several smaller cornuti. Female genitalia with angled diverticulum posteriorly on right side of corpus bursae.**Description.** Not distinguishable from *Marimatha piscimala* except by distribution, DNA, and the genital characters given in the diagnosis.**Distribution and Biology.** Caribbean and southern Florida. Flight season late April to mid-October.**Remarks.** This species was tentatively identified in Florida as *Thioptera* [= *Marimatha*] *aurifera* (Walker, 1862) by Kimball (1965) and was listed as *T. aurifera* by Franclemont and Todd (1983) and Heppner (2003). *Marimatha aurifera* is a South American species that lacks a frontal tubercle and has very different genitalia (Fig. 16).***Marimatha piscimala* Ferris & Lafontaine, sp. n.**

urn:lsid:zoobank.org:act:F610BE0F-C8CF-4BA7-9C3D-BB88F91EB1DF

Figs 9, 10, 15, 22

**Type material.** **Holotype** ♂. **Texas.**, Kimble Co., Fred Coleman Ranch, 12 mi S Junction, 16 June 1972, B. Wright; Genitalia CNC slide # 15033 m. CNC. **Paratypes:** 22 ♂, 17 ♀. **USA. Arizona.** Cochise Co., Ash Canyon, Huachuca Mts., 5170', 20 July 2006 (1 ♀), 4 Aug. 2009 (1 ♀), C. D. Ferris; Pima Co., Baboquivari Mts., Brown Canyon, 3880', 18–19 Aug. 2006, C. D. Ferris (6 ♂, 3 ♀); Pima Co., Baboquivari Mts., Brown (Bear) Canyon, 5300–5900', 2 Aug. 2008, C. Schmidt & L. Crabo, mesquite/riparian (1 ♂); Santa Cruz Co., Madera Canyon 4880', 13 July – 28 Aug. 1959, J. G. Franclemont (3 ♂, 3 ♀); Santa Cruz Co., Peña Blanca 3950', 7 Aug. 1959 (1 ♂), 23 Aug. 1960 (1 ♂), J. G. Franclemont; Santa Cruz Co., Patagonia, 4050', 8 Aug. 2009, C. D. Ferris (1 ♂). **Texas.** Cameron Co., Audubon Sabal Palm Grove, 11 Oct. 1996, C. Bordelon (1 ♀), 20 April 1997 E. C. Knudson (1 ♀); Comal-Hayes Counties, El Rancho, 29 Aug. 1975, A. & M. E. Blanchard (1 ♂); Hidalgo Co., Bentsen State Park, 18–19 April 1997, E. C. Knudson (1 ♀); Hidalgo Co., Mission, 12 Oct. 2008, C. W. Bordelon (1 ♂); Jeff Davis Co., Ft Davis, Jeff Mts. State Park, 11–13 Sept. 2008, Knudson/Bordelon (1 ♂, 1 ♀); Kerr Co., Kerrville State Park, 19 Aug.





**Figures 18–22.** *Marimatha* female genitalia. **18** *M. nigrofimbria* **19** *M. squala* **20** *M. quadrata* **21** *M. tripuncta* **22** *M. piscimala*.

1980, E. C. Knudson (1 ♀); Starr Co., Roma, 6,7 Oct. 1996, E. C. Knudson (1 ♀). **Mexico. Chiapas:** 5 mi NW Pijijiapan, Hwy. 200, 31 May 1969, A. Mutuura (5 ♂, 1 ♀); Chiapas, 15 May, R. Muller (1 ♀); **San Luis Potosi**, El Naranjo, El Salto, 29 June 1965, P. Spangler (1 ♀). **Panama.** La Chorrera, 12 May, August Busck (1 ♂). Paratypes deposited in CDF, CNC, CUIC, JBW, TLSC, and USNM.

**Other material examined. USA. Arizona.** Cochise Co., Ash Canyon, Huachuca Mts, 31°23.17'N 110°14.281'W, 5170', 4 August 2009, C. D. Ferris. Santa Cruz Co., Patagonia (in town), 31°32.62'N 110°45.31'W, 4050', 8 August 2009, C. D. Ferris. **Costa Rica.** Guanacaste, Area de Conservacion Guanacaste, Sector Santa Elena, La Angostura, 26 May 2006 (1 ♀), 24 July 2006 (1 ♂), F. Quesada & R. Franco.

**Etymology.** The species name is derived from the Latin for fish (*Piscis*) and jaw (*mala*) and refers to the fish-jaw like appearance of the male valva.

**Diagnosis.** Head with frontal protuberance. Male genitalia: valva broad, ventral margin even; dorsal margin slightly concave to middle, then tapering to apex with multiple narrow dentate projections from dorsal margin; vesica with a long apical cornutus and postmedial cluster of cornuti with mixture of two large and many small cornuti. Female genitalia: ostial plate heart shaped with cleft in middle of posterior margin extending almost to base of plate.

**Description. Adult:** *Head* – Frontal protuberance shallow crater-like prolate ellipsoidal. *Thorax* – Yellow with brown flecks. *Legs*: yellow, flecked with brown scales, more heavily on forelegs and middle legs, and in females. *Wings* (both sexes): DFW golden yellow with dark discal spot and additional dark spot in fold at  $\frac{1}{4}$  from wing base; often with a smaller third spot below costa at  $\frac{1}{4}$  from base; a thin orange-brown postmedial line deeply curving around discal spot in some males and most females; specimens from southeastern Texas, and less commonly those from elsewhere, may have increased dark shading on the postmedial line and sometimes a longitudinal streak along the middle of the wing like that often present in *M. tripuncta*. DHW pale fuscous. VFW yellow, heavily infused with brown scales with well-defined pale band along inner margin. VHW yellow, moderately flecked with brown scales, indistinct brown marginal line; in some specimens a suggestion of a brown discal spot and postmedial line. *Male genitalia* – *Uncus*: decurved, slender, slightly spatulate tip. *Valvae*: symmetrical, broad basally, ventral margin even; dorsal margin slightly concave to middle, then tapering sharply to apex with multiple (7 typically) narrow dentate projections from dorsal edge; apex pointed, corona absent. *Aedeagus*: smoothly sclerotized; vesica with one large apical cornutus and postmedial cluster of smaller cornuti. *Female genitalia* – Corpus bursae elongate without surface features; ductus seminalis on right side about  $\frac{1}{3}$  from anterior end. Anterior part of ductus bursae broad and lightly sclerotized, ductus constricted and elbowed at  $\frac{1}{3}$  from anterior end with posterior  $\frac{2}{3}$  narrower and increasingly heavily sclerotized. Ostial plate heart shaped with cleft in middle of posterior margin extending almost to base of plate; when apex of plate brushed in undissected specimens protruding sides of plate project posterolaterally.

**Distribution and biology.** Southeastern Texas to Arizona southward to Panama. Flight season mid-April to mid-October, probably several generations.

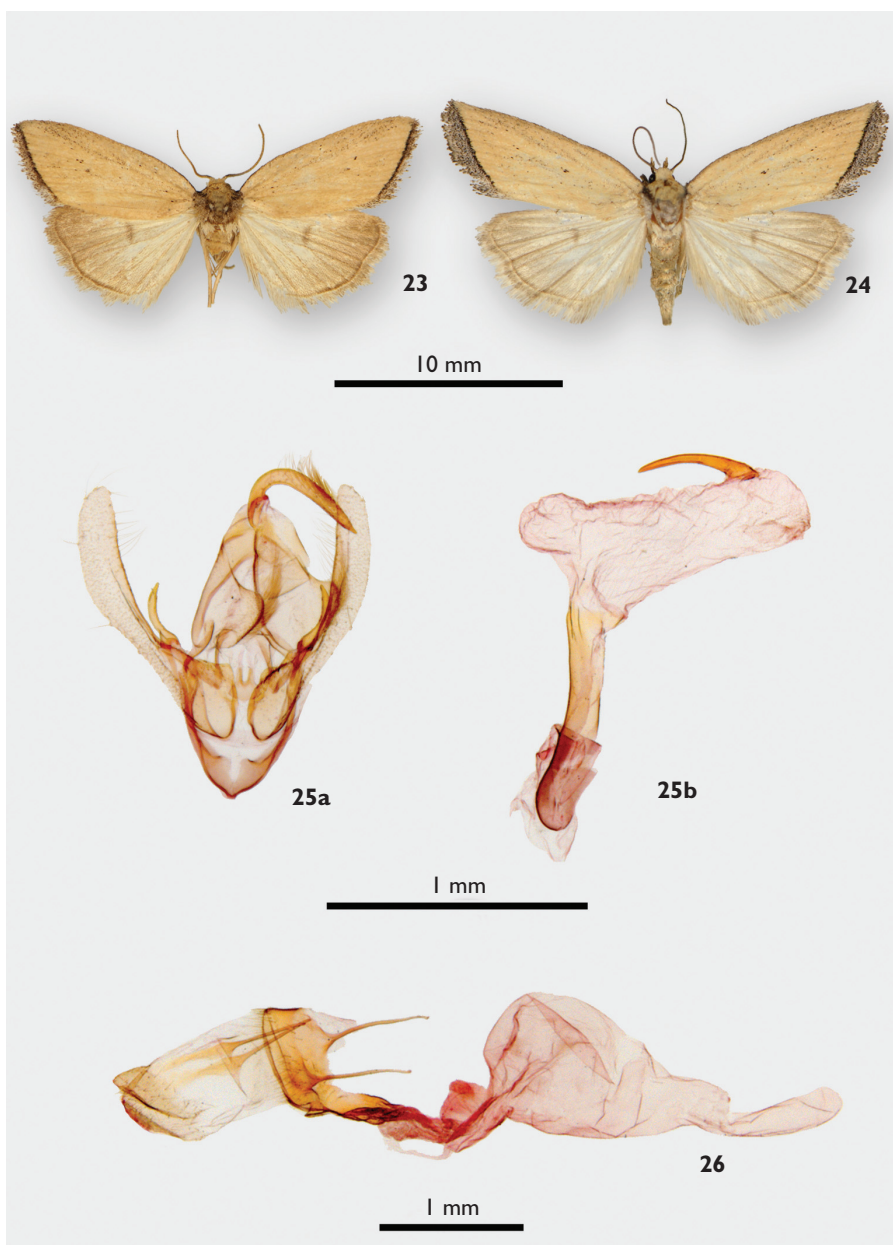
***Pseudomarimatha* Ferris & Lafontaine, gen. n.**

urn:lsid:zoobank.org:act:E5E1E7DD-E742-4003-9B0E-91167C8277C3

**Type species.** *Pseudomarimatha flava* Ferris & Lafontaine, sp. n.

**Etymology.** The generic name *Pseudomarimatha* is taken from the Latin *Pseudo* (false) and *Marimatha* (the noctuid genus with which *Pseudomarimatha* has been confused and is likely to continue to be confused).

**Diagnosis.** Head with rounded slightly bulging frons; hindwing with vein  $M_2$  reduced to fold near middle of cell, veins  $M_2$  and  $CuA_1$  on common stalk; tympanic membrane with central sclerite raised and nodular. Male genitalia: tegumen broad, en-



**Figures 23–26.** *Pseudomarimatha flava* adults and genitalia. **23** ♂, Portal, Cochise Co, Arizona **24** ♀, Onion Saddle, Chiricahua Mts, Cochise Co., Arizona **25** male genitalia **26** female genitalia.

larged into posterior lobe ventrally; valva with triangular saccus with apex separated from remainder of saccus by membranous band; valva narrow at apex of saccus, gradually widening to broadly rounded apex, without corona; clasper on costal margin of valva, about  $1/4 \times$  valva length; vesica slightly longer than aedeagus with subbasal

diverticulum and large apical cornutus  $3/4 \times$  as long as aedeagus. Female genitalia: corpus bursae globular posterior, abruptly tapered anteriorly; posterior  $1/3$  of ductus bursae heavily sclerotized; apophyses long and narrow with triangular plate in posterior apophysis near middle; anal papillae sclerotized.

*Pseudomarimatha* appears to be most closely related to *Elaphria* Hübner, but differs in that the costa of the male valva is continuously sclerotized almost to the apex of the valva; the clasper is a simple tapered sinuate structure arising from a swollen base; the isolated apical part of the sacculus is lightly sclerotized, like the rest of the sacculus. In *Elaphria* there is a gap in the sclerotization of the costal margin of the valva near the end of the clasper, so in dissection the valva tends to fold back on itself at this point; the base of the clasper is forked with a ventrally directed process; and the isolated apical part of the sacculus is much more heavily sclerotized than the basal part.

**Description. Adult:** *Head* – Frons rounded, slightly bulging; labial palpus curving upward with third segment slightly porrect, middle segment  $3 \times$  as long as basal and apical segments; male antenna filiform, densely setose ventrally, female similar but sparsely setose ventrally; eye rounded; ocellus present; vestiture of head and palpi of broad flat scales with slightly raised tuft of scales projecting forward between bases of antennae. **Thorax** – Patagia clothed with broad, yellow scales; tegulae and posterior part of thorax covered with blackish-gray scales with white on sides and tip and amount of dark shading more extensive on anterior and middle part of thorax than farther posteriorly. *Legs*: spiniform setae confined to tarsi and setae minute; foretibia slightly shorter ( $0.8 \times$ ) than femur and tarsus. *Wings*: forewing venation typically quadrifine with cubital vein appearing four branched; forewing with obtusely angled tornus and acutely angled apex giving wing an elongated appearance; hindwing with typical trifine venation (i.e.,  $M_2$  reduced to fold near middle of cell), but veins  $M_2$  and  $CuA_1$  on common stalk (extending  $0.10\text{--}0.25 \times$  length of  $M_3$ ). *Abdomen* – basal abdominal brushes and pockets absent. *Male genitalia* – *Uncus*: decurved, cylindrical, abruptly tapered to spine-like apex, with brush of long stout setae dorsally toward apex. *Tegumen*: broad, enlarged into posterior lobe ventrally, about  $2 \times$  as wide ventrally as mesially with tuft of long setae on ventral lobe; vinculum with short centrally angled sacculus ventrally. *Juxta*: small, heavily sclerotized diamond-shaped plate with deep central notch posteriorly. *Valvae*: symmetrical, basally broad, narrowed mesially, broadening to broadly rounded apex, without corona; sacculus triangular, widest at base; apex of sacculus separated by narrow membranous band (typical of Elaphrini); clasper near dorsal margin of valva, arising from wider base immediately distal to sacculus, then narrow, curving and finger-like, about  $1/4 \times$  valva length; valva distal to sacculus lightly sclerotized except for band along costal margin. *Aedeagus*: smoothly sclerotized; everted vesica tubular, slightly longer than vesica with large subbasal diverticulum and large apical cornutus about  $3/4 \times$  as long as aedeagus. *Female genitalia* – corpus bursae gourd shaped, rounded posteriorly, abruptly tapered anteriorly into appendix-like tube; ductus bursae rugose with bands of sclerite, irregularly twisted to straight, heavily sclerotized posterior  $1/3$  of ductus bursae; apophyses long and narrow with triangular plate near middle of posterior apophysis; anal papillae broad, laterally flattened, setae sparse.

**Distribution and biology.** Known only from southwestern New Mexico and southeastern Arizona.

**Remarks.** This species would not normally be associated with the Noctuinae Elaphrini, except by the genitalia and DNA. It is confused with *Marimatha* species in all collections where we have found material. It can readily be distinguished from *Marimatha* by the narrow, acutely pointed forewing, the lack of a dark discal spot, the raised nodular sclerite of the metathoracic ear, and the characteristics of the genitalia given above.

***Pseudomarimatha flava* Ferris & Lafontaine, sp. n.**

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Figs 23–26

**Type material. Holotype** ♂. **New Mexico.** Grant Co., Spring Canyon, Mimbres Mts, 32°54.16'N 107°49.15'W, 7000' (2135 m), 22–24 June, 2009. C. D. Ferris. CNC. **Paratypes:** 33 ♂, 48 ♀. **USA. Arizona.** Cochise Co., Chiricahua Mts., Onion Saddle, 7700', 2 July 2005, B. Walsh, Ponderosa Pine/Oak habitat (1 ♀); Cochise Co., Chiricahua Mts., Cave Creek Canyon, 5400', 13–24 June 1966, J. G. Franclemont (1 ♂, 4 ♀); Cochise Co., Chiricahua Mts., East Turkey Creek, 25 June – 8 July 1966, J. G. Franclemont (6 ♀); Cochise Co., Chiricahua Mts., Onion Saddle, 7600', 7 July 1966 (1 ♀), 28 June 1967 (1 ♀), 29 July 1967 (1 ♀), J. G. Franclemont; Cochise Co., Chiricahua Mts., Pinery Canyon, 31°56.90'N 109°18.43'W, 5980' (1824 m), 31 July, 2007, C. D. Ferris (1 ♀); Cochise Co., Portal, 10 Aug. 1976, H. F. Howden. Genitalia CNC slide # 15035 m (1 ♂); Cochise Co., Southwest Research Station, 5400', 5 mi W Portal, C & M. Cazier (1 ♀); Santa Cruz Co., Harshaw Rd, Patagonia Mts, 31°28.201 N 110°42.45'W, 4820' (1537 m), 29 June, 2005, C. D. Ferris (4 ♂, 1 ♀); Santa Cruz Co., Harshaw Rd., Patagonia Mts., 31°27.701N 110°47.21'W, 5040' (1470 m), 29 June, 2005, C. D. Ferris (2 ♂); Santa Cruz Co., Madera Canyon, 5800', Santa Rita Mts., 1–13 July 1960, J. G. Franclemont (6 ♀). **New Mexico.** Grant Co., Spring Canyon, Mimbres Mts., 32°54.16'N 107°49.15'W, 7000' (2135 m), 22–24 June, 2009 (23 ♂, 22 ♀), 24 June 2008 (1 ♂, 3 ♀), C. D. Ferris; Grant Co., Cherry Creek Canyon, Pinos Altos Mts., 32°54.74'N 108°13.61'W, 6800' (2074 m), 25 June, 2008 (1 ♂). Paratypes deposited in CDF, CNC, CUIC, JBW, and USNM.

**Etymology.** The species name refers to the yellow color of the forewings and body.

**Diagnosis.** Recognized by elongate, acutely-angled, yellow forewing with no trace of maculation except for gray and blackish-gray shading on forewing margin and fringe. Male genitalia: recognized as member of Elaphrini by membranous suture dividing sacculus; other characteristics: tegumen broad, enlarged into posterior lobe ventrally; clasper near costal margin of valva; vesica with large apical cornutus  $3/4 \times$  as long as aedeagus. Female genitalia: corpus bursae gourd shaped, narrowing into anterior extension; anal papillae broad, flat, heavily sclerotized, sparsely setose.

**Description.** Genus monotypic, so structural characters given in generic description.

**Distribution and biology.** Known only from southeastern Arizona and southwestern New Mexico. Flight season late June to mid-August.

## Acknowledgments

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# Review of the New World genera of the subfamily Acontiinae (Lepidoptera, Noctuidae)

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## Abstract

The taxonomic status of the 138 species of Acontiinae are reviewed and assigned to seven genera, *Ponometia* Herrich-Schäffer, *Tarache* Hübner, *Acontia* Ochsenheimer, *Eusceptis* Hübner, *Pseudalypia* H. Edwards, *Spragueia* Grote, and *Trogotorna* Hampson. A key to the genera, diagnoses of the genera, species groups of *Tarache*, illustrations of adults and genitalia of representatives of the seven genera, and a check list of the New World species are included.

## Keywords

Taxonomy, Acontiinae, New World, *Acontia*, *Eusceptis*, *Ponometia*, *Pseudalypia*, *Spragueia*, *Tarache*, *Trogotorna*

## Introduction

The purpose of this paper is to propose a new classification for the New World species of the noctuid subfamily Acontiinae.

The subfamily “Acontiinae” has a checkered history. It has been treated as a receptacle for a large number of unrelated small genera of the Noctuidae. The family as treated in the last check list of the moths of North America (Franclemont and Todd 1983) included the tribes Acontiini, Eustrotiini, Bagisarini, Cydosiini, and Eublemmini. These tribes have been disassociated and given subfamily ranking following

Crumb (1956), Poole (1995), Kitching and Rawlins (1998), Fibiger and Lafontaine (2005), Lafontaine and Fibiger (2006), and Lafontaine and Schmidt (in press).

The subfamily Acontiinae as currently classified by Fibiger and Lafontaine (2005) includes four tribes: Acontiini, Armadini, Aediini, and Hypercalymniini. Of the four, only the tribe Acontiini occurs in the New World and is the same group of genera listed as Acontiini in Franclemont and Todd (1983).

The Old World Acontiini was recently revised by Hacker et al. (2008). In this classification the world fauna of the Acontiini is placed in a single genus (*Acontia* Ochseneimer) and the species arranged in seven subgenera: one restricted to the New World (subg. *Euseptis* Hübner), two Holarctic (*Acontia* and *Emmelia* Hübner) and four Palearctic. One would expect that a tribe with a single genus with more than 300 species would be very conservative structurally, but the situation is the opposite. The “genus” is so structurally diverse that the authors have restricted the diagnosis of the tribe and the genus to the type species, *Acontia lucida* Hufnagel, stating that the other members of the genus share “the same autapomorphic characters as those of the type-species, though sometimes in different states, and some of which might have been lost” (Hacker et al. 2008: 10). A number of the more striking apomorphic characters, such as the hair tufts on the scaphium and the characters of the tympanic area, apply to the subfamily. The larval characters apply to the tribe, and most of the other characters listed (bird-dropping appearance, shape of the valves and vesica, asymmetry of the valves, sacculi, and claspers) are so varied throughout the “genus” that they are of little use in diagnosing any of the “subgenera” except a few small subgenera segregated out because of a particularly unusual character state, in one case the forewing maculation. The derived character states that support the monophyly of the subfamily Acontiinae, and those that characterize the tribe Acontiini, are combined and applied to a single genus by Hacker et al. (2008) as a way of dealing with the huge amount of structural diversity among the several hundred species in the tribe Acontiini. The result is that the genus *Acontia* (s.l.) is very well defined, being equivalent to the tribe and largely to the subfamily. Molecular data and a phylogenetic analysis of genital characters may be useful in arranging the Old World fauna into smaller better defined monophyletic genera.

The classification that we present here is the result of the fusion of two separate research efforts. An online draft of the Acontiinae of North America by the junior author (R.W. Poole) intended as the basis for an online identification manual of the subfamily arranged the 100 or so species into six genera, mainly on the basis of genital structure. The senior author (J.D. Lafontaine), working on the classification mainly with DNA data from a molecular gene sequence of 658 base-pairs of the cytochrome c oxidase 1 (COI) mitochondrial gene, commonly called “barcodes,” arrived at the same six lineages that we treat as genera. The New World fauna of the Acontiinae was arranged in 14 genera by Poole (1989). We arrange the fauna in seven genera with the addition of the Neotropical genus *Trogotorna* Hampson to the six North American genera. A list of New World Acontiinae is given in the Appendix. Our classification based on morphology is similar in most respects to the phenetic clustering-produced neighbor-joining tree analysis of the 658 base-pair sequences of the COI barcodes of

the available 68 species of New World Acontiinae (Fig. 49). Although the COI DNA sequence analysis shows many relationships supported by genital characters, the placement of the genera *Spragueia* and *Trogotorna* are not consistent with their placement according to genital characters

**Genital terminology.** Terms for genital structures and wing markings follow Lafontaine (2004).

### Key to genera of North American Acontiinae (male genitalia)

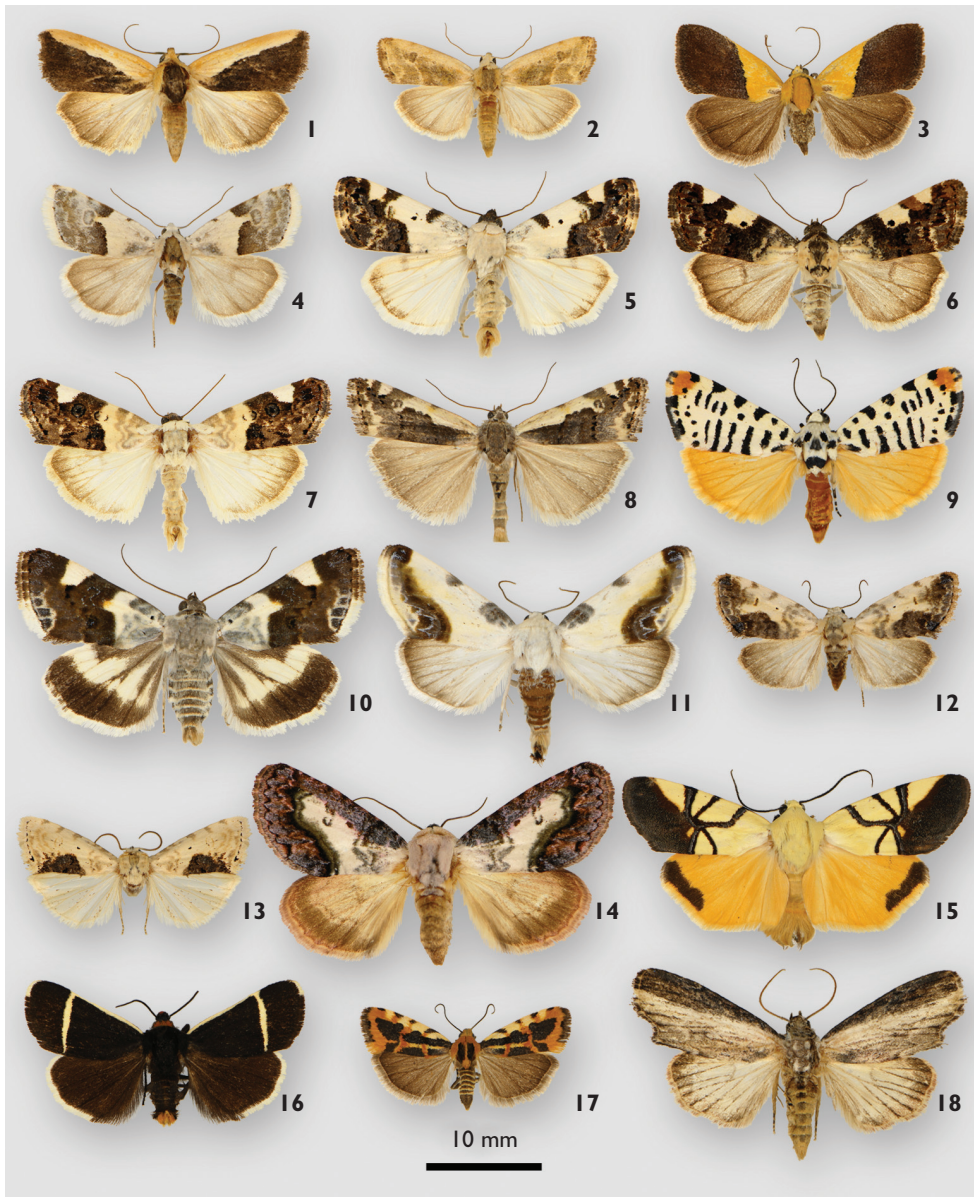
1. Ventral surface of uncus with rows of spine-like setae; southern Texas and Neotropics ..... *Eusceptis*
- Ventral surface of uncus smooth or with a few hair-like setae ..... 2
2. Valves with prominent, rounded or elongated setose ampulla on dorsal margin of clasper ..... 3
- Valves without ampulla; some species with spiny posterior extension of sacculus ..... 5
3. Apical part of the vesica membranous, but with elongated tapered diverticulum covered with spicules forming a false cornutus ..... *Acontia*
- Apical part of vesica with several pouch-like diverticula covered with dense patches of spines ..... 4
4. Valves bilaterally symmetrical except for longer ampulla on right valve ..... *Pseudalypia*
- Valves prominently asymmetrical ..... *Spragueia*
5. Aedeagus short, about 3 × as long as wide; valve tapered apically; Neotropics .. *Trogotorna*
- Aedeagus at least 5 × as long as wide; valve wider toward apex; widespread .... 6
6. Vesica with one or two medial diverticula with longitudinally ridged cornutus at apex of each diverticulum; apical part of vesica with comb-like row of short cornuti; valves bilaterally symmetrical in most species ..... *Ponometia*
- Vesica with dense field of spines toward apex or at end of subapical diverticulum; valves bilaterally asymmetrical in most species ..... *Tarache*

### Synoptic descriptions of the New World genera

#### *Ponometia* Herrich-Schäffer, 1868

Figs 1–4, 19–22, 39

*Ponometia* is a large genus of New World Acontiinae with 47 described species. We list it first because of the bilaterally symmetrical male genitalia, a character likely to be primitive and apparently absent in Old World Acontiinae (Hacker et al. 2008). Unlike *Tarache* and *Acontia*, only a few species have a moth that resembles a bird dropping.



**Figures 1–18.** Acontiinae adults [former generic name in brackets]. **1** *Ponometia* [*Ponometia*] *exigua* **2** *Ponometia* [*Fruva*] *fasciatella* **3** *Ponometia* [*Tarachidia*] *semiflava* **4** *Ponometia* [*Conocharis*] *altera* **5** *Tarache* [*Acontia*] *aprica*, m **6** *Tarache* [*Acontia*] *aprica*, f **7** *Tarache* [*Acontia*] *areli* **8** *Tarache* [*Therapsea*] *augustipennis* **9** *Tarache* [*Hemispragueia*] *idella* **10** *Acontia* [*Acontia*] *lucida* **11** *Acontia* [*Acontia*] *cretata* **12** *Acontia* [*Stylorache*] *albida* **13** *Acontia* [*Chelichares*] *nubifera* **14** *Acontia* [*Hoplotarache*] *ruffinellii* **15** *Eusceptis* [*Eusceptis*] *flavifrimbriata* **16** *Pseudalyptia* [*Pseudalyptia*] *crotchii* **17** *Spragueia* [*Spragueia*] *leo* **18** *Trogotorna* [*Trogotorna*] *persecta*.



The genus is most easily characterized by the relatively small size of the moth (forewing length: 6–16 mm, but most species 8–12 mm), and the male and female genitalia. **Male genitalia** (Figs 19–22). The valves are bilaterally symmetrical with only a few species showing slight differences between the valves (e.g., *P. albitermen*, *P. binocula*, *P. tortricina*). The clasper is a long spine-like process on the ventral margin of the valve that turns upward, often abruptly so, to project onto the inner surface of the valve. The diagnostic feature of *Ponometia* is the vesica; there are one or two long diverticula, each with a longitudinally-ridged apical cornutus, and there is a comb-like row of small cornuti on the apical part of the vesica. **Female genitalia** (Fig. 39). The inner surface of the corpus bursae is covered posteriorly, sometimes entirely, with large patches of long spines 5–10 × as long as wide.

**Food plants.** Food plants are recorded for *Ponometia candefacta* (*Ambrosia* spp.), *Ponometia erastrioides* (*Ambrosia* spp.), *Ponometia acutus* (*Ambrosia* sp.), *Ponometia altera* (*Haplopappus* Cass. and *Ericameria* Nuttall), and *Ponometia libedis* (*Iva ambrosiæ-folia* A. Gray), all in the Asteraceae. In addition *Ponometia bicolorata* has been reared from *Simsia foetida* (Cav.) S. F. Blake in the Asteraceae and *Heliotropium indicum* L. in the Boraginaceae.

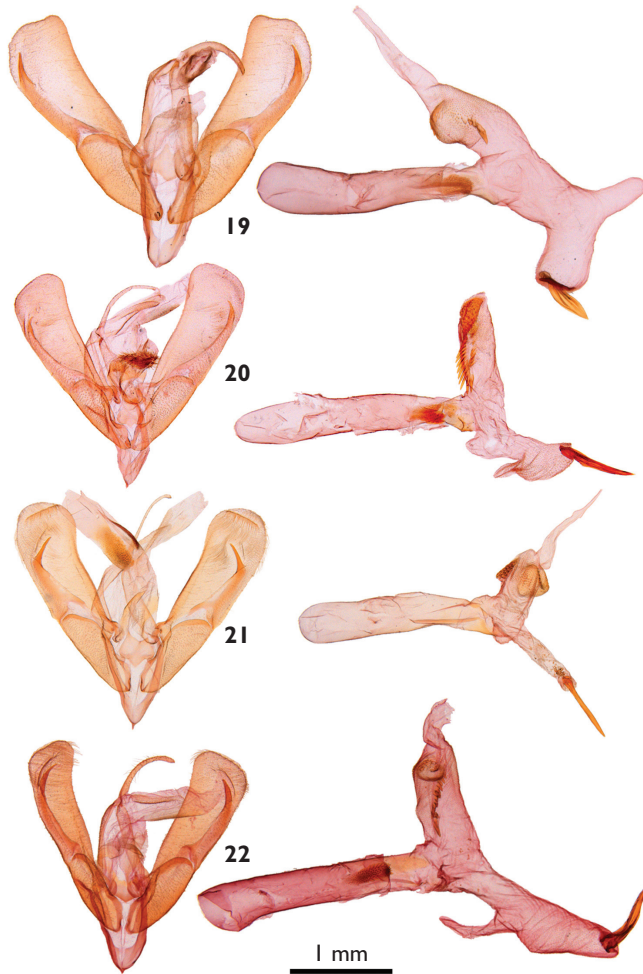
### *Tarache* Hübner, [1823]

Figs 5–9, 23–30, 40–43

The genus *Tarache* contains 46 species, the majority of the species previously assigned to *Acontia* in the New World. The genus is heterogeneous in morphology, but can be arranged in three relatively well-defined and more homogeneous species-groups, and two of these can be divided further into subgroups. It may be desirable at some point in the future to subdivide the genus, but overlap in the presence of diagnostic character states among the species groups has encouraged us to adopt a larger definition of the genus. Included in *Tarache* are species previously placed in *Therapsea* and *Hemispragueia*. **Male genitalia** (Figs 23–30). Valves usually bilaterally asymmetrical, often markedly so; vesica with a dense rasp-like patch or patches of short spines at or near apex of vesica or on a diverticulum. **Female genitalia** (Figs 40–43). Inner surface of corpus with patches of spines 2–4 × as long as wide; appendix bursae sclerotized, most frequently forming a posterior lobe of corpus bursae but wrapping around and partially or completely fused to right side of corpus bursae in *T. aprica* group and in *T. angustipennis* and *T. cora*, so that ductus seminalis arises at or near anterior end of corpus bursae.

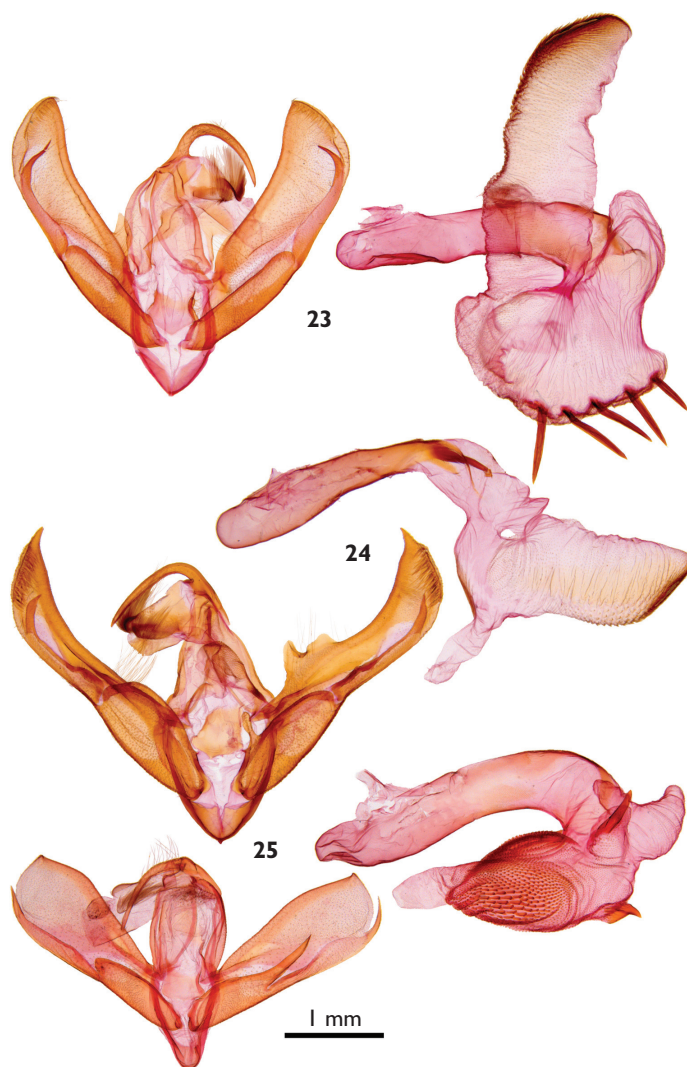
**Food plants.** The food plants are recorded for *T. aprica* (*Althaea rosea* Cav.), *T. delecta* (*Hibiscus moschuetos* L.), *T. tetragona* (*Malvaviscus arboreus* Cav. and *Herssantia crispa* (L.) Brizicky) all in the family Malvaceae.

***Tarache aprica* species-group.** This species-group contains the type species of *Tarache* (*T. aprica*) and 22 other species (*Tarache abdominalis*, *T. apela*, *T. ardoris*, *T. assimilis*, *T. dacia*, *T. cratina*, *T. delecta*, *T. destructa*, *T. flavipennis*, *T. isolata*, *T. knowltoni*, *T. lagunae*, *T. lactipennis*, *T. morides*, *T. parana*, *T. phrygionis*, *T. quadriplaga*, *T.*



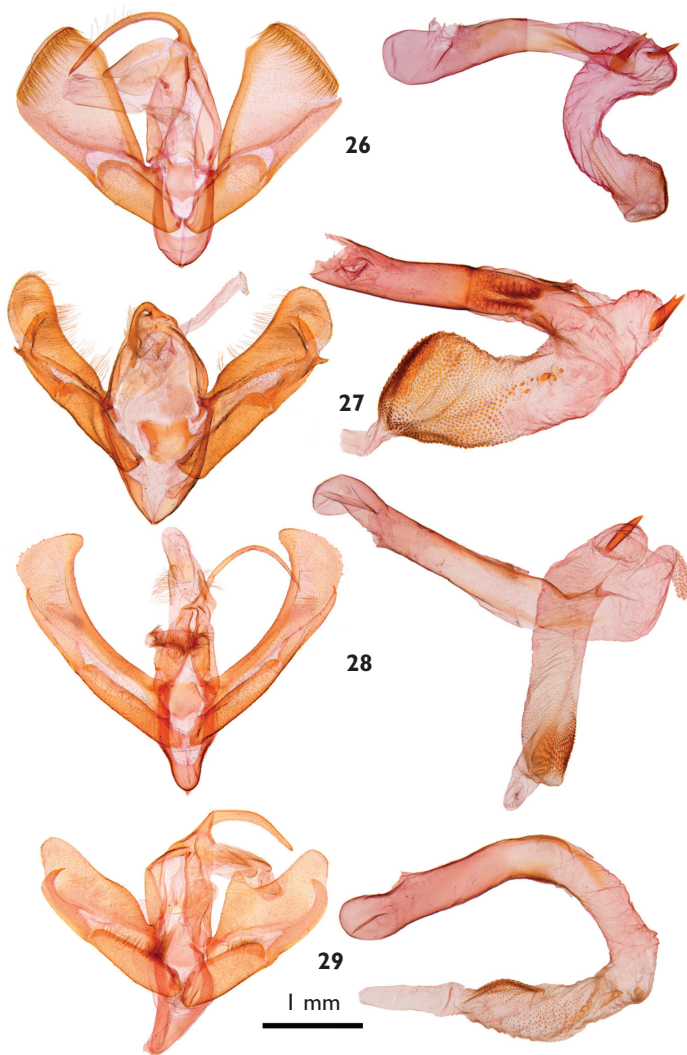
**Figures 19–22.** Male genitalia of *Ponometia* [former generic name in brackets]. **19** *Ponometia* [*Ponometia*] *megocula* **20** *Ponometia* [*Fruva*] *fasciatella* **21** *Ponometia* [*Tarachidia*] *venustula* **22** *Ponometia* [*Conochara*] *altera*.

*rufescens*, *T. sutor*, *T. tenuicola*, *T. terminimaculata* and *T. tetragona*). The vesica of the aedeagus is the most distinctive feature of the *T. aprica* species-group; it tends to be globular with small subbasal diverticula and a massive subapical diverticulum, almost as long as the aedeagus, with its apex covered by a dense patch of spines. Species of the *T. aprica* subgroup have a distinctive subbasal lobe on the vesica armed with a row of 2–8 (depending on the species) large spike-like cornuti (Fig. 23). This row of cornuti is absent in the other three subgroups: *T. terminimaculata* (with *T. dacica*, *T. cratina*, *T. phrygionis*, and *T. isolata*), *T. tetragona* (with *T. quadriplaga*), and *T. ardoris* (with *T. morides*, *T. parana*, and *T. rufescens*). A diagnostic feature of species in the *T. aprica*, *T.*



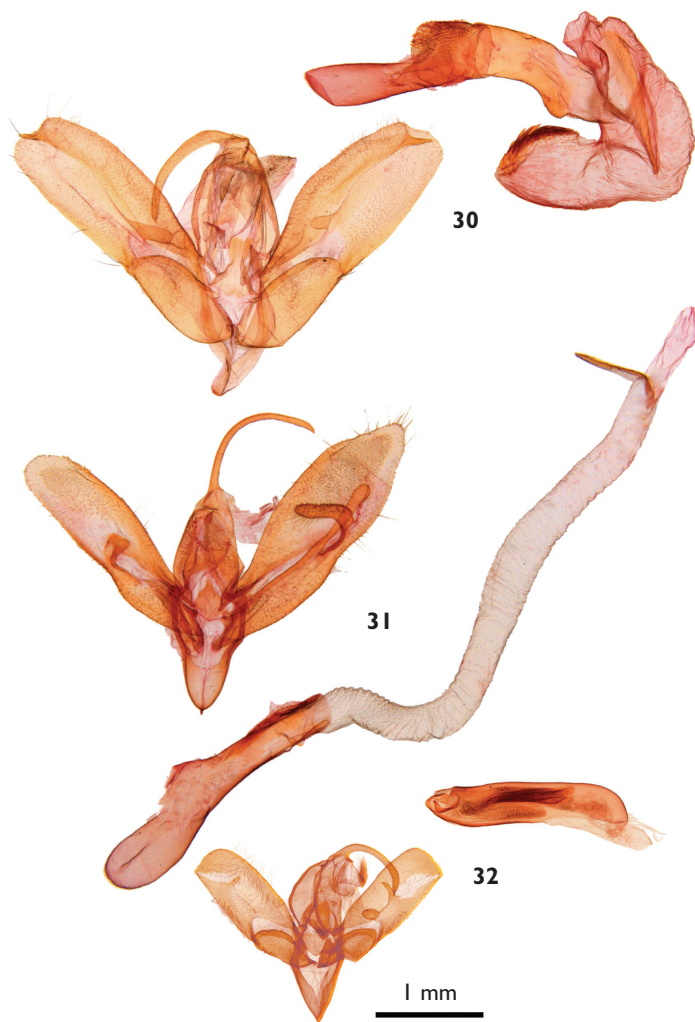
**Figures 23–25.** Male genitalia of *Tarache* [former generic name in brackets]. **23** *Tarache* [*Acontia*] *aprica*  
**24** *Tarache* [*Acontia*] *tetragona* **25** *Tarache* [*Acontia*] *areli*.

*terminimaculata*, and *T. tetragona* subgroups, is the presence of a clavus at the base of the dorsal margin of the sacculus on the right valve, but absent on the left one (Figs 23, 24). The South American *Tarache ardoris* subgroup lacks the clavus on the right valve. In the female, the appendix bursae is very long and is fused to the right wall of the corpus bursae and extends 0.5–0.8 of the distance to the anterior end of the corpus bursae (Fig. 40). A similar form of bursa copulatrix is in *T. augustipennis* (Fig. 41) and *T. cora*, but in the former the fusion is less complete and in the latter there is no distinction between the corpus bursae and appendix bursae, and the ductus seminalis is at the anterior end of the bursa.



**Figures 26–29.** Male genitalia of *Tarache* [former generic name in brackets]. **26** *Tarache* [*Acontia*] *ex-polita* **27** *Tarache* [*Hemispragueia*] *idella* **28** *Tarache* [*Therasea*] *augustipennis* **29** *Tarache* [*Acontia*] *lucasi*.

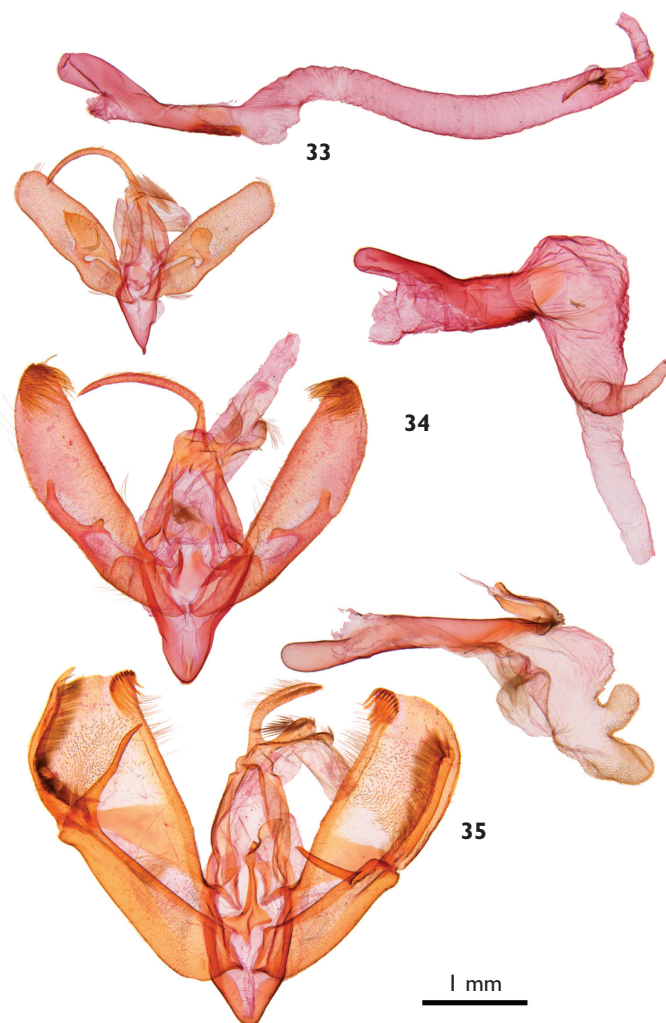
***Tarache bilimeki* species-group.** This species-group contains 21 species found in North and Central America. Like the species of the *T. aprica* species-group, the moths and male valve structure varies greatly, and the moth of the majority of the species resembles a bird-dropping when at rest. The species associated with the *T. bilimeki* species-group are best characterized by the form of the vesica (Figs 25–28). The apical part of the vesica has two, sometimes partially merged, fields of dense spines that form a rasp-like area; there are several sub-basal diverticula, some of which have peculiar cornuti that arise obliquely, sometimes to the degree that they appear to be on their side. In the female genitalia (Fig. 41) the posterior part of the ductus bursae forms a



**Figures 30–32.** Male genitalia of *Acontia* [former generic name in brackets]. **30** *Acontia* [*Acontia*] *lucida*  
**31** *Acontia* [*Acontia*] *crenata* **32** *Acontia* [*Stylorache*] *albida*.

sclerotized, pouch-like ostium bursae, and the appendix bursae is sclerotized, mostly posteriorly, but sometimes partially or completely fused with the right side of the corpus bursae, as in the *T. aprica* species-group. Species in the *T. bilimeki* species-group can be arranged in four subgroups. **1) *Tarache areli* subgroup** (with *T. albifusa*, *T. areletta*, *T. areloides*, *T. geminocula*, and *T. toddi*) characterized by a forewing divided into a mainly pale basal half and a mainly dark outer half, except for a contrasting white preapical patch and a contrasting reniform spot, usually with some blue scaling (Fig. 7). The group was recently revised by Ferris and Lafontaine (2009). **2) *Tarache expolita* subgroup** (with *T. arida*, *T. bella*, *T. cora*, *T. phaenna*) with dark and light shading forming



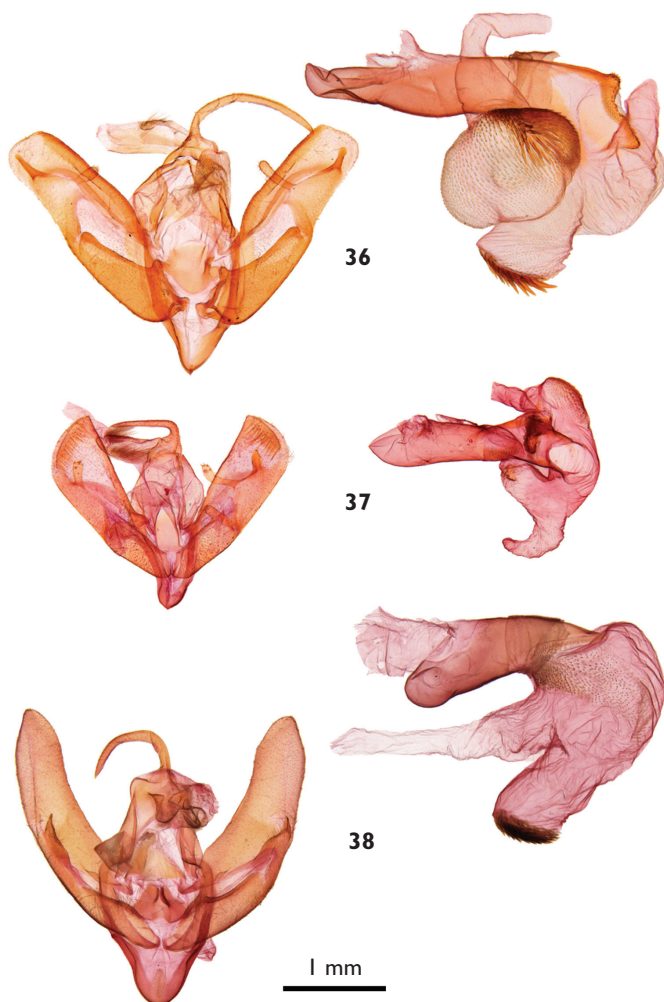


**Figures 33–35.** Male genitalia of *Acontia* [former generic name in brackets]. **33** *Acontia* [*Chelichares*] *nubifera* **34** *Acontia* [*Hoplotarache*] *ruffinellii* **35** *Eusceptis* [*Eusceptis*] *flavifrimbriata*.

a patchwork pattern (*T. arida*, *T. bella*), or a dark streak through the middle and lower part of the wing that curves up to the forewing apex (*T. cora*, *T. expolita*) or almost entirely dark (*T. phaenna*). **3) *Tarache bilimeki* subgroup** (with *T. acerba*, *T. augustipennis*, *T. axendra*, *T. lanceolata*, *T. major*, *T. mizteca*, and *T. sedata*) characterized by elongated forewings with the costal half mainly pale and the posterior half mainly dark (Fig. 8). **4) *Tarache idella* subgroup** that includes a single species with a white forewing with narrow black transverse bands and a clear yellow-orange hindwing (Fig. 9).

***Tarache lucasi* species-group.** This species group includes only two species (*T. lucasi* and *T. vittamargo*). The males resemble some species in the *T. bilimeki* subgroup and females are like some in the *T. aprica* subgroup. The male genitalia (Fig. 29), how-





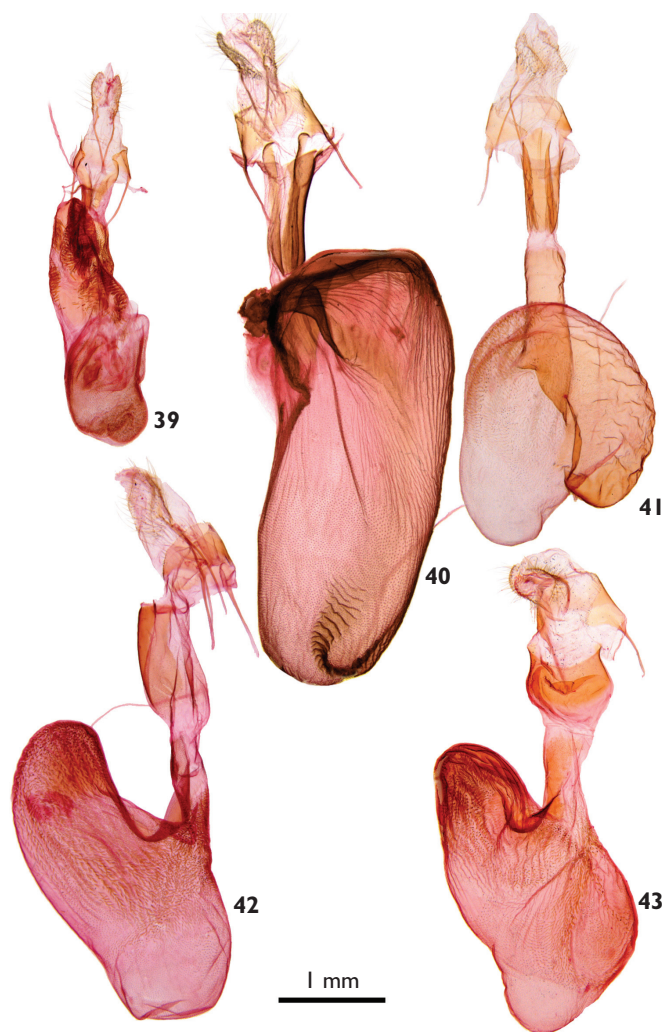
**Figures 36–38.** Male genitalia of Acontiinae. **36** *Pseudalypia crotchii* **37** *Spragueia leo* **38** *Trogotorna persecta*.

ever, are atypical for either group. The male valves are short and stumpy with strong claspers on both the right and left valves and spine-like setae along the dorsal margins of the sacculi; the aedeagus and vesica are elongate and narrow.

### ***Acontia* Ochsenheimer, 1816**

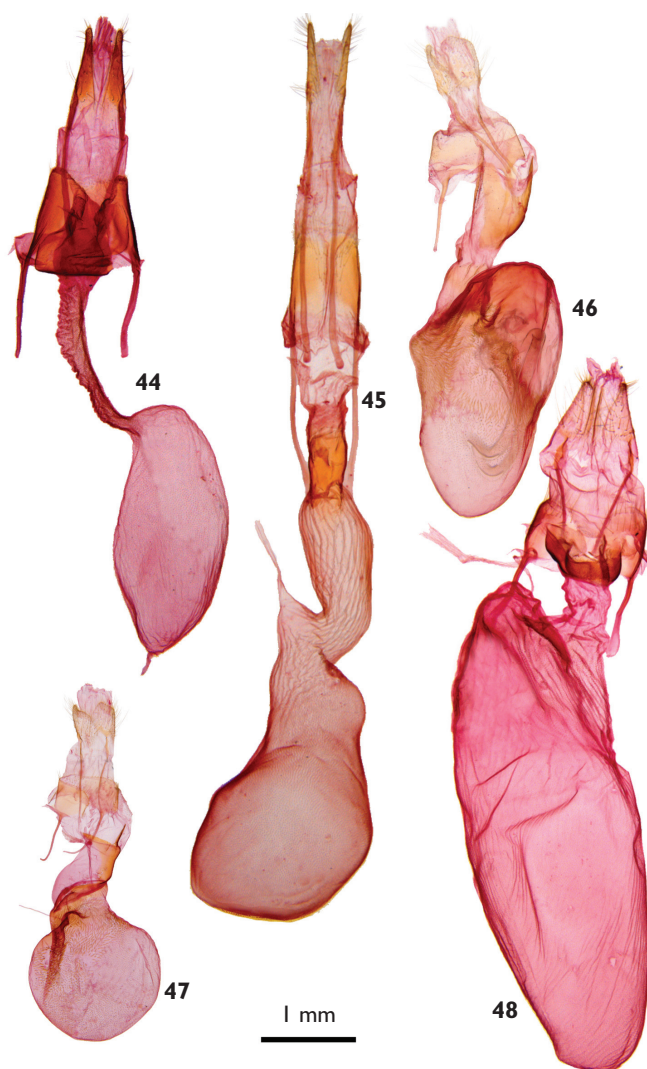
Figs 10–14, 30–34, 44

*Acontia* is the only New World genus also represented in Old World as well. There are five described species in the genus in North America and six in Central and South America. The



**Figures 39–43.** Female genitalia of Acontiinae [former generic name in brackets]. **39** *Ponometia* [*Tarachidia*] *nannodes* **40** *Tarache* [*Acontia*] *aprica* **41** *Tarache* [*Therasea*] *augustipennis* **42** *Tarache* [*Acontia*] *lucasi* **43** *Tarache* [*Hemispragueia*] *idella*.

moths differ greatly in appearance and size; however most species tend to be some combination of white and gray, the white tending to be shiny. The forewing tends to be broad, often with a rounded apex. **Male genitalia** (Figs 30–34). All of the species have a well-developed, setose ampulla on the clasper and the clasper is usually weakly sclerotized except for a spine-like apex. In many species the costal part of the valve is more heavily sclerotized than the ventral part. The vesica in the New World species is elongated and without diverticula or spiny areas, except for a long, tapered, horn-like subapical diverticulum that is covered with minute denticles so that it appears to function as an enlarged cornutus; *Acontia lucida*, the type-species from western Eurasia, has a spinulose subbasal diverticulum with a spiny



**Figures 44–48.** Female genitalia of Acontiinae. **44** *Acontia cretata* **45** *Eusceptis lelae* **46** *Pseudalypia crotchii* **47** *Spragueia leo* **48** *Trogotorna persecta*.

apex, as well as the false cornutus. **Female genitalia** (Fig. 44). These consist of an elongate, sclerotized, ostium bursae, a tubular, membranous ductus bursae, and an oval membranous corpus bursae with the ductus seminalis at the anterior end. In Old World *Acontia* there are separate sclerotized plates in the ostium and ductus bursae and the ductus seminalis is at the end of a sclerotized appendix bursae, which is on the posterior left side of the corpus bursae.

**Food plants.** The food plants are recorded in the New World only for an undescribed species related to *A. cretata* that occurs in Texas and northeastern Mexico; it has been reared from *Abutilon pedunculare* Kunth (Malvaceae). In the Old World, *Acontia lucida* feeds primarily, but not exclusively, on species of Malvaceae.

***Eusceptis* Hübner, [1823]**

Figs 15, 35, 45

This genus includes 11 species, mainly of the Neotropical Region, but one species extends northward to Texas. The relatively large moths (forewing length 9–17 mm) with their broad boldly-patterned forewings, are more reminiscent of some species of *Eulepidotis* Hübner than an acontiine. One species (*E. obscura*) is drably colored with more rounded wings, but the genitalia are typical for *Eusceptis*. **Male genitalia** (Fig. 35). The rows of stiff setae on the ventral surface of the uncus are diagnostic for the genus. The valves are broad and apically rounded, widest near the apex; they are highly asymmetrical in almost all species (less so in *E. irretita*) and in most the right valve is more structurally complex than the left one. In all species except two the corona is concentrated in a small cluster at the dorsal-apical corner of the valve at the apex of a rod-like thickening of the costal margin of the valve. **Female genitalia** (Fig. 45). These are similar to those of *Acontia*. The ostial area is sclerotized but the ductus bursae and corpus bursae are elongated and membranous; the appendix bursae is on a short membranous lobe on the left posterior margin of the corpus bursae. The apophyses and abdominal segment eight are very long and suggest a different mode of oviposition than other acontiines.

**Food plant.** *Malvaviscus arboreus* Cav. (Malvaceae); reared by D. Janzen and W. Hallwachs in Costa Rica.

***Pseudalypia* H. Edwards, 1874**

Figs 16, 36, 46

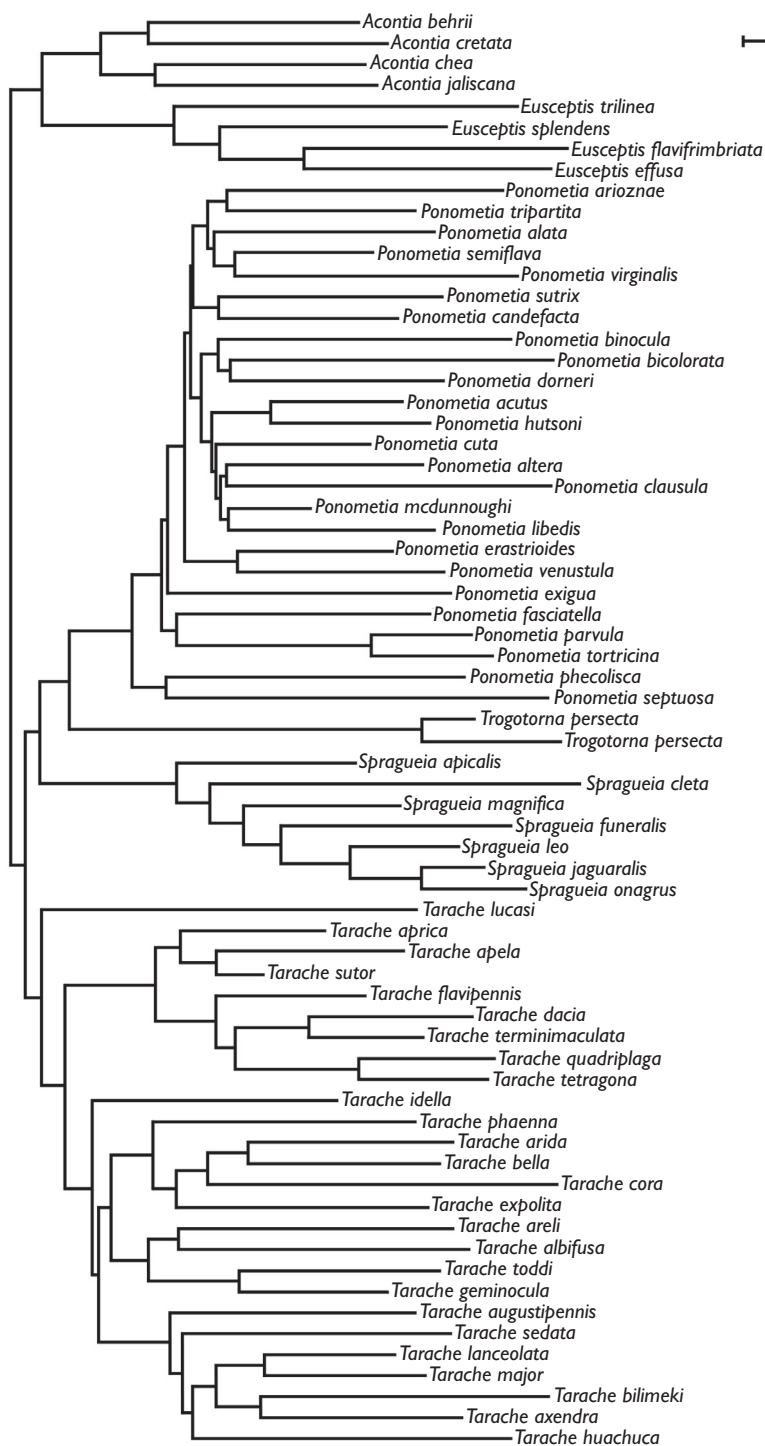
This only species known in the genus *Pseudalypia* is *P. crotchii* and is so different from other acontiines that it was described in the Agaristinae. It was first recognized as an acontiine by Crumb (1956) from the larval characters. The moth is unmistakable (Fig. 16) and is reminiscent of an arctiine because of the contrasting orange prothoracic collar. **Male genitalia** (Fig. 36). These are most similar to those of *Spragueia*, but the valves are almost bilaterally symmetrical, except for the larger ampulla on the right valve. The vesica has two large subapical diverticula covered with spines. **Female genitalia** (Fig. 46). These are similar to those of *Tarache* and have a large sclerotized appendix bursae that extends anteriorly part way down the right side of the corpus bursae.

**Food plants.** *Malvastrum exile* A. Gray and *M. parviflora* Phil. (Malvaceae).

***Spragueia* Grote, 1875**

Figs 17, 37, 47

The genus *Spragueia* contains 21 species of small, colorful moths found from southern Canada to the American tropics. The genus has traditionally been associated with the group of genera now amalgamated into *Ponometia*, probably because of small size



**Figure 49.** COI neighbor-joining tree of available taxa of New World Acontiinae.

and bold forewing pattern, compared with the bird-dropping look of most species of *Tarache* and *Acontia*. The male genitalia, however, are asymmetrical, and the ampulla well developed, as in *Acontia*, *Pseudalypia*, and *Eusceptis*, so we associate *Spragueia* with these genera. **Male genitalia** (Fig. 37). The clasper of each valve is a broad plate arising from the ventral margin of the valve with a well developed ampulla on each side with the setae enlarged, so the ampulla resembles a mace. The right clasper ends in a heavily sclerotized spine-like process that is absent on the left valve. The vesica has four lobes covered with spicules. A strong corona is usually present. **Female genitalia** (Fig. 47). The ostium is deeply invaginated and heavily sclerotized with the sclerotization commonly extended into the corpus bursae. The corpus bursae is usually globular with its anterior half weakly sclerotized.

**Food plants.** Species have been reared from plant species in the families Malvaceae, Sterculiaceae, Asteraceae, Convolvulaceae, and Poaceae.

### ***Trogotorna* Hampson, 1910**

Figs 18, 38, 48

This genus has only recently been confirmed as an acontiine though the research of J. B. Sullivan. It currently contains only the type species, *Trogotorna persecta*, but several undescribed species are under study (J. B. Sullivan, pers. comm.). The moth (Fig. 18) does not at all look like it would belong to the Acontiinae, but the scaphium has the characteristic pair of setose patches, the enlarged alula over the tympanum, a vestigial tympanal hood, and asymmetrical male sacculi and claspers. Also, the CO1 barcode consistently places *Trogotorna* among the acontiine genera. **Male genitalia** (Fig. 38). These would hardly be recognizable as belonging to the Acontiinae were it not for the characteristic setose pouch on each side of the scaphium. The valve tapers apically, unlike most acontiines, and the clasper is short leaf-shaped. There is no corona, ampulla, or saccular extension. The valves are slightly asymmetrical in that the sacculus and clasper on the left valve are smaller than those on the right valve. The aedeagus is unusually short and wide for an acontiine. The vesica is short and bulbous, except for a large subapical diverticulum with a dense patch of spines at the apex. **Female genitalia** (Fig. 48). The apophyses, abdominal segment eight, and the ostium and ductus bursae are very short, whereas the corpus bursae is very large, 10 × as long as the ductus bursae.

**Food plants.** Unknown.

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## Appendix: Checklist of the New World species of the subfamily Acontiinae

\* Neotropical species not known from the United States or Canada

\*\* Old World generic synonymy omitted

***Ponometia*** Herrich-Schäffer, 1868 [Type species: *Ponometia ochricosta* Herrich-Schäffer; = *P. exigua* (Fabricius)]

= *Fruva* Grote, 1877, **syn. n.** [Type species: *Spragueia fasciatella* Grote]

= *Heliodora* Neumoegen, 1891 [Type species: *Acontia costalis* Walker;  
= *P. exigua* (Fabricius)]

= *Graeperia* Grote, 1895 [Type species: *Acontia costalis* Walker;  
= *P. exigua* (Fabricius)]

= *Tarachidia* Hampson, 1898, **syn. n.** [Type species: *Tarachidia flavibasis* Hampson]

= *Tornacontia* Smith, 1900 [Type species: *Tarache sutrix* Grote]

= *Conochares* Smith, 1905, **syn. n.** [Type species: *Conochares acutus* Smith]

= *Neptunia* Barnes & McDunnough, 1911, **syn. n.** [Type species: *Azena pulchra* Barnes & McDunnough]

= *Uniptena* Nye, 1975, **syn. n.** [Type species: *Azena pulchra* Barnes & McDunnough]

*Ponometia albitermen* (Barnes & McDunnough, 1916) (*Tarachidia*), **comb. n.**

*Ponometia bicolorata* (Barnes & McDunnough, 1912) (*Tarachidia*), **comb. n.**

*Ponometia flavibasis* (Hampson, 1898) (*Tarachidia*), **comb. n.\***

*Tarachidia holophaea* Hampson, 1898

*Ponometia semiflava* (Guenée, 1852) (*Xanthoptera*), **comb. n.**

*Ponometia septuosa* (A. Blanchard & Knudson, 1986) (*Tarachidia*), **comb. n.**

*Ponometia carmelita* (Dyar, 1914) (*Tarachidia*), **comb. n.\***

*Ponometia clausula* (Grote, 1883) (*Xanthoptera*), **comb. n.**

*Ponometia venustula* (Walker, 1865) (*Acontia*), **comb. n.**

*Acontia discoidalis* Walker 1866

*Thalpochares fortunata* Grote, 1882

*Thalpochares perita* Grote, 1882

*Orobena subcitrinalis* Hulst 1886

*Ponometia virginalis* (Grote, 1881) (*Tarache binocula* var.), **comb. n.**

*Acontia tenuescens* Smith, 1902

*Ponometia binocula* (Grote, 1875) (*Tarachidia*), **comb. n.**

*Ponometia candeffecta* (Hübner, 1831) (*Tarache*), **comb. n.**

*Micra haworthana* Westwood, 1851

*Acontia debilis* Walker, [1858]

*Acontia neomexicana* Smith, 1900

*Ponometia dorneri* (Barnes & McDunnough, 1913) (*Tarache*), **comb. n.**

*Ponometia huita* (Smith, 1903) (*Acontia*), **comb. n.**

- Ponometia heonyx* (Dyar, 1913) (*Tarachidia*), **comb. n.**  
*Ponometia cuta* (Smith, 1905) (*Acontia*), **comb. n.**  
*Ponometia erastrioides* (Guenée, 1852) (*Acontia*), **comb. n.**  
*Ponometia libedis* (Smith, 1900) (*Acontia*), **comb. n.**  
*Ponometia nannodes* (Hampson, 1910) (*Tarachidia*), **comb. n.**  
*Ponometia phecolisca* (Druce, 1889) (*Acontia*), **comb. n.**  
*Ponometia alata* (Smith, 1905) (*Tarachidia*), **comb. n.**  
*Ponometia albimargo* (Barnes & McDunnough, 1916) (*Tarachidia*), **comb. n.**  
*Ponometia parvula* (Walker, 1865) (*Xanthodes*), **comb. n.**  
*Fruva georgica* Grote, 1881  
*Ponometia tortricina* (Zeller, 1872) (*Agrophila*), **comb. n.**  
*Fruva obsoleta* Grote, 1877  
*Fruva deleta* H. Edwards 1884  
*Fruva modesta* H. Edwards, 1884  
*Ponometia fumata* Smith, 1905 (*Spragueia*), **comb. n., stat. rev.**  
[treated as valid species because of differences in genitalia and sympatry with *P. tortricina*]  
*Ponometia nigra* (Mustelin, 2006) (*Tarachidia*), **comb. n.**  
*Ponometia fasciatella* (Grote, 1875) (*Spragueia*), **comb. n.**  
*Ponometia hutsoni* (Smith, 1906) (*Thalpochares*), **comb. n.**  
*Ponometia pulchra* (Barnes & McDunnough, 1910) (*Azenia*), **comb. n.**  
*Ponometia acutus* (Smith, 1905) (*Conochares*), **comb. n.**  
*Thalpochares catalina* Smith, 1906  
*Ponometia altera* (Smith, 1903) (*Tornacontia*), **comb. n.**  
*Graeperia concharodes* Hampson 1910  
*Ponometia elegantula* (Harvey, 1876) (*Thalpochares*), **comb. n.**  
*Tarache semiopaca* Grote, 1878  
*Conochares arizonae* (H. Edwards, 1878), **syn. n.**  
*Thalpochares arizonae* H. Edwards, 1878, **syn. n.**  
*Conochares interruptus* Smith, 1905, **syn. n.**  
*Orobena seminivealis* Hulst, 1886, **syn. n.**  
*Conocharis* [sic] *rectangula* McDunnough 1943, **syn. n.**  
*Ponometia exigua* (Fabricius, 1793) (*Bombyx*)  
*Nonagria indubitans* Walker 1857  
*Acontia costalis* Walker [1858]  
*Acontia dimidiata* Walker 1865  
*Ponometia ochricosta* Herrich-Schäffer, 1868  
*Monodes citrina* Druce, 1889  
*Heliadora magnifica* Neumoegen, 1891  
*Ponometia macdunnoughi* (Barnes & Benjamin, 1923) (*Graeperia*)  
*Ponometia megocula* (Smith, 1900) (*Tornacontia*)  
*Ponometia tripartita* (Smith, 1903) (*Tornacontia*)  
*Ponometia sutrix* (Grote, 1880) (*Tarache*)

*Ponometia albisecta* (Hampson, 1910) (*Tarachidia*), **comb. n.\***

*Ponometia bruchi* (Breyer, 1931) (*Eugraphia*), **comb. n.\***

*Ponometia corrientes* (Hampson, 1910) (*Tarachidia*), **comb. n.\***

*Ponometia margarita* (Schaus, 1904) (*Spragueia*), **comb. n.\***

*Ponometia marginata* (Köhler, 1979) (*Tarachidia*), **comb. n.\***

*Ponometia mixta* (Möschler, 1890) (*Acontia*), **comb. n.\***

*Ponometia morsa* (Köhler, 1979) (*Tarachidia*), **comb. n.\***

*Ponometia nigrans* (Köhler, 1979) (*Tarachidia*), **comb. n.\***

*Ponometia semibrunnea* (Druce, 1909) (*Tarachidia*), **comb. n.\***

*Ponometia viridans* (Schaus, 1904) (*Tarache*), **comb. n.\***

*Ponometia vinculis* (Dyar 1914) (*Fruva*), **comb. n.\***

***Tarache*** Hübner, [1823] [Type species: *Noctua aprica* Hübner]

= *Trichotarache* Grote, 1875 [Type species: *Trichotarache assimilis* Grote]

= *Therasea* Grote, 1875, **syn. n.** [Type species: *Tarache augustipennis* Grote]

= *Conacontia* Smith, 1900, **syn. n.** [Type species: *Conacontia flavicosta* Smith]

= *Hemispragueia* Barnes & Benjamin, 1923, **syn. n.** [Type species: *Cerathosea idella* Barnes]

*Tarache apela* (Druce, 1889) (*Acontia*), **comb. n.**

*Acontia philomela* Druce, 1889

*Tarache dstricta* Draudt, 1936, **comb. rev.\***

*Tarache tenuicola* Morrison, 1874, **comb. rev.**

*Acontia nuicola* Smith, 1900

*Acontia meskei* Smith, 1900

*Tarache mescei* Hampson, 1910

*Graeperia carcharodonta* Hampson, 1910

*Tarache sutor* (Hampson, 1910) (*Graeperia*), **comb. n.**

*Tarache aprica* (Hübner, [1808]), (*Noctua*), **comb. rev.**

*Noctua alboater* Haworth, 1809

*Acontia unocula* Freyer, 1849

*Acontia biplaga* Guenée, 1852

*Acontia redita* Felder & Rogenhofer, 1874

*Tarache assimilis* (Grote, 1875) (*Trichotarache*), **comb. n.**

*Tarache abdominalis* Grote, 1877, **comb. rev.**

*Tarache knowltoni* (McDunnough, 1940) (*Acontia*), **comb. n.**

*Tarache flavipennis* Grote, 1873, **comb. rev.**

*Tarache lagunae* (Mustelin & Leuschner, 2000) (*Acontia*), **comb. n.**

*Tarache delecta* (Walker, [1858]) (*Acontia*), **comb. n.**

*Acontia metallica* Grote, 1865

*Tarache lactipennis* Harvey, 1875, **comb. rev.**

*Tarache terminimaculata* Grote, 1873, **comb. rev.**

*Tarache pulchella* Grote, 1874

*Tarache dacia* (Druce, 1889) (*Acontia*), **comb. n.**

*Tarache curvilinea* Barnes & McDunnough, 1913

- Tarache phrygionis* (Hampson, 1910) (*Acontia*), **comb. n.\***  
*Tarache cratina* (Druce, 1889) (*Acontia*), **comb. n.\***  
*Tarache isolata* (Todd, 1960) (*Acontia*), **comb. n.\***  
*Tarache quadriplaga* (Smith, 1900) (*Acontia*), **comb. n.**  
     *Acontia alessandra* Smith, 1903, **syn. n.**  
*Tarache tetragona* (Walker, [1858]) (*Acontia*), **comb. n.**  
     *Acontia aprica* var. *ceyvenstensis* Dyar, 1904  
     *Tarache gonoides* McDunnough, 1943  
*Tarache ardoris* Hübner [1831], **comb. rev.\***  
     *Tarache duenna* Schaus, 1898  
*Tarache morides* (Schaus, 1894) (*Acontia*), **comb. n.\***  
     *Tarache ochrochroa* Druce, 1909, **syn. n.**  
*Tarache parana* (Jones, 1921), **comb. rev.\***  
*Tarache rufescens* Hampson, 1910, **comb. rev.\***  
*Tarache areloides* (Barnes & McDunnough, 1912) (*Acontia*), **comb. n.**  
*Tarache areletta* (Dyar, 1897) (*Acontia*), **comb. n.\***  
*Tarache areli* (Strecker, 1898) (*Acontia*), **comb. n.**  
*Tarache toddi* (Ferris & Lafontaine, 2009) (*Acontia*), **comb. n.**  
*Tarache geminocula* (Ferris & Lafontaine, 2009) (*Acontia*), **comb. n.**  
*Tarache albifusa* (Ferris & Lafontaine, 2009) (*Acontia*), **comb. n.**  
*Tarache arida* (Smith, 1900) (*Acontia*), **comb. n.**  
*Tarache bella* Barnes & Benjamin, 1922, **comb. rev.**  
*Tarache cora* Barnes & McDunnough, 1918, **comb. rev.**  
*Tarache expolita* Grote, 1882, **comb. rev.**  
     *Acontia embolima* Druce, 1889  
*Tarache phaenna* (Druce, 1889) (*Acontia*), **comb. n.\***  
*Tarache idella* (Barnes, 1905) (*Cerathosia*), **comb. n.**  
*Tarache augustipennis* Grote, 1875, **comb. rev.**  
     *Conacontia flavicosta* Smith, 1900, **syn. n.**  
*Tarache huachuca* (Smith, 1903) (*Conacontia*), **comb. n.**  
     *Conacontia orba* Smith, 1903 (*Conacontia*), **syn. n.**  
*Tarache sedata* (H. Edwards, 1881), **comb. rev.**  
     *Acontia gonella* Strecker, 1898  
     *Acontia niveicollis* Smith, 1902  
     *Acontia cacola* Smith, 1907  
*Tarache acerba* (H. Edwards, 1881) (*Fruva*) **comb. rev.**  
     [name preoccupied by *Acontia acerba* Felder & Rogenhofer, 1874 when included in *Acontia* by Poole (1983)]  
     *Acontia acerboides* Poole, 1989, **syn. n.** [becomes a synonym when secondary homonymy with *Acontia acerba* is removed]  
*Tarache axendra* Schaus, 1898, **stat. rev., comb. rev.**  
*Tarache bilimeki* (Felder & Rogenhofer, 1874) (*Acontia*), **comb. n.**  
     *Tarache bilimeci* Hampson, 1910, invalid emendation

- Acontia disconnecta* Smith, 1903, **syn. n.**  
*Tarache mizteca* Schaus, 1898, **comb. rev.\***  
*Tarache major* (Smith, 1900) (*Acontia*), **comb. n.**  
*Tarache lanceolata* Grote, 1879, **comb. rev.**  
*Tarache lucasi* Smith, 1900 (*Acontia*), **comb. n.**  
*Acontia aniluna* Smith, 1905  
*Acontia pima* Smith, 1905  
*Tarache vittamargo* (Dyar, 1912), **comb. rev.\***  
**Acontia** Ochseneimer, 1816 \*\* [Type species: *Noctua solaris* Denis & Schiffermüller;  
 = *Acontia lucida* (Hufnagel)]  
 = *Stylorache* Hampson, 1910, **syn. n.** [Type species: *Stylorache albida* Hampson]  
 = *Chelichares* Hampson, 1910, **syn. n.** [Type species: *Chelichares nubifera*  
 Hampson]  
*Acontia behrii* Smith, 1900  
*Acontia cretata* Grote & Robinson, 1870  
*Acontia neocula* Smith, 1900  
*Acontia schwarzii* Smith, 1900  
*Tarache schvarzi* Hampson, 1910  
*Acontia fiebrigi* (Zerny, 1916) (*Tarache*) \*  
*Acontia chea* Druce 1898  
*Acontia eudryada* Smith, 1905, **syn. n.**  
*Acontia jaliscana* (Schaus, 1898) (*Tarache*)  
*Acontia coquilleltii* Smith, 1900  
*Acontia micropis* (Druce, 1909) (*Tarache*) \*  
*Acontia albida* (Hampson, 1910) (*Stylorache*), **comb. n.\***  
*Acontia nubifera* (Hampson, 1910) (*Chelichares*), **comb. n.\***  
*Acontia ruffinellii* (Biezanko, 1959) (*Hoplotarache*) \*  
*Acontia viridifera* (Hampson, 1910) (*Hoplotarache*), **comb. n.\***  
**Eusceptis** Hübner, [1823] [Type species: *Eusceptis irretita* Hübner]  
 = *Eugraphia* Guenée, 1852 [Type species: *Eusceptis irretita* Hübner]  
*Eusceptis irretita* Hübner, 1823 \*  
*Noctua melanogramma* (Perty, [1833])  
*Eusceptis koehleri* Todd, 1966 \*  
*Eusceptis obscura* (Schaus, 1898) (*Acontia*) \*  
*Acontia trilinea* (Schaus, 1898)  
*Eusceptis effusa* (Druce, 1889) (*Eugraphia*) \*  
*Eusceptis atriora* Todd, 1966  
*Eusceptis flavifrimbriata* Todd, 1971  
*Eusceptis incomptilinea* Todd, 1971 \*  
*Eusceptis lelae* Todd, 1966 \*  
*Eusceptis splendens* (Druce, 1896) (*Eugraphia*) \*  
*Eusceptis extensa* (Strand, 1913) (*Eugraphia*) \*  
*Eusceptis robertae* Todd, 1966 \*



*Eusceptis paraguayensis* (Draudt 1939) (*Eugraphia splendens* form) \*

***Pseudalypia*** H. Edwards, 1874 [Type species: *Pseudalypia crotchii* H. Edwards]

*Pseudalypia crotchii* H. Edwards, 1874

*Pseudalypia crotchii* var. *atrata* H. Edwards, 1884

***Spragueia*** Grote, 1875 [Type species: *Agrophila leo* Guenée]

= *Heliocontia* Hampson, 1910 [Type species: *Emmelia apicella* Grote]

= *Mnesipyrga* Meyrick, 1913 [Type species: *Mnesipyrga trichostrota* Meyrick]

*Spragueia magnifica* Grote, 1883

*Spragueia dama* (Guenée, 1852) (*Agrophila*)

*Agrophila transmutata* Walker, 1865

*Agrophila trifariana* Walker, 1865

*Spragueia pardalis* Grote, 1881

*Spragueia cleta* (Druce, 1889) (*Agrophila*)

*Spragueia perstructana* (Walker, 1865) (*Agrophila*)

*Emmelia felina* Herrich-Schäffer, 1868

*Emmelia trigidula* Herrich-Schäffer, 1868

*Agrophila phaenna* Druce, 1889

*Agrophila mata* Druce, 1898

*Spragueia guttata* Grote, 1875

*Spragueia onagrus* (Guenée, 1852) (*Agrophila*)

*Spragueia leo* (Guenée, 1852) (*Agrophila*)

*Spragueia jaguaralis* Hampson, 1910

*Spragueia funeralis* Grote, 1881

*Spragueia obatra* (Morrison, 1875) (*Tarache*)

*Spragueia plumbifimbriata* Grote, 1877

*Agrophila velata* Strecker, 1898

*Spragueia apicalis* (Herrich-Schäffer, 1868) (*Emmelia*)

*Emmelia apicella* Grote, 1872

*Agrophila truncatula* Zeller, 1873

*Fruva accepta* H. Edwards, 1881

*Mnesipyrga trichostrota* Meyrick, 1913

*Spragueia margana* (Fabricius, 1794) (*Pyrallis*)

*Grapholita subapicana* Walker 1863

*Agrophila rudisana* Walker 1865

*Spragueia inornata* Grote 1882

*Spragueia sordida* Grote, [1883]

*Emmelia variegata* Möschler 1890

*Emmelia variegata* var. *ochracea* Möschler, 1890

*Spragueia canofusa* Hampson, 1898

*Spragueia tarasca* Schaus, 1904

*Spragueia basipuncta* (Schaus, 1914) (*Helicontia*) \*

*Spragueia creton* Schaus, 1923 \*

*Spragueia plumbeata* Schaus, 1923

- Spragueia grana* (Dognin, 1897) (*Agrophila*) \*  
*Spragueia lepus* (Guenée, 1852) (*Agrophila*) \*  
    *Aphusia marmorea* Butler, 1879  
    *Spragueia inversa* Schaus, 1904  
    *Spragueia taragma* Schaus, 1904  
    *Helicontia lepus* subsp. *concordens* Dyar, 1914  
*Spragueia pantherula* (Herrich-Schäffer, 1868) (*Emmelia*) \*  
    *Emmelia uncinula* Herrich-Schäffer, 1868  
*Spragueia pyralidia* (Schaus, 1898) (*Tarache*) \*  
*Spragueia speciosa* (Draudt, 1936) (*Heliacontia*) \*  
*Spragueia turca* Köhler, 1979 \*  
*Spragueia valena* (Druce, 1889) (*Acontia*) \*  
***Trogotorna*** Hampson, 1910 [Type species: *Trogotorna persecta* Hampson]  
*Trogotorna persecta* Hampson, 1910 \*

#### Unknown species (types lost)

- Acontia decisa* Walker, [1858] TL: Brazil  
*Acontia quadrata* Walker, 1866 TL: Brazil

# The North American species of *Charadra* Walker, with a revision of the *Charadra pata* (Druce) group (Noctuidae, Pantheinae)

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## Abstract

The North American species of the genus *Charadra* Walker are reviewed, and the species of the yellow-hindwing (*C. pata*) group are revised. Four species of the *pata* group are described as new: *Charadra franclemonti* **sp. n.** (Arizona), *C. tapa* **sp. n.** (Arizona), *C. cakulha* **sp. n.** (Mexico), and *C. coyopa* (Mexico) **sp. n.** A new species related to *C. deridens* (previously treated as *C. ingenua*) is described from Arizona / New Mexico / Texas, and *Charadra ingenua* **syn. n.** is synonymized with *Charadra deridens*. The types of *Charadra pata*, *C. oligarchia*, *C. patafex* and *C. ingenua* are illustrated.

## Keywords

*Charadra*, new species, taxonomy, Arizona, New Mexico, Mexico, *Quercus*

## Introduction

The genus *Charadra* Walker as currently understood is comprised of three yellow-hind-winged species (*C. pata* (Druce), *C. oligarchia* Dyar, and *C. patafex* Dyar) and five grey-hindwinged species (*C. deridens* (Guenée), *C. ingenua* J.B. Smith, *C. dispulsa* Morrison, *C. nigracreta* H. Edwards and *C. nitens* Schaus). *Charadra* is restricted to the New World with the greatest species diversity found from the southwestern United States to Central America. The widespread and variable *Charadra deridens* is a well-known species found across most of the continental United States and southern Canada. Based on phenotype and genitalic structure, the genus is arranged into three groups: **1) the *pata* group** (yellow hindwing; male vesica with two simple thorn-like cornuti; clasper not reaching apex of valve; saccus V-shaped; female antevaginal plate bilobed or double pronged; female ductus bursae lacking lateral twisted flanges); includes *C. pata*, *C. oligarchia*, *C. patafex*, and four additional species described herein (*C. franclemonti* sp. n., *C. tapa* sp. n., *C. cakulha* sp. n., *C. coyopa* sp. n.). This group is primarily Mexican – Central American in distribution, with two species reaching southeastern Arizona. **2) the *C. deridens* group** (male cornuti multi-spined, basal cornutus crest-like; clasper reaching apex of valve; saccus broadly U-shaped; female ductus bursae with lateral, ventrally twisted flanges); includes *C. deridens*, *C. moneta* sp. n., *C. dispulsa*, *C. nitens*, and several undescribed Central American species (BCS, in prep.); as a whole, this group occurs from temperate North America southward to at least Costa Rica. **3) the *nigracreta* group**, with only *C. nigracreta*, is characterized by a simple valve that lacks a clasper; a massive plate-like transtilla; absence of cornuti on the vesica, and presence of a sclerite between the ductus and corpus bursae. These groups may warrant recognition as separate genera, but a review of other pantheine genera, notably the closely related *Colocasia* Ochseneimer and *Pseudopanthea* McDunnough, is needed before generic limits can be revised and is beyond the scope of this work.

With the exception of Arizona material, the *pata* group is very poorly represented in collections. It appears to be quite diverse in Mexico, where more species will likely be discovered. J. G. Franclemont collected and reared series of the yellow-winged species in southern Arizona in the 1960's; this material consists of two species, neither has an available name. These two Arizona taxa and two new Mexican species are described herein. The western North American taxon *C. ingenua* has been misunderstood and is here synonymized under *C. deridens* syn. n., and a new name is provided for the taxon previously treated as *C. ingenua*.

## Methods and materials

Adult genitalia were prepared following the methods detailed by Lafontaine (2004). Cleaned, stained genitalia were stored and examined in 30% ethanol, and slide-mounted in Euparal before being photographed. Molecular variation for some species was assessed based on the 658 base-pair 'barcode' region of the first subunit of the

cytochrome oxidase (*cox1*) gene (Hebert et al. 2003). DNA was extracted from one leg removed from a dried specimen, and processed at the Canadian Centre for DNA Barcoding, Guelph, Ontario. DNA extraction, amplification and sequencing protocols for the Barcode of Life initiative are given in Hebert et al. (2003). Haplotypes of all barcode sequences were compared with phylograms constructed using the neighbour-joining method in PAUP 4.0\*b10 (Altvect) (Swofford 2002). Phyletic distances were calculated using the Kimura-2-Parameter (K2P) distance model. Data for molecular voucher specimens, including trace files and photographs, are available at <http://barcodinglife.com> (project: Lepidoptera of NA Phase II: “*Charadra* revision” under the “Published Projects” tab). Molecular sequences have been submitted to GenBank, but accession numbers were not available at the time of publication.

**Institutional collections are abbreviated as follows:**

- AMNH** American Museum of Natural History, New York, New York, USA.  
**BMNH** The Natural History Museum (formerly British Museum [Natural History]), London, United Kingdom.  
**CNC** Canadian National Collection of Insects, Arachnids and Nematodes, Ottawa, Ontario, Canada.  
**CUIC** Cornell University Insect Collection, Ithaca, New York, USA.  
**MCZ** Museum of Comparative Zoology, Cambridge, Massachusetts, USA.  
**USNM** National Museum of Natural History (formerly United States National Museum), Washington, D.C., USA  
**UASM** University of Alberta Strickland Museum, Edmonton, Alberta, Canada.

## Systematics

### *Charadra* Walker

*Charadra* Walker, 1865: 445.

Type species: *Charadra contigua* Walker, 1865, a junior subjective synonym of *Charadra deridens* (Gueneé).

The generic placement of *Charadra* in relation to other pantheine genera, especially *Pseudopanthea* and *Colocasia*, is in need of review, and more than one genus for the species currently placed in *Charadra* may need to be recognized. The morphology of the genus is quite heterogeneous, but important shared genital characters include the following: apex of uncus with slight to very pronounced medial notch; clasper parallel to ventral valve margin (perpendicular in *Panthea* Hübner) but absent in *C. nitens*; dorsal tegumen lacking process (lobed in *Panthea*, prong-like or flange-like in *Colocasia*); basal costal process absent or highly developed; vesica with two strongly sclerotized cornuti (absent in *C. nitens*); female ductus bursae sclerotized laterally; corpus bursae

lacking signa. Some of the character states treated as autapomorphic for *Panthea* by Fibiger et al. (2009) are also present in *Charadra*, including a dorsally membranous aedeagus and the presence of cornuti on the vesica.

***Charadra pata* (Druce)**

Fig. 1

*Trisulodes pata* Druce, 1894: 362.

*Charadra patens* J. B. Smith, 1908; misspelling.

‡*Charadra basiflava* J. B. Smith, 1908; unavailable name.

**Type material.** *Charadra pata* – Guatemala, Guatemala City. **Holotype** female. BMNH; examined. *Charadra basiflava* – this taxon was listed as a synonym of *pata* by Franclemont & Todd (1983). Todd (1982) questioned the validity of Smith's description, which consists of: "*Trisuloides patens* [sic] Druce, is a *Charadra* which I had named *basiflava* before Dr. Barnes called my attention to the figure in the Biologia (II, 509, p. 96). It has been taken at Palmerlee, Cochise Co., Arizona, and is no doubt a member of our fauna." (Smith 1908). The question is then what Smith meant when he said "had named." Since there is no earlier published mention of *basiflava*, we take this statement to mean that Smith had determined and labeled a specimen as a new species and intended to describe it as *basiflava*. Todd (1982) also concluded this was the most likely meaning of Smith's statement, and designated as lectotype a specimen labeled "*Charadra basiflava* Smith Type". However, Smith's (1908) statement does not qualify as a valid description under the provision of Article 12 of the ICZN (1999), and *basiflava* is therefore an unavailable name (a conclusion apparently also reached by Poole 1989, as the taxon is not included in his publication). The lectotype designated by Todd (1982) is therefore not a true "type." Even if Smith's description is deemed to be valid, the type specimen is the illustration of *C. pata* in Druce (1894), not the specimen designated as lectotype by Todd (1982).

**Diagnosis.** The wing markings of the female holotype, the only known specimen of this species, are most similar to those of *C. oligarchia* (only known from two males) and *C. patafex*. Compared to *C. oligarchia*, *C. pata* has a darker grey-brown forewing subterminal area with a contrasting white reniform area, but lacks any outline of a reniform (reniform outlined in *oligarchia*); the orbicular spot is slightly larger and more oblong in *C. oligarchia*. Compared to *C. patafex*, the forewing medial area of *C. pata* is contrastingly darker (concolorous with basal area in *C. patafex*) and the reniform area is white (brownish grey in *C. patafex*); also the hindwing marginal band is darker and narrower in *C. pata* than in *C. patafex*.

**Distribution and biology.** Known only from the type locality, Guatemala City, Guatemala. Nothing is known of the biology, although the larvae possibly feed on oak, as do those of *C. tapa* and *C. franclemonti*.



**Remarks.** After studying the type specimen of *C. pata*, we have come to the conclusion that this is not the same species as the Arizona taxon that has gone under this name, and belongs to a southern Mexican / Central American group of species consisting of *C. pata*, *C. oligarchia*, *C. cakulha* sp. n. and *coyopa* sp. n., here termed the *oligarchia* subgroup. The holotype female of *C. pata* (Fig. 1) differs from the *tapa* subgroup (*C. franclemonti* sp. n. and *C. tapa* sp. n.) in several key characters, namely the white, almost completely unmarked reniform area (grey and well marked with the usual markings in the *tapa* subgroup), a prominent and thick, well-defined black terminus of the subterminal line near the anal angle characteristic of the *oligarchia* subgroup (thinner, diffuse and poorly defined in *tapa* subgroup), browner tone of the forewing ground colour (grey in *tapa* subgroup). The genitalic structure of the type female of *C. pata* differs from that of both *C. franclemonti* and *C. tapa* in that the antevaginal plate has short lobes, like *C. tapa* (long and prong-like in *C. franclemonti*), but with a more flared-out basal region than in either *C. tapa* or *C. franclemonti*, and the sclerotized lateral margins of the ductus bursae are nearly symmetrical, lacking the pronounced ventral twist of the right lateral margin of *C. tapa* (also nearly symmetrical in *C. franclemonti*).

Based on the brownish ground colour, prominent black mark of the anal angle and whitish reniform area, we place *C. pata* in the *oligarchia* subgroup. The lack of associated specimens of corresponding sexes is problematic, as it leaves the possibility that *C. pata* is the same species as *C. oligarchia*, *C. patafex*, *C. cakulha* or *C. coyopa*; a correlation in the structure of the male and female genitalia in this group is of some help, since asymmetrical placement or size of the male vesica cornuti corresponds to asymmetry in the shape and sclerotization of the ductus bursa (where the cornuti are presumably positioned during copulation: for example, in *C. tapa*, males have both cornuti positioned on the right, while females have a more heavily sclerotized, twisted right lateral margin of the ductus bursae). The nearly symmetrical ductus bursae of *C. pata* suggests a similar symmetrical placement and size of male cornuti, which would rule out *C. oligarchia* and *C. patafex*, (Figs 2, 3), a conclusion that also is supported by differences in wing markings. *C. cakulha* has both symmetrical placement and size of cornuti (Fig. 24), but differs markedly in wing markings (Fig. 7), as does *C. coyopa* (Fig. 10).

### *Charadra patafex* Dyar

Fig. 2

*Charadra patafex* Dyar, 1916: 19.

**Type material.** Type locality: “Guerrero Mill, Hidalgo, Mexico, 9000 feet” Holotype ♂. USNM; examined.

**Diagnosis.** The relatively uniform grayish-brown forewing pattern is similar to that of *C. tapa* and *C. franclemonti*, but the latter two species lack the bold, thick anal

terminus of the subterminal line. The huge costal process of the male valve are unique in the yellow-winged *Charadra* species.

**Distribution and biology.** Known only from the type locality of Guerrero Mill, State of Hidalgo, Mexico at 9000 feet elevation. Possibly associated with dry oak woodlands at higher elevations, as are *C. tapa* and *C. franclemonti*.

***Charadra oligarchia* Dyar**

Figs 3, 13

*Charadra oligarchia* Dyar, 1916: 19.

**Type material.** Type locality: “Guerrero Mill, Hidalgo, Mexico, 9000 feet” Holotype ♂. USNM; examined.

**Diagnosis.** Superficially similar to *C. cakulha* and *C. pata*. The contrastingly pale outer third of the forewing is similar only to *C. cakulha*, but *C. oligarchia* is darker overall; internally, the male vesica has the two cornuti placed at the base of the vesica, one massive, one small, whereas *C. cakulha* has two lateral, symmetrical cornuti that are fused to the aedeagus. See also ‘Diagnosis’ of *C. pata*.

**Distribution and biology.** Known only from Guerrero Mill, Mexico. Possibly associated with dry oak woodlands at higher elevations, as in *C. tapa* and *C. franclemonti*.

**Remarks.** As discussed in the diagnosis of *C. pata*, *C. oligarchia* and *C. pata* may be the same species, but lack of specimens of each taxon of the corresponding sex prevents further comparison; however, the *pata* holotype differs slightly in wing markings, and the type localities of the two species are in different mountain ranges separated by several hundred kilometers, so we treat both as distinct taxa until more study material becomes available.

***Charadra franclemonti* Anweiler & Schmidt, sp. n.**

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Figs 5, 6, 23, 30

**Type material. Holotype** ♂ – UNITED STATES. “USA: Cochise Co. [County] Chirica / hua Mtns [Mountains]. Pinery Cyn [Canyon] cmpgd [campground] / 31.93N 109.27W 6500’ / 5-VIII-08 pine/oak/riparian / MV lt. C. Schmidt & B. Walsh.”; “HOLOTYPE / *Charadra franclemonti* / Anweiler & Schmidt” [red label]. Deposited in CNC. **Paratypes** – 22 ♂, 5 ♀ [CNC, CUIC, USNM, UASM]. United States: Arizona: same data as holotype (18 ♂, 3 ♀); Cochise Co., Chiricahua Mtns, East Turkey Creek 6400’, 7 Aug. 1967, J. G. Franclemont (1 ♀); Cochise Co., Chiricahua Mtns., Cave Creek Canyon, 5400’, 21 Sept. 1966, J. G. Franclemont, reared *ex ova*, on *Quercus gambelii* (1 ♂); Cochise Co., Chiricahua Mtns, Onion Saddle 7600’, 17 July 1966, J.G. Franclemont (1 ♂); Santa Cruz County, Santa Rita Mtns, Madera Canyon 5800’, Sierra Vista, 9 Sept. 1967, R. F. Sternitzky (1 ♂), 13 Jul 1960, J. G. Franclemont (1 ♀);

Coconino Co., 6 1/3 mi. ESE Flagstaff, Walnut Canyon., 6500', 24 July 1965, J. G. Franclemont (1 ♂).

**Etymology.** We name this species after the late John G. Franclemont who collected and reared this species and recognized that there were two distinct species in southern Arizona.

**Diagnosis.** Superficially very similar to *Charadra tapa*, but can be separated by the forewing pattern and in particular by genital characters in both sexes. The outer half of the forewing in both sexes is darker and more patterned, with the outer forewing more even and paler grey in *C. franclemonti* than in *C. tapa*. Females can be separated without dissection by brushing the underside of the terminus of the abdomen and examining the sterigma and in particular the lamella antevaginalis, which extends caudally in two long prongs in *C. franclemonti* (often visible with the naked eye); in *C. tapa* these prongs are reduced to two blunt lobes. In males, the vesica of *C. franclemonti*, when inflated, expands into a pouch as it exits the aedeagus, and the two cornuti are on opposite sides of the vesica; in *C. tapa* the vesica is not significantly expanded where it exits the aedeagus and the two cornuti are together on one side. The valves of *C. franclemonti* are more truncated and squared off than those of *C. tapa*, which are slightly more produced and tapered. Although there is some overlap in flight periods, *C. franclemonti* primarily flies in July and August, whereas *C. tapa* flies in September and October.

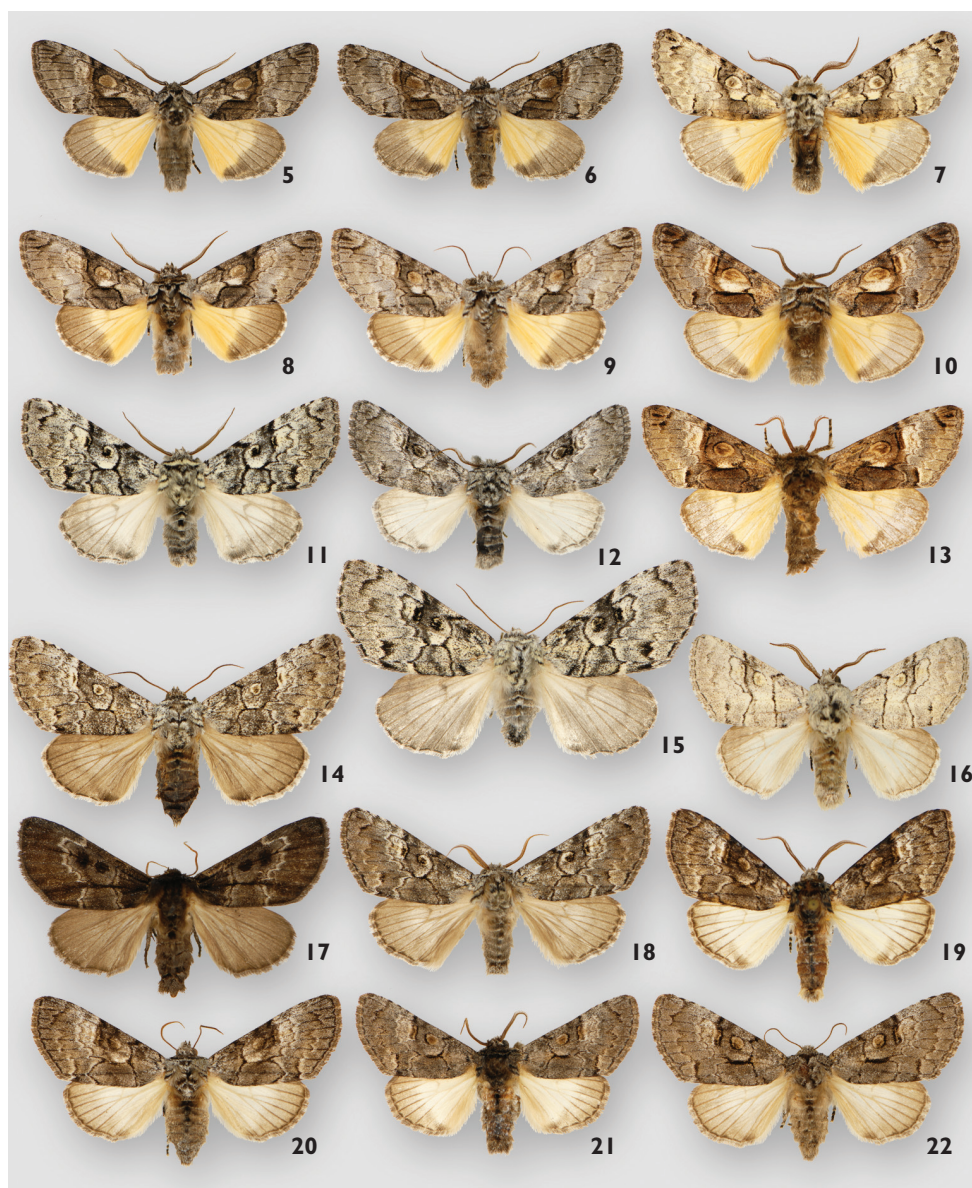
**Description.** Sexes externally alike, except females slightly larger than males. FW length averaging 18 mm in males, 19 mm in females. *Head* – palps short, covered in stiff grey, black and white hair-like scales; proboscis well developed; eyes large, globular; frons with short grey and black hair; antennae broadly bipectinate, with longest rami about 7 times as long as width of shaft. *Thorax* – clothed in long dark-grey, black, and white scales; tegulae mostly white anteriorly, black and grey banded on posterior; Forewing dark grey with a brown-black medial band. Basal area a mix of black and white scales, appearing light grey, with white scales bleeding into medial area below orbicular producing a small pale streak. Antemedial line narrow, black, erratic and dragged outward below orbicular to meet or almost meet postmedial line midway. Orbicular spot prominent, oval, filled with dark blackish-brown scales and narrowly outlined in black. Medial band broad, brownish black, narrower on upper side and extending to upper margin above orbicular, but extending almost to wing base on lower half. Postmedial line black, narrow, erratic, pulled inward to meet or almost meet antemedial line midway. Postmedial line erratic, poorly defined, bordered outwardly with white scales that expand into a diffuse whitish-grey reniform spot. Subterminal line poorly defined by dark scales, except more prominently lined with black at lower margin of wing and where it bends basad before meeting upper margin of wing. A diffuse patch of white scales at anal angle. Terminal line narrow, black, broken at veins. Fringe dark grey and black, faintly checked with lighter grey at veins. Veins beyond medial area narrowly lined with black. Hindwing pale yellow with an orange tint on basal half, sharply divided from grey black outer half. Fringe grey on inner half, white on outer half and lightly checkered with black between veins. *Abdomen* – clothed in lead grey hair-like scales mixed with numerous white scales at terminus, with a series



**Figures 1–4.** Adults and genitalia of *Charadra* type specimens. **1** *C. pata*, holotype, Guatemala City, Guatemala **2** *C. patafex*, holotype, Guerrero Mill, Hidalgo, Mexico **3** *C. oligarchia*, holotype, Guerrero Mill, Hidalgo, Mexico **4** *C. ingenua*, lectotype, Durango, Colorado.

of 3–4 small dark-grey tufts midway along dorsal centerline. Legs grey, banded with black at the joints. *Male genitalia* (Fig. 23) – Valves simple, subquadrate apically with a slightly pointed dorsal apex; costal process absent; clasper a simple scoop-shaped process about 1/10 length of dorsal valve margin, with broad surface directed dorso-cephalad; sacculus unmodified; uncus with a wide base and narrowest medially, apex broadly





**Figures 5–22.** Adult habitus of *Charadra* species. **5** *C. franclemonti*, ♂ holotype, Pinery Cyn., Chiricahua Mtns., AZ **6** *C. franclemonti*, ♀ paratype, Pinery Cyn., Chiricahua Mtns., AZ **7** *C. cakulba*, ♂ holotype, San Cristobal de las Casas, Chiapas, Mexico **8** *C. tapa*, ♂ paratype, Madera Cyn., Santa Rita Mtns., AZ **9** *C. tapa*, ♀ paratype, Madera Cyn., Santa Rita Mtns., AZ **10** *C. coyopa*, ♂ holotype, Distrito Federal, Mexico **11** *C. deridens*, ♂, Edmunston, NB **12** *C. deridens*, ♂, Garfield Co., CO **13** *C. oligarchia*, ♂, Guerrero, Mexico **14** *C. deridens*, ♀, Morehead, KY **15** *C. deridens*, ♀, Edmunston, NB **16** *C. dispulsa*, ♂, Georgetown, TX **17** *C. deridens*, ♀, Mt. Pocono, PA **18** *C. deridens*, ♂, Morehead, KY **19** *C. moneta*, ♂ holotype, Walnut Cyn., Coconino Co., AZ **20** *C. moneta*, ♀ paratype, Walnut Cyn., Coconino Co., AZ **21** *C. moneta*, ♂, Big Bend National Park, Brewster Co., TX **22** *C. moneta*, ♀, Big Bend National Park, Brewster Co., TX.



**Figures 23–25.** Male genitalia of *Charadra* species. **23** *C. franclemonti* paratype, Pinery Cyn., Chiricahua Mtns., AZ **24** *C. tapa* paratype, Ash Cyn., Huachuca Mtns., AZ **25** *C. cakulha* holotype, San Cristobal de las Casas, Chiapas, Mexico.





**Figures 26–29.** Male genitalia of *Charadra* species. **26** *C. coyopa* holotype, Distrito Federal, Mexico **27** *C. deridens*, Morehead, KY **28** *C. moneta* paratype, Walnut Cyn., Coconino Co., AZ **29** *C. dispulsa*, Sinton, TX.

squared with a medial notch giving a slightly bifid appearance; tegumen greatly expanded dorsally; saccus quadrate with broad U-shaped medial dorsal notch; aedeagus 5x longer than diameter, with a very wide, dorsally directed opening to vesica, opening about 1/3 total length of aedeagus; bulbous base of vesica directed at about 90 degrees to aedeagus; vesica base with two large, equal-sized, thorn-like cornuti positioned opposite each other, one ventral and one dorsal; one medial and one distal diverticulum of similar size, oriented dorsally. *Female genitalia* (Fig. 30) – Papillae anales blunt with very slight medial tip; antevaginal plate (caudal extension of sternum VII) prominent, slightly longer than length of sternum VIII and with two prongs extending beyond caudal margin of sternum VIII; ductus bursae heavily sclerotized and short, slightly wider than long, flattened dorso-ventrally and asymmetrical due to a ventral twist of right lateral margin; corpus bursae asymmetrically heart-shaped, membranous, finely spiculate under high magnification; ductus seminalis exiting caudally on left chamber of corpus bursae.

**Distribution and biology.** *Charadra franclemonti* ranges from central Arizona (Coconino Co.) southward to at least Durango, Mexico. The flight period is from mid-July into August. Captive larvae were reared on *Quercus gambelii* Nuttall.

**Remarks.** One slightly larger, darker male specimen from El Salto, Durango, Mexico is provisionally treated as this species since it is indistinguishable in genital structure, but is excluded from the type series. Although this species and *C. tapa* have both been treated and identified as *C. pata*, neither *C. tapa* nor *C. franclemonti* is closely related to *C. pata*; see ‘Remarks’ under *C. tapa*, below.

Five specimens from the type locality exhibited a single barcode haplotype that was more than 5% divergent from those of *C. deridens*, *C. moneta*, and *C. dispulsa*; no barcodes for any other *pata* group species were available for comparison.

### ***Charadra tapa* Schmidt & Anweiler, sp. n.**

urn:lsid:zoobank.org:act:00370BBD-8B85-4AA1-A8AB-9AF7D6CB7FE2

Figs 8, 9, 24, 31

**Type material. Holotype** ♂ – UNITED STATES. “AZ; Cochise Co. / Huachuca Mts, 5354 Ash / Cyn [Canyon] Rd. 0.5miW [0.5 miles west of] Hwy [Highway] 92 / 15.IX.1992 5100’ / N. McFarland UV light”; “HOLOTYPE / *Charadra tapa* / Schmidt & Anweiler” [red label]. Deposited in CNC. **Paratypes** – 21 ♂, 9 ♀ [CNC, CUIIC, USNM, UASM]. Same data as holotype (all reared ex ova on *Quercus gambelii*), 5 Oct 1959 (1 ♂); 15 Aug 1965 (1 ♂); 27 Aug. 1965 (1 ♀); United States: Arizona: Cochise Co., Huachuca Mountains, Ramsey Canyon., R. F. Sternitzky, 2 Oct. 1967 (3 ♂, 1 ♀), 13 Sept. 1967 (1 ♂), 25 Sep 1967 (1 ♂), 29 Oct. 1967 (3 ♂, 1 ♀), 24 Sept. 1967 (1 ♀); Cochise Co., Huachuca Mountains, Carr Canyon., R. F. Sternitzky, 28 Sep 1967, (1 ♀), 24 Sep 1967 (3 ♂), 28 Sep 1967 (2 ♂); Cochise Co., Sierra Vista, F. Sternitzky, 8 Sept. 1967, (1 ♂), 25 Sept. 1967 (1 ♂), 18 Sep 1966 (1 ♀); Cochise Co., Huachuca Mtns, Garden Cyn., F. Sternitzky, 9 Oct. 1967, (1 ♂); Cochise Co.,

Huachuca Mtns, 5354 Ash Canyon. Rd. 0.5 mi W Hwy. 92, 15 Sept. 1992, 5100', N. McFarland, (1 ♂), 22 Sep 1992 (1 ♀), 24 Sep 1992 (1 ♂), 21 Sep 1992 (1 ♂); Cochise Co., Chiricahua Mtns, Southwestern Research Station, 21 May 1960, C.W. Kirkwood (1 ♀); Santa Cruz Co., Santa Rita Mtns, Madera Canyon, 4880', 1 Oct. 1959, (1 ♀), 14 Aug 1965 (1 ♂), J.G. Franclemont.

**Etymology.** The name *tapa* is an anagram of *pata*.

**Diagnosis.** Most similar to *C. franclemonti*; see diagnosis under that species.

**Description.** Sexes externally alike, except females slightly larger than males. FW length averages 18 mm in males, 19 mm in females. *Head, thorax, abdomen* – as for *C. franclemonti*, with following differences in wing markings: Forewings slightly paler grey overall, particularly distal third; medial dark area slightly paler; hindwing with slightly paler yellowish base, dark marginal band on average slightly wider than in *C. franclemonti*. *Male genitalia* (Fig. 24) – structurally very similar to that of *C. franclemonti*, with following differences: valve tip slightly more triangular (more squared in *C. franclemonti*); base of vesica with two large, thorn-like cornuti positioned adjacent to each other on left-sublateral area. *Female genitalia* (Fig. 31) – as in *C. franclemonti*, with following differences: antevaginal plate with broad U-shaped medial notch and two short, broadly-rounded triangular lobes, not extending beyond margin of sternum; ductus bursae with a more pronounced ventral twist of right lateral margin.

**Distribution and biology.** The known distribution of *C. tapa* is limited to the Chiricahua, Huachuca, and Santa Rita Mountains of southeastern Arizona, although the species probably occurs in adjacent parts of Mexico. The main flight period is from September to October; a single specimen from early May indicates there may be spring flight. Larvae have been reared on Gambel Oak (*Quercus gambelii*).

**Remarks.** Although previously treated as such, neither *C. tapa* nor *C. franclemonti* is referable to *C. pata*, as pointed out in the 'remarks' section of *C. pata*.

### ***Charadra cakulha* Schmidt & Anweiler, sp. n.**

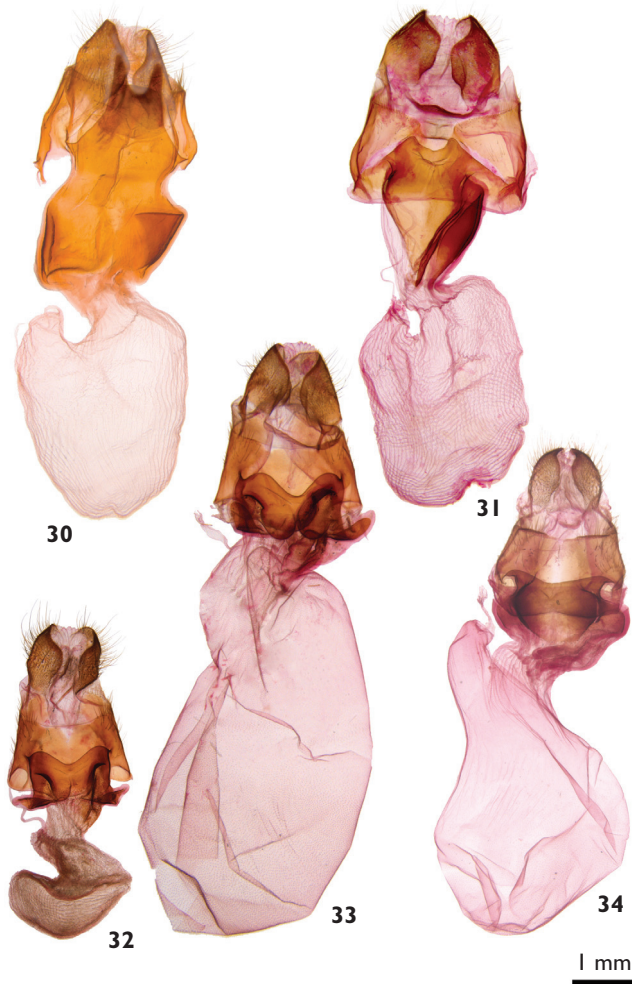
urn:lsid:zoobank.org:act:3FCD51C4-A812-49D5-B653-56922696F08B

Figs 7, 25

**Type material. Holotype** ♂ – MEXICO: "MEX., San Cristobal / de Las Casas, Chi[apa]s. / June 17 1969 / A. Mutuura"; "HOLOTYPE / *Charadra cakulha* / Schmidt & Anweiler" [red label]. CNC. Paratypes – same data as holotype, (1♂). CNC.

**Etymology.** A deity from Mayan mythology, Cakulha is the ruler of the lesser lightning bolts, and brother of Coyopa. It is a noun in apposition.

**Diagnosis.** Externally recognizable by the very pale greyish-white outer third of the forewing and thorax, unique among the *pata* group. In addition to the wing markings, *C. cakulha* is distinguishable from the similar *C. oligarchia* by the lateral, symmetrical cornuti that are fused to the aedeagus (in *C. oligarchia* they are at the base of the vesica with one cornutus massive and one small).



**Figures 30–34.** Female genitalia of *Charadra* species. **30** *C. franclemonti* paratype, Madera Cyn., Santa Rita Mtns., AZ **31** *C. tapa* paratype, Ramsey Cyn., Huachuca Mtns., AZ **32** *C. moneta* paratype, Walnut Cyn., Coconino Co., AZ **33** *C. deridens*, Morehead, KY **34** *C. dispulsa*, Sinton, TX.

**Description.** Female unknown. Forewing length 19.7 mm. *Head, thorax and abdomen* – as in *C. franclemonti*, differing in the following characters: vestiture much paler grey, nearly white; thorax with margin of tegulae and patagia bordered with black scales. Forewing light grey, distal third powdery whitish grey; reniform spot not discernible, reniform area entirely whitish; orbicular broadly oval, whitish with brown diffuse central area; subterminal line poorly defined medially by irregular white line, black scales at costal and anal margin, expanded to a thick, prominent line at anal margin. *Male genitalia* (Fig. 25) – Valves simple, subquadrate apically with a strongly incurved, scoop-shaped dorsocaudal apex; costal process absent; clasper a simple scoop-shaped process about 1/6 length of dorsal valve margin, with broad surface directed dorso-

cephalad; sacculus unmodified; uncus strongly constricted medially and apex bifid, with an overall Y-shaped appearance; tegumen expanded dorsally; saccus V-shaped; juxta triangular; subscaphium strongly sclerotized; aedeagus  $3 \times$  longer than wide, with a very wide, dorsally directed opening to vesica, opening about  $1/3$  total length of aedeagus; vesica directed at about  $90^\circ$  to aedeagus; cornuti usually placed on base of vesica and fused laterally to aedeagus, so aedeagus armed distolaterally with two stout, laterally projecting spines, left one placed slightly more apically; one medial and one distal diverticulum of similar size, oriented dorsally.

**Distribution and biology.** Known only from the two specimens of the type series, collected in mid-June at San Cristobal de las Casas, Chiapas, Mexico.

***Charadra coyopa* Schmidt & Anweiler, sp. n.**

urn:lsid:zoobank.org:act:C3A359C5-34C7-4A8A-BB1D-B6DFCD099CE8

Figs 10, 26

**Type material. Holotype** ♂ – MEXICO: “10268 / Mexico, D. F. [Distrito Federal, Mexico City] / 17 – I – 1946” [white handwritten label]; “T. Escalante / Collection / through / A. C. Allyn, 1974” [white typed label]; “Photographed / by JDG 1001” [pink typed label]; “HOLOTYPE / *Charadra coyopa* / Schmidt & Anweiler” [red label]. USNM.

**Etymology.** The name is derived from Mayan mythology. Coyopa is the ruler of the sound of thunder, and the brother of Cakulha. It is a noun in apposition.

**Diagnosis.** *Charadra coyopa* is superficially most similar to *C. oligarchia*, but with an oblong rather than a round orbicular, and with a prominent pale patch (absent in *C. oligarchia*) below the orbicular. The male vesica has a single massive cornutus, unique in *Charadra*.

**Description.** Female unknown; forewing length 18.9 mm. *Head, thorax and abdomen* – as for *C. franclemonti*, differing in the following characters: prothoracic collar pale brown with a whitish-grey border; vestiture paler grey brown; forewings with basal two-thirds grey brown, distal third (beyond postmedial line) grey, terminal area grey brown; reniform spot yellowish white with oblong, hollow-centered medial line; orbicular elongate oval, yellowish white with diffuse brown central scales; postmedial line distinct and serrate at veins; subterminal line diffuse and brown, expanded to a thick black line at costal and anal margins, two apical black dashes along veins. *Male genitalia* (Fig. 24) – Valves simple, subquadrate apically with an incurved, scoop-shaped dorso-caudal apex, which appears irregular and somewhat spinulose; costal process absent; clasper a simple scoop-shaped process about  $1/6$  length of dorsal valve margin, with broad surface directed dorso-cephalad; sacculus unmodified; uncus strongly constricted medially and apex bifid, Y-shaped; tegumen expanded dorsally; saccus V-shaped; juxta triangular; subscaphium sclerotized and minutely scobinate; aedeagus  $4.5 \times$  longer than wide, with a very wide, dorsally directed opening to vesica, opening about  $1/3$  total length of aedeagus; vesica directed at about  $90^\circ$  to aedeagus; a single, massive rose-thorn like cornutus positioned near base on left side, directed towards vesica base.



**Distribution and biology.** Known only from the holotype specimen from the Mexico City area. The collection date indicates a flight period in January.

***Charadra deridens*** (Guenée)

Figs 11, 12, 14, 15, 17, 18, 27, 33

*Phalaena Bombyx corylina* Martyn, 1797: pl. 26 fig. 70; **syn. n., nomen oblitum.**

*Diphthera deridens* Guenée, 1852 in Boisduval & Guenée 1852: 35 pl. 3, fig. 8.

*Acronycta circulifera* Walker, 1857: 709.

*Charadra contigua* Walker, 1865: 446.

*Charadra ingenua* J. B. Smith, 1906: 10; **syn. n.**

*Charadra sudena* J. B. Smith, 1908: 80.

‡*Charadra deridens* ab. *nigrosuffusa* Strand, [1917]: 46; **unavailable**

*Charadra deridens* form *fumosa* Draudt, in Seitz 1924: 19.

**Type material.** *Phalaena Bombyx corylina* – Type locality: [USA:] Georgia. Unstated number of types [unknown]. **Note** – this name was transferred to the genus *Charadra* by Poole (1989) and therein stated to probably be conspecific with *C. deridens*. *Bombyx corylina* has otherwise not appeared in the published literature in the past 200 years, nor since Poole’s (1989) mention. To preserve the name *Charadra deridens* for a well-known North American species, which has appeared in many publications since its description, we treat *Bombyx corylina* Martyn as a *nomen oblitum* and *Diphthera deridens* Guenée as a *nomen protectum* under the provisions of Article 23.9.2 of the International Code of Zoological Nomenclature (1999). The suppression of the name *corylina* requires that 1) it has not been used as a valid name after 1899 (the usage of the name in Poole (1989) must not be taken into account under the provisions of Article 23.9.6), and 2) the junior synonym (*deridens*) has been used as the presumed valid name, 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. A search of the Zoological Record indicates that both provisions are met.

*Diphthera deridens* – Type locality: North America.

*Acronycta circulifera* – [USA:] East Florida. Female holotype. BMNH; photograph examined.

*Charadra contigua* – [USA:] Georgia. Male holotype. BMNH; photograph examined.

*Charadra ingenua* – Type locality: [USA:] Durango, Colorado. Male lectotype (Fig. 4) designated by Todd (1982). AMNH; examined. **Note** – *Charadra ingenua* has been a “ghost species,” rarely mentioned in the literature and with few specimens in collections. The lectotype is a specimen typical of eastern Colorado *C. deridens* populations, which are slightly smaller and have less contrastingly marked forewings and paler hindwings than eastern North American *C. deridens*. Examination of specimens from western Colorado matching the type of *C. ingenua* are not distinguishable in genital characters from *C. deridens*, so we place *C. ingenua* syn. n. in synonymy with *C. deri-*



*dens*. Specimens from the Guadalupe Mountains of west Texas reported as *C. ingenua* by Blanchard and Franclemont (1981) are *C. moneta* sp. n. (see below).

*Charadra sudena* – Type locality: [USA:] Florida, Miami. Male lectotype designated by Todd (1982). AMNH; photograph examined.

*Charadra deridens* ab. *nigrosuffusa* – an unavailable infrasubspecific name.

*Charadra deridens* form *fumosa* – Type locality: None given [unknown].

**Diagnosis.** *C. deridens* can be identified by it being the only *Charadra* species throughout its range, and is characterized by the typically monochromatic colouring of the forewing (lacking brown shades), and the black scaling in the orbicular spot (diffuse and brownish in *C. moneta*). *Charadra deridens* may prove to be sympatric with *C. moneta* in New Mexico and western Texas, but the two can be distinguished by the more contrasting ‘pupil’ of the orbicular spot in *deridens*, and the white-grey rather than brownish forewing colour of *moneta*, as well as by the genital differences presented in the diagnosis of *C. moneta*.

**Distribution and biology.** Widely distributed, from Nova Scotia to British Columbia (not yet recorded from Alberta), south to Florida, Texas (Knudson and Bordelon 2004) and northeastern New Mexico (Raton, Colfax Co.). The larva, illustrated by Wagner (2005), feeds primarily on beech, oak, and white birch.

**Remarks.** Although quite consistent in appearance within a given geographic region, there is a moderate amount of variation in phenotypes across its range, and a melanistic form (Fig. 16) occurs in the northeastern part of its range (Klots 1968). The palest specimens are from Atlantic Canada (Fig. 11, 15), particularly Nova Scotia. Kentucky specimens are on average smaller with a slight brown cast and reduced white scaling (Figs 14, 18), whereas Colorado specimens are paler overall with less contrasting forewing markings (*ingenua*, Fig. 12).

Four specimens of *C. deridens* from Ontario and Kansas expressed three haplotypes, differing by less than 1%, and at least 2.5% divergent from three *C. moneta* samples.

### ***Charadra moneta* Schmidt & Anweiler, sp. n.**

urn:lsid:zoobank.org:act:3650C4F0-1233-44D0-977B-1FC79CC18A14

Figs 19–22, 28, 32

**Type material.** **Holotype** ♂ – UNITED STATES: “Walnut Canyon 6500’ / 6-1/3 mi EESE Flagstaff / Coconino co., Arizona / 12 September 1965 / J. G. Franclemont”; “HOLOTYPE / *Charadra moneta* / Schmidt & Anweiler” [red label]. CUIC. Paratypes – (33 ♂, 33 ♀) CNC, CUIC, USNM. Arizona: same data as holotype, 9–18 Sep 1965 (27 ♂, 13 ♀); 15 May – 22 June 1966 (6 ♂, 14 ♀); 17 Dec. 1965 (1 ♀); 30 Jan. 1966 (1 ♀); 20 Feb. 1966 (1 ♀); 17 Apr. 1966 (1 ♀); 29 Apr. 1966 (1 ♀). Arizona, Apache Co., 3 mi. S Alpine, 15 June 1966, R.F. Sternitzky (1 ♀).

**Etymology.** During a discussion regarding the distinctness of this taxon compared to *C. deridens*, BCS bet GGA ten dollars that the DNA barcodes of *C. moneta* and *C. deridens* would be more than 1% divergent. *Moneta* is the Latin term for money.

**Diagnosis.** *Charadra moneta* is most likely to be confused with *C. deridens*, from which it differs externally in the overall warm brown tones of the fore- and hindwing (the forewing having more the appearance of the *pata* group), compared to the grey, black and white colour of *C. deridens*. The orbicular spot in *moneta* has a brownish, diffuse pupil, whereas that of *C. deridens* almost invariably has a well-defined central black pupil. Internally, the subdorsal cornuti of the male vesica lacks subapical spines (two or three spines in *C. deridens*), and the vesica differs in shape. The base of the vesica is smaller, with the diameter  $1.3 \times$  that of the aedeagus apex, compared to nearly  $2 \times$  the diameter in *C. deridens*. The basal diverticulum of the vesica has a constricted base in *C. moneta*, but is very broad-based in *C. deridens*. The barcode fragment of the COI gene is about 2.5% divergent between *C. moneta* (New Mexico) and *C. deridens* (Colorado and various eastern North American localities).

**Description.** Sexes externally alike, except females slightly larger than males. FW length averaging 18 mm in males, 19 mm in females. *Head* – palps short, covered in stiff grey, black and white hair-like scales; proboscis well developed; eyes large, globular; frons with short grey and black hair; male antenna broadly bipectinate, with longest rami about seven times as long as width of shaft; female antennae biserrate. *Thorax* – clothed in long light grey, black and brown scales; forewing dark brown, sometimes with a poorly defined slightly darker medial area; antemedial and postmedial black lines well defined to nearly obsolete, often joined medially by a dark lateral streak; area around reniform spot and below orbicular spot with pale-grey or whitish-gray scales; reniform whitish, indistinct, with a diffuse pale-brown infill; orbicular round to slightly oblong, pale grey with diffuse brown infill; subterminal line poorly defined with dark scales, except more prominently lined with black where it meets lower margin and where it bends basad before meeting upper margin; terminal line narrow, black, broken at veins; fringe dark grey and black, faintly checked with lighter grey at veins; hindwing pale fuscous, almost white in basal half with a slightly darker marginal area in distal third; veins darkly scaled along outer half of wing; fringe grey on inner half, white on outer and lightly checkered with black between veins. *Abdomen* – clothed in lead grey hair-like scales mixed with numerous white scales at terminus, with a series of three small dark-grey tufts midway along dorsal centerline; legs grey, banded with black at joints. *Male genitalia* (Fig. 28) – Valve simple and relatively short, lobate; apical and dorsal margin slightly convex; costal process long and sickle shaped, extending to valve apex, with fine, apically directed spinules; clasper club shaped with a caudoventrally directed, pyriform apex, extending to valve apex; sacculus unmodified; uncus slightly constricted medially, apex bluntly rounded with a slight medial notch; tegumen narrow and band-like dorsally; saccus broadly U-shaped; juxta Y-shaped with a triangular base; aedeagus  $4 \times$  longer than wide, with a very wide, dorso-caudally directed opening to vesica, opening about  $1/3$  total length of aedeagus; bulbous base of vesica oriented about  $90^\circ$  to aedeagus; base of vesica with two large cornuti on right side, a subdorsal thorn-like cornutus directed basad, terminating in two or three irregular points; second cornutus situated laterad, consisting of a low, multi-spined crest; one medial and one distal diverticulum, both bulbous, distal one slightly smaller, oriented dorsad.

*Female genitalia* (Fig. 32) – Papillae anales blunt, unmodified; antevaginal plate with broad U-shaped medial notch, proximal margin with a pair of shallow, lightly sclerotized pockets; laterally with ventrally curved, flange-like pockets; ductus short, lightly sclerotized;; corpus bursae pyriform with a broad triangular diverticulum dorsally near junction of ductus bursae; ductus seminalis exiting caudo-ventrally.

**Distribution and biology.** Recorded from central and eastern Arizona (Coconino and Apache Cos.), the San Mateo Mountains of New Mexico, the Guadalupe Mountains of New Mexico and Texas, and the Big Bend region of Texas; south to the Sierra Madre in Nuevo Leon, northern Mexico. Collection dates range from March to June (Arizona, Texas, and New Mexico) and September (Mexico), possibly indicating two or more broods. Much of the type series was reared on *Quercus gambelii*.

**Remarks.** Specimens from New Mexico and Texas have a more smoothly-marked forewing and a less contrasting hindwing marginal band than those from Arizona, but are indistinguishable internally; the type series is therefore restricted to Arizona specimens.

Three barcoded specimens from NM exhibited a single haplotype, at least 2.5% divergent from the sampled *C. deridens* haplotypes.

### ***Charadra dispulsa* Morrison**

Figs 16, 29, 34

*Charadra dispulsa* Morrison, 1875: 214.

**Type material.** Type locality: [USA:] “Waco, Texas.” Holotype female. MCZ; photograph examined, available at <http://insects.oeb.harvard.edu/MCZ/>.

**Diagnosis.** A relatively small, pale silvery-grey species with few forewing markings that are largely confined to a narrow, black antemedial line and a prominent partial medial band from the costa to mid wing. The small size, pale colour, reduced markings, lack of central orbicular black scales, and black medial dash connecting the AM and PM lines allow this species to easily be distinguished.

**Distribution and biology.** Occurs from Texas southward and westward to at least San Luis Potosi, Mexico. Collection records range from March through May and July for southern Texas. Nothing is known of the larval stages or food plants, but larvae are possibly oak feeders.

**Remarks.** Barcode sequence for one specimen of *C. dispulsa* was available, which differed about 3.5% from *C. deridens*, 4% from *C. moneta*, and 6% from *C. franclemonti*.

### **Acknowledgements**

We thank Jan Metlevski and Chuck Harp for providing additional specimens for this study, and Jocelyn Gill for preparing the specimen images. Bruce Walsh kindly

hosted BCS during a field trip where much of the type series of *C. franclemonti* was collected. Evgeny Zakharov, Paul Hebert and other members of the Barcode of Life Project at the University of Guelph, Ontario, Canada, provided DNA data. Molecular analyses were carried out through grants from the National Science and Engineering Research Council of Canada and Genome Canada through the Ontario Genomics Institute.

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# *Cucullia umbratica* (Lepidoptera, Noctuidae), a new European noctuid in North America

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## Abstract

The discovery of a noctuid new for North America, *Cucullia umbratica* (Linnaeus, 1758) (Lepidoptera: Noctuidae), is reported from the Magdalen Islands (Québec, Canada). A male and a female from the Islands are illustrated as well as specimens of the superficially similar species *Cucullia intermedia* Speyer, 1870. The male genitalia of both species are illustrated.

## Keywords

*Cucullia umbratica*, *Cucullia intermedia*, non-native species, alien species, European noctuid, introduction, Magdalen Islands, Québec

## Introduction

Since 1998, whenever the weather was favorable, Sandrine Papageorges has collected Lepidoptera using a light trap on behalf of the senior author (LH) at Havre-aux-Maisons, Magdalen Islands, in the province of Québec, Canada.

Each year, from 1998 to 2003, some specimens (5–10 each season) of the genus *Cucullia* Schrank (Lepidoptera: Noctuidae) were collected, and considering the low numbers and generally poor condition, they were identified as *Cucullia intermedia* Speyer, 1870. After 2003, *Cucullia* appeared in much larger numbers, 40–70 each

season, culminating with more than 100 in 2008. The numbers and the quality of the specimens collected led the author to investigate further and to realize, to his surprise, that the specimens were *Cucullia umbratica* (Linnaeus, 1758), a Eurasian species not previously reported from North America (Poole 1995, Handfield 1999, Ronkay and Ronkay 1994). Re-examination of the older material revealed that both *Cucullia intermedia* and *Cucullia umbratica* had been in the samples since 1998, but the latter had not been recognized.

Considering the small numbers collected when it was first detected, *Cucullia umbratica* was probably accidentally introduced in the 1990s. We believe that its rapid spread on the Magdalen Islands and its strong flight habits (Ronkay and Ronkay 1994) suggest an imminent arrival on the mainland, either in the adjacent Maritime Provinces, or in the Gaspé Region of Québec.

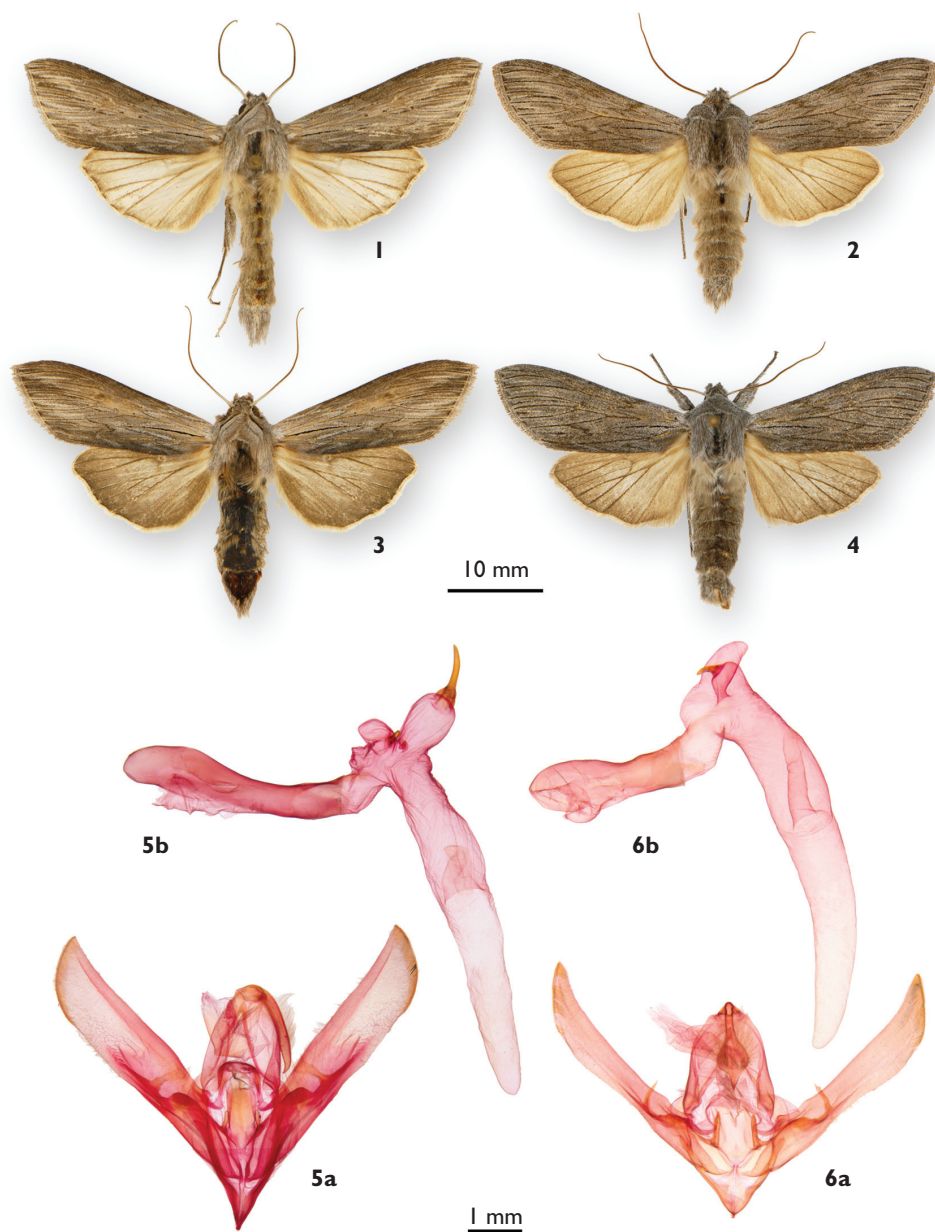
The larvae primarily use the flowers of *Sonchus* L., *Hieracium* L. and *Lactuca* L. (Asteraceae) (Ronkay and Ronkay 1994) as host plants in Europe. Plants in these genera of European origin are now common not only on the Magdalen Islands, but also throughout most of eastern North America (Rousseau 1968, 1974). Consequently, no significant impact is predicted either economically or on the flora and Lepidoptera fauna, including the indigenous species of *Cucullia* because the native species are not known to use these plants as primary hosts (Robinson et al. 2002). *Cucullia intermedia*, however, may be an exception because it has apparently declined in numbers with increasing abundance of *C. umbratica*; it has not been caught since 2002, and was rarely collected prior to this.

Adult specimens of *C. umbratica* were first collected on the Magdalen Islands in 1998 and each year thereafter from mid-June to mid-August, with a peak during the last three weeks of July. Only one generation per year has been observed on the Magdalen Islands. This species most closely resembles the North American *C. intermedia*, although the hind wings of males are mainly dirty white (Fig. 1) compared to fuscous brown in *C. intermedia* (Fig. 2). In females, the hindwing is dark brown in both species (Figs 3, 4). A thin reddish-brown band longitudinally crossing the forewing to the apex is characteristic of *C. umbratica* (Figs 1, 3) (Ronkay and Ronkay 1994).

The male genitalia of *C. umbratica* (Fig. 5) differ from those of *C. intermedia* (Fig. 6) in that the uncus is tapered, the clavus is shorter than the width of the sacculus, the sacculus is angled posteriorly, the clasper is apically enlarged, and in the vesica there is a large subbasal diverticulum with an apical cornutus, both longer than the basal diverticulum. In *C. intermedia* the uncus is expanded and rounded subapically, the clavus is longer than the width of the sacculus, the sacculus is tapered posteriorly, the clasper is apically spine-like, and in the vesica the subbasal diverticulum and cornutus are both shorter than the basal diverticulum.

## Acknowledgements

We thank Sandrine Papageorges and Lucie d'Amours for their constant and valuable collaboration in the study of the Lepidoptera fauna of the Magdalen Islands. We are



**Figures 1–6.** *Cucullia* spp.: 1–4 Adults of *Cucullia* spp. 1 *Cucullia umbratica*, ♂, Havre-aux-Maisons, Magdalen Islands, Québec 2 *Cucullia intermedia*, ♂, Edmundston, New Brunswick 3 *Cucullia umbratica*, ♀, Havre-aux-Maisons, Magdalen Islands, Québec 4 *Cucullia intermedia*, ♀, Edmundston, New Brunswick 5–6 Male genitalia of *Cucullia* spp. 5 *Cucullia umbratica* 6 *Cucullia intermedia*.

also grateful to Donald Lafontaine not only for the loan of the trap used, but also for the dissection of the genitalia of the specimens of *C. umbratica* from Europe and the Magdalen Islands, and of *C. intermedia*. Finally, we thank Jocelyn Gill, of the Canadian National Collection of Insects, Arachnids, and Nematodes (CNC) in Ottawa, for her care in preparing the genitalia and the photographs.

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# A revision of the genus *Bryolymnia* Hampson in North America with descriptions of three new species (Lepidoptera, Noctuidae, Noctuinae, Elaphriini)

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[urn:lsid:zoobank.org:pub:D51F6A11-B3CD-4877-9B75-36B966F299C1](https://doi.org/urn:lsid:zoobank.org:pub:D51F6A11-B3CD-4877-9B75-36B966F299C1)

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## Abstract

The three known North American species of *Bryolymnia* Hampson, 1908 are reviewed and three additional species are described as new. Two additional species, *Elaphria ensina* (Barnes, 1907) and *Cryphia viridata* (Harvey, 1876) are transferred to *Bryolymnia* as new combinations. The North American species are compared with related species in Central America. Adults of 11 species and male and female genitalia, where available, are illustrated.

## Keywords

Taxonomy, *Bryolymnia*, *Elaphria*, *Bryolymnia anthracitaria*, *Bryolymnia biformata*, *Bryolymnia ensina*, *Bryolymnia marti*, *Bryolymnia mixta*, *Bryolymnia semifascia*, *Bryolymnia viridata*, *Bryolymnia viridimedia*, *Cryphia*, Arizona, California, Costa Rica, Guatemala, Mexico, New Mexico

## Introduction

The genus *Bryolymnia* Hampson, 1908 includes 17 species occurring from western United States to Argentina (Poole 1989). An additional two species transferred to *Bryolymnia*, one from *Elaphria* Hübner, one from *Cryphia* Hübner, and the three species described below, bring the total to 22 species.

The genus is associated with the Elaphrini on the basis of the weakly sclerotized area on the costa of the male valve near the apex of the digitus, and by the membranous transverse suture in the sacculus about 2/3 from its base that isolates the apical triangular sclerite that usually is more heavily sclerotized than the basal part of the sacculus.

*Bryolymnia* can be recognized by the large, rounded or lobed plate-like process arising from the sclerotized rod that connects the dorsoanterior rod of the clasper to the costal margin of the valve. In most species this process extends dorsally beyond the dorsal margin of the valve. Superficially, in most species of *Bryolymnia* the medial forewing area is pale and contrasts with black patches in the basal area, before or distal to the reniform spot, and/or in the costal part of the subterminal area. In some species the medial area is dark brown (and some species have forms in which the medial area may be dark or light); usually the dark patches are still contrasting, and frequently the reniform and orbicular spots are shaded with white scales.

The genus is closely related to *Hampsonodes* Nye, which has 17 species ranging from Mexico to South America. These species have an orange-red forewing with thin white antemedial and postmedial lines that unite toward the hind margin to isolate the medial area in a rounded lobe. The genitalia are similar to those of *Bryolymnia* except that the vesica is very long and coiled. The relationship of *Bryolymnia* and *Hampsonoides* remains to be resolved and it appears that numerous species currently associated with *Hampsonoides* and *Elaphria* may belong in *Bryolymnia*. One species is transferred from *Elaphria* Hübner (*B. ensina* (Barnes, 1907), comb. n.) and one (*B. viridata* (Harvey, 1876), comb. n.) is transferred from *Cryphia* Hübner.

## 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
- CDF** Personal Collection of Clifford D. Ferris, Laramie, Wyoming, USA.
- CNC** Canadian National Collection of Insects, Arachnids, and Nematodes, Ottawa, Ontario, Canada.
- CSUC** C. P. Gillette Museum of Arthropod Diversity, Colorado State University, Fort Collins, Colorado, USA.
- CUIC** Cornell University Insect Collection, Ithaca, New York, USA.



- JBW** Personal collection of J. Bruce Walsh, Tucson, Arizona, USA.  
**NMSU** New Mexico State University, Las Cruces, New Mexico, 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).

### ***Bryolymnia* Hampson, 1908**

Type species. *Dacira roma* Druce, 1894, by subsequent designation by Hampson 1910.

**Diagnosis. Adults.** Males and females of similar size; forewing length 9–18 mm.  
**Head** – Male antenna filiform to beadlike, occasionally very slightly biserrate; setae tending to group into tuft on each side in species with slightly biserrate antenna. Female antenna filiform, minutely setose ventrally. Frons rounded and smooth, or slightly bulging in middle, covered with short broad scales. Eye rounded, surface smooth, without surface hair. Labial palpus porrect, apical segment  $0.3\text{--}0.4 \times$  as long as second segment. **Thorax** – *Thorax*: covered with broad apically serrated scales; scales tend to form slightly raised dorsal tuft on prothorax and spreading, slightly doubled dorsal tuft on metathorax. *Wings*: Forewing ground color typically of brown and black with areas of white or pale green, especially medial area. Hindwing white to fuscous. *Legs*: Covered with short broad scales; tarsi with three ventral rows of spiniform setae. **Abdomen** – Base of abdomen with basal abdominal brushes, levers, levers and pockets in most species. Eighth abdominal sternite of male with slightly eversible coremata with a tuft of long setae. **Male genitalia** – Uncus cylindrical, thin, tapered from base to spine-like apex. Tegumen broad, truncated apically, ventrally expanded on posterior surface into round projecting lobe on each side. Valve long and mainly parallel sided, most often bent dorsally at point of weakness of costa; costa a sclerotized thickening on dorsal margin of valve, but dorsal margin with weakly sclerotized area at point where digitus bends away from costa; a slightly expanded cucullus with partial or complete corona on apical margin; digitus mainly a sclerotized band fused to mesial surface of valve adjacent and partially fused with costa, except at weakened area of costa where digitus bends obliquely posteroventrally across valve with apex tapered and free from surface of valve; apical part of clasper a simple curved (or slightly S-shaped) rod projecting posteriorly on inner surface of valve, with minute teeth or short subbasal process in some species; ventral base of clasper extending as a thin sclerotized rod to apex of sacculus; dorsal base of clasper diagnostic, expanded into large, rounded or lobed heavily sclerotized plate extending above dorsal margin of valve; sacculus  $0.3\text{--}0.4 \times$  length of valve, mainly weakly sclerotized, with membranous transverse suture at  $2/3$  from base and with apical  $1/4$  more heavily sclerotized. Aedeagus weakly and patchily sclerotized, often with apical part of aedeagus extended as variably sclerotized straps onto base of vesica. Vesica short, about  $1.5\text{--}2.0 \times$  length of aedeagus; vesica variably armed with “brushes” of long

thin spines, stout cornuti, often projecting obliquely from a strongly sclerotized base, or with fields of minute spinules. **Female genitalia** – Corpus bursae thin and membranous, rounded, oval, or elongated, with one or two long signa in some species. Ductus seminalis at posterior end of corpus bursae in most species. Appendix bursae absent in most species; one species in North America (*B. semifascia*) with rounded, sclerotized appendix bursae at junction of corpus bursae and ductus bursae. Ductus bursae with length, shape, and amount and position of sclerotization highly variable and species-specific. Ventral wall of ostium bursae sclerotized and forming a plate that projects posteriorly. Anterior and posterior apophyses rod-like,  $1.0\text{--}1.5 \times$  length of abdominal segment eight. Anal papillae lightly sclerotized rounded posteriorly, covered with mixture short and long setae.

### Key to species of *Bryolymnia* of North America north of Mexico

1. Forewing with green\* shading in medial area ..... 2
- Forewing with yellow-brown to dark-brown shading in medial area (a white patch in lower part of medial area in one species) ..... 4
2. Forewing ground color almost entirely green ..... *B. viridata*
- Forewing with green or white shading confined to medial area ..... 3
3. Middle part of antemedial line with squared off indentation basal to claviform spot; lower part of antemedial line extending outward as lobe into medial area; forewing length 14 to 18 mm ..... *B. viridimedia*
- Middle part of antemedial line with small rounded indentation basal to claviform spot; lower part of antemedial line extending inward, so green shading in medial extends almost to wing base; forewing length 11 to 13 mm .... *B. marti*
4. Forewing with black streak extending from orbicular spot, through lower part of reniform spot to subterminal line ..... *B. anthracitarea*
- Forewing with dark patch or streak, if present, between reniform spot and subterminal line ..... 5
5. Dorsum of thorax with white scales; lower 1/2 of medial area usually with white shading ..... *B. semifascia*
- Dorsum of thorax brown or black; medial area without white shading ..... 6
6. Forewing with basal, antemedial, medial, and subterminal areas mottled with pale-brown and blackish-brown shading ..... *B. mixta*
- Forewing with medial area orange brown to brown, contrasting with blackish-brown shading in antemedial and subterminal areas ..... 7
7. Forewing with medial area brown or orange brown with one or two black streaks between reniform spot and subterminal line; upper 1/2 of antemedial area dark blackish brown; subterminal area brown and black ..... *B. ensina*
- Forewing with medial area mainly yellowish brown or brown with contrasting dark-brown or blackish-brown shading in basal and antemedial areas and between reniform spot and postmedial line; subterminal area brown with extensive hoary-gray shading ..... *B. biformata*

\* Note – Green color changes to yellowish white in preserved specimens after exposure to excessive humidity.

## Systematics

### *Bryolymnia viridimedia* (Smith, 1905)

Figs 1–3, 25, 34

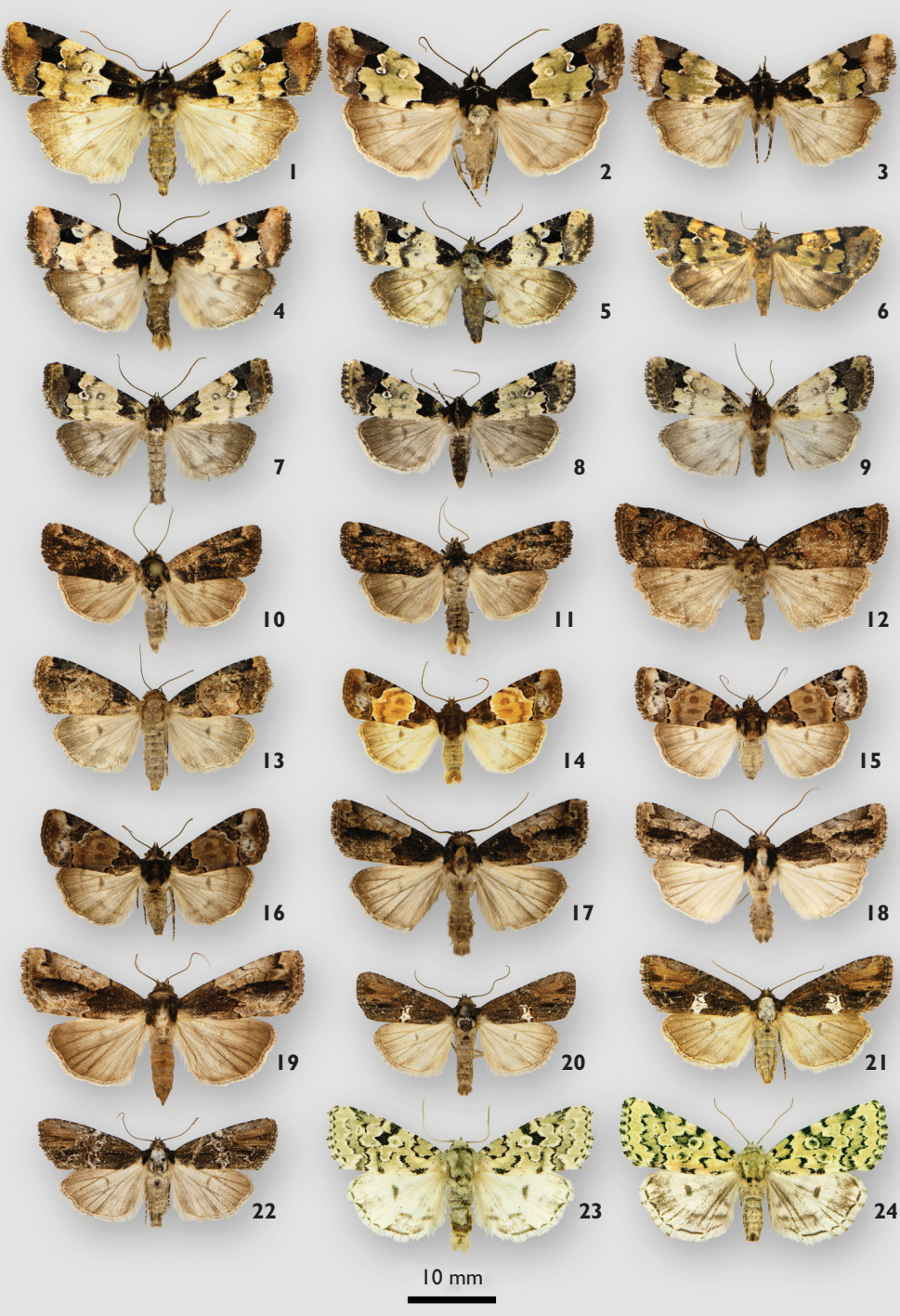
*Bryophila viridimedia* Smith 1905: 188.

**Type material.** Holotype ♂. Arizona, Cochise Co. AMNH, examined.

**Other material examined and distribution.** **Mexico:** States of Chihuahua, Durango (Sierra Madre Occidental), Mexican Federal District. **USA: Arizona:** Cochise Co. (Huachuca Mts) and Santa Cruz Co. (Santa Rita Mts).

**Diagnosis.** Superficially *Bryolymnia viridimedia* can be recognized by large size (forewing length: 14–18 mm), extensive pale-green shading in the medial area, and the course of the antemedial line on the forewing. On the forewing the antemedial line has a rectangular indentation between the cubital and anal veins, and an outward loop below the anal vein; the basal area is black, except for the area below the anal vein, which is pale green; the subterminal and terminal areas are mainly brown with gray scales (mainly adjacent to the lower part of the postmedial line, and with a dark-fuscous truncated wedge-shaped patch on the costa. The hindwing is pale fuscous with darker shading on the veins, discal spot, postmedial line, and wing margin. *Bryolymnia viridimedia* is similar to *B. poasia* Schaus, 1911 from Costa Rica (Figs. 4, 5, 26, 35) and *B. marti* (described below). *Bryolymnia poasia* is smaller (forewing length: 12–14 mm) than *B. viridimedia*, the forewing medial area is white or whitish buff, not green, and the genitalia differ. **Male genitalia.** In *B. viridimedia* the cucullus is short, similar in width to the rest of the valve, and has a partial corona on the dorsal-apical margin; the clasper is a simple finger-like process with a large rounded or slightly lobed sclerotized plate on the dorsal-anterior rod at the base of the clasper. The vesica has two dense patches of long spines ventrolaterally on the right, one postmedial and one preapical, the latter on a short diverticulum. In *B. poasia* (Fig. 26) the valve is straighter and narrower toward the base, the rounded sclerotized plate on the dorsal-anterior rod at the base of the clasper is larger and more rounded, and the vesica is short with a single large basal cornutus on a large base. **Female genitalia.** The corpus bursae is oval, 4 × as long as abdominal segment eight and 0.8 × as long as the ductus bursae. The ductus bursae is long and narrow with irregular sclerotized ridges longitudinally, especially mesially and anteriorly. The ostium bursae has an elongated heavily sclerotized plate in the ventral wall with rounded sides and a deep central notch posteriorly.

**Distribution and biology.** *Bryolymnia viridimedia* occurs from southeastern Arizona (Huachuca and Santa Rita Mountains) southward in the Sierra Madre Occidental to the Mexico City area. Collecting dates range from early July to mid-September. *Bryolymnia bicon* occurs south of the range of *B. viridimedia*, from the State of Veracruz in central-eastern Mexico southward to Costa Rica.





***Bryolymnia marti* Holland, sp. n.**

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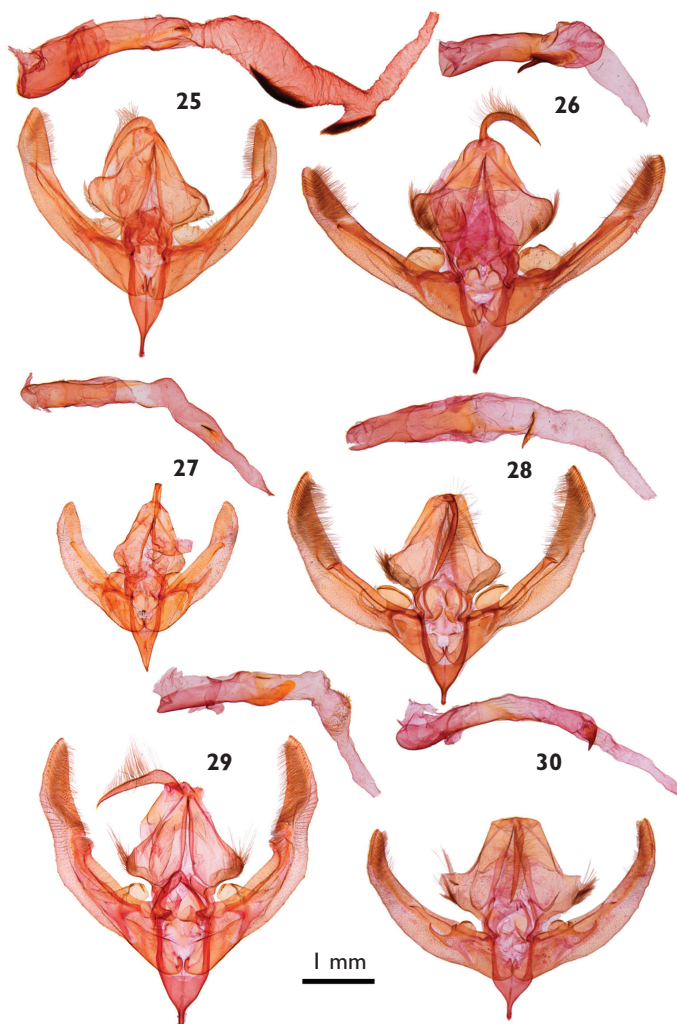
Figs 7–9, 27, 36

**Type material. Holotype** ♂. New Mexico, Bernalillo Co., Manzanita Mts. south of Tijeras, 7500', Locust site, Oak Flat Picnic Area, 17 June 2007, R. Holland & M. Romero. CNC. **Paratypes:** 16 ♂, 19 ♀. **USA, Arizona.** Graham Co., Mt. Graham, Pinaleno Mts., 9000', Cunningham Campground, 26 June 2007, J. B. Walsh (1 ♂, 1 ♀). **New Mexico.** Same locality and collectors as for holotype, 23 May 2006, 14 June 2006, 1 July 2006, 17 June 2007 (9 ♂, 11 ♀); Grant Co., Mimbres Mts., Spring Canyon, 7000', 24 June 2008 (2 ♂, 1 ♀), 22–23 June 2009 (3 ♂, 6 ♀), C. D. Ferris; Otero Co., Cathey Canyon Overlook, 8500', Route 6563 12.4 mi S of junction with Rt. 330 south of Cloudcroft, 16 June 2006, G. S. Forbes, coniferous forest (1 ♂). Paratypes deposited in AMNH, BMNH, CDF, CSUC, CNC, JBW, NMSU, USNM.

**Other material examined. Mexico. Durango.** 10 mi W El Salto, 9000', 6–23 June 1964, J. E. H. Martin & W. C. McGuffin (5 ♀).

**Etymology.** The species is named in honor of Marti Romero, who first collected the species and was extremely helpful in collecting most of the type series.

**Figures 1–24.** *Bryolymnia* adults. **1** *B. viridimedia* ♀, Mexico, Durango, 10 mi W El Salto, 9000' **2** *B. viridimedia* ♀, Arizona, Santa Cruz Co., Santa Rita Mts., Madera Canyon, 5800' **3** *B. viridimedia* ♀, Mexico, Zacualpan **4** *B. poasia* ♂, Costa Rica, San Jose, San Gerardo de Dota, 2230 m **5** *B. poasia* ♀, Costa Rica Prov. Cartago, R. F. Los Santos, 2400 m **6** *B. picturata* holotype ♀, Mexico, Veracruz, Las Vigas **7** *B. marti* holotype ♂, New Mexico, Bernalillo Co., Manzanit Mts. south of Tijeras, 7500' **8** *B. marti* ♀, New Mexico, Bernalillo Co., Manzanit Mts. south of Tijeras, 7500' **9** *B. marti* ♂, Arizona, Graham Co., Pinaleno Mts., Cunningham Campground, 9000' **10** *B. mixta* holotype ♂, Arizona, Santa Cruz Co., Patagonia Mts., rest stop on Arizona Hwy 82, 3 mi W of Patagonia, 4000' **11** *B. mixta* ♂, Arizona, Santa Cruz Co., Patagonia Mts, Patagonia roadside rest, Hwy mile 15.6 **12** *B. ensina* ♀, Mexico, Durango, 10 mi W El Salto, 9000' **13** *B. ensina* ♀, New Mexico, Grant Co., Pinos Altos Mts., south end of Cherry Creek Campground, 6753' **14** *B. biformata* holotype ♂, Arizona, Santa Cruz Co., Santa Rita Mts., Madera Canyon, 5800' **15** *B. biformata* paratype ♀, Arizona, Santa Cruz Co., Santa Rita Mts., Madera Canyon, 5800' **16** *B. biformata* paratype ♀, Arizona, Santa Cruz Co., Santa Rita Mts., Madera Canyon, 5800' **17** *B. anthracitaria* paratype ♂, Arizona, Cochise Co., Huachuca Mts, Ash Canyon, 5100' **18** *B. anthracitaria* paratype ♂, Arizona, Santa Cruz Co., Pena Blanca, 3950' **19** *B. anthracitaria* paratype ♀, Arizona, Santa Cruz Co., Santa Cruz Co., Santa Rita Mts., Madera Canyon **20** *B. semifascia* ♂, Cochise Co., Huachuca Mts, Ash Canyon, 5100' **21** *B. semifascia* ♀, Colorado, Grand Co., Radium State Wildlife Area, 7040' **22** *B. semifascia* ♀, New Mexico, Socorro Co., Bosque del Apache Nacional Wildlife Refuge **23** *B. viridata* ♂, California, Sonoma Co., Petaluma **24** *B. viridata* ♀, California, Sonoma Co., Petaluma.



**Figures 25–30.** *Bryolymnia* male genitalia. **25** *B. viridimedia* **26** *B. poasia* **27** *B. marti* **28** *B. mixta* **29** *B. ensina* **30** *B. biformata*.

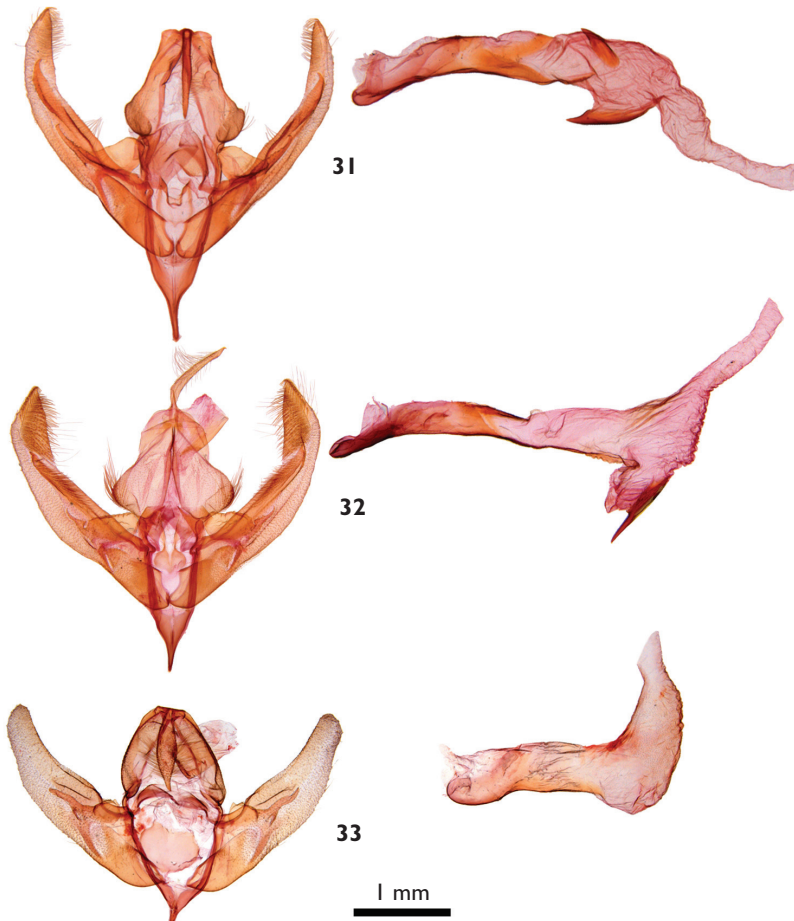
**Diagnosis.** *Bryolymnia marti* can be recognized by small size (forewing length: 11–13 mm), the pale-green shading in the medial area, mainly blackish-gray shading in the subterminal and terminal areas, except near the forewing apex, and by the course of the antemedial line, which has a shallow, rounded indentation between the cubital and anal veins, and curves in toward the wing base at the anal vein. It is most closely related to *B. picturata* (SE Mexico) (Fig. 6) and *B. poasia* (Costa Rica) (Figs. 4, 5, 26, 35). *Bryolymnia marti* differs from *B. picturata* in having paler green shading in the medial area, mainly dark fuscous shading in the subterminal and terminal areas,



instead of gray-green shading, a less prominent medial line, and a smaller black dot in the orbicular spot.

**Description. Adults.** Male and female similar in size, color, and maculation. **Head** – Male antenna with flagellomeres very slightly swollen laterally; setae tending to group into two or three clusters on each side of each segment. Palpi and head a mixture of broad, apically serrated pale-brown and blackish-brown scales predominating. **Thorax** – Covered with scales similar to those on head, except blackish-brown scales predominating; a slightly divided dorsal tuft on metathorax. **Legs:** Covered with blackish-brown scales with white band in middle of tibiae and at apices of tarsal segments. Tibia without spiniform setae. **Wings:** Forewing length: 11–12 mm. Dorsal forewing ground color black in basal and antemedial area, pale whitish green in medial area, and a mixture of black, brown and greenish gray in subterminal and terminal areas; subterminal line with concave notch between cubital and anal veins, and bending abruptly toward wing base below anal vein; medial line obscure or diffuse in most specimens; postmedial line black, slightly serrated with a series of short wedge-shaped extensions projecting into medial area; subterminal line evident only near costa where blackish gray in upper part of subterminal area contrasts with paler greenish gray in upper part of terminal area; terminal line black; fringe dark gray with white scales at end of veins; orbicular spot usually obscure but outlined partially or completely in black in some specimens; reniform spot shaped like figure 8 but upper part usually obscure, lower part white with black outline and small black central dot.

Dorsal hindwing white with varying amount of fuscous, especially on veins, discal spot, postmedial line, and wing margin; females averaging slightly darker than males; fringe fuscous with white basal line and sometimes with white on outer margin. **Male genitalia** – Uncus cylindrical, tapered to spine-like apex. Valve somewhat oval, broad mesially, tapered apically with dorsal margin angled upward at membranous part of costa; cucullus with weak corona on apical half of outer margin; digitus long and tubular, fused to costal margin of valve to costal angle, then free of valve and slightly spatulate; apical part of clasper slender and very slightly upcurved, dorsal part of basal rod extending to dorsal margin of valve enlarged into apically rounded process extending beyond dorsal margin of valve; apical part of sacculus beyond postmedial suture more heavily sclerotized than basal part. Aedeagus irregularly sclerotized with narrow sclerite extending onto vesica ventrally to base subbasal bend in vesica. Vesica about 1/2 as long as aedeagus with postmedial cornutus tapered to sharp point. **Female genitalia** – Corpus bursae membranous, oval, slightly shorter than ductus bursae, with single long signum ventrally and ductus seminalis arising on right near junction with ductus bursae. Ductus bursae long and slender, membranous except for lightly sclerotized band about 3/4 from posterior end. Ostium bursae with broad sclerotized plate in ventral wall with deeply concave posterior margin.



**Figures 31–33.** *Bryolymnia* male genitalia. **31** *B. anthracitaria* **32** *B. semifascia* **33** *B. viridata*.

**Distribution and biology.** *Bryolymnia marti* occurs from central New Mexico and east-central Arizona southward to the State of Durango in northern Mexico. Adults have been collected between early June and early July in conifer forests.

***Bryolymnia mixta* Lafontaine & Walsh, sp. n.**

urn:lsid:zoobank.org:act:1F7549F2-FF28-406A-8DEC-AC617DBA532E

Figs 10, 11, 28

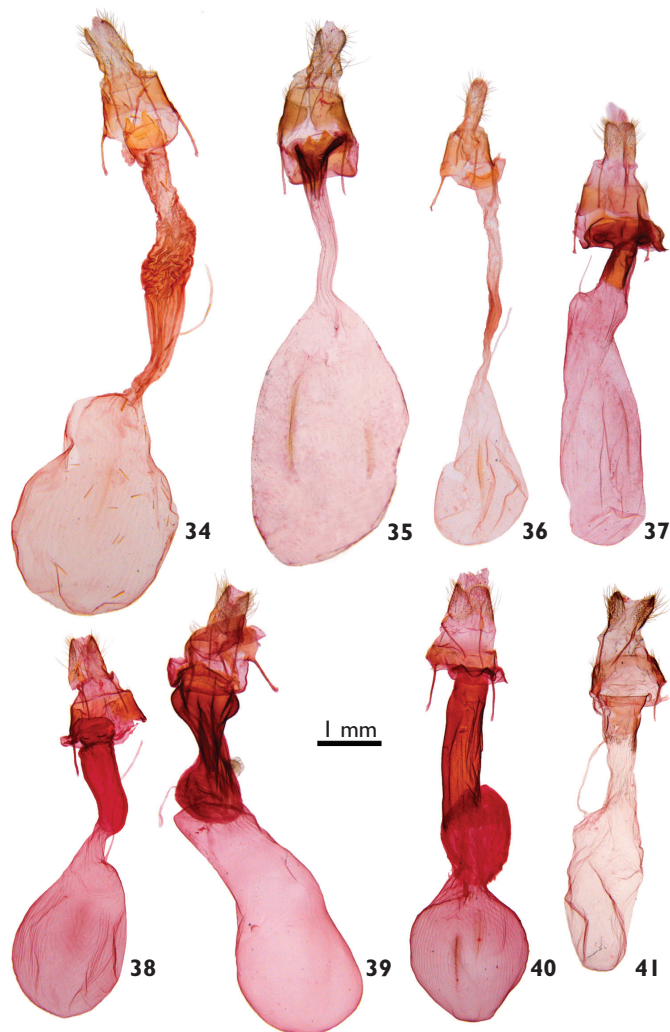
**Type material.** **Holotype** ♂. Arizona, Santa Cruz Co., Patagonia Mts., rest stop on Arizona Hwy. 82, 3 mi W of Patagonia, 4000', 11 July 2002, B. Walsh. CNC. **Para-type:** 1 ♂. **USA, Arizona.** Santa Cruz Co., Patagonia Mts., Patagonia roadside rest, Hwy mile 15.6, 27 June 2006, B. Walsh, riparian habitat. Paratype deposited in JBW.

**Etymology.** The name *mixta* is from the Latin *mixtus*, meaning mixed or mingled and refers to the blotchy confused appearance of the forewing maculation.

**Diagnosis.** *Bryolymnia mixta* can be recognized the mottled black and brown forewing pattern that obscures the maculation. It is most similar to *B. ensina*, but in *B. mixta* there is much more black shading in the medial area than the basal area, the opposite of *B. ensina*. In the male genitalia the sclerotized plate at the base of the clasper is somewhat mushroom shaped, narrow basally and abruptly expanded apically, and the apex of the digitus also is abruptly expanded. In the vesica there is a narrow sclerotized rod that extends from the apex of the aedeagus to a long spine-like medial cornutus. In *B. ensina* the sclerotized plate on the basal arm of the clasper is tapered to a broadly rounded apex, and the digitus is tapered apically. In the vesica of *B. ensina* there is a broad, heavily-sclerotized lobe extending from the apex of the aedeagus onto the vesica and the apical 1/2 of the vesica is covered with minute spines.

**Description. Adults.** Female unknown. **Head** – Male antenna with flagellomeres very slightly swollen laterally; setae tending to group into two or three clusters on each side of each flagellomere. Palpi and head a mixture of broad apically serrated pale-brown and blackish-brown scales, the latter predominating. **Thorax** – Covered with scales similar to those on head, except blackish-brown scales predominating; a slightly divided dorsal tuft on metathorax. **Legs:** Covered with blackish-brown scales with white band in middle of tibiae and at apices of tarsal segments. Tibia without spiniform setae. **Wings:** Forewing length: 12 mm (2 specimens). Dorsal forewing ground color brown heavily dusted with blackish-brown scales, especially in lower part of medial area, to a lesser degree in lower part of basal and subterminal areas, and forming a dark streak distal to reniform spot and in costal part of subterminal area; antemedial and postmedial lines black but partially obscured by scattered black scales on forewing; reniform and orbicular spots with some gray scales but mainly obscured by mottled ground color; subterminal line and apical part of terminal area pale brown; fringe dark gray. Dorsal hindwing fuscous, darker on discal spot, veins, and wing margin. Fringe pale buff with fuscous medial line. **Male genitalia** – Uncus cylindrical, tapered to spine-like apex. Valve strap-like with ventral margin slightly convex near middle and dorsal margin slightly angled at point of weak sclerotization; apex of valve with well-developed corona on outer margin; digitus long and tubular, mainly fused to costal margin of valve except for short spatulate apex; apical part of clasper slender and upcurved, dorsal part of basal rod extending to dorsal margin of valve enlarged into apically rounded process with narrow base, somewhat mushroom shaped; apical part of sacculus beyond postmedial suture slightly more heavily sclerotized than basal part. Aedeagus irregularly sclerotized with narrow sclerite extending onto vesica on right to base of submedial cornutus. Vesica about as long as aedeagus with tapered cornutus about 2/3 as long as width of vesica. **Female genitalia** – Unknown.

**Distribution and biology.** *Bryolymnia mixta* is known only from the Patagonia Mountains in southeastern Arizona. Adults were collected in late June and mid-July.



**Figures 34–41.** *Bryolymnia* female genitalia. **34** *B. viridimedia* **35** *B. poasia* **36** *B. marti* **37** *B. ensina* **38** *B. biformata* **39** *B. anthracitaria* **40** *B. semifascia* **41** *B. viridata*.

***Bryolymnia ensina* (Barnes, 1907), comb. n.**

Figs 12, 13, 29, 37

*Oligia ensina* Barnes 1907: 12.

*Calymniodes obliquirena* Hampson 1918: 151.

**Type material.** *Oligia ensina*: **holotype** ♂, USNM, examined. Type locality: USA, Arizona, [Cochise Co.], Huachuca Mts. *Calymniodes obliquirena*: **holotype** ♂, BMNH, examined. Type locality: USA, Arizona, [Cochise Co., Huachuca Mts.], Palmerlee.

**Other material examined and distribution.** **Mexico:** State of Durango (Sierra Madre Occidental). **USA: Arizona:** Cochise Co. (Huachuca Mts); **New Mexico:** Grant Co. (Pinos Altos Mts).

**Diagnosis.** *Bryolymnia ensina* is a medium-sized species (forewing length: 12–14 mm), with a mainly brown or orange-brown forewing with blackish-brown shading in the upper half of the antemedial area, in the subterminal area, especially toward the costa, and as one or two dark streaks between the reniform spot and the subterminal line. It looks like a large form of *Bryolymnia biformata*, but the dark shading on each side of the paler medial area is much more patchy than in *B. biformata*. The hindwing is pale fuscous basally with darker fuscous on the veins, discal spot, and on the outer 1/3 of the wing. *Bryolymnia ensina* appears to be most closely related to *B. mixta* on the basis of the male genitalia, but the details of male genitalia and the mainly pale medial area of the forewing allow the two species to be readily separated. **Male genitalia.** The male genitalia are similar to those of *B. mixta*, but in *B. ensina* the uncus is swollen dorsally toward the base, not cylindrical, the dorsal process from the basal arm of the clasper is rounded and tapered, not basally constricted, the digitus is fused to the inner surface of the valve, not free of the valve and apically spatulate as in *B. mixta*, and the clasper has a short dorsal branch about 1/3 from the base. The sclerotized extension of the aedeagus is broad, heavily sclerotized, and apically rounded, unlike the slender extension in *B. mixta*. The vesica has no cornutus, unlike many other species of *Bryolymnia*, and the apical half of the vesica is covered with minute spines. **Female genitalia.** These are most likely to be similar to the female genitalia of *B. mixta*, which are unknown. The ductus bursae is short, 1/3 as long as the corpus bursae, and the posterior 2/3 is heavily sclerotized and fused into a broad posteriorly convex ostium bursae with a small pouch on each side of the ostium. The corpus bursae is oblong, 3 × as long as wide, with two long thin signa.

**Distribution and biology.** *Bryolymnia ensina* occurs in coniferous forests from southeastern Arizona (Huachuca Mts.) and southwestern New Mexico (Pinos Altos Mountains) southward in the Sierra Madre Occidental to the State of Durango. Collecting dates range from mid-June to mid-July.

***Bryolymnia biformata* Lafontaine & Walsh, sp. n.**

urn:lsid:zoobank.org:act:972C9617-5788-4CD9-B565-61ACC6A0F1C3

Figs 14–16, 30, 38

**Type material.** **Holotype** ♂. Arizona, Santa Cruz Co., Santa Rita Mts., Madera Canyon, 5800', 30 June 1960, J. G. Franclemont [pale form]. **CUIC.** **Paratypes:** 73 ♂, 227 ♀. **USA, Arizona.** Cochise Co., Huachuca Mts., Cave Canyon, 6075', 19 July 1995, Thomas E. Dimock (1 ♀). Santa Cruz Co., same locality and collector as for holotype, 16 June – 12 July 1960 (66 ♂, 207 ♀); Santa Cruz Co., Patagonia Mts., Harshaw, 4900', UV/MV lights, 3 August 2007, B. Walsh (1 ♀); Santa Cruz Co., Santa Rita Mts., Madera Canyon, 4800', 2–24 July 1959, 14 June – 23 July 1960, J. G. Franclemont (7 ♂, 18 ♀). Paratypes deposited in CDF, CNC, CUIC, JBW, USNM.

**Etymology.** The name *biformata* is from Latin and refers to the two color forms of this species.

**Diagnosis.** *Bryolymnia biformata* can be recognized by the contrast between the gray-brown or pale yellow-brown shading of most of the medial area compared to the blackish-brown shading in the basal and subterminal areas and in the medial area between the reniform spot and subterminal line. The contrast in the shading is much more sharply defined than in either *B. ensina* or *B. mixta*, although *B. biformata* went unrecognized for many years because the two forms were treated as additional forms of *B. ensina*. The genitalia are significantly different from those of *B. ensina*. The male genitalia are similar to those of *B. ensina* in that the uncus is swollen basally, the clasper has a dorsal process near the base, and the sclerotized lobe on the basal extension of the clasper is tapered and rounded. However, the vesica in *B. biformata* does not resemble that of *B. ensina* but is more like that of *B. mixta* in having a postmedial cornutus, although much stouter and angled, and no apical spines. The valve is tapered apically, unlike that of either *B. ensina* or *B. mixta*. In the female genitalia the ductus bursae is almost as long as the corpus bursae, and the ostium bursae, unlike that in *B. ensina*, lacks a pouch on each side of the ostium bursae.

**Description. Adults.** Male and female similar in size, color, and maculation. **Head** – Male antenna with flagellomeres very slightly swollen laterally; setae tending to group into two or three clusters on each side of each segment. Palpi and head mainly of broad apically serrated dark-brown scales with a speckling of gray scales on sides of palpi. **Thorax** – Scales similar in shape to those on head, dark brown to blackish brown, similar in color to basal area of forewing; a slightly divided dorsal tuft on metathorax. **Legs:** Covered with gray-brown scales with white band in middle of tibiae and at apices of tarsal segments. Tibia without spiniform setae. **Wings:** Forewing length: 11–12 mm. Dorsal forewing ground color variable by area; basal and antemedial areas and medial area between reniform spot and postmedial line dark brown to blackish brown; remainder of medial area usually either pale orange brown, reddish brown, with a few intermediates; subterminal and terminal areas a mixture of brown, hoary gray, and blackish brown with hoary gray predominating in subterminal area, brown in terminal area, and blackish brown mainly forming a patch in subterminal area adjacent to costa; basal, antemedial and postmedial lines black, narrowly bordered by a pale line; subterminal line diffuse; reniform, orbicular, and claviform spots, and medial line, a shade darker than medial area ground color, not contrasting, but reniform spot sometimes with partial pale-gray outline; fringe dark gray brown with tiny yellow dots at base between wing veins. Dorsal hindwing pale fuscous with darker on discal spot, veins, postmedial line, and wing margin. Fringe pale buff with fuscous medial line. **Male genitalia** – Uncus mainly cylindrical, slightly swollen dorsally toward base, tapered to spine-like apex. Valve strap-like, mainly parallel sided but slightly tapered apically; apex of valve with corona on outer margin; digitus mainly fused to costal margin of valve except for short tapered apex; apical part of clasper slender and upcurved, with dorsal process near base; dorsal part of basal rod extending from clasper to dorsal margin of valve a large rounded process extending beyond dorsal margin of valve; apical part of sacculus beyond post-



medial suture slightly less heavily sclerotized than basal part. Aedeagus irregularly sclerotized, with narrow sclerite extending onto vesica on right as far as base of cornutus. Vesica about as long as aedeagus, with large basally-stout, apically-angled postmedial cornutus. **Female genitalia** – Corpus bursae oval, slightly longer than ductus bursae with ductus seminalis at posterior end of corpus bursae. Ductus bursae with posterior 3/4 heavily sclerotized, slightly wider posteriorly, with irregularly sclerotized suture separating ductus bursae from heavily sclerotized rounded plate of ostium bursae.

**Distribution and biology.** *Bryolymnia biformata* is known only from the Huachuca, Patagonia, and Santa Rita Mountains in southeastern Arizona. Adults have been collected between mid-June and late July.

***Bryolymnia anthracitaria* Ferris & McFarland, 2007**

Figs 17–19, 31, 39

*Bryolymnia anthracitaria* Ferris & McFarland 2007: 196

**Type material. Holotype** ♂. Arizona, Cochise Co., Huachuca Mts., Ash Canyon, 31°23.27'N, 110°14.28'W, 5170' (1577 m), 1015 July 2006, N McFarland. USNM, examined.

**Other material examined and distribution. USA:** Arizona: Cochise Co. (Huachuca Mts) and Santa Cruz Co. (Atascosa, Patagonia, and Santa Rita Mts).

**Diagnosis.** *Bryolymnia anthracitaria* can be recognized by its grayish-brown forewing with almost all of the basal and antemedial areas blackish brown and with a thick blackish-brown streak extending from the orbicular spot (in some specimens from the antemedial line) to the terminal line. The reniform and orbicular spots are outlined in black and the postmedial line is black but the lines are thin, so they tend to be partially covered and obscured by the prominent dark streak. The subterminal line is pale and usually obscure, being most evident near the costa because of black shading in the upper part of the subterminal area adjacent to the line. Forewing length ranges from 12–16 mm with males averaging 1.7 mm larger than females (Ferris and McFarland 2007). In the male the hindwing is pale fuscous with darker fuscous on the veins, discal spot, and wing margin. In the female the hindwing is dark fuscous, slightly paler toward the wing base. **Male genitalia.** These are similar to those of *Bryolymnia biformata*, but in *B. anthracitaria* the dorsal surface of the clasper is serrated, the clasper is without a basal dorsal process, the digitus is much larger and widens apically into a plate that is serrated on both sides, and the vesica is more globular with two stout cornuti. **Female genitalia.** These also are similar to those of *Bryolymnia biformata*, but in *B. anthracitaria* the corpus bursae is more elongated and the ductus bursae is completely sclerotized and markedly expanded anteriorly and posteriorly.

**Distribution and biology.** *Bryolymnia anthracitaria* is known only from southeastern Arizona where it has been collected in oak scrub grassland. Collecting dates range from late June to late August.

***Bryolymnia semifascia* (Smith, 1900)**

Figs 20–22, 32, 40

*Chytonix semifascia* Smith 1900: 415.

**Type material.** **Lectotype** ♂. USNM, examined. Designated by Todd (1982). Type locality: USA, Colorado, Garfield Co.

**Other material examined and distribution.** **USA:** Arizona: Cochise Co. (Huachuca Mts), Graham Co. (Pinaleno Mts), Pima Co. (Santa Catalina Mts), Santa Cruz Co. (Atascosa, Patagonia, and Santa Rita Mts), and Yavapai Co.; Colorado: Grand Co. and Garfield Co. New Mexico: Los Alamos Co., and Socorro Co.; Utah: San Juan Co.

**Diagnosis.** *Bryolymnia semifascia* can be recognized by the brown forewing with blackish-brown shading and streaks, especially toward the hind margin of the wing, and usually with a contrasting white patch in the lower part of the medial area. The white patch, the best character to recognize this species, may consist of only a few scattered white scales, but in most specimens it covers most, sometimes all, of the lower half of the medial area. In many specimens light-gray scales form partial highlights to the otherwise obscure reniform and orbicular spots, and the postmedial and subterminal lines. Forewing length ranges from 11 to 14 mm. The hindwing is pale fuscous with darker fuscous on the veins, discal spot, postmedial line and wing margin with that of the female only slightly darker than in the male. **Male genitalia.** These are most similar to those of *Bryolymnia anthracitaria*. As in *B. anthracitaria* the dorsal surface of the clasper is serrated, the clasper is without a subbasal process, and the digitus is large and heavily sclerotized. The main differences from the genitalia of *B. anthracitaria* are that the dorsal surface of the digitus is densely hairy, the clasper is much smaller, and the vesica has only a single slender tapered cornutus. **Female genitalia.** The corpus bursae is rounded, about  $0.6 \times$  as long as the heavily sclerotized, parallel-sided ductus bursae, and gives rise to a rounded lightly sclerotized appendix bursae ventrally at the junction with the ductus bursae. The sclerotized plate in the ostium bursae has a wide V-shaped notch on the posterior margin.

**Distribution and biology.** *Bryolymnia semifascia* occurs from northern Colorado and southern Utah southward to southeastern Arizona and south-central New Mexico. Adults have been collected from mid-June to mid-September in conifer forests.

***Bryolymnia viridata* (Harvey, 1876), comb. n.**

Figs 23, 24, 33, 41

*Jaspidea viridata* Harvey 1876: 35.

**Type material.** **Holotype** ♂. Location of type unknown. Type locality: USA, California, San Diego.

**Other material examined and distribution.** **USA:** California: Alameda Co., Los Angeles Co., San Diego Co., Sonoma Co.

**Remarks.** This species previously has been associated with the genus *Cryphia* Hübn. in the Bryophilinae. Chris Schmidt, working with DNA barcodes of *Cryphia* species noted that *Cryphia viridata* associated with *Bryolymnia*. Examination of the male genitalia confirmed this generic association. The male genitalia are more weakly sclerotized than most other Elaphriini, but the membranous transverse postmedial suture of the sacculus, and the membranous weak area on the costal margin of the valve associate this species with the Elaphriini, and the sclerotized plate on the dorsal rod extending from the base of the clasper to the dorsal margin of the valve associates it with *Bryolymnia* within the Elaphriini.

**Diagnosis.** *Bryolymnia viridata* differs from all other congeners in the genus in having the forewing ground color almost entirely green. There usually is some fuscous shading over the ground, especially in the subterminal area, but not in the terminal area. In most specimens there is dark fuscous or black shading between the reniform and orbicular spots, on the costa above the orbicular spot, representing the upper part of the medial line, and on the costal part of the subterminal area. A rounded spot in the fold, possibly derived from the claviform spot, looks like a second orbicular spot and often has a similar dark central dot. The terminal line is a series of black dashes between the wing veins, and this in combination with a white fringe with black wedge-shaped spots at the end of the veins, give the fringe a checkered pattern. Forewing length ranges from 12 to 15 mm. The hindwing is white with a variable amount of fuscous on the veins, discal spot, postmedial line and terminal line. Females tend to have more fuscous shading in these areas than do males. **Male genitalia.** The valve is more oval than in other species of *Bryolymnia*, broader mesially and tapered apically with the cucullus not differentiated from the rest of the valve and the apical corona weak and confined to the dorsal half of the outer margin. The clasper has a slight subbasal tooth dorsally and ventrally, and the sclerotized dorsal lobe on the dorsal rod extending from the base of the clasper is somewhat inflated and lobed, not a flat rounded plate as in most other species. The uncus is broad mesially and tapered toward each end, unlike other species. Both the aedeagus and vesica are unarmed, the latter being about as long as the aedeagus, slightly swollen at the base, then tapered to the apex. **Female genitalia.** The corpus bursae is oval, about 2 × as long as the ductus bursae, without signa, and with the ductus seminalis on a small appendix bursae posteriorly on the left. The posterior 1/3 of the ductus bursae is heavily sclerotized and this expands into a broad U-shaped ostium bursae with a very slightly convex posterior margin.

**Distribution and biology.** *Bryolymnia viridata* occurs in western California from Sonoma County north of San Francisco southward to San Diego County. Adults have been collected late May to mid-October.

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# Review of the Nearctic species of *Enargia* Hübner, [1821] (Noctuidae, Noctuinae, Xylenini)

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## Abstract

The taxonomy and nomenclature of the Nearctic species of *Enargia* Hübner shows a long history of misunderstood species concepts and misapplied names, and the group is revised here. *Enargia infumata* (Grote, 1874) is a senior synonym of what has been referred to as *E. mephisto* Franclemont, 1939 for the past 70 years. Late summer moths from boreal areas of Canada and northeastern United previously identified as *E. infumata* have no available name and are here described as *E. fausta* sp. n. A lectotype for *Orthosia infumata* Grote is designated. Adults and genitalia of the three North American species (*E. infumata*, *E. fausta*, and *E. decolor*) are illustrated, and a diagnostic key is provided.

## Keywords

Aspen two-leaf tier, taxonomy, Cosmiina, Canada, United States, North America, *Populus tremuloides*, defoliator

## Introduction

*Enargia* Hübner, [1821] (subtribe Cosmiina) contains about 13 species worldwide (Poole 1989). Fibiger and Hacker (2007) list eight Palaearctic species, and treat the

two European species in detail. In the Nearctic three species were revised by Franclemont (1939). As such, *Enargia* is a Holarctic genus primarily of temperate zones. A diagnosis of the genus is given by Fibiger and Hacker (2007), who note the following autapomorphies: 1) peniculus (lobe-like extension of the dorsal tegumen) extremely large and consisting of two lobes: a stout lobe at the base of the uncus and a long, rounded-triangular lobe on the subdorsal tegumen, and 2) vesica with two broad-based cornuti, with the apex directed toward the base of the vesica.

In North America, *Enargia decolor* (Walker) has a transcontinental distribution and can reach population levels high enough to cause extensive defoliation of aspen (*Populus tremuloides* Michx.) stands in boreal forests (Wong and Melvin 1976, and references therein). The other two Nearctic species, which have previously gone under the names *E. infumata* (Grote) and *E. mephisto* (Franclemont), apparently do not reach outbreak population levels, although records could possibly be confounded by the difficulty in identifying adults and particularly larvae of all three species, and given the taxonomic issues discussed below. All three species can be quite variable in wing markings, and prior to Franclemont's revision all North American taxa were treated as a single species, although Dod (1905; 1913) recognized that *E. infumata* was distinct from *E. decolor*.

Due to the variability in wing pattern and colour, and inadequate study of diagnostic morphology traits, the two closely-related species previously known as *E. mephisto* and *E. infumata* have been misunderstood. *Enargia infumata* (including *E. mephisto*) is actually more widespread and variable than previously defined, whereas *E. infumata* (of authors) is much more conservative in colour variation and has a narrower more northerly distribution. The confusion of these two taxa is compounded by the fact that the type specimen of *E. infumata* (Grote) is the same species as *E. mephisto* (Franclemont), so *E. infumata* (Grote) is a senior synonym of *E. mephisto*, and *E. infumata* (of authors) has no available name. The purpose of this paper is to rectify this taxonomic issue, and to provide a diagnostic review of the North American *Enargia*.

## Methods and materials

Adult genitalia were prepared following the methods detailed by Lafontaine (2004). Cleaned, stained genitalia were stored and examined in 30% ethanol, and slide-mounted in Euparal before being photographed. Inflated male vesicae were photographed in ethanol prior to being slide-mounted to prevent distortion and ensure consistent viewing angles.

Specimens examined during the course of this study were primarily those of the CNC, UASM, and NOFC. Standard two-letter postal abbreviations for Canadian provinces and U.S. states are used here.

Molecular variation was assessed based on the 658 base-pair 'barcode' region of the first subunit of the cytochrome oxidase (*cox1*) gene (Hebert et al. 2003). DNA was



extracted from one leg removed from a dried specimen, and processed at the Canadian Centre for DNA Barcoding, Guelph, Ontario. DNA extraction, amplification and sequencing protocols for the Barcode of Life initiative are given in Hebert et al. (2003). Barcode haplotypes were compared with phylograms constructed using the neighbour-joining method in PAUP 4.0\*b10 (Altevec) (Swofford 2002). Phyletic distances were calculated using the Kimura-2-Parameter (K2P) distance model. Data for molecular voucher specimens, including trace files and photographs, are available at <http://barcodinglife.com> (project: Lepidoptera of NA Phase II: “*Enargia* revision” under the “Published Projects” tab).

Abbreviations of collections referred to herein are as follows:

<b>AMNH</b>	American Museum of Natural History, New York, New York, USA
<b>BMNH</b>	The Natural History Museum (formerly British Museum [Natural History]), London, UK.
<b>CUIC</b>	Cornell University Collection, Ithaca, New York, USA.
<b>CNC</b>	Canadian National Collection of Insects, Arachnids, and Nematodes, Ottawa, Ontario, Canada
<b>DHC</b>	Daniel Handfield Collection, St-Mathieu-de-Beloeil, Québec, Canada
<b>LHC</b>	Louis Handfield Collection, Mt-St-Hilaire, Québec, Canada.
<b>NOFC</b>	Northern Forestry Centre, Canadian Forest Service, Edmonton, Alberta, Canada.
<b>UASM</b>	University of Alberta Strickland Entomological Museum, Edmonton, Alberta, Alberta, Canada.
<b>USNM</b>	National Museum of Natural History (formerly United States National Museum), Washington, D.C., USA.

## Systematics

### Key to species of Nearctic *Enargia* Hübner

1. Forewing without black spot at base of reniform, at most with basal grey shading, but this never darker than other forewing markings; outline of claviform spot often present as thin dark line below orbicular; break of antemedial line generally pointed, at right angle or slightly greater; male with corona of valve extending along 1/2 of valve length (Figs 55, 56); females with abdomen thinly scaled and longer than that of males, ovipositor usually protruding beyond terminal scales; ductus bursae (appearing as bulbous rugose area separated from corpus bursae) 0.4–0.6 × as long as (sclerotized) segment VIII (Figs 64, 65) ..... *E. decolor*
- Forewing with black spot at base of reniform that is distinctly darker than other forewing markings (Figs 1–33) (may be obscure in very dark specimens, e.g. Figs 1, 16); claviform entirely absent; angle of antemedial line generally rounded, obtuse; male with corona of valve extending along valve

- for 2/3 of valve length; females with abdomen scaled as in male (except for lateral and terminal tufts); abdomen length same as that of male, ovipositor not usually protruding beyond terminal scales; ductus bursae (appearing as bulbous rugose area separated from corpus bursae)  $0.8\text{--}1.0 \times$  as long as (sclerotized) segment VIII (Figs 66, 67) ..... **2**
2. Forewing highly variable in colour, but only rarely yellow ochre with contrasting dark markings (Figs 1–18); AM and PM lines usually indistinct, not thin, sharp, and contrasting; border of reniform and orbicular usually weakly defined and interrupted, or absent altogether; hindwing ground colour dull ochre to greyish ochre; male genitalia with right cornutus relatively small, i.e., length of sclerotized plate  $4\text{--}5 \times$  greater than length of free apex of cornutus (Fig. 59); female corpus bursae  $5\text{--}6 \times$  length of segment VIII, and gradually tapering to terminal sac (Fig. 64) ..... ***E. infumata***
- Forewings yellow ochre to orange ochre with contrasting dark markings (Figs 19–30), never unicolourous grey or brown; AM and PM lines distinct, sharp, and contrasting; border of reniform and orbicular usually sharply defined and continuous; hindwing ground colour yellow ochre; male genitalia with right cornutus relatively large, i.e., length of sclerotized plate only  $2\text{--}2.5 \times$  greater than length of free apex of cornutus (Fig. 60); female corpus bursae  $3.5\text{--}4 \times$  length of segment VIII, with terminal sac abruptly tapered (Fig. 65) ..  
..... ***E. fausta* sp. n.**

### ***Enargia infumata* (Grote, 1874)**

Figs 1–18, 55, 59, 64.

*Orthosia infumata* Grote, 1874; 160.

*Cosmia punctirena* Smith, 1900; 222, pl. 5, f. 6.

*Cosmia punctirena*; Dod 1905.

*Enargia mephisto* Franclemont, 1939; 115, f. 2, **syn. n.**

*Enargia infumata*; Forbes 1954, in part

*Enargia mephisto*; Rings et al. 1992, pl. XV f. 23. Handfield 1999, p. 92, f. 9551-1, 9551-2.

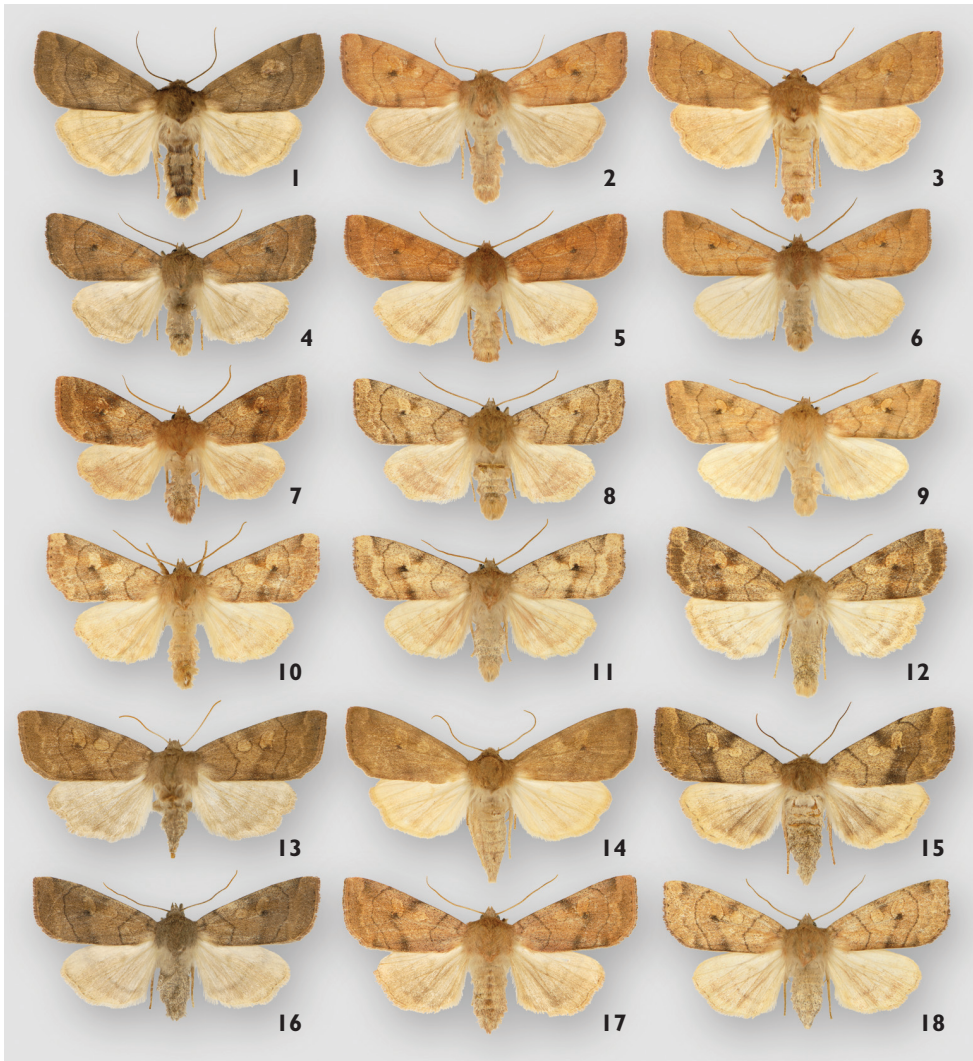
**Type material.** *Orthosia infumata*: **lectotype** female, here designated. BMNH, examined. Type locality: “Chautauqua Co., N. Y.” Although Grote’s (1874) statement in the original description that “specimens received from Mr. Geo. Norman” suggests that *E. infumata* could have been based on several syntypes, only one wing expanse measurement is given, and the type locality is restricted to Chautauqua Co., NY. Norman’s material originates from Ontario (M. Honey, pers. comm.). The type material most likely was a single Chautauqua Co. specimen, although this is not beyond question. To ensure the stability of the name *Orthosia infumata*, the following female specimen is therefore designated as **lectotype**: “Grote Coll.”; “U.S. America / [crossed out,

undecipherable] Co. / Chautauqua / Co. / N.Y.”; “1938. / 265”; “Type” [round, red bordered label]; *Orthosia* / *infumata* / Type Grote” [BMNH]. The following label will be added: “*Orthosia* / *infumata* Grote / Lectotype by / Schmidt, 2010”. Although the abdomen is missing, the specimen is otherwise in good condition, and shows the dusky grey-ochre forewing colour (probably reflected by the name *infumata*) with a poorly contrasting reniform and orbicular, less sinuate AM line, dull ochre hindwing, and smaller wing expanse compared to the species previously thought to be *E. infumata* and described here as *E. fausta*.

*Cosmia punctirena*: **lectotype** male (designated by Todd 1982). USNM, photograph examined. Type locality: “Yellowstone Park, Wyoming.” The specimen illustrated by Smith (1900) is the lectotype designated by Todd (1982), and the relatively unicolourous, dark forewing, non-contrasting reniform and orbicular, and pronounced black spot in the reniform, show that *E. punctirena* is correctly attributed to the synonymy of *E. infumata*. Additional Barnes specimens collected in August in Yellowstone (CNC) are of the same provenance as the original types, although these are not paralectotypes, and are also *E. infumata*. The original description of *E. punctirena* was probably based on a mixed series of *E. infumata* and *E. decolor*, as *E. decolor* specimens in the CNC from Glenwood Springs, Colorado (Barnes, September) and *E. decolor* from Cartwright, MB (Heath, August) are of the same provenance as the original syntype series. Although this does not affect the synonymy of *punctirena*, the diagnosis of the taxon by Smith is inaccurate.

*Enargia mephisto*: **holotype** male. CUIC, examined. Type locality: “Ithaca, New York.” see ‘Remarks’ below.

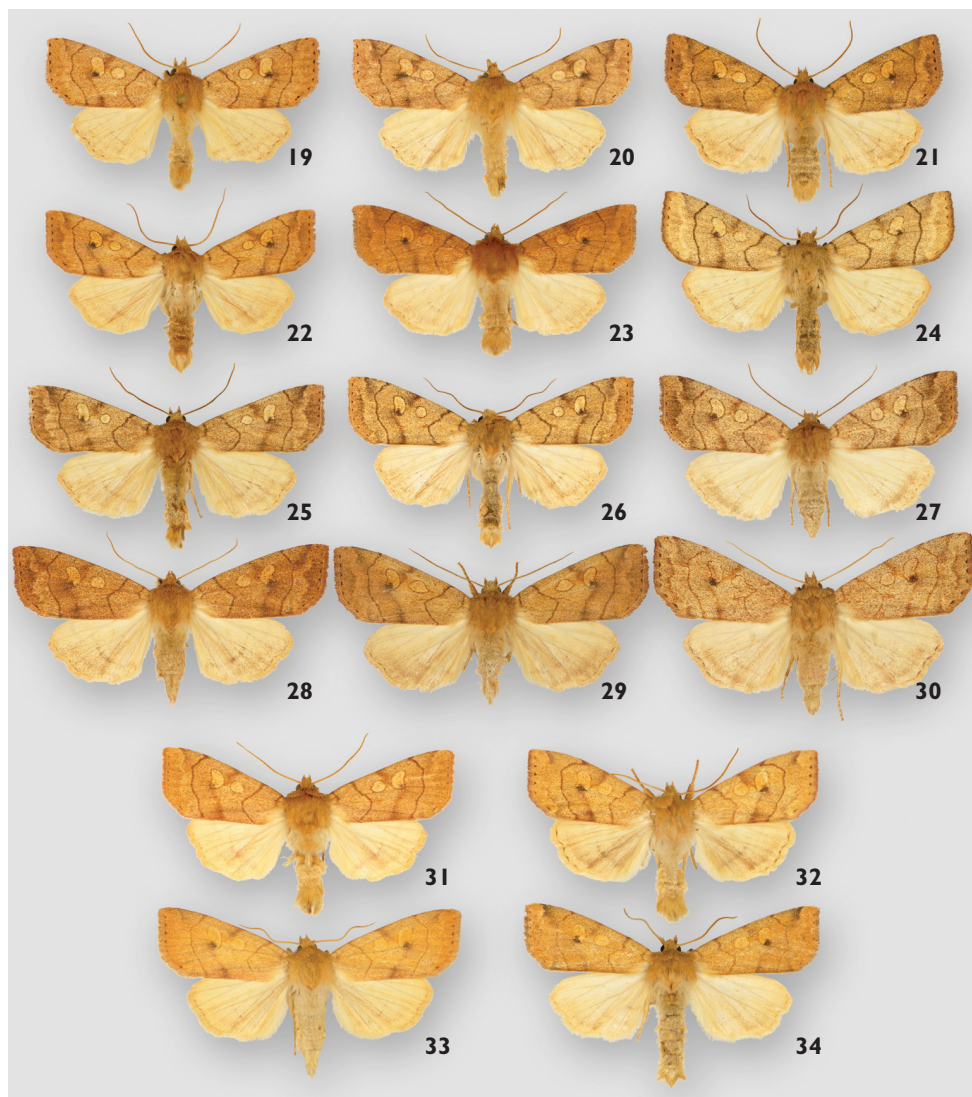
**Diagnosis.** *Enargia infumata* is most similar to *E. fausta*. Overall, *E. infumata* has a paler ochre, less yellow look to it with less contrasting markings and greater variation in colour. The unicolorous smoky-grey forms are unique to *E. infumata* (it was this phenotype that formed the basis of Franclemont’s description of *E. mephisto*). Compared to *E. fausta*, *E. infumata* is slightly smaller, has slightly thicker, less sharply defined AM and PM lines (when these are visible at all), less sinuate PM line, a dull, pale ochre (vs. yellow-ochre) hindwing ground colour, and the reniform and orbicular are often concolourous with the forewing ground colour (not paler and contrasting), and with a discontinuous or absent outline (thin, crisp outline in *E. fausta*). Specimens of *E. infumata* from the Prairie Provinces average slightly larger and paler than eastern *E. infumata*, and therefore have a general appearance more like that of *E. fausta*. Internally, the valve length is shorter in *E. infumata* (2.6–2.9 mm from apex to clasper at dorsal margin, vs. 3.3–3.5 mm in *E. fausta*), the cornuti of the vesica are smaller overall (length of free apex less than 0.10 mm vs. greater than 0.11 mm in *E. fausta*), with a relatively much larger sclerotized plate of the right cornutus (length of plate 4–5 × greater than length of free apex of cornutus, compared to 2.0–2.5 × in *E. fausta*). The peniculum (tegumen lobes) are on average shorter and broader (Franclemont 1939; Forbes 1954), but there is much overlap in shape between the two species and this is not a reliable diagnostic trait. In the female, the corpus bursae differs in size and shape, being longer (5–6 × length of segment VIII vs. 3.5–4.0 × in *E. fausta*), and more narrow-elongate than *E. fausta* (Fig. 64).



**Figures 1–18.** *Enargia infumata* adults. **1–3** ♂, Kootenay Plains, AB, CAN **4–11** ♂, Edmundston, NB, CAN **12** ♂, Taber, AB, CAN **13** ♀, Panguitch, UT, USA **14–15** ♀, Kootenay Plains, AB, CAN **16–18** ♀, Edmundston, NB, CAN.

**Redescription.** *Head* – Antenna of male prismatic, segments as wide as long; antenna of female filiform and ciliate; scales of dorsal antenna, scape, vertex, and palpus unicolorous but co-varying with ground colour of wings, from pale ochre, yellow ochre, brownish grey, to dull rusty brown. *Thorax* – Vestiture of thorax, patagia and prothoracic collar unicolorous, but varying from pale ochre, yellow ochre, brownish grey, to dull rusty brown; legs dull ochre yellow with longer scales of corresponding colour on femur and tibia. *Wings* – Forewing length: eastern populations average slightly smaller at 16.4 mm (n = 6) versus 17.4 mm (n = 6) for western populations; females slightly larger overall at 17.5 mm (n = 3) for eastern and 18.4 mm (n = 3) for western





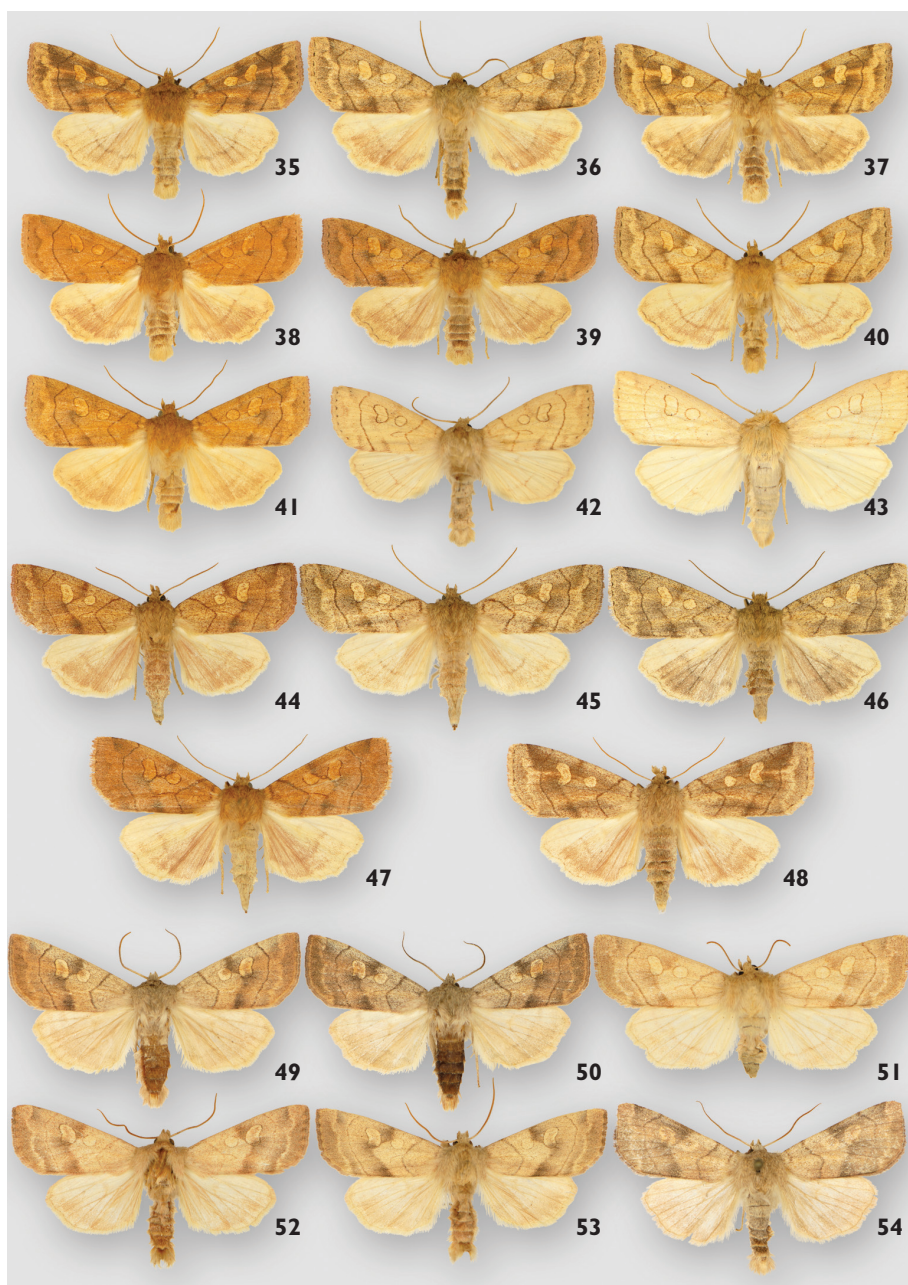
**Figures 19–34.** *Enargia* adults. **19** *E. fausta*, holotype ♂, St.-Basile, NB, CAN **20** *E. fausta*, ♂, Edmunston, NB, CAN **21** *E. fausta*, ♂, Temiscouata Co., QC, CAN **22** *E. fausta*, ♂, Black Sturgeon L., ON, CAN **23** *E. fausta*, ♂, Edmunston, NB, CAN **24** *E. fausta*, ♂, Peers, AB, CAN **25** *E. fausta*, ♂, Edmunston, NB, CAN **26** *E. fausta*, ♂, Black Sturgeon L., ON, CAN **27** *E. fausta*, ♀, St.-Basile, NB, CAN **28–30** *E. fausta*, ♀, St.-Basile, NB, CAN **31** *E. ?paleacea*, Delta, BC, CAN **32** *E. paleacea*, ♂, Hungary **33** *E. paleacea*, ♀, Hungary **34** *E. paleacea*, ♂, Finland.

specimens; forewing ground color varying from pale ochre, yellowish ochre, brownish grey to rusty brown; dark markings varying from charcoal grey to reddish brown, and highly contrasting to virtually absent; angle of antemedial line rounded and obtuse, about 130°–140°; postmedial line evenly rounded to slightly sinuate; medial band varying from thick and diffuse to obsolete, co-varying with dark terminal and sub-

apical shading; pale subterminal line present in specimens with dark terminal shading (Fig. 12); reniform and orbicular usually concolorous with wing ground colour or only slightly paler, rarely contrastingly pale; border of reniform and orbicular weakly defined and usually interrupted, or absent altogether; base of reniform (towards anal margin) with dark grey spot of varying size, but spot nearly always darkest of forewing markings; claviform absent; fringe concolorous with ground colour; ventral forewing less variable than dorsum, ground colour pale yellowish ochre with postmedial line and reniform spot variously developed, more so in specimens with contrasting dorsal markings and antemedial line absent. Hindwing ground colour pale yellowish ochre with dark shading varying in extent and colour from grey to dull maroon; postmedial line and broader, diffuse subterminal band visible when dark markings developed, varying to entirely absent; medial line better defined ventrally, with ventral discal spot similarly dark (rarely visible dorsally). *Abdomen* – Vestiture mix of pale yellowish-ochre and darker scales of colour of those on forewing dark markings; males with terminal and lateral scale tufts, which are absent in females. *Male genitalia* – (Figs 55, 59). Uncus cylindrical, tapering to a small distal hook; tegumen with large peniculum, consisting of long, triangular subdorsal lobe,  $0.3 \times$  length of valve, and short, rounded lobe adjacent to uncus base; valve 2.6–2.9 mm long,  $4 \times$  as long as wide (measured at widest part), corona extending from apex along ventral margin over  $1/2$  length of valve; sacculus  $0.5 \times$  valve length; clasper spatulate, recurved, and directed caudally; aedeagus  $7 \times$  as long as wide, tube shaped, with field of 10–18 short, stout backward-directed spines at ventral margin of apex; ventral margin of apex rounded and slightly scoop-like; vesica small, simple, bulbous,  $0.4 \times$  length of aedeagus, with two stout cornuti positioned laterally and directed caudad; free apex of cornuti equally sized (0.082–0.099 mm); distal opening of vesica extending dorsally from vesica as gradually tapering tube. *Female genitalia* – (Fig. 64). Ovipositor lobes bluntly triangular in lateral view, ventral margin slightly concave, covered in short hair-like setae; abdominal segment VIII  $0.7 \times$  as long as wide, anterior apophysis  $1.5 \times$  and posterior apophysis  $2.3 \times$  length of abdominal segment VIII; ductus bursae extremely short,  $2 \times$  length of ostium, appearing thicker and more rugose than corpus bursae; long, duct-like proximal two-thirds of corpus bursae (which initially appears to be ductus bursae) with only slight widening toward ovoid distal chamber; corpus bursae  $5\text{--}6 \times$  length of segment VIII, lacking signa; ductus seminalis originating dorsad and slightly caudad of distal end of ductus bursae.

**Distribution and biology.** *Enargia infumata* has a broad North American distribution, occurring from Alaska south to California and the Pinaleno Mountains of Arizona, east to New Brunswick and New York. No specimens were seen from Nova Scotia although the species undoubtedly occurs there; the Nova Scotia specimen illustrated by Ferguson (1954: pl. x, fig. 4) is *E. fausta*. In the eastern part of the range, the peak flight period occurs between mid- and late July, with extreme dates from mid-June to mid-August. *Enargia infumata* flies three to four weeks earlier than *E. fausta*, and there is very little temporal overlap between the two in any given year; generally, *E. fausta* does not appear until late July and peaks in mid- to late August. Flight times for the boreal forest region from northern Ontario westward indicate slightly later





**Figures 35–54.** *Enargia* adults. **35** *E. decolor*, ♂, Temiscouata Co., QC, CAN **36** *E. decolor*, ♂, Princeton, BC, CAN **37–38** *E. decolor*, ♂, St.-Basile, NB, CAN **39–41** *E. decolor*, ♂, Edmundston, NB, CAN **42** *E. decolor*, ♂, Wainwright sand dunes, AB, CAN **43** *E. decolor*, ♀, Josephine, OR, USA **44** *E. decolor*, ♀, Hanwell, NB, CAN **45–48** *E. decolor*, ♀, Edmundston NB, CAN **49** *E. decolor*, ♂, Dalton Springs cmpgd., San Juan Co., UT, USA **50** *E. decolor*, ♂, Dalton Springs cmpgd., San Juan Co., UT, USA **51** *E. decolor*, ♀, Chiloquin, OR, USA **52** *E. decolor*, ♂, McGill, NV, USA **53** *E. decolor*, ♂, Durango, CO, USA **54** *E. decolor*, ♂, Mt. Graham, Graham, Co., USA.

flight dates for *E. infumata*: In central Alberta, *E. infumata* peaks from late July to mid August, with *E. fausta* again slightly later in mid- to late August.

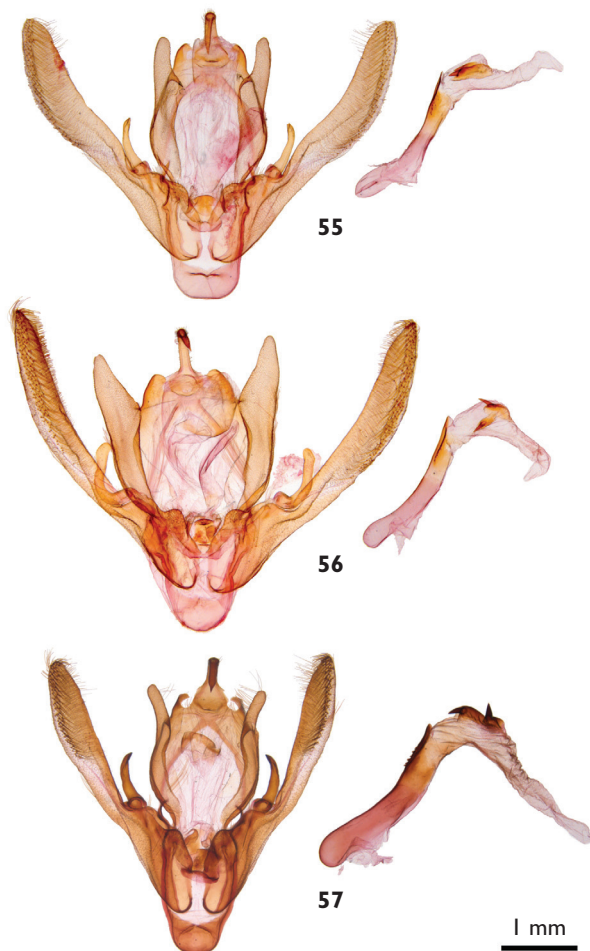
McGuffin (1958) illustrates the larval head capsule and provides a detailed description identified as *E. infumata*, but given the past confusion of *E. infumata* and *E. fausta*, it is not certain which species his account pertains to. I have not been able to find vouchers or associated adults in McGuffin's material at the CNC. Prentice (1962) reports most larval collections (45/61) from *Populus tremuloides* Michx., some from *Betula papyrifera* Marsh. (13/61) and a few collections from *Salix* sp. (2 collections) and *Populus balsamifera* L. (1 collection), but again it is not clear if these records pertain to *E. infumata* or *E. fausta*, but likely both, since *E. mephisto* is not mentioned in Prentice (1962). I have confirmed *P. tremuloides* as a definite (and probably preferred) host from reared specimens. The larval biology and description needs to be re-evaluated.

**Remarks.** Franclemont (1939) correctly recognized that three species were going under what had previously been treated as a single species, *E. decolor*. Dod (1905) also recognized early on that *E. decolor* and *E. infumata* were separate species, and gave several diagnostic traits separating the two (which I had initially overlooked, and Franclemont (1939) made no mention of either). Franclemont (1939) recognized a third species and described it as *E. mephisto*, based on two specimens. Comparison of phenotype and genitalic variation in long series of *E. mephisto* and *E. infumata* (of authors), and *CO1* sequence data shows that these two taxa have been largely misunderstood. Variation in the size and shape of the tegumen arms ('shoulders' of Franclemont) shows that these characters are not diagnostic, and the most consistent male genitalic character is the size and position of the cornuti of the inflated vesica (Fig. 59) (Franclemont used uninflated vesicae in his diagnosis). Additional distinguishing characters are given under 'Diagnosis,' above.

Why Franclemont considered all of the other 81 specimens from sites across the continent to be *E. infumata* (of authors; = *fausta*) rather than *E. mephisto* is not clear, since many western specimens are indistinguishable from eastern *E. mephisto* (compare Figs 1, 13, 16). Presumably he had few western specimens and lacked the 'typical' *E. mephisto* phenotype in his material, compounded by the slightly larger, paler western phenotype of *E. infumata* (Grote), which therefore bears greater resemblance to *E. fausta*. It would therefore have been difficult to 'draw the line' between *E. fausta* and phenotypic variation in *E. mephisto* without long series of specimens and extensive comparison of dissections.

Following Franclemont's revision, the more northerly pale species described herein as *E. fausta* and the paler forms of the widespread species *E. infumata* were both treated as *E. infumata*, whereas the darker forms of *E. infumata* were treated as *E. mephisto*. *Enargia infumata* (as *E. mephisto*) was thought to be the less common taxon with a more easterly distribution (Forbes 1954). In reality *Enargia infumata* s.s. is widespread and common, whereas *E. fausta* has a more restricted distribution.

The seventeen sequenced specimens of *E. infumata* from British Columbia, Alberta, Ontario, and New Brunswick exhibited seven haplotypes, differing at most by approximately 0.6 % from each other, compared to a 1.7% divergence from the single *E. fausta* specimen.



**Figures 55–57.** Male genitalia of *Enargia*. **55** *E. infumata* **56** *E. fausta* **57** *E. decolor*.

***Enargia fausta* Schmidt, sp. n.**

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Figs 19–30, 56, 60, 65

*Enargia infumata* Franclemont 1939, in part; Handfield 1999: p. 92 f. 9550; Rockburne and Lafontaine 1976: f. 434; Ferguson 1954: pl. X f. 4.

**Type material. Holotype** ♂. St.-Basile, N. B. [New Brunswick] / Canada. 14. VIII. 1994 / leg. Henry Hensel “HOLOTYPE / *Enargia fausta* / Schmidt, 2010” [red typed label] [CNC]. **Paratypes:** 55 ♂, 49 ♀ (CNC, UASM, DHC, LHC). **New Brunswick.** Same data as holotype, 19 Aug 1993 (1 ♀); Edmunston, 31 Aug 1991 (1 ♂), 16 Aug

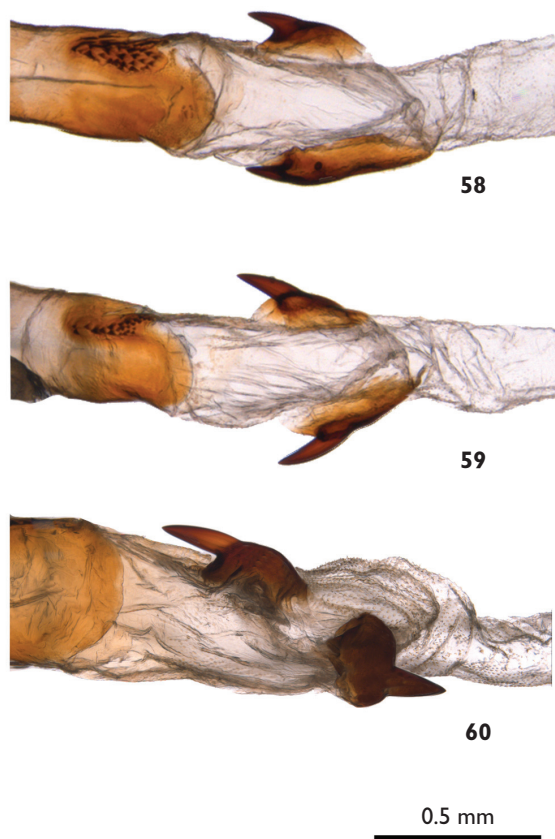
2002 (1 ♂), 8 Aug 2003 (1 ♀), 20 Aug 2003 (4 ♂, 3 ♀), 17 Aug 2003 (1 ♂, 1 ♀), 21 Aug 2003 (1 ♂), 27 Aug 2003 (1 ♀), 25 Aug 2003 (1 ♀), H. Hensel; Hanwell, 14 Aug 2007, G. Hensel (1 ♂). **Quebec.** Temiscouata Co., 18 Aug 1992, H. Hensel (1 ♂); Lac Mondor, Ste. Flore, 27 Jul 1951, E.G. Munroe (1 ♂); Laniel, 23 Aug 1932 (2 ♂, 2 ♀), 24 Aug 1932 (1 ♂), 26 Aug 1932 (1 ♀), W.J. Brown; Forestville, 11 Aug 1950 (2 ♂), R. de Ruelle; Belisle Beach, Luskville, 12–19 Aug 1961, E.G. Munroe (1 ♂); La Présentation, 5 Aug 1971, L. Handfield (2 ♂); Mont-Saint-Hilaire (Chemin des Lots), 3 Sep 1971, L. Handfield (1 ♀); Mont-Saint-Hilaire (Manoir Rouville-Campbell), 20 Aug 1969 (1 ♀), 23 Aug 1969 (1 ♀), 26 Aug 1968 (1 ♀), 29 Aug 1969 (1 ♀), 30 Aug 1971 (1 ♂, 4 ♀), 31 Aug 1971 (1 ♀), 2 Sep 1971 (9 ♀), L. Handfield; Mont-Saint-Hilaire (Rang des Étangs), 21 Aug 1978 (1 ♂, 1 ♀), L. Handfield; Saint-Valérien, comté de Rimouski, I. Blais, 21 Aug 1971 (1 ♀), L. Handfield; St-Michel des Saints, Lac Dussault, 8 Aug 2005, D. Handfield, barcode voucher DH010701, (1 ♂); Terrebonne High, 13 Aug 1938 (1 ♀), 3 Aug 1941 (1 ♂), L. Auger. **Ontario.** Thunder Bay Co., Inwood Prov. Park nr. Upsala, 10 Aug 1982, J.F. Landry; Black Sturgeon Lake, 3 Aug 1964 (1 ♂, 1 ♀), 14 Aug 1963 (1 ♂, ♀), 2 Sep 1964 (1 ♂), 28 Aug 1964 (2 ♂), 21 Aug 1963 (1 ♂); Thunder Bay, Stanley Area, 12 Aug 1980 (1 ♂), J. P. Wales; La Passe, 16 Aug 1974 (1 ♂), E.W. Rockburne; Biscotasing, 16 Aug 1931 (1 ♂), 29 Jul 1931 (1 ♂), 30 Aug 1931 (1 ♂), K. Schedl; Ogoki, 14 Aug 1952 (2 ♂), 19 Aug 1952 (10 ♂, 7 ♀), 15 Aug 1952 (2 ♀), 21 Aug 1952 (1 ♀), 16 Aug 1952 (3 ♂); Mississagi Is., North Channel, 7 Aug 1977 (1 ♂), J.K. Morton. **Michigan.** Sault St. Marie, 27 Aug 1960, (1 ♂), Kelton & Whitney. **Alberta.** Peers, 4 mi. N, 2650', 26 Jul 1961, D.F. Hardwick (1 ♂); Edmonton, 2 Aug 1942, K. Bowman, UASM14971, (1 ♂); Heart Valley, (no date), reared ex *Populus tremuloides*, (1 ♀); Wembley, 1954, reared ex *Populus tremuloides*, (1 ♂ 1 ♀); Overflow, (no date), reared ex *Populus balsamifera* (1 ♂, stunted); Rocky Lake, 1957, reared ex *Betula papyrifera* (2 ♀).

**Diagnosis.** Similar to and long confused with *E. infumata*, see diagnosis under that species.

**Etymology.** The specific epithet is derived from Faustus, the alchemist of German legend who sold his soul to Mephistopheles, or Mephisto, in exchange for knowledge. The ending is amended for a more euphonious combination with *Enargia*, and is a noun in apposition.

**Description.** *Head and thorax* – Colour ranging from pale ochre, yellow ochre, to rusty orange yellow, otherwise not differing from that of *E. infumata*. *Wings* – Forewing length: males 17.5 mm (n = 6), females slightly larger overall at 19.4 mm (n = 5); forewing ground color varying from yellowish ochre to rusty ochre, but not exhibiting the very pale ochre or greyish phenotypes observed in *E. infumata*; dark markings varying from charcoal grey to brownish grey, usually highly contrasting and sharply defined; angle of antemedial line rounded and obtuse, but less so than in *E. infumata*, averaging 110°–120°; postmedial line evenly slightly sinuate medially, only rarely evenly rounded; medial band moderately to poorly developed, co-varying with dark terminal and subapical shading but without the variation extremes seen in *E. infumata*; pale subterminal line present in specimens with dark terminal shading (Figs 12, 15); reni-





**Figures 58–60.** Comparison of male vesica cornuti in *Enargia* species. **58** *E. infumata* **59** *E. fausta* **60** *E. decolor*.

form and orbicular usually paler than ground colour, rarely concolorous; reniform and orbicular with sharply defined, uninterrupted border; base of reniform (toward anal margin) with dark grey spot of varying size, but spot nearly always darkest of forewing markings; fringe concolorous with ground colour; ventral forewing less variable than dorsum, ground colour pale yellowish ochre with postmedial line and reniform spot variously developed, more so in specimens with contrasting dorsal markings, and antemedial line absent. Hindwing ground colour pale yellowish ochre with maroon-grey dark shading of varying extent, but not as grey or extensive as variants of *E. infumata*; postmedial line and broader, diffuse subterminal band visible when dark markings developed, varying to entirely absent; medial line better defined ventrally, with ventral discal spot similarly dark (rarely visible dorsally). *Abdomen* – not differing from that of *E. infumata*. *Male genitalia* – (Figs 56, 60). As for *E. infumata*, but differing in following characters: valve length 3.3–3.5 mm; vesica with free apex of both cornuti equal

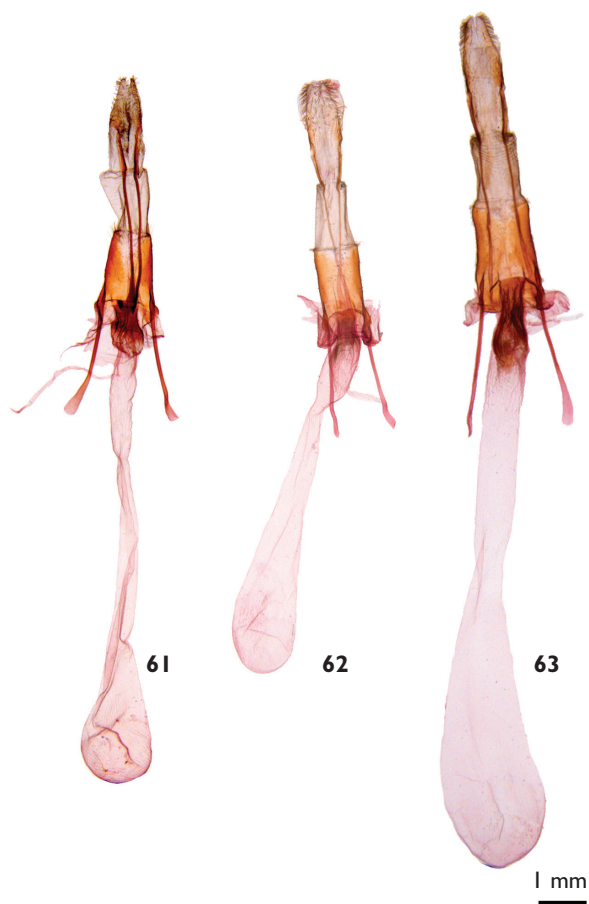
in size to each other, ranging from 0.11–0.15 mm; right cornutus small, i.e., length of sclerotized plate of right cornutus only 2.0–2.5 × greater than length of free apex of cornutus (Fig. 60). *Female genitalia* – (Fig. 65). As for *E. infumata*, but differing in size and shape of corpus bursae, in that basal duct-like part shorter and more poorly defined, with a more gradual widening toward apical sac-like chamber; corpus bursae 3.5–4.0 × length of segment VIII.

**Distribution and biology.** *Enargia fausta* has a narrower distribution than *E. infumata* and is essentially restricted to the boreal forest and boreal-deciduous forest transition zone, and unlike *E. infumata* does not range south along the Rocky Mountains nor as far north. Specimens examined range from central Alberta to New Brunswick (but see also Remarks, below) and in the East as far south as the Ottawa River Valley, but the species presumably also occurs in appropriate habitats in northern New York and New England; Ferguson (1954) illustrates a specimen from Glenngville, Nova Scotia. Reports of this species from northeastern Ohio (Rings et al. 1992, as *E. infumata*) need to be verified. Flight dates range from late July to early September with most records after mid-August. As discussed under *E. infumata*, the peak flight of *E. fausta* is three to four weeks later than that of *E. infumata*. Available records indicate that this species is much less common than *E. infumata*. It appears that the preferred larval host is white birch (*Betula papyrifera* Marsh.) based on specimens reared from larval collections by the Forest Insect and Disease Survey (NOFC), and also trembling aspen (*Populus tremuloides* Michx.), with a single stunted specimen reared from balsam poplar, *Populus balsamifera* L.. A preference for birch would explain the narrower habitat preference, more restricted range, and lower abundance of this species compared to *E. decolor* and *E. infumata*, both associated with aspen.

**Remarks.** The taxonomic status of an *Enargia* species in the Pacific Northwest (PNW) (Fig. 31) remains unresolved; structurally, they are indistinguishable from boreal *E. fausta*, but externally they are more similar to the European *E. paleacea* (Esper, 1788), with more evenly coloured, orange-yellow forewings (Figs 32–34). *E. paleacea* and *E. fausta* differ in phenotype and DNA barcode divergence, but I have not been able to find genitalic differences. The fact that the PNW specimens are phenotypically most similar to *E. paleacea*, and the large apparent range disjunction of these populations from *E. fausta* (which is not known from central or eastern British Columbia), suggests that the PNW taxon could be a Eurasian introduction via the Vancouver area shipping ports. Alternatively, it could be a coastal segregate of *E. infumata*, or a native Nearctic population of a Holarctic, trans-Beringian *E. paleacea*. However, *E. paleacea* is not known from eastern Siberia, Yukon, or Alaska. It seems most likely that the PNW species represents an accidental introduction of *E. paleacea*, but more research is needed, and DNA sequencing particularly would help to elucidate the taxonomy of these interesting populations.

The single specimen of *E. fausta* for which DNA barcode sequence is available differed by a minimum of 1.7% from *E. infumata* haplotypes. An additional sequenced specimen *E. fausta* (D. Handfield collection, voucher # DH010701), confirmed by dissection, exhibited an *E. infumata* haplotype, suggesting the two species may share haplotypes and that barcodes may not reliably distinguish the two; this requires further study.





**Figures 61–63.** Female genitalia of *Enargia*. **61** *E. infumata* **62** *E. fausta* **63** *E. decolor*.

***Enargia decolor* (Walker, 1858)**

Figs 35–54, 57, 60, 63

*Mythimna decolor* Walker, 1858: 1658.

*Enargia discolor*; Smith 1900; misspelling.

*Cosmia discolor*; Dod 1905; Dod 1910; misspelling.

*Enargia decolor*; Franclemont 1939.

*Enargia decolora*; Hampson 1910: 239; unjustified emendation.

‡*Enargia decolora* ab. *mia* Strand, 1916: 164; unavailable infrasubspecific name.

‡*Enargia decolora* ab. *sia* Strand, 1916: 164; unavailable infrasubspecific name.

**Type material.** *Mythimna decolor*: male **holotype**. BMNH, examined. Type locality: “Orilla [*sic*], West Canada” [Orillia, Ontario, Canada].

**Diagnosis.** *Enargia decolor* is externally most similar to and broadly sympatric with *E. infumata*. Specimens with little dark shading can also be similar to *E. fausta*, particularly females of both species. About 90% of *E. decolor* specimens can be recognized by one or more of the following external characters: reniform spot lacking pronounced dark scaling at base, or if dark scaling present, not darker than color of adjacent medial line; claviform often present as dark dash; well-marked specimens with pronounced hindwing medial line; male antenna slightly serrate, not prismatic. Internally, in males the corona extends only halfway along the ventral margin of the valve (2/3 in *E. infumata* and *E. fausta*, Figs 55, 56), and the vesica cornuti and aedeagus are larger (compare Fig. 60 to Figs 58 and 59). Females have a longer ovipositor and corpus bursae (Fig. 63).

**Distribution and biology.** *Enargia decolor* has a boreal-transcontinental distribution, occurring across the Canadian boreal plain and then southward through the western cordillera at higher elevations, where it is presumably limited by the availability of trembling aspen and possibly other poplars. Records for examined specimens range from northernmost British Columbia (Ft. Nelson) and south-western Northwest Territories (Ft. Smith) east to New Brunswick; also reported from Nova Scotia (Ferguson 1954), Ohio (Rings et al. 1992) and New York (Forbes 1954). In the western United States, specimens were examined from western Montana, Idaho, Washington, Oregon, Nevada, Utah, Wyoming (Albany and Carbon counties), western Colorado, New Mexico (Grant Co.), and Arizona (Graham Co.). Notably, I have not seen any specimens from the Rocky Mountain front ranges of Colorado, where it would be expected to be widespread if there is a continuous distribution southward into New Mexico / Arizona. As discussed under Remarks, the populations from west of the Rocky Mountains south to New Mexico / Arizona may represent a distinct species.

The larvae prefer *Populus tremuloides*, and Prentice (1962) also reported a small number of larval collections from *Betula papyrifera*, *Populus balsamifera*, *Salix* sp., *Populus grandidentata* Michx. and *Alnus rugosa* (Ait.) Pursh. Since this species has mostly been correctly identified, Prentice's larval host records are also probably mostly correct. Larvae can reach high population densities, causing local defoliation of *P. tremuloides* (Wong and Melvin 1976). The balsam poplar group have quite resinous buds and leaves at bud break, so these may not be suitable hosts, at least for early instar larvae. McGuffin (1958) gives detailed descriptions including setal maps of *E. decolor*, but a diagnostic comparison of morphology and biology of larvae to *E. infumata* and *E. fausta* is still needed. Wong and Melvin (1974) describe the larvae and larval biology of *E. decolor*.

**Remarks.** *Enargia decolor* as it is currently defined may consist of two species. Specimens from Nevada, Utah, western Colorado, Arizona and New Mexico are on average duskier, and the medial area tends to be the darkest forewing area (subterminal area equally dark in boreal *E. decolor*); specimens have the markings more obscure overall, often with a pinkish tinge not seen in boreal *decolor*. Comparison of male genitalia from this region to boreal *decolor* also suggest a slight difference. Five bar-coded specimens from Alberta and New Brunswick exhibited four haplotypes, with a

maximum divergence of about 0.26 %; three Utah specimens representing two haplotypes differed between 0.86–1.37 % from the Alberta / New Brunswick material. Additional specimens from key geographic areas (Colorado, Wyoming, Idaho, Oregon) are needed to fully evaluate the taxonomic status of these populations.

## Discussion

The North American *Enargia* species fall into two groups, the *decolor* group and the *infumata* group; the *decolor* group currently includes only *E. decolor*, and possibly an unrecognized species (See ‘Remarks’ under *E. decolor*). *Enargia infumata* and *E. fausta* make up the *infumata* group; *E. fausta* appears to be most closely related to the Eurasian *E. paleacea*. Poole (1989) lists 13 species in *Enargia* globally, although *E. ypsillon* has subsequently been transferred to the genus *Apterogenum* Berio, 2002, and with two additional Palearctic species listed by Fibiger and Hacker (2007). The only European species closely related to the North American group is *E. paleacea*. A cursory examination of the remaining Eurasian species not illustrated in Fibiger and Hacker (2007) in the literature (Hampson 1908; Draudt 1950) shows that two additional species are likely part of the *paleacea* / Nearctic group, namely *E. kansuensis* Draudt, 1935 and *E. fuliginosa* Draudt, 1950, both described from China. The description and type illustration of *E. fuliginosa* is quite similar to *E. infumata*, and genitalic comparison of the two may show they are closely related. Additional research is needed to fully evaluate the taxonomic status of the western U.S. *E. decolor* populations, and the enigmatic Pacific Northwest *E. fausta* populations.

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Martin Honey and Don Lafontaine kindly provided images of type specimens. I thank Cliff Ferris, Daniel Handfield, Louis Handfield, Chuck Harp, Henry Hensel, Greg Pohl, and Bruce Walsh for providing additional specimens and/or data, Jocelyn Gill for preparing the figures, and Gary Anweiler and Cliff Ferris for reviewing the manuscript. Evgeny Zakharov, Paul Hebert, and other members of the Barcode of Life Project at the University of Guelph, Ontario, Canada, provided DNA data. Molecular analyses were carried out through grants from the National Science and Engineering Research Council of Canada and Genome Canada through the Ontario Genomics Institute.

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# A revision of the genus *Hypotrix* Guenée in North America with descriptions of four new species and a new genus (Lepidoptera, Noctuidae, Noctuinae, Eriopygini)

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‡ [urn:lsid:zoobank.org:author:80047B1E-99C4-4227-B92B-5C430A916BEA](https://doi.org/urn:lsid:zoobank.org:author:80047B1E-99C4-4227-B92B-5C430A916BEA)

§ [urn:lsid:zoobank.org:author:EFCD84CA-F880-4BC5-8AEC-BF2C7323920B](https://doi.org/urn:lsid:zoobank.org:author:EFCD84CA-F880-4BC5-8AEC-BF2C7323920B)

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## Abstract

The genus *Hypotrix* Guenée, 1852 is synonymized with *Trichorthosia* Grote, 1883, *Proteinania* Hampson, 1905, *Ursogastra* Smith, 1906, and *Trichagrotis* McDunnough, [1929]. Four species are transferred from the genus *Hexorthodes* McDunnough [*Hypotrix trifascia* (Smith, 1891), **comb. n.**, *H. alamosa* (Barnes, 1904), **comb. n.**, *T. hueco* (Barnes, 1904), **comb. n.**, and *T. optima* (Dyar, 1920), **comb. n.**]. Four new species are described (*T. basistriga* Lafontaine, Ferris & Walsh; *T. naglei* Lafontaine, Ferris & Walsh;

*T. ocularis* Lafontaine, Ferris & Walsh; and *T. rubra* Lafontaine, Ferris & Walsh). A new genus, *Anhypotrix* Lafontaine, Ferris & Walsh, is proposed for *Polia tristis* Barnes & McDunnough, 1910, currently misplaced in *Trichorthosia*. A key to species, descriptions, illustrations of adults and genitalia are included.

## Keywords

Taxonomy, *Anhypotrix*, *Hexorthodes*, *Hypotrix*, *Proteinania*, *Trichagrotis*, *Trichorthosia*, *Ursogastra*, Arizona, Brazil, Colorado, Mexico, New Mexico, Texas, Utah

## Introduction

The genus *Hypotrix* Guenée, 1852 includes 23 species occurring from southern Mexico southward to Brazil and Peru (Poole 1989). These species, together with 11 species of *Trichorthosia* Grote, 1883, mainly from southwestern United States and Mexico, one species of *Ursogastra* Smith, 1906, one species of *Trichagrotis* McDunnough, [1929], and four species transferred from *Hexorthodes* McDunnough, [1929], are brought together to form an expanded concept of *Hypotrix*. Although this assemblage of species is dissimilar in adult appearance, genital characters and the “barcode” (part of Cox1 *mt* DNA) indicate that they form a monophyletic group. The most easily observed diagnostic character for the genus is the form of the anal papillae in the female. These are swollen and bulbous basally, then abruptly tapered to a narrow pointed apex. In preserved specimens the anal papillae are frequently curved below the end of the abdomen, sometimes by as much as 180° to project anteriorly. In males the diagnostic character is the membranous flap arising from the middle of the sacculus and partially overtopping the sclerotized part of the sacculus. The genus is peculiar in that there are frequently masses of long scales on the pleural membrane of the abdomen of the male, especially prolific in Central and South American *Hypotrix* species, but sometimes seen in other species as well, such as *H. ocularis*, sp. n., *H. hueco* (Barnes), and *H. lunata* (Smith). In some species these scales form persistent patches that at first look like basal abdominal brushes, but there are no levers or pockets so the scales cover the underside of the abdomen like a cloak. Some species have a basal abdominal brush, with a lever and pocket, as well as a secondary tuft of scales almost at the same place (e.g., *H. purpurigera* Guenée, Fig. 49); in some species the brushes are present but the levers are vestigial and the pockets have been lost (e.g., *H. ocularis*, Fig. 50); in other species the secondary abdominal tufts are posterior to the position where the basal abdominal brushes would be (e.g., *H. lunata*, Fig. 51). There is a great deal of structural diversity in *Hypotrix* in Central and South America and although the group appears to be monophyletic, a revision of the entire group may find that arranging the group into several genera is preferable.

The closest relative of *Hypotrix* appears to be *Orthodes* Guenée. The two genera have the membranous area on the sacculus, which in some species of *Orthodes* is enlarged into a long eversible coremata, and basally swollen anal papillae, although in *Orthodes* the papillae are membranous and broad posteriorly. The two genera typically associate in barcode analyses.

Most species in the genus can be arranged in one of two groups. In the first group (formerly *Trichorthosia*, *Trichagrotis*, and some already in *Hypotrix*), the uncus is spatulate apically, the cucullus is separated from the rest of the valve by a deep ventral notch, the anal angle of the cucullus has an enlarged cornutus, the digitus is slender and tapered, and in the female genitalia the two sides of the ductus bursae are similar. In the second group (*Ursogastra*, *Proteinania*, the species removed from *Hexorthodes*, and some already in *Hypotrix*) the uncus is broad, lightly sclerotized, and densely setose, the cucullus is lightly sclerotized and setose, the digitus is apically blunt or spatulate, and in the female genitalia the ductus bursae has a prominent bulge to the left when viewed ventrally. Although this distinction works generally, there is some overlap in the distribution of the characters, and some of the characters are missing in some species in each group, so a formal taxonomic recognition of the two groups, even as subgenera, seems impractical. The exception is "*Trichorthosia*" *tristis* (Barnes & McDunnough), which shows no structural affinities with *Hypotrix*, or with any other known genus, so it is placed in *Anhypotrix* gen. n.

The type-species, *Hypotrix purpurigera*, is one of the more atypical species in the genus in male genitalia (Fig. 32), although in external appearance (Fig. 17) and female genitalia (Fig. 47), it is similar to other species in *Hypotrix*. In the male genitalia the membranous flap from the cucullus forms a large setose membrane over the entire ventral half of the valve and tapers to a point at the neck of the cucullus. The clasper and digitus are reduced and mainly rod-like; they extend posteriorly just below the costal margin of the valve and end in short, pointed processes at the costal angle of the valve. The cucullus is reduced to a small rounded lobe with a multiple-rowed corona covering the apical half. The male vesica and female genitalia are most like those of *H. hueco* and *H. lunata*.

In addition to the new combinations proposed in the systematics section, the synonymy of *Trichorthosia* with *Hypotrix* creates the following additional combinations. *Hypotrix cirphidia* (Draudt, 1924), comb. n., *H. clarcana* (Dyar, 1916), comb. n., *H. diapera* (Hampson, 1913), comb. n., *H. duplicilinea* (Dognin, 1908), comb. n., *H. euryte* (Druce, 1898), comb. n., *H. niveilinea* (Schaus, 1894), comb. n., *H. umbrifer* (Dyar, 1916), comb. n.

## 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.

**CDF** Personal Collection of Clifford D. Ferris, Laramie, Wyoming, USA.

**CNC** Canadian National Collection of Insects, Arachnids, and Nematodes, Ottawa, Ontario, Canada.

<b>CUIC</b>	Cornell University Insect Collection, Ithaca, New York, USA.
<b>JBW</b>	Personal collection of J. Bruce Walsh, Tucson, Arizona, USA.
<b>NMSU</b>	New Mexico State University, Las Cruces, New Mexico, USA.
<b>RL</b>	Personal collection of Ronald H. Leuschner, Manhattan Beach, California, USA.
<b>TLSC</b>	Texas Lepidoptera Survey Collection, Houston, Texas, USA.
<b>USNM</b>	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).

### *Hypotrix* Guenée, 1852

Type species. *Hypotrix purpurigera* Guenée, 1852, by subsequent designation by Hampson 1905.

*Trichorthosia* Grote, 1883, **syn. n.**

Type species: *Trichorthosia parallela* Grote, 1883, by monotypy.

*Proteinania* Hampson, 1905, **syn. n.**

Type species: *Chloridea viciasia* Schaus, 1894, by original designation.

*Ursogastra* Smith, 1906, **syn. n.**

Type species: *Ursogastra lunata* Smith, 1906, by monotypy.

*Trichagrotis* McDunnough, [1929], **syn. n.**

Type species: *Trichorthosia spinosa* Barnes & McDunnough, 1912, by original designation.

**Diagnosis. Adults.** Males and females of similar size (forewing length 13–18 mm). *Head* – Male antenna beadlike to biserrate, lateral setae tending to group into two tufts on each side and clearly doubly bifasciculate in some species. Female antenna filiform, minutely setose ventrally. Frons rounded and usually covered with long scales, but partially exposed and centrally roughened in some species. Eye covered with surface hair. Labial palpus porrect or slightly upturned, apical segment usually about 1/3 as long as second segment, occasionally 1/4 as long (e.g., *H. lunata*) to 1/2 as long (e.g., *H. nagleri*). *Throat* – *Wings*: Forewing ground color typically gray, brown, or orange; pattern variable but typically with reniform and orbicular spots with a pale outline, often filled with black, especially in Neotropical species; subterminal line typically straight. Hindwing white to fuscous. *Legs*: Sclerotized spiniform setae on middle and hind tibiae in most species formerly associated with *Trichorthosia*; spiniform setae on all tibiae in *H. spinosa*. Basitarsus with three ventral rows of spiniform setae; central row of setae tending to

duplicate into two irregular rows on tarsal segments 2–5. *Abdomen* – Base of abdomen usually without basal abdominal brushes (e.g., *H. trifascia*, Fig. 52), but fully-developed brushes, levers and pockets in a few species including type-species *H. purpurigera* (Fig. 49). Brushes present but levers vestigial in some species (e.g., *H. ocularis*, Fig. 50). Many species, especially those formerly in *Hypotrix*, with masses of long scales in pleural membrane of abdomen and in some species one or more patches of scales persistently attached (e.g., *H. lunata*, Fig. 51). Eighth abdominal sternum of male with a tuft of long setae on a short eversible coremata in most species. *Male genitalia* – Uncus typically with expanded often spatulate apex. Valve usually with well-defined triangular cucullus with narrow “neck,” apical corona, usually with one stout seta near anal angle, and digitus narrow and tapered and projecting into ventral notch proximal to cucullus; a subgroup with cucullus mainly membranous, defined by slight “neck,” with corona reduced or absent; apex of digitus blunt or rounded; clasper a simple curved (or slightly S-shaped) rod projecting above dorsal margin of valve; sacculus only sclerotized dorsally with middle part of sacculus forming membranous flap partially overtopping sclerotized part and extending to posteriorly to “neck” of cucullus. Vesica most often long and partially coiled, usually with band of minute spinules toward apex, with several to many long spike-like cornuti in subbasal swollen area; some species with thorn-like spine or tight cluster of cornuti at apex of aedeagus, and some with cornutus with bulbous base on small diverticulum. *Female genitalia* – Corpus bursae thin and membranous, rounded or oval, without obvious signa. Appendix bursae typically long and coiled. Ductus bursae heavily sclerotized, usually about as long as corpus bursae. Anterior and posterior apophyses rod-like, 1.0–1.5 × length of abdominal segment eight. Anal papillae diagnostic; base swollen, almost bulbous laterally, then abruptly tapered to a narrow almost spine-like apex; apex of anal papillae usually down-turned and when protruding, often bending ventrally through 180° to project anteriorly.

### Key to North American species of *Hypotrix*

1. Forewing longitudinally streaked; antemedial, medial, and postmedial lines absent ..... 2
- Forewing pattern mottled or well defined but not longitudinal streaking; some transverse lines evident..... 3
2. Forewing with yellow or orange on veins and black streaks between veins .... *H. ferricola*
- Forewing cream colored with fine dark streaks and speckling and dark shading toward posterior margin of wing ..... *H. diplogramma*
3. Reniform spot large, black and crescentic, usually fused to rounded black orbicular spot..... *H. lunata*
- Reniform spot, if dark, then kidney shaped or oval ..... 4
4. Middle and hind tibiae with spiniform setae posteriorly near tibial spurs ... 5
- Middle and hind tibiae without spiniform setae..... 8
5. Forewing with subterminal line straight with dark line proximally ..... 6
- Forewing with subterminal line absent or irregular..... 7

6. Reniform and orbicular spots with pale contrasting outline; foretibia with spiniform setae..... *H. spinosa*  
– Reniform spot mainly obscure, except for dark area in lower part of reniform spot; orbicular spot a dark dot; foretibia without spiniform setae .....  
.....*H. parallela*
7. Forewing without basal dash; antemedial line separated from orbicular spot by distance equal to width of line.....*H. ocularis*  
– Forewing with black basal dash; antemedial line touching orbicular spot .....  
.....*H. basistriga*
8. Forewing silvery gray with contrasting orange and orange-brown shading in terminal area .....*H. naglei*  
– Forewing reddish brown, orange brown, or yellow brown; terminal area similar in color to remainder of forewing..... 9
9. Forewing with three mainly parallel dark and/or light transverse lines.....  
.....*H. trifascia*  
– Forewing with transverse lines more irregular..... 10
10. Forewing with reniform and orbicular spots gray with contrasting yellow triangular spot between them and below costa.....*H. optima*  
– Forewing without yellow between reniform and orbicular spots ..... 11
11. Forewing with medial area much paler than basal and subterminal areas, so reniform and orbicular spots contrastingly darker ..... *H. hueco*  
– Forewing with medial area similar in color to basal and subterminal areas and with reniform and orbicular spots not especially contrasting ..... 12
12. Forewing with subterminal line irregular; reniform and orbicular spots with pale-yellow outline; reniform and orbicular spots not especially contrasting.  
.....*H. alamosa*  
– Forewing with subterminal line straight, except toward apex; reniform spot mainly obscure, except for dark area in lower part of spot; orbicular spot absent..... *H. rubra*

## Systematics

### *Hypotrix ferricola* (Smith, 1905), comb. n.

Figs 1, 2, 19, 34

*Leucania ferricola* Smith, 1905: 203.

**Type material.** Holotype ♂. Arizona, Cochise Co. AMNH, examined.

**Other material examined and distribution.** **Mexico:** State of Durango (Sierra Madre Occidental). **USA:** Arizona: Cochise Co. (Chiricahua Mts), Graham Co. (Pinaleno Mts), Pima Co. (Santa Catalina Mts), and Santa Cruz Co. (Santa Rita Mts). New Mexico: Grant Co.



**Diagnosis.** Within United States the boldly streaked orange and blackish-gray forewing pattern of *Hypotrix ferricola* is unmistakable. *Hypotrix ferricola* is closely related to *H. aselenographa* (Dyar, 1916), comb. n. [*Trichorthosia aselenographa* Dyar, 1916] from Mexico, except the subterminal line in *H. ferricola* is parallel to the wing margin in the middle part of the wing and then curves outward near the forewing apex (the subterminal line is almost straight to the forewing apex in *H. aselenographa*, so the terminal area is broad mesially and tapered toward each end), and the dark patch in the cell through the reniform and orbicular spots is paler, so the orbicular spot is evident as a dark streak and the reniform spot as a dark crescent (the streak in the cell in *H. aselenographa* is black, completely obscuring the reniform and orbicular spots). The forewing length in *H. ferricola* is 13 to 15 mm. The *male genitalia* of *H. ferricola* have a small, triangular, heavily sclerotized cucullus with a stout seta at the anal angle, a rounded U-shaped notch in the ventral margin of the valve anterior to the cucullus, an apically spatulate uncus, and a long, slender digitus. The vesica is very long and narrow with a dense band of spinules on the apical half, a stout rose-thorn spine at the base, and a field of six or seven spike-like cornuti subbasally. In the *female genitalia* the corpus bursae is rounded and the appendix bursae is long and narrow and gently coiled.

**Distribution and biology.** *Hypotrix ferricola* occurs in southeastern Arizona, southwestern New Mexico, and northern Mexico. Collecting dates range from early April to early August, possibly representing several generations. Most records are from ponderosa pine forests.

***Hypotrix diplogramma* (Schaus, 1903), comb. n.**

Figs 3, 20, 35

*Himella diplogramma* Schaus, 1903: 232.

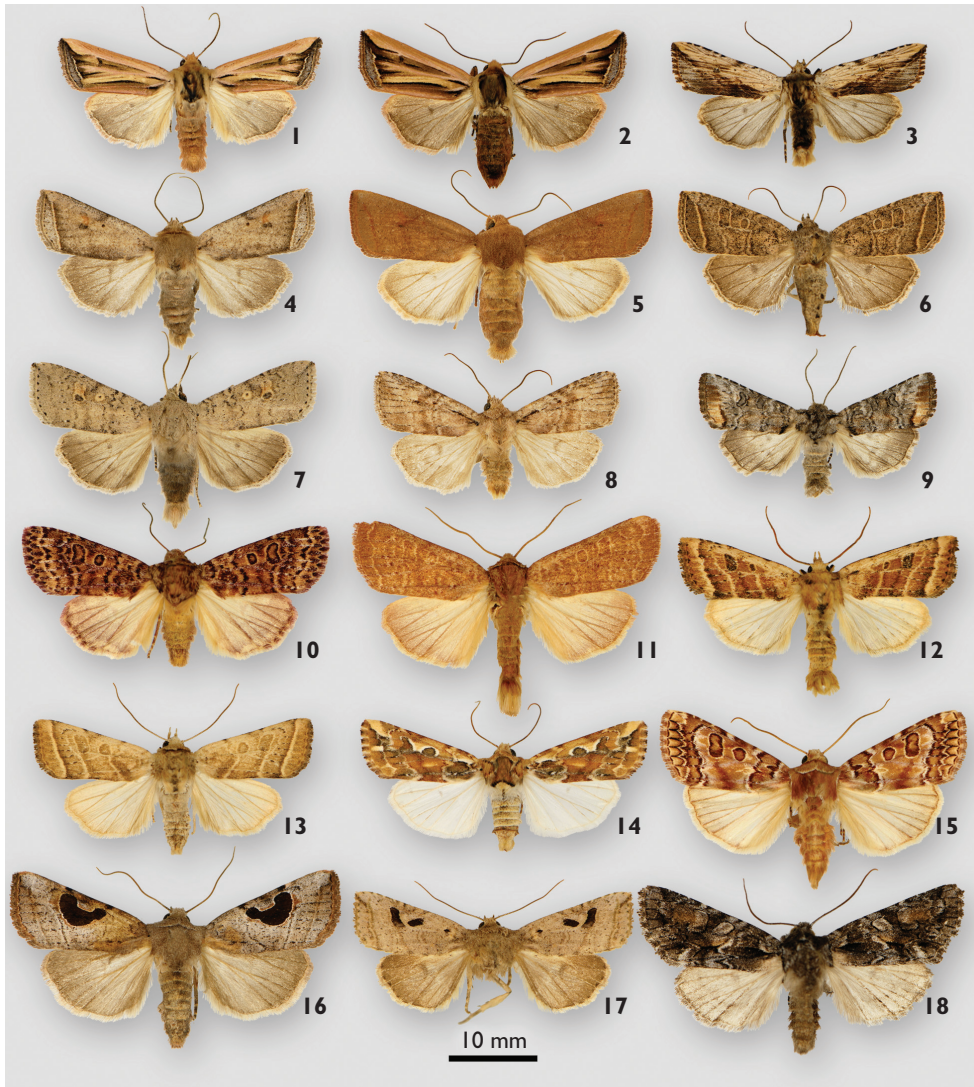
*Morrisonia albidior* Barnes and McDunnough, 1910: 153.

*Scriptania inquisita* Dyar, [1920]: 164.

**Type material.** *Himella diplogramma*: **syntypes**, USNM, examined. Type locality: Mexico, Las Vigas. *Morrisonia albidior*: **syntypes**, USNM, examined. Type locality: USA, Arizona, Redington. *Scriptania inquisita*: **holotype** ♀, USNM, examined. Type locality: Mexico, Mexico City.

**Other material examined and distribution.** **Mexico:** Veracruz; Federal District. **USA:** Arizona: Cochise Co. (Chiricahua Mts), Graham Co. (Pinaleno Mts), Pima Co. (Santa Catalina Mts), Santa Cruz Co. (Santa Rita Mts), and Yavapai Co. New Mexico: Grant Co.

**Diagnosis.** *Hypotrix diplogramma* is unmistakable in appearance, but structurally it is closely related to *H. ferricola* and similar in size (forewing length: 13–15 mm). The subterminal line is a diffuse series of dark streaks, so the gray shading of the terminal area, so well defined in *H. ferricola*, bleeds into the subterminal area in *H. diplogramma*. Most of the forewing is cream colored with fine black streaks on and between the veins, and the dark shading intensifies toward the posterior margin of the wing, forming a



**Figures 1–21.** *Hypotrix* and *Anhypotrix* adults. **1** *H. ferricola*, 1 ♂, Arizona, Pima Co., Santa Catalina Mts, 7800' **2** *H. ferricola*, ♀, Arizona, Graham Co., Pinaleno Mts, 9000' **3** *H. diplogramma* ♂, Arizona, Pima Co., Santa Catalina Mts, 7800' **4** *H. parallela* ♂, Arizona, Cochise Co., Huachuca Mts, 6200' **5** *H. rubra* ♀, Arizona, Pima Co., Mt. Lemmon **6** *H. spinosa* ♀, Mexico, Durango, 10 mi W El Salto, 9000' **7** *H. ocularis* ♂, Arizona, Cochise Co., Chiricahua Mts, Onion Saddle, 7700' **8** *H. basistriga* ♀, Arizona, Apache Co., White Mts, 8300' **9** *H. naglei* ♂, Arizona, Pima Co., Santa Catalina Mts, Mt. Lemmon, 9100' **10** *H. alamosa* ♀, Arizona, Pima Co., Santa Catalina Mts, Mt. Lemmon, 9100' **11** *H. alamosa* ♀, Arizona, Cochise Co., Huachuca Mts, Ramsey Canyon, 6000' **12** *H. trifascia* ♂, New Mexico, Colfax Co., Sangre de Cristo Mts, 7900' **13** *H. trifascia* ♀, Arizona, Cochise Co., Huachuca Mts, Ash Canyon, 5100' **14** *H. optima* ♀, Arizona, Cochise Co., Chiricahua Mts, Onion Saddle, 7600' **15** *H. hueco* ♀, Arizona, Cochise Co., Huachuca Mts, Ash Canyon, 5100' **16** *H. lunata* ♀, Arizona, Santa Cruz Co., Santa Rita Mts, Madera Canyon, 4880' **17** *H. purpurigera* ♀, Brazil, Parana, Mandirituba **18** *Anhypotrix tristis* ♂, New Mexico, McKinley Co., Zuni Mts, McGaffey, 7500'.

large black patch in some specimens. The *male genitalia* are similar to those of *H. ferricola* but in *H. diplogramma* the ventral margin of the valve proximal to the subapical notch is extended ventrally into a sharply angled process defining the anterior margin of the notch. In the vesica the basal spine is minute, but the subbasal cornuti are much larger than in *H. ferricola*. The *female genitalia* are also similar to those of *H. ferricola*, but the appendix bursae is shorter and more tightly coiled basally in *H. diplogramma*.

**Distribution and biology.** *Hypotrix diplogramma* occurs from eastern Arizona and southwestern New Mexico southward at least to Mexico City. Collection dates are from late March to late October, probably representing multiple generations. Most records are from ponderosa pine forests.

***Hypotrix parallela* (Grote, 1883), comb. n.**

Figs 4, 21, 36

*Trichorthosia parallela* Grote, 1883: 31.

*Taeniocampa terminatissima* Dyar, 1904: 104.

**Type material.** *Trichorthosia parallela*: **holotype**. New Mexico [location unknown]. *Taeniocampa terminatissima*: **holotype** ♀ [USNM, examined]. Type locality: New Mexico, Las Vegas.

**Other material examined and distribution.** **Mexico:** State of Durango (Sierra Madre Occidental). **USA:** Arizona: Apache Co. (White Mts) and Cochise Co. (Huachuca Mts). Colorado: La Plata Co. (San Juan Mts); New Mexico: Colfax (Sangre de Cristo Mts), Grant Co. (Pinos Altos Mts), Lincoln (Capitan Mts), McKinley Co. (Zuni Mts), and Rio Arriba Co. Texas: Jeff Davis Co. (Davis Mts).

**Diagnosis.** *Hypotrix parallela* is a medium-sized species (forewing length: 13–15 mm) with a pale silky brownish-gray forewing and fuscous hindwing. Most of the forewing markings are obscure except for a straight white subterminal line bordered proximally by dark-gray, a dark spot in the lower part of the pale-orange reniform spot, and a small black dot in a pale area representing the orbicular spot. The medial line is somewhat diffuse but still distinctive because it extends in an oblique line from the costa to the dark patch in the reniform spot, then bends abruptly about 90° to continue in a straight but oblique line to the posterior margin of the forewing. There are spiniform setae near the ends of the middle and hind tibiae. The *male genitalia* are similar to those of *Hypotrix ferricola* and *H. diplogramma*, but the uncus is less spatulate apically, the cucullus much broader with a narrow gap between it and the sacculus, and the vesica has a bulbous cornutus on a short diverticulum about 1/3 from its base. The genitalia are most similar to those of *Hypotrix rubra*, described below. In the *female genitalia* the corpus bursae is much larger, and the appendix bursae is shorter and wider than in *H. ferricola* and *H. diplogramma*.

**Distribution and biology.** *Hypotrix parallela* occurs from southwestern Colorado southward through eastern Arizona, New Mexico, and western Texas to the State of

Durango in northern Mexico. Collecting dates range from early July to late August in ponderosa pine parkland.

***Hypotrix rubra* Lafontaine, Ferris & Walsh, sp. n.**

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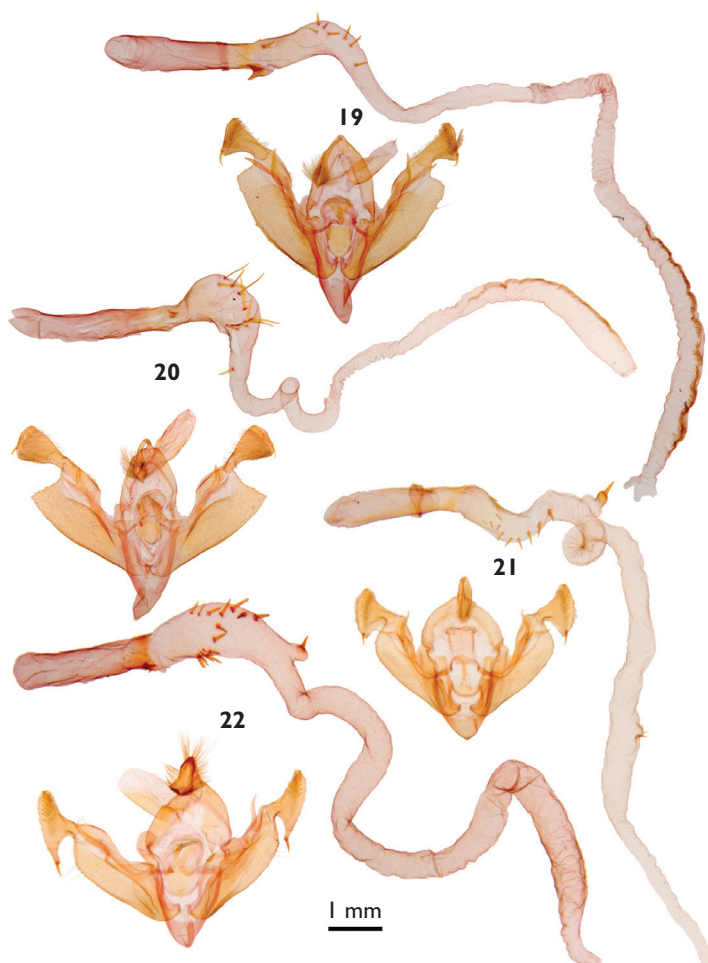
Figs 5, 22, 37

**Type material. Holotype** ♂. Arizona, Cochise Co., Chiricahua Mts, Onion Saddle, 7700', Ponderosa pine/oak habitat, uv/mv lights, 6 June 2004, B. Walsh. CNC. **Paratypes:** 11 ♂, 35 ♀. **USA, Arizona.** Same locality and collector as for holotype, 26 May 2003, 6 June 2004, 6 June 2007, 14 June 2007 (2 ♂, 3 ♀); Cochise Co., Chiricahua Mts, Barfoot Park, 8370', 17 June 2009, C, D, Ferris (1 ♀); Cochise Co., Chiricahua Mts, canyon below Barfoot Park, 8320', 18 June 2009, C, D, Ferris (1 ♂); Cochise Co., Chiricahua Mts, Cave Creek Canyon, 5400', 18 May–19 June 1966, J. G. Franclemont (1 ♂, 7 ♀); Cochise Co., Chiricahua Mts, Onion Saddle, 7600', 27 June – 1 July 1967, J. G. Franclemont (4 ♀); Cochise Co., Chiricahua Mts, Shaw Peak Trail above Onion Saddle, 7630', 22 June 2008, C, D, Ferris (3 ♀); Cochise Co., Chiricahua Mts, mi 10.6 Turkey Creek Road, 6400', pine/oak forest, uv/mv lights, 5 May 2002, B. Walsh (1 ♂); Graham Co, Pinalena Mts, Cummingham Campground, 9000', 5 June 2007, B. Walsh (2 ♀); Graham Co., Mt. Graham (Pinellelo Mts), Snow Flat, 8775', 18 May 2009, C, D, Ferris (1 ♂); Pima Co., Mt Lemmon, Summerhaven, 25 May 1991, R. Nagle (1 ♀); Pima Co., Mt Lemmon, Summerhaven, 32°46'N, 110°74'W, 8200', 1 June 1997, R. Leuschner (1 ♂); Pima Co., Santa Catalina Mts, Summerhaven, 7845', 10–11 June 2008, C, D, Ferris (1 ♂, 3 ♀); Pima Co., Santa Catalina Mts, forestry road 39, 2.7 mi E junction with Mt Lemmon Hwy., mixed pine/oak on east facing slope, 25 May 2005, B. Walsh (1 ♀); Santa Cruz Co., Madera Canyon 5000', 12–14 June 1963, J. G. Franclemont (3 ♀); Santa Cruz Co., Madera Canyon 4880', 11 June 1963, J. G. Franclemont (1 ♂). **New Mexico.** Grant Co., Pinos Altos Mts, S end Cherry Creek Campground, 6753', 32°54'39.1"N, 108°13'44.6"W, conifer forest, 22 May 2007, G. Forbes (1 ♀); Grant Co., Pinos Altos Mts, Cherry Creek Canyon, 6500', 16–17 June 1999, C. D. Ferris (2 ♀); Grant Co., Mimbres Mts, Spring Canyon, 7000', 24 June 2008, C, D, Ferris (1 ♂, 1 ♀); Otero Co., Sacramento Mts, Dry Creek Road 2.1 mi N Rt 82, 6 mi E Rt 244 at Cloudcroft, conifer forest, 17 May 2006, G. Forbes (1 ♀); Otero Co., Haynes Canyon Vista, Sunspot Road 1.2 mi SW Cloudcroft, 8830', conifer forest, 23 June 2006, G. Forbes (1 ♀); Sierra Co., Mimbres Mts, Emory Pass, summit overlook, 8828', conifer forest, 18 May 2006, G. Forbes (1 ♀). **Mexico. Durango.** 30 mi W Durango, 8000', 6 May 1961, Howden & Martin (1 ♂). Paratypes deposited in CDE, CNC, CUIC, JBW, NMSU, RL, USNM.

**Etymology.** *Rubra* is taken from the Latin for red and refers to the reddish color of the forewings and body of the moth.

**Diagnosis.** *Hypotrix rubra* can be recognized by the reddish-brown forewing with the maculation obscure except for a diffuse reddish-brown medial line that is sharply





**Figures 19–22.** *Hypotrix* male genitalia. 19 *H. ferricola* 20 *H. diplogramma* 21 *H. parallela* 22 *H. rubra*.

angled at the reniform spot, a dark-gray spot in the lower part of the reniform spot, and an almost straight red subterminal line. It is most closely related to *H. parallela*, both species having similar male and female genitalia with a bulbous cornutus on a submedial diverticulum in the vesica. They differ in that *H. rubra* lacks spiniform setae on the middle and hind tibiae, the uncus is much broader apically, the cucullus extended farther ventrally, and the vesica in the male and appendix bursae in the female are correspondingly longer.

**Description. Adults.** Male and female similar in size, color, and maculation. Forewing length: 12–16 mm. *Head* – Male antenna with individual segments swollen laterally, slightly diamond-shaped; ventral setae with tendency to divide into two tufts on each side. Female antenna filiform, minutely setose ventrally. Palpi and head unicolorous, clothed with deeply-forked, reddish-brown scales. *Thorax* – Covered with deeply-forked, reddish-brown scales; without tufting. *Legs*: Covered with reddish-brown scales with scattered dark-gray scales,

especially on outer side of tarsi. Tibia without spiniform setae. *Wings*: Dorsal forewing reddish brown (occasionally reddish-gray) with maculation obscure except for a diffuse red medial line, sharply angled at reniform spot, a dark-gray spot in lower part of reniform spot, and an even, slightly concave red subterminal line; some specimens with patch of gray scales near apex of wing. Fringe similar to forewing ground color, or slightly darker red. Dorsal hindwing dirty white or very pale fuscous with darker fuscous on discal spot, wing veins, and wing margin. Fringe pale reddish buff with diffuse darker medial line. *Male genitalia* – Uncus gradually widening from base, then abruptly expanded and wedge shaped at apex. Valve with well-defined triangular cucullus with narrow “neck,” dorsoapical corona, and one stout seta at protruding anal angle; digitus short, tapered and lightly sclerotized, projecting into base of ventral notch proximal to cucullus; clasper a slightly upcurved rod extending to dorsal margin of valve; membranous part of sacculus extends along ventral half of valve to notch anterior to cucullus; lower margin of valve evenly curved into notch. Aedeagus with cluster of small spines at apex on right side. Vesica very long and gently coiled, about 6 × as long as aedeagus; vesica swollen at base with 16–18 long stout cornuti forming longitudinal row along swollen area and transverse row across middle of it; cornutus with bulbous base on a short diverticulum at about 1/5 from base of vesica. *Female genitalia* – Corpus bursae membranous, rounded; appendix bursae long, narrow, and coiled, about 3 × as long as corpus bursae. Ductus bursae about as long as corpus bursae, heavily sclerotized on sides, more so on left side. Anal papillae narrow and sharply pointed with large bulbous base.

**Distribution and biology.** *Hypotrix rubra* occurs from southwestern New Mexico and southeastern Arizona southward to the State of Durango in northern Mexico. Adults have been collected between early May and early July in ponderosa pine forests and mixed woodlands of pine and oak.

***Hypotrix spinosa* (Barnes & McDunnough, 1912), comb. n.**

Figs 6, 23, 38

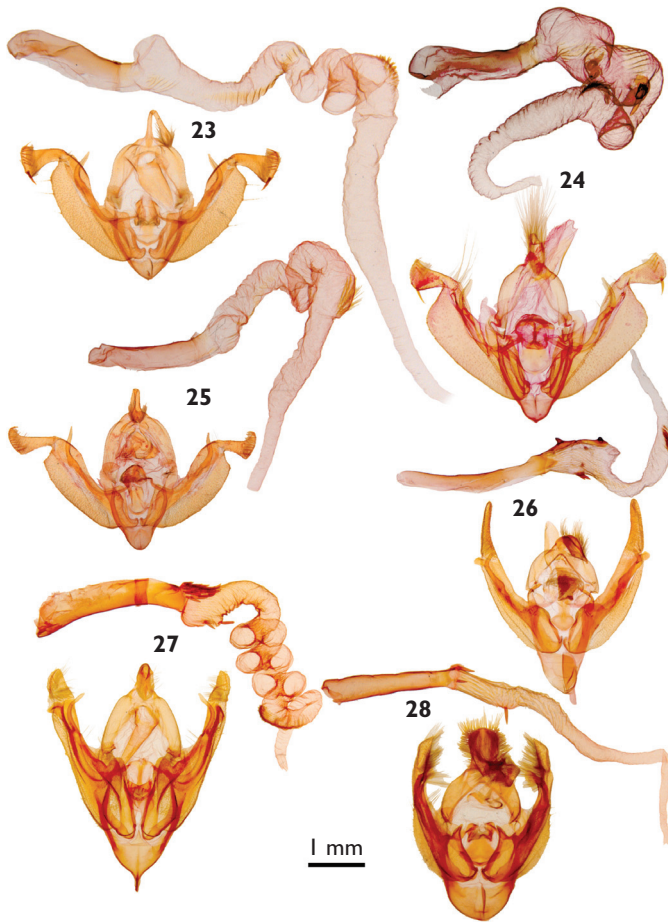
*Trichorthosia spinosa* Barnes & McDunnough, 1912: 9.

**Type material.** **Syntypes** 2 ♀, USNM, examined. Type locality: Arizona, [Cochise Co., Miller Canyon], Palmerlee.

**Other material examined and distribution.** **Mexico:** State of Durango (Sierra Madre Occidental). **USA:** Arizona: Cochise Co. (Chiricahua and Huachuca Mts). New Mexico: Grant Co. (Pinos Altos Mts).

**Diagnosis.** *Hypotrix spinosa* superficially looks like a brown, well-marked form of *H. parallela*, but averages slightly larger (forewing length: 13–15 mm), the reniform and orbicular spots are larger and outlined by a contrasting pale line, the reniform spot is more rectangular, and spiniform setae are on all three pairs of tibiae. The *male genitalia* also are very different from those of *H. parallela*; the uncus is slender with an abruptly spatulate apex, the cucullus is longer and narrower, and the vesica lacks subbasal cornuti, is more tightly coiled medially, and has a field of minute spines postmedially. In the *female geni-*





**Figures 23–28.** *Hypotrix* male genitalia. 23 *H. spinosa* 24 *H. ocularis* 25 *H. basistriga* 26 *H. naglei* 27 *H. alamosa* 28 *H. trifascia*.

*talia* the corpus bursae is smaller than that of *H. parallela*, the appendix bursae is coiled mesially, and the ductus bursae is mostly membranous, sclerotized only posteriorly.

**Distribution and biology.** *Hypotrix spinosa* is a very rarely collected species that is known only from southeastern Arizona, southwestern New Mexico, and the State of Durango in northern Mexico. Collecting dates range from mid-July to mid-August.

***Hypotrix ocularis* Lafontaine, Ferris & Walsh, sp. n.**

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Figs 7, 24, 39, 50

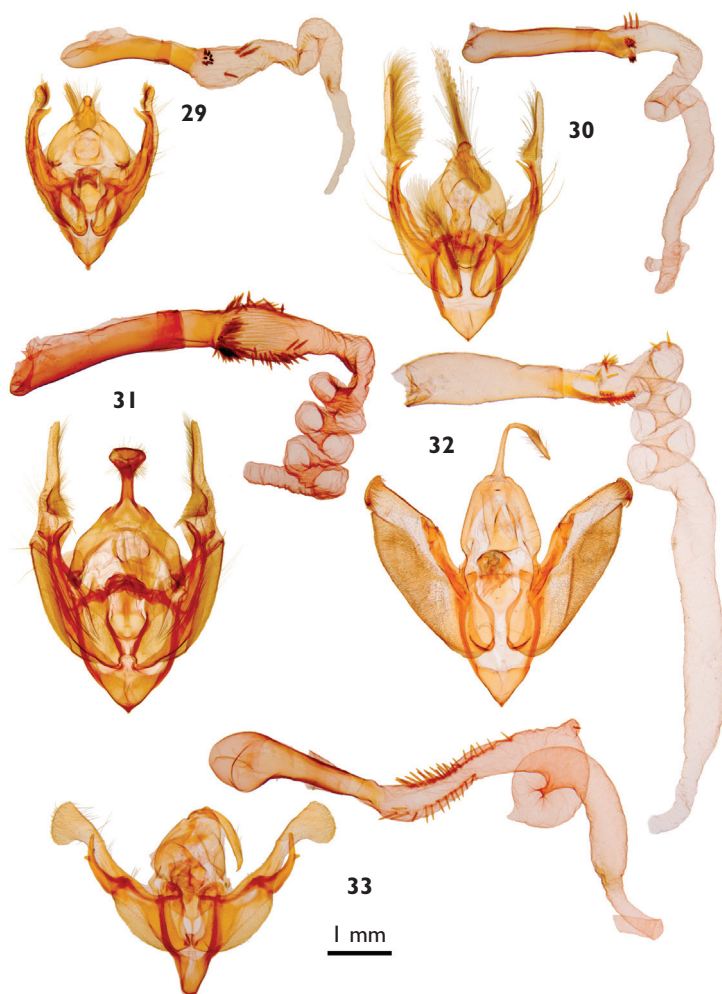
**Type material.** **Holotype** ♂. Arizona, Cochise Co., Chiricahua Mts, Onion Saddle, 7700', mixed pine-oak forest, 29 June 2003, B. Walsh. CNC. **Paratypes:** 8 ♂, 4 ♀.

**USA, Arizona.** Cochise Co., Chiricahua Mts, canyon below Barfoot Park, 8320', 18 June 2009, C. D. Ferris (1 ♂); Cochise Co., Chiricahua Mts, Rustler Park, 8500', 13 June 2001, B. Walsh (1 ♂); Cochise Co., Huachuca Mts, Carr Canyon, 5600' 11 June 2009, C. D. Ferris (1 ♀); Cochise Co., Mule Mts, Banning Creek, north side of Mule Pass, 5700', 21 June 2008, C. D. Ferris (1 ♂). **New Mexico.** Grant Co., Mimbres Mts, Spring Canyon, 7000', 24 June 2008 (1 ♂); 22 June 2009 (1 ♂, 1 ♀), C. D. Ferris; New Mexico, Grant Co., Pinos Altos Mts, 32°58.7'N 108°13.4'W 7720', 21 June 2009, C. D. Ferris (1 ♀). **Mexico, Federal District.** Lomas, 15–19 June 1939, 20–25 June 1940, T. Escalante (3 ♂, 1 ♀). Paratypes deposited in CDE, CNC, JBW, RL, USNM.

**Etymology.** The name of this species, *ocularis*, is Latin for eye and refers to the eye-like reniform spot on each forewing.

**Diagnosis.** *Hypotrix ocularis* can be recognized by the pale gray, or brownish-gray forewing, the pale rounded orbicular spot with a black central pupil or “bull’s eye,” and the irregular subterminal line. The male genitalia are most similar to those of *H. spinosa* but the apical half of the uncus is broadly spatulate (apically spatulate in *H. spinosa*), and the vesica is much shorter and with fewer coils and a large medial cornutus. The female genitalia also are similar to those of *H. spinosa*, but the corpus bursae is larger, the appendix bursae smaller, and the anal papillae more sharply pointed.

**Description. Adults.** Male and female similar in size, color, and maculation. Forewing length: 14–16 mm. **Head** – Male antenna with individual segments slightly swollen and rounded laterally; ventral setae with tendency to divide into two tufts on each side. Female antenna filiform, minutely setose ventrally. Palpi and head clothed with slightly-forked, pale brownish-gray strap-like scales, some black tipped. **Thorax** – Covered with similar scales to those of head; without tufting. **Legs:** Appearing speckled with mixture of pale gray and blackish-brown scales. Middle and hind tibiae with one or two spiniform setae near tibial spurs. **Wings:** Dorsal forewing pale gray or pale brownish gray; maculation usually contrasting; basal, antemedial and postmedial lines black, partially double with filling slightly paler than ground color; medial line dark, but diffuse, angled at reniform spot; postmedial line irregular as a thin pale sinuate line with varying amounts of dark speckling on proximal margin; wing margin with prominent black dots between wing veins and with black spot at apex; orbicular spot a contrasting rounded pale spot, partially outlined with dark scales and with black central spot, resembling a “bull’s eye;” orbicular spot separated from antemedial line by distance equal to width of line; reniform spot with both sides concave, so more 8-shaped than kidney shaped, filled with pale reddish-brown shading outlined by a pale line and with a large black spot in lower part of Figure 8. Fringe slightly paler than forewing ground color and with darker gray medial line. Dorsal hindwing pale fuscous with darker fuscous on discal spot, wing veins, postmedial line, and marginal 1/3 of wing; a series of black dashes on wing margin between veins. Fringe pale gray with thin dark-gray medial line. **Male genitalia** – Apical 1/2 of uncus broadly spatulate. Valve with well-defined triangular cucullus with narrow “neck,” dorsoapical corona, and one stout seta at rounded anal angle; digitus short, tapered, ending before reaching notch proximal to cucullus; clasper strongly upcurved, extending



**Figures 29–33.** *Hypotrix* and *Anhypotrix* male genitalia. **29** *H. optima* **30** *H. hueco* **31** *H. lunata* **32** *H. purpurigera* **33** *Anhypotrix tristis*.

beyond dorsal margin of valve; membranous part of sacculus very large, with flap extending over most of sclerotized part of sacculus and along ventral half of valve to notch anterior to cucullus; lower margin of valve rounded into notch. Aedeagus unarmed. Vesica short and stout, about  $3 \times$  as long as aedeagus; vesica swollen at base, without cornuti, with three half coils in middle third; a large stout cornutus near middle of vesica and a brush-like cluster of spines postmedially. *Female genitalia* – Corpus bursae membranous, oval; appendix bursae only slightly longer than corpus bursae, strongly ribbed, with three partial coils. Ductus bursae about  $2/3$  as long as corpus bursae, lightly sclerotized except posterior  $1/4$ . Anal papillae narrow and sharply pointed with sclerotized bulbous base.

**Distribution and biology.** *Hypotrix ocularis* occurs from southwestern New Mexico and southeastern Arizona southward to Mexico City. Adults have been collected in June.

***Hypotrix basistriga* Lafontaine, Ferris & Walsh, sp. n.**

urn:lsid:zoobank.org:act:1D9C6212-F3A9-4C8B-B95D-D024061EE26D

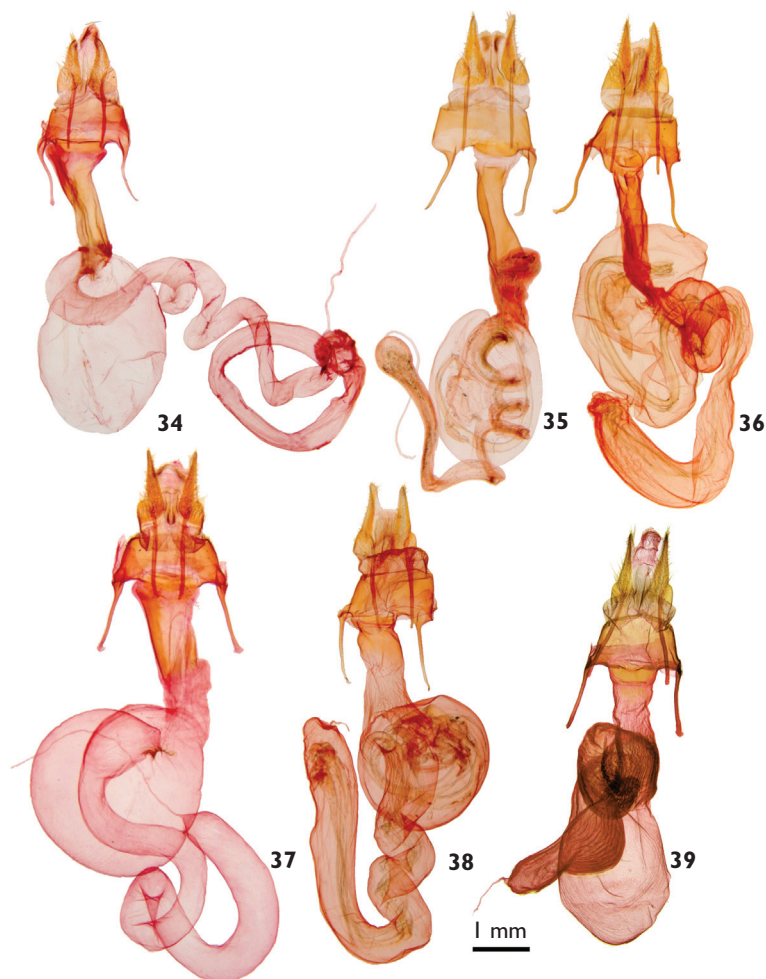
Figs 8, 25, 40

**Type material.** **Holotype** ♂. Arizona, Graham Co., Pinaleno Mts, Cunningham Campground, 9,000', ponderosa pine habitat, 14 June 2005, B. Walsh. CNC. **Paratypes:** 4 ♂, 1 ♀. **USA, Arizona.** [Apache Co.], White Mts, Greer, 8300', 26 June 1968, R. H. Leuschner (3 ♂, 1 ♀); [Apache Co.], White Mts, Greer, 8300', 24–25 July 1965, R. H. Leuschner (1 ♂). Paratypes deposited in CNC, JBW, RL.

**Etymology.** *Basistriga* is Latin and refers to the black dash or streak at the base of the forewing.

**Diagnosis.** *Hypotrix basistriga* can be recognized by its small size, streaked appearance created by the black basal dash and the combination of black on the forewing veins and pale gray-brown shading between the veins, the orbicular spot touching the outer edge of the antemedial line, and the obscure subterminal line. The male genitalia are most similar to those of *H. ocularis* but in *H. basistriga* the corona extends along the entire outer margin of the cucullus, there is no stout cornutus at the anal angle of the cucullus, and the vesica is much longer and without a large medial cornutus. The female genitalia also similar to those of *H. ocularis*, but in *H. basistriga* the appendix bursae is much longer.

**Description. Adults.** Male and female similar in size, color, and maculation. Forewing length: 12–13 mm. **Head** – Male antenna with individual segments slightly swollen and rounded laterally; ventral setae with tendency to divide into two tufts on each side. Female antenna filiform, minutely setose ventrally. Palpi and head clothed with slightly-forked, pale buff and brown strap-like scales, a few black tipped. **Thorax** – Covered with similar scales to those of head; without tufting. **Legs:** Appearing speckled with mixture of pale gray and blackish-brown scales. Middle and hind tibiae with 2–5 spiniform setae near tibial spurs. **Wings:** Dorsal forewing ground color appearing blotchy because of pale-brown shading mixed with patches of darker-brown; scattered white scales give wing a hoary appearance; wing appearing streaked because of long black basal dash and black shading on wing veins, especially in subterminal and terminal areas; maculation generally obscure; antemedial line with a faint darker gray inner line, a darker gray outer line, filled with pale ground color; postmedial line with faint scalloped inner line followed by diffuse pale gray shading; medial line gray brown, broad but diffuse, angled at reniform spot; postmedial line essentially absent but terminal area partially indicated by generally darker shading that blends into subterminal area; wing margin with small black dots between wing veins; orbicular spot a faint pale patch with a black spot in inner margin forming part of outer element of antemedial line, so antemedial line touching orbicular spot; reniform spot a rectangular pale patch with an elongated black spot or streak in lower proximal corner. Fringe with thin pale basal line, but mainly similar in color to darker ground shading on forewing. Dorsal hindwing very pale fuscous with darker fuscous on discal spot, wing veins, postmedial line, and mar-



**Figures 34–39.** *Hypotrix* female genitalia. **34** *H. ferricola* **35** *H. diplogramma* **36** *H. parallela* **37** *H. rubra* **38** *H. spinosa* **39** *H. ocularis*.

ginal 1/3 of wing; a broken terminal line indicated by dark fuscous line between some wing veins. Fringe pale buff. *Male genitalia* – Uncus thin from base, abruptly spatulate at apex. Valve with well-defined triangular cucullus with narrow “neck,” complete outer corona, without stout seta at anal angle; digitus short, tapered, ending at notch proximal to cucullus; clasper strongly upcurved, extending beyond dorsal margin of valve; membranous part of sacculus not overlapping sclerotized part, extending along ventral 1/3 of valve to notch in valve anterior to cucullus; lower margin of valve angled in to notch. Aedeagus unarmed. Vesica about  $3\frac{1}{2}$  × as long as aedeagus; vesica swollen at base, without cornuti, with coil in middle; vesica and a brush-like cluster of long spines postmedially. *Female genitalia* – Corpus bursae membranous, round; appendix bursae about 4 × longer than corpus bursae with



medial coil and curved through 180°, apical 1/2 projects posteriorly. Ductus bursae about 2/3 as long as corpus bursae, lightly sclerotized except posterior 1/4. Anal papillae tapered from large bulbous base.

**Distribution and biology.** *Hypotrix basistriga* is known only from the White Mountains and Pinaleno Mountains in eastern Arizona. Adults have been collected from mid-June to late July in open ponderosa pine forests.

***Hypotrix naglei* Lafontaine, Ferris & Walsh, sp. n.**

urn:lsid:zoobank.org:act:E737E121-2A58-44CE-B455-F8122C653139

Figs 9, 26, 41

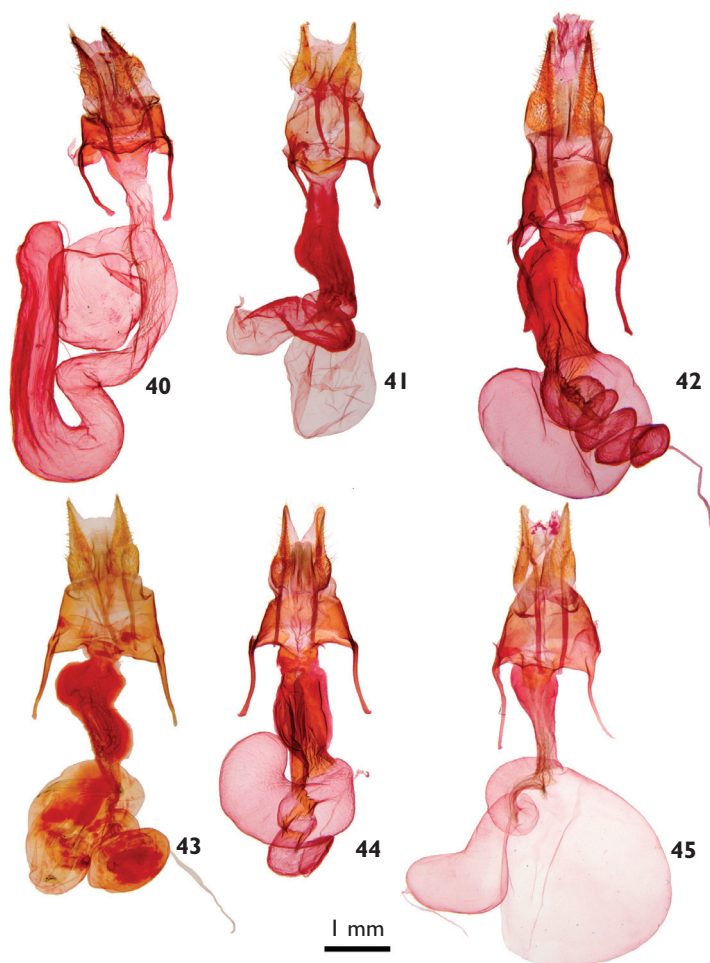
**Type material. Holotype** ♂. Arizona, Pima Co., Santa Catalina Mts, Mt. Lemmon, 9100', meadow in aspen/pine forest, 1 July 2007, B. Walsh. CNC. **Paratypes:** 23 ♂, 35 ♀. **USA, Arizona.** Same data as holotype (11 ♂, 25 ♀); Apache Co., Greer, 8300', 1–3 July 1993, 8200', 26 June 1968, 4–5 July 1988, R. Leuschner (5 ♀); Cochise Co., Chiricahua Mts, Barfoot Park, 8370', 17 June 2009, C. D. Ferris (1 ♀); Graham Co., Pinaleno Mts, Solider Creek Campground, 9400', Ponderosa Pine habitat, 26 June 2007, B. Walsh (3 ♂, 2 ♀); Pima Co., Santa Catalina Mts, Summerhaven, 7845', 10 June 2008, C. D. Ferris (3 ♂); Pima Co., Santa Catalina Mts, Bear Wallow Road, 7800', 3 July 2004, 23 June 2007, B. Walsh (4 ♂). **New Mexico.** New Mexico, Grant Co., Mimbres Mts, Spring Canyon, 7000', 22 June 2009, C. D. Ferris (1 ♀); Lincoln Co., Capitan Mts, summit Capitan Ridge, 10000', 3 & 10 July 1982, R. W. Holland (1 ♂, 1 ♀); Otero Co., Cathey Canyon overlook at Rt, 6563, 12.4 mi S junction Rt. 330, S of Cloudcroft, 16 June 2006, G. S. Forbes (1 ♂). CDF, CNC, CUIC, JBW, NMSU, RL, USNM.

**Etymology.** We take pleasure in naming *Hypotrix naglei* after Ray Nagle, a Lepidopterist who has graciously opened his home in the Santa Catalina Mountains for Lepidoptera research and where some of the type series was collected.

**Diagnosis.** *Hypotrix naglei* is a small silvery-gray or brownish-gray species with the maculation sharply defined in back, and a contrasting pale-orange patch in the lower half of the terminal area on the forewing. The male genitalia are characterized by an elongated, narrow cucullus, an apically rounded digitus, and a mesially broad uncus tapered to a double-toothed apex. The female genitalia have a heavily sclerotized ductus bursae and relatively small corpus bursae and appendix bursae. *Hypotrix naglei* belongs to the second clade of the genus in which the cucullus is elongated, without a distinct “neck,” the digitus is apically spatulate, and the uncus is not usually apically spatulate.

**Description. Adults.** Male and female similar in size, color, and maculation, except female hindwing averages slightly darker than for male. Forewing length: 11–12 mm. **Head** – Male antenna with individual segments very slightly swollen laterally; ventral setae with tendency to divide into two tufts on each side, becoming doubly bifasciculate apically. Female antenna filiform, minutely setose ventrally. Palpi and head clothed with slightly-forked, strap-like scales; appearing grizzled because of areas of





**Figures 40–45.** *Hypotrix* female genitalia. **40** *H. basistriga* **41** *H. naglei* **42** *H. alamosa* **43** *H. trifascia* **44** *H. optima* **45** *H. hueco*.

white, gray, and brown on scales. *Thorax* – Mainly covered with scales similar to those of head, but black-tipped scales form a transverse band on back of prothoracic collar, around tegulae, and on dorsal metathoracic tuft. *Legs*: Tibiae and tarsi mainly blackish-gray with ring of white scales at apex of each segment. Tibiae without spiniform setae. *Wings*: Dorsal forewing gray or brownish gray; maculation sharply defined in black; basal, antemedial and postmedial lines black, distinctly double with pale-gray filling; medial line dark gray but diffuse and indistinct; postmedial line defined on anterior half of wing only by contrast between orange-brown shading in terminal area and gray in subterminal area; posterior half of subterminal line black and contrasting and dividing pale orange-brown shading in terminal area from gray subterminal area; wing

margin with continuous black terminal line, slightly concave between veins; kidney-shaped reniform spot and rounded orbicular spot surrounded by black outline and filled with dark gray. Fringe with orange-brown scales basally, blending into dark gray scales distally. Dorsal hindwing pale fuscous with darker fuscous on discal spot, wing veins, postmedial line, and marginal 1/3 of wing; terminal line continuous, dark fuscous. Fringe a mixture of white and dark-fuscous scales. *Male genitalia* – Middle of uncus expanded laterally, tapered to double-toothed apex. Valve with elongated, tapered cucullus with only slight “neck” cucullus setose but no differentiated corona; digitus sclerotized, rounded apically, extending beyond ventral margin of valve anterior to neck of cucullus; clasper mainly straight, on inner surface of valve, abruptly upturned proximal to digitus; sacculus well-differentiated as a heavily sclerotized lobe on basal 1/4 of valve with membranous part of sacculus forming small flap overlapping sacculus and tapering to narrow area at ventral notch in valve. Aedeagus unarmed, very long and slender, about 10 × as long as wide and 0.8 × as long as vesica. Vesica basal swollen area with three sclerotized plates, each with short thorn-like cornutus in middle; short and stout, about 3 × as long as aedeagus; apical 2/3 of vesica curving in half coil and cluster of preapical spines. *Female genitalia* – Corpus bursae membranous, oval; appendix bursae only slightly longer than corpus bursae, partial coil at base; ductus bursae 1.3 × as long as corpus bursae with heavily sclerotized ridges and rounded mesial bulge on left. Anal papillae narrow and sharply pointed; base sclerotized, bulbous.

**Distribution and biology.** *Hypotrix naglei* is known from east-central Arizona (White Mountains), southeastern Arizona (Pinaleno, and Santa Catalina Mountains), south-central New Mexico (Capitan and Sacramento Mountains), and southwestern New Mexico (Mimbres Mountains). Adults have been collected from mid-June to mid-July in open meadows in forests of aspen and pine.

***Hypotrix alamosa* (Barnes, 1904), comb. n.**

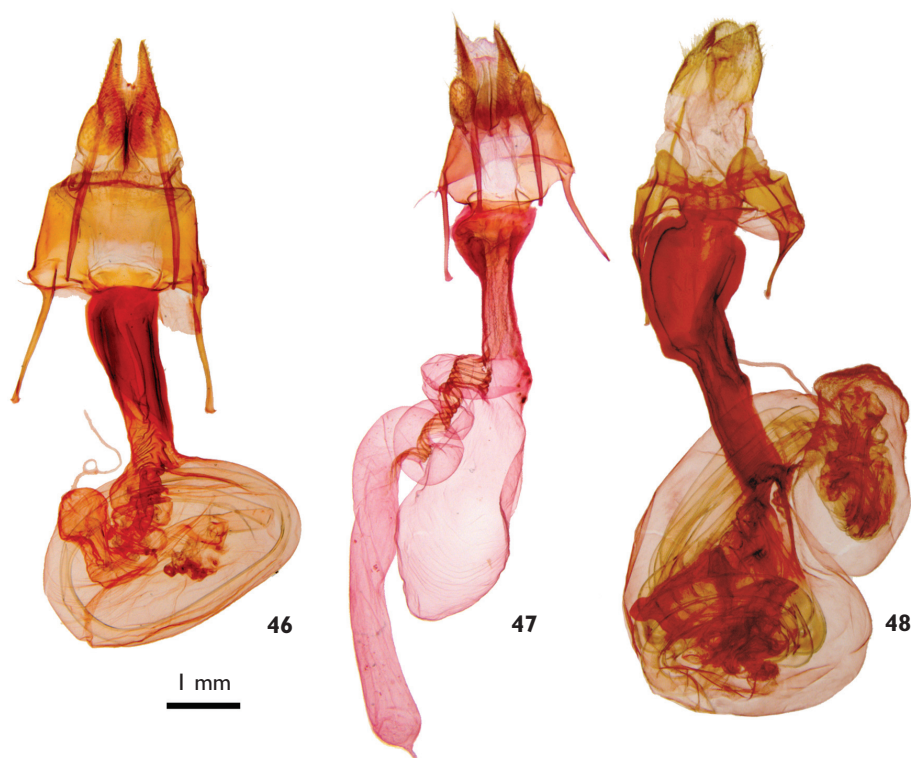
Figs 10, 11, 27, 42

*Taeniocampa alamosa* Barnes, 1904: 201.

**Type material.** The species was described from a male and a female in USNM. Type locality: USA, Arizona, Huachuca Mts. The female is in better condition and represents the more common dark form, so it is here designated as **lectotype**. It is labeled “*Taeniocampa alamosa* type ♀ Barnes/ Huachuca Mts. Ariz./ Photograph Pl. VI No. 18 [green printed label with “VI” and “18” hand written in black ink]/ Barnes Collection.” It is in good condition except that the antennae are missing.

**Other material examined and distribution.** **USA:** Arizona: Cochise Co. (Chiricahua and Huachuca Mts), Pima Co. (Santa Catalina Mts), and Santa Cruz Co. (Santa Rita Mts).

**Diagnosis.** *Hypotrix alamosa* (forewing length 14–16 mm) occurs in two forms. In the darker, more common form (Fig. 10) the forewing is reddish brown with the



**Figures 46–48.** *Hypotrix* and *Anhypotrix* male genitalia. **46** *H. lunata* **47** *H. purpurigera* **48** *Anhypotrix tristis*.

maculation sharply defined by dark-red lines. The medial area is similar in color to the remainder of the forewing and the postmedial line touches, or almost touches, the reniform spot. Superficially this form is most similar to *Hypotrix hueco* (see under *H. hueco*) and *Xestia bolteri* (Smith), both of which occur with *H. alamosa*. It differs from *Xestia bolteri* in that *H. alamosa* has smaller reniform, orbicular, and claviform spots, and in lacking spiniform setae on the tibiae; *Xestia bolteri* is illustrated in Lafontaine 1998. The pale form of *H. alamosa* looks like the specimens have been bleached, so the forewing is light orange with the maculation weakly defined by fine yellow lines. The dark and light forms frequently occur together and the two syntypes of *H. alamosa* represent a specimen of each form. The *male genitalia* differ from those of other species in many features: the valves are tapered from the base to apex a slightly indented “neck” at the base of the triangular cucullus; the sacculus is very large with a rounded lobe projecting from the dorsal margin and the membranous saccular flap overtops almost the entire sclerotized part; the digitus is wide and truncated apically; the apical half of the uncus is broad and spatulate; the vesica has a mass of cornuti near the apex of the aedeagus, and the apical part of the vesica has four tight coils. In the *female genitalia* the appendix bursae has four tight coils, corresponding to those

in the vesica, and the ductus bursae is heavily sclerotized with a prominent posterior bulge to the left.

**Distribution and biology.** *Hypotrix alamosa* is known only from southeastern Arizona. Collecting dates range from early June to mid-July and early to late September.

***Hypotrix trifascia* (Smith, 1891), comb. n.**

Figs 12, 13, 28, 43, 52

*Taeniocampa trifascia* Smith, 1891: 118.

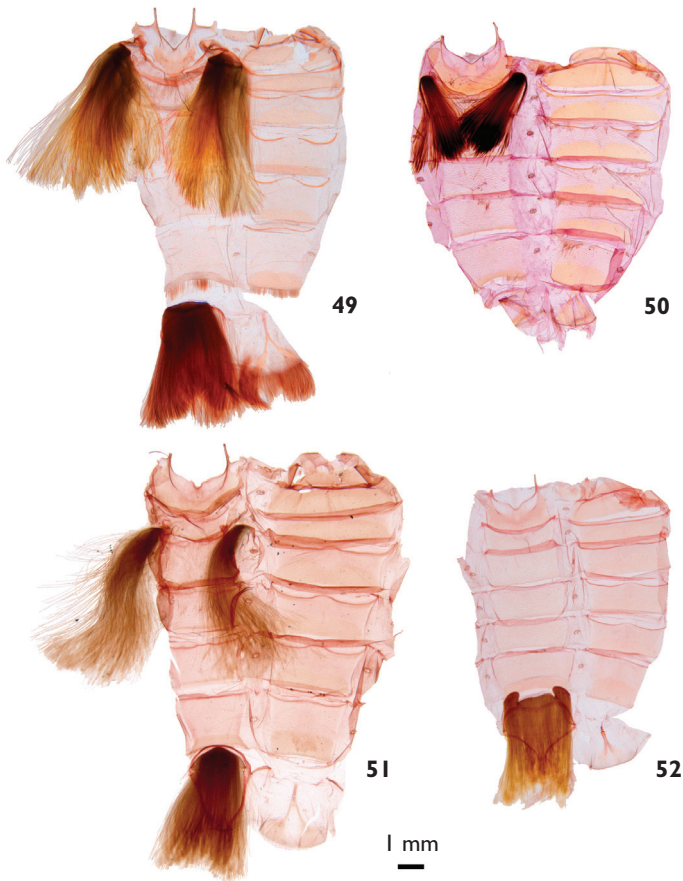
**Type material.** **Lectotype** ♂ [USNM, examined]. Designated by Todd (1982). Type locality: USA, Colorado, “foot hills.”

**Other material examined and distribution.** **Mexico:** States of Chihuahua and Durango (Sierra Madre Occidental). **USA:** Arizona: Cochise Co. (Chiricahua and Huachuca Mts), Graham Co. (Pinaleno Mts), and Pima Co. (Santa Catalina Mts). Colorado: La Plata Co. (San Juan Mts). New Mexico: Catron Co. (Mogollon Mts), Colfax Co. (Sangre de Cristo Mts), and Grant Co (Pinos Altos Mts). Texas: Culberson Co. (Guadalupe Mts). Utah: San Juan Co.

**Diagnosis.** *Hypotrix trifascia* is smaller than *H. alamosa* in size (forewing length 11–14 mm). It is variable in forewing ground color, varying from pale yellowish buff to dark reddish orange. As the name implies, the two transverse lines and the subterminal line are prominently marked by light and dark lines and are relatively straight and at least partially parallel, creating its distinctive “three-fascia” appearance. The hindwing is translucent white with a slight pinkish blush. The *male genitalia* are similar to those of *H. alamosa*, but in *H. trifascia* the dorsal process of the sacculus is pointed and the saccular flap is less extensive. The uncus is unique in *H. trifascia*; it is broad mesially, narrows subapically, and broad and truncated at apex. The vesica is about 2 × as long as the aedeagus, gently coiled, with two basal and one subbasal cornuti. The *female genitalia* are similar to those of *H. alamosa* but in *H. trifascia* the ductus bursae has a posterior bulge to the left and right and a mesial bulge to the right, and the appendix bursae is short with a single coil.

*Hypotrix trifascia* is closely related to *H. vigasia* (Schaus, 1894), **comb. n.** from the State of Veracruz in southeastern Mexico, but the forewing of *H. vigasia* is buffy-brown with the maculation muted, and the subterminal line is not as straight as in *H. trifascia*. Poole (1989) lists *H. vigasia* as a synonym of *Bombyx agavis* Blasquez, 1870, but the location of the types of *Bombyx agavis*, if any exist, is unknown and the original paintings (Blasquez, 1870, Figs 6, 9) are not identifiable as a noctuid and may be a cossid (Martin Honey, pers. comm.).

**Distribution and biology.** *Hypotrix trifascia* occurs from southern Utah and Colorado southward through Arizona, New Mexico, and western Texas to northern Mexico. Collecting dates range from early April to mid-July and early to late September.



**Figures 49–52.** Male abdominal pelts of *Hypotrix*. **49** *H. purpurigera* **50** *H. ocularis* **51** *H. lunata* **52** *H. trifascia*.

***Hypotrix optima* (Dyar, [1920]), comb. n.**

Figs 14, 29, 44

*Scriptania optima* Dyar, [1920]: 163.

**Type material.** **Holotype** ♂ [USNM, examined]. Type locality: Mexico, Mexico City.

**Other material examined and distribution.** **Mexico:** Federal District, State of Durango (Sierra Madre Occidental). **USA:** Arizona: Cochise Co. (Chiricahua Mts).

**Diagnosis.** *Hypotrix optima* is a small *Hypotrix* (forewing length 11–14 mm) with an unmistakable forewing pattern. The mainly orange and gray pattern is dominated by the pale yellow shading around the orbicular spot that forms a flat-bottomed wedge mark between the dark gray reniform and orbicular spots, and the yellow streak at the forewing

apex. Dark-gray shading in the basal area, on the reniform and orbicular spots, and in the subterminal area gives the forewing a distinctive blotchy look. The hindwing is translucent white in both sexes. The *male genitalia* are most similar to those of *H. trifascia*, but the valves are more slender and the apical half of the uncus is broad and spatulate. The vesica is about  $2 \times$  as long as the aedeagus with a tight cluster of cornuti at the base, several scattered spike-like cornuti subbasally, and a cluster of minute spines subapically after a postmedial coil. The *female genitalia* are similar to those of *H. trifascia* but the corpus bursae is curved rather than oval, and the ductus bursae is heavily sclerotized with long medial bulges on both sides.

**Distribution and biology.** *Hypotrix optima* occurs from southeastern Arizona and central New Mexico southward to Mexico City. Collecting dates range from mid-June to mid-July.

***Hypotrix hueco* (Barnes, 1904), comb. n.**

Figs 15, 30, 45

*Mamestra hueco* Barnes, 1904: 198.

**Type material. Syntypes** [USNM, examined]. Type locality: USA, Arizona, Huachuca Mts.

**Other material examined and distribution. USA:** Arizona. Cochise Co. (Chiricahua and Huachuca Mts), Graham Co. (Pinaleno Mts), and Santa Cruz Co. (Santa Rita Mts).

**Diagnosis.** *Hypotrix hueco* is superficially similar to *H. alamosa*, but averages larger (forewing length: 14–16 mm), the medial area is pale with whitish shading that contrasts with the darker color of the basal and subterminal areas, and the postmedial line is well removed from the outer edge of the reniform spot. The outward displacement of the postmedial line results in a very narrow subterminal area, similar in width to the terminal area. Surprisingly, the *male genitalia* are most similar to those of *H. lunata*, with a high dorsal tuft of setae on the broadly spatulate uncus and the cucullus is long and tapered with a folded depressed area at the base of the dorsal margin. The vesica is about  $3 \times$  as long as the aedeagus; there are two spiny clusters where the aedeagus joins the vesica, a row of three long spike like cornuti near the vesica base, and a premedial coil. The female genitalia are similar to those of *H. lunata*, but the appendix bursae has only one coil.

**Distribution and biology.** *Hypotrix hueco* is known only from southeastern Arizona. Collecting dates range from mid-June to mid-August.

***Hypotrix lunata* (Smith, 1906), comb. n.**

Figs 16, 31, 46, 51

*Urasogastra lunata* Smith, 1906: 13.

**Type material. Lectotype** ♂ [AMNH, examined]. Lectotype designated by Todd (1982). Type locality: USA, Arizona, Huachuca Mts.



**Other material examined and distribution.** **Mexico:** Durango. **USA:** Arizona. Cochise Co. (Huachuca Mts) and Santa Cruz Co. (Patagonia and Santa Rita Mts).

**Diagnosis.** *Hypotrix lunata* is a relatively large moth (forewing: 15–17 mm) that is superficially unlike any other species in North America. The forewing is a hoary gray with a large entirely black crescent-shaped reniform spot that is fused posteriorly with the black orbicular spot. It is most closely related to *Hypotrix quindiensis* (Draudt, 1924) that was originally described as a form of *H. lunata*; it occurs from Colombia to Peru. *Hypotrix lunata* differs from *H. quindiensis* in having a smaller orbicular spot (the two sides of the black mark formed by the fusion of the spots are similar in size in *H. quindiensis*), the postmedial line is an even black line (an irregular series of black dashes in *H. quindiensis* ending in a black spot on the costa), the basal line is obscure (a contrasting black spot in *H. quindiensis*) and the hindwing is fuscous, not dirty white. In the genitalia of *H. quindiensis* there are two rather than three coils in the vesica and appendix bursae and only the posterior half of the ductus bursae is sclerotized. *Hypotrix purpurigera* (Fig. 17) and several of its South American relatives also have black reniform and orbicular spots that are frequently fused posteriorly, creating a wide V-shaped mark. Within the North American fauna the *male genitalia* of *Hypotrix lunata* are most similar to those of *H. hueco*, but differ in that only the apical part of the uncus is expanded in *H. lunata* whereas the apical 2/3 is wide in *H. hueco*, the clasper is stouter and abruptly tapered apically in *H. lunata*, and the dorsal lobe on the sacculus is much larger. The vesica is very different from that of *H. hueco* in having much more extensive basal cluster of spines and subbasal cornuti in a longitudinally ribbed basal swelling, and the vesica has three tight medial coils rather than one as in *H. hueco*. In the *female genitalia* the appendix bursae has a corresponding three coils to those in the vesica and the ductus bursae is more heavily sclerotized.

**Distribution and biology.** *Hypotrix lunata* occurs from southeastern Arizona (Chiricahua, Huachuca and Santa Rita Mountains) southward to the State of Durango in northern Mexico. Collecting dates range from late May to mid-September, probably representing two generations.

***Anhypotrix* Lafontaine, Ferris & Walsh, gen. n.**

urn:lsid:zoobank.org:act:95031C4C-626F-4B91-803F-7C322588E240

Type species. *Polia tristis* Barnes & McDunnough, 1910: 152.

**Etymology.** The generic name *Anhypotrix* is a reference to this species being removed from its former congeners. From the Greek *An* [not] *Hypotrix*.

**Diagnosis.** The genus *Anhypotrix* differs from *Hypotrix* in that the uncus in *Anhypotrix* is cylindrical, tapered to a spine-tipped apex, the clasper is massive, gently curved on the ventral margin of the valve with a preapical tooth, the digitus is vestigial, the aedeagus has a large bulbous base and a narrow neck-like apex, and the details of the vesica are different. The female genitalia in *Anhypotrix* differ from those of *Hypotrix* in having

lightly sclerotized anal papillae that are short and rounded posteriorly, and abdominal segment eight has a rounded sclerotized posterior plate on each side of the ostium.

*Anhypotrix tristis* never associates with species in the genus *Hypotrix* in barcode analyses, a result already suggested by the very different form of male clasper and female anal papillae. No other known species has similar male genitalia and the barcode results do not suggest any known genus with which the species can be associated so we describe a new genus for it. We place it with the other southwestern genera that have spiniform tibiae (*Hypotrix* (some species), *Trichofeltia* McDunnough, and *Mimobarthra* Barnes & McDunnough) and within this group after *Hypotrix* because of the similarities in the form of the various parts of the bursa copulatrix in the female genitalia.

**Description. Adult:** *Head* – Frons rounded; labial palpus with apical segment about 1/4 as long as second segment; male antenna narrowly biserrate, individual segments diamond shaped, bifasciculate; female antenna filiform, densely setose ventrally; eye rounded, hairy; ocellus present. *Thorax* – Thorax clothed with hair-like scales and spatulate, apically serrated scales that form a slightly raised tuft on the prothorax, and a partially divided tuft on the metathorax that blends with a broad dorsal tuft of scales on the first abdominal segment. *Legs*: spiniform setae on middle and hind tibiae near tibial spurs, and in three ventral rows on tarsi. *Wings*: forewing venation typically quadrifine, cubital vein appearing four branched; hindwing with typical trifine venation (i.e., M2 reduced, about 2/3 down cell and parallel to M3. *Abdomen* – basal abdominal brushes and pockets absent. Eighth abdominal sternite of male with an eversible coremata with a tuft of long setae. *Male genitalia* – *Uncus*: decurved, cylindrical, abruptly tapered to flat heavily sclerotized apex. *Valva*: symmetrical, basally broad, narrowed postmesially into an elongated “neck,” broadening to rounded cucullus with scattered slender setae forming partial corona; sacculus short, heavily sclerotized, with a large, rounded dorsal process, but without membranous flap; clasper near middle of valve on ventral margin, stout and heavily sclerotized, slightly upturned apically with preapical tooth; clasper connected to apex of sacculus and valve costa by long sclerotized rods; digitus absent. *Aedeagus*: base bulbous, tapered to narrow “neck” at apex, smooth (without spines or spinules); everted vesica tubular, about 3 × as long as aedeagus, basal 1/4 with double row of 23–26 long cornuti on left side and single row of 12–14 long cornuti on right; vesica with postmedial coil; small diverticulum at base of coil with apical cornutus and small diverticulum in middle of coil; apex of vesica covered with spinules. *Female genitalia* – Corpus bursae gourd shaped, rounded anteriorly, tapered posteriorly into wide appendix bursae on right side with single coil. Ductus bursae heavily sclerotized, middle surface rugose with thicker bands of sclerite; posterior half of ductus abruptly wider and bulging to sides, especially on left, then constricting to narrower ostium. Abdominal segment eight extended posteriorly into rounded sclerotized plate on each side of ostium. Anterior apophyses rod-like, widening posteriorly, slightly longer than abdominal segment eight. Posterior apophyses about 2 × longer than anterior apophyses. Anal papillae lightly sclerotized, slightly wider mesially, gradually tapered to rounded apex; surface covered with long hair-like setae.

**Distribution.** Known from New Mexico, Arizona, and northern Mexico.

***Anhypotrix tristis* (Barnes & McDunnough, 1910), comb. n.**

Figs 18, 33, 48

*Polia tristis* Barnes & McDunnough, 1910: 152.

**Type material.** **Holotype** ♂. USNM, examined. Type locality: USA, Arizona, [Cochise Co., Miller Canyon], Palmerlee.

**Other material examined and distribution.** **Mexico:** State of Durango (Sierra madre Occidental). **USA:** Arizona: Apache Co. (White Mts), Cochise Co. (Chiricahua and Huachuca Mts); New Mexico: Catron Co. (Mogollon Mts), Colfax Co. (Sangre de Cristo Mts), Grant Co. (Pinos Altos Mts), McKinley Co. (Zuni Mts), and Socorro Co. (San Mateo Mts).

**Diagnosis.** *Anhypotrix tristis* can be recognized by the blackish-gray and pale gray streaked forewing pattern. The streaked appearance is enhanced by the strongly zigzagged antemedial line and a deep V-shaped notch in the postmedial line with a black bar connecting it to the antemedial line. There is also a black basal dash and a black and white patch near the anal angle of the wing, this latter patch giving the moth the appearance of a large (forewing length: 15–18 mm) *Lacinipolia* McDunnough. In many specimens there is some brown shading on or beyond the reniform spot, below the orbicular spot, and near the anal angle. The hind wing in males varies from dirty white (e.g., Fig. 18), to entirely fuscous, with dark-fuscous on the veins, postmedial line and wing margin. The hindwing in females averages darker than in the males. The male genitalia are best recognized by the massive ventral clasper, the tapered uncus, and the form of the vesica and the female genitalia by the rounded anal papillae and shape of the bursa copulatrix.

**Distribution and biology.** *Anhypotrix tristis* occurs from eastern Arizona and northern New Mexico southward in the Sierra Madre Occidental to the State of Durango in Mexico. Adults have been collected in conifer forest habitats from early May until early August.

**Acknowledgments**

We thank Gregory Forbes (New Mexico State University), Martin Honey (Natural History Museum, London, UK), Ed Knudson and Charles Bordelon (TLSC, Houston, Texas), James Liebherr and Richard Hoebeke (CUIC, Ithaca, New York), and Michael Pogue (Systematic Entomology Laboratory, National Museum of Natural History, Washington, DC), for the loan of specimens. Martin Honey also helped with literature. We also thank Jocelyn Gill (CNC, Ottawa, Canada) for assistance with the preparation of the genitalia and photographs. Paul Hebert and the staff at the Canadian Centre for DNA Barcoding, Biodiversity Institute of Ontario, University of Guelph, Guelph, Canada, provided data and information from the Barcode of Life Data (BOLD) system. Bo Sullivan, Chris

Schmidt, and Eric Metzler reviewed the manuscript and provided us with many helpful suggestions.

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# Two new species of the *Euxoa westermanni* species-group from Canada (Lepidoptera, Noctuidae, Noctuinae)

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## Abstract

Two new species of *Euxoa* Hübner are described from northern and western Canada: *Euxoa apopsis* Troubridge & Lafontaine, related to *E. macleani* McDunnough, and *E. muldersi* Lafontaine & Hensel, related to *E. churchillensis* McDunnough. *Euxoa chimoensis* Hardwick, **stat. rev.**, is recognized as a valid species rather than as a subspecies of *Euxoa macleani*. A diagnosis of the *E. westermanni* species-group is given with descriptions and illustrations of the new species and their relatives.

## Keywords

Systematics, Canada, *Euxoa*, *Euxoa westermanni* species-group

## Introduction

The genus *Euxoa* Hübner was revised as a “Moths of America North of Mexico” volume by Lafontaine (1987) and included 180 species. Since that time two undescribed species of the *Euxoa westermanni* species-group (subgenus *Pleonectopoda* Grote) have been found in northern and western Canada. In addition, many additional specimens of *Euxoa chimoensis* Hardwick have been collected in northeastern and central Canada that show this it is a valid species, not a subspecies of *Euxoa macleani*, which occurs in western Canada. In 1987, *Euxoa chimoensis* was known only from male specimens and *Euxoa macleani* from only five males and a female. The two new species and *Euxoa chimoensis* Hardwick are described below.

## Materials and methods

Specimens were examined from the following collections:

**AMNH** American Museum of Natural History, New York, NY, USA

**BMNH** Natural History Museum, London, UK

**CNC** Canadian National Collection of Insects, Arachnids, and Nematodes, Ottawa, Ontario, Canada.

**HHC** Personal collection of Henry Hensel, Edmundston, New Brunswick, Canada.

**JTTC** Personal collection of James Troubridge, Selkirk, Ontario, Canada.

**USNM** National Museum of Natural History, Washington, District of Columbia, USA.

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

## Systematics

### *Euxoa westermanni* species-group

The *Euxoa westermanni* species-group is included in the subgenus *Pleonectopoda* Grote, one of seven subgenera of *Euxoa* (Lafontaine 1987). The *E. westermanni* species-group is the largest of the six species-groups in the subgenus, and includes 20 of the 27 species in the subgenus. It is the only species-group in the subgenus *Pleonectopoda* Grote that occurs in the Palearctic.

Species in the *E. westermanni* species-group are best characterized by the male genitalia: the vesica has a subbasal coil (like other species in subgenus *Pleonectopoda*), the medial diverticulum is closer to the subbasal coil of the vesica than the apex, the subbasal diverticulum is bilobed, and the saccular extensions are short, shorter than the clasper and about  $\frac{1}{3} \times$  as long as the valve.

Most species of the *E. westermanni* species-group occur in subarctic, alpine, and subalpine habitats and they dominate the *Euxoa* fauna in these areas. Six species are associated with dunes and open sandy habitats, three in the subarctic (*E. hyperborea* Lafontaine, 1987, *E. churchillensis* (McDunnough, 1932), and *E. muldersi* Lafontaine & Hensel, sp. n.) and three farther south in Canada and northern United States (*E. scandens* (Riley, 1869), *E. quebecensis* (Smith, 1900), and *E. aurulenta* (Smith, 1890)).

One of the species described below is associated with open dunes in northern Canada; the other occurs in alpine areas in western British Columbia.

## Descriptions

### *Euxoa muldersi* Lafontaine & Hensel, sp. n.

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Figs 1–4, 19, 24

**Type material.** **Holotype**♂: **Canada, Nunavut:** Austin Island, Maguse Point, 29 km N of Arviat, 12 July 1996, H. Hensel & R. Mulders [CNC]. **Paratypes** 38♂, 13♀: same locality as for holotype; 26 July 1992, R. Mulders; 12, 16 July 1996, H. Hensel & R. Mulders; 18 July 1996, H. Hensel; 7, 8 July 1998, H. Hensel; 17 July 2000, H. Hensel; vicinity of Arviat, 11, 12 July 1998, H. Hensel; 18–27 July 2000, H. Hensel; 16–22 July 2002, H. Hensel. BMNH, CNC, HHC, JTTC, USNM, and personal collection Hartmut Rietz, Hamburg, Germany.

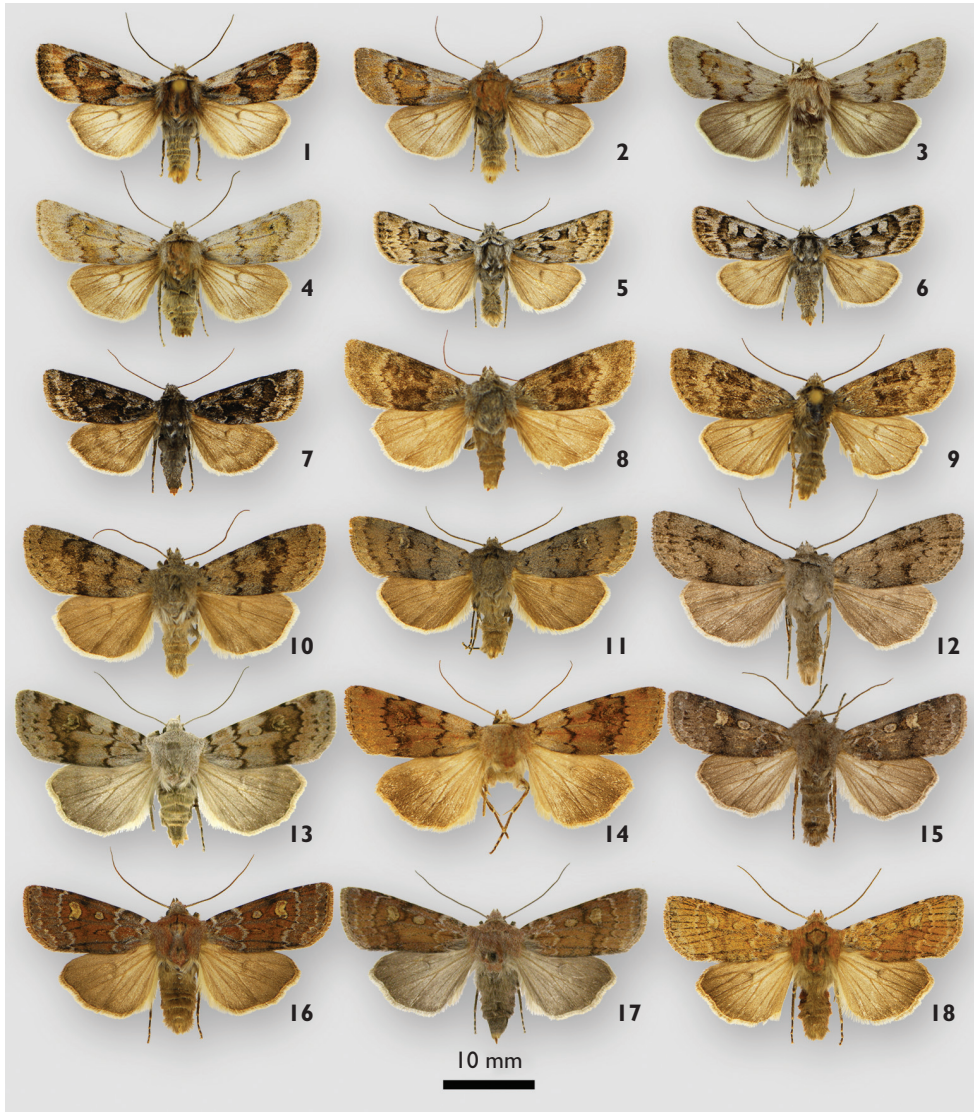
**Other material examined.** **Canada.** Canada, Northwest Territories, Ford Lake, 63°11'N 107°19'W, 25 June 1966, G. E. Shewell (2♂).

**Etymology.** The species is named for Robert Mulders, a biologist at Arviat who collected the first specimen and brought it to the attention of Henry Hensel.

**Diagnosis.** In the key to species of the *Euxoa westermanni* species-group in Lafontaine (1987) *E. muldersi* keys out to *Euxoa churchillensis* McDunnough. It differs from *E. churchillensis* (Figs 5–7, 20, 25) in larger size (forewing length 13–15 mm versus 10–13 mm in *E. churchillensis*), more blurry forewing pattern usually with brown shading, basally paler more mottled hindwing, reduced, vestigial frontal tubercle, shorter, stouter saccular extension and straight sub-basal diverticulum (curved in *E. churchillensis*) in the male genitalia (compare Figs 19 and 20). In females, the anal papillae are broad and more rounded compared to bullet-shaped in *E. churchillensis*.

**Description. Adult:** *Head* – Frontal tubercle vertically elongated but small, low, only slightly raised from frons; male antenna slightly biserrate, about 1.3 × as wide as shaft; eye reduced, ellipsoid, with sparse surface hair; vestiture of head and thorax a highly variable mixture of buff, brown, and black hair-like and strap-like scales, usually covering frontal tubercle. *Thorax* – *Legs*: tibia with spiniform setae typical for *Euxoa*. *Wings* (both sexes); most common form (Fig. 1 [80% of specimens]) ground color a variable mixture of pale-gray, brown, and black scales, usually with darker colors

predominating in medial area; basal dash and antemedial and postmedial lines black but diffuse and appearing blurry; terminal area dark gray to black with diffused streaks extending into subterminal area; reniform and orbicular pale gray, sometimes with



**Figures 1–18.** *Euxoa* adults. **1–4** *E. muldersi*, **1** ♂ holotype **2** ♂ paratype, Maguse Point, Austin Island, 29 km N of Arviat, Nunavut, Canada **3** ♀ **4** ♀ paratypes, Maguse Point, Austin Island, 29 km N of Arviat, Nunavut, Canada; **5–7** *E. churchillensis*, **5** ♂ **6** ♀ **7** ♀, Arviat, Nunavut, Canada; **8, 9** *E. apopsis*, **8** ♀ paratype, Mt. McLean, British Columbia, Canada **9** ♂ holotype, Gott Peak, 7100', British Columbia, Canada; **10–12** ♂ *E. macleani*, Gott Peak, 7100', British Columbia, Canada; **13–18** *E. chimoensis*, **13** ♀, Schefferville, Labrador, Canada **14** ♀, Post-de-la-Baleine, Quebec, Canada **15** ♂, L'Anse au Loup, Labrador, Canada **16** ♂ **17** ♀ **18** ♂, Northern Study Centre, 24 km E Churchill, Manitoba, Canada.

darker outline and darker central spot; paler form (Fig. 2 [10% of specimens]) with less brown shading and less mottling of ground color; dark shading in reniform spot filling most of spot; pale form (Figs 3, 4 [10% of specimens]) mainly pale gray with blurry dark-gray transverse lines and reniform spot. Hindwing dirty white mottled with fuscous shading, especially on outer half of wing, postmedial line, and discal spot; fringe white. *Male genitalia* – Similar to those of *E. churchillensis* in most details except saccular extension shorter and slightly stouter ( $0.54\text{--}0.58 \times$  as long as ampulla of clasper (harpe) versus  $0.60\text{--}0.68 \times$  as long in *E. churchillensis*); subbasal diverticulum in vesica straight (curved in *E. churchillensis*). *Female genitalia* – Similar to those of *E. churchillensis* but anal papillae broad and more rounded in lateral view (bullet shaped in *E. churchillensis*).

**Distribution and biology.** *Euxoa muldersi* is known only from north central Canada with all specimens except two from the vicinity of Arviat, Nunavut. The species must use a similar pheromone to *E. churchillensis* because H. Hensel observed males of *E. churchillensis* being attracted to calling *E. muldersi* females, although no attempts at mating were observed. It is restricted to open dunes where it flies close to the sand. The reduced frontal tubercle is typical of *Euxoa* species that inhabit dunes.

***Euxoa apopsis* Troubridge & Lafontaine, sp. n.**

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Figs 8, 9, 21, 26

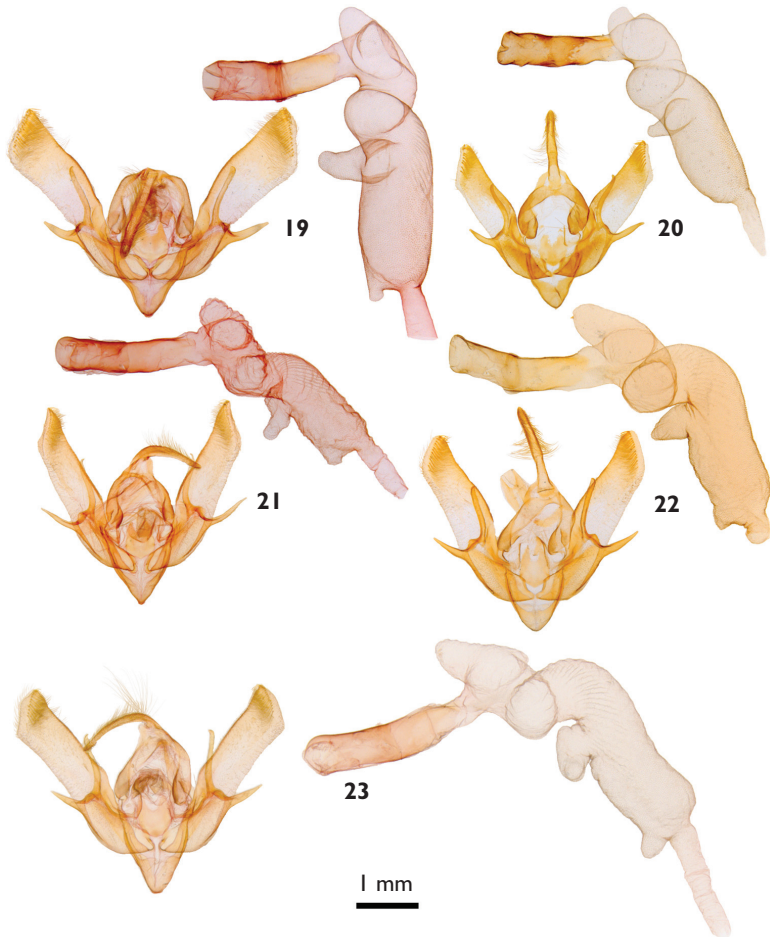
**Type material.** Holotype♂: Canada, British Columbia: Gott Peak, 7100', 50°21'N 122°08'W, 12 July 1992, J. Troubridge [CNC]. Paratypes 1♂, 1♀: same data as for holotype (1♂); British Columbia, Mt McLean, 7500', 8 July 1921, A. W. Hanham (1♀).

**Etymology.** The species name is a Greek noun used in apposition and means “a lofty spot,” in reference to the high elevation of the type locality.

**Diagnosis.** In the key to species of the *Euxoa westermanni* species-group in Lafontaine (1987) *E. apopsis* keys out to *Euxoa macleani* McDunnough. It differs from *E. macleani* (Figs 10–12, 22, 27) in having a more deeply biserrate male antenna, more extensive dark shading on the medial line of the forewing, a paler hindwing, thinner saccular extensions and a smaller subbasal diverticulum in the male genitalia, and a smaller appendix bursae in the female genitalia.

**Description. Adult:** *Head* – Frontal tubercle prominent and rounded; male antenna deeply biserrate,  $2.0 \times$  as wide as shaft ( $1.5 \times$  as wide in *E. macleani*); eye reduced, ellipsoid; vestiture of head and thorax mainly of dark gray hair-like and strap-like scales with some white scales and some white-tipped scales. *Thorax* – *Legs*: tibia with spiniform setae typical for *Euxoa*. *Wings* (both sexes); ground color gray with scattered white and dark-gray scales that give wing a grizzled look; basal area medium gray; medial area extensively shaded with dark gray; subterminal area pale gray with dark-gray streaks in outer part of subterminal area; terminal area similar in color to basal area; antemedial (am) and postmedial (pm) lines black with pale-gray shading proximal to



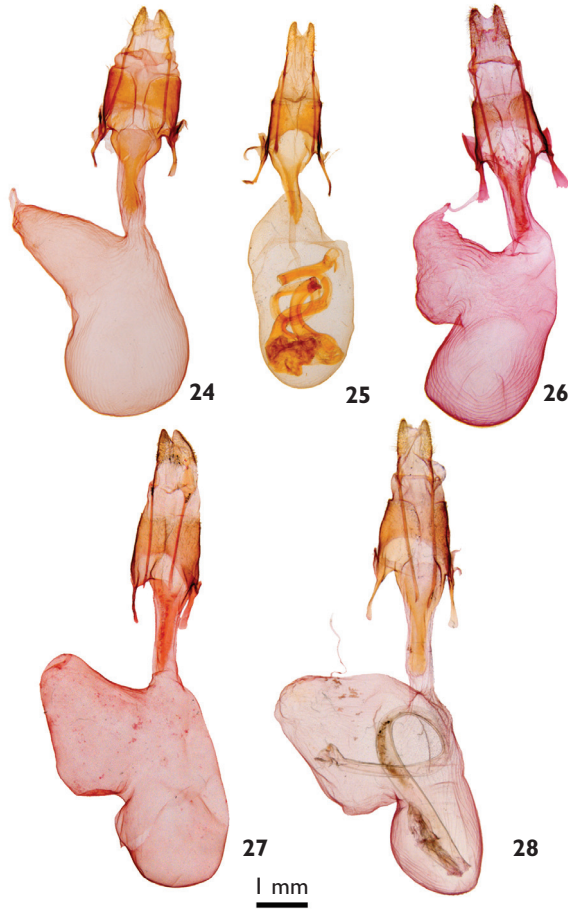


**Figures 19–23.** *Euxoa* male genitalia. **19** *E. muldersi* **20** *E. churchillensis* **21** *E. apopsis* **22** *E. macleani* **23** *E. chimoensis*.

am line and distal to pm line; reniform and orbicular spots paler than medial area but small and obscure; forewing length: 14–15 mm (14–18 mm in *E. macleani*). Hind-wing pale fuscous gray with darker veins and discal spot; fringe yellowish buff basally, white distally. *Male genitalia* – Similar to those of *E. macleani* in most details except saccular extensions thinner than ampulla of clasper (harpe) (stouter in *E. macleani*); subbasal diverticulum in vesica shorter,  $2.0 \times$  as wide as aedeagus ( $2.5 \times$  as wide in *E. macleani*). *Female genitalia* – Similar to those of *E. macleani* but appendix bursae smaller,  $0.5 \times$  as long as corpus bursae ( $0.7 \times$  as long in *E. macleani*).

**Distribution and biology.** *Euxoa apopsis* is known only from high elevations in the mountains of southwestern British Columbia. Adults may be partially diurnal, which may explain why only two specimens were collected at the type locality in spite of many nights of collecting over a period of six years.





**Figures 24–28.** *Euxoa* female genitalia. **24** *E. muldersi* **25** *E. churchillensis* **26** *E. apopsis* **27** *E. macleani* **28** *E. chimoensis*.

***Euxoa chimoensis* Hardwick, stat. rev.**

Figs 13–18, 23, 28

**Diagnosis.** This species was treated as a subspecies of *Euxoa macleani* in Lafontaine (1987). Unlike *Euxoa macleani*, which occurs only as a single form (Figs 10–12) with a dark brownish-gray forewing with most maculation obscure except for black transverse lines and medial line, *E. chimoensis* occurs in three color forms with two pattern forms. The forewing may be reddish brown, blackish brown or gray. For each of these color forms the forewing occurs in two pattern forms; in one form (Figs 13, 14) the transverse lines are prominent and the reniform and orbicular spots are similar to the ground color or darker; in the second form (Figs 15–18) the transverse lines and or-

bicular and reniform spots appear mainly paler than the ground color; both of these forms seem to be equally common in Quebec and Labrador, but only the form with pale markings is known from the west coast of Hudson Bay. Forewing length varies from 13 to 17 mm. The *male and female genitalia* (Figs 23, 28) are similar to those of *E. macleani* (Figs 22, 27), but the appendix bursae in *E. chimoensis* projects mainly to the left, whereas in that of *E. macleani* has a lobe of the appendix bursae that projects posteriorly giving the appendix a longitudinal orientation.

**Distribution and biology.** *Euxoa chimoensis* is known only from two localities in Labrador, three in Quebec, and one in Manitoba, but these are widely scattered and indicate that the species is widely distributed in Labrador and northern Quebec and along the west coast of Hudson Bay. Adults have been collected throughout July.

## Acknowledgments

We thank Jocelyn Gill (CNC, Ottawa) for assistance with the preparation of the genitalia and photographs. Paul Hebert and the staff at the Canadian Centre for DNA Barcoding, Biodiversity Institute of Ontario, University of Guelph, Guelph, Canada, provided data and information from the Barcode of Life Data (BOLD) system. Gary Anweiler and Chris Schmidt reviewed the manuscript and provided many helpful suggestions.

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# New species of the Neotropical genus *Camptonema* Jones (Geometridae, Ennominae) with the first description of the female

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## Abstract

Two new species of *Camptonema* Jones are described, *C. tapantia* **sp. n.** from Costa Rica and *C. yanayacua* **sp. n.** from Ecuador. A third species, *Camptonema lineata* (Schaus), is transferred to *Camptonema* from “*Sabulodes*.” The female of *Camptonema* is described for the first time, and the tribal placement of *Camptonema* is discussed.

## Keywords

Taxonomy, *Camptonema*, *Sabulodes*, Ourapterygini, Costa Rica, Ecuador

## Introduction

In her review of the Neotropical ennomine geometrids, Pitkin (2002) placed *Camptonema* in the tribe Ourapterygini?, with some reservations. The only species of *Camptonema* described at the time, *C. marginata* Jones, was known only from several males from Brazil. The genus was not placed in Ourapterygini sensu stricto because the furca of *C. marginata* was not clearly homologous to the furca that characterizes the Ourapterygini. The tapered, pointed furca and the distinctive yellowish-cream color and pattern of the wings were used to characterize the genus *Camptonema*.

Recent collecting in Costa Rica and Ecuador has turned up specimens of three additional species of *Campatonema*, including the first females. Pitkin et.al. (1996) did not report the genus from Costa Rica.

## Materials and methods

### Repository abbreviations

**BMNH** Natural History Museum, London, UK

**INBI** Instituto Nacional de Biodiversidad, Santo Domingo de Heredia, Costa Rica

**JBS** J. Bolling Sullivan, Beaufort, North Carolina, USA

**USNM** National Museum of Natural History, Washington, District of Columbia, USA

Photographic methods used herein are described in Sullivan and Adams (2009). Procedures for dissecting and preparing genitalia follow that of Lafontaine (2004). DNA sequencing of the barcode fragment of the COI gene was carried out at the Canadian Center for DNA barcoding in Guelph, Ontario. Barcode sequences were compared by nearest neighbor analyses as implemented on the Barcode of Life Data systems website (Ratnasingham and Hebert 2007).

## Systematics

### *Campatonema* Jones

*Campatonema* Jones, 1921: 334. Type species, *Campatonema marginata* Jones (1921) (by monotypy).

Pitkin (2002) characterized *Campatonema* by its peculiar furca (tapered, pointed shape), by the shape of the band on the dorsal forewing, and by the pointed, cream-colored forewing. In the three new species the furca is typical, of the Ourapterygini and located near the middle of the juxta and able to deflect to either side. The shape of the dark band on the dorsal forewing is variable among species, and the cream-colored forewing can be overlaid with reddish-brown scaling. The pointed forewing is characteristic. The unusual setal arrangement on the antenna with two rows of setae per segment on the ventral surface is a useful character for separating species of *Campatonema* from similar looking species in other genera. The genitalia are rather simple and have few characters useful for diagnosing the genus, so members of the genus are most easily recognized by a combination of wing shape, maculation, and antennal structure.

***Campatonema tapantia* Sullivan sp. n.**

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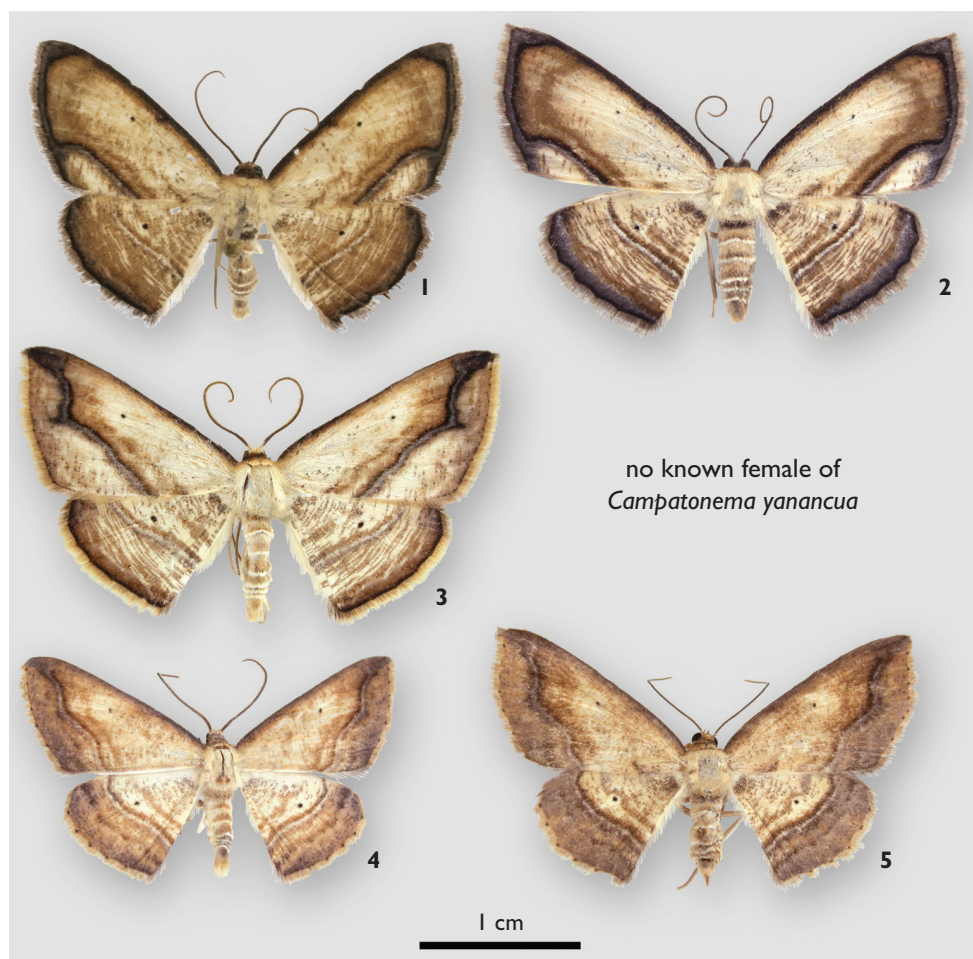
Figs 1, 2, 6a, b, 9

**Type material.** **Holotype** ♂: Costa Rica, Tapanti National Park, Orosi, Cartago Province, 1300–1400 m, 9 April 1984, D. H. Janzen and W. Hallwachs (INB0004129291) (INBI). **Paratypes:** 10 ♂ 5 ♀ same locality as type. 1 ♂ (INB0003015185), June 1998, R. Delgado, 1 ♂ (INB0003041671), October 1999, R. Delgado; 1 ♂ (INB0004129282), 17 November 1982, Janzen and Hallwachs; 1 ♂ (INB0004129288), 23 January 1985, Janzen and Hallwachs; 1 ♂ (INB0004129289), 9 April 1984, Janzen and Hallwachs; 1 ♂ (INB0004129290), 9 April 1984, Janzen and Hallwachs; 1 ♂ 12–17 February 2006, J. Bolling Sullivan, 3 ♂ 7–9 July 2008, J. Bolling Sullivan; 1 ♀ (INBIOC-RI002025033), October 1994, R. Delgado; 1 ♀ (INBIOCRI002553384), 17 November 1982, Janzen and Hallwachs; 1 ♀ 7–9 July 2008, J. Bolling Sullivan; 2 ♀ 5–9 August 2007, 1480m, La Paz Waterfall Garden, Vera Blanca, Montana Azul, Alajuela Province, J. Bolling Sullivan. (INBI, BMNH, USNM, JBS).

**Etymology.** The name refers to Tapanti National Park, Costa Rica, the location where *C. tapantia* has been found most frequently.

**Diagnosis.** The species is readily recognized by its maculation. The dark chocolate line running from the middle of the lower forewing margin to the outer margin in combination with the chocolate marginal bands are diagnostic.

**Description. Male.** *Head* – Palps very small, less than eye width, third segment half length of first and second segments, which are equal in size. Palp with chocolate-brown scaling on outer and dorsal surface, cream on inner and ventral surfaces; frons squarish; ground cream with chocolate-brown dusting becoming dense dorsally; scape cream; area between antennae dirty cream; collar chocolate with erect brown scales. Antenna bifasciculate, segments Y-shaped, orange on ventral surface, dorsal scaling brown, lighter toward antennal tip. Setal rows arranged in two groups per segment, one at midpoint of segment, other at distal end on lateral expansions of segment. *Thorax and abdomen* – Thorax cream dorsally; abdominal segments cream with heavy brown dusting laterally especially on first segment; ventral surface cream. Legs dusted with fine brown scales dorsally, otherwise cream. Metathoracic tibia slightly swollen. Two pairs of tibial spurs on hind legs, one pair on middle legs. *Wings* – forewing length 15 mm; ground color cream; costa and margin of forewing chocolate brown; chocolate submarginal line begins subapically on costa and runs parallel to wing margin to slightly below midpoint, (between M1 and M2) then angles to midpoint of lower margin of wing. Postmedial line (PM) indistinct. Discal spot chocolate, small but prominent. Hindwing ground cream, crossed by a series of brown lines parallel to margin. Discal dot distinct, medial line prominent. Wing margin dark brown, chocolate scaling forming a subapical spot. Fringe brown. Dorsal surface cream with brown dusting overlay particularly where PM line originates subapically, line incomplete, not extending to anal edge of wing. Margin with distinct line of chocolate scales. Discal spots distinct on both wings. Apex with a well defined white area. *Male genitalia* – Uncus rod shaped. Valva elongate, sweeping



**Figures 1–5.** Adults of *Campatonema*. **1** *Campatonema tapantia* Sullivan, male holotype, Tapanti National Park, Orosi, Cartago Province, Costa Rica, 9 April 2, 1984 **2** *Campatonema tapantia* Sullivan, female paratype, La Paz Waterfall Garden, Vera Blanca, Montana Azul, Alajuela Province, Costa Rica, 5–9 August 2007 **3** *Campatonema yanayacua* Sullivan, male paratype, Yanayacu Biological Station, 5 km West of Cosanga, Napo Province, Ecuador, 20 January 2009 **4** *Campatonema lineata* (Schaus), male, Monteverde Biological Station, Monteverde, Puntarenas, Costa Rica, 23–27 August 2003 **5** *Campatonema lineata* (Schaus), female, Monteverde Biological Station, Monteverde, Puntarenas, Costa Rica, 23–27 August 2003.

upward slightly toward uncus. Costal edge sclerotized with hairlike bristles below costal edge more numerous toward valve apex, which is acute and slants slightly upward. Arms of gnathos indistinct, medial junction forming oval pad and covered with spines. Anellar arms swollen and appear as an inward extension of costa. Tegumen arms extended diagonally to fuse posteriorly below uncus. Vincular arms straight. Furca diverted to left to gnathos, apex pointed; bristle area occupies terminal 15%. Right juxtal arm swollen at base. Saccus with squared base. Aedeagus straight, lightly sclerotized, with basal keel, expands medially, apex acutely pointed. Vesica expanded slightly with patch



of cornuti basally and hair-like bristles distally. No distinct features on pelt. **Female.** Antenna filiform, otherwise similar to male but slightly larger (FW length 16 mm) and with chocolate dusting more extensive. Underside of forewing with distinct apical spot. *Female genitalia* – Anal papillae elongated, tip rounded, extended on ventral side. Posterior apophyses 2 × length of anterior apophyses, thin, expanded and paddle shaped at terminus. Anterior apophyses kinked at posterior end, paddle shaped at terminus, but less broadly than posterior apophyses. Seventh tergite forms lightly sclerotized shield over ostium. Ostium sclerotized, oval with posterior margin deeply concave on left side. Ductus very long; bursa saclike; signa a narrow slit. Pelt without distinct features.

**Distribution and biology.** *C. tapantia* has been collected in the provinces of Alajuela, Cartago, and Heredia, Costa Rica. It has been found along a rather narrow elevational range, from 1100–1600 m. Adults are on the wing throughout the year.

***Campatonema yanayacua* Sullivan sp. n.**

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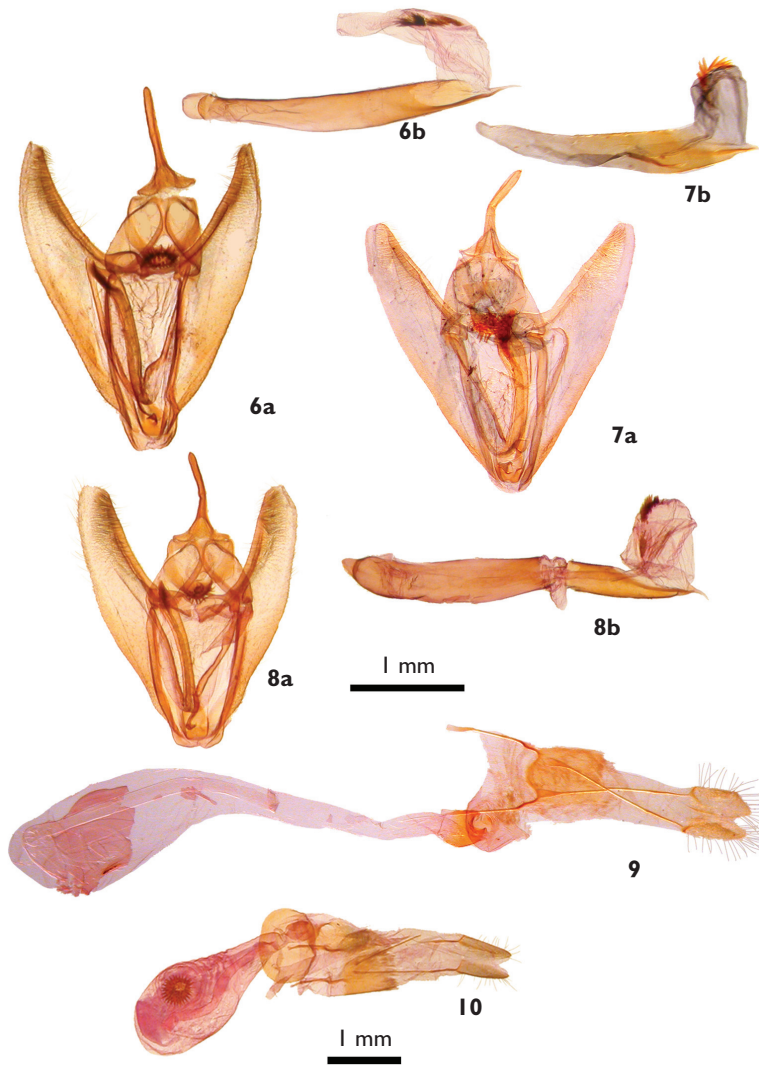
Figs 3, 4, 7a, b

**Type material.** **Holotype** ♂: Ecuador, Yanayacu Biological Station, 4 km west of Cosanga, Napo Province, 2160 m, 20 January 2009, J. S. Miller, D. Wagner and R. Tapia, (USNM) **Paratypes:** 2 males. Same data as holotype except 18 January 2009. (BMNH, JBS).

**Etymology.** *Campatonema yanayacua* is named for the type locality, Yanayacu Biological Station, Napo, Ecuador.

**Diagnosis.** This species is readily recognized by the shape of the forewing PM line, which has an outward deflection at M3 that allows it to be distinguished from the other species of *Campatonema*.

**Description.** **Male.** *Head* – Palp slightly longer than width of eye; mid-segment longer than first and about 4 × length of third; first two segments light brown outwardly with scattered chocolate scales. Cream scaling just below third segment with a few brown and chocolate scales dorsally. All segments with cream scaling inwardly. Frons squared with cream scales near palps and a mixture of brown and chocolate scales over the upper 80 %. Area between antennae with scales cream, erect; collar cream with brown scales adjacent to thorax; thorax cream with scattered brown scales. Antenna fasciculate, segments flared distad with bristle rows at middle and at distal end; antenna brown dorsally with two scale rows per segment. *Thorax and abdomen* – Abdomen cream with brown bands of various shades; Abdominal segments cream basally becoming pale-brown posteriorly with white ring on posterior margin. Underside cream with scattered brown scales. Forelegs with brown scaling dorsally, cream ventrally. Hind tibia slightly swollen. Two pairs of tibial spurs on hind leg, one pair on middle legs. *Wings* – Forewing length 15–17 mm. PM line a double brown line, outer element fading on lower half of wing, middle part of PM line with blue gray; PM line expanded outwardly to form dark-brown wedge-shaped patch at forewing apex; medial area with a diffuse



**Figures 6–10.** Genitalia of *Campatonema*. **a** valves **b** aedeagus **6a,b** *Campatonema tapantia* Sullivan, male, Cartago Province, Costa Rica (JBS 1497) **7a,b** *Campatonema yanayacua* Sullivan, male, Napo Province, Ecuador (JBS 2803) **8a,b** *Campatonema lineata* (Schaus), male, Puntarenas Province, Costa Rica (JBS 1498) **9** *Campatonema tapantia* Sullivan, female, Alajuela Province, Costa Rica (JBS 1494) **10** *Campatonema lineata* (Schaus), female, Puntarenas Province, Costa Rica (JBS 1499).

brownish-gray band along inner margin of PM line. Costa brown basally becoming tan throughout mid-section and fusing with PM line at apex. Wing margin with row of chocolate scales forming terminal line, slightly wider at veins. Discal dot distinct. Hind-wing with a series of tan and brown lines parallel to margin and crossing cream ground; brownish-gray PM line with blue-gray filling prominent. Margin a broad brown band. Ventral surface cream with chocolate PM line on costal half of forewing. Wing apex

almost white. Discal dots distinct. Brown scaling over cream ground color particularly strong in costal area. *Male genitalia* – Uncus rod shaped, valves elongate, tapering to a rounded apex. Costa heavily sclerotized, with a slight bulge 1/3 from apex. Costal half of valva with fine setae, without processes or well-defined ridges. Gnathos arms poorly defined, medial junction a well-defined pad covered with bristles or spines. Furca deflecting to right and extending to slightly above medial pad on gnathos. Outer third of furca with bristles. Furca slightly S-shaped, tapering little from base to rounded tip. Saccus slightly rounded. Aedeagus diameter increasing posteriorly before ending abruptly in a narrow spine; lightly sclerotized, particularly anteriorly. Everted vesica expanded slightly with a patch of 8 cornuti. Pelt without distinct features. **Female.** unknown.

**Distribution.** Known only from the type locality, Yanayacu Biological Station, Ecuador.

**Remarks.** Similar specimens have been collected at Estacion Cientifica San Francisco, Zamora-Chinchi, Ecuador by Gunnar Brehm. Pictures of the adults and dissections of the genitalia were examined, but differ enough from the Yanayacu specimens that they are not included in the type series.

### ***Campatonema lineata* (Schaus) comb. n.**

Figs 4, 5, 8a, b, 10

*Sabulodes? lineata* Schaus, 1911: 590.

**Type material. Syntypes:** USNM. Type locality: Juan Vinas, Costa Rica.

**Diagnosis.** *Campatonema lineata* is readily separated from the other species of *Campatonema* by its wing pattern. In particular, no other species of *Campatonema* has broad, reddish-brown bands along the margins of both sets of wings.

**Redescription. Male.** *Head* – Palp short, less than length of round eye, slightly correct, third segment 1/2 length of first two segments, which are equal in length. Palp mostly cream on inner surface and brown on external surface. Frons rectangular, brown. Area between antennae and scape cream. Antenna fasciculate with bristles originating in middle and distal end of each segment; antenna brown dorsally, two rows of scales per segment, distal row darker. Scales of collar erect, dirty cream in color. *Thorax and abdomen* – Dorsal thoracic scales cream with two tan spots on distal end. Abdomen cream with tan scales on posterior half of each segment, segments 6–7 with dorsal scales brown, tipped with cream, segment 8 tan with darker brown central spot. Ventral abdomen cream. Legs finely scaled with grey brown dorsally, cream ventrally, two pairs of tibial spurs on hind leg, one pair on middle leg. *Wings* – Forewing length 14 mm. Forewing slightly pointed, ground color cream heavily dusted with tan and chocolate brown; PM line originating subapically on costa and undulating to point at outer 1/4 of lower margin; PM line double on costal half, formed by two rows of chocolate scales with only inner one prominent and continuing to lower margin of wing. Traces of other tan lines parallel to wing margin both proximal and distal to PM

line. Discal dot dark, distinct. Hindwing much as forewing, with a series of lines parallel to margin. PM line distad of discal dot darkest and most prominent. Margins of both wings tan with small chocolate patches at ends of veins. Ventral surface of wings with cream ground color and dusting of brown scales, becoming denser distally before forming a distinct marginal band. Apex of forewing lighter and forming a light band on forewing parallel to margin. **Female.** Slightly larger than male (forewing length 15 mm), maculation much like male but colors more intense. Antenna filiform. *Male genitalia* – Uncus rod shaped; gnathos arms indistinct, medial pad oval and covered with spines. Valves slightly shorter than in other species, more rounded apically. Area of bristles on valves adjacent to sclerotized costa and broadest apically. Annular arms appear bifurcate, without sclerotized medial area. Arms of tegumen meeting medially below uncus, fused. Vincular arms straight. Furca deflected to left, extending to gnathos and with bristled area toward apex. Saccus squared. Juxta bending slightly to median at base. Aedeagus straight, pointed at apex, vesica expanded with patch of cornuti which are with cornuti slightly larger on basal side of patch. Pelt without distinct features. *Female genitalia* – Anal papillae elongated with apex rounded. Posterior apophyses twice as long as anterior ones, thin, straight, paddlelike at apex. Anterior apophyses with knob-like junction about 1/3 distance from posterior end, causing a slight redirection. Terminal ends paddlelike. Seventh tergite forming an oval shield with sclerotized ostial area below. Sclerotization on ostium forming a half collar dorsally. Ductus very short, forming a narrow neck to bursa, which expands slightly forming tear-drop shape. Signum on dorsal side a spiked sphere with hollow center. Pelt without distinct features.

**Distribution and biology.** Specimens have been collected in the provinces of Alajuela, Cartago, Guanacaste, and Puntarenas, Costa Rica, at elevations of 700–1500 m. Adults are on the wing throughout the year.

## Discussion

Based on a single male of *Camptonema marginata*, Pitkin (2002) characterized the genus *Camptonema* by its tapered, pointed forewing shape and yellowish-cream wing color with tan border and a tan band crossing the dorsal surface of both wings. The peculiar furca-like process of *C. marginata* prevented Pitkin from including *Camptonema* in the Ourapterygini. The discovery of three additional species of *Camptonema*, all with a normal furca, supports placement of *Camptonema* in Ourapterygini. *Camptonema* is characterized by the tapered, pointed wing shape. The yellowish-cream wing color is distinctive in most members but can be overlaid with lines parallel to the wing margin which can extend inwardly past the discal spot. Antennal pectination, strongly fasciculate to bifasciculate with rows of bristles at the midpoint and at the terminus of each segment, will distinguish *Camptonema* from similar appearing species of *Isochromodes* Warren and *Eusarca* Hübner. The female genitalia offer no diagnostic characters, in part because the signum varies from a simple ridge to a stellate hollow

sphere in the two known species. The female from southern Ecuador that was excluded from *N. yanayacua* also has a signum which is a stellate hollow sphere.

*Campatonema* species occur at moderate elevations (1000–2000 m) in Costa Rica and Ecuador, with an outlying species in Brazil. Almost nothing is known regarding the life history. *C. tapantia* usually came to mercury vapor and blacklights between 8–9 pm. None of the species appears to be common and the number of sites where they have been found in Costa Rica and Ecuador are few. Additional species undoubtedly await discovery.

Bar-code data from two individuals of each of the two new species added to the genus *Campatonema* form a monophyletic cluster with no close generic relatives among the many hundreds of ennomine species that have been barcoded. Both *Eusarca* and *Isochromodes* include species externally similar to *Campatonema* and barcoding indicates they may be the most closely related genera but both are likely to be polyphyletic and in need of revision.

## Acknowledgements

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