

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

*Edited by*

B. Christian Schmidt & J. Donald Lafontaine



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CONTRIBUTIONS TO THE SYSTEMATICS OF NEW WORLD MACRO-MOTHS VI

*Edited by* B. Christian Schmidt & J. Donald Lafontaine

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# Contents

- I Contributions to the systematics of New World macro-moths VI**  
*B. Christian Schmidt, J. Donald Lafontaine*
- 3 A revision of the genus *Doryodes* Guenée, 1857, with descriptions of six new species (Lepidoptera, Erebidae, Catocalinae, Euclidiini)**  
*J. Donald Lafontaine, J. Bolling Sullivan*
- 31 Revision of the genus *Heteranassa* Smith, 1899 (Lepidoptera, Erebidae, Omopterini)**  
*Nicholas Homziak, Heidi Hopkins, Kelly B. Miller*
- 51 A new species of *Ogdoconta* Butler (Lepidoptera, Noctuidae, Condicinae, Condicini) from southeastern Arizona, USA**  
*Lars G. Crabo*
- 57 Revision of the genus *Aseptis* McDunnough (Lepidoptera, Noctuidae, Noctuinae, Xylenini) with a description of two new genera, *Paraseptis* and *Viridiseptis***  
*Tomas Mustelin, Lars G. Crabo*
- 103 Revision of the *Lacinipolia vicina* (Grote) complex (Noctuidae, Noctuinae, Eriopygini)**  
*B. Christian Schmidt*
- 127 Additions and corrections to the check list of the Noctuoidea (Insecta, Lepidoptera) of North America north of Mexico III**  
*J. Donald Lafontaine, B. Christian Schmidt*



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

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This special issue of ZooKeys is the sixth volume in the “Contributions” series, dedicated to disseminating systematics research on the Noctuoidea, Geometroidea, and other macro-moth groups. Previous volumes were published in May 2009 (volume I, ZooKeys 9), March 2010 (volume II, ZooKeys 39), November 2011 (volume III, ZooKeys 149), February 2013 (volume IV, ZooKeys 264) and June 2014 (volume V, ZooKeys 421) (see Schmidt and Lafontaine 2009, 2010, 2011, 2013, 2014). Authors interested in contributing to future “Contributions” volumes are encouraged to contact us.

In the current volume, eight authors contributed six manuscripts on North American taxa in the Erebidae and Noctuidae. In addition to 55 taxonomic changes, ten new taxa are described from North America, including six species of *Doryodes* from the eastern United States (*D. desoto* Lafontaine & Sullivan, **sp. n.**; *D. okaloosa* Sullivan & Lafontaine, **sp. n.**; *D. fusselli* Sullivan & Lafontaine, **sp. n.**; *D. reinecke* Sullivan & Lafontaine, **sp. n.**; *D. broui* Lafontaine & Sullivan, **sp. n.**; and *D. latistriga* Sullivan & Lafontaine, **sp. n.**), two species from the western United States (*Ogdoconta margareta* Crabo, **sp. n.** and *Lacinipolia dimocki* Schmidt, **sp. n.**), and two new genera (*Paraseptis* Mustelin & Crabo, **gen. n.** and *Viridiseptis* Mustelin & Crabo, **gen. n.**). All updates and corrections to the Check List of North American Noctuoidea (Lafontaine and Schmidt 2010) since the last update in 2013 are summarized.

## References

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# A revision of the genus *Doryodes* Guenée, 1857, with descriptions of six new species (Lepidoptera, Erebiidae, Catocalinae, Euclidiini)

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## Abstract

The genus *Doryodes* Guenée is revised to include ten species including six species described as new (*D. desoto* Lafontaine & Sullivan; *D. okaloosa* Sullivan & Lafontaine; *D. fusselli* Sullivan & Lafontaine; *D. reimeckei* Sullivan & Lafontaine; *D. broui* Lafontaine & Sullivan; and *D. latistriga* Sullivan & Lafontaine). A key to species, descriptions, and illustrations of adults and genitalia are included.

## Keywords

Taxonomy, Erebiidae, Erebiinae, Euclidiini, *Doryodes*, *Spartina*, *Aristida*

## Introduction

The genus *Doryodes* Guenée, 1857, currently includes five species, four occurring in United States and Canada (Lafontaine and Schmidt 2010), and one occurring in the Bahamas.

Most species are very difficult to identify from external appearance, however, the vesica in males, the genitalia in females, and the barcodes, are diagnostic. All except one of the ten species in the genus are associated with coastal salt marshes.

## Materials and methods

### Repository abbreviations

Specimens were examined from the following collections:

- BIO** Biodiversity Institute of Ontario, University of Guelph, Ontario, Canada.  
**BMNH** The Natural History Museum (statutorily, British Museum (Natural History), London, UK.  
**CNC** Canadian National Collection of Insects, Arachnids, and Nematodes, Ottawa, Ontario, Canada.  
**EHMC** Eric H. Metzler Collection, Alamogordo, New Mexico, USA.  
**FSCA** Florida State Collection of Arthropods, McGuire Center for Lepidoptera & Biodiversity, Gainesville, Florida, USA.  
**JBSC** J. Bolling Sullivan Collection, Beaufort, North Carolina, USA.  
**MEM** Mississippi Entomological Museum, Mississippi State University, Mississippi, USA.  
**USNM** National Museum of Natural History (formerly, United States National Museum), Washington, District of Columbia, USA.  
**VABC** Vernon Antoine Brou Jr. Collection, Abita Springs, Louisiana, USA.

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

## Systematics

### *Doryodes* Guenée, 1857

**Type species.** *Ligia acutaria* Herrich-Schäffer, [1852].

### *Themma* Walker, 1863

**Type species.** *Themma divisa*, 1863. Monotypy.

### *Tunza* Waker, 1863

**Type species.** *Tunza promptella* Walker, 183. Monotypy.

**Diagnosis.** The genus *Doryodes* is easily recognized because of the elongated, apically pointed wings and the elongated abdomen. Males have broadly bipectinate antennae with pectinations 3–5 × as long as the width of the antennal shaft; females

have filiform antennae. The frons is bare ventrally, covered with rough scaling dorsally. The eyes are rounded, without hairs or lashes. Ocelli are present. The labial palpus usually is directed forward, occasionally with the terminal segment angled ventrally; the basal and apical segments are about half as long as the middle segment. Forewing length varies from 13–21 mm, females, on average, are longer winged than males. The forewing in the male usually is pale buffy brown; some species have longitudinal streaks of gray, brown, or yellowish orange. There is a blackish-brown stripe along the middle of the wing, almost straight from the wing base to three-quarters of the distance to the apex, at which point it curves upward toward the apex and tends to narrow and fade out between the curve and the apex. The dark stripe is bordered dorsally by a narrow white line extending from the wing base to the point where the dark stripe curves upward; the dark stripe is bordered ventrally by a narrow white line on the outer half or third of the wing to, or almost to, the wing apex. Usually there are one or two dark dots representing the reniform spot, orbicular spot, or both. The forewing of the female usually is paler and more acutely-pointed apically than that of the male. The dark longitudinal stripe along the middle of the forewing is narrower in most females than in males. The hindwing is white to buff, and the color can vary with seasonal generations. In particular, many individuals captured from November to March are much darker than those found in spring and summer. The winter forms are often misidentified because superficially they differ more from the “summer” forms than most species differ from each other. The legs have spiniform setae on the tibia; the basitarsus has two or three ventral rows of spiniform setae. The abdomen is without tufts or abdominal brushes. In the male genitalia the tegumen, and especially the vinculum, are long and have a simple articulation with each other and with the valves; the vinculum ends ventrally as a deep V-shaped sacculus. The uncus is shorter than the tegumen, bulbous at the base, then slightly tapered to the apex, with a spine-like tip. The juxta is strongly fused to the base of the valves, so it is difficult to spread the valves laterally without distorting or tearing the middle part of the genitalia. The valve is elongate and tripartite with the medial part lightly sclerotized apically. The base of the valve has a long lens-shaped sacculus extending about half way to the valve apex. The sacculus is extended as a sclerotized tube along (and fused with) the ventral margin of the valve, except toward the apex of the valve where the saccular extension is free from the valve and tapered to a pointed or blunt apex. A medial sclerotized ridge extends posteroventrally across the ventral surface of the valve from the base of the tegumen to fuse with the saccular extension on the lower edge of the valve (transverse ridge most prominent in *D. tenuistriga*); the costal margin of the valve also is heavily sclerotized, more so toward the apex of the valve where it ends in a pointed or bluntly-rounded process, often free from the medial part of the valve at the apex. In one species (*D. tenuistriga*) the sclerotized costal and ventral margins of the valves are broadly rounded at their apices and end well before the valve apex. The middle part of the valve is lightly sclerotized, especially the almost membranous, rounded, apical part of the valve. The aedeagus is

elongated and cylindrical, 7–10 × as long as its mesial width in most species (4–5 × as long in *D. tenuistriga* and *D. okaloosa*). The vesica is about as long as the aedeagus in most species, although abruptly curved ventrally or laterally near its middle. The vesica has numerous diverticula, typically five (numbered on Figs 33, 34, 36, 37, 38, 39), each usually with a cornutus that may be broad and shaped like a shark fin, or slightly to markedly serrated into several to many basally-fused spines; the basal part of the vesica, just beyond the end of the aedeagus is often slightly to markedly swollen and has one to five sclerotized plates, often armed with one to many spinules. The narrow ductus seminalis arises near the middle of the vesica ventrally and typically clogs the narrow opening rather than everting during dissection. The recognition of most species requires examination of the relative position, size, and shape of the diverticula and their associated cornuti. The female genitalia are elongated with an oblong corpus bursae, which occasionally has a small signum, and has a well-developed and variably-sclerotized ventro-lateral appendix bursae posteriorly on the right. The ductus bursae is straight and varies in length, with the sclerotized plate wider at each end than mesially, except in *D. reinecke* and *D. tenuistriga*. The ductus bursae extends posteriorly as a sclerotized quadrangular plate over the ostium bursae. The ductus seminalis arises at the base of the appendix bursae posteriorly; in most species it is abruptly tapered at its base and thread-like after that, however in *D. reinecke* and *D. tenuistriga* it is wider and only gradually tapered. The anal papillae are lightly sclerotized and apically rounded or tapered, covered laterally with hair-like setae. The anterior apophyses are rod-like and usually are about as long as the posterior apophyses.

**Distribution and biology.** Species of *Doryodes* occur from Atlantic Canada southward along the Atlantic Coast to the tip of peninsular Florida, and along the Gulf Coast to southern Texas and into Mexico. All species are associated with coastal salt marshes and creeks, except for *D. bistrialis*, which occurs from North Carolina to Mississippi and Florida in pine savannas and other open habitats where wiregrass occurs. One species apparently is endemic to the Bahamas. Wagner et al. (2011) reared larvae of *Doryodes spadaria* in captivity on Bermuda grass (*Cynodon dactylon* (L.) Pers.), however, it is thought that species of cordgrass (*Spartina* spp.) are more probable larval hosts in salt marshes where it occurs. The larvae have longitudinal stripes typical of grass- and sedge-feeding species of Lepidoptera. *Doryodes bistrialis* is thought to feed on wiregrass (*Aristida stricta* Michx.).

**Remarks.** Adults bear little superficial resemblance to other genera of the Erebiinae: Euclidiini, however, the male genitalia are typical for the Euclidiini with the central apical part of the valve lightly sclerotized and rounded, and with the costal and ventral margins heavily sclerotized and apically free from the central part and extending into apical processes. The narrow-winged, longitudinally-streaked forewings of the adults are in keeping with the habitus of many grass and sedge-feeding species of Lepidoptera. All species for which data are available differ significantly in characters of the genitalia, particularly the shape of the vesica in males, and the shape of the bursa copulatrix in females, and also differ in the barcode sequences.

**Key to *Doryodes* based on adults and distribution**

- 1 Forewing brownish gray to whitish gray above and below the dark longitudinal medial stripe; Atlantic Canada and eastern United States ..... **2**
- Forewing with orange stripe above and below dark longitudinal medial stripe; Bahamas ..... *D. insularia*
- 2 Males ..... **3**
- Females (females of two species from the Gulf Coast of Florida, *D. desoto* and *D. okaloosa*, are unknown) ..... **11**
- 3 Costal process of valve tapered to a point at or beyond central membranous part of valve ..... **4**
- Costal processes of valve blunt and rounded apically and ending well before apical part of valve (Fig. 42); longitudinal stripe on forewing narrow and extending almost to wing apex; Gulf Coast of Texas and Louisiana ..... *D. tenuistriga*
- 4 Vesica with diverticulum 1 with deeply-serrated rooster-comb-like sclerotized cornutus (Figs 33–36, 41) ..... **5**
- Vesica with diverticulum 1 with triangular shark-fin-like sclerotized cornutus, which may have minute serrations on one side (Figs 37–40) ..... **9**
- 5 Vesica with diverticulum 1 elongated, 2–5 × as long as mesial width (Figs 33, 34) ..... **6**
- Vesica with diverticulum 1 about as long as mesial width (Figs 35, 36, 41) **7**
- 6 Diverticulum 1 usually 2–3 × as long as mesial width; diverticulum 2 on posterior surface; apex of vesica symmetrical with broad triangular cornutus on each side projecting laterally (Fig. 33); inland species associated with wire-grass savannah from North Carolina to Mississippi and southern Florida ..... *D. bistrialis*
- Diverticulum 1 4–5 × as long as mesial width; diverticulum 2 lateral on left; apex of vesica asymmetrical with single triangular cornutus on diverticulum 5 (Fig. 34); salt marsh species known from Gulf Coast of Florida.. *D. desoto*
- 7 Aedeagus short, about 5 × as long as wide (Fig. 35); ventral process on valve broadly rounded apically; Gulf Coast of Florida ..... *D. okaloosa*
- Aedeagus 7–10 × as long as wide (Figs 36, 41); ventral process on valve tapered apically ..... **8**
- 8 Diverticulum 2 of vesica larger than diverticulum 1 (Fig. 36); forewing with longitudinal stripe dark brown and sharply defined; known only from coastal North Carolina; superficially not safely distinguishable from *D. spadaria*, although usually smaller ..... *D. fusselli*
- Diverticulum 2 of vesica a slight hump (Fig. 41); forewing with longitudinal stripe faint and diffuse, fading into paler coloration below stripe; Gulf Coast from the Florida Panhandle to Texas ..... *D. reineckeii*
- 9 Vesica T- or Y-shaped at apex with diverticula 4 and 5 projecting to each side, each with a triangular cornutus at apex (Figs 37, 38); Atlantic Coast from Canada to southern Florida and on southwestern coast of Florida ..... *D. spadaria*

- Vesica with rounded, bulging apex with preapical cornuti on left side (Figs 39, 40); Gulf Coast from Alabama to Texas..... **10**
- 10 Longitudinal forewing stripe broad, sharply defined or diffuse; vesica with position of diverticulum 1 barely raised from curve in vesica; apex of vesica an elongated lobe (Fig. 39) ..... *D. latistriga*
- Longitudinal forewing stripe narrow; diverticulum 1 of vesica a prominent posterior lobe from curve of vesica; apex of vesica bluntly rounded (Fig. 40)... *D. broui*
- 11 Sclerotized plate in ductus bursae about as long as posterior width of plate; left posterior side of corpus bursae with protruding sclerotized lobe opposite appendix bursae; ductus bursae and corpus bursae very short (Fig. 49) ..... *D. tenuistriga*
- Sclerotized plate in ductus bursae about 2–4 × as long as posterior width (Figs 43–48); left posterior side of corpus bursae tapered opposite appendix bursae ..... **12**
- 12 Forewing mainly white; longitudinal dark stripe absent or barely discernable; sclerotized plate in ductus bursae broad posteriorly, tapered anteriorly, 0.55–0.65 × length of ductus bursae (Fig. 48) ..... *D. reineckeii*
- Forewing pale buffy brown with dark longitudinal stripe sharply defined; sclerotized plate in ductus bursae broader anteriorly and posteriorly, narrower in middle, 0.75–0.85 × length of ductus bursae (Figs 43–47) ..... **13**
- 13 Corpus bursae slightly constricted mesially; appendix bursae elongated; sclerotized plate in ductus bursae not abruptly widened at anterior end (Figs 43, 45) ..... **14**
- Corpus bursae constricted post-mesially at base of rounded, wrinkled appendix bursae; sclerotized plate in ductus bursae widened at anterior end (Figs 44, 46, 47) ..... **15**
- 14 Ductus bursae tapered from posterior end to anterior end; appendix bursae rounded posteriorly (Fig. 43); inland species of pine savannah associated with wiregrass; North Carolina to Florida and Mississippi..... *D. bistrialis*
- Ductus bursae almost even in width throughout; appendix bursae truncated posteriorly (Fig. 45); salt march species known only from coastal North Carolina ..... *D. fusselli*
- 15 Longitudinal forewing stripe broad, sharply defined or diffuse (Figs 16, 17); appendix bursae with posterior margin straight and heavily sclerotized (Fig. 46) ..... *D. latistriga*
- Longitudinal forewing stripe narrow, sharply defined (Figs 8, 22); appendix bursae rounded or notched posteriorly and lightly sclerotized (Figs 44, 47) ... **16**
- 16 Sclerotized plate over ostium bursae deeply concave on posterior margin; appendix bursae bilobed posteriorly (Fig. 44); Atlantic Coast from Canada to southern Florida and on Gulf Coast as far north as Punta Gorda ..... *D. spadaria*
- Posterior margin of ostium bursae essentially straight (Fig. 47); Gulf Coast from Alabama to Texas ..... *D. broui*

***Doryodes* Guenée, 1857*****Doryodes bistrialis* (Geyer, 1832)**

Figs 1–3, 33, 43

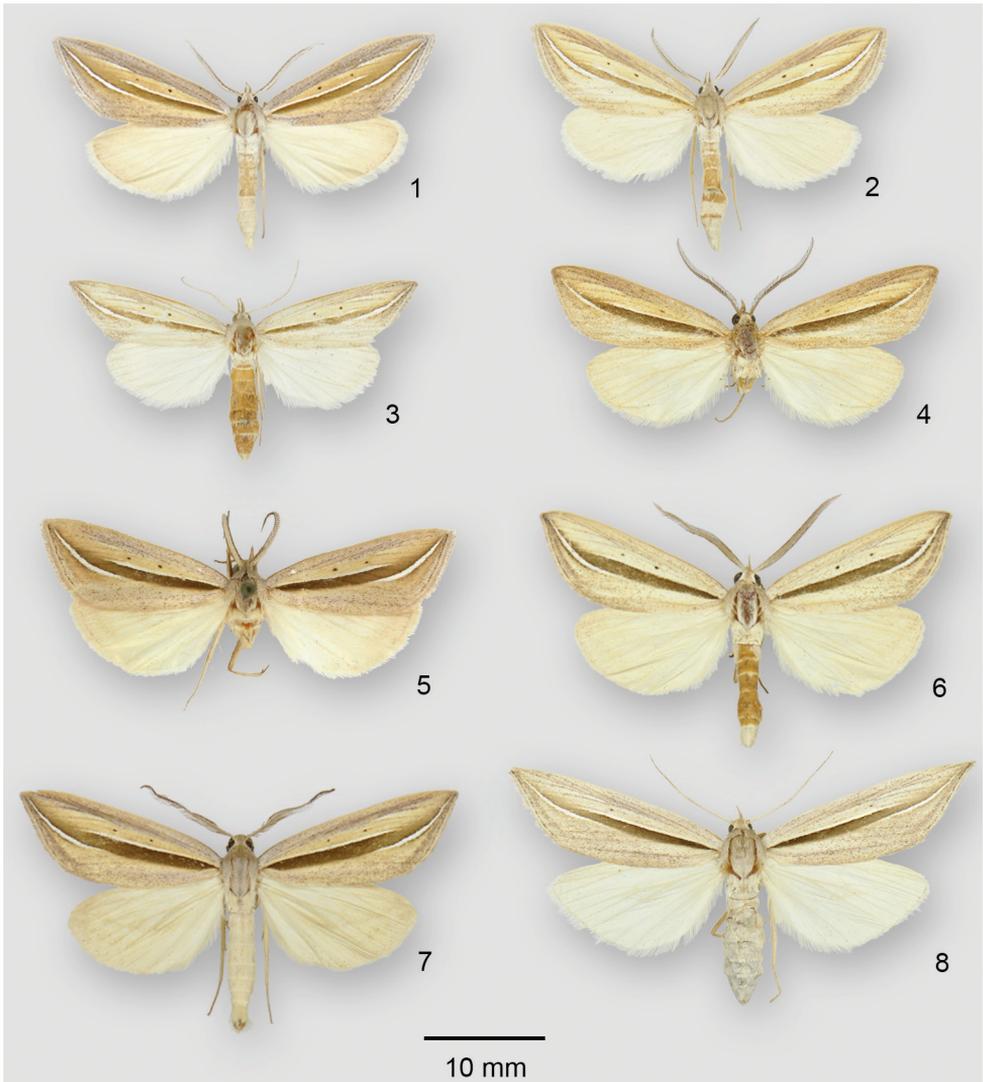
*Agriphila bistrialis* Geyer, 1832: 38; pl. 133, figs 775, 776.*Ligia acutaria* Herrich-Schäffer, [1852]: 74; pl. 73, fig. 447.

**Type material.** *Agriphila bistrialis*: type lost. Given the difficulty of identifying species of *Doryodes* from an illustration, and the lack of a type locality for *Agriphila bistrialis*, we designate a neotype in order to preserve the long-standing identity of the inland species of *Doryodes*. **Neotype** ♂, USA, North Carolina, Carteret Co., Croatan National Forest, Sam Hatcher Road, 23 April 2006, J. Bolling Sullivan. BOLD barcode Sample ID: 06-NCCC-932 [USNM].

*Ligia acutaria* is nominally described from southern Russia, although already in 1852 Herrich-Schäffer suspected it was mislabeled. The type is lost, so to ensure that the current synonymy is maintained, we designate the neotype of *Agriphila bistrialis* as **Neotype** of *Ligia acutaria* also.

**Other material examined and distribution.** We have examined material from North Carolina east of the Piedmont, from most of Florida except for the Keys and Panhandle and a single male from a power cut near Grand Bay National Wildlife Refuge, Jackson County, Mississippi. Specimens from Florida, Mississippi and North Carolina are closely similar in appearance, genitalia and barcodes.

**Diagnosis.** Superficially, adults usually can be identified by the narrower dark stripe on the forewing and their relatively small size (forewing length: ♂ 13.0–15.5 mm, ♀ 14.5–16.0 mm). Compared to *D. spadaria* the medial longitudinal stripe on the forewing of *D. bistrialis* is much narrower and the hindwings are whitish not buff through June emergences. Later in the year, *D. spadaria* hindwings become more whitish, so wing length and the width of the longitudinal line must be relied upon to distinguish the species, or genital characters must be examined for positive identification. Females of *D. bistrialis* do not overlap those of *D. spadaria* in size, females of *D. spadaria* having a forewing length of 18.0–21.0 mm. The male vesica is also diagnostic in *D. bistrialis* in that there is a line of smaller cornuti extending along the trunk usually in three patches, whereas in *D. spadaria* there are two side-by-side cornuti on the basal trunk of the vesica. In *D. bistrialis*, diverticulum 1 is 2–3 × as long as wide and has a deeply-serrated rooster-comb-like cornutus at the apex; *D. spadaria* has no diverticulum in this position and the cornuti in the vesica are triangular, sometimes minutely serrated on one side. *D. bistrialis* can be distinguished from *D. fusselli* by the shape of diverticulum 1, which is rounded in *D. fusselli* and about as long as wide; also the apex of the vesica in *D. bistrialis* is symmetrical with a triangular cornutus on a pouch on each side (diverticula 4 and 5). *D. bistrialis* can be distinguished from *D. reineckeii* and *D. latistriga* by the wing pattern and by size and from *D. broui* by the characters



**Figures 1–8.** *Doryodes* adults. **1** *D. bistrialis* ♂, USA, Florida, Marion Co., Ocala Nat'l Forest FR-88 **2** *D. bistrialis* ♂, USA, North Carolina, Pender Co., Holly Shelter Game Land **3** *D. bistrialis* ♀, USA, North Carolina, Pender Co., Holly Shelter Game Land **4** *D. desoto* holotype ♂, USA, Florida, Pinellas Co., Ft Desoto Park nr St. Petersburg **5** *D. okaloosa* holotype ♂, USA, Florida, Okaloosa Co., Shalimar **6** *D. spadaria* ♂, USA, North Carolina, Onslow Co., Camp Lejeune, Corn Landing **7** *D. spadaria* ♂, USA, South Carolina, Charleston Co., The Wedge Plantation, 7 mi N McClellanville **8** *D. spadaria* ♀, USA, South Carolina, Charleston Co., The Wedge Plantation, 7 mi N McClellanville.

of the vesica. Along the Gulf Coast *D. bistrialis* could be confused with *D. broui* and *D. tenuistriga*, but characters of the vesica (*D. broui*, Fig. 40 and *D. tenuistriga*, Fig. 42, versus *D. bistrialis*, Fig. 33) readily distinguish these three species and *D. bistrialis*

occurs farther inland. The female genitalia of *D. bistrialis* are elongated with a more compact, less differentiated, appendix bursae than in *D. spadaria*.

**Distribution and biology.** *Doryodes bistrialis*, unlike all other species in the genus, occurs mainly inland away from coastal salt marshes. It occurs in pine savannas where wiregrass (*Aristida stricta*), the presumed food plant, is abundant. It has only been recorded in North Carolina, Mississippi and Florida, and it follows the distribution of the presumed foodplant, *Aristida stricta*. The species is on the wing from April through October in North Carolina, and throughout the year in Florida. The species appears to be associated with wiregrass, but we were unable to successfully rear it on cut grasses. Eggs should be placed on potted *Aristida* and larvae monitored to determine their preference for the grass or detritus in the base of the grass clump. In North Carolina the savannas are usually a half mile or more inland from coastal marshes and extend westward into the Sandhills adjacent to the piedmont. It is possible that the salt marsh species and the wiregrass species could occur in the same or very close areas where coastal marshes penetrate inland but we did not find such areas.

***Doryodes desoto* Lafontaine & Sullivan, sp. n.**

<http://zoobank.org/16419019-B413-405D-99A9-8717D8C12BF1>

Figs 4, 34

**Type material. Holotype** ♂. **Florida**, Pinellas Co., Ft. Desoto Park nr St. Petersburg, 4 Jan. 1968, J. D. Lafontaine. CNC. **Paratypes:** 2 ♂. **Florida**. Gulf Co., Rd. to Cape San Blas, nr Port St Joe, 29.8°N, 85.3°W, 31 July 1998, Jeff Slotten, genitalia slide FLMNH-MGCL 02944 (1 ♂). Florida, Sarasota Co., Siesta Key, 3 Feb. 1952, C.P. Kimball, genitalia slide FLMNH-MGCL 02948 (1 ♂). FSCA.

**Etymology.** This species is named after Ft. De Soto Park, Florida.

**Diagnosis.** This species is superficially indistinguishable from *D. spadaria*, *D. fusselli*, and *D. broui*, although its range on the Gulf Coast of Florida is north and west of the range of *D. spadaria* and *D. fusselli*, and east of the range of *D. broui*. Forewing length is 16 mm, on the small size for *D. spadaria*, but within the normal range of the other similar species. The species can be definitively identified only by the male vesica, particularly by the long, narrow diverticulum 1, which is about 4–5 × as long as its basal width and with an apical, deeply serrated rooster-comb-like cornutus; diverticulum 2 is on the left side of the vesica, not posterior as in *D. bistrialis*; diverticulum 4 is preapical on the right, without a cornutus, and diverticulum 5 forms a projecting lobe with a cone-shaped diverticulum on its left side.

**Description.** External structural characters as described for genus. Forewing length 16 mm; forewing whitish buff with slightly darker-buff and pale-gray streaks; a prominent blackish-brown stripe along the middle of wing, curving upward and tapered at about  $\frac{3}{4}$  from base; stripe narrower than for *D. spadaria* and *D. okaloosa*, but wider than for *D. bistrialis*; stripe bordered by narrow white line above extending to  $\frac{3}{4}$  from base, and with similar white line below stripe extending from above forewing

tornus almost to wing apex. Hind wing white with very faint buffy tone. Male genitalia mainly as described for genus. Dorsal heavily-sclerotized margin of valve extending beyond middle membranous part, then tapered abruptly into a sharp spine; ventral sclerotized margin of valve not evenly tapered, but widens slightly preapically then tapered to blunt point free from inner membranous part of valve. Aedeagus cylindrical, 8–9 × as long as mesial width. Vesica with swollen area distal to end of aedeagus, 0.4–0.5 × as long as aedeagus and about 2 × as long as wide, with two spinule-covered sclerotized plates, these partially or completely divided into as many as four plates each with less spinules; diverticulum 1 finger-like, 4.5–5.5 × as long as mesial width, with apical serrated cornutus; diverticulum 2 rounded, on left side at base of diverticulum 1, with shark-fin-like cornutus; diverticulum 3 quadrate, on right side and without a cornutus; diverticulum 4 preapical, on right side without a cornutus; diverticulum 5 forming a bulbous apical lobe with a rounded spine-tipped cornutus on left side.

**Distribution and biology.** This species is known only from three male specimens, all from the Gulf Coast of Florida between Sarasota County and Gulf County. Collecting dates are in January, February, and July. Nothing is known of its biology except it is associated with coastal salt marshes.

***Doryodes okaloosa* Sullivan & Lafontaine, sp. n.**

<http://zoobank.org/1CA76187-9C9D-4972-865C-B0CBB4D6A6A6>

Figs 5, 35

**Type material.** Holotype ♂, Florida, Okaloosa Co., Shalimar, black light trap, 3461, H. G. Hilton, genitalia slide FLMNH-MGCL 02951. FSCA.

**Etymology.** The species name is in honor of the Okaloosa, a tribe of the Creek Nation and longtime inhabitants of the area.

**Diagnosis.** This species probably occurs with *D. desoto* and *D. reinecke*i in the salt marshes and tidal creeks throughout the coastal panhandle area of Florida. The species is slightly larger than *D. bistrialis*, which may occur nearby but inland. The washed out appearance of *D. reinecke*i immediately distinguishes it from *D. okaloosa*. *Doryodes desoto* is very similar and at present dissection of the male genitalia is the only reliable way to distinguish these two species, although based on the single specimen of *D. okaloosa*, it appears that *D. okaloosa* is broader winged than *D. desoto*, but not as broad winged as *D. reinecke*i. The abundance of large cornuti in the vesica, as well as the spatulate lower process of the valve and the short, broad aedeagus distinguishes *D. okaloosa* from all other *Doryodes* species.

**Description.** Forewing length 16.5 mm; forewing stripe dark brown, narrower than for *D. spadaria* but wider than for *D. desoto*; forewing wider and browner than in *D. spadaria* and *D. desoto*, but not as wide as in *D. reinecke*i, and longitudinal stripe sharply defined, unlike that of *D. reinecke*i. Antennae missing but presumed to be bipectinate as in other species in genus. Hind wing white with buff tinge. Male genitalia mainly as described for genus. Dorsal heavily-sclerotized margin of valve wider and less

well defined than in other species except for tapered spine-like apex; apex not rounded as in *D. tenuistriga*, but wider than in other species; ventral sclerotized margin of valve slightly tapered to a broadly spatulate apex, much as in *D. tenuistriga*. Aedeagus cylindrical, about 5 × as long as mesial width. Vesica with swollen area distal to end of aedeagus about 0.5 × as long as aedeagus and about 2 × as long as wide, with four large spine-covered sclerotized plates; diverticulum 1 slightly longer than wide with large deeply-serrated cornutus near apex; three preapical diverticula, each with large shark-fin-like cornutus; arrangement of large cornuti not seen in any other species of *Doryodes*.

**Distribution and biology.** At present this species is known from the holotype collected in Okaloosa County, Florida. It likely ranges south in the coastal brackish marshes toward the St. Petersburg/Tampa area and to the west along the Florida coast but little collecting has been done in salt marshes of the Florida Panhandle.

***Doryodes spadaria* Guenée, 1857**

Figs 6–9, 37, 38, 44

*Doryodes spadaria* Guenée, 1857: 234.

*Themma divisa* Walker, 1863: 186.

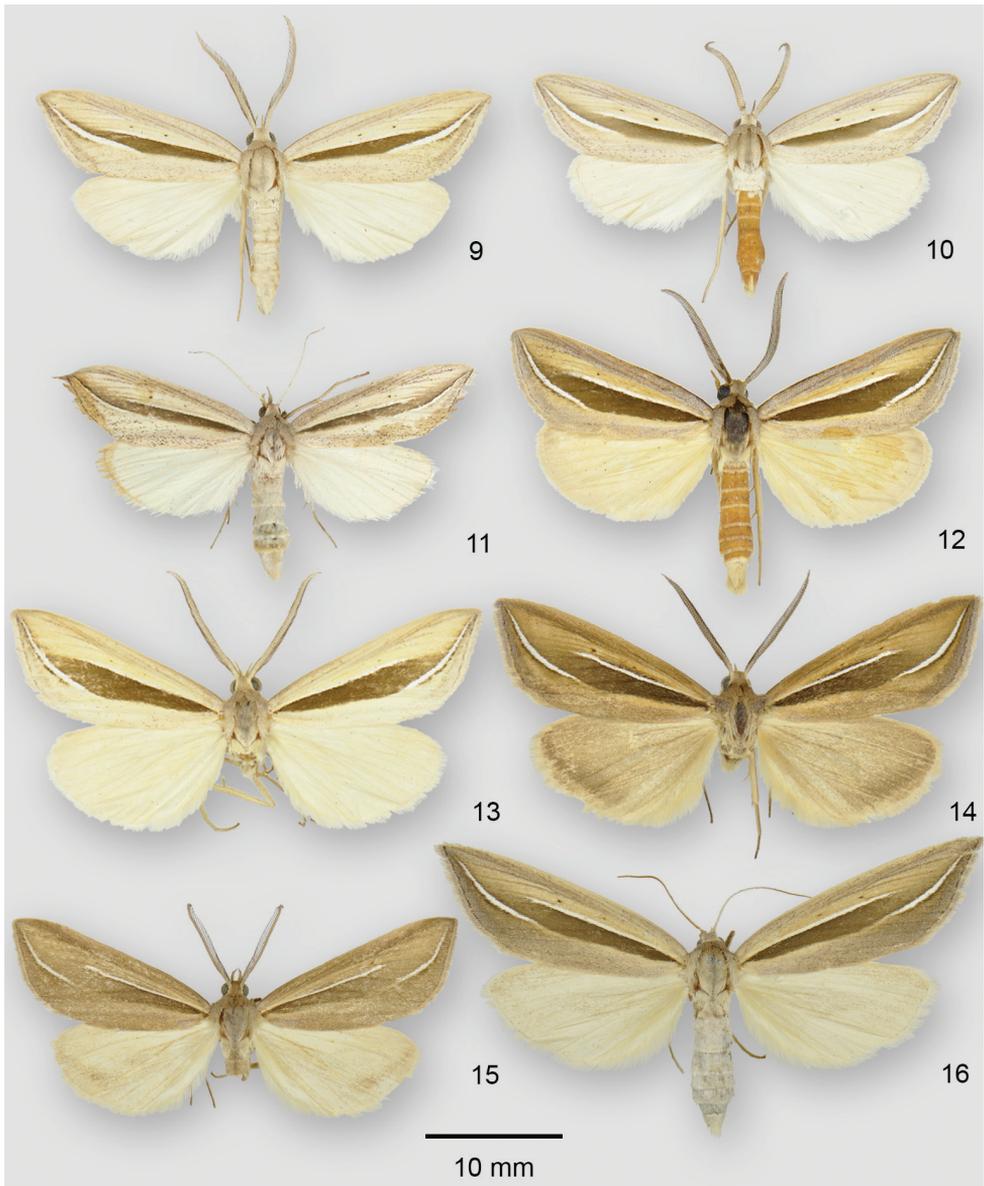
*Tunza promptella* Walker, 1863: 196.

*Doryodes spadaria* race *grandipennis* Barnes & McDunnough, 1918: 117; pl. 17, figs 1, 2, **syn. rev.**

**Type material.** *Doryodes spadaria*: type lost. It is impossible to identify this species from the description given by Guenée, but the type, listed as being from Florida, would most likely be from the East Coast, which would mean it represented the species now known either as *D. bistrialis*, *D. fusselli* or *D. spadaria*. In order to maintain the longstanding identity of this species as the widespread species in salt marshes of the Atlantic Coast, we designate the lectotype of *Themma divisa* Walker as **neotype** of *Doryodes spadaria*, an action that will ensure the current identity and synonymy. The data are given under *Themma divisa*. ***Themma divisa*: lectotype** ♂, here designated, BMNH, examined; male in good condition except right antenna and tip of left antenna missing; forewing length 18.1 mm; data “E. Doubleday, St John’s Bluff, E Florida/ *Themma divisa*/ syn-type [blue circle]/ 40-1-14-84/ S.O. 153.” ***Tunza promptella*: holotype** ♂, no locality, BMNH, examined. ***Doryodes spadaria* race *grandipennis*: syntypes** ♂, ♀, USNM, examined.

**Other material examined and distribution.** Canada: Quebec, Nova Scotia, Prince Edward Island. USA: Maine, New York, New Jersey, Maryland, North Carolina, South Carolina, Georgia, Florida.

**Diagnosis.** External structural characters as described for genus. *Doryodes spadaria* is the most widespread and common species in the genus, and except for *Doryodes fusselli* in coastal North Carolina, all specimens of *Doryodes* from salt marshes along the Atlantic Coast of Canada and the United States that we have seen are *Doryodes spadaria*. Adults



**Figures 9–16.** *Doryodes* adults. **9** *D. spadaria* ♂, USA, North Carolina, Carteret Co., Ft Macon State Park **10** *D. fusselli* paratype ♂, USA, North Carolina, Carteret Co., Ft Macon State Park **11** *D. fusselli* paratype ♀, USA, North Carolina, New Hanover Co., Fort Fisher Maritime Forest **12** *D. latistriga* paratype ♂, USA, Alabama, Baldwin Co., Camp Beckwith **13** *D. latistriga* paratype ♂, USA, Mississippi, Harrison Co., Long Beach **14** *D. latistriga* paratype ♂, USA, Louisiana, Lafourche Parish, nr Golden Meadow **15** *D. latistriga* paratype ♂, USA, Louisiana, St Tammany Parish, 4.2 mi N Abita Springs **16** *D. latistriga* paratype ♀, USA, Mississippi, Jackson Co., Gulf Islands Nat. Seashore.

are relatively larger (forewing length: ♂ 13–20 mm, most commonly 16–18 mm; ♀ 18–21 mm, most commonly 19 mm) than those of *Doryodes bistrialis* (forewing length: ♂, 13.5–15.5 mm, ♀ 14.5–16.0 mm), the species most likely to be confused with it in southeastern United States outside of North Carolina where the smaller *D. fusselli* also occurs in salt marshes. The forewing ground color in males varies from whitish buff to yellow buff with gray streaks; the longitudinal dark stripe is dark brown and conspicuously wider than in *D. bistrialis*; the ground color in females averages paler than that of males and the wings and dark longitudinal stripe are narrower. In the male genitalia, most structural characters are as described for the genus; the sclerotized costal margin of the valve is more heavily sclerotized apically and extends farther beyond the central membranous part of the valve than in most other species; the sclerotized ventral margin of the valve ends in a blunt point before the end of the central part of the valve. Two examples of the genitalia are illustrated, one to show the typical orientation of the vesica in comparison with other species (Fig. 37), and a ventral orientation of the vesica (Fig. 38) to illustrate the shape and positions of the two preapical diverticula and their cornuti. The vesica is slightly shorter than the aedeagus; the basal, swollen part of the vesica is armed with two thorn-like cornuti on sclerotized plates; the left preapical diverticulum (# 5) is tapered to a large triangular cornutus, whereas the right preapical diverticulum (# 4) has a bulge in the middle and a smaller cornutus. In the female genitalia the corpus bursae is elongated with the part anterior to the opening of the ductus bursae swollen laterally and with longitudinal “ribbons” of sclerotization. The appendix bursae is lightly sclerotized and slightly bilobed posteriorly. The ductus bursae is almost as long as the corpus bursae, and is heavily sclerotized dorsally and ventrally with the plates slightly narrower mesially and expanded laterally and more heavily sclerotized at their junction with the corpus bursae; the ventral plate at the end of the ductus bursae is extended posteriorly as a quadrangular plate that projects over the opening to the ductus with the posterior margin of the plate concave. The anterior and posterior apophyses are similar in length (posterior slightly longer), about half the length of the ductus. The anal papillae are lightly sclerotized, produced ventrally anteriorly, rounded posteriorly, with the surface setose.

**Distribution and biology.** *Doryodes spadaria* is widely distributed in coastal salt marshes on the Atlantic Coast of Canada and the United States from eastern Quebec to southern Florida. A few inland records in southern Florida (e.g., Kissimmee Prairie) are anomalous, unless there is brackish water in these areas. Adults occur in Canada and northeastern United States from June to August. In southeastern United States there are spring and summer generations and at least three generations in Florida.

***Doryodes fusselli* Sullivan & Lafontaine, sp. n.**

<http://zoobank.org/AF95A06B-AFB2-4CDD-B51C-18540F87E766>

Figs 10, 11, 36, 45

**Type material.** Holotype ♂, North Carolina, New Hanover Co., Fort Fisher Maritime Forest, A trail, 775504 W 335833 N, 15 Watt UV trap, Coastal fringe Evergreen

Forest, June 3, 1995, J. Bolling Sullivan, Richard Broadwell & Brad Smith. USNM. **Paratypes:** 8 ♂, 4 ♀. **North Carolina.** Same data as for holotype (2 ♂, 2 ♀); same locality and collector as holotype, June 27, 1995 (1 ♂, 1 ♀), April 19, 1995 (1 ♂), November 8, 1994 (1 ♂), October 5, 1994 (1 ♀). North Carolina, Carteret Co., Ft Macon State Park, 15 July 1999 (1 ♂); Carteret Co., maritime scrub, N34.697°, W-76.683°, 29 Aug. 2005, J. Bolling Sullivan, barcodes 05-NCCC-523, & 05-NCCC-524 (2 ♂). BIO, CNC, JBSC, USNM.

**Etymology.** The species name is in honor of John Fussell from Morehead City, North Carolina, who has worked tirelessly for decades to describe and protect the unique flora and fauna of the North Carolina coastal plain, particularly the Croatan National Forest. All of our lives are richer for his efforts.

**Diagnosis.** This species occurs with *D. spadaria* in the salt marshes and tidal creeks throughout coastal North Carolina. Adults are slightly larger than *D. bistrialis*, but noticeably smaller (especially females) than *D. spadaria*. The medial chocolate stripe on the forewing is broader than in *D. bistrialis*, but narrower than that of *D. spadaria*. Spring males are larger than those of the summer and fall generations, so they are more easily confused with *D. spadaria*. The hind wing is white, without the buff coloring of *D. spadaria*; in late summer some males of *D. spadaria* can have white hind wings, but size ranges for the two species do not overlap in this generation. Similar changes in size with season are seen for many other species (Sullivan and Miller 2007). The vesica differs in having a diffuse line of cornuti along the basal trunk and by the symmetrical pair of cornuti-tipped diverticula at the apex. *Doryodes spadaria* is described in full, so only differences from it are given in the description.

**Description.** Smaller than *D. spadaria*; spring males (forewing length: 16–17 mm [16–20 mm for *D. spadaria*]), slightly larger than summer males (forewing length: 14–15 mm); some small individuals (forewing length: 12–13 mm) late in season; females of *D. fusselli* (forewing length: 16 mm) smaller than those of *D. spadaria* (forewing length: 18–21 mm) but larger than those of *D. bistrialis*. Hindwing pearly white. Male genitalia with valves similar to those of *D. spadaria* but slightly smaller (valve length: 4.45 mm versus 4.75 mm for *D. spadaria*). Vesica basal trunk with single band of cornuti, usually separated into two elongated sections; diverticulum 1 rounded with toothed, rooster-comb-like cornutus on dorsal side; diverticulum 2 rounded, about 1.0–1.5 × as long as wide, with triangular cornutus on ventral surface near apex; terminus of vesica with two similar cornuti-tipped diverticula projecting distally [in *D. spadaria* two terminal diverticula are more elongated, different in shape from each other, and project laterally]. Female genitalia differ from those of *D. spadaria* in more even width of ductus bursae, and appendix bursae more elongated with posterior margin even, not bilobed as in *D. spadaria*.

**Distribution and biology.** At present this species is known only from North Carolina, occurring from Dare County in the north to Brunswick and New Hanover counties in the south. It is likely that it occurs farther south but may have been overlooked as *D. spadaria*. Specimens have been collected from April through October and the species appears to be on the wing continuously. Eggs were obtained from a female

and fed cut *Spartina alterniflora* Loisel. leaves and fresh and wilted Bermuda grass. The larvae survived to the second instar and were similar to those of *D. spadaria* (Wagner et al. 2011). Larvae have not been located in the field.

***Doryodes latistriga* Sullivan & Lafontaine, sp. n.**

<http://zoobank.org/7DF697E9-B84B-4B13-9257-640523BB3568>

Figs 12–17, 39, 46

**Type material. Holotype** ♂, **Alabama.** Baldwin Co., Camp Beckwith, UV trap, *Spartina-Juncus* marsh, N 30.39538°; W -87.84657°; 5 Aug. 2009. J. Bolling Sullivan. USNM. **Paratypes:** 44 ♂, 9 ♀. **Alabama.** Same data as holotype (2 ♂); same locality and collector as holotype, 7, 9 & 14 August 2009 (3 ♂); Baldwin Co., Weeks Bay Preserve, N 30.414°, W -87.833°; 4 Aug. 2009. J. Bolling Sullivan, barcodes 09-MISC-046, 047, 048, 049 (4 ♂). **Louisiana.** St. Tammany Parish, 4.2 mi NE Abita Springs, sec 24, T6S R12E, N 30°30.986', W 89°57.276', 25 Feb. 1997, V.A. Brou Jr. CNC slide ♂ 16049 (1 ♂); same locality and collector, 20 May & 27 Nov. 1983 (2 ♂), 23 May 1984 (1 ♂), 26 March 1985 (1 ♂), 27 March 1987 (1 ♂), 14 Aug. 1988 (1 ♂), 13 Jan. & 20 March 1989 (2 ♂), 13 Sept. 1998 (1 ♂), 28 May 2000 (1 ♂), 12 Oct. 2001 (1 ♂), 27 Jan. & 16 March 2002 (2 ♂), 3 April 2008, Barcode CNCLEP00113508 (1 ♂), 11 April 2008 (1 ♂), 12 April & 28 Oct. 2009 (2 ♂, 1 ♀), 21 March 2010 (1 ♂), 7 Feb. 2011, CNC slide 16058 (1 ♀), 22 April 2012, Barcode CNCLEP00113566 (1 ♂). Cameron Parish, Johnson's Bayou, 16 March 2002, V.A. Brou Jr. (1 ♀). Lafourche Parish, near Golden Meadow, 5 March 2006, V.A. Brou Jr., CNC slide ♂ 16054 (1 ♂); same locality and collector, 2 July 2005 (1 ♀), 5 March 2006 (6 ♂). **Mississippi.** Harrison County, Long Beach, 17 June 1992, V.A. Brou Jr. (1 ♀); same locality, 2 June 1996, CNC slide ♂ 16679, R. Kergosien (1 ♂), same locality and collector, 2 May 1997, CNC slide ♂ 16681 (1 ♂), 20 Nov. 1992, CNC slide ♂ 16706 (1 ♂), 17 May 1996, CNC slide ♀ 16440, (1 ♀). Jackson County, Gulf Coast Islands National Seashore, 19–20 April 1985, R.L. Brown (1 ♀). Jackson Co., Ocean Springs, 12, 15, 17 June 1992 & 1 Aug. 1992 (5 ♂, 2 ♀), V.A. Brou Jr. CNC, JBSC, MEM, USNM, VABC.

**Etymology.** The name of this species refers to the width of the longitudinal dark stripe on the forewing in both sexes.

**Other material examined and distribution.** We have examined material from southern Alabama, Mississippi, and Louisiana. Specimens in Bold database exhibit considerable heterogeneity but all sequences are within 0.8% of each other.

**Diagnosis.** This species occurs with *D. broui*, *D. reinecke*, and *D. tenuistriga*. It is the largest species and with the most distinctive forewing pattern. It should not be confused with *D. tenuistriga*, which has a narrow forewing stripe, or with *D. broui*, which is smaller (forewing length: 13.0–15.5 mm) and also has a narrower forewing stripe. It can be distinguished from *D. reinecke* by the breadth and distinctness of the longitudinal stripe; in females of *D. reinecke* the forewing stripe is absent or pale

gray, hardly contrasting with the ground color. The most distinguishing character of the male genitalia is the elongated terminal diverticulum of the vesica that projects ventrally. Females are similar to males but have longer, more pointed forewings and whiter hindwings. The female genitalia are the most robust of any *Doryodes* species. The corpus bursae has a bulge on the right side that is more pointed than in the other species, and the appendix bursae is quadrate with the posterior margin almost straight and heavily sclerotized.

**Description.** Forewing ground color in spring and summer specimens yellowish white to buff with gray streaking, hindwing white to whitish buff; forewing in fall and winter specimens darker with more brown shading, hindwing variably suffused with brown, especially along wing margin. Forewing length 14.5–18.0 mm (males), 17.5–20.0 mm (females), similar in length to those of *D. spadaria*, but wings somewhat broader. Longitudinal stripe broader than in any other species in genus. Male genitalia with cornuti in variable patches on basal trunk of vesica, larger patch dorsal and most basal, two smaller patches of cornuti lateral and more distal (but one or both can be absent). Vesica with diverticulum 1 absent, its position represented by rounded curve of vesica posterior to swollen part of vesica after aedeagus; diverticulum 2 a rounded bulge on left side of vesica with large, slightly-serrated shark-fin-like cornutus; diverticula 3 a short quadrate pouch on right side almost opposite position of diverticulum 2; diverticulum 4 cone shaped, dorsolaterally on right, with bulbous spine-tipped cornutus at base near junction with elongated ventral lobed representing diverticulum 5. Female genitalia similar to those of the other species but more robust, and appendix bursae quadrate with posterior margin almost straight and heavily sclerotized.

**Distribution and biology.** The adults are found in tidal creeks and salt marshes from Alabama to Louisiana. The biology is unknown, but presumed to be similar to other species of *Doryodes* that occur in similar habitats. Adults occur throughout the year, but concentration of collecting dates suggests a primary brood from March to May and a secondary brood in September and October (V.A. Brou Jr. pers. comm.).

***Doryodes broui* Lafontaine & Sullivan, sp. n.**

<http://zoobank.org/B53AB087-6A59-436F-B0CB-91DA7C90172F>

Figs 18–22, 40, 47

**Type material.** **Holotype** ♂, **Louisiana.** St. Tammany Parish, 4.2 mi NE Abita Springs, sec 24, T6S R12E, N 30°30.986', W 89°57.276', 3 May 2010, V.A. Brou Jr.; slide CNC 16053; barcode CNCLEP 00113565. **CNC. Paratypes:** 98 ♂, 49 ♀. **Louisiana.** Same locality and collector as holotype, 25 April 1984, CNC slide ♀ 16057 (1 ♀), 24 May 1984 (1 ♀), 25 April 1985 (1 ♂), 5 & 28 May & 30 June 1986 (3 ♂), 2, 15 & 16 June & 12 Aug. 1988 (4 ♂), 5 & 20 March & 28 April 1989 (4 ♀), 16 & 22 June & 20 Dec. 1990 (2 ♂, 1 ♀), 14 April 1991 (1 ♀), 22 May & 1 Nov. 1992 (1 ♂, 1 ♀), 18 Oct. 1993 (1 ♀), 11 & 29 May, 13 June & 16 Sept. 1996 (4 ♂), 1 March & 9 April 1997 (2 ♂), 26 & 28 May 1998 (2 ♂), 5, 8 & 11 May 1999 (2 ♂,

1 ♀), 26 Jan. & 15 May 2000 (1 ♂, 1 ♀), 18 & 19 March 2002 (1 ♂, 2 ♀), 5, 11 & 31 May 2003 (3 ♂, 2 ♀), 3 June 2005 (1 ♀), 19 May & 2 & 12 June 2006 (2 ♂, 1 ♀), 20 Feb., 6 April, & 6 & 25 May 2008 (2 ♂, 2 ♀), 26 March & 12 May 2009 (2 ♂), 21 March & 13 May 2010 (1 ♂, 3 ♀), 7 & 23 April, 3, 21 & 25 May & 7 July 2011 (2 ♂, 4 ♀), 8 & 10 April & 12 May 2013 (1 ♂, 3 ♀). St. Tammany Parish, Hwy 90 at Hwy 433, 8 May 1971, E.H. Metzler, Female genitalia on slide # E.H.M. 686 (1 ♀). Cameron Parish, Johnson's Bayou, 19 April 1985, CNC slide ♀ 16048 (1 ♂, 1 ♀), 10 & 19 Sept. 1985, (4 ♂), 14 Sept. 1990, V.A. Brou Jr. (3 ♂). Cameron Parish, Little Chenier, 14 May 1981, V.A. Brou Jr. (1 ♂). Lafourche Parish, Golden Meadow, 28 April 1975, V.A. Brou Jr. (2 ♂). Lafourche Parish, near Golden Meadow, 25 March 2007, V.A. Brou Jr. (1 ♀). St. John the Baptist Parish, Edgard, 29 March, 2 & 9 April & 9 June 1976 (4 ♂, 1 ♀), 7 April, 20 May, 5 June & 5 Aug. 1977 (4 ♂), 10 Aug., 6 May, 1 June & 7 Aug. 1978 (4 ♂, 1 ♀), 1 April, 12 & 21 May, 24 July & 17 Aug. 1979 (3 ♂, 3 ♀), 25 June, 25 July, 4 & 12 Aug., 27 Sept., 17 & 29 Oct. & 2 Dec. 1980 (7 ♂, 2 ♀), 17 April, 9 May, 4 & 6 June & 2 Oct. 1981 (6 ♂, 1 ♀), 16 & 25 March, 17 & 20 April, 12, 21 & 24 May, 4 & 26 June, 11 Aug., 6 Sept., 7 Oct. & 25 Dec. 1982 (11 ♂, 7 ♀), 14 May 1983 (1 ♂), 23 May 1984 (1 ♀), V.A. Brou Jr. St. John the Baptist Parish, Edgard, 10 May 1971, E.H. Metzler, Male genitalia on slide # E.H.M. 685 (1 ♂). Vermillion Parish, Intracoastal City, 26 July 1984, V.A. Brou Jr. (1 ♂). **Mississippi.** Harrison County, Long Beach, 18 May 1992, R. Kergosien (1 ♂); same collector and locality, 15 May 1997, CNC slide 16680 (1 ♂); Jackson Co., Grand Bay Nat'l Wildlife Refuge, N 30°41.3' W 60°40.6', coastal marsh savanna, 21 July 2014, J. Bolling Sullivan, barcodes 14-NCCC-470, 471, 472, 473, 474 & 475 (5 ♂). **Texas.** Jackson Co., Deutechburg, 7 Oct. 1974, A. & M.E. Blanchard, slide CNC 16682 (1 ♂); Brownsville, 6-11, Geo. Dorner (1 ♂). CNC, EHMC, JBSC, MEM, USNM, VABC.

**Etymology.** We name this species after Vernon A. Brou, Jr. in recognition of his impressive and tireless efforts in collecting and researching the Lepidoptera of Louisiana.

**Diagnosis.** This species occurs with *D. latistriga*, *D. reinecke*, and *D. tenuistriga* in coastal salt marsh habitats from Alabama to southern Texas. *D. broui* is superficially indistinguishable from *D. spadaria*, but differs from it in male genitalia, barcodes, and occurs far to the west of the known range of *D. spadaria*. It can be distinguished from *D. reinecke* in having a sharply-defined longitudinal dark stripe on the forewing, and from *D. latistriga* by the narrower forewing stripe in *D. broui*. It is most likely to be confused with *D. tenuistriga*, which typically is larger, but because of variation in both species, some specimens must be dissected or barcoded, for positive identification. The male genitalia of *D. broui* are most similar to those of *D. latistriga*, but the diverticula and cornuti are smaller, especially the terminal diverticulum (# 5), which is short and rounded, not elongated as in *D. latistriga*.

**Description.** Forewing length: 13.0–15.5 mm (males), 13.5–17.0 mm (females), Forewing buffy brown to whitish gray with faint buffy streaks, darker forms in colder months; longitudinal stripe dark brown, similar in width to that of *D. spadaria*, narrower than for *D. latistriga*, wider than for *D. tenuistriga*. Male genitalia. Aedeagus 8



**Figures 17–24.** *Doryodes* adults. **17** *D. latistriga* paratype ♀, USA, Mississippi, Harrison Co., Long Beach **18** *D. broui* holotype ♂, USA, Louisiana, St John Parish, Edgard **19** *D. broui* paratype ♂, USA, Mississippi, Harrison Co., Long Beach **20** *D. broui* paratype ♂, USA, Texas, Jackson Co., Deutschburg **21** *D. broui* paratype ♂, USA, Louisiana, St John Parish, Edgard **22** *D. broui* Paratype ♀, USA, Louisiana, St Tammany Parish, 4.2 mi N Abita Springs **23** *D. reineckei* paratype ♂, USA, Louisiana, St Tammany Parish, 4.2 mi N Abita Springs **24** *D. reineckei* paratype ♂, USA, Louisiana, St Tammany Parish, 4.2 mi N Abita Springs.

× as long as mesial width; vesica with dorsolateral toothed triangular cornutus on left side of basal part of vesica distal to end of aedeagus; a sclerotized plate in anterior 90° bend in vesica at position of ductus seminalis; posterior curve in vesica extended posteriorly into rounded diverticulum 1 with toothed preapical cornutus; diverticulum 2 on left side reduced to low bulge with large conical cornutus in middle; preapical posterior diverticulum (# 4) tapered with conical cornutus at distal base and also at base of short rounded apical diverticulum 5. The female genitalia are similar to those of *D. latistriga*, but the appendix bursae is rounded posteriorly and only lightly sclerotized.

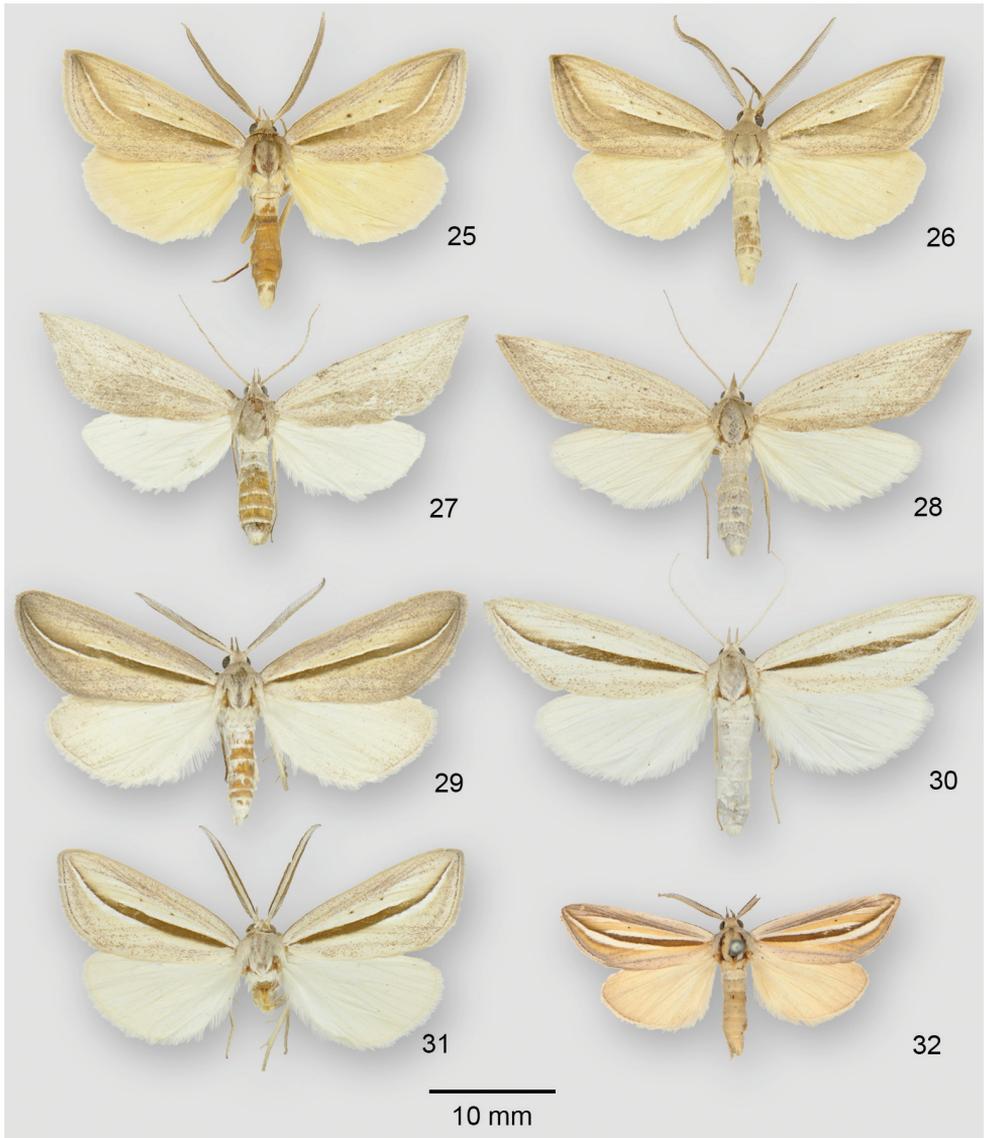
**Distribution and biology.** *Doryodes broui* occurs from Alabama to southern Texas. Nothing is known of its biology. Adults occur throughout the year, but concentration of collecting dates suggests a primary brood between mid-March and mid-June and a secondary protracted brood between late July and mid-October (V.A. Brou Jr. pers. comm.).

***Doryodes reineckeii* Sullivan & Lafontaine, sp. n.**

<http://zoobank.org/07D8C57D-B2CF-478B-84A5-5642E4BA09D9>

Figs 23–28, 41, 48

**Type material. Holotype** ♂, **Alabama.** Baldwin Co., Camp Beckwith, UV trap, Spartina-Juncus marsh, W 30.39538; N -87.84657; 7 Aug. 2009. J. Bolling Sullivan. USNM. **Paratypes:** 122 ♂, 74 ♀. **Alabama.** Same data as for holotype but collected 5 Aug. 2009 (one with slide CNC 16414) (5 ♂), 9 Aug. 2009, one with barcode label CNCLEP 00113509 (2 ♂); Baldwin Co., Weeks Bay Preserve, N 30.414°, W -87.833°; 4 Aug. 2009. J. Bolling Sullivan, barcodes 09-MISC-050, 051, 052, 053 (4 ♂). **Louisiana.** St. Tammany Parish, 4.2 mi NE Abita Springs, sec 24, T6S R12E, N 30°30.986', W 89°57.276', 8 April 1983, V.A. Brou Jr. (1 ♂); same locality and collector, 15 & 20 May, 2 Sept. 1983 (5 ♂, 2 ♀), 13, 26–30 April, 8 & 23 May & 8 Aug. 1984 (2 ♂, 7 ♀), 26 & 28 April 1985 (1 ♂, 1 ♀), 1 May, 10 May, CNC ♀ slide 16056, 11, 14, 16 & 22 May 1986 (5 ♂, 4 ♀), 9 & 31 May & 29 Nov. 1988 (2 ♂, 1 ♀), 8 April, 25 May & 6 June 1989 (2 ♂, 1 ♀), 26 Feb., 10 March, 14 May & 2 June 1990 (3 ♂, 1 ♀), 12 April 1991 (1 ♀), 24 June 1992 (1 ♂), 14 April & 16 Nov. 1993 (2 ♂), 17 April & 4 May 1994 (2 ♂), 29 March, 23 April & 2 Aug. 1995 (3 ♂), 20 & 22 April, 20 May & 29 May 1996 (4 ♂, 2 ♀), 24 Feb. & 1 March 1997 (2 ♂), 16 June 1998 (1 ♂), 4 April 1999 (1 ♂), 19 March 2000 (2 ♀), 28 April 2001 (1 ♂), 24 Jan., 15, 16 & 22 March 2002 (3 ♂, 7 ♀), 7 & 8 April 2005 (1 ♂, 2 ♀), 27 March, 26 April & 2 May 2006 (3 ♂), 28 April, 5 May & 6 June 2007 (3 ♂), 28 March slide CNC 16410 ♂, 31 March, 11 April barcode CNCLEP 00113564, 16 April, 1 May, 19 June & 11 Aug. 2008 (4 ♂, 3 ♀), 14 Feb., 21 March, 12, 19, 21 & 28 April 2009 (7 ♂, 1 ♀), 21 March, 3, 23 & 25 April, 5, 24 & 26 May 2010 (6 ♂, 2 ♀), 21 Jan., 8, 22, 25, 26 & 27 April, 3, 8 & 28 May 2011 (8 ♂, 6 ♀), 12 Feb., 10 April 2012, barcodes CNCLEP 00113563 & 00113568, 22 April, 9 June 2012 (2 ♂, 3 ♀), 10 April 2013, barcode CNCLEP 00113511, 10 April 2013, CNC slide ♀ 16436 (2 ♀),



**Figures 25–32.** *Doryodes* adults. **25** *D. reineckeii* paratype ♂, USA, Alabama, Baldwin Co., Camp Beckwith **26** *D. reineckeii* paratype ♂, USA, Alabama, Baldwin Co., Camp Beckwith **27** *D. reineckeii* paratype ♀, USA, Louisiana, St Tammany Parish, 4.2 mi N Abita Springs **28** *D. reineckeii* paratype ♀, USA, Louisiana, St Tammany Parish, 4.2 mi N Abita Springs **29** *D. tenuistriga* ♂, USA, Texas, Cameron Co., Laguna Atascosa **30** *D. tenuistriga* ♀, USA, Texas, Cameron Co., Brownsville. **31** *D. tenuistriga* ♂, USA, Louisiana, Cameron Parish, Johnson Bayou. **32** *D. insularia* syntype ♂, Bahamas, Nassau.

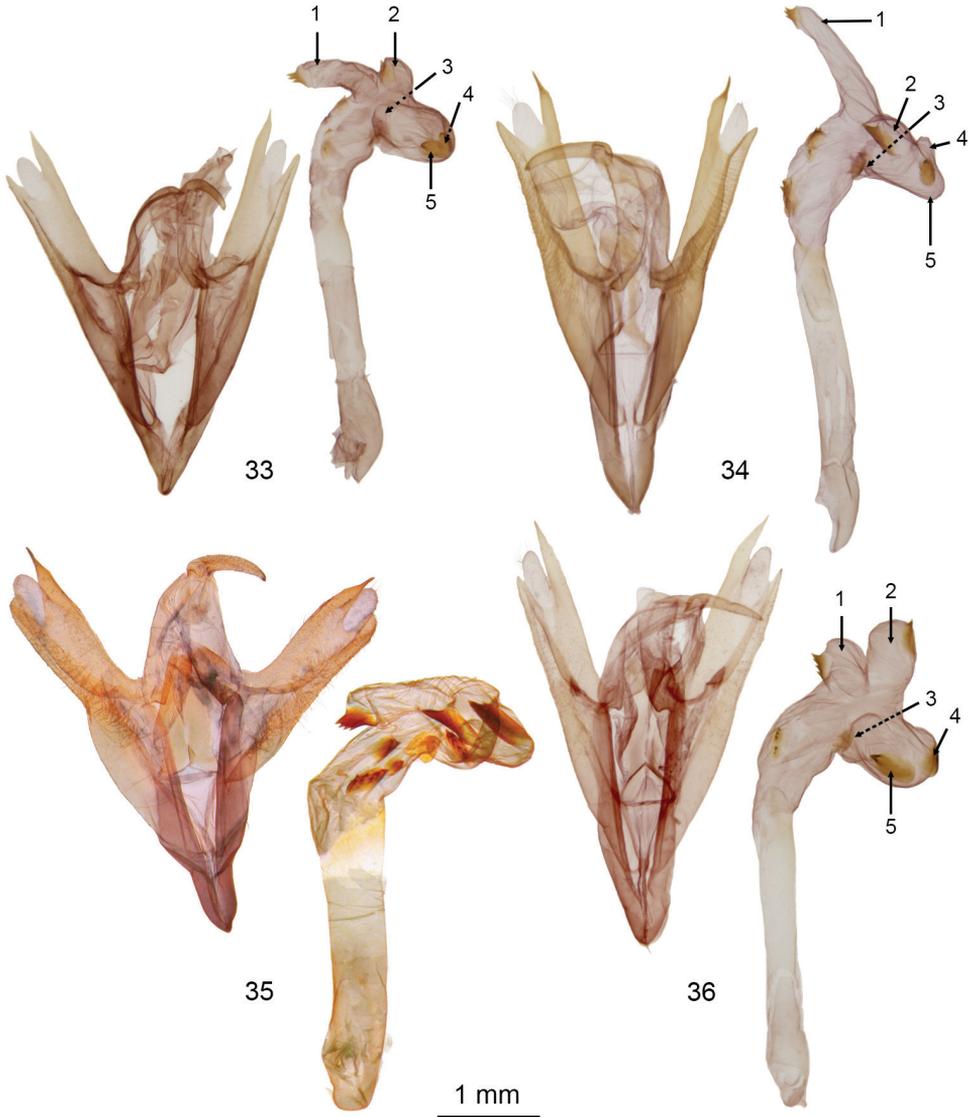
V.A. Brou Jr. St. Tammany Parish, Hwy 90 at Hwy 433, 8 May 1971, E.H. Metzler, Female genitalia on slide # E.H.M. 683 (1 ♀). Cameron Parish, Johnson's Bayou, 23 Oct. 1985, V.A. Brou Jr. (1 ♂). Lafourche Parish, Cut Off, 21 Feb., 11 & 19, 20, 21,

& 25 April, 16 May 1975, V.A. Brou Jr. (3 ♂, 14 ♀). Lafourche Parish, near Golden Meadow, 2 July & 6 Aug. 2005 (3 ♀), 25 March 2007, V.A. Brou Jr. (1 ♀). St. John the Baptist Parish, Edgard, 23 April 1973, (1 ♂), 16 April 1975 (1 ♂), 26 March, 18 & 23 April & 1 May 1976 (5 ♂, 1 ♀), 22 April, 5, 6 & 23 May 1977 (3 ♂, 2 ♀), 1, 7, 8 & 11 May & 3 June 1978 (5 ♂), 22 March, 1, 13 & 24 April & 2 May 1979 (6 ♂, 2 ♀), 9 May 1981 (1 ♂), 6 Jan., 16 & 24 March, 2, 17, 18 & 24 April 1982 (6 ♂, 1 ♀), 14 May 1983 (2 ♂, 1 ♀), V.A. Brou Jr. **Mississippi**. Harrison County, Long Beach, 11 Feb. 1995, R. Kergosien (1 ♂); Jackson Co., G.C.R.L. Ocean Sp. [Gulf Coast Research Laboratory, Ocean Springs], 25 January 1993, R. Kergosien (1 ♂). CNC, EHMC, FSCA, JBSC, MEM, USNM, VABC.

**Etymology.** The species is named for John P. Reinecke, a retired USDA entomologist who worked in Mississippi and developed insect organ culture techniques and detailed the anatomy of the hindgut of larval Lepidoptera.

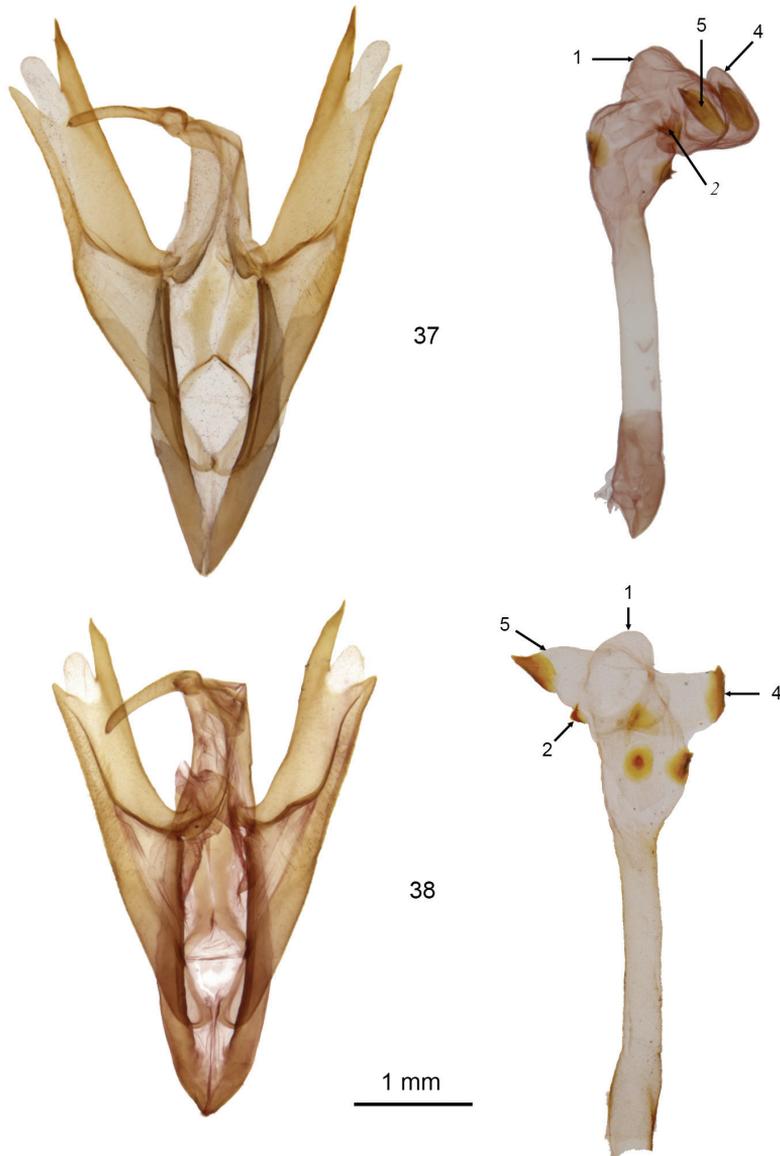
**Diagnosis.** This species occurs with *D. latistriga*, *D. broui*, and *D. tenuistriga* in coastal salt marsh habitats from Alabama to Texas. *Doryodes bistrialis* may occur nearby on the Gulf Coast, but inhabits inland longleaf pine savannas rather than salt marshes. *Doryodes reinecke* is immediately distinguished from other species of *Doryodes* in having a broader forewing in the male, the wing pattern appears faded and smudged, and the ventral margin of the longitudinal stripe appears to blend into the forewing ground color below it, not sharply defined as in other species. The male genitalia of *D. reinecke* are smaller than those of *D. latistriga*, but the characters of the vesica are definitive. In *D. reinecke* the three patches of cornuti on the basal trunk of the vesica are rotated to the left, so the basal one is more lateral than dorsal; diverticulum 1 of the vesica projects dorsally and has a rooster-comb-like cornutus, whereas in *D. latistriga* and *D. broui* there is a tapered diverticulum (or rounded lobe) projecting posteriorly with a small spined cornutus on the side, and diverticulum 2 has no cornutus in *D. reinecke*, whereas in the other two species there is a large cornutus at the base of the diverticulum. Females are immediately distinguishable by their whitish-gray forewing color with the longitudinal stripe is absent, or very faint, compared with the normal pattern seen in other species of *Doryodes*. Females have acutely pointed forewings.

**Description.** Forewing length 15.0–17.0 mm (males), 17.0–20.0 mm (females). Male noticeably broader winged than other species of *Doryodes*. Forewing pale brown to dark gray brown, darker forms in colder months; longitudinal dark stripe paler and less sharply defined than in other species, lower margin of stripe blending into darker ground color below it; wing margin more rounded than in other species. Male genitalia with valve similar in size to that of *D. spadaria* but aedeagus much shorter (2.29 versus 2.97 mm), about 7.5 × as long as mesial width; basal trunk of the vesica with three patches of cornuti, two ventrolaterally on right side of aedeagus, largest one basal, dorsolaterally on left with multiple spinules on a heavily-sclerotized oval plate. Vesica above basal trunk T-shaped, elongated posteriorly-directed diverticulum 1 with a preapical rooster-comb-like cornutus on anterior surface, a small rounded diverticulum 2 on posterior right side opposite end of aedeagus, a sclerotized plate at 90° ventral angle in vesica next to ductus seminalis, and a ventral rounded apical diverticulum 5 with a conical cornutus on left



**Figures 33–36.** *Doryodes* male genitalia (vesica from left lateral view). **33** *D. bistrialis*, Florida, Stemper, CNC slide 16409 **34** *D. desoto* holotype, CNC slide 16050 **35** *D. okaloosa* holotype, JBS slide FLMNH-MGCL 02951 **36** *D. fusselli* paratype, CNC slide 16418.

side. Female genitalia disproportionally small, especially sclerotized plate in ventral wall of ductus bursae only 2.5 × as long as posterior width, plate tapered anteriorly, only 0.55–0.65 × as long as ductus bursae; ductus seminalis broad at base and gradually tapered, so appearing much wider than other species except *D. tenuistriga*, and, like *D. tenuistriga*, corpus bursae more rounded than in other species; appendix bursae a rounded lightly-sclerotized lobe with slightly bilobed posterior margin.



**Figures 37, 38.** *Doryodes* male genitalia. **37** *D. spadaria* (vesica from left lateral view), CNC slide 16051 (valves), 16415 (vesica) **38** *D. spadaria* (vesica from ventral view), CNC slide 16415 (valves), 16052 (vesica).

**Distribution and biology.** The species has been collected from the western panhandle of Florida along the Gulf Coast to eastern Texas. Dates are from April to August but it is likely on the wing throughout the year. Nothing is known of its biology other than its association with *Spartina* marshes. Adults probably occur throughout the year, but most records are from a large brood occurring between mid-March and late June, with a minor second brood in the late summer and fall (V.A. Brou Jr. pers. comm.).

***Doryodes tenuistriga* Barnes & McDunnough, 1918**

Figs 29–31, 42, 49

*Doryodes tenuistriga* Barnes & McDunnough, 1918: 117.**Type material. Syntypes** ♂, ♀, Benito, Texas, USNM, examined.**Other material examined and distribution. USA:** Louisiana, Texas.

**Diagnosis.** *Doryodes tenuistriga* adults usually can be distinguished from other species in the genus by the narrow forewing stripes. The forewing length varies from 16.5–18.0 mm (males) and 15.5–18.5 mm (females). Some specimens of *D. broui* can be similar, but the male and female genitalia are diagnostic. In the male genitalia the sclerotized areas on the dorsal and ventral margins of the valve end in broadly rounded processes well before the mainly membranous apex of the valve; in other species the process on the dorsal margin of the valve is pointed and extends to the apex of the valve, or beyond it, and the ventral process extends to, or almost to, the valve apex and is bluntly pointed or narrowly rounded. The aedeagus is short and wide, only about 5 × as long as wide. In the vesica the dorsal and ventral diverticula are similarly elongated, giving the vesica a T-shape; the vesica immediately posterior to the aedeagus has a rounded ventral lobe with a massive spine-covered sclerotized apical plate that is unique in the genus. In the female genitalia the ventral sclerotized plate on the ductus bursae is short and wide, about as long as wide and extending about ½ length of ductus; corpus bursae rounded, with protruding sclerotized lobe on posterior left opposite appendix bursae; appendix bursae rounded, lightly sclerotized.

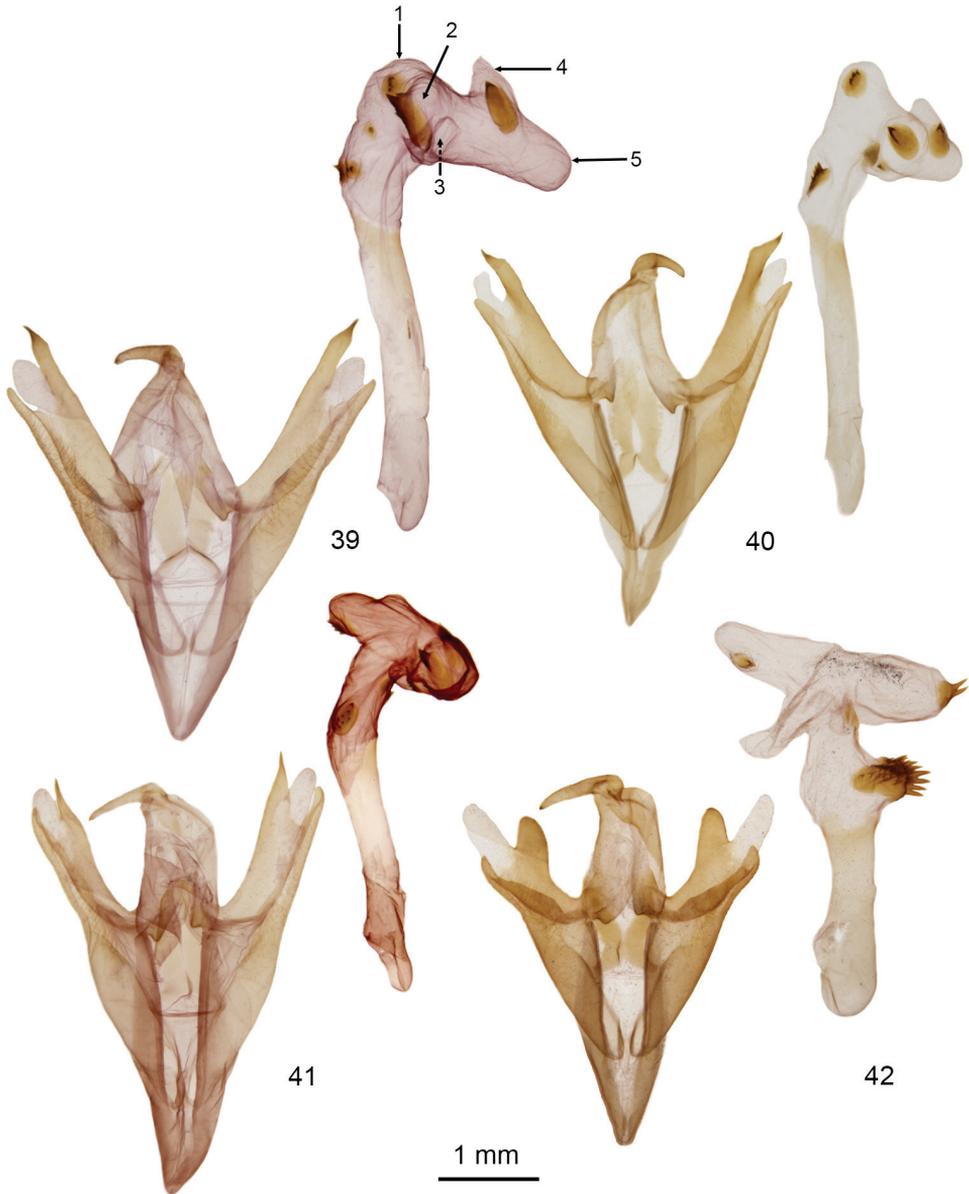
**Distribution and biology.** *Doryodes tenuistriga* is known only from the Gulf Coast of Texas and Louisiana, occurring as far south as Brownsville, Texas. Its range overlaps those of *D. broui*, *D. reineckeii*, and *D. latistriga*, and among these species, it is likely only to be confused with *D. broui*. The immature stages and larval host plants are unknown. Based on very few records, it appears that *D. tenuistriga* flies throughout the year but with a primary brood in April and May and a secondary protracted brood in the fall (V.A. Brou Jr. pers. comm.).

***Doryodes insularia* Hampson, 1904**

Fig. 32

*Doryodes insularia* Hampson, 1904: 174.**Type material. Syntype** ♂, Nassau, Bahamas, BMNH, examined.

**Diagnosis.** *Doryodes insularia* is unique in the genus because of small size (forewing length: 12.5 mm), the white lines bordering the longitudinal dark stripe on the forewing are thicker than those of any other species, there is a contrasting orange-brown band below the forewing costa and another one below the white line bordering



**Figures 39–42.** *Doryodes* male genitalia (vesica from left lateral view). **39** *D. latistriga* paratype, CNC slide 16049 **40** *D. broui* holotype, CNC slide 16053 **41** *D. reineckei* paratype, CNC slide 16414 **42** *D. tenuistriga*, CNC slide 16055.

the lower margin of the black stripe, and occurrence in the Bahamas. The species is known only from the type series. The type material in the Natural History Museum, London, has not been dissected.

**Distribution and biology.** Bahamas. Nothing is known of the biology of *D. insularia*.



**Figures 43–49.** *Doryodes* female genitalia **43** *D. bistrialis*, CNC slide 16046 **44** *D. spadaria*, CNC slide 16047 **45** *D. fusselli*, JBS-6645 **46** *D. latistriga* paratype, CNC slide 16439 **47** *D. broui* paratype, CNC slide 16057 **48** *D. reineckei* paratype, CNC slide 16056 **49** *D. tenuistriga*, CNC slide 16798.

## Check list

- 930925 *Doryodes bistrialis* (Geyer, 1832)  
syn. *D. acutaria* (Herrich-Schäffer, [1852])  
930925.1 *Doryodes desoto* Lafontaine & Sullivan, 2015  
930925.2 *Doryodes okaloosa* Sullivan & Lafontaine, 2015  
930927 *Doryodes spadaria* Guenée, 1857  
syn. *D. divisa* (Walker, 1863)  
syn. *D. promptella* (Walker, 1863)  
syn. *D. spadaria* race *grandipennis* Barnes & McDunnough, 1918  
930927.1 *Doryodes fusselli* Sullivan & Lafontaine, 2015  
930927.2 *Doryodes latistriga* Sullivan & Lafontaine, 2015  
930927.3 *Doryodes broui* Lafontaine & Sullivan, 2015  
930927.4 *Doryodes reineckei* Sullivan & Lafontaine, 2015  
930928 *Doryodes tenuistriga* Barnes & McDunnough, 1918  
\* *Doryodes insularia* Hampson, 1904 (\*Bahamas)

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# Revision of the genus *Heteranassa* Smith, 1899 (Lepidoptera, Erebiidae, Omopterini)

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## Abstract

*Heteranassa* Smith (Erebiidae, Omopterini), native to the southwestern United States and Mexico, includes two recognized species, namely *H. mima* (Harvey) and *H. fraterna* Smith. These are separated mainly by subtle differences in wing color and pattern, leading to speculation about the validity of the described species. This study examines variation in external and internal morphology across the geographic range of the genus, aiming to clarify species limits, describe morphology, and provide a comprehensive assessment of variation within the genus. Results indicate that *H. fraterna* **syn. n.**, is a junior synonym of *H. mima*.

## Keywords

*Prosopis*, Omopterini, *Heteranassa*, Mesquite, *Acacia*

## Introduction

*Heteranassa* Smith, 1899, is a genus of moths native to warmer desert regions of southwestern United States southward to southern Mexico, currently containing two valid species. *Heteranassa mima* (Harvey, 1876), described from Texas, and *H. fraterna* Smith, 1899, described from Death Valley, California. Mustelin (2006) synonymized

an additional species, *H. minor* Smith, 1899, with *H. fraterna*. *Heteranassa* feed on mesquite (*Prosopis* sp.) and Acacia (*Acacia* sp.) (both Fabaceae) and are multivoltine (Crumb 1956), with adults occurring year round.

*Heteranassa* species show a range of wing pattern variation within series collected at the same locality, but also seem to exhibit some geographic variation. To aid in the identification of these common moths, this study assesses the number of species in *Heteranassa*, clarifies the nomenclature, provide detailed descriptions of the adults and larvae, and document the phenotypic variation.

## Methods

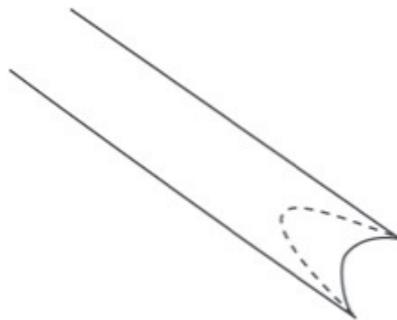
Specimens were collected in Death Valley, Inyo Co., California, (February 2005), White Sands National Monument, Otero Co., New Mexico, (August 2010, 2011), Cuatrocienagas Protected Area, Cuatrociénagas, Coahuila, Mexico, (June, September 2011), Pima Co., Arizona, (July 2012), and Socorro Co., New Mexico (October 2012). Specimens were collected with a sheet trap using 15W UV fluorescent lamp, 175W Mercury Vapor lamp, or a 175W, 6500K metal halide lamp. Death Valley specimens were collected at incandescent or fluorescent outdoor lighting at the Furnace Creek Ranch Hotel.

Specimen loans were generously provided by the following institutions:

- UASM** University of Alberta Strickland Entomology Museum, Edmonton, Alberta (F.A.H. Sperlring)
- EMEC** Essig Entomology Museum, University of California, Berkeley (J. Powell)
- LACM** Natural History Museum of Los Angeles County, Los Angeles, California (B. Brown)
- UAIC** University of Arizona Insect Collection, Tucson (W. Moore)
- ASUT** Arizona State University Entomology Collection, Tempe (T. Dowling)
- CUIC** Cornell University Insect Collection, Ithaca, New York (J. Liebherr)
- KSUC** Kansas State Entomological Museum, Manhattan (G. Zolnerowich)

Specimens were also examined during visits to the United States National Museum (USNM, M. Pogue) and the McGuire Center for Lepidoptera and Biodiversity (MGCL, A. Warren). A complete list of specimens examined is included in Suppl. material 1. Dissected material was selected to represent the range of size and coloration found across the range of *Heteranassa*. A list of dissected specimens is included in Suppl. material 2.

Genitalic dissections follow techniques described by Hardwick (1950) and McCabe (1980). Terminology follows Forbes (1923, 1954) and Mikkola et al. (2009). Abdomens were removed from specimens by gently applying upward pressure near the end of the abdomen with a pair of angle-tipped forceps. Abdomens were cleared in 10% KOH overnight or in hot KOH for 15 minutes. The abdomens were then placed in a



**Figure 1.** 30 Gauge syringe modified to fit over aedeagus.

watch glass with distilled water, and scales were removed with a fine brush. Once clear of scales, the integument of the abdomen was cut along the left pleural membrane, and the genital capsule removed. On male specimens setae were carefully removed from the membranous costal region of valves with a fine camel's hair brush. The aedeagus was separated from the valves by grasping the distal end with fine-tipped forceps, and gently pulling to separate from the juxta. The ductus seminalis was then cut where it enters the side of the proximal part of the aedeagus. The vesica was then carefully teased out of the aedeagus with a #20 minuten with the tip bent to a right angle, held in a standard pin vice, and with water pressure from a syringe. A syringe with a modified 30 gauge needle (Fig. 1) was used to force water into the opening of the ductus seminalis to help evert and inflate the vesica. The aedeagus was transferred to 95% ETOH to dehydrate. The vesica was inflated with ETOH, following the procedures described by McCabe (1980), for several seconds using the modified syringe. The valves were transferred to 95% ETOH, and the membranous lobes of the sacculus were inflated with 95% ETOH. Abdomens of female specimens were cleared in hot KOH. The abdomen was cut along the left pleural membrane, and then a circular incision was made around abdominal segment VIII to remove the female genitalia. Genitalia dissections were placed in Chlorazol Black® stain for ~10 seconds, then transferred to 95% ETOH to dehydrate overnight. The genitalia were placed overnight in orcein stain dissolved in 2-propanol. Genitalia and abdomen "pelts" were stored in pin-mounted glycerin vials. Material from the first author's personal collection was slide mounted following Winter (2000). The structure of the male genitalia did not allow the valves to be spread and flattened without damaging the sacculus, juxta, and transtilla. Whole specimens were cleared and stained following similar procedures as described for the genitalia.

Photographs of dissected specimens, genitalia, and adults were made using a Visionary Digital imaging system (<http://www.visionarydigital.com>, R. Larimer). Line drawings were made in Adobe Illustrator with a Wacom Intuos 4 drawing tablet from photographs or sketches made with a drawing tube attached to a Wild M5 stereomicroscope.

Eggs were obtained from gravid females collected in Box Canyon, Pima Co., AZ (18 July 2012). The females were placed in brown paper bags with Honey Mesquite (*Prosopis glandulosa* Torr.) foliage and bark. Larvae were reared on *P. glandulosa* foliage.

## Systematics

### *Heteranassa* Smith, 1899

**Type species.** *Homoptera mima* Harvey, by subsequent designation by Nye 1975.

**Taxonomy.** *Heteranassa* Smith, 1899: 105; Smith et al. 1903: 5; Barnes et al. 1917: 86; McDunnough 1938: 121; Kimball 1965: 130; Nye 1975: 239; Franclemont and Todd 1983; Poole 1989; Poole and Gentili 1996; Mustelin 2006: 7; Lafontaine and Schmidt 2010: 37; Zahiri et al. 2012: 118.

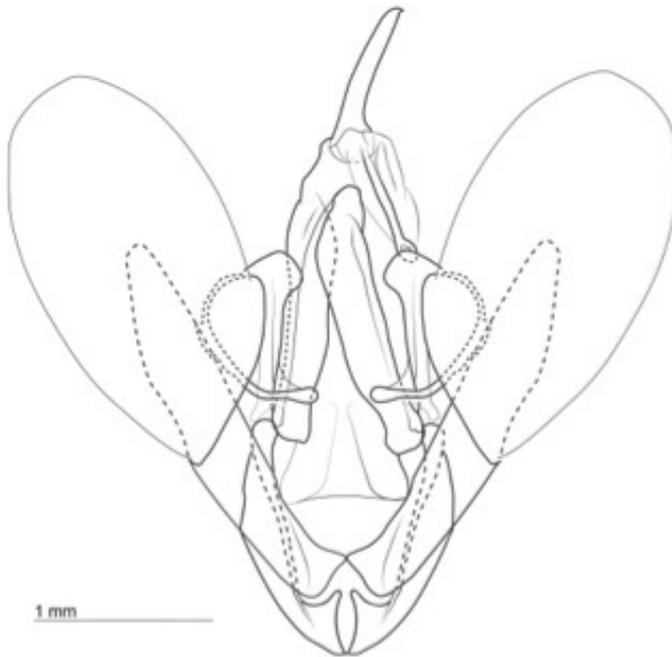
**Diagnosis.** *Heteranassa mima* is now the only valid species in the genus. The genus and species can be distinguished from similar genera by the absence of spine-like setae on the mesothoracic tibia (Fig. 2) (Smith 1899). The male genitalia (Figs 3, 4) serve to distinguish *Heteranassa* from other genera of Erebinae in the southwestern United States by the presence of a setose, membranous costal region of valves (Fig. 3) (Franclemont 1986), and a “D” shaped, sclerotized saccular process connecting to the saccular region of the valves (Fig. 3). The female genitalia (Fig. 5) does not differ dramatically from other Omopterini. Male antennae fasciculate (Fig. 6), female antennae filiform. The proboscis (Fig. 7) is well-developed.

Specimens of *Eubolina impartialis* Harvey, *Matigramma* species, *Acritogramma metaleuca* (Hampson), *Toxonprucha* species and *Coxina* species are frequently misidentified as *Heteranassa*. Of these, *A. metaleuca* is the most similar to *Heteranassa* (Franclemont 1986). *Acritogramma metaleuca* can be most easily distinguished by the presence of spine-like setae on the mesothoracic tibia, and there are also subtle differences in wing pattern (Franclemont 1986). *Acritogramma metaleuca* has no brown lines or shading on the forewing, and the discal spot is distinctly lunulate. *Eubolina impartialis* is similar to both *Heteranassa* and *A. metaleuca* but has a brownish ground color on the hindwings, instead of grayish white, and spine-like setae on the mesothoracic tibia. From southern Texas into Mexico, *Heteranassa* may be confused with co-occurring *Coxina* species. This genus shows affinities to *Heteranassa* in forewing pattern and genitalia, but a lighter hindwing ground color serves to separate *Heteranassa*. Additionally, similarities in wing pattern and genital morphology suggest a relationship to the Caribbean and South American genus *Elousa* Walker. The ranges of *Heteranassa* and *Elousa* may overlap in southern Mexico. *Elousa* can be separated from *Heteranassa* by its smaller size, and the light gray to white mottling of the forewings. *Toxonprucha* species are generally smaller than *Heteranassa*, and they possess hindwings with a darker ground color and more distinct patterning than those of *Heteranassa*. A key to *Heteranassa* and similar species is provided below.

**Taxonomic history.** Harvey (1876) described *Homoptera mima* from a single female from Texas, listing Belfrage as the source of the specimen. He referred the species to the genus *Homoptera* Guenée, but did not mention any characters used to determine generic placement. Grote (1882), in a checklist, moved *H. mima* to the genus *Eubolina* Harvey, 1875, again without any mention of characters used. Smith (1899) described *H. fraterna* and *H. minor* and placed these species in the genus *Campometra*



**Figure 2.** Middle leg of *Heteranassa mima*, showing middle tibia with spines absent.



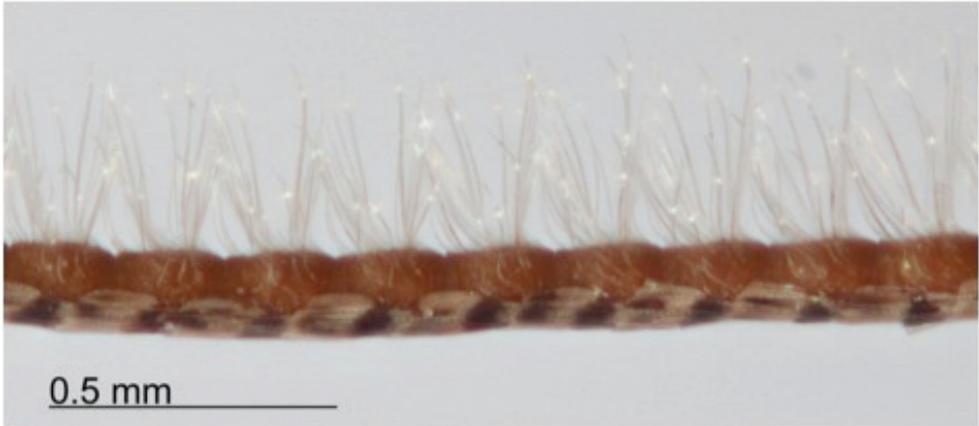
**Figure 3.** Valves, *Heteranassa mima*, ventral view.



**Figure 4.** Aedeagus with vesica everted, showing diverticula.



**Figure 5.** Female genitalia of *Heteranassa mima*.



**Figure 6.** Fasciculate antenna of male *Heteranassa mima*.



**Figure 7.** SEM of *Heteranassa mima* proboscis, showing sensilla styloconica.

Guenée, 1852. *Campometra fraterna* was described from a series of six lightly-marked specimens collected in Death Valley, California., and a single specimen from Catalina Springs, Arizona. *Campometra minor* was described from a series of five small female specimens collected in Arizona. Smith described these two species as new based on differences in size, coloration, and patterning. Smith (1899) proposed the genus *Heteranassa* to circumscribe *H. mima*, *H. fraterna*, and *H. minor* based on the absence of

spine-like setae on the mesothoracic tibia in these three species. Smith (1899) wrote, "I prefer leaving them with *Campometra* temporarily, until all of the allied genera can be carefully studied, but suggest the term *Heteranassa* in case generic separation seems desirable." These three species were formally referred to *Heteranassa* by Smith et al. (1903). Todd (1982) reviewed Smith's type series and designated lectotypes for *H. minor* and *H. fraterna*. The pupa of *Heteranassa* was first described by Comstock (1955), and Crumb (1956) gave a description of the larva of *Heteranassa*.

In his study of southern California Noctuoidea, Mustelin (2006) determined *H. minor* to be a synonym of *H. fraterna*. He found no differences in genital morphology between the types of *H. fraterna* and *H. minor* (Mustelin 2006). Mustelin (2006) did not examine the type specimen of *H. mima*, located in the Natural History Museum, London.

**Description. Adult male** (Fig. 8): **Head:** front smooth scaled, vertex scales erect, elongate; labial palpi elongate, erect, three segments; area of frons behind labial palpi unscaled with domed center; antennae (Fig. 6) fasciculate, smooth scaled, conspicuous sensory setae on ventral surface; eyes smooth; proboscis well developed, coiled between labial palpi (Fig. 7). **Thorax:** smooth scaled dorsum; ventrally lighter; thick tuft of hairs arising below base of forewing. **Legs:** smooth scaled; prothoracic tibia with spatulate epiphysis, flattened hairs on ventral surface; mesothoracic tibia with thick tuft of scales, expanded distally, pair of spurs at distal end, spine-like setae absent; metathoracic tibia with pair of spurs mesially and at distal end; tarsi with three rows of spine-like setae. **Forewing:** 9.7–14.9 mm; antemedial line pointed apically on anal vein; medial line black, pointed mesially on radial, cubital, and anal veins; postmedial line black, outlining apical half of discal area; subterminal line brown, jagged, bordering lighter colored terminal area; terminal line scalloped outwardly at termini of veins, apical margin traced in lighter coloration; fringe scalloped apically at termini of veins; reniform spot markings range from white spot (Fig. 9), to thin white vertical dash (Fig. 10), to a barely visible dash (Figs 8, 11), or black (Fig. 12). **Hind wing:** ground color gray-white, darker shading distally; terminal line black, scalloped apically at termini of veins; fringe light gray, with dark shading between termini of  $M_3$  and  $CuA_2$  and between termini of 2A and 3A. **Abdomen:** segments 1 through 4 tufted dorsally. **Genitalia** (Figs 3, 4): Tegumen slightly excurved dorsally, lateral processes at distal end of each arm, process dorsally at distal end; uncus sparsely setose, curved, pointed; tuba analis membranous; scaphium sclerotized, tuba analis opening apically; juxta lightly sclerotized, excurved ventrally; transtilla membranous; vinculum U-shaped, mesial margin heavily sclerotized towards articulation with tegumen, widened in middle; valves conjoined basally, sclerotized basally, membranous distally; sacculus sclerotized; saccular process extended dorsally connected to membranous costal region; sclerotized part of valve with finger-like extension half distance from base; base of costa with a looped sclerite, connected to saccular process; aedeagus curved, narrowed apically, rounded anteriorly, dorsally sclerotized, ventrally membranous, dorsal surfaces undulating apically, apex pointed; ductus seminalis on ventral side; vesica membranous, without setae or cornuti, not elongated, four diverticula: one subbasal, two medial, and one apical. **Adult Female:** (Figs 7–10, 12) forewing length 11.0–16.7 mm. Exterior similar to male, except antennae filiform, mesothoracic tibiae not expanded distally. Genitalia: (Fig. 5)



**Figure 8.** Male *Heteranassa mima*, showing complete FW maculation. Cuatrociénegas, Coahuila, Mexico, June.



**Figure 9.** FW with dark ground color, white reniform spot, AM, medial, and PM lines very faint. Female *Heteranassa mima*, Inyo Co. CA, February.

papilla analis membranous, rounded apically, setae stout, variable length; posterior apophysis extending just beyond anterior margin of 8<sup>th</sup> abdominal segment, apically curved inwards; anterior apophysis ca. 0.5 × length of posterior apophysis, paddle-shaped apex; anal tube: interior lining of anal tube with many rows of minute spines directed anteriorly on dorsal wall, ventral wall densely covered with shark-tooth-like tubercles; intersegmen-



10 mm

**Figure 10.** Thin, white dash in reniform, AM, medial lines visible, PM line extremely faint. Female *Heteranassa mima*, Maricopa Co. Arizona, March.



10 mm

**Figure 11.** Thin, white reniform dash barely visible, PM line faint, AM, medial lines barely visible. Female *Heteranassa mima*, San Bernadino Co., California, April.

tal membrane with many shark-tooth-like tubercles; 8th abdominal segment ringed with stout setae caudally; ostium bursae lightly sclerotized; antrum circular, membranous; ductus bursae reduced, membranous; corpus bursae elongate, membranous.

**Eggs.** Dark bluish gray, ~1/2 mm diameter; captured females laid eggs singly or in groups of less than five in crevices of host plant bark, or singly on sides of enclosing container.



10 mm

**Figure 12.** Tan FW ground color, AM, medial, PM lines absent. Female *Heteranassa mima*, Inyo Co., CA, February.

**Larvae.** Variable in color; eggs developed into adults within five weeks; observations are consistent with Comstock (1955) and Crumb (1956). Larvae pupated before high-quality photographs could be taken.

### *Heteranassa mima* (Harvey, 1876)

*Homoptera mima* Harvey, 1876: 155–156.

*Eubolina mima*; Grote 1882: 42; Smith 1891: 63; 1893: 372.

*Campometra mima*; Smith 1899: 104–105; Dyar 1903: 237.

*Elousa mima*; Draudt and Gaede (in Seitz) 1923: 478.

*Heteranassa mima* (Harvey, 1876); Smith et al. 1903: 5; Barnes et al. 1917: 86; McDunnough 1938: 121; Kimball 1965: 130; Franclemont and Todd 1983; Poole 1989, 1996; Mustelin 2006: 7; Lafontaine and Schmidt 2010: 37.

*Campometra fraterna* Smith, 1899: 104, **syn. n.**; Dyar 1903: 236.

*Heteranassa fraterna* (Smith, 1899); Smith et al. 1903: 5; Barnes et al. 1917: 86; McDunnough 1938: 121; Kimball 1965: 130; Franclemont and Todd 1983; Poole 1989, 1996; Mustelin 2006: 7; Lafontaine and Schmidt 2010: 37.

*Elousa fraterna*; Draudt and Gaede (in Seitz) 1923: 478.

*Campometra minor* Smith, 1899: 104–105; Dyar 1903: 236.

*Elousa minor*; Draudt & Gaede (in Seitz) 1923: 478.

*Heteranassa minor* (Smith, 1899), **syn. n.**; Smith et al. 1903: 5; Barnes et al. 1917: 86; McDunnough 1938: 121; Kimball 1965: 130; Franclemont and Todd 1983; Poole 1989, 1996; Mustelin 2006: 7.

**Diagnosis.** This is the only species in the genus and can be diagnosed with the generic combination (see above).

**Type material.** *Heteranassa mima* (Harvey, 1875). Holotype, (Fig. 13) ♀ in the Natural History Museum, London (BMNH) labeled: “Homoptera mima, type, Harvey, Holotype, 15/9, 73.” The specimen and associated labels were examined through high-resolution photographs provided by the BMNH. Type locality: Texas [USA]

*Heteranassa fraterna* (Smith, 1899). Lectotype (Fig. 14) ♀ in USNM, designated by Todd (1982), labeled: “Death Valley, April ‘91 K., 677, 115 [circled], ♀ genitalia on slide, Sept. 21, 1938, J.F.G.C. #2035, Type No. 4313 U.S.N.M., Lectotype, Campometra fraterna, Smith, Genitalia slide U.S.N.M. 40478, Campometra fraterna, ♀ Cotype, Smith” Type locality: Death Valley [California, USA]

*Heteranassa minor* (Smith, 1899). Lectotype, (Fig. 15) ♀ in USNM labeled: “Campometra minor, ♀ type, Smith, Lectotype, Campometra minor, Smith, ♀ genitalia on slide, Sept. 21, 1938, J.F.G.C. #2035, Genitalia slide, U.S.N.M. 40477, Type No. 4314 U.S.N.M., U.S.N.M. Acc. no. 35005, Ariz., Collection G.D. Hulst.” Type locality: Arizona [USA]

**Description. Adult male** (Fig. 8): **Head:** scaling dark gray to gray-brown to tan; alternating uneven banding of white to light brown scales, and dark-brown scales, labial palpus concolorous with head and body, antenna scaling: each segment alternating light gray and dark brown. **Thorax:** dorsum dark gray to gray brown to tan; venter lighter grayish brown. Legs: dorsally concolorous with thorax, ventrally light gray with darker scales, tarsi alternating white and dark brown; tarsal segments alternating dark-brown to white scaling. Forewing: length as for genus description, basal line black; band of darker color runs vertically, adjacent to antemedial line, terminating where antemedial line points apically; area between medial and postmedial lines shaded darker, excluding reniform area; crenulations on margin of forewing with gray-white punctations. Hind wing: shaded gray brown from medial area distally; postmedial line complete, or faintly visible distally; subterminal line darker gray brown, outlined with light coloration distally. **Abdomen:** dorsum dark gray to gray brown to tan, laterally gray; venter gray, dusted with darker scales. **Genitalia** (Figs 3, 4) (24 dissections): Lateral processes at distal end of tegumen arms wavy; process at dorsal end fin shaped, very weakly sclerotized; ventral membrane on distal end weakly sclerotized; juxta with numerous short, pointed tubercles mesially, narrowed caudally; transtilla attached to costal parts of valve processes; vinculum with flared, fin-like processes directed anteriorly; sclerotized saccular process looping, connecting to costal region, “D” shaped; base of costa thumblike, connected to transtilla; aedeagus with dorsal surface undulating apically; vesical with five diverticula. **Adult Female** (Figs 9–15): forewing length as in genus description. Similar to male, except antennae filiform. **Genitalia** (Fig. 5) (12 dissections): Postvaginal plate narrowed anteriorly, densely covered in shark-tooth-like tubercles, caudal 7/8<sup>th</sup> outlined in stout setae; sterigma with sclerotized ridges laterally.

**Variation.** Specimens tend to be larger in the eastern part of the range in Texas, and smaller specimens are more common in Arizona and California. Forewing coloration ranges from dark gray with some brown dusting to tan. Maculation ranges from



**Figure 13.** Holotype of *Heteranassa mimia*, Texas.



**Figure 14.** Lectotype of *Heteranassa fraterna*, Death Valley, California.

well-defined antemedial, postmedial, and subcostal lines to lightly marked specimens with only the subcostal line well defined. Lightly marked specimens are found most commonly in the Mojave Desert. Ground color of hind wings is lighter towards the western range of the species. Specimens from the eastern part of the range show distinctly marked discal spots and shading on the margins on ventral surface of the wings, and the undersides are more heavily dusted with darker scales. The size of the white



**Figure 15.** Lectotype of *Heteranassa minor*, Arizona.

patch in the reniform area varies from a narrow dash to a large spot, while forewing ground color ranged from dark gray to gray brown among moths reared from the same female collected in Southeast Arizona.

Barcode variation in *Heteranassa* is very conservative. Examination of more than 160 full-sequence (658 base-pair) barcodes from California, Arizona, New Mexico, Texas, and northern Mexico showed a maximum divergence of less than 0.8%. One haplotype\* dominated the sample, representing more than half of the specimens; the other barcodes included 36 haplotypes that had no more than two base-pair differences from each other. One haplotype, restricted to central and southern Texas, departed from this pattern in being 0.8% different from those from farther west. This is most probably the haplotype that should be associated with the name *Heteranassa mima*, it being described from this part of Texas. However, this “eastern” haplotype is found with “western” haplotypes in central Texas and there is no indication in genital structural characters, or wing color or pattern, that *Heteranassa* includes more than a single species. The barcodes of *Heteranassa* are so divergent that they give no indication of a close relationship to any other erebid genus, other than belonging in the subfamily Erebinae, tribe Omopterini. *Heteranassa* specimens from Texas and Mexico are frequently confused with some species associated with the genus *Coxina* Guenée, which can have a similar superficial pattern, but the barcodes are more than 10% different and the two genera do not appear to be closely related. (D. Lafontaine pers. comm.).

\*CNCNoctuoidea13382 [Baboquivari Mts., Pima Co., Arizona, USA]

AAC TTTATATTTTATTTTGG AATTTGAGCAGGAATAGTAGGAAC-  
CTCTTTAAGTTTATTAATTCGTGCTGAATTAGGAAACCCTGGTTCTT-  
TAATTGGAGATGATCAAATTTATAATACTATTGTTACAGCTCATGCTTT-

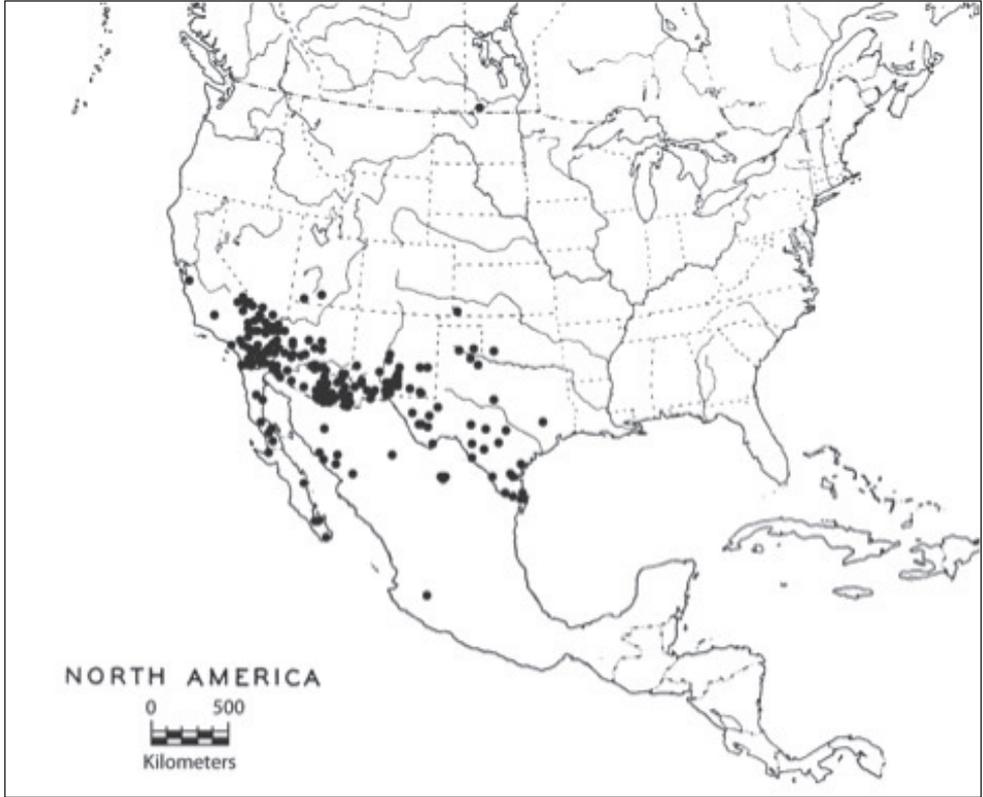
TATTATAATTTTCTTTATAGTTATACCAATTATAATTGGAGGATTTG-  
 GAAATTGATTAGTCCCCTTAATATTAGGAGCTCCTGATATAGCTTTC-  
 CCTCGAATAAATAATATAAGTTTCTGATTATTACCCCATCTT-  
 TAACTCTTTAATCTCAAGAAGAATCGTAGAAAATGGAGCAGGAACAG-  
 GATGAACAGTTTACCCCCCACTTTCATCTAACATTGCTCATAGAGGAA-  
 GATCAGTAGATTTAGCAATTTTCTCTCTTCATTTAGCTGGAATTTTCA-  
 CAATTTTAGGAGCTATTAATTTTATTACTACTATTATCAATATACGAT-  
 TAAATAGATTAATATTTGACCAAATACCTTTATTTGTTTGAGCTGTTGG-  
 TATTACTGCTTTTTTACTATTATTATCTTTACCTGTTTTAGCTGGAGC-  
 TATTACTATACTCTTAACAGATCGAAAATTTAAATACTTCTTTTTT-  
 GATCCTGCTGGAGGAGGAGATCCTATTCTTTACCAACATCTATTT

**Distribution and habitat.** Warm, arid habitats from California to Texas, northward to Oklahoma, and south as far as Oaxaca, Mexico (Fig. 16). A single specimen from Cartwright, Manitoba is in the LACM.

**Discussion.** The variation in *Heteranassa* wing pattern and coloration is continuous, with many specimens appearing intermediate to the phenotypes described by Smith (1899) and Harvey (1876). Genitalic morphology does not, however, correlate with wing pattern differences. These observations suggest that *Heteranassa* contains a single, highly variable species, *H. mima*. Studies of another erebine genus, *Catocala*, have shown that pressure from avian predators may drive high levels of polymorphism in forewing pattern and coloration (Ricklefs and O'Rourke 1975, Bond and Kamil 2002, Webster et al. 2009), and *Heteranassa* may be subject to similar evolutionary processes.

A series of *Heteranassa* from Death Valley, California collected in February, 2005, is the most variable in forewing pattern and coloration among the thousands of specimens observed to date. *Heteranassa* comprised roughly 90% of the moth specimens collected during this period, demonstrating that the genus is an abundant and likely ecologically important insect herbivore in North American desert biomes.

During the course of this research, we became aware of potential taxonomic affinities with the neotropical genera *Elousa* Walker (1857) and *Coxina* Guenée (1852). These genera have not been studied in a systematic framework since the turn of the 20th Century. A preliminary examination of male genitalia and wing pattern show significant overlap of characteristics between the genera. These three genera lack spines on the mesothoracic tibiae, and possess symmetrical male genitalia with membranous costal regions of the valves. These processes are larger in *Heteranassa* and *Elousa albicans* (Walker, 1857) than they are in *Elousa schausi* (Giacomelli, 1911) and the other *Coxina* species we have dissected. We have examined 10 species in these genera from the Caribbean and South America. Specimens belonging to this group that we collected in the Nicaraguan highlands appear more similar to *E. schausi* specimens from Argentina and *Coxina* specimens from Mexico, south Texas, and Florida, than they do to Caribbean *Elousa* or North American *Heteranassa*. Future research could test the monophyly of *Coxina* and *Elousa* with respect to *Heteranassa*, and how these genera speciated in North and South America and the Caribbean.



**Figure 16.** The distribution of *Heteranassa* in North America, ranging from Texas and Oklahoma west to California, USA, south to Jalisco Mexico. A single stray is recorded from Manitoba, Canada.

**Key to *Heteranassa* and similar species in the southwestern United States**

- 1 Hindwing and forewing with similar coloration and patterning.....  
.....*Matigramma, Toxonprucha*
- Hindwing with different coloration and patterning than forewing..... 2
- 2 Ground color of hindwings chocolate to dark brown..... 3
- Ground color of hind wings light gray to white, with some darker scaling  
towards the margins..... 4
- 3 Middle tibia with spine-like setae..... *Eubolina*
- Middle tibia without spines ..... *Coxina*
- 4 Middle tibia with spines ..... *Acritogramma metaleuca*
- Middle tibia without spines ..... *Heteranassa*

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## Supplementary material 1

### Table S1. List of examined *Heteranassa* specimens.

Authors: Nicholas Homziak, Heidi Hopkins, Kelly B. Miller

Data type: occurrence

Explanation note: Contains localities of all specimens examined in this study.

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## Supplementary material 2

### Table S2. List of dissected *Heteranassa* specimens.

Authors: Nicholas Homziak, Heidi Hopkins, Kelly B. Miller

Data type: occurrence

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# A new species of *Ogdoconta* Butler (Lepidoptera, Noctuidae, Condicinae, Condicini) from southeastern Arizona, USA

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<http://zoobank.org/1179BE9A-8284-42CC-BF8C-FE649A05B725>

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## Abstract

A new species of *Ogdoconta* Butler (Lepidoptera, Noctuidae, Condicinae, Condicini) is described from the Patagonia Mountains, Santa Cruz County, Arizona, USA. *Ogdoconta margareta* **sp. n.**, is related closely to *Ogdoconta tacna* (Barnes) from Texas. Modifications are proposed to a recently published key to the *Ogdoconta* species north of Mexico to allow identification of the new species.

## Keywords

DNA barcode, Sonora

## Introduction

The North American noctuid moth genus *Ogdoconta* Butler was revised recently by Metzler et al. (2013). There are approximately 16 species in the genus, of which nine occur north of Mexico. The most characteristic feature of the genus is a horizontal cleft in the valve of the male genitalia that divides it into dorsal and ventral components.

A single specimen of a new *Ogdoconta* species resembling *Ogdoconta tacna* (Barnes), a species that is known only from Texas in the United States, was collected in 2013 near Harshaw in the Patagonia Mountains, Santa Cruz County, Arizona. While the

new species and *O. tacna* are very similar superficially, their male genitalia are distinct and their CO1 barcode sequences differ by nearly 4%. A second specimen of the new species from Sonora, Mexico, was identified by its CO1 barcode and is included in the type series. This new species is described herein.

## Materials and methods

Wing pattern and genitalia structure terminology follow Lafontaine (2004).

The male genitalia were prepared using standard methods (Hardwick 1950, Lafontaine 2004). The detached abdomen was boiled in 10% KOH for 40 minutes. Dissection was performed initially in water followed by hardening with isopropyl alcohol. The male vesica was everted and inflated. The preparation was stained with orcein and was mounted in Euparal on a glass slide.

The 658 base pair DNA “barcode” region of the mitochondrial cytochrome *c* oxidase subunit 1 (CO1) was used to assess molecular variation in the genus *Ogdoconta*. A leg of the Arizona specimen was submitted to the Barcodes of Life Campaign (BOLD) at the University of Guelph (Ontario, Canada) where it was analyzed by standard DNA extraction, amplification, and sequencing protocols as described by Hebert et al. (2003). The barcode sequence was compared to pre-existing *Ogdoconta* material at BOLD using the Kimura-2-Parameter distance model as implemented on the Barcode of Life Data Systems website (<http://www.barcodinglife.org>).

The following collection abbreviations are used:

- CNC** Canadian National Collection of Insects, Arachnids, and Nematodes, Ottawa, Ontario, Canada  
**LGC** Lars Crabo personal collection, Bellingham, Washington, USA

## Results

### *Ogdoconta margareta* Crabo, sp. n.

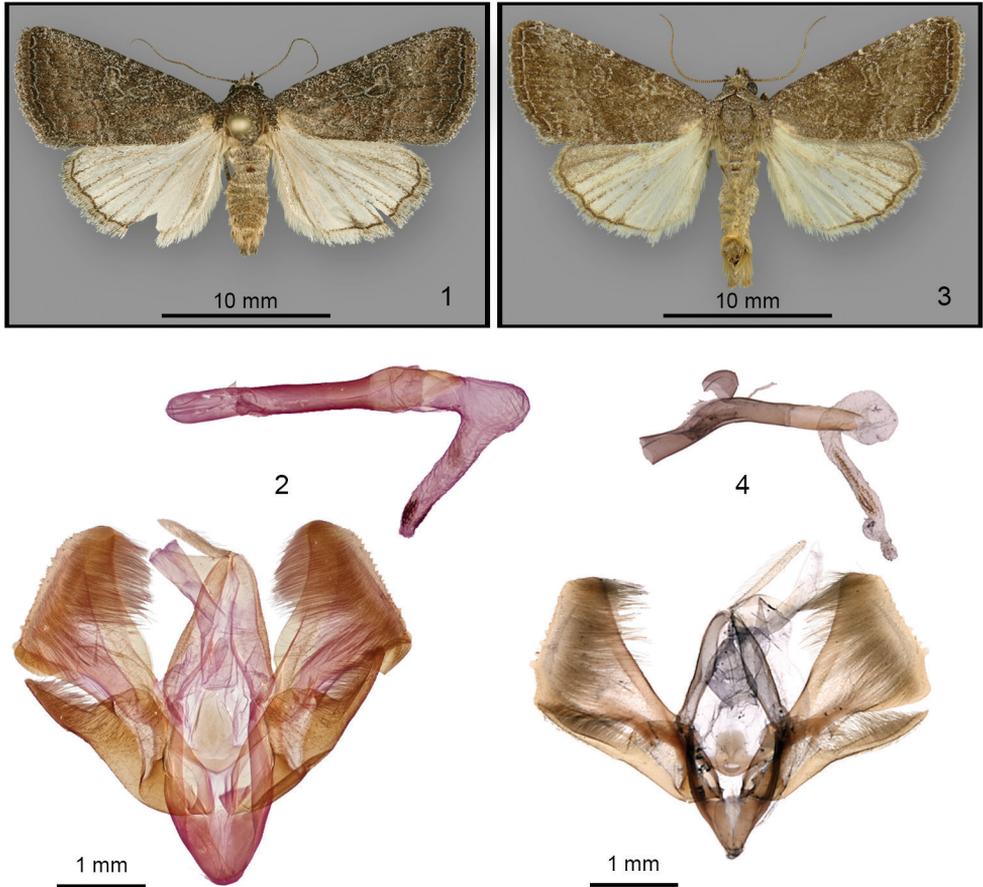
<http://zoobank.org/3E1BF3CD-CEB1-430E-8F5E-64CDF35248EC>

Figs 1, 2

**Type locality.** Harshaw, 2.9–5 km SW, Santa Cruz County, Arizona, USA.

**Type material. Holotype:** Male: USA: AZ: Santa Cruz Co., Harshaw, 2.9–5 km SW, 31.42–[31].45° -110.72–[110].74°, 1490–1765 m, 1 IX 2013, L Crabo leg./Crabo [genitalia] slide 681/BOLD CNCLEP 00113651. CNC. **Paratype:** One male: Mexico, Sonora/BOLD CNCLEP 83594. LGC.

**Etymology.** I take pleasure in naming this species after my mother, Margareta Crabo of Cave Creek, Arizona. The holotype was collected three days prior to her 80<sup>th</sup> birthday. The name is a noun in apposition.



**Figure 1–4.** **1** *Ogdoconta margareta*, holotype male (abdomen removed subsequently for dissection) **2** *Ogdoconta margareta*, male genitalia, valves and aedeagus **3** *Ogdoconta tacna*, adult male, Texas, USA (CNC) **4** *Ogdoconta tacna*, male genitalia, valves and aedeagus (source image same as in Metzler et al. (2013), used with permission).

**Diagnosis.** The male of *Ogdoconta margareta* (Fig. 1) resembles the male of *O. tacna* (Fig. 3), although the ranges of these species are not known to overlap. *Ogdoconta margareta* occurs in southeastern Arizona, USA and northeastern Sonora, Mexico and *O. tacna* occurs in central and southeastern Texas, USA (Metzler et al. 2013).

The valves of both species are unique in the genus in having a broadly triangular cucullus with an irregular outer margin with a series of small knobs. The most prominent structural differences between these species are in the aedeagus, vesica, and sacculus of the valve. In the genitalia of *O. margareta* (Fig. 2) the aedeagus is straight and the vesica is straight distal to a basal 135° bend, whereas in the genitalia of *O. tacna* (Fig. 4) the aedeagus has a proximal bend and the proximal and distal portions of the vesica are coiled. The dorsal sacculus of *O. margareta* is triangular with greatest width near the distal end, whereas that of *O. tacna* is rounded with greatest width at the

mid-point. The saccular extension of *O. margareta* is relatively short, not reaching the ventral cucullus as in *O. tacna*.

The female of *O. margareta* is unknown.

Superficially, *O. margareta* and *O. tacna* are very similar and key out together in couplet 6 of the key to species in Metzler et al. (*op cit.*). The forewings of *O. margareta* have a violet tint whereas those of *O. tacna* are greenish. The hindwing of *O. margareta* is paler than that of *O. tacna* without significant dark suffusion at the anterior margin. *Ogdoconta margareta* can be distinguished from all of the other *Ogdoconta* species that are known to occur in Arizona, *Ogdoconta cinereola* (Guenée), *Ogdoconta moreno* Barnes, and *Ogdoconta rufipenna* Metzler, Knudson, & Poole, by its uniform purplish brown forewing and pale whitish hindwing. The forewings of the other species are either dark red brown or have lighter areas on the distal wing, and their hindwings are darker. Modifications to the *Ogdoconta* key to species in Metzler (*op cit.*) are given in the Discussion, below.

**Description. Adult male** (Fig. 1). *Head*: Antenna filiform with sparse ventral cilia, dorsum with alternating off-white and gray scales; scape, head, and labial palpus covered with gray, off-white-tipped gray, and sparse off-white scales; frons smooth, unmodified; labial palpus with third segment one-third the length of the second segment; eye smooth, normal sized. *Thorax*: Entire thorax, including prothoracic collar and patagium, covered with off-white-tipped gray and gray scales, appearing uniform purplish brown similar to the forewings; legs with off-white and gray scales, prothoracic leg palest, tarsal segments gray with distal off-white bands. Forewing: length 13 mm excluding fringe; covered with brown-gray, off-white, and fawn scales, appearing hoary purplish brown, slightly darker gray medial to the subterminal line and terminal area and slightly paler near the postmedial line; basal and antemedial lines nearly obsolete, evident as a few pale scales on the costa and in the fold; medial shade dark gray, faint and diffuse; postmedial line brown gray, double with filling of the adjacent ground color, outer portion weakly dentate with dark and pale scales on the veins lateral to the line, oriented parallel to outer margin, nearly straight; subterminal line a hoary sinuous row of pale scales; terminal line dark brown bordered mesially by an incomplete line of pale scales; fringe gray brown with hoary pale tips; orbicular and reniform spots hoary, filled with the adjacent ground color, orbicular spot irregularly ovate, lateral portion touching posterior reniform spot; reniform spot asymmetrically figure-eight shaped with posterior margin extended toward base and touching orbicular spot; claviform spot absent; hindwing slightly brownish off white with slight dusting of pale gray scales near anterior margin and darker gray veins; terminal line dark brown; hindwing fringe pale tan with scattered gray scales and paler outer margin. *Abdomen* (removed for dissection after photography): covered with fuscous scales, slightly darker weak dorsal tufts on the first two segments. *Male genitalia* (Fig. 2): Uncus cylindrical, 6× as long as thick, apex pointed bluntly; juxta 1.25× as tall as wide with arrowhead-shaped caudal portion; valve bifid with larger dorsal portion bearing triangular cucullus and small ventral portion comprised of saccular extension; sacculus 0.5× as long as valve, dorsal margin bluntly triangular and extending to near dorsal valve margin distal to mid-

point of sacculus near mid-valve, blade-like saccular extensions 0.4× as long as sacculus, extending to near ventral cucullus margin, asymmetrical, slightly shorter and more robust on the right than the left; dorsal margin of mid-valve slightly convex, cucullus large, triangular, 0.5× as wide as valve length, with finely crenulate lateral margin and rounded dorsal and truncate ventral margins, mesial surface covered with fine hairs; aedeagus cylindrical, straight, 10× as long as wide, without ornamentation; vesica 1× as long as aedeagus with slight expansion at subbasal bend but otherwise similar in width to aedeagus, straight beyond 135° subbasal bend toward left, subapex with two short fields of innumerable short cornuti. **Female:** unknown.

**Distribution and biology.** *Ogdocoonta margareta* is a rarely collected species that is known only from the type locality in southeastern Arizona, USA and Sonora, Mexico.

The two known specimens were collected in early September. It is possible that *O. margareta* also flies during the spring because the closely related species *O. tacna* has two broods (Metzler et al. 2013).

The holotype was collected in one of a series of black light traps placed mostly in a forest of oak and pine, with a few traps in the ecotone between forest and shrub desert. The habitat of this species in Mexico is unknown.

The early stages are unknown.

**Discussion.** The Key to the species of *Ogdocoonta* in North America north of Mexico in Metzler et al. (*op cit.*) can be modified to include *O. margareta* by substituting the following couplet 6 for the original and inserting the following couplet 8 after couplet 7:

- 6 Forewing with subterminal area lighter than medial and terminal area; post-medial area usually shaded with pink (specimens from southeastern Arizona with less pink); hindwing of both sexes solidly dark brown..... *cinereola*
- Forewing with subterminal area barely lighter than medial and terminal area; hind wing of male white; hind wing of female pale at base, darker towards outer margin (female of *O. margareta* unknown but likely similar) ..... **8**
- 8 Sacculus of male valve with rounded dorsal margin, broadest at mid-sacculus; distributed in Texas ..... *tacna*
- Sacculus of male valve with triangular dorsal margin, broadest near distal sacculus; distributed in southeastern Arizona..... *margareta*

**Acknowledgements**

I am grateful to the following individuals for help with this project: Jocelyn Gill photographed the *O. tacna* adult and prepared the illustrations; J. Donald Lafontaine suggested that this species might be distinct, submitted the *O. margareta* DNA sample to BOLD, and shared *Ogdocoonta* CO1 similarity trees; Eric Metzler graciously allowed the use of the images of the *O. tacna* genitalia; Merrill Peterson took the photographs of *O. margareta*; and B. Christian Schmidt gave editorial advice and other assistance.

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# Revision of the genus *Aseptis* McDunnough (Lepidoptera, Noctuidae, Noctuinae, Xylenini) with a description of two new genera, *Paraseptis* and *Viridiseptis*

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## Abstract

The genus *Aseptis* McDunnough (Lepidoptera, Noctuidae, Noctuinae, Xylenini, Xylenina) is revised to include 15 species based on morphological and molecular data. Several new synonymies are introduced. In addition, two genera are described because of significant morphological differences from *Aseptis*: *Paraseptis* **gen. n.**, and *Viridiseptis* **gen. n.**, resulting in the new combinations *Paraseptis adnixa* (Grote), **comb. n.**, and *Viridiseptis marina* (Grote), **comb. n.** Although this work is primarily based on morphological data, DNA sequence data for the 658-base pair “barcode” segment of the mitochondrial gene for subunit 1 of cytochrome c oxidase was used as a secondary support for taxonomic changes within *Aseptis* and for the two new genera. Our work should provide clarity and stability in a previously difficult genus.

## Keywords

DNA barcode

## Introduction

The genus *Aseptis* was described by McDunnough in 1937. A typical feature of the genus is the indentation of the outer margin of the hindwing beneath its apex between veins M1 and M3. Most species are rather dull gray or brown, many with diffuse mac-

ulation in darker brown or black. Several species display marked variation between different geographical areas, as well as within any given locality. This often correlates with the habitat and tends to yield paler and more diffusely marked individuals in dry and sandy habitats, and darker more contrasting specimens in moist and lush habitats such as in the Pacific Northwest. Many of these forms were described as separate species, resulting in many more names than true species. From a total of 31 published species names the latest checklist of North American Noctuoidea (Lafontaine and Schmidt 2010) contains 24 species, including “*Aseptis*” *marina* (Grote), which is associated tentatively with *Aseptis*. In this revision the number of species is reduced further to 17, of which 15 are retained in *Aseptis* and two are placed in new genera.

Most species of *Aseptis* were described in the late 1800s and the first two decades of the 1900s, with exception of four recent ones from southern California (Mustelin et al. 2000, Mustelin 2006). At the time of these older descriptions, the West was a frontier and entomological collecting was restricted to a few localities such as Pacific ports, Provo, Utah, a few localities in Colorado, and scattered sites sampled during geological expeditions. Hence it is not surprising that short series from disparate sites were described as new species without more thorough comparisons or anatomical examination. Indeed, *Aseptis binotata* (Walker) was described seven times including in three different genera in a single publication in 1865. The material accumulated in public collections over the last 100 years now reveals that many species are polymorphic, while others are remarkably constant.

The combination of too many names, geographical variation, and the fact that many *Aseptis* are similar gray-brown moths with diffuse markings has given rise to considerable confusion in public collections. A lack of published illustrations of most species since Barnes & McDunnough’s publications a century ago (Barnes and McDunnough 1912a) has also contributed to a lack of clarity. In this revision, we define the status of the species of *Aseptis*, describe two new genera for species previously associated with the genus, and illustrate one or more representative adult specimens and the genitalia of all of them.

## Materials and methods

Wing pattern and genitalia structure terminology follow Lafontaine (2004). Terms not defined in this reference are the penicillus, a broad-based lateral extension of the tegumen near the attachment to the vinculum (Forbes 1954), and the term “postreniform patch” which we introduce for a pale area abutting the lateral reniform spot in the distal medial and adjacent postmedial areas of the forewing (Fig. 1).

The male and female genitalia were prepared using standard methods (Hardwick 1950, Lafontaine 2004). Briefly, the detached abdomen was soaked in 10% KOH to dissolve soft tissues. Dissection was performed initially in water followed by hardening with isopropyl alcohol or ethanol. The male vesica and female bursa were inflated. The preparations were stained with Chlorazole Black or orcein and were mounted in Euparal on glass slides.

Table 1.

Species	Haplotype	Voucher #	Seq-length	Country	State/Prov.	Exact Site	Lat	Lon	Collectors	Deposition
<i>Aseptis binotata</i>	AB1	CNCNocuoidea12188	658[0n]	USA	CA	Pine Mountain, Ventura Co.			T. Dimmock	CNC
<i>Aseptis binotata</i>	AB2	CNCNocuoidea12190	658[0n]	USA	CA	Laguna Mountains, San Diego Co.			T. Mustelin	CNC
<i>Aseptis binotata (bulbata)</i>	AB3	CNCNocuoidea12200	658[0n]	USA	UT	Capital Reef, Garfield Co.			P. Opler	CNC
<i>Aseptis binotata (dilara)</i>	AB4	TMustelin#319	609[0n]	USA	CO	John Brown Canyon, Mesa Co			J.S. Nordin	TMC
<i>Aseptis binotata (genitrix)</i>	AB5	CNCNocuoidea12164	658[0n]	USA	WY	Upper Blair P.G. north of Rd 705, Albany Co.			J.S. Nordin	CNC
<i>Aseptis binotata (genitrix)</i>	AB6	CNCNocuoidea12165	658[0n]	USA	NV	11 mi SW Wells			Lafontaine and Troubridge	CNC
<i>Aseptis binotata (genitrix)</i>	AB7	TMustelin#317	658[0n]	USA	WY	Fox Creek, Albany Co			J.S. Nordin	TMC
<i>Aseptis catalina</i>	ACA1	CNCNocuoidea12193	658[0n]	USA	CA	Anza Borrego, San Diego Co.			T. Mustelin	CNC
<i>Aseptis catalina</i>	ACA2	CNCNocuoidea12196	658[0n]	USA	CA	Anza Borrego, San Diego Co.			T. Mustelin	CNC
<i>Aseptis catalina</i>	ACA3	CNCNocuoidea12197	658[0n]	USA	AZ	Hwy 88 12miNE Apache Jct, Maricopa Co.			J. Troubridge	CNC
<i>Aseptis characta</i>	ACH1	CNCNocuoidea12207	658[0n]	USA	WA	Bridgeport	48	-119,617	J. Troubridge	CNC
<i>Aseptis characta</i>	ACH2	CNCNocuoidea12209	658[0n]	Canada	BC	Mount Kobau	49,1	-119,65	J. Troubridge	CNC
<i>Aseptis characta</i>	ACH3	CNCNocuoidea12212	658[0n]	USA	NV	Angel Lake	41,01	-115,04	Troubridge and Lafontaine	CNC
<i>Aseptis characta</i>	ACH4	CNCNocuoidea13376	658[0n]	USA	CA	San Bernardino Mountains, San Bernardino Co.	34,175	-116,803	T&S Mustelin	CNC
<i>Aseptis ethnica</i>	AET1	CNCNocuoidea12175	658[0n]	USA	CA	Magalia, Butte Co.			L. Crabtree	CNC
<i>Aseptis ethnica</i>	AET2	TMustelin# 193	592[0n]	USA	CA	2 mi south of Lake Henshaw, San Diego Co			T. Mustelin	TMC
<i>Aseptis ethnica</i>	AET3	TMustelin#258	609[0n]	USA	OR	Illinois River, Josephine Co	42,75	-123,683	J. Troubridge	TMC
<i>Aseptis fanatica</i>	AFA1	CNCNocuoidea13155	658[0n]	USA	CA	Laguna Mountains, San Diego Co.			T&S Mustelin	CNC
<i>Aseptis fanatica</i>	AFA2	CNCNocuoidea13378	658[0n]	USA	CA	Laguna Mountains, San Diego Co.			T. Mustelin	CNC
<i>Aseptis ferruginea</i>	AFF	CNCNocuoidea12170	658[0n]	USA	CA	2miNE of Julian, San Diego Co.			T. Mustelin	CNC
<i>Aseptis fumcola</i>	AFUE1	CNCNocuoidea12176	658[0n]	USA	CA	Laguna Mountains, San Diego Co.			T. Mustelin	CNC
<i>Aseptis fumcola</i>	AFUE2	CNCNocuoidea13380	658[0n]	USA	CA	Laguna Mountains, San Diego Co.			T. Mustelin	CNC

Species	Haplotype	Voucher #	Seq-length	Country	State/Prov.	Exact Site	Lat	Lon	Collectors	Deposition
<i>Aseptis fumosa</i>	AFUM	CNCNocuoidea12161	658[0n]	USA	CA	Pine Mountain, Ventura Co.			T. Dimock	CNC
<i>Aseptis lichena</i>	ALI	TMustelin#318	609[0n]	USA	CA	Twain Harre, [? County],			Lundgren	TMC
<i>Aseptis murina</i>	MU	CNCNocuoidea12173	612[0n]	USA	CA	Inaja Picnic Ground, San Diego Co.			T. Mustelin	CNC
<i>Aseptis perfumosa</i>	APE1	CNCNocuoidea12127	658[0n]	USA	CA	Laguna Mountains, San Diego Co.			T. Mustelin	CNC
<i>Aseptis perfumosa</i>	APE2	CNCNocuoidea12129	658[0n]	USA	CA	Peñasquitos Canyon, San Diego			T. Mustelin	CNC
<i>Aseptis perfumosa</i>	APE3	TMustelin#307	609[0n]	USA	CA	Upper Ojai Valley, Ventura Co			T.E. Dimock	TMC
<i>Aseptis pseudolichena</i>	APS	CNCNocuoidea12148	658[0n]	USA	CA	Laguna Mountains, San Diego Co.			T. Mustelin	CNC
<i>Aseptis serrula</i>	ASE	TMustelin#316	572[0n]	USA	CA	In-Ko-Pah Gorge, Imperial Co			T. Mustelin and N. Bloomfield	TMC
<i>Aseptis susquesa</i>	ASU1	TMustelin#22	603[0n]	USA	CA	San Diego				TMC
<i>Aseptis susquesa (monica)</i>	ASU2	TMustelin#15	609[0n]	USA	CA	Scissors Crossing, San Diego Co.			T. Mustelin	TMC
<i>Aseptis susquesa (monica)</i>	ASU3	TMustelin#321	609[0n]	USA	CA	Laguna Mountains, San Diego Co.			T. Mustelin	TMC
<i>Aseptis torreyana</i>	ATO	TMustelin#284	609[0n]	USA	CA	Torrey Pines State Reserve, San Diego			N. Bloomfield	TMC
<i>Paraseptis adnixa</i>	PAD1	CNCNocuoidea12201	658[0n]	Canada	BC	Vancouver Island, Saanichron			J. Troubridge	CNC
<i>Paraseptis adnixa</i>	PAD2	CNCNocuoidea12202	658[0n]	USA	CA	Lee Vining, Mono Co.	37,941	-119,123	J. Troubridge, L. Crabo	CNC
<i>Paraseptis adnixa</i>	PAD3	CNCNocuoidea12206	658[0n]	Canada	BC	Kirby Flats			J. Troubridge	CNC
<i>Paraseptis adnixa (pausis)</i>	PAD4	CNCNocuoidea12203	658[0n]	USA	CA	Laguna Mts, San Diego Co.			T. Mustelin	CNC
<i>Paraseptis adnixa (pausis)</i>	PAD5	CNCNocuoidea12204	658[0n]	USA	CA	Alamo Mountain, Ventura Co.			T. Dimmock	CNC
<i>Paraseptis adnixa (pausis)</i>	PAD6	LEP038031	658[0n]	USA	CA	2 mi. E. Bassetts, Hy 49, Sierra Co.			P. A. & E. Opler	CNC
<i>Viridiseptis murina</i>	VMA	CNCNocuoidea12235	658[0n]	USA	CA	McCain Valley, San Diego Co.	32,703	-116,265	T. Mustelin	CNC



**Figures 1–2.** Characters and nomenclature of the genus *Aseptis*. **1** Forewing of *Aseptis binotata* **2** hindwing of male *Aseptis fumosa*. The arrow points at the indentation typical of *Aseptis*.

The 658 base pair DNA “barcode” region of the mitochondrial cytochrome *c* oxidase subunit 1 (CO1) was used to assess molecular variation of the species included in *Aseptis* and related genera in recent check lists. Previously submitted samples available as of February, 2015 at the Barcodes of Life Campaign (BOLD) at the University of Guelph (Ontario, Canada) had been analyzed by standard DNA extraction, amplification, and sequencing protocols for the BOLD initiative as described by Hebert et al. (2003). The barcode sequences were compared using similarity trees obtained using the Kimura-2-Parameter distance model as implemented on the Barcode of Life Data Systems website (<http://www.barcodinglife.org>). Table 1 lists the major haplotypes of specimens examined in this study.

This study is based on examination of material, including type specimens and genitalia preparations, in the following collections:

- |              |  |
|--------------|--|
| <b>AMNH</b>  | The American Museum of Natural History, New York, New York, USA                            |
| <b>BMNH</b>  | The Natural History Museum [British Museum of Natural History], London, UK                 |
| <b>CNC</b>   | Canadian National Collection of Insects, Arachnids, and Nematodes, Ottawa, Ontario, Canada |
| <b>FMNH</b>  | Field Museum of Natural History, Chicago, Illinois, USA                                    |
| <b>LACM</b>  | Los Angeles County Museum, Los Angeles, California, USA                                    |
| <b>LGC</b>   | Lars Crabo Collection, Bellingham, Washington, USA   |
| <b>MSU</b>   | Michigan State University, East Lansing, Michigan, USA                                     |
| <b>ODAC</b>  | Oregon Department of Agriculture, Salem, Oregon, USA                                       |
| <b>OSAC</b>  | Oregon State Arthropod Collection, Corvallis, Oregon, USA                                  |
| <b>RHLC</b>  | Ronald H. Leuschner Collection, now at the McGuire Center, Gainesville, Florida, USA       |
| <b>SDNHM</b> | San Diego Natural History Museum, San Diego, California, USA                               |
| <b>TEDC</b>  | Thomas E. Dimock Collection, Ventura, California, USA                                      |

<b>TMC</b>	Tomas Mustelin Collection, Potomac, Maryland, USA
<b>UCR</b>	University of California at Riverside, Riverside, California, USA
<b>USNM</b>	National Museum of Natural History [formerly United States National Museum], Washington, District of Columbia, USA
<b>WFBM</b>	W. F. Barr Entomological Collection, University of Idaho, Moscow, Idaho, USA
<b>WSUC</b>	James Entomological Collection, Washington State University, Pullman, Washington, USA
<b>ZMH</b>	Zoological Museum, Helsinki, Finland

## Results

### Key to genera included in *Aseptis* McDunnough sensu Lafontaine & Schmidt, 2010

- 1 Male vesica with apical long spine-like cornutus; posterior half of female ductus bursae membranous ..... *Aseptis*
- Male vesica apex lacking cornutus or with minute cornutus; posterior half of female ductus bursae at least partially sclerotized..... **2**
- 2 Ampulla of male clasper present; female corpus bursae with four long signa and posterior ductus bursae sclerotized circumferentially ..... *Paraseptis*
- Ampulla of male clasper absent; female corpus bursae lacking signa and posterior ductus bursae with sclerotized plate in ventral wall..... *Viridiseptis*

### Key to the genus *Aseptis* McDunnough

- 1 Male ..... **2**
- Female..... **19**
- 2 Antenna serrate..... *A. serrula*
- Antenna filiform ..... **3**
- 3 Digitus absent..... **4**
- Digitus elongate, narrow..... **8**
- 4 Ventral cucullus with spike-like process; forewing mottled olive green to olive yellow; California..... **5**
- Ventral cucullus normal, rounded; forewing not olive; widespread, including California ..... **6**
- 5 Forewing ground color olive green with yellow tan and black pattern; Kern and Tuolumne counties, California, and north; male valve nearly straight; female genitalia indistinguishable from *A. pseudolichena* ..... *A. lichena*

- Forewing ground color light olive to olive-yellow; Kern and Tuolumne counties, California and south; male valve bent slightly ventrad at mid-point; female genitalia indistinguishable from *A. lichena* ..... ***A. pseudolichena***
- 6 Vesica with single cornutus; forewing mottled light yellow tan and gray; deserts of southern California and Arizona ..... ***A. catalina***
- Vesica with two or more cornuti; forewing not as above; widespread in western North America ..... **7**
- 7 Valve slightly S-shaped; forewing mottled gray, or gray and tan... ***A. characta***
- Valve nearly straight; forewing dark, blackish ..... ***A. fumosa***
- 8 Digitus perpendicular to valve; southern California ..... **9**
- Digitus oblique to valve, pointed  $\sim 45^\circ$  toward ventral cucullus; widespread, including southern California ..... **10**
- 9 Digitus origin near ventral valve with most of it below ventral valve margin; forewing dark brown to black brown; widespread in southern California..... ***A. perfumosa***
- Digitus origin on mid-valve near base of ampulla, barely reaching ventral margin; immediate coast near San Diego, California ..... ***A. torreyana***
- 10 Aedeagus longer,  $> 4\times$  as wide as long; smaller narrower-winged species (wingspan  $\leq 35$  mm); forewing with contrasting light postreniform patch or small black basal dash ..... **11**
- Aedeagus stout,  $\leq 4\times$  as wide as long; large broad-winged species (wingspan  $\geq 35$  mm); forewing without basal dash and usually without postreniform patch..... ***Aseptis fumeola* species group... 12**
- 11 Small basal dash present, evident in all but the darkest specimens; forewing a shade of brown; hindwing base gray; widespread in western North America... ***A. binotata***
- Basal dash absent; forewing gray with patches of pale rusty brown; hindwing base white with streaks extending distally; deserts of Southwest and southern California ..... ***A. susquesa***
- 12 Forewing smooth gray with pale costa; maculation reduced to dark filling of spots and dotted lines; extreme southern California ..... ***A. murina***
- Forewing not as above, costa similar to rest of wing; West Coast and parts of Southwest, including southern California ..... **13**
- 13 Forewing mottled gray brown with conspicuous gray filling of spots, small yellowish postreniform spot, and irregular black to dark gray shade proximal to subterminal line; California, Arizona, and southern Utah and Nevada ..... ***A. fumeola***
- Forewing light or dark but more uniform, filling of spots not strongly contrasting, medial area between reniform spot and postmedial line not significantly lighter than rest of wing or reddish in central and northern California; California, Arizona, Oregon, and Washington..... **14**
- 14 Forewing ground color strongly red brown ..... **15**

- Forewing not red brown, sometimes patchy reddish areas near reniform spot in central and northern California ..... **18**
- 15 Forewing rusty red brown with darker markings; extreme southern California ..  
..... *A. ferruginea*
- Forewing bright red brown, occasionally with darker markings; San Benito County, California..... *A. fanatica* (part)
- 16 Southern California ..... **17**
- Central California to Washington..... **18**
- 17 Forewing ground color slightly mottled pale gray brown; male valves oriented  $\geq 120^\circ$  relative to each when mounted flat; female corpus bursae  $\sim 5\times$  as long as wide..... *A. ethnica* (part)
- Forewing ground color medium to dark brown; male valves oriented at  $\sim 90^\circ$  when displayed similarly; female corpus bursae  $\sim 7\times$  as long as wide.....  
..... *A. fanatica* (part)
- 18 Forewing ground color slightly mottled brown, usually with evident dark shade preceding subterminal line and often with reddish postreniform spot; male valves oriented  $\geq 120^\circ$  relative to each when mounted flat; female corpus bursae  $\sim 5\times$  as long as wide ..... *A. ethnica* (part)
- Forewing ground color blackish brown, maculation faint; male valves oriented at  $\sim 90^\circ$  when displayed similarly; female corpus bursae  $\sim 7\times$  as long as wide..... *A. fanatica* (part)
- 19 Corpus bursae elongate,  $5\text{--}7\times$  as long as wide, with small cone-shaped appendix bursae; papilla analis without long hair-like basal seta.....  
..... *Aseptis fumeola* species group... **12**
- Corpus bursae wider, ovoid,  $1.3\text{--}1.5\times$  as long as wide, with appendix bursae not as above; papilla analis with sparse or thick hair-like basal setae ..... **20**
- 20 Forewing mottled olive green to yellow green; California..... **5**
- Forewing ground color gray or brown; widespread, including California... **21**
- 21 Apex of papilla analis with a thin sclerotized flange..... *A. perfumosa*
- Apex of papilla analis lacking a flange ..... **22**
- 22 Hairs at base of papilla analis dense, with expanded ventral patches; Southwest deserts and southern California ..... **23**
- Papilla analis with a sparse single row of basal hair-like setae; widespread, including southern California ..... **24**
- 23 Papilla analis covered with short needle-like setae, medial dorsal margin smooth; forewing patchy light yellow tan and gray ..... *A. catalina*
- Papilla analis rugose, scale-like, dorsal medial margin irregular; forewing gray with few light marks ..... *A. serrula*
- 24 Ground color of forewing dark smoky brown to nearly black; appendix bursae bluntly rounded and mediolaterally compressed..... *A. fumosa*
- Ground color variable, brown to gray; if dark brown then more light scaling including filling of lines and ochre postreniform patch; appendix bursae not as above, asymmetric ..... **25**

- 25 Ground color of forewing a shade of brown (including gray brown), but lacking extensive gray areas ..... *A. binotata*
- Forewing gray or gray with light tan or rusty accents ..... 26
- 26 Forewing mottled light gray, with at most minor patches of olive or tan scales..... 27
- Forewing gray with extensive tan or rusty-tan scales..... 28
- 27 Forewing mottled light gray, markings include a thin black basal dash; Pacific Coast near San Diego, California; female genitalia unknown.... *A. torreyana*
- Forewing mottled light and medium dark gray to darker medium gray, black dash absent; widespread, including in southern California; appendix bursae broad based but short; corpus bursae lacking signa ..... *A. characta* (part)
- 28 Forewing pattern longitudinally streaked, with rusty patches that are most prominent in fold and distal to reniform spot; bursa copulatrix with corpus bursae and appendix bursae nearly equal in size; desert Southwest and southern California ..... *A. susquesa*
- Forewing pattern mottled gray and tan or rusty tan, not streaky; appendix bursae much smaller than corpus bursae; widespread in western North America ...  
..... *A. characta* (part)

### *Aseptis* McDunnough, 1937

*Aseptis* McDunnough, 1937: 59.

**Type species.** *Hadena genitrix* Grote (a synonym of *Aseptis binotata* (Walker)) by original designation.

**Diagnosis.** *Aseptis* is a moderate-sized genus of medium-sized noctuids (wing-span 27.5–45.0 mm) in the subtribe Xylenina Guenée of the tribe Xylenini Guenée of the subfamily Noctuidae Latreille (Lafontaine and Schmidt 2010) from western North America. Adults are typically dull mottled gray or brown, although a few species are red brown or nearly black, with typical noctuid lines and spots, often with a pale patch in the medial and postmedial areas abutting the lateral reniform spot (“postreniform patch” (Fig. 1)), which is easily mistaken for the reniform spot. The reniform, orbicular, and claviform spots are present in most species and are often large and closely positioned; the reniform spot is usually figure-eight shaped. The hindwing outer margin is concave between M1 and M3, M2 is visible and is closer to M3 than M1, and the wing is often palest with loss of scales between M1 and M3 (Fig. 2). The male antenna is filiform, serrate in *Aseptis serrula* (Barnes & McDunnough). The male abdomen has basal coremata with pockets extending on segments one and two. The male genitalia have a narrow sharply-pointed uncus; a tegumen that is laterally compressed near the uncus base and has broad penicillus lobes; a strap-like valve with small sacculus and weakly differentiated rounded cucullus with a weak corona (ventral cucullus pointed in the *Aseptis lichena* species group), a curved ampulla of the

clasper oriented perpendicular to or parallel to the costa, and an elongate triangular or spike-like digitus arising from a weakly sclerotized plate on the mid-valve (digitus absent in several species); the aedeagus is tubular with slight ventrad bend distally, and the vesica is  $1\frac{1}{4}$ –2 × aedeagus length with 90–180° bend ventrad at the base, and bears a long proximally-directed apical cornutus and additional 0–2 smaller cornuti and 2–3 broad-based diverticula. In the female, the papilla analis is lightly sclerotized, triangular, with a rounded tip, and is covered with short spike-like setae (rugose scales in *A. serrula*) and from zero to innumerable hair-like basal setae; the ductus bursae is membranous except near the corpus bursae; the moderately-sclerotized appendix bursae is sack-like or weakly bilobed and extends posteriorly from the left ventral corpus bursae; the corpus bursae is ovoid, 1.3–7 × as long as wide, with 0–4 long narrow signa.

*Aseptis* can be distinguished from all genera other than *Paraseptis* Mustelin & Crabo and *Viridiseptis* Mustelin & Crabo, both described below, by the concave hindwing notch. *Aseptis* males have long apical cornutus on the vesica, absent or very small in the other genera. *Aseptis* females lack sclerotization of the posterior ductus bursae.

**Distribution and biology.** *Aseptis* species mainly occur west of the Great Plains from south-central Alberta and southern British Columbia to northwestern Mexico; one species, *Aseptis characta*, extends eastward into the Great Plains as far as Manitoba. The greatest concentration of species is near the Pacific Coast, particularly in southern California, and in the desert Southwest. The adult flight season is from late spring to late summer and is often fairly long, but species in desert habitats usually fly only during the spring. They occur in a variety of habitats from forest, shrub steppe and chaparral, to desert. As typical of the tribe Xylenini (Fibiger and Lafontaine 2005), the larvae feed on the leaves of woody plants.

**Discussion.** Fifteen *Aseptis* species are recognized herein. Seven sort easily into species groups, five in the *Aseptis fumeola* species group and two in the *Aseptis lichena* species group. No natural groupings were found for the other species.

Two species previously associated with *Aseptis* differ significantly in structure from the other members of the genus. “*Aseptis*” *marina* was moved recently to *Aseptis* from *Oligia* Hübner in the Apameini (Lafontaine and Schmidt 2010). They noted that although it appears to be related to *Aseptis* they are not congeneric, adding the quotations to denote the tentative association. Its hindwing margin has a slightly concave segment like those of *Aseptis*, but the male and female genitalia are strikingly different. We describe *Viridiseptis* for it below and introduce *Viridiseptis marina* (Grote), comb. n. Its relationship to the Xylenini is also discussed further. The other outlier, *Paraseptis adnixa* (Grote), comb. n., is surprising because it superficially resembles *A. binotata* but differs from *Aseptis* in several features of the male and female genitalia. In addition to the anatomic differences, the CO1 barcodes of *V. marina* and *P. adnixa* variably sort away from *Aseptis* and each other within a large selection of Xylenini.

The name *Aseptis* was presumably chosen by James McDunnough to denote its distinction from *Septis* Hübner, a synonym of *Apamea* Ochsenheimer, in the Apameini. *Aseptis* and *Apamea* are not related closely.

***Aseptis fumeola* species group**

The *Aseptis fumeola* species group consists of five species (*Aseptis fumeola* (Hampson), *Aseptis ethnica* (Smith), *Aseptis murina* Mustelin, *Aseptis ferruginea* Mustelin, and *Aseptis fanatica* Mustelin). Its members are relatively large (wingspan  $\geq 35$  mm) with broad forewings with diffuse markings. The hindwing is dark, which obscures the veins. The male valve is long and narrow with a truncated or foot-shaped cucullus, upright ampulla, and oblique pointed digitus. The aedeagus is stubby, usually 3–4 $\times$  as long as wide, with a large sack-like vesica with large diverticula and long apical cornutus. Females have bursae with an elongate corpus bursae and small appendix bursae, and lack basal hairs on the papillae anales. The genitalia are similar within the group and the species are most easily identified by their habitus.

*Aseptis ethnica* and *A. fanatica* display geographical variation in that both are much darker at the northern than at the southern ends of their ranges. Nevertheless, members of this species group tend to be relatively constant in appearance at any given location. An exception to this is a population of *A. fanatica* from San Benito County, California, in which approximately half of the specimens are bright reddish whereas the other half are of the typical black color.

All species in the *Aseptis fumeola* species group occur in California. The ranges of two of the species extend north to the Pacific Northwest, two as far East as Arizona, and two are restricted to southern California. All five species are sympatric in southern California.

The larvae of *A. fumeola*, *A. ethnica*, and *A. fanatica* feed on Manzanita (*Arctostaphylos* spp., Ericaceae) and related plants.

The CO1 barcodes of the species in this species group are relatively similar and cluster tightly within the genus. The largest difference in barcode sequences between two species in the group is 2.4%. *Aseptis fanatica* is the only species in the species group with more than a single barcode haplotype.

***Aseptis fumeola* (Hampson, 1908)**

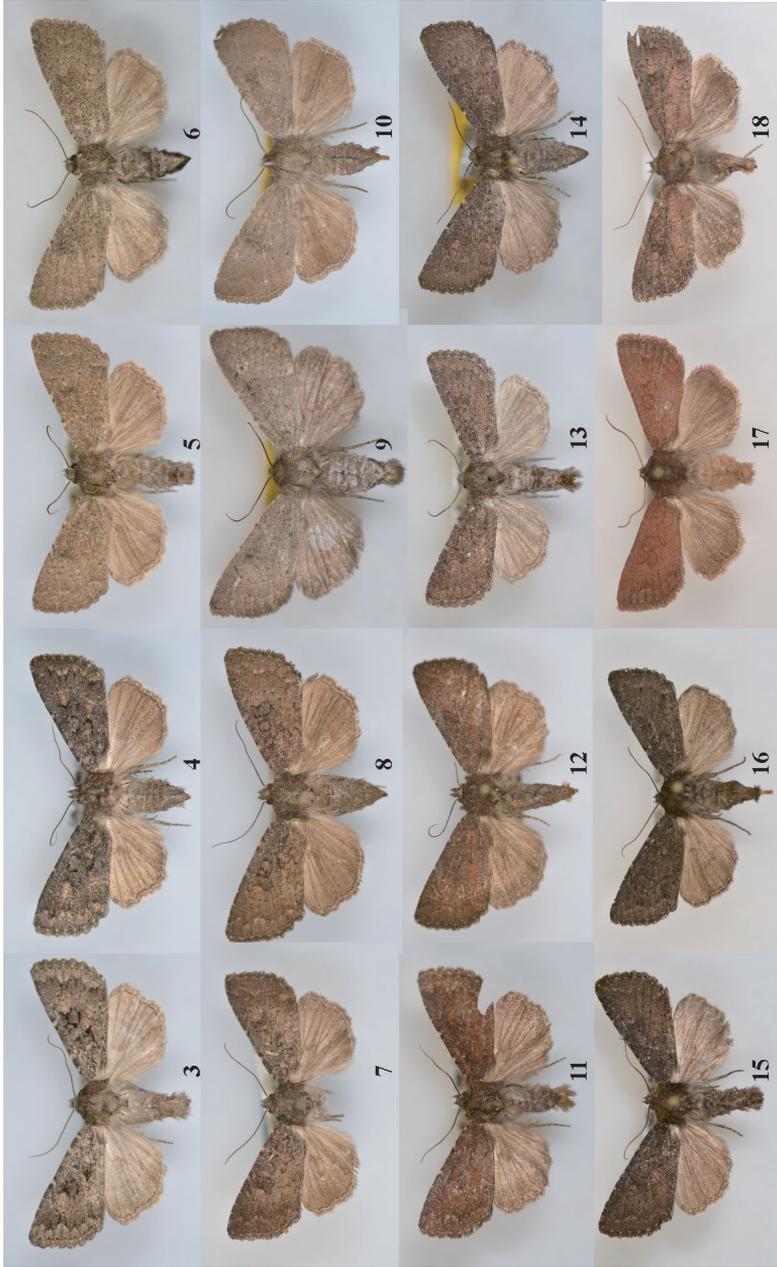
Figs 3, 4, 59, 76

*Trachea fumeola* Hampson, 1908: 186.

*Trachea (Hadena) probata* Barnes & McDunnough, 1910: 153.

**Type material.** *Trachea fumeola*: **Holotype** male [BMNH, photograph examined]. Type Locality: Pinal Mountains, Arizona. *Trachea (Hadena) probata*: **Holotype** female [USNM, photograph examined]. Type Locality: Huachuca Mountains, Arizona.

**Diagnosis.** A large and broad-winged *Aseptis*, wingspan  $41.1 \pm 1.6$  mm ( $n=25$ ; range 38.5–45.0 mm), with a dark slightly shiny gray-brown forewing with contrasting dark patches, particularly in the basal and postmedial areas. The medial area typically is paler with reddish tan near the conspicuous large black reniform spot, small round orbicular spot, and short claviform spot. The reddish postreniform patch is relatively prominent



**Figures 3–18.** *Aseptis fumeola* species group. **3** *Aseptis fumeola*, male (San Diego Co., CA) **4** *Aseptis fumeola*, female (San Diego Co., CA) **5** *Aseptis ethnica*, male (Ventura Co., CA) **6** *Aseptis ethnica*, female (Ventura Co., CA) **7** *Aseptis ethnica*, male (Josephine Co., OR) **8** *Aseptis ethnica*, female (Josephine Co., OR) **9** *Aseptis murina*, male Paratype (San Diego Co., CA) **10** *Aseptis murina*, female Paratype (San Diego Co., CA) **11** *Aseptis ferruginea*, male (Ventura Co., CA) **12** *Aseptis ferruginea*, female (San Diego Co., CA) **13** *Aseptis fanatica*, male Paratype (San Diego Co., CA) **14** *Aseptis fanatica*, female Paratype (San Diego Co., CA) **15** *Aseptis fanatica*, male (Kititas Co., WA) **16** *Aseptis fanatica*, female (Kititas Co., WA) **17** *Aseptis fanatica*, male (San Benito Co., CA) **18** *Aseptis fanatica*, female (San Benito Co., CA).

for the species group. The postmedial line usually is well marked and curves around the reniform spot. The serrated subterminal line is a prominent border between the postmedial and paler subterminal areas. The hindwing is smoky gray brown, darker in females.

*Aseptis fumeola* can be identified by its large size and patchy forewing maculation. Some northern California *A. ethnica* have a similar brown forewing with reddish tan around the spots; *A. fumeola* tends to be more contrasting, less reddish, and a bit larger. Occasional *Aseptis perfumosa* specimens are dark brown with reddish suffusion in the upper medial area. This form is always much smaller and darker than *A. fumeola*, has a narrower forewing, and much different genitalia. The male and female genitalia are as in the description to the species group. The male valve has a foot-shaped cucullus.

**Distribution and biology.** *Aseptis fumeola* is known from Arizona, southern and central California, southern Nevada, and south-eastern Utah. It flies in the foothills and mountains in dry chaparral, parkland, and conifer forest. Most records are from June and July. The larva and pupa were described and figured by Comstock (1940a). The pale-green larvae were found and reared on new leaves of manzanitas (*Arctostaphylos* spp.). Crumb (1956) found it on *A. pungens* Kunth in Arizona and described the larva as strange and sluggish.

**Remarks.** The Latin name *fumeola* means smoked, likely to denote its black-peppered maculation.

### *Aseptis ethnica* (Smith, 1899)

Figs 5–8, 60, 77

*Hadena ethnica* Smith, 1899: 263.

**Type material.** **Holotype** male [USNM, examined]. Type Locality: Yosemite, California.

**Diagnosis.** *Aseptis ethnica* is a large and broad-winged, wingspan  $41.2 \pm 1.5$  mm ( $n=25$ ; range 38.0–43.5 mm) with ill-defined markings. In southern California its forewing is dull grayish tan with a grainy appearance (Figs 5 and 6). In central and northern California and Oregon, it is dull deeper brown, sometimes with some reddish tones surrounding the dark-filled reniform and orbicular spots (Figs 7 and 8). The holotype from Yosemite is of the darker form and is reminiscent of *A. fumeola*. Most *A. ethnica* are much less contrasting than *A. fumeola* and lack its contrasting black-outlined spots, patchy dark shading, and reddish postreniform patch. *Aseptis ethnica* can be challenging to distinguish from *A. fanatica*, particularly when worn. Typically, *A. ethnica* is larger with a broader forewing, has a grainier forewing pattern, and is the lighter species in any location. In southern California, *A. ethnica* is pale grayish tan whereas *A. fanatica* is darker gray brown. In northern California, *A. ethnica* is as dark as *A. fanatica* in San Diego County, but in this area *A. fanatica* is nearly black. In San Diego County, *A. ethnica* can be distinguished from *A. murina* by being grainier and browner, and by lacking its characteristic pale costa.

The male genitalia of *A. ethnica* can be distinguished from those of *A. fanatica* by the angle subtended by the two valves as noted in the key. The female bursa is slightly shorter in *A. ethnica* than in *A. fanatica*, approximately 5× its width in *A. ethnica* and 7× in the latter species.

The CO1 barcode DNA sequence of *A. ethnica* is closest to *A. murina*, differing by 1.8%.

**Distribution and biology.** *Aseptis ethnica* is known from Arizona, California, western Oregon, and Baja California Norte, Mexico. The northern limit is not known precisely due to similarity of this species and *A. fanatica* in this portion of its range; however, it occurs at least to Jefferson County, Oregon, based on DNA. *Aseptis ethnica* flies in open Pine and Oak forest and mountain chaparral, mostly at elevations of above 1500 m in southern California but at lower elevations farther north. It has been found from early May to August and can be locally abundant during its peak flight in June and July. In the mountains of southern California (e.g., Laguna, Volcan, Palomar, and Santa Rosa Mountains) it often flies together with *A. fumeola*, *A. fanatica*, and occasional specimens of *A. ferruginea*. The immature stages are unknown, but the larval food plant was revealed by J.B. Smith's description of the species in 1899 based on adult specimens raised from caterpillar on manzanitas (*Arctostaphylos* spp.).

**Discussion.** The name *ethnica* is Latin and means heathen. Perhaps Smith was inspired by the raw wilderness of Yosemite in late 1899.

### *Aseptis murina* Mustelin, 2000

Figs 9, 10, 61, 78

*Aseptis murina* Mustelin, 2000. In: Mustelin et al. 2000: 8.

**Type material. Holotype** male [SDNHM, examined]. Type locality: Inaja Picnic Ground, San Diego County, California.

**Diagnosis.** This is a large species with perhaps the broadest forewing in the group, wingspan 40.0±1.0 mm (n=12; range 39–42 mm). The forewing is smooth gray with a slightly bluish sheen when fresh, a diffuse and faint dark reniform spot, postmedial line of black dots, and a pale-cream costa in fresh specimens. The hindwing is barely a shade paler than the forewing.

This species can be identified by the combination of large size, smooth gray forewing with pale costa, and southern California distribution. It is most likely to be confused with *A. ethnica*, especially when worn.

**Distribution and biology.** *Aseptis murina* is known only from southern California where it occurs in coastal chaparral, foothills, mountain brush land and oak forest, and in the mountain-desert transition zone from sea level to 2000 m. It can be found with all other species of the species group. Localities for it include the Cuyamaca, Laguna, and San Gabriel Mountains, Pinyon Crest, and San Marcus Pass in Santa Barbara County. The flight period is from early May to July. The early stages are unknown.

**Discussion.** The name *murina* is Latin and means mouse-like to denote the smooth murine appearance of the moth.

***Aseptis ferruginea* Mustelin, 2000**

Figs 11, 12, 62, 79

*Aseptis ferruginea* Mustelin, 2000. In: Mustelin et al. 2000: 8.

**Type material. Holotype male** [SDNHM, examined]. Type locality: Wynola, San Diego County, California.

**Diagnosis.** *Aseptis ferruginea* is one of the smallest and most narrow-winged species in the group, wingspan  $36.4 \pm 0.5$  mm (n=6; range 35.5–37.0 mm). Its brown forewing is distinctly reddish, deep claret when fresh and rustier when worn, and the veins are usually black. Most specimens have a clearly-marked dark-filled reniform spot and a jagged pale subterminal line. The hindwing is distinctly paler than the forewing. The male valve differs from others in the species group in being even and straight with a perpendicular lateral cucullus that is straight or slightly concave.

*Aseptis ferruginea* can usually be identified by superficial appearance, especially its red color, and males can be confirmed by dissection. Some central California *A. fanatica* are bright red brown and could be confused with it, although this morph is not known from within its geographical range; these *A. fanatica* are smoother than *A. ferruginea* and lack the other forewing markings described above.

The CO1 barcode sequence of *A. ferruginea* is the most unique of any member of the species group. It is closest to that of *A. ethnica* from which it differs by at least 2.2%.

**Distribution and biology.** This species is endemic to southern California. All records are from San Diego County from an area between Boulevard-Manzanita near the Mexican border north to Lake Henshaw at altitudes of 800–1600 m. It flies in open oak forest, foothill chaparral, and in the mountain-desert transition zone. *Aseptis ferruginea* can be encountered together with the much more abundant *A. ethnica* and *A. fanatica* at higher altitudes and with *A. murina* at lower elevations. Records are from late June to August. The early stages are unknown.

**Discussion.** The name *ferruginea* is Latin and means rusty.

***Aseptis fanatica* Mustelin, 2006**

Figs 13–18, 63, 80

*Aseptis fanatica* Mustelin, 2006: 27.

**Type material. Holotype male** [SDNHM, examined]. Type locality: Pine Cove, San Jacinto Mountains, Riverside County, California.

**Diagnosis.** This species is similar in size and shape to *A. ferruginea*, wingspan  $38.9 \pm 1.6$  mm ( $n = 25$ ; range 35–42 mm). In southern California *A. fanatica* has a dark chocolate-brown forewing (Figs 13 and 14), whereas in northern California, Oregon, and Washington it is darker brown to nearly black (Figs 15 and 16). Some individuals in central California are smooth bright red brown (Figs 17 and 18). The maculation is dark, either diffuse or weakly contrasting. The most prominent markings are the black-filled reniform spot, a black shade proximal to the incomplete pale subterminal line, and pale-yellowish spots on the costa at the antemedial and postmedial lines. Well-marked specimens have a serrate black postmedial line, some black on the veins, and scattered pale scales giving them a peppered look. The hindwing is slightly paler than the forewing, particularly in males.

Separating *A. fanatica* from *A. ethnica* can be challenging. As a rule, *A. fanatica* is the darker species at any location. In southern California *A. fanatica* is dark gray brown whereas *A. ethnica* is pale tan gray. In northern California where *A. ethnica* is darker and often has some reddish brown around the spots, *A. fanatica* is nearly black. *Aseptis fanatica* tends to be narrower winged and smaller, but there is overlap in size. If necessary, the genital characters of the male valves and female bursae given in the key to species can be used to distinguish the two species.

*Aseptis fanatica* is the only species in the species group with two CO1 barcode haplotypes, these separated by 1.3%. Specimens with both haplotypes are found throughout its range and display no consistent differences in habitus or male or female genitalia. Similarly, the distinctive red morph from San Benito County flies with typical black specimens with which they are indistinguishable by barcodes or genitalia.

**Distribution and biology.** *Aseptis fanatica* is known from Washington, Oregon, California, and Baja California Norte, Mexico. It flies in many different habitats like brush land and open forest in southern California mostly at 1000–2000 m but occurs at lower elevations farther north. The flight period is from early May to August in the south and in mid-summer in the Cascades. It can be abundant. In the Pacific Northwest, *A. fanatica* feeds on species of Ericaceae such as madrone (*Arbutus menziesii* Pursh.) and various species of manzanitas and bearberry (*Arctostaphylos* spp.) (Miller & Hammond 2003, as *A. ethnica*). Bearberry (*Arctostaphylos uva-ursi* (L.) Spreng.) is probably the only suitable foodplant for this species in the Washington Cascades.

**Discussion.** Prior to its description in 2006, this species was thought to represent the southern California form of *A. ethnica*. In fact, the holotype of *Hadena ethnica* is quite similar to *A. fanatica* from San Diego County.

The mixed red and black population from San Benito County is a unique phenomenon. The red color might be due to a gene mutation, but could also be adaptive. Many noctuids that feed on *Arctostaphylos* as larvae are a similar red color, including *Mesogona rubra* Hammond & Crabo in the subtribe Xylenina.

The name *fanatica* means fanatic and was selected as the antithesis of *ethnica* (heathen). At the time, fanatic had a less sinister meaning than it does in today's world.

### *Aseptis lichena* species group

The *Aseptis lichena* species group consists of two closely related species from the mountains of central and southern California. They are unique in the genus in that the forewing is mottled olive, darker olive green in *Aseptis lichena* (Barnes & McDunnough) and paler yellow tan in *A. pseudolichena* Mustelin & Leuschner. The male valves have a unique acute spine from the ventral cucullus and lack a digitus. The vesicas have a single long apical cornutus. The female bursae are indistinguishable, with large corpora bursae without distinct signa and rounded appendices bursae. The CO1 barcode sequences of the two species differ by approximately 2.3%.

### *Aseptis lichena* (Barnes & McDunnough, 1912)

Figs 19, 20, 64, 81

*Andropolia lichena* Barnes & McDunnough, 1912b: 17.

**Type material.** **Holotype** female [USNM, examined]. Type locality: Deer Park Springs, Lake Tahoe, California.

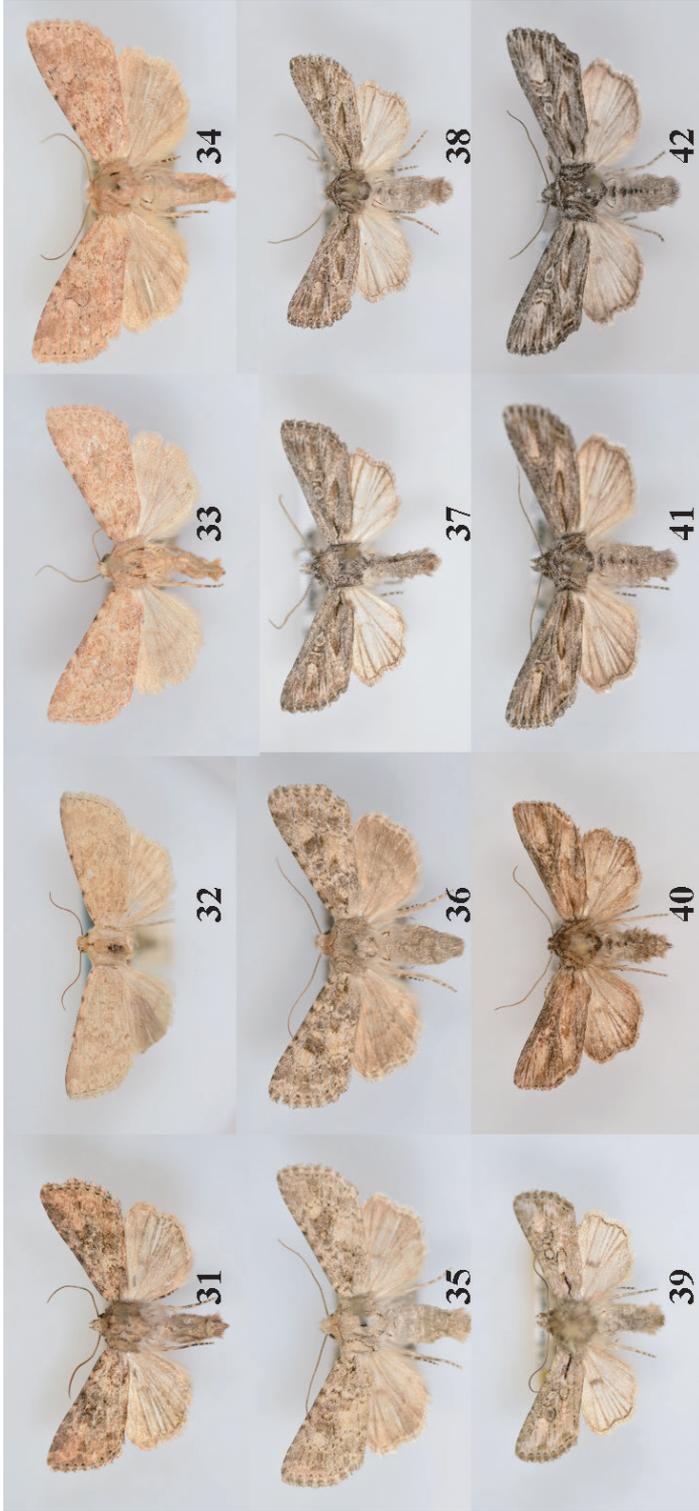
**Diagnosis.** A medium-sized noctuid with a wingspan of  $35.5 \pm 1.8$  mm ( $n=8$ ; range 33–39 mm) with a powdery dark olive-green forewing produced by a mixture of black, green, and yellow scales. *Aseptis lichena* is darker green than *A. pseudolichena*. The male valve of *A. lichena* is nearly straight whereas that of *A. pseudolichena* is bent slightly ventrad at its midpoint. In practice, most specimens can be assigned to a species based on geography, except in an area of overlap at the south end of the Sierra Nevada in Kern and Tuolumne counties. *Aseptis lichena* occurs to the north of this zone. Females are best associated with the males.

**Distribution and biology.** The relatively few specimens of *A. lichena* we have examined are from south-central California (Tehachapi Mountain Peak, Kern Co.) and north-central California (near Blairsden, Plumas Co., Lake Tahoe, and Yosemite Park). It is also reported from Mount Shasta, Mount Lassen, and other locations in northern California. It flies during mid-summer. The early stages are unknown.

**Discussion.** This species was described in the genus *Andropolia* Grote, possibly because the holotype is a dark female with a relatively inconspicuous indentation of the hindwing. Specimen labels found by the senior author suggest that McDunnough suspected that this was incorrect. A female collected in Yosemite National Park, Camp 19, on 15 July 1937 by F.L. Cramer has a second label: "McD needs," a third label: "*Andropolia lichena* B & McD., Det. Dr. J. McDunnough," and a fourth label: "Probably misplaced in "*Andropolia*" – McD." Nonetheless, it remained in *Andropolia* until it was associated with *Aseptis* by Mustelin et al. (2000).



**Figures 19–30.** *Aseptis* adults. **19** *Aseptis lichena*, male (Plumas Co., CA) **20** *Aseptis lichena*, female (Tuolumne Co., CA) **21** *Aseptis pseudolichena*, male (Los Angeles Co., CA) **22** *Aseptis pseudolichena*, female Paratype (San Diego Co., CA) **23** *Aseptis pseudolichena*, male (San Diego Co., CA) **24** *Aseptis pseudolichena*, female (Ventura Co., CA) **25** *Aseptis binotata*, male (Kittitas Co., WA) **26** *Aseptis binotata*, male (San Diego Co., CA) **27** *Aseptis binotata*, male (Ventura Co., CA) **28** *Aseptis binotata*, male (Okanogan Co., WA) **29** *Aseptis binotata*, female Type of *genitrix* (Nevada) **30** *Aseptis binotata*, male (Summit Co., CO).



**Figures 31–42.** *Aseptis* adults. **31** *Aseptis binotata*, male (Laramie Co., WY) **32** *Aseptis binotata*, female (Glenwood Springs, CO) **33** *Aseptis binotata*, male (San Juan Co., UT) **34** *Aseptis binotata*, female (Garfield Co., UT) **35** *Aseptis catalina*, male (San Diego Co., CA) **36** *Aseptis catalina*, female (San Diego Co., CA) **37** *Aseptis serrula*, male (Imperial Co., CA) **38** *Aseptis serrula*, female (San Bernardino Co., CA) **39** *Aseptis torreyana*, female (San Diego Co., CA) **40** *Aseptis susquesa*, male (San Diego Co., CA) **41** *Aseptis susquesa*, male (San Diego Co., CA) **42** *Aseptis susquesa*, female (San Diego Co., CA).

***Aseptis pseudolichena* Mustelin & Leuschner, 2000**

Figs 21–24, 56, 82

*Aseptis pseudolichena* Mustelin & Leuschner, 2000. In Mustelin et al. 2000: 10.

**Type material.** **Holotype** male [LACM, examined]. Type locality: East Fork of Woodwardia Camp, San Gabriel Mountains, Los Angeles County, California.

**Diagnosis.** *Aseptis pseudolichena* is similar in size or slightly smaller than *A. lichena*, wingspan  $33.8 \pm 1.4$  mm (n=25; range 30.5–36.0 mm) and resembles it closely. *Aseptis pseudolichena* is more yellowish as a result of a mixture of pale tan or yellowish scales and scattered tan, olive, and black scales. Some specimens are very pale yellow, others pale tan, and some olive tan. The antemedial and postmedial lines are serrate, and the postmedial line is followed by white and black dots on the veins. A pale subterminal line is usually visible. The orbicular spot is round and filled with ground color, whereas the reniform spot is large, outlined in black and filled with dark scales. A faint pale postreniform patch is present. Males have a pale streak between hindwing veins M1 and M3.

Most *A. pseudolichena* can be separated readily from *A. lichena* by their pale-yellowish to olive-tan color, which is darker olive tan in *A. lichena*; however, dark specimens of *A. pseudolichena* may not be distinguishable without dissection. The male genitalia are similar to those of *A. lichena*, but differ in that the valves are angled ventrad at mid-length and the cucullus is smaller. Most specimens can be assigned to a species based on locality as described under *A. lichena*.

**Distribution and biology.** *Aseptis pseudolichena* is endemic to southern California with records from San Diego, Riverside, Los Angeles, Ventura, San Bernardino, and Tuolumne counties. It may overlap with *A. lichena* in Kern and Tuolumne counties. *Aseptis pseudolichena* is found in open pine and oak forest, open areas with grass and scrub, and foothill chaparral. It seems to be most common on the desert side of the mountain peaks, and can be locally abundant. It flies from June to August depending on elevation. A number of specimens in the Los Angeles County Museum were raised from larva on *Ribes malvaceum* Sm. (Grossulariaceae). The pupa was described and figured by Comstock (1955) under the name *Andropolia lichena*.

***Aseptis binotata* (Walker, 1865)**

Figs 25–34, 66, 83

*Mamestra binotata* Walker, 1865a: 663.*Miana rubiginosa* Walker, 1865a: 675.*Hadena extersa* Walker, 1865b: 728.*Taeniocampa paviae* Strecker, 1874: 94, **syn. n.***Hadena curvata* Grote, 1874b: 157, **syn. n.***Hadena genitrix* Grote, 1878: 237, **syn. n.**

*Hadena inconspicua* Smith, 1893: 142, **nomen nudum**

*Hadena dilara* Strecker, 1898: 7, **syn. n.**

*Hadena bultata* Smith, 1906: 228, **syn. n.**

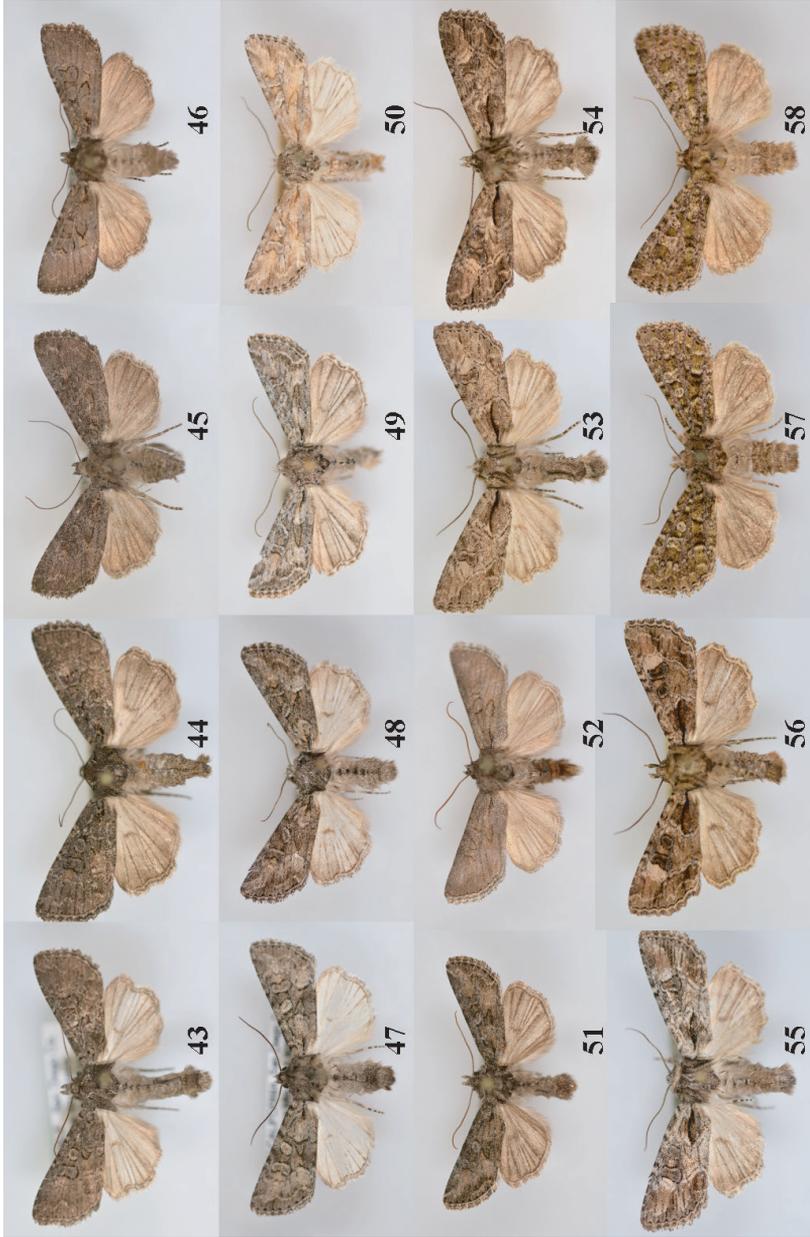
*Trachea cara* Barnes & McDunnough, 1912c: 52, **syn. n.**

**Type material.** *Mamestra binotata*: **Holotype** male [BMNH, photograph examined]. Type locality: Vancouver Island, British Columbia. *Miana rubiginosa*: **Holotype** male [BMNH, not examined]. Type locality: Vancouver Island, British Columbia. *Hadena extersa*: **Holotype** male [BMNH, photograph examined]. Type locality: Vancouver Island, British Columbia. *Taeniocampa paviae*: **Syntypes** [Strecker coll., not examined]. Type locality: California. *Hadena curvata*: **Holotype** female [BMNH, photograph examined]. Type locality: Mendocino, California. *Hadena genitrix*: **Holotype** female [BMNH, photograph examined]. Type locality: Nevada. *Hadena inconspicua*: **Lectotype** male designated by Todd (1982) [USNM, examined]. Type locality: California. *Hadena dilara*: **Holotype** female [FMNH, photograph examined]. Type locality: Colorado. *Hadena bultata*: **Lectotype** male designated by Todd (1982) [AMNH, examined]. Type locality: Glenwood Springs, Colorado. *Trachea cara*: **Syntypes** [USNM, examined]. Type locality: Eureka and Provo, Utah.

**Diagnosis.** *Aseptis binotata* is a common medium-sized member of the genus with a wingspan of  $32.5 \pm 1.3$  mm ( $n=25$ ; range 29.5–35.0 mm). It is the most variable *Aseptis* with respect to forewing color and pattern strength. It may be brownish, warm dark brown, pale to medium gray brown, yellowish light brown, or reddish brown depending on locality. The most noticeable marking in dark specimens is the large pale yellowish postreniform patch, which is bisected by the dark postmedial line. The antemedial line is strongly convex laterally and is filled with light tan. Black forewing markings include a series of wedges near the outer margin below the apex, the outlines of the three forewing spots, and in most specimens a short black basal dash. Pale specimens can be washed out or have contrasting dark markings.

There is striking variation in this species, both within populations and over larger distances. Specimens from the coastal region of the Pacific Northwest are fairly uniform with a warm dark brown forewing with distinct maculation (Fig. 25). Southern California specimens of *A. binotata* range from nearly as dark (Fig. 26) as Northwestern ones to pale reddish, tan, or pale gray brown with a less contrasting postreniform patch (e.g., Fig. 27). These pale forms were described as *Hadena curvata* Grote and *Taeniocampa paviae* Strecker. Populations from drier habitats east of the coastal mountains also tend to be pale and more uniform in color, often with gray tones (Figs 28, 29). Populations from near the Rocky Mountains are also variable, mostly dull gray brown (Figs 30, 31, but those from areas of Colorado, Utah, and New Mexico with reddish substrate are yellow tan to orange tan, often with reduced dark patterns (Figs 32–34). These colorful morphs were described as *Hadena dilara* Strecker and *Hadena bultata* Smith.

The male genitalia of *A. binotata* have a valve with a curved upright ampulla, a long downwardly curving digitus, and a weak constriction at the base of the cucullus. The



**Figures 43–58.** *Aseptis fumosa*, male (San Diego Co., CA) **44** *Aseptis fumosa*, female (San Diego Co., CA) **45** *Aseptis perfumosa*, female (San Diego Co., CA) **46** *Aseptis perfumosa*, male (San Diego Co., CA) **47** *Aseptis characta*, male (San Diego Co., CA) **48** *Aseptis characta*, male (Summit Co., CO) **49** *Aseptis characta*, male (Yakima Co., WA) **50** *Aseptis characta*, male (Lost River, AB) **51** *Aseptis characta*, male (Seton Lake, BC) **52** *Aseptis characta*, male (Prineville, OR) **53** *Paraseptis adnixa*, male (San Diego Co., CA) **54** *Paraseptis adnixa*, female (Inyo Co., CA) **55** *Paraseptis adnixa*, female (Inyo Co., CA) **56** *Paraseptis adnixa*, male (Langley, BC) **57** *Viridiseptis marina*, male (San Diego Co., CA) **58** *Viridiseptis marina*, male (San Diego Co., CA).



**Figures 59–65.** *Aseptis* male genitalia. **59** *Aseptis fumicola* **60** *Aseptis eibnica* **61** *Aseptis murina* **62** *Aseptis ferruginea* **63** *Aseptis fanatica* **64** *Aseptis lichena* **65** *Aseptis pseudolichena*.

vesica is average in size for the genus with a single long apical cornutus and two small diverticula located at the base and mid-portion. The female bursa is 1.3× as long as wide, has distinct signa, and a short slightly bent appendix bursae with a crenulate shape.

Most specimens of *A. binotata* can be recognized, despite the variation in this species, by their brownish color and pale postreniform patch. They are most likely to be confused with *Paraseptis adnixa*, which occurs with it in the Pacific Coast states. The basal dash of *A. binotata* is short, not reaching the antemedial line, whereas that of *P. adnixa* extends to the antemedial line. Structurally, the male vesica of *P. adnixa* is coiled and lacks a large apical cornutus, and the female ductus bursae has a sclerotized plate in its posterior wall, unlike those of *Aseptis*.

**Distribution and biology.** This species is widespread in western North America west of south-central Alberta, Wyoming, and Nebraska. Along the Pacific Coast it occurs from northern Mexico to south-central British Columbia. It can be found from sea level to altitudes over 2000 m in a variety of habitats from dense forest to shrub desert. In the south the flight begins in March at low elevations and in April to July in the mountains. In the north the flight begins later and lasts into August. The larva is green with a white and red lateral stripe. It feeds on numerous woody shrubs, including *Ribes* spp. (Grossulariaceae), *Oemleria cerasiformis* (Torr. & Gray ex Hook. & Arn.) (Rosaceae), *Salix* spp. (Salicaceae), *Acer* spp. (Aceraceae), and *Symphoricarpos* spp. (Caprifoliaceae) (Miller and Hammond 2000, Miller and Hammond 2003). Hampson (1908) mentions *Adenostoma fasciculatum* Hook. & Arn. (Rosaceae) as a foodplant and Crabtree and Leuschner (2000) found larvae on *Prunus emarginata* (Douglas ex Hook.) D. Dietr., *P. virginiana* (L.) var. *demissa* (Nutt.) Torr., and *P. subcordata* Benth. (Rosaceae).

**Discussion.** Despite the superficial variability of *A. binotata* the male and female genitalia and CO1 barcodes of this species are remarkably uniform. Barcodes from parts of its northern distribution differ by circa 1% from other populations but there is almost no variation elsewhere, including the reddish forms in the Southwest or the variable California populations. We do not advocate the use of subspecies in *A. binotata* because the variation is clinal and because of significant variation in color within populations.

The species name *genitrix* has often been misspelled as “*genetrix*”.

### *Aseptis catalina* (Smith, 1899)

Figs 35, 36, 67, 84

*Hadena catalina* Smith, 1899: 261.

**Type material.** *Hadena catalina*: **Lectotype** [USNM, examined]. Type locality: Catalina Springs, Arizona.

**Diagnosis.** An average or slightly smaller than average *Aseptis* species, wingspan 31.8±0.9 mm (n=25; range 30–33 mm), with a powdery pale yellow-tan forewing

with patchy contrasting darker gray markings including the filling of the reniform spot and the adjacent medial area. The postreniform patch is large but only slightly lighter in color than the fold portion of the medial area and the filling of the lines. The basal and postmedial areas are darker. The reniform spot is large and it and the claviform spot are filled with dark gray. The antemedial and postmedial lines are black, filled with pale cream and the postmedial line is often followed by black and white dots on the veins. The subterminal area is pale cream, the terminal line is a series of black spots and the fringe is checkered. There is some variation in the color and tone of the ground color, which can be very pale cream or more tan colored. Although the pattern is complete, the maculation is usually indistinct.

The male genitalia are similar to those of *A. binotata* but the valve lacks the digitus, the ampulla of the clasper is thicker and is oriented parallel to the dorsal valve margin, and the dorsal apex of the cucullus is pointed slightly. The aedeagus and vesica are like those of *A. binotata* except for the presence of a granulose area on the ventral apex of the aedeagus. In the female, the corpus bursae is oblong, circa 2.4× as long as wide, with a curved appendix bursae of nearly the same size. The papillae anales are unique in the genus in that they are covered by sparse short needle-like setae with brush-like very dense basal setae condensed into patches on the ventral sides.

*Aseptis catalina* can be recognized by its patchy pale-tan and gray forewing and is unlikely to be confused with other *Aseptis*; however, they resemble superficially *Tridepia nova* (Smith) and *Scotogramma densa* Smith, both in the Hadenini, and are often mixed with them in collections. It is easily separated from them by the eyes, naked in *Aseptis*, but covered in fine hairs in the two hadenines, as well as by the lack of a notched hindwing in these species.

**Distribution and biology.** This species occurs in deserts of Arizona, California and Baja California, Mexico. Most specimens are from the western edge of the Colorado Desert in San Diego, Imperial, and Riverside counties, California, but there are colonies throughout the Colorado, Mojave, and Sonora deserts. Like many desert insects, the flight period depends on winter rainfall and is early, generally early March to April. The food plants and immature stages are unknown.

***Aseptis serrula* (Barnes & McDunnough, 1918)**

Figs 37, 38, 68, 85

*Trachea serrula* Barnes & McDunnough, 1918: 104.

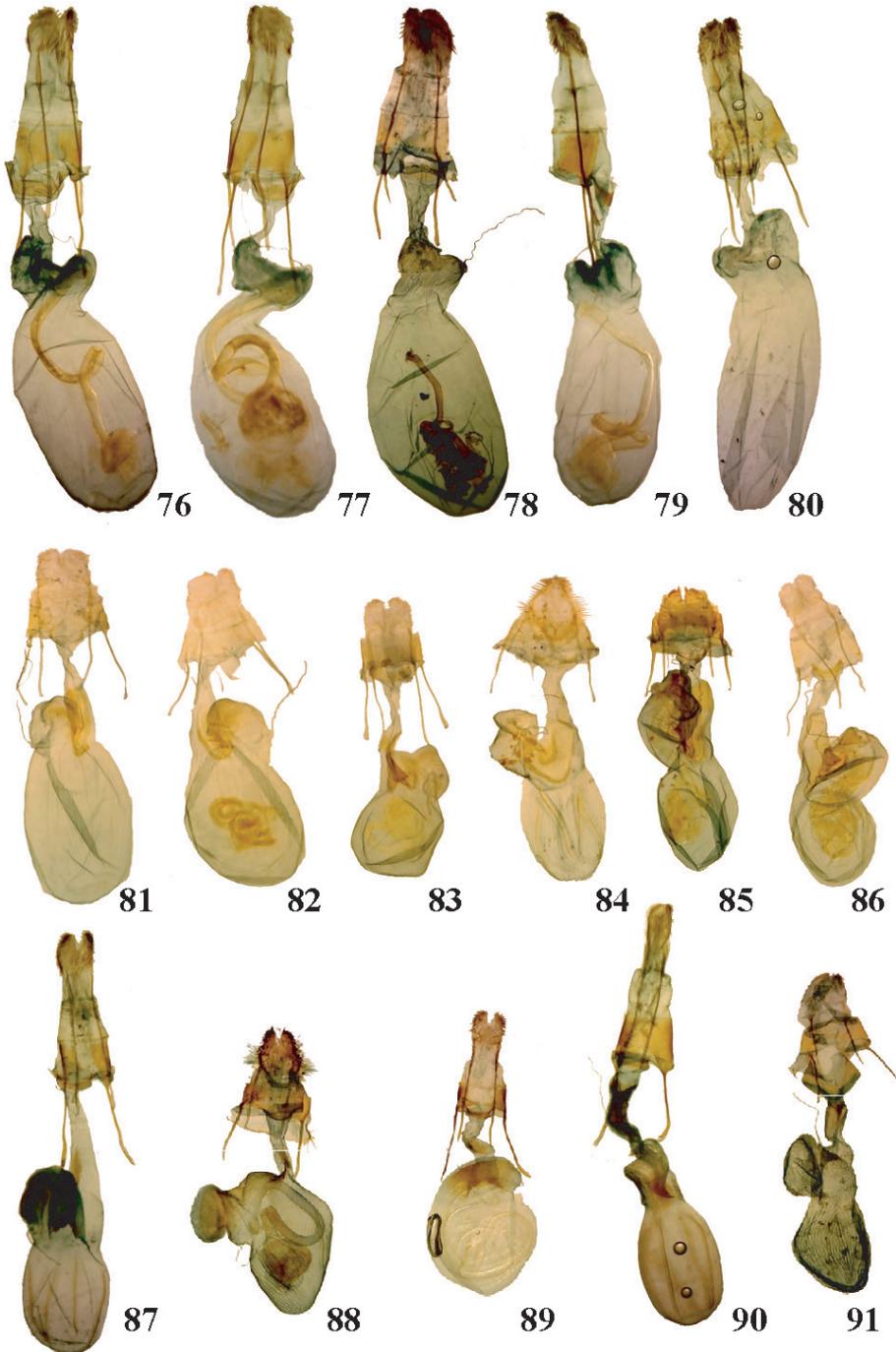
**Type material.** **Holotype** male [USNM, examined]. Type locality: Palm Springs, Riverside County, California.

**Diagnosis.** This below-average-sized *Aseptis*, wingspan 31.7±1.2 mm (n=19; range 29–34), is the only one with a serrate male antenna. The forewing is relatively narrow, powdery gray, with the pointed black claviform spot as the most prominent mark. The dark reniform and orbicular spots are less prominent, the basal, antemedial, and postmedial lines



**Figures 66–75.** *Aseptis*, *Paraseptis*, and *Viridiseptis* male genitalia. **66** *Aseptis binotata* **67** *Aseptis catalina*  
**68** *Aseptis serrula* **69** *Aseptis torreyana* **70** *Aseptis susquesa* **71** *Aseptis fumosa* **72** *Aseptis perfumosa* **73** *Aseptis*  
*characta* **74** *Paraseptis adnixa* **75** *Viridiseptis marina*.

are faint or absent, and the subterminal line is often evident as a pale W-mark on veins M3 and CuA1. The postreniform patch is relatively small, and the medial area is often lighter than the ground color near the claviform spot. The hindwing is off-white with dark veins and terminal area in males and darker gray with light base and dark veins in females.



**Figures 76–91.** *Aseptis*, *Paraseptis*, and *Viridiseptis* female genitalia. **76** *Aseptis fumeola* **77** *Aseptis ethnica* **78** *Aseptis murina* **79** *Aseptis ferruginea* **80** *Aseptis fanatica* **81** *Aseptis lichena* **82** *Aseptis pseudolichena* **83** *Aseptis binotata* **84** *Aseptis catalina* **85** *Aseptis serrula* **86** *Aseptis susquesa* **87** *Aseptis fumosa* **88** *Aseptis perfumosa* **89** *Aseptis characta* **90** *Paraseptis adnixa* **91** *Viridiseptis marina*.

The male uncus is unique in that the subbasal segment is expanded and dorsoventrally flattened to an elongate rhomboid shape with a slight constriction at the end of the swollen segment. The valve is most similar to those of *A. catalina* and *A. torreyana*, with a gently-curving S-shape, a curved ampulla of the clasper that is directed distally, a narrow pointed digitus, and a slightly pointed cucullus. The vesica is like that of *A. binotata*. In the female, the papillae anales are unique in being covered dorsally by short scales with a rugose medial margin. The bursa copulatrix is nearly round with strong signa and the appendix bursae is as long as the corpus bursae and curved leftward and dorsad from its origin.

Males of *A. serrula* are distinguished easily by the serrate antenna, filiform in other *Aseptis*. Females are readily identified by their unique papillae anales. Many gray desert noctuids resemble *A. serrula*, including several species of Hadenini with which it is often confused. Differences between *Aseptis* and hadenines are described under *A. catalina*.

**Distribution and biology.** This is a species of the lower mountain-desert transition zone and high desert and has been collected in the Mojave, Colorado, and Sonora deserts of southeastern California, Nevada, Arizona, and Baja California. It flies during the desert spring, between March and early May depending on winter rainfall. Its host plants and immature stages are unknown.

### *Aseptis torreyana* Mustelin, 2006

Figs 39, 69

*Aseptis torreyana* Mustelin, 2006: 29.

**Type material. Holotype** male [SDNHM, examined]. Type locality: Torrey Pines State Reserve, La Jolla, California.

**Diagnosis.** This is the smallest and rarest *Aseptis* (wingspan 27.5 mm). It has a pale buff forewing overlaid with pale gray scales and marked with black basal dash and outlines of the three spots. The reniform spot is the largest and is filled with dark scales. The pale postmedial line is barely visible while the antemedial line is missing. The strong black basal dash gives the impression of a small pale *P. adnixa*.

Males of *A. torreyana* have a narrow S-shaped valve with an ampulla of the clasper that is oriented toward the apex of the valve, a small digitus that arises near the ventral attachment of the clasper and is oriented perpendicular to the valve, and a small rounded cucullus. The aedeagus and vesica resemble those of *A. binotata*. The female is unknown.

This species is unlikely to be confused with any other *Aseptis* because of its small size and isolated habitat. It resembles a pale *A. serrula*, although the markings of *A. torreyana* are more distinct. The male antenna of *A. torreyana* is filiform rather than serrate. *Aseptis torreyana* is also reminiscent of *Aseptis characta* (Grote) but is easily distinguished from it by the present of a digitus on the male valve.

**Distribution and biology.** This species is known only from the south side of the sea level salt marsh estuary of the Torrey Pines State Reserve. The habitat is most likely

salt marsh, although it could be coastal chaparral. The capture date of April 21 is in line with the spring flight period of most *Aseptis* species in southern California. The foodplant is unknown.

**Discussion.** *Aseptis torreyana* is enigmatic because of its rarity. It was discovered in a small isolated coastal chaparral remnant bordering the salt marsh within Torrey Pines State Reserve, San Diego, California. Only two males were ever found, both at this locality on the same night, despite a two-year moth survey by Norris Bloomfield and the senior author. The latter also ran a blacklight nearly every night for five years at the rim of the Peñasquitos Canyon, which runs into the same estuary 5 miles east of the type locality without finding additional specimens. Similarly, none were found at the nearby Miramar Air Station that was surveyed extensively for Lepidoptera for years with same traps (Brown and Bash 2000). Taken together, it appears that *Aseptis torreyana* is very local, perhaps tied to a food plant in the salt marsh. Another example of such a restricted species is *Orthomoia bloomfieldi* Mustelin that was described from 30 specimens from a single locality during the Miramar study.

***Aseptis susquesa* (Smith, 1908)**

Figs 40–42, 70, 86

*Hadena susquesa* Smith, 1908: 116.

*Trachea monica* Barnes & McDunnough, 1918: 104, **syn. n.**

**Type material.** *Hadena susquesa*: **Lectotype** male designated by Todd (1982) [AMNH, examined]. Type locality: Claremont, California. *Trachea monica*: **Holotype** male [USNM, examined]

**Diagnosis.** This is a slender-winged small to medium-sized *Aseptis*, wingspan  $31.4 \pm 1.2$  mm ( $n=25$ ). It is readily recognized by its streaky medium-gray to dark-brown gray forewing with streaks of warm light orange tan to yellow tan at the postreniform patch, in the fold, and in the large pointed claviform spot. A thin tan line parallels the margin near the anal angle. The reniform and orbicular spots are outlined in black with paler peripheral and darker central scaling. The distal forewing is streaky due to black veins and pale-gray scales abutting R5, M1, M3, and CuA1. The transverse lines are obsolete. The hindwing is light whitish gray with brown-gray marginal shading and dark veins, darker in females. *Aseptis susquesa* from coastal California tend to be rustier than those from inland locations.

The male valve of *A. susquesa* is similar to that of *A. binotata*, although the cucullus is larger. The uncus is thin, the valve has an upright ampulla, the oblique digitus is long and pointed, and the cucullus is approximately 1.5× as wide as the valve and slightly pointed. The vesica has two small diverticula and a single apical cornutus. The female genitalia has a papilla analis covered by similar-length needle-like setae and sparse hair-like basal setae; the corpus bursae is relatively small and short, 1.25× as long as wide, with a similar sized appendix bursae that is laterally compressed and asymmetrically bulging ventrally.

No other *Aseptis* is streaked gray with patches of light orange or rusty color. *Aseptis susquesa* is most similar to *A. serrula* and flies with it. It is similar gray but has light color restricted to a small postreniform patch. Males of these species are easily distinguished by their antennae

**Distribution and biology.** *Aseptis susquesa* is known from Arizona, California, and Baja California, Mexico, at least as far south as Ensenada. Most records of the rusty coastal form are from San Diego, Riverside, and Los Angeles counties, California, where it inhabits coastal chaparral and canyons from late March to early June. The grayer inland form is found in the Mojave and Colorado deserts of southern California and in the Sonora Desert of Arizona. *Aseptis susquesa* prefers rocky areas in the mountain-desert transition zone and high desert. The larva is dark green marked with white and feeds on *Artemisia californica* Less. (Asteraceae) (unpublished) and *Ericameria laricifolia* (A. Gray) Shinners (Asteraceae) (Crumb 1956).

**Discussion.** In their original description of *Trachea monica* from Redington, Arizona, Barnes and McDunnough (1918) pointed out that it is similar to *Hadena susquesa*, described previously from Claremont, California, and might be a gray inland form of it. In support of that notion, the lectotype of *Hadena susquesa* is rather gray whereas some desert specimens from farther inland have considerable rusty brown demonstrating variability and overlap. The male genitalia of these forms are virtually uniform throughout the range. The CO1 barcodes, including specimens typical of coastal and inland forms, vary by less than 0.8%. For these reasons, we treat *Trachea monica* Barnes & McDunnough as a junior subjective synonym of *Hadena susquesa* Smith.

### *Aseptis fumosa* (Grote, 1879)

Figs 43, 44, 71, 87

*Hadena fumosa* Grote, 1879: 205.

**Type material. Holotype female** [BMNH, photograph examined]. Type Locality: Colorado.

**Diagnosis.** A medium-sized *Aseptis*, wingspan  $34.9 \pm 1.5$  mm (n=25; range 31.5–38 mm) with a very dark forewing and whitish hindwing with black veins in males and darker gray hindwing in females. The forewing is uniform smoky dark blackish brown with brown filling of the antemedial and postmedial lines that is most evident as dots on the costa. The weakly figure-eight shaped reniform spot, orbicular spot, and short claviform spot are black filled with ground color or slightly darker scales. The male hindwing is pearly gray distal to the spot that accentuates the vein asymmetry. The hindwing of the female is smoky dark with dark but less conspicuous veins.

The male genitalia of *A. fumosa* are unique in several respects. The valve extends nearly 90° lateral from its support and is a simple strap with a narrow base, very weak sacculus, convex ventral mid-portion, and undifferentiated cucullus; the clasper is near the base with a short straight ampulla parallel to the costa, and the digitus is absent.

The uncus is thin and cylindrical. The penicillus is weak with a pointed dorsal margin. The vesica is similar to that of *A. binotata* but bears an additional thick-based thorn-like mesial cornutus.

The female has a papilla analis covered with short needle-like setae and sparse basal hairs. The corpus bursae is fairly short, 1.5× as long as wide, with strong signa and the appendix bursae is box shaped and laterally compressed.

*Aseptis fumosa* males are distinctive due to the combination of blackish forewing and white hindwing with dark veins. Despite this, *A. fumosa* is often confused with *A. perfumosa* in collections. Females of both species have dark hindwings and are less easily separated. *Aseptis fumosa* is usually larger with a broader forewing and its spots, especially the claviform spot, are less prominent than in *A. perfumosa*. *Aseptis fumosa* females can also be confused with dark species in the *Aseptis fumeola* species group such as *A. ethnica* and *A. fanatica*. The shapes of the bursae are distinctive. The blunt rounded appendix bursae of *A. fumosa* distinguishes it from all of the look-alikes.

**Distribution and biology.** *Aseptis fumosa* is widespread in western North America and is known from western Canada, Washington, Nebraska, Colorado, Utah, Arizona, Nevada and California. It occurs in a variety of diverse habitats including coast chaparral, dry conifer forest, and shrub steppe; it is not found in mesic forests. The flight begins in April or May and lasts to July. The larva is smooth green with a white subdorsal stripe and broad red and white lateral stripe (Miller and Hammond 2003). It has been reared on *Purshia tridentata* (Pursh) DC., *Cercocarpus* sp. and *Adenostoma fasciculatum* Hook. & Arn. (all Rosaceae) (Crumb 1956, Crabo et al. 2012). At higher altitudes in the Cascades and in southwestern Oregon it feeds on *Ceanothus integerrimus* Hook. & Arn. (Rhamnaceae) (Miller and Hammond 2000).

**Discussion.** The simple valve of *A. fumosa* is similar to that of *A. characta*. Both of them also have multiple cornuti on the vesica. Although these derived states of the valve suggest a close relationship, their female bursae differ in shape and that of *A. characta* lacks signa.

### *Aseptis perfumosa* (Hampson)

Figs 45, 46, 72, 88

*Trachea perfumosa* Hampson, 1918: 131.

**Taxonomy.** The type material of *Trachea perfumosa* Hampson, the holotype female and two paratype females, was originally part of the type series of *Trachea fumeola* Hampson 1908. In fact, the female later selected as the *T. perfumosa* holotype was depicted on plate 112 as *T. fumeola*. The male and females were described in separate paragraphs and the male was selected as the type of *T. fumeola*. Hampson later realized that these females and the male type were separate species, naming the females *Trachea perfumosa* Hampson, 1918. The 1918 work lacks a description—initially leading us to suspect that *Trachea perfumosa* is a nomen nudum—but instead references the female

*T. fumeola* description and illustration in the earlier work. This indication thereby validates the name.

**Type material. Holotype:** female [BMNH, photograph examined]. Type locality: USA, California.

**Diagnosis.** This is a small dark *Aseptis* with a wingspan of  $32.7 \pm 1.2$  mm ( $n=25$ ; range 30.5–34.5 mm). The body appears short and stout and the wings short and stubby. The forewing is slightly mottled dark gray brown, almost black in some specimens, often with a few grayish, brownish, olive, or reddish scales in the medial area around the velvety black spots of which the acute claviform spot is usually the most prominent. Less conspicuous forewing markings include a short black basal dash, incomplete faint wavy basal, antemedial and postmedial lines filled with brown, and irregular complete brown subterminal line. The hindwing of both sexes is dark grayish brown with inconspicuous veins.

Males of *A. perfumosa* are separated easily from all other species of *Aseptis* by the short spike-like digitus that arises near the ventral margin and is perpendicular to it. The 90° basal bend of the vesica and basally-constricted medial diverticulum are also diagnostic. Females are identified by the thin flange on the tip of each papilla analis and by the bilobed appendix bursae.

Superficially, *A. perfumosa* is most similar to *A. fumosa*. *Aseptis perfumosa* tends to be smaller and narrower winged than *A. fumosa*. Males are separated easily by hindwing color, dark in *A. perfumosa* and pale in *A. fumosa*. Females can often be separated based the maculation as the claviform spot is usually the most prominent feature on *A. perfumosa*, whereas the postmedial line is clearer in *A. fumosa*. The correct identity can be confirmed by examining the tips of the ovipositors under magnification.

**Distribution and biology.** *Aseptis perfumosa* is endemic to southern California where it occurs in many habitats such as coastal chaparral and canyons, urban areas, brush land, and open oak forest from sea level to 2000 m. It is often very common and can be the most abundant noctuid species. The peak of its flight is early April to early June in coastal areas and a little later at higher elevations. The larva and pupa are described and figured by Comstock (1940b). The green larvae were found and reared on Manzanita (*Arctostaphylos* spp.).

**Discussion.** Hampson (1918) gives the expanse of the type of *Trachea perfumosa* as 36 mm. This is larger than any *A. perfumosa* specimens examined by us. This led us initially to question whether he might have described a female of the larger species *A. fumeola* rather than *A. perfumosa*, given that the latter species was named from a specimen in the type series of the former species. While enquiring about the types at the BMNH, Alberto Zilli (pers. comm. 2015) explained that Hampson's wingspans are almost always greater than those of the actual moth because of his method of measurement. He measured from the pin to the apex of the forewing and doubled the result. While the actual wingspan of the female type of *Trachea perfumosa* is 33.5 mm, a normal size for the species, the result using Hampson's method yields the published result of 36 mm.

***Aseptis characta* (Grote, 1880)**

Figs 47–52, 73, 89

*Hadena characta* Grote, 1880: 243.*Hadena luteocinerea* Smith, 1900: 468.*Hadena erica* Smith, 1905: 258.*Hadena pluraloides* McDunnough, 1922: 237.

**Type material.** *Hadena characta*: **Holotype** female [BMNH, photograph examined]. Type locality: Nevada. *Hadena luteocinerea*: **Holotype** male [USNM, examined]. Type Locality: Montana. *Hadena erica*: **Lectotype** male designated by Todd (1982) [AMNH, examined]. Type Locality: Stockton, Utah. *Hadena pluraloides*: **Holotype** female [CNC, examined]. Type Locality: Lethbridge, Alberta.

**Diagnosis.** This is a narrow-winged smaller *Aseptis*, wingspan  $32.0 \pm 1.2$  mm ( $n=25$ ; range 29.5–35 mm), with complete forewing pattern of typical lines and spots. The forewing is ash gray to pale tan, often darker gray in the medial area and with variable olive-gray, tan, or orange-tan patches. The basal, antemedial and postmedial lines are double, dark gray filled with pale gray. The postmedial area is lighter with a shade preceding the pale subterminal line and a number of black wedges between the veins. The three spots are outlined in black and are filled with the ground color and, except the claviform spot, peripheral lighter gray scales. The hindwing is gray, pale gray, or white with dark discal spot, veins, and terminal line, darker in females.

*Aseptis characta* is geographically variable, appearing slightly different in each region. In extreme southern California it is relatively smooth gray with a white hindwing (Fig. 47), becoming more powdery with a gray hindwing in Los Angeles and San Bernardino counties and more mottled in the Sierra Nevada. In the Pacific Northwest it is usually darker gray with variable subtle olive or brown shades on the forewing and a fuscous hindwing (Figs 49 and 51), although populations from the Blue Mountains of Washington and Oregon resemble those from the Sierra Nevada. On the Great Plains *A. characta* is lighter, often pale tan with a warm orange cast (Fig. 50).

The male valve is strap-like with a slight S-shape, with a very weak sacculus, slightly expanded cucullus with a rounded apex, rod-like straight ampulla oriented parallel to the costa, and no digitus. The vesica is similar to that of *A. binotata* but has one or two additional spine-like cornuti on its mid-portion. The female has a papilla analis covered densely with short needle-like setae and sparse basal hairs, a rounded corpus bursae lacking signa, and a short appendix bursae that barely changes the outline of the bursa.

*Aseptis characta* can be identified by its small size, mottled gray forewing, and complete pattern of lines and spots. The male is the only *Aseptis* with two or three slender cornuti on the vesica and the female is the only one with an immaculate corpus bursae and weak appendix bursae. This species is similar to several species of *Lacinipolia* McDunnough in the Eriopygini, especially *Lacinipolia pensilis* (Grote), and is often

intermixed with them in collections. They can be distinguished by the hindwing notch of *Aseptis* and minute hairs on the eyes of *Lacinopolia*.

**Distribution and biology.** *Aseptis characta* is widespread in western North America in the western Great Plains, Great Basin, and Pacific regions from British Columbia, Alberta, and Saskatchewan to Colorado, Utah, northern Arizona and southern California. It does not occur on the immediate Pacific Coast north of central California. It flies in dry habitats like sagebrush steppe, juniper woodlands, and open forest from sea level to 2500 m and is often common. In southern California it is most often found on the dry side of the mountain ranges, in the mountain-desert transition zone, and in the deserts. Emergence is earliest in xeric habitats, usually April in California and mid-May in the Pacific Northwest. The flight lasts until July to August depending on locality. The striped gray-green and white larva has been found feeding on *Artemisia* spp. (Asteraceae) (Comstock 1955, Crumb 1956).

**Discussion.** Similarities between the male genitalia of this species and *A. fumosa* are noted under the latter species. The female corpus bursae lacking signa and shallow appendix bursae of *A. characta* are unique.

Given the geographic variability of *A. characta* it is almost surprising that not more names have been given to the various forms. *Hadena erica* Smith was based on specimens from Utah which are bluish ash gray with patches of paler gray and an ochreous tinge on the basal and distal wing similar to Fig. 48. The light orange-tan Great Plains populations were described twice, as *Hadena luteocinerea* Smith from Montana and *Hadena pluraloides* McDunnough from Alberta; both are similar to Fig. 50. The latter name denotes the resemblance to *Euxoa pluralis* (Grote). *Aseptis characta* has a nearly continuous distribution within its range and the different forms are not well enough separated to warrant the use of subspecies.

In contrast to the variation in habitus of this species, the genitalia are uniform. Similarly, the variation of CO1 barcode sequences is small despite a large number of samples (n=67) from throughout its distribution. Multiple slightly different haplotypes cluster within a total range of less than 1%.

### **Genus *Paraseptis* gen. n.**

<http://zoobank.org/E3418CA4-70AB-4F26-8EE6-ED770970B171>

**Type species.** *Hadena adnixa* Grote.

**Etymology.** The name *Paraseptis* is derived from *para* meaning next to and *septis* by analogy to *Aseptis*. The name is feminine.

**Diagnosis.** *Paraseptis* is a monotypic genus whose sole member occurs near the Pacific Coast of North America. It is mottled brown with typical noctuid wing markings, including a basal dash and dark wedges near the outer margin, and a pale off-white to ochre postreniform patch. The outer edge of the hindwing is concave focally between M1 and M3 as in *Aseptis* and *Viridisepis*. The male genitalia resemble those of *Aseptis* but differ as follows: the valve has a much larger sacculus that extends above

the costal margin, a twisted upright ampulla, a rod-like digitus arising near the base of the cucullus from a longitudinal bar near the costa; a long curved aedeagus with distal spine patches of small spines; and a coiled vesica with basal and medial cornuti, but no long apical cornutus (occasional specimens with a minute apical cornutus). The female genitalia are also similar to those of *Aseptis* but differ in having more narrow papillae anales and a strongly sclerotized posterior ductus bursae. CO1 DNA barcodes of *Paraseptis* are not similar to those of *Aseptis* and cluster variably with other genera in the Xylenini when representatives from a large number of species are included in the sample set.

**Description. Adults: Head:** Eye rounded, normal sized. Antenna filiform in both sexes. Labial palpus unmodified with longer second segment and short third segment. Frons slightly convex, smooth. *Thorax:* Paired moderate-sized dorsal mesothoracic and smaller metathoracic tufts. Legs without tibial spines; tarsal segments with three rows of short spine-like setae. **Abdomen:** Male with coremata at base of abdomen, complete with lever, pocket, and Stobbe's gland; proximal segments with weak dorsal tufts. **Forewing:** Venation as typical for subfamily, approximately 0.6× as wide as long, with brownish, black, and off-white scales, appearing mottled brown with black typical noctuid markings including a basal dash. **Hindwing:** Venation trifine as typical for subfamily, M2 weak but usually visible, clustered close to M3 and CuA1; outer margin contour concave between veins M1 and M3. **Male genitalia** (Fig. 74): Tegumen narrow near base of uncus; penicillus large, quadrate. Uncus smoothly downcurved, narrow, tapering smoothly from base to acute tip. Juxta rectangular, circa 2/3× as wide as long. Valve weakly S-shaped, tapered from base to mid-portion then even in width to base of cucullus; sacculus strong, moderately sclerotized, 0.4× valve length and 2× valve width at base of ampulla, extending above costa; cucullus weakly constricted at base and expanded to 1.5–1.7× valve width, slightly rounded with blunt apex, corona of circa 30 claw-like setae; clasper on mesial third, ampulla oriented perpendicular to valve and extending above costa, rod-like with slightly twist to mediolaterally flattened tip; digitus at distal end of an evenly-thick sclerotized ridge located slightly below costa from clasper to digitus origin near cucullus base, rod-like with blunt tip, oriented 45° to valve, ending near ventral cucullus. Aedeagus narrower and more robustly sclerotized than in *Aseptis*, 7× as long as wide, distal half bent ventrad approximately 60°, small patches of small spines near dorsal and ventral apex; vesica slightly wider than aedeagus, coiled 360° to right and ventrad to end posterior, ventrad, and left of aedeagus tip, with subbasal patch of short cornuti on right, single spike-like diverticulum perpendicular to axis on anterior distal third, minute spike-like cornutus directed basad at apex in a few specimens, and very small dome-like mesial diverticulum. **Female genitalia** (Fig. 90): Papillae anales weakly sclerotized, asymmetrically cone-shaped with point near dorsum, circa 1.7× as long as wide, covered posteriorly and apically with short thin setae that are slightly shorter near tip, lacking hair-like basal setae; apophyses moderately long, posterior apophysis 1.7× anterior apophysis; ostium bursae membranous except for thin weak band in ventral wall; ductus bursae tubular, 1× corpus bursae length, proximal 2/3 sclerotized with longitudinal ridge in dorsum,

distal 1/3 membranous; corpus bursae ovoid, 0.75× as wide as long, with four long signa evenly spaced on anterior, posterior, and lateral sides; appendix bursae arising from right paramedial ventral posterior corpus bursae, moderately sclerotized, rugose, 0.75× corpus bursae length, conical with 45–60° rightward bend to end ventral to, or slightly to right and ventral to, distal ductus bursae, with ductus seminalis near apex.

**Discussion.** The structural differences of *Paraseptis* and *Aseptis* are surprising given the nearly identical habitus of *P. adnixa* and *A. binotata*, which are often mixed in collections.

Several similar features of *Paraseptis* and *Aseptis*, including the hindwing shape and superficial resemblance, suggest that these genera are related closely. The hindwing shape is rare in other genera in the Xylenini. It is a prominent feature of the Eurasian monotypic genus *Atypha* Hübner. The male genitalia of *Atypha pulmonaris* (Esper), illustrated by Fibiger and Hacker (2007), are similar to those of *A. fumosa* and *A. characta* in having a simple valve, horizontal ampulla, and no digitus, suggesting that these three genera might share a common ancestor.

***Paraseptis adnixa* (Grote, 1880), comb. n.**

Figs 53–56, 74, 90

*Hadena adnixa* Grote, 1880: 243.

*Hadena pausis* Smith, 1899: 262, **syn. n.**

**Type material.** *Hadena adnixa*: **holotype** male [BMNH, photograph examined]. Type locality: Nevada. *Hadena pausis*: **lectotype** male designated by Todd (1982) [USNM, examined]. Type locality: Los Angeles County, California.

**Diagnosis.** A medium-sized noctuid, wingspan 34.9±1.3 mm (n=25; range 32–37.5 mm), that resembles strongly a narrow-winged *A. binotata* in color and pattern. It is gray brown, has a full complement of dark lines and spots and a pale postreniform patch, and has a streaky hindwing with dark veins. The basal dash is thicker black than that of *A. binotata* and extends fully to the antemedial line. Black wedges on the wing distal to the lower cell and in the fold are also more prominent in *P. adnixa*. In the Pacific Northwest, *P. adnixa* is typically patchy brown, often with a reddish tint, with a large pale ochre postreniform patch and contrasting black markings (Fig. 56). In most of California, it tends to be paler and less well marked with a speckled gray-brown or brown-gray forewing, less conspicuous postreniform patch and black marks, and slightly lighter hindwing. This form is even more similar to *A. binotata* from the same region (Figs 53, 54). In the vicinity of Mono Lake in east-central California, *P. adnixa* is powdery pale gray with red-brown basal and postmedial areas, an off-white postreniform patch, and more dark streaks on the distal wing (Fig. 55).

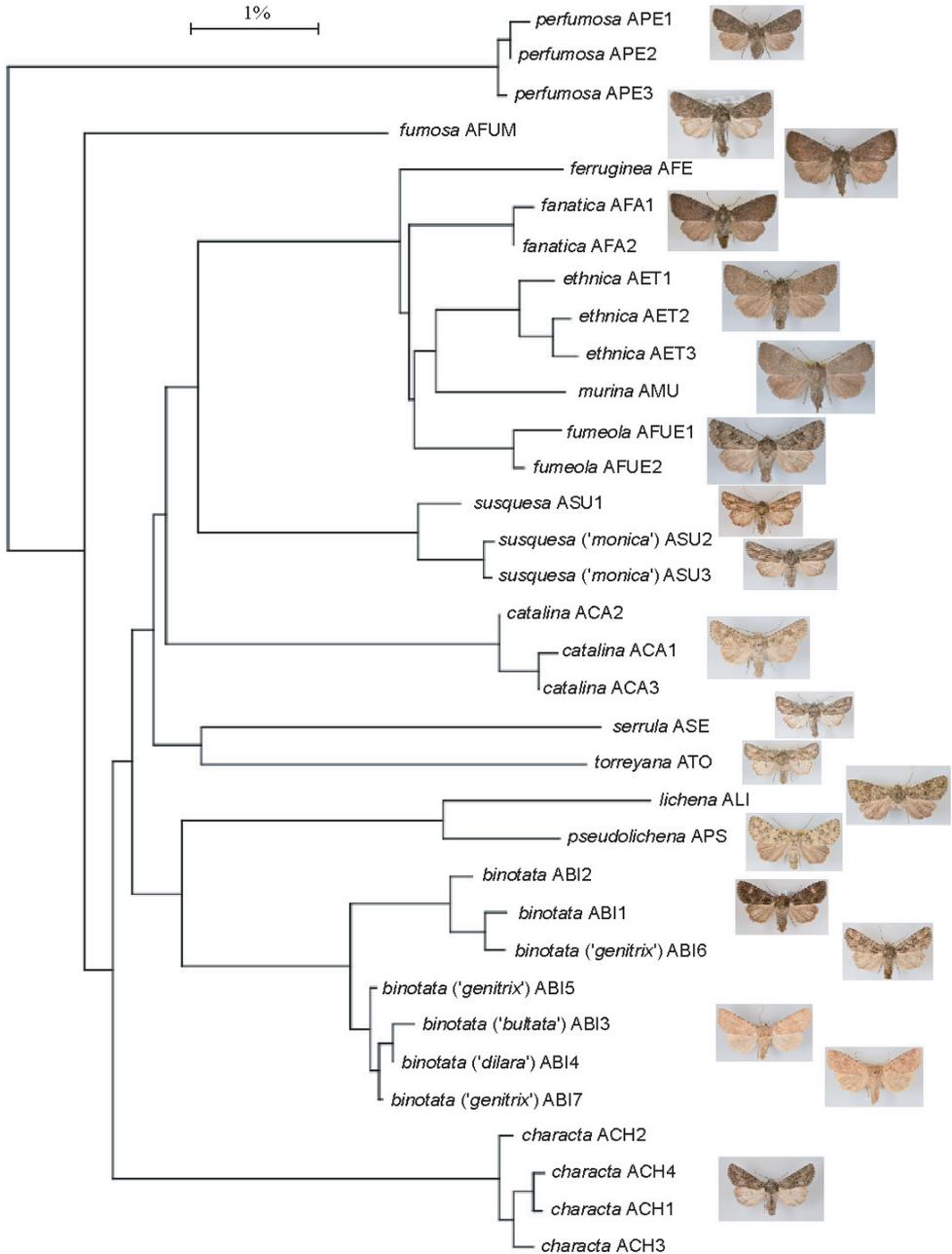
Differences in genitalia between *Paraseptis* and *Aseptis* are described under the *Paraseptis* genus description. *Paraseptis adnixa* can usually be identified without dissection

by the combination of notched hindwing, brown forewing with pale postreniform patch, and long basal dash.

The CO1 barcodes of *Paraseptis* based on 59 samples from British Columbia to southern California demonstrate six major haplotype clusters separated by at least 0.5% (Fig. 92). Of these, three clusters separated by at least 1.8% (PAD4, PAD5, PAD6) are from California west of the Sierra Nevada divide. The other two are more divergent: two from southwestern British Columbia (PAD1+PAD3) and a single Washington specimen, and the other from near Mono Lake, California (PAD2). The BC/WA cluster differs by at least 2.6% from the Mono cluster and 2.5% from the CA cluster, and the Mono and CA clusters differ by at least 2.8%. Interestingly, the three most divergent clusters (BC/WA, Mono, and CA) correlate with the geographic variation described above. Although the alignment of barcode haplotypes and phenotypes could suggest the presence of more than one species, no consistent male or female genitalia differences were found to suggest the presence of more than a single species, and all male genitalia match those of the lectotype of *Hadena pausis* at USNM (slide #54). We therefore conclude that *Hadena pausis* Smith is a junior subjective synonym of *Hadena adnixa* Grote.

**Distribution and biology.** This species is widely distributed along the Pacific Coast from northern Mexico to southwestern British Columbia. It is found mostly west of the divides of the Sierra Nevada, Cascades, and British Columbia Coast Mountains but there are at least three colonies east of these mountains: Inyo and Mono County, California; Klamath and Lake counties, Oregon; and interior British Columbia near Lillooet. *Paraseptis adnixa* is common in the Pacific Northwest, where it can be found in a variety of forested habitats. In southern California, it occurs in coastal chaparral and in oak and brush land in the foothills and mountains. The flight period is April to June in California and mid-May to August in the Pacific Northwest. The larva feeds on Indian plum (*Oemleria cerasiformis*) in the Rosaceae (Miller and Hammond 2000) and might be a specialist on it in parts of its range (including the Pacific Northwest). It has also been reported as feeding on *Prunus* (Rosaceae), which is the likely foodplant where the moth is found outside of the range of *Oemleria*, such as in interior British Columbia, south-central Oregon, and far-eastern California..

As described above, *P. adnixa* has three distinct populations based on superficial appearance and CO1 barcodes. Although there is little evidence to suggest more than a single species, we considered using subspecies to distinguish these forms. The Pacific Northwest populations are continuous to the border with California (Crabo et al. 2012) suggesting that a cline to the California form may exist in northern California. Until this is refuted it is best to consider these forms the ends of a north-south cline. By contrast, the eastern California populations near the border with Nevada are probably isolated. If distinguishing them with a subspecies epithet is desired the type locality of *Hadena adnixa* Grote should be restricted since the stated type locality, Nevada, could refer to Nevada or an unspecified site in eastern California (Lafontaine JD pers. comm. 2015).



**Figure 92.** Neighbor-joining CO1 tree of *Aseptis*. The letter and number code after each species is the haplotype identifier as indicated in Table 1. An illustrative specimen for each species is shown on the right hand side. For *binotata* and *susquesa*, the geographical forms are also shown.

**Genus *Viridiseptis* gen. n.**

<http://zoobank.org/35396DDB-5784-4ACB-B5F9-821760B83BAF>

**Type species.** *Hadena marina* Grote, 1874.

**Etymology.** The name is derived from *viridis* meaning green and *septis* by analogy to *Aseptis* and *Paraseptis*. The name is feminine.

**Diagnosis.** *Viridiseptis* is a monotypic genus whose only member is found in California and adjacent Oregon. It is a stout small to medium-sized moth with a powdery mottled-green forewing.

The genitalia differ greatly from those of *Aseptis* and *Paraseptis*. In the male the distal half of the uncus is broad, flat, and covered densely by short fine hairs; the valve has triangular process from the inner surface of the sacculus, lacks an ampulla, has a thick blunt digitus, and the distal end is rhomboid without a typical cucullus or corona. The females of these genera are also highly divergent. That of *Viridiseptis* has soft, pad-like ovipositor lobes, very short apophyses, a sclerotized plate in the ventral wall of the proximal ductus bursae, and a membranous corpus bursae lacking signa with a membranous appendix bursae arising perpendicularly from the wall of the posterior corpus bursae rather than as a sclerotized posterior extension of it.

**Description. Adult: Head:** Antenna filiform in both sexes. Frons smooth. Eye rounded, normal size, naked. Labial palpus unmodified, with moderately long second segment and short distal segment, reaching mid-eye. **Thorax:** Dorsal paired tufts on meso- and metathorax. Legs with tibiae lacking spiniform setae; tarsal segments with three rows of short spiniform setae on each segment. **Forewing:** Short and rounded, outer margin weakly scalloped, covered with olive-green, gray, black, and off-white scales, pattern of ordinary transverse lines, orbicular and reniform spots, but lacking distinct claviform spot and dashes. **Hindwing:** Venation typical of trifine noctuids with vein M2 weak, M2 closest to M1; outer margin contour weakly concave between veins M1 and M3, less prominent than in *Aseptis*. **Abdomen:** Base of male with paired hair-pencils, complete with levers and pockets. Weak dorsal scale tufts on proximal segments. **Male genitalia** (Fig. 75): Tegumen shape unmodified without narrower area near uncus; penicillus broad, rounded. Uncus base, narrow, cylindrical, distal two-thirds thicker and wider, roughly canoe shaped with proximal and distal tapered areas separated by even-width segment, dorsal distal portion and undersurface of tip covered densely with short hairs. Saccus of vinculum long and narrow. Juxta base broadly shield shaped, tapering to slight waist at junction with apical third, apical segment at base of aedeagus expanded to slightly wider than “waist” with raised sclerotized structure with slightly overhanging lateral edges and rounded tip. Valve narrow, 6× as long as narrow mesial section at end of sacculus, slightly curved dorsally; sacculus 0.4× as long as valve, reaching 2/3× to base of costa, with tooth-like triangular process on distal portion near ventral part of clasper; cucullus large, costal portion thick and apex and ventral portions thin, rhomboid with three points: right-angle point at dorsal base, slightly acute apex lacking a corona, and more rounded and obtuse ventral margin; clasper reduced to attachment on valve, ampulla absent; digitus arising at ventral cucullus from weak plate on ventral distal valve, stout, short, tooth-like or curved ventrad. Aedeagus 5× as long as

wide, distal third curved slightly ventrad, with abrupt reduction in caliber at mid-point from bull-nosed sclerotized ridge across ventral wall, a patch of distal striae with long extensions onto vesica and patch of small spines near ventral apex; vesica slightly shorter than aedeagus, bent nearly 90° ventrad and to right at base, then curved slightly leftward to end with tip ventrad to end of aedeagus, with moderate-sized basally-constricted diverticulum on posterior wall at 1/3 from base and smaller dome-shaped diverticulum on left wall at 2/3 from base, cornuti absent. **Female genitalia** (Fig. 91): Papilla analis broadly triangular with rounded tip, covered by hair-like posteriorly-directed setae that are shorter and more dense at tip; segment VIII and apophyses very short; median posterior 7<sup>th</sup> sternite concave at ostium bursae; ostium bursae broad, weakly sclerotized; ductus bursae cylindrical, 4× length of segment VIII, membranous with granulose sclerotized plate with thicker posterior portion forming a slight lip in ventral wall ¼ distance from ostium to corpus bursae; corpus bursae membranous without signa, pear shaped with narrow posterior and larger ovoid anterior portions, ~1.7× as long as ductus bursae; appendix bursae extending ventrad and slightly rightward perpendicular to corpus bursae from origin on posterior ventral wall of corpus bursae, membranous, ovoid, ~1/3 size of corpus bursae, with junction with ductus seminalis at left posterior base near corpus bursae.

**Discussion.** The higher classification of this genus is enigmatic. Although *Viridiseptis* clusters with genera in the tribe Xylenini by CO1 barcodes and its hindwing notch suggests an affinity to *Aseptis* and *Paraseptis*, absence other structural similarities between them and the biology of its larva suggest that the recent association with *Aseptis* is incorrect. The distal male valve of *Viridiseptis* bears some resemblance to other genera in the Xylenini such as *Sunira* Franclemont, but the valve differs greatly in other respects such as absence of the ampulla. A long twisted ampulla is one of the defining characters of the subtribe Xylenina (Fibiger and Lafontaine 2005). In addition, the larva of *Viridiseptis* feeds externally on forbs rather than woody plants, a defining character of the entire tribe Xylenini (op. cit.), further clouding the relationship. There is little evidence that *Viridiseptis* is related closely to *Oligia* Hübner where it had been placed (Franclemont and Todd 1983) prior to the most recent check list (Lafontaine and Schmidt 2010). For these reasons, the phylogenetic position of *Viridiseptis* in the Noctuinae is uncertain. We suggest that it be placed in the Xylenini (incertae sedis) section pending a more encompassing revision of the subfamily.

The ridge on the ventral male aedeagus and plate in the ventral wall of the female ductus bursae might be engaged during copulation.

***Viridiseptis marina* (Grote, 1874), comb n.**

Figs 57, 58, 75, 91

*Hadena marina* Grote, 1874a: 67.

**Type material.** Holotype female [BMNH, photograph examined]. Type locality: California.

**Diagnosis.** A medium-sized or slightly smaller than average stout species, wingspan  $31.9 \pm 1.5$  mm ( $n = 25$ ; range 29.5–35 mm). The forewing is granular mossy green, occasionally yellowish green, with mottled dark-gray to black and light-green pattern that obscures all but the darkest parts of the lines and spots. The darkest areas are a small patch at the base of the trailing edge of the wing, the cell and fold in the medial area, a bar on the costa preceding the subterminal line, and terminal area opposite the reniform spot. The relatively small reniform spot and round orbicular spot are filled with peripheral whitish and central green scales. The basal, antemedial and postmedial lines are double, black filled with green, and the subterminal line is green; all are sinuous and appear incomplete. The fringe is checkered green and gray. The hindwing is light brown gray with a darker border.

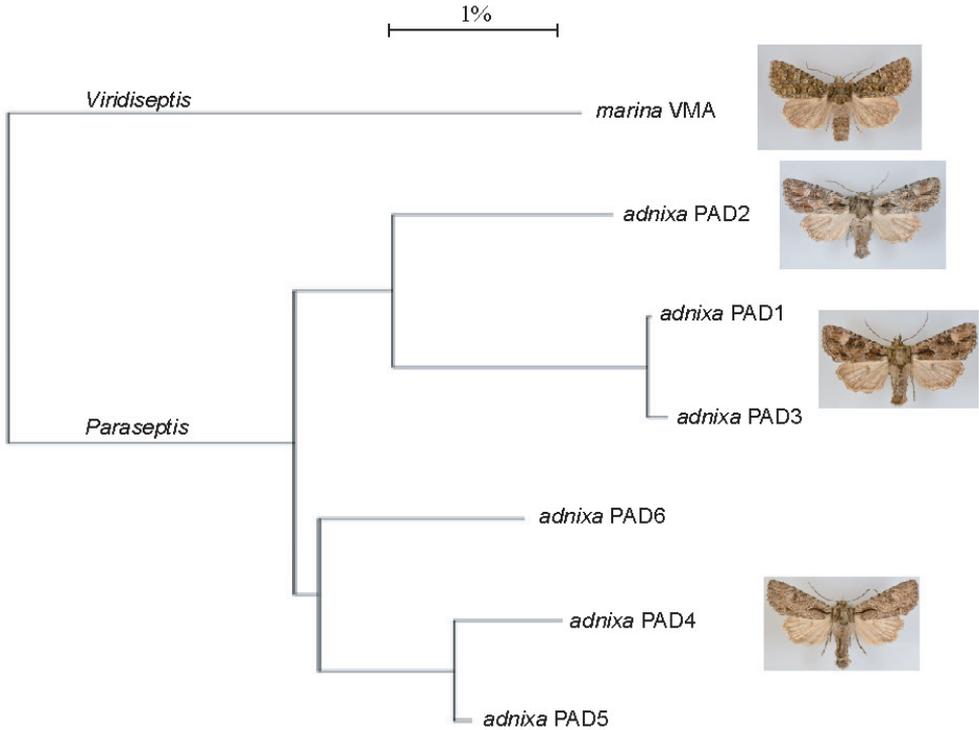
This species can usually be identified by superficial appearance alone. If in doubt, the male genitalia described under the genus description are diagnostic.

**Distribution and biology.** *Viridisepitis marina* occurs throughout coastal California and in southwestern Oregon as far north as Douglas County. It is widely distributed in southern California, where it is often common. It is found in many habitats such as coastal chaparral, mountain forest, mountain-desert transition zone, and occasionally in the deserts from sea level to at least 2000 m. It flies from April to early July. The larva feeds on forbs and has been recorded on *Nemophila* spp. and *Pholistoma auritium* (Lindl.) Lilja (Hydrophyllaceae) and *Lithophragma* spp. (Saxifragaceae) (Robinson et al. 2010).

## Discussion

This revision should help clear up confusion in the genus *Aseptis* by facilitating identification of the species—in no small part impeded prior to this study by more names than actual species—and by refining the generic relationships of species included with *Aseptis* in recent check lists. Of the genera treated herein, *Aseptis* and *Paraseptis* are retained in the tribe Xylenini, subtribe Xylenina and *Viridisepitis* is transferred to Xylenini (incertae sedis).

Although our work is based primarily on structural evidence, we also accessed a large pre-existing data base of CO1 barcodes available at BOLD and tested our theories against it during the course of this work. We observed, for the most part, a good correlation between structural and molecular data. Lack of significant variation in two variable widespread species, *A. binotata* and *A. characta*, supported pre-existing synonymies in both species and the proposed new ones in *A. binotata*, and was reassuring evidence that no cryptic species were being overlooked. As recently reported for a number of Canadian moths (Zahiri et al. 2014), we found additional instances of morphologically and biologically well-defined species with no more than 1.5% difference in CO1 DNA sequence, e.g., within the *Aseptis fumeola* species group (Fig. 92), as well as examples of structurally well-delineated species within which there is greater diversity of CO1 DNA. The latter was most evident in *Paraseptis adnixa* which has several major barcode haplotype clusters that differ by up to 2.8% (Fig. 93).



**Figure 93.** Neighbor-joining CO1 tree of *Paraseptis* and *Viridiseptis*. The letter and number code after each species is the haplotype identifier as indicated in Table 1. Illustrative specimens for *Viridiseptis marina* and the three geographical phenotypes of *adnixa* are shown on the right hand side.

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## Check list of the species of *Aseptis* McDunnough, *Paraseptis* Mustelin & Crabo, and *Viridiseptis* Mustelin & Crabo

### *Aseptis* McDunnough, 1937

- fumeola* (Hampson, 1918)
  - = *probata* (Barnes & McDunnough, 1910)
- ethnica* (Smith, 1899)
- murina* Mustelin, 2000
- ferruginea* Mustelin, 2000
- fanatica* Mustelin, 2006
- lichena* (Barnes & McDunnough, 1912)
- pseudolichena* Mustelin & Leuschner, 2000
- binotata* (Walker, 1865)
  - = *rubiginosa* (Walker, 1865)
  - = *extersa* (Walker, 1865)
  - = *paviae* (Strecker, 1874)
  - = *curvata* (Grote, 1874)
  - = *genitrix* (Grote, 1878)
  - = *inconspicua* (Smith, 1893), **nomen nudum**
  - = *dilara* (Strecker, 1899)
  - = *bultata* (Smith, 1906)
  - = *cara* (Barnes & McDunnough, 1918)
- catalina* (Smith, 1899)
- serrula* (Barnes & McDunnough, 1918)
- torreyana* Mustelin, 2006
- susquesa* (Smith, 1908)
  - = *monica* (Barnes & McDunnough, 1918)
- fumosa* (Grote, 1879)
- perfumosa* (Hampson, 1918)
- characta* (Grote, 1880)
  - = *erica* (Smith, 1905)
  - = *luteocinerea* (Smith, 1900)
  - = *pluraloides* (McDunnough, 1922)

### *Paraseptis* Mustelin & Crabo, 2015

- adnixa* (Grote, 1880)
  - = *pausis* (Smith, 1899)

### *Viridiseptis* Mustelin & Crabo, 2015

- marina* (Grote, 1874)

# Revision of the *Lacinipolia vicina* (Grote) complex (Noctuidae, Noctuinae, Eriopygini)

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## Abstract

The *Lacinipolia vicina* (Grote) species complex, previously consisting of *L. vicina*, *L. teligera* (Morrison), *L. pensilis* (Grote), and *L. subalba* Mustelin is revised to six species: *L. vicina* (eastern USA), *L. teligera* (southern Great Plains), *L. pensilis* (Pacific Northwest and northern Rocky Mountains), *L. acutipennis* (Grote), **stat. rev.** (= *L. subalba* **syn. n.**) (western North America), *L. sareta* (Smith), **stat. rev.** (Canada and western USA) and *L. dimocki*, **sp. n.** (California and Pacific Northwest). Lectotypes are designated for *L. vicina*, *L. teligera* and *L. pensilis*.

## Keywords

Cryptic species, Pacific Northwest, California

## Introduction

*Lacinipolia* McDunnough is currently one of the largest North American noctuid genera with 61 species, and includes another 10 species described from Mexico and Central America. The diversity centers for *Lacinipolia* are the arid habitats of the American Southwest and Mexico. Like many of the constituent genera of the

Eriopygini, a diverse, largely New World tribe, the current concept of *Lacinipolia* is not monophyletic and in need of revision. Lloyd Martin initiated this considerable undertaking in the 1960s, but abandoned the project after the loss of all his notes and type photographs (Leuschner 1992). Selman (1975) based his unpublished thesis dissertation on the earlier work of Lloyd Martin, and since Selman's thesis was never published, Selman and Leuschner (2001) described the nine new species treated therein. Within *Lacinipolia* (*sensu stricto*), the *L. vicina* (Grote) group previously consisted of four species, here revised to six species.

## Methods and materials

Adult genitalia were prepared following the methods of Lafontaine (2004). Cleaned, stained genitalia were stored and examined in 30% ethanol, and slide-mounted in Euparal before being photographed using a Nikon D200 digital camera. Distribution maps for examined material were generated using SimpleMapp (Shorthouse 2010).

## Repository abbreviations are as follows

<b>AMNH</b>	American Museum of Natural History, New York, NY
<b>BMNH</b>	The Natural History Museum (statutorily: British Museum [Natural History]), London.
<b>CNC</b>	Canadian National Collection of Insects, Arachnids and Nematodes, Ottawa, ON
<b>USNM</b>	National Museum of Natural History (formerly United States National Museum), Washington, DC
<b>MCZ</b>	Museum of Comparative Zoology, Cambridge, MA
<b>MSU</b>	Michigan State University, East Lansing, MI
<b>CUIC</b>	Cornell University, Ithaca, NY

Variation of the 'barcode' section of the COI gene was compared among 264 specimens representing all six species (Suppl. material 1). DNA extraction, PCR amplification, and sequencing of the COI barcode region were performed at the Canadian Centre for DNA Barcoding (CCDB) and followed standard protocols (Hajibabaei et al. 2005; Ivanova et al. 2006; deWaard et al. 2008; Hebert et al. 2013; <http://www.ccdb.ca/resources.php>). PCR and sequencing generally used a single pair of primers: LepF1 (ATTCAACCAATCATAAAG ATATTGG) and LepR1 (TAAACTTCTG-GATGTCCAAAAATCA) (Hebert et al. 2004) which recovers a 658 bp region near the 5' end of COI including the 648 bp barcode region for the animal kingdom (Hebert et al. 2003). Only sequence records greater than 500 bp (range 500 bp–658 bp) are included.

## Systematics

### Key to species of the *Lacinipolia vicina* group

- 1 Male ..... **2**  
 – Female ..... **7**  
 2 Spines posterior to juxta ('above' juxta in slide preparations) pointing antero-ventrally and forming spinose crests or simple patch<sup>1</sup> (Figs 55–58) ..... **3**  
 – Spines posterior to juxta pointing postero-dorsally and situated on inside surface of spade-like plate (Figs 59, 60) ..... **6**  
 3 Medial field of ventrally projecting spines located adjacent to juxta (Figs 55, 56) ..... **4**  
 – No medial spine patch adjacent to juxta (Figs 57, 58) ..... **5**  
 4 Clasper with thumb positioned at basal third of distance to apex (Fig. 55); hindwing with dark fuscous terminal shade (Figs 1, 2); occurring east of the Mississippi Valley (Fig. 69) ..... ***L. vicina***  
 – Clasper with thumb positioned nearly halfway to apex (Fig. 56); hindwing without dark fuscous terminal shade (Figs 4, 5); occurring west of the Mississippi Valley (Fig. 70) ..... ***L. teligera***  
 5 Crest of phallus usually with a thin, delicate apically-directed spine (sometimes broken off, in which case base is still evident) (Fig. 61), or if thin spine absent, then entire crest reduced with fewer and smaller cornuti (Fig. 61c); forewing ground colour highly variable, but medial area concolourous with postmedial and antemedial areas, and antemedial line absent or poorly defined; usually with apical pale area that extends through postmedial line into reniform spot; subterminal area usually darker than postmedial area; reniform and orbicular spot often only faintly visible; orbicular spot sometimes flattened and elongated; arid low elevation habitats including shortgrass prairie and sagebrush steppe ..... ***L. acutipennis***  
 – Crest of phallus never with a thin, delicate basally-directed spine (Fig. 62), rarely with robust cornutus directed apically (Fig. 62h); forewing ground colour varying in saturation but consistent in tone, with medial area containing brown tones that are lacking in the grey-and-black postmedial and antemedial areas; antemedial line usually well defined; pale apical area not extended through postmedial line; subterminal area not darker than postmedial area; reniform and orbicular spot conspicuous, paler than ground; orbicular spot never highly flattened and elongated; low to high elevation woodland, particularly dry, montane pine and Douglas-fir woodlands ..... ***L. pensilis***

<sup>1</sup> The spine field above the juxta and even the aedeagal cornuti can often be examined without dissection by carefully removing the terminal abdominal hairs with a small brush, especially if the valves have previously been spread by squeezing the base of the genital capsule when specimen is still fresh.

- 6 Clasper with a thumb-like process on ventral margin, clasper flattened and apex rounded; digitus pointed (Fig. 59); widely distributed, including West Coast states (Fig. 73) ..... ***L. sareta***
- Clasper without process, shaped like a sinuate spine with a pointed apex; digitus rounded (Fig. 60); West Coast states (Fig. 74) ..... ***L. dimocki***
- 7 Ostium asymmetrical, like opening of a conch; margin of prevaginal plate straight or slightly convex (Figs 63–66)..... **8**
- Ostium symmetrical, opening simple; margin of prevaginal plate strongly convex (Figs 67, 68)..... **1**
- 8 Ostium complex 1.4–1.5 × longer than wide; caudal portion of ostial slit gradually curved (Figs 65, 66)..... **9**
- Ostium complex 1.0–1.1 × longer than wide; caudal portion of ostial slit sinuate (Figs 63, 64) ..... **10**
- 9 Forewing ground colour highly variable, but medial area concolourous with postmedial and antemedial areas, and antemedial line absent or poorly defined; usually with apical pale area extended through postmedial line into reniform spot; subterminal area usually darker than postmedial area; reniform and orbicular spots often only faintly visible; orbicular spot sometimes flattened and elongated; arid low elevation habitats including shortgrass prairie and sagebrush steppe..... ***L. acutipennis***
- Forewing ground colour varying in saturation but consistent in tone, with medial area containing brown tones that are lacking in grey-and-black postmedial and antemedial areas; antemedial line usually well defined; pale apical area not extended through postmedial line; subterminal area not darker than postmedial area; reniform and orbicular spot conspicuous and paler than ground; orbicular spot never highly flattened and elongated; low to high elevation woodlands, particularly dry, montane pine and Douglas-fir woodland ..... ***L. pensilis***
- 10 Basal half of hindwing conspicuously lighter than marginal portion and forewing (Fig. 6); occurring in southern Great Plains west of Mississippi River (Fig. 70)..... ***L. teligera***
- Basal half of hindwing nearly as dark as marginal portion and forewing (Fig. 3); occurring in the eastern United States east of Mississippi River (Fig. 69)..... ***L. vicina***
- 11 Ductus bursae highly flattened dorsoventrally, with pronounced ribbon-like oblique fold (Fig. 67); corpus bursae 2–2.5 × diameter of ductus bursae; widely distributed, including West Coast states (Fig. 73)..... ***L. sareta***
- Ductus bursae moderately flattened dorsoventrally, with slight oblique fold; corpus bursae 3–4 × diameter of ductus bursae (Fig. 68); West Coast states from Washington to California (Fig. 74) ..... ***L. dimocki***

***Lacinipolia vicina* (Grote, 1874)**

Figs 1–3, 55, 69

*Mamestra vicina* Grote, 1874a: 156.*Mamestra imbuna* Smith, 1905a: 201, **syn. rev.**

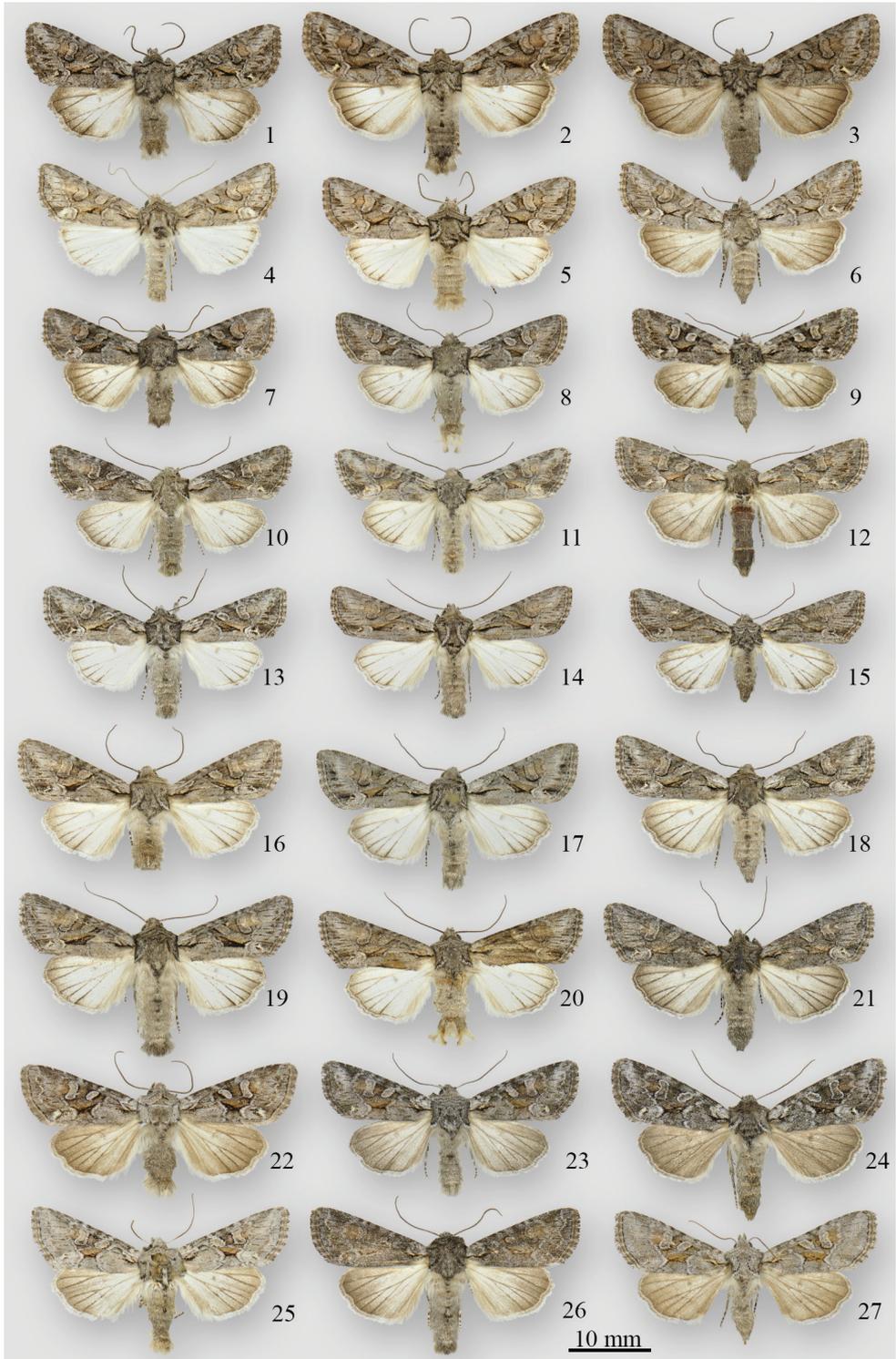
**Type material.** *Mamestra vicina*: The type material of *L. vicina* almost certainly consisted of two species, the eastern species known previously as *L. imbuna* or *L. teligera* (Franclemont and Todd 1983) and represented by a female syntype from Massachusetts (BMNH; examined), in addition to the widespread species previously called *L. vicina*, represented by at least one syntype from St. Catherines, Ontario (lost). I was unable to locate any St. Catherines specimens, stated by Grote to have come from George Norman. Other syntypes from the Norman collection (*Crocigrapha normani* (Grote) and *Xestia normanianus* (Grote)) are also considered to be lost (D. Lafontaine pers. comm.). This is unfortunate since it would have been preferable to fix the name *vicina* as the widespread, well-known species here treated as *L. sareta*, but as the only extant primary type, the following female specimen [BMNH] must be designated as **lectotype**: “*Mamestra / vicina / Type Grote*” [red-bordered label]; “Type” [round red-bordered label]; “*vicina / TYPE*” [small handwritten label]; Grote Coll. / 81-116.” [type-written label]; “U.S.America.” [type-written label]; “Noctuidae / Brit. Mus. slide / No. 8237” [blue type-written label]. Type locality: “Massachusetts”.

*Mamestra imbuna*: Male lectotype (AMNH; examined), designated by Todd (1982). Type locality: Luzerne Co., Pennsylvania. The original type series of *Mamestra imbuna* probably also included *L. sareta* from the southern Lake Michigan region, as Smith (1905a) mentions an August specimen from Hessville, Indiana (a suburb of Chicago), but Todd’s lectotype designation fortunately restricts the concept of the name.

**Diagnosis.** Within the eastern North American range of *L. vicina*, *L. sareta* is most similar but the two can usually be separated without dissection by the more southern distribution, larger size and bivoltine spring / fall flight (April-May and September - October) of *L. vicina* (univoltine from late June to early August for *L. sareta*). In the male genitalia, *L. vicina* differs most obviously in the arrangement of the spines above the juxta, consisting of two lateral and one medial field of ventrally projecting spines, whereas in *L. sareta* the spines are directed dorsally and are on the inside of a large, rhomboid plate. Females of *L. vicina* have an asymmetrical, invaginated ostium, like the opening of a conch, compared to a simpler ostium with a convex prevaginal plate margin in *L. sareta*.

Although *L. vicina* is most closely related to *L. teligera*, *L. vicina* and *L. teligera* are not likely to be confused given the range disjunction and more extensive dark fuscous shading of the hindwing in *L. vicina*. The male genitalia differ in the shape of the clasper, with the apical lobe narrower and more pointed in *L. vicina*, and the thumb-like lobe situated one third the distance from the base, compared to halfway in *L. teligera*.

**Distribution and biology.** Specimens of *L. vicina* were examined from Massachusetts, New York, Pennsylvania, Virginia and North Carolina (Fig. 69); Forbes (1954) also cites New Jersey (Lakehurst) and Indiana records. The Indiana record (Smith



1905a) may be erroneous given the long-standing confusion with *L. sareta*, as discussed in the “Type material” section above. Eastern Ohio records of *L. teligera* from May and September given by Rings et al. (1992) are most likely *L. vicina*. Moore’s (1955) records for Michigan probably all apply to *L. sareta* based on flight dates and the widespread distribution of *L. sareta* in the Great Lakes region. There is no clear indication of habitat preference; in North Carolina *L. vicina* occurs in open oak-hickory forest (B. Sullivan pers. comm.). Despite the relatively broad distribution and apparent lack of specialized habitat requirements, *L. vicina* records are few. *Lacinipolia vicina* is apparently bivoltine, flying in spring (April–May) and in late summer to early fall (late August to early October), with later dates farther south. The larvae were described and illustrated by Godfrey (1972) (reared vouchers examined; CUIIC), and are probably polyphagous ground dwellers like other *Lacinipolia* (Wagner et al. 2011).

**Remarks.** As defined here, *L. vicina* is the same species later described by Smith (1905a) as *Mamestra imbuna*, differing considerably in morphology from both *L. sareta* (= *vicina* of authors) and *L. pensilis*, although more closely related to the latter. *Lacinipolia imbuna* was previously treated as a junior synonym of *L. teligera* (Franclemont and Todd 1983).

### *Lacinipolia teligera* (Morrison, 1875)

Figs 4–6, 56, 64, 70

*Mamestra teligera* Morrison, 1875: 215.

**Type material.** Morrison’s original description was based on two specimens, and Wilterding (1997) discussed two Morrison specimens in the MSU collection: a male with two conflicting locality labels (Texas and New York), and a damaged female

**Figures 1–27.** *Lacinipolia* adults. **1** *L. vicina* ♂ NC, Watauga Co., Beech Ck. bog **2** *L. vicina* ♂ PA, Beaver Co., 6 mi SW Darlington **3** *L. vicina* ♀ PA, Beaver Co., 6 mi SW Darlington **4** *L. teligera* ♂ TX, Lampasas Co., Lampasas R. 8 mi S Rte. 190 **5** *L. teligera* ♂ TX, Travis Co., Austin **6** *L. teligera* ♀ TX, Lampasas Co., Lampasas R. 8 mi S Rte. 190 **7** *L. sareta* ♂ ON, Manitoulin Is., Dominion Bay dunes **8** *L. sareta* ♂ BC, [Lillooet], Kirby Flats Rd. **9** *L. sareta* ♀ ON, Manitoulin Is., Sheguindah **10** *L. sareta* ♂ AB, Waterton Lakes NP, Blakiston Ck. fan **11** *L. sareta* ♂ AB, Manyberries, Pakowki Dunes **12** *L. sareta* ♀ AB, Manyberries, Pakowki Dunes **13** *L. sareta* ♂ CA, Mono Co., Lee Vining **14** *L. sareta* ♂ AZ, Cochise Co., Huachuca Mtns, Ash Cyn. Rd. **15** *L. sareta* ♀ AZ, [Maricopa Co.], Congress **16** *L. dimocki* ♂ CA, Plumas Co., Jackson Ck., DNA voucher # CNCNoctuoidea7972 **17** *L. dimocki* ♂ Holotype, CA, Ventura Co., Cuyama Valley, Apache Cyn. **18** *L. dimocki* ♀ Paratype, CA, Ventura Co., Cuyama Valley, Apache Cyn. **19** *L. dimocki* ♂ WA, Klickitat Co., Simcoe Butte **20** *L. dimocki* ♂ WA, Klickitat Co., Munson Prairie **21** *L. dimocki* ♀ WA, Yakima Co., South Fork Ahtanum Cr. **22** *L. pensilis* ♂ BC, Squamish, Diamond Head Trail **23** *L. pensilis* ♂ BC, [11 km WSW Invermere], Watch Peak **24** *L. pensilis* ♀ BC, [11 km WSW Invermere], Watch Peak **25** *L. pensilis* ♂ UT, [Utah Co.], 12 mi N Provo **26** *L. pensilis* ♂ WA, Yakima Co., Bethel Ridge **27** *L. pensilis* ♀ UT, Salt Lake City.

specimen labelled simply “19/10” and probably not a syntype. A third specimen in MCZ (photo available at [http://insects.oeb.harvard.edu/mcz/Species\\_record.php?id=1585](http://insects.oeb.harvard.edu/mcz/Species_record.php?id=1585)), dissected and labelled as follows, is here designated as **lectotype**: “Dianthoecia / teligera / Type / Morr”; “Tex.”; “27/10”; “Certainly not / vicina as / refined by Grote”; “Peab. Acad.”; “Type / 1742”; “M.C.Z. Type # / gen. 1742 / 28 Jan. 33 H[?]. B.”; the following label will be added: “Lectotype / Dianthoecia / teligera Morr., 1875 / desig. by Schmidt 2015”. Type locality: Waco, Texas.

**Diagnosis.** Although closely related to *L. vicina*, the challenge in identifying *L. teligera* is in separating it from *L. sareta* in the southwestern Great Plains where the ranges of the two can overlap. Compared to *L. sareta*, *L. teligera* is slightly larger with a broader forewing and better-defined, crisper forewing maculation. Reliable identification should be based on genitalic structure, where *L. teligera* males have a medial and lateral field of short, ventrally directed spines above the juxta, rather than two large flanges laterally on the juxta with dorsally directed spines in *L. sareta*. The female *L. teligera* has an asymmetrical, invaginated ostium (like the opening of a conch), whereas that of *L. sareta* has a simple ostium with the margin of the prevaginal plate convex.

**Distribution and biology.** *Lacinipolia teligera* is known from the Great Plains of central Colorado and eastern Kansas southward to central Texas (Fig. 70). Nothing is known of the early stages, although these are undoubtedly similar to those of *L. vicina*.

**Remarks.** *Lacinipolia teligera* is closely related to *L. vicina*, and the two have previously been considered conspecific (as *L. imbuna*; Franclemont and Todd 1983). However the two differ structurally as outlined in the *L. vicina* diagnosis, in addition to a DNA barcode difference of 1.0%. The two species occupy separate ecoregions and different habitats, with *teligera* in the grasslands of the Great Plains and *vicina* in deciduous forest of the Appalachian and Atlantic region.

### *Lacinipolia pensilis* (Grote, 1874)

Figs 22–27, 57, 61, 65, 71

*Dianthoecia pensilis* Grote, 1874b: 199.

**Type material.** described from at least 1 male and 1 female syntype; the following male [BMNH] is here designated as **lectotype**: “Dianthoecia / pensilis ♂ / Type Grote” [red-bordered handwritten label]; “Type” [round, red-bordered, typed label]; Vancouver I / Grote Coll. / 81 – 116”; “5597”; Noctuidae / Brit. Mus. slide / No. 4912 ♂” [blue type-written label]; the following label will be added: “Lectotype / Dianthoecia / pensilis Grote, 1874 / desig. by Schmidt 2015.” Type locality: Victoria, [Vancouver Island, British Columbia, Canada].

**Diagnosis.** *Lacinipolia pensilis* is a northwestern montane species that is often confused with *L. sareta* and also *L. acutipennis* in parts of the range. Compared to *L. sareta*, *L. pensilis* flies later (August to September versus June to early August), and differs

considerably in genitalic structure of both males and females as outlined in the key and the *L. sareta* account.

Separating *pensilis* from dark forms of *L. acutipennis*, which are prevalent in montane habitats of the Pacific Northwest, poses the greatest identification challenge in the *L. vicina* group. *Lacinipolia pensilis* usually has better-defined forewing markings, richer brown tones in the forewing medial area, and no tendency for streaky pale patches in the forewing apical area; *L. pensilis* also averages slightly larger with a broader forewing. The spined crest of the male phallus is more robust and usually with more spines, and never has the thin apically-projecting spine that is normally found in *L. acutipennis*. In montane parts of the Pacific Northwest (interior British Columbia, northern and central Washington) habitat can help to separate the two, with *L. pensilis* occurring from dry montane woodland to high elevation subalpine forest, whereas *L. acutipennis* is characteristic of the dry, low-elevation habitats of the major intermontane valleys. See also remarks in the *L. acutipennis* account.

**Distribution and biology.** This species occurs in the western cordilleran region from central British Columbia and western Alberta southward to at least Washington and central Utah. The distribution pattern suggests it may occur farther south along the Cascade–Coast Ranges through Oregon, and further work is needed to establish the southwestern range limits. The larval description and host plants require clarification since the information given by Crumb (1956) and Godfrey (1972) was probably based on both *L. acutipennis* and *L. pensilis*. The larvae likely are ground-dwelling, general feeders on shrubs and herbs.

***Lacinipolia acutipennis* (Grote, 1880), stat. rev.**

Figs 28–54, 58, 62, 66, 72

*Mamestra acutipennis* Grote, 1880: 214.

*Mamestra doira* Strecker, 1898: 7, **syn. rev.**

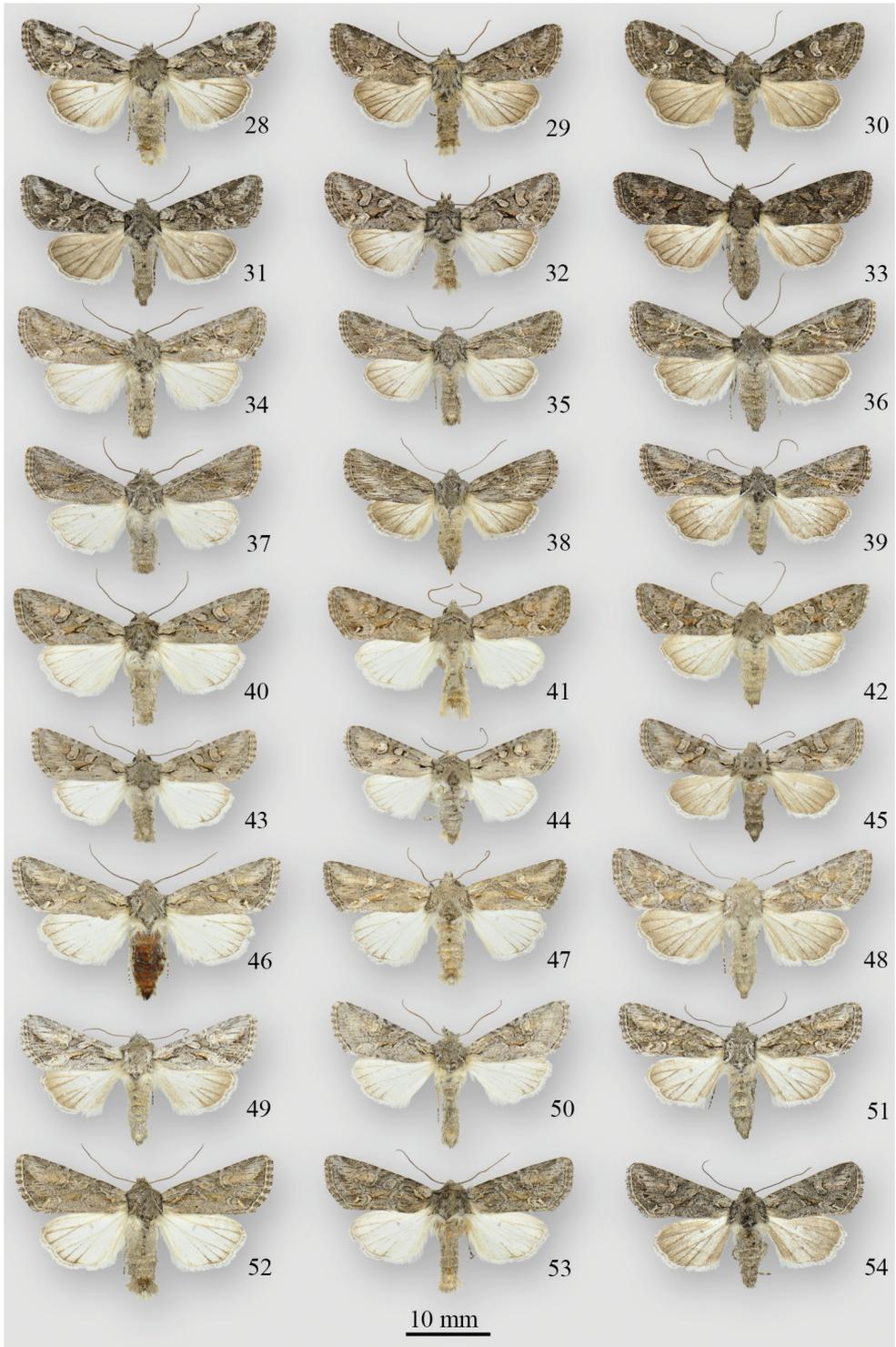
*Mamestra ascula* Smith, 1905b: 257, **syn. rev.**

†*Polia pensilis* ab. *indistincta* Strand, 1917: 28, **unavailable**; infrasubspecific name.

*Lacinipolia subalba* Mustelin, 2000: 13, **syn. n.**

**Type material.** *Mamestra acutipennis*: type female (BMNH; examined); type locality: Nevada. *Mamestra doira*: type female (FMNH, examined); type locality: Utah. *Mamestra ascula*: lectotype male designated by Poole (1982), (AMNH, examined); type locality: Stockton, Utah. *Lacinipolia subalba*: South rim of Los Peñasquitos Canyon, 76 m, San Diego Co., California (SDNHM).

**Diagnosis.** *Lacinipolia acutipennis* is a western steppe / grassland species that shows considerably greater regional phenotypic variation than others in the *L. vicina* group. In more mesic habitats (including higher elevations) of the Pacific Northwest and central Rocky Mountains *L. acutipennis* is replaced by the very similar *L. pensilis*. The two occur sympatrically in many transitional habitats, mostly dry montane woodlands at

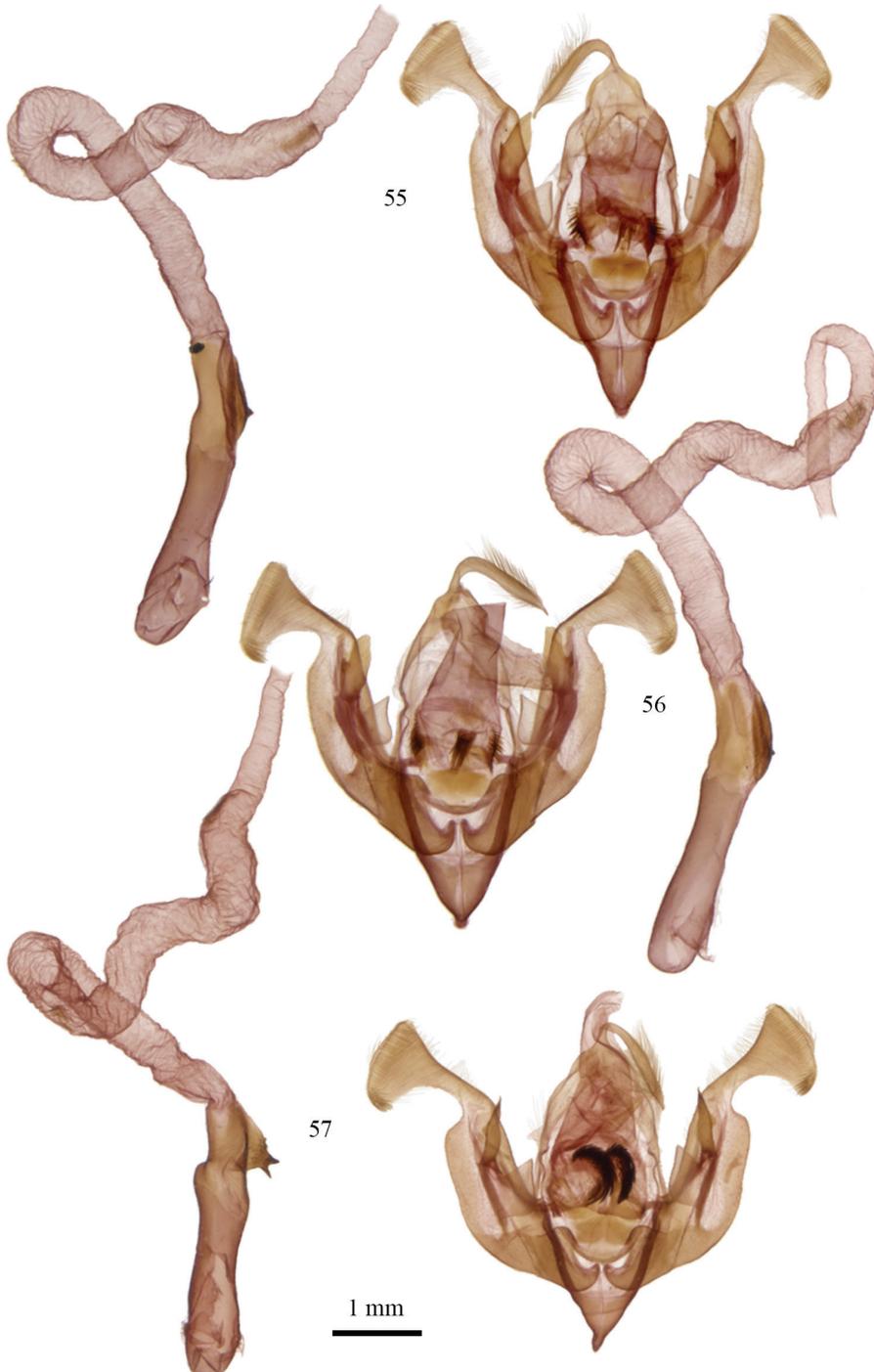


moderate elevations. Although phenotypes of *L. acutipennis* from the most arid habitats (e.g., Figs 34–39) can be distinguished from *L. pensilis* with relative ease, many northern *L. acutipennis* populations in the Pacific Northwest are dark, well-marked and very similar to *L. pensilis*, which makes identifying the two very difficult and led previous workers to conclude that they represent the same species. Compounding this difficulty is the lack of conspicuous genitalic differences that are otherwise typical of the genus. Despite the identification difficulties in the Pacific Northwest, other sympatric populations of *L. acutipennis* and *L. pensilis* have clearly different phenotypes. Differences are most pronounced in Great Basin populations (*L. pensilis*, Figs 25, 27 and *L. acutipennis*, Figs 49–51) and in the northern Rockies/Great Plains (e.g., Montana *L. pensilis*, like those in Figs 23, 24, and *L. acutipennis*, Figs 46–48). The two differ in male genitalia structure as discussed below. These differences, in addition to a minimum 2.5% divergence in DNA barcodes (Fig. 75), show that (at least) two species are involved.

Similar phenotypes of *L. acutipennis* and *L. pensilis* differ in the shape and size of the forewing, which averages more acute and smaller in *L. acutipennis*; the brown tones of the medial forewing are more muted in *L. acutipennis* compared to *L. pensilis*, giving an overall lower contrast in tone of the medial area with the grey-black antemedial and postmedial areas; the white spot in the anal angle is often more prominent in *L. acutipennis*, particularly in females; the forewing apex has a more contrastingly pale diffuse area that usually extends farther towards the reniform. In the male genitalia of *L. acutipennis*, the spinose crest of the phallus usually has a thin, delicate apically-directed spine (which is sometimes broken off, in which case the spine base is still evident), which is absent in *L. pensilis*; this thin spine is sometimes absent also in *L. acutipennis*, but in such individuals the entire crest is small and with fewer, smaller cornuti (Fig. 61c) compared to *L. pensilis* (Fig 62).

Two phenotypes have been recognized as separate species, *L. doira* of the Great Basin (Figs 49–51) and *L. subalba* of southern California (Figs 43–45). Clinal phenotypic variation, lack of diagnostic structural characters, and similarity in DNA barcodes, lead me to treat –*doira* and –*subalba* as regional forms.

**Figures 28–54.** *Lacinipolia acutipennis* adults. **28** ♂ BC, [Lillooet], Kirby Flats Rd. ♂ BC, Savona, 2 mi SW **30** ♀ BC, [Lillooet], Kirby Flats Rd., DNA voucher # CNCNoctuoidea7978 **31** ♀ BC, [Lillooet], Kirby Flats Rd. **32** ♂ WA, [Okanogan Co.], Tonasket, 8 mi S **33** ♀ CA, Plumas Co., Jackson Ck. **34** ♂ WA, Douglas Co., Jameson L. **35** ♂ WA, Grant Co., Dodson Rd. **36** ♀ WA, Yakima Co., South Fork Ahtanum Cr. **37** ♂ OR, Crook Co., Suplee **38** ♀ OR, Lake Co., Alkali L. **39** ♀ OR, Baker Co., Burnt River, 20 mi S **40** ♂ CA, Ventura Co., Cuyama Valley, Apache Cyn. **41** ♂ CA, [Monterey Co.], Pinnacles Nat. Mon. **42** ♀ CA, [Monterey Co.], Pinnacles Nat. Mon. **43** ♂ [*subalba* paratype] CA, San Diego Co., S rim Peñasquitos Cyn. **44** ♂ [*subalba* paratype] CA, San Diego Co., S rim Peñasquitos Cyn. **45** ♀ [*subalba* paratype] CA, San Diego Co., NAS Miramar **46** ♂ AB, Dinosaur PP **47** ♂ MT, [Philips Co.], Malta, 19 mi NE **48** ♀ WY, [Albany Co.], Laramie **49** ♂ UT, [Juab Co.], Eureka **50** ♂ ID, Owyhee Co., [Castle Ck. Rd.] **51** ♀ UT, Grand Co., Thompson Cyn. **52** ♂ CO, Adams Co., Bennett **53** ♂ CO, Larimer Co., Flatiron Reservoir **54** ♀ CO, Larimer Co., Flatiron Reservoir.



**Figures 55–57.** *Lacinipolia* male genitalia. **55** *Lacinipolia vicina* MA, Barnstable, CNC Gen. Prep. # CNCLEP16884 **56** *Lacinipolia teligera* TX, 6 mi E Canadian, CNC Gen. Prep. # CNCLEP16886 **57** *Lacinipolia pensilis* BC, Crowsnest, 5 mi NW, CNC Gen. Prep. # CNCLEP16852.

**Distribution and biology.** *Lacinipolia acutipennis* is a western species common throughout xeric, low elevation habitats of western North America. The core range includes the dry, western portions of the Great Plains, the Great Basin, and the western intermontane valleys north of the Sonoran zone, from southern Saskatchewan and Alberta southward to northern Arizona and New Mexico. Reports from Wisconsin (cited in Forbes 1954), Texas and southern Arizona (Hampson 1905) are probably misidentifications of *L. sareta*. Crumb's (1954) records from Nebraska and Kansas are plausible; the easternmost specimens I examined were from Watford City in western North Dakota. In the intermontane valleys west of the Rocky Mountains *L. acutipennis* occurs from southern British Columbia to southern California and northernmost Arizona and New Mexico (Fig. 72). All Pacific Northwest specimens examined from subalpine habitats and from sites west of the Coast Ranges proved to be *L. pensilis*.

The larval description and host plants require clarification since the information given by Crumb (1956) and Godfrey (1972) was probably based on both *L. acutipennis* and *L. pensilis*. The larvae likely are general feeders and may ascend shrubs to feed. *Lacinipolia acutipennis* flies in late summer with most specimens recorded from mid-August to late September.

**Remarks.** The name *acutipennis* has historically been associated with the taxon *L. sareta* (i.e. *L. vicina* of authors) rather than *L. pensilis*. This apparently stemmed from the fact that historical *L. acutipennis* specimens from western Nevada (the type locality of *L. acutipennis*) and adjacent northeastern California had been wrongly associated; a series from Truckee, California, examined by Lloyd Martin (and probably others before him, including McDunnough) consists of male *L. sareta* and female *L. acutipennis*, but only the male *L. sareta* were previously dissected. Female *L. sareta* from the northern Sierra Nevada and especially Nevada are considerably paler. Comparison of the type female of *L. acutipennis* to all other *L. vicina*-group taxa occurring in the region of the type locality shows that *L. acutipennis* is a dark female of the low-elevation taxon previously treated as a form of *L. pensilis*.

Variation in the DNA barcodes (Fig. 75) could be indicative of cryptic species, but genitalic structure is highly conserved and phenotypic blending is apparent from regions where adequate samples were available.

### *Lacinipolia sareta* (Smith, 1906)

Figs 7–15, 59, 67, 73

*Mamestra sareta* Smith, 1906: 229.

**Type material.** lectotype male (AMNH, examined), designated by Todd (1982); type locality: Minnehaha, Yavapai Co., Arizona.

**Diagnosis.** *Lacinipolia sareta* is the most common and widespread species in the *L. pensilis* group, and most of the identification difficulties are in separating it from *L. pensilis* and *L. acutipennis* in the West. This is most reliably done based on genitalia, where



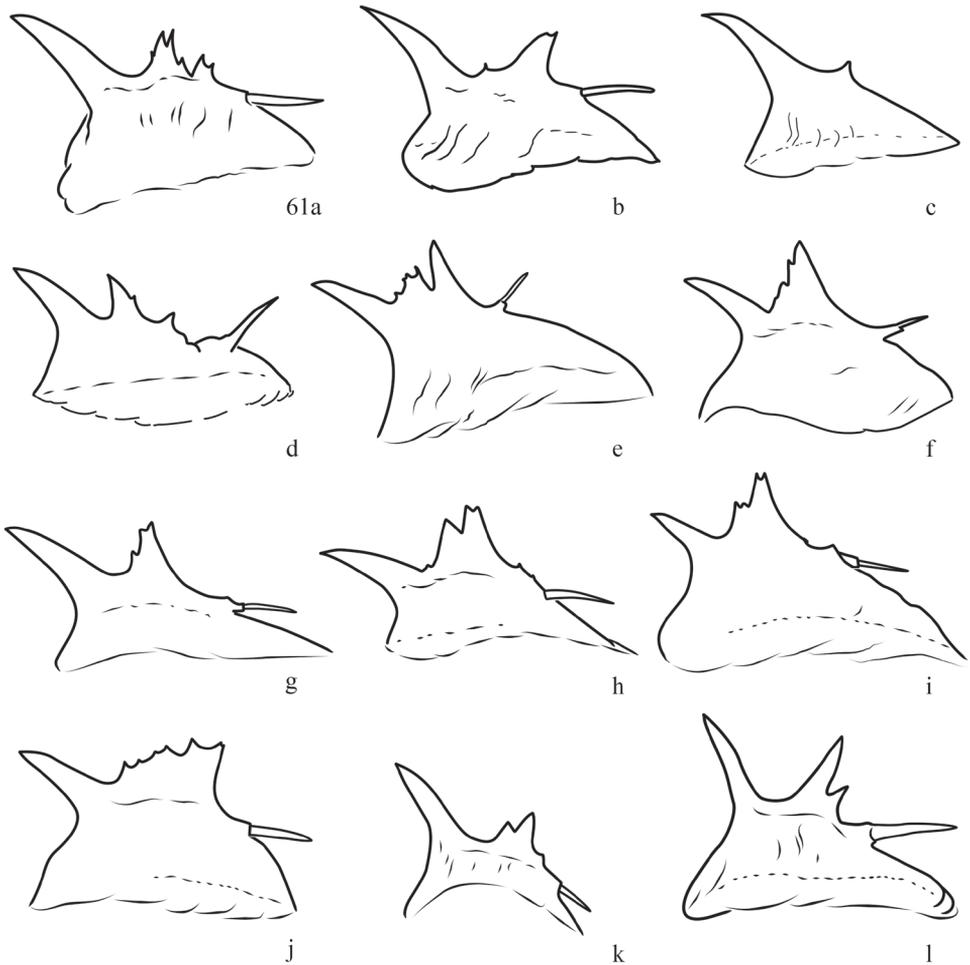
**Figures 58–60.** *Lacinipolia* male genitalia. **58** *Lacinipolia acutipennis* AB, Steveville, CNC Gen. Prep. # CNCLEP16843 **59** *Lacinipolia sareta* AZ, Prescott, CNC Gen. Prep. # CNCLEP16867 **60** *Lacinipolia dimocki* CA, Mt. Laguna, CNC Gen. Prep. # CNCLEP16871.

males lack the ventrally projecting, paired spinose crests above the juxta that are found in *L. acutipennis* and *L. pensilis*; females of *L. sareta* have a simple ostium with a strongly convex prevaginal margin, compared to those of *L. pensilis* and *L. acutipennis* which have an asymmetrical, conch-shaped ostium with a straight prevaginal margin. *Lacinipolia sareta* flies earlier in the year (mostly June–July) than *L. pensilis* and *L. acutipennis* (August–September), although the southernmost *L. sareta* populations in Arizona, New Mexico, and Texas fly again in late September–October after an initial May flight.

The remaining species (*L. vicina*, *L. teligera*, and *L. dimocki*) can, for the most part, be distinguished from *L. sareta* by geographic distribution; in Washington, Oregon and California, where the range of *L. sareta* overlaps that of *L. dimocki*, *L. sareta* is smaller and has a duller white hindwing, in addition to the genitalic characters given under *dimocki*. From eastern Colorado and New Mexico through western Oklahoma and northern Texas *L. sareta* overlaps with *L. teligera*; characters given in the keys and the *L. teligera* diagnosis will separate the two. The range of *L. sareta* might overlap with that of *L. vicina* in the East (from the Great Lakes region eastward through New York and New England), where the smaller size, different flight period and genitalic differences given under *L. vicina* will reliably separate the two.

**Distribution and biology.** *Lacinipolia sareta* occurs throughout western North America from the southern Yukon and Northwest Territories to Texas, Arizona and California; it undoubtedly also occurs in northern Mexico. It ranges eastward across the southern boreal region to at least Quebec, with an unverified record from Maine (Forbes 1954). Most or all records of *L. vicina* for Michigan (Moore 1955) probably apply to this species, but *L. sareta* is not known from Ohio (Rings et al. 1992) where it would be expected in sandy habitats along Lake Erie. Although found in a huge variety of woodland, steppe and prairie habitats, *L. sareta* particularly favours sandy soils and can be abundant in dune and beach habitats. Crumb (1956) describes the ground-dwelling, polyphagous larva (as *L. vicina*). Godfrey (1972) illustrates the larva, and states that Arizona and Montana larvae are identical.

**Remarks.** The vast geographic range and considerable DNA barcode variation suggest that *L. sareta* could be a cryptic species complex. Alternatively, DNA barcode variation simply may not be fully congruent with species limits in the group, a phenomenon that occurs in about 10% of Noctuoidea (Zahiri et al. 2014). In contrast to the mtDNA variation, genitalic structure and wing pattern is highly conserved, and I could find no way to segregate specimens with divergent barcodes or those from different ecoregions. The shape of the digitus varies somewhat, with nominate *L. sareta* from the southwestern United States with a slightly longer, narrower tine-like digitus, compared to most (but not all) northern specimens, which have a shorter more triangular digitus, but the differences are inconsistent and again do not correlate with geographic or molecular differences. This is surprising given that molecular divergence among *L. sareta* haplogroups was greater than the minimum divergence between *L. sareta* and *L. dimocki* (Fig. 75), despite the considerable morphological differences between the two species. Studies of pheromone variation, nuclear DNA sequence data, and immature stages would provide more insight into this difficult group.



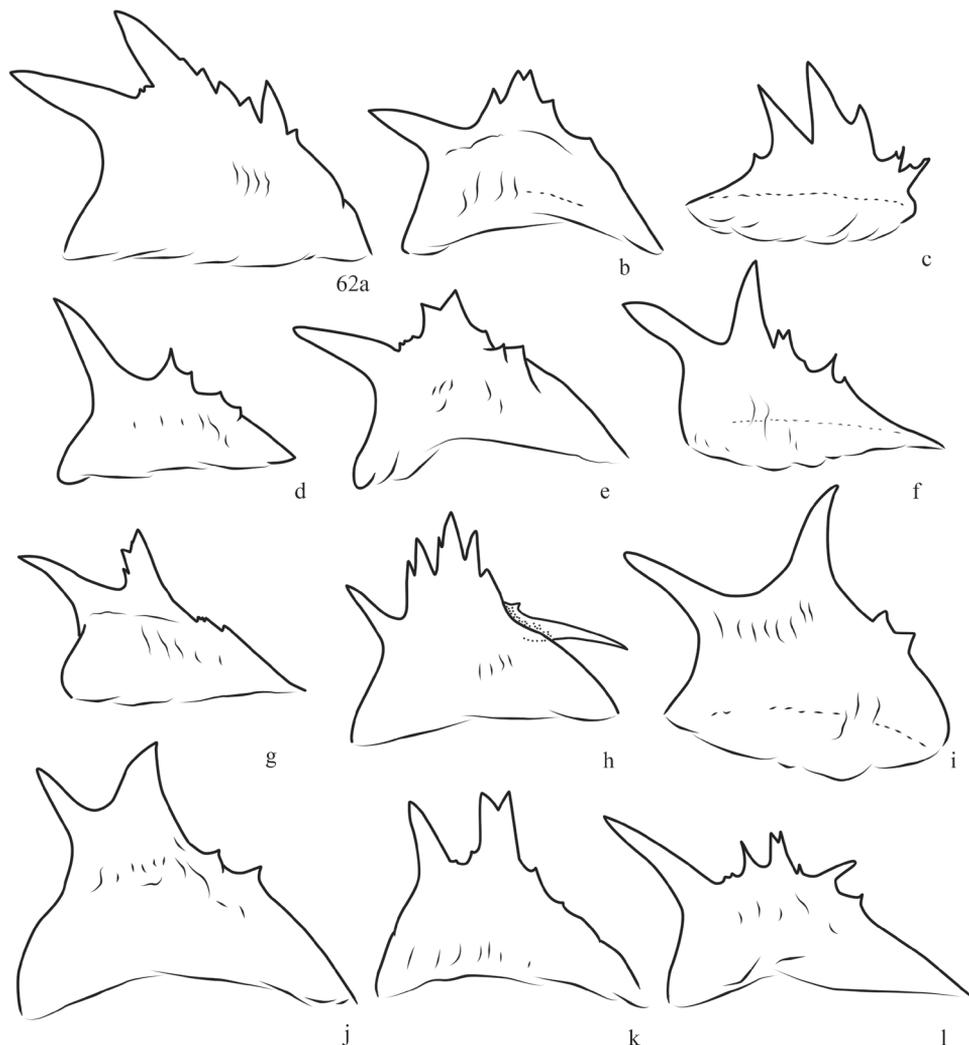
**Figure 61.** Variation in spined crest of male phallus, *Lacinipolia acutipennis*. **a–c** UT, Stockton **d** NV, Ely **e** WA, Omak **f** WA, Tonasket **g–h** OR, Biggs **i** BC, Kamloops **j** BC, Keremeos **k** AB, Dinosaur PP **l** MT, Joliet.

***Lacinipolia dimocki* Schmidt, sp. n.**

<http://zoobank.org/3818A542-7458-4999-9547-F2DCFB980F1B>

Figs 16–21, 60, 68, 74

**Type material. Holotype** ♂. California: Ventura Co., Cuyama Valley, Apache Canyon, 0.6 mi E of Hwy. 33, 34.751193°N, 119.399772°W, 3497', 19.Jun.2009, T. E. Dimock [CNC]. **Paratypes** 17♂ 18♀. Same data as holotype, 2♂ 7♀; California: Ventura Co., Pine Mountain, Pine Mountain campground, 6620', 21.Aug.2000, T. E. Dimock, 1♂ 1♀, 27.Jun.2000, 2♀; Ventura Co., Sespe Creek at Derrydale Creek, 34.583992°N, 119.262757°W, 15.Jul.2009, T. E. Dimock, 2♂ 2♀; Ventura Co., Sespe Creek at Tule Creek, 34.561350°N, 119.264780°W, 1♂; Ventura Co.,



**Figure 62.** Variation in spined crest of male phallus, *Lacinipolia pensilis*. **a** WA, Satus Ck. **b** UT, Grantsville **c** MT, Brooks **d** UT, Logan **e-f** BC, Squamish **g-h** BC, Wellington **i** BC, Riondel **j** BC, Crowsnest **k** BC, Okanagan Falls **l** BC, Squamish.

Upper Ojai Valley, 34.451°N, 119.121°W, 2120', 31.May.2003, T. E. Dimock, 1♂; Ventura Co., Cuyama Valley, 34.695°N, 119.398°W, 3540', 14.Jun.2005, T. E. Dimock, 3♂; San Diego Co., Laguna Mountains, Pine Creek Road, 5500', 1.Jul.2000, T. Mustelin, 2♂; same data, DNA barcode vouchers # CNCNoctuoidea7969 and CNC LEP00053134, 2♂; same locality, 29.Aug.2000, 1♀; San Diego Co., Laguna Mountains, Desertview Overlook, 5800', 29.Aug.2000, T. Mustelin, 1♂ 1♀; San Diego Co., Laguna Mountains, Kitchen Creek Road, 5500', 29.Aug.2000, T. Mustelin, 1♂ 1♀; San Bernardino Co., San Bernardino Mountains, Cactus Flats, 34°18.32' N 116°47.99' W, 6100', 25.May.2006, T. Mustelin, 1♀; San Bernardino Co., San Ber-



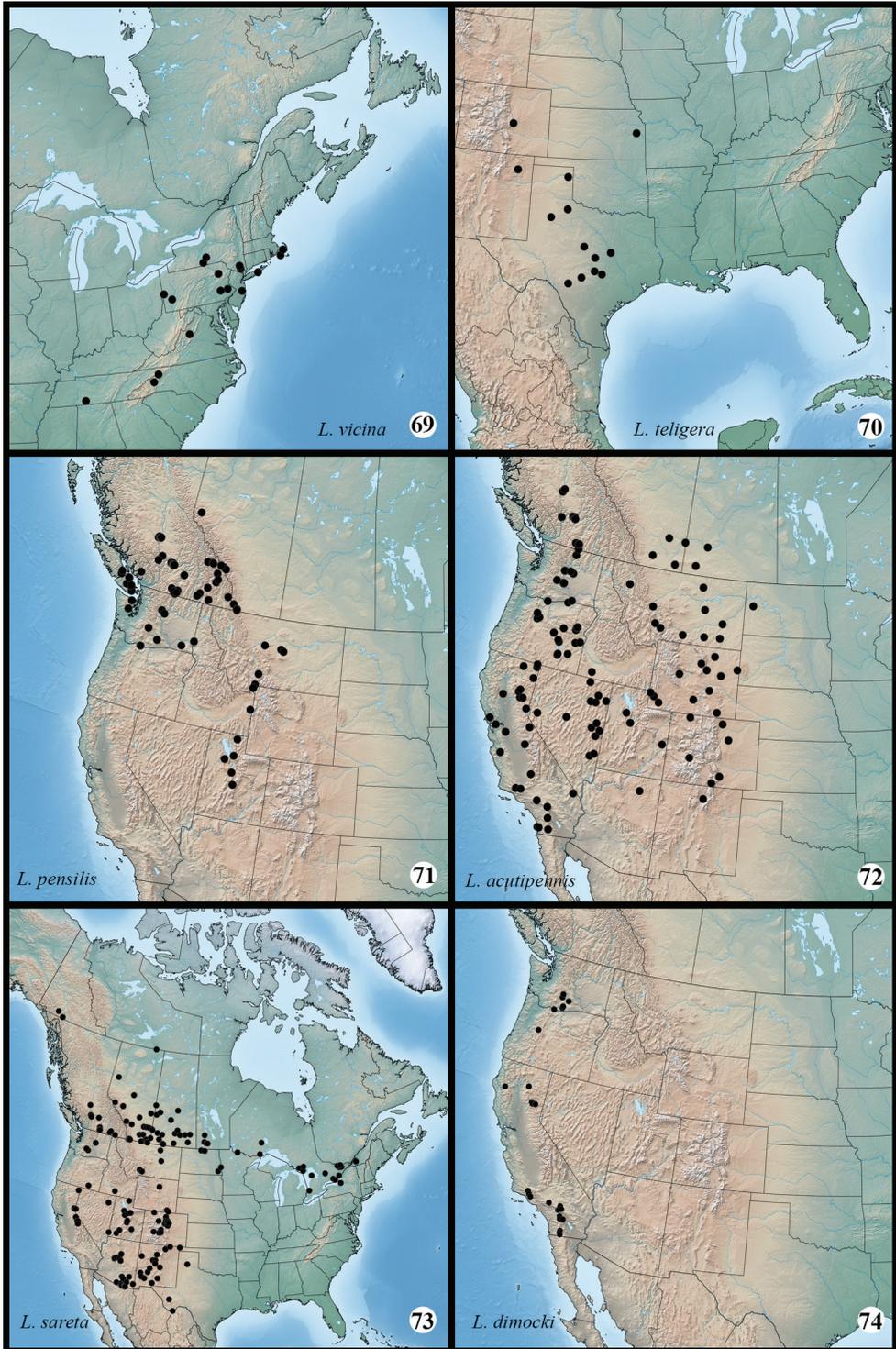
nardino Mountains, Onyx Summit, 34°11.50' N 116°43.06' W, 8500', 25.May.2006, T. Mustelin, 1♀; 1.Aug.2006, 1♀; Riverside Co., Pinyon Crest, 33.614N 116.446 W 4200', 29.Sep.2001, R. Leuschner, 1♂. CNC, USNM. The type material is restricted to specimens from southern California.

**Etymology.** This species is named in honour of Thomas E. Dimock for his contributions to the knowledge of southern California moths. His efforts to collect research specimens provided most of the type series of *L. dimocki*.

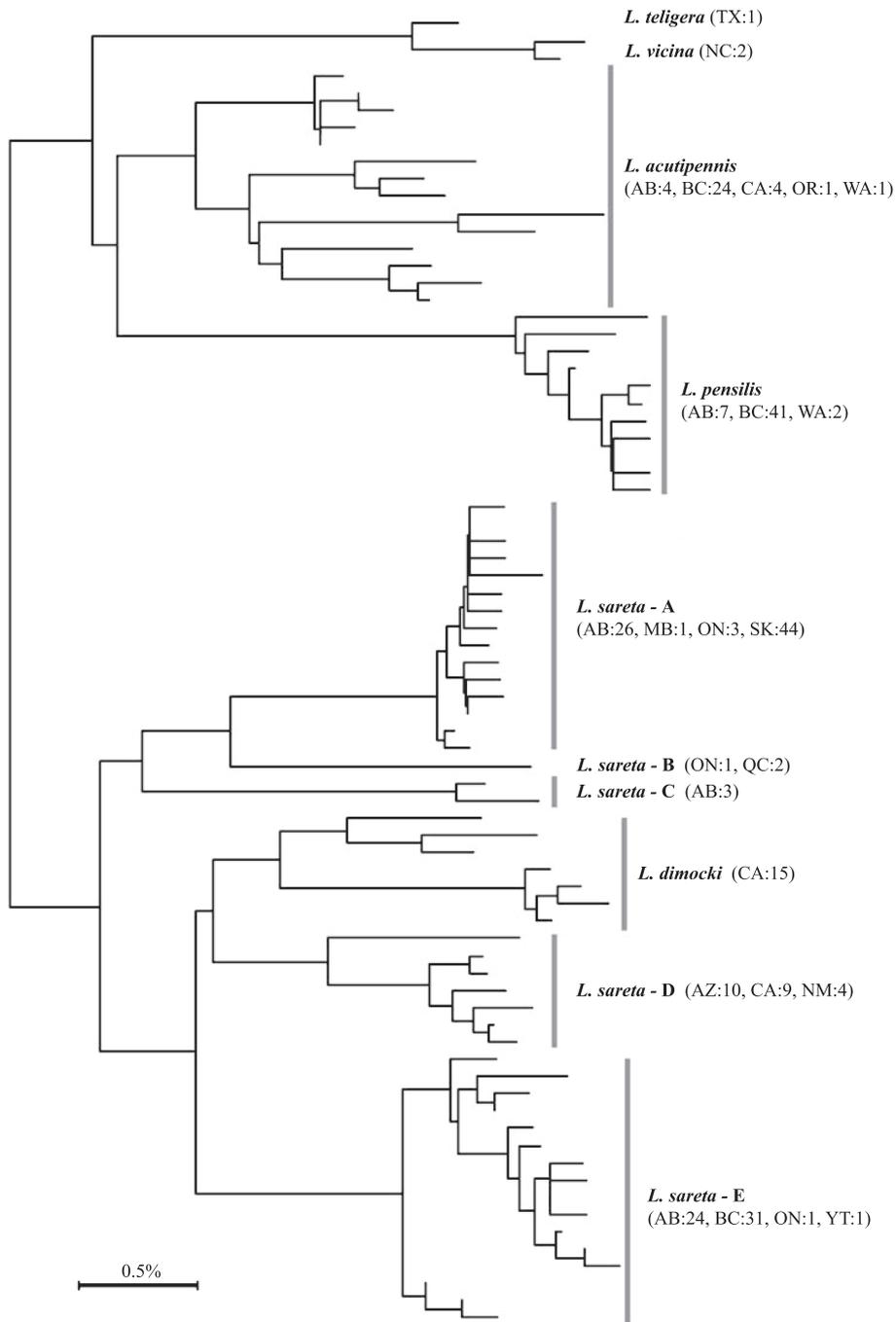
**Diagnosis.** This western species was previously included with *L. sareta* (*L. vicina* of authors), but it is a cryptic, mostly parapatric species that replaces *L. sareta* from the Washington coast ranges southward through California. The two occur sympatrically in south-central Washington, and possibly elsewhere along the interface of the Great Basin–Coast Ranges and Sierra Nevada. Externally *L. dimocki* is larger with an overall paler, less contrasting forewing pattern and usually a lighter, more pearly-white hindwing. The male genitalia differ in having a sinuate, tine-like clasper rather than the flattened, two-lobed clasper of *L. sareta*; also the ventral swelling of the phallus is much more pronounced in *L. dimocki*. Females can be difficult to separate from those of *L. sareta*; in addition to the forewing characters mentioned above, *L. dimocki* is generally larger overall and with a less sinuous, less dorsoventrally flattened ductus bursae and a relatively larger corpus bursae.

**Description. Head.** Antenna of male appearing filiform, but slightly serrate under magnification; antenna of female filiform; dorsal scaling grey; scape, and vertex with a mix of dull-white and dark-grey scales, these spatulate and bifid apically; frons with thin white, strap-like scales, bordered by transverse band of dark-grey scales at dorsal margin; labial palpi with mix of dull-white and dark-grey scales; 3<sup>rd</sup> segment 0.4× length of 2<sup>nd</sup> segment. **Thorax.** Vestiture of light-grey scales tipped with dark-grey apex; tegula and patagium with subterminal border of black scales, border of the tegula diffuse, but that of patagium forming distinct black prothoracic line; caudal margin with slight tuft; legs with mix of light- and dark-grey scales, tarsi with slight banding pattern formed by border of lighter scales along distal margin of each tarsal segment. **Wings.** Average forewing length of males 15.0 mm (n = 9, range 14.2–15.8 mm), females 15.1 mm (n = 9, range 13.8–16.9 mm); forewing ground colour pale grey, medial area pale grey brown; antemedial and postmedial line incomplete or absent, when present then best developed toward anal margin and fading out towards costa, antemedial line double, sometimes with slightly paler grey infill; postmedial line double, often forming pale, indistinct crescent opposite claviform spot; subterminal area with diffuse dark shading in subapical and anal areas, latter sometimes with a small white crescent; basal dash black and crisp; orbicular spot slightly oblong to slightly kidney shaped, with incomplete, thin black border and interior slightly paler than ground colour; reniform

**Figures 63–68.** *Lacinipolia* female genitalia. **63** *Lacinipolia vicina* MA, Barnstable, CNC Gen. Prep. # CNCLEP16883 **64** *Lacinipolia teligera* TX, 16 mi ESE Canyon, CNC Gen. Prep. # CNCLEP16885 **65** *Lacinipolia pensilis* BC, Mt. Kobau, CNC Gen. Prep. # CNCLEP16840 **66** *Lacinipolia acutipennis* CA, Truckee, CNC Gen. Prep. # CNCLEP16847 **67** *Lacinipolia sareta* AB, Wainwright Dunes, CNC Gen. Prep. # CNCLEP16837 **68** *Lacinipolia dimocki* CA, Plumas Co., Happy Valley, CNC Gen. Prep. # CNCLEP16881.



Figures 69–74. Distribution of examined specimens of *Lacinipolia*.



**Figure 75.** Neighbour-joining tree of representative mtDNA barcode haplotypes in species of the *Lacinipolia vicina* group. Sample size and locality are given in brackets, with number of specimens indicated after two-letter state/province abbreviation. *Lacinipolia sareta* variation is divided into five haplogroups, **A–E**. Voucher specimen data is given in Suppl. material 1.

spot with incomplete thin black border, interior slightly paler than ground, with indistinct, darker inner ring; claviform usually distinct, forming a thin black, open V; fringe dark grey, pale grey at vein terminus resulting in indistinct striping; male hindwing bright, slightly pearlescent white with terminal third of veins, and thin diffuse margin fuscous; female hindwing duller white overall with more extensive fuscous shading on veins and marginal area. **Abdomen.** Vestiture light grey, first four segments with slight dorsal tufts of darker grey scales; tuft of 4<sup>th</sup> segment most prominent. **Male genitalia.** Uncus slender, 10–11× longer than wide, evenly tapered from base to apex, with sparse long setae directed basad; valve with extreme subapical constriction forming a narrow neck, such that apex consists of strongly spatulate cucullus; valve abruptly angled caudoventrally beyond apical third; cucullus anvil shaped, interior surface densely covered with fine long hairs; corona consisting of a single row of flattened marginal spines, and a cluster of spines in tip of caudoventral lobe; sacullus with membranous, rectangular flap (possibly a modified editum), which is densely covered in long setae; clasper forming a long, simple sinuate tine, extending to, or slightly beyond, costa; digitus a simple flattened lobe, 2× longer than wide; juxta with two lateral, rounded triangular plates flanking phallus, these with short, straight dorsally directed spines on inner surface; phallus with ventral swelling 2/3 from base; apical third curving ventrad slightly; phallus with small, broad-based, thorn-like dorsal cornutus at apical 3/4; vesica directed left-ventrad, then coiling dorsad and forming extended spiral through one rotation; vesica with small medial patch of spinules, and larger preapical patch extending slightly along axis of vesica. **Female genitalia.** Bursa copulatrix unisaccate; ductus bursae moderately sclerotized and dorsoventrally flattened, 5× longer than wide; corpus bursae globose, membranous and slightly corrugated, lacking signa; appendix bursae slightly coiled, with ductus seminalis situated preapically; ostium bursae extending caudad as an invaginated slit; prevaginal margin convex and slightly rounded-conical; terminal segments telescopic, with posterior apophysis twice as long as anterior apophysis; papillae small, narrow and lobe-like, membranous and moderately setose.

**Distribution and biology.** The early stages and larval food plants are unknown, but like other species in the group, larvae of *L. dimocki* probably are ground-dwelling and polyphagous on herbaceous plants. It occurs from the east slope of the Washington Coast Ranges to southern California.

## Acknowledgements

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## Supplementary material I

### Table S1. Specimen data for mtDNA barcode vouchers

Authors: B. Christian Schmidt

Data type: data spreadsheet

Explanation note: Haplogroup numbers refer to those given in Fig. 75. Abbreviations for specimen depositories are as given in Methods and materials section.

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

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## Abstract

A total of 124 additions and corrections are listed and discussed for the check list of the Noctuoidea of North America north of Mexico published in 2010. Twenty-eight species are added to the list, 16 through new species descriptions, eight as a result of taxonomic splits, and four based on newly recorded species. Forty-eight species are deleted from the list, 41 through synonymy, and seven that were based on misidentifications. Twelve changes are corrections in the spelling of names, or changes in parentheses on dates of publication. Twenty-seven are changes in taxonomy of names where no species are added or deleted; eight changes involve the renumbering of existing species for better taxonomic arrangement. Within the text 2 **stat. n.**, 10 **stat. rev.**, 27 **syn. n.**, 5 **syn. rev.**, and 1 **comb. n.** are proposed for the first time.

## Keywords

Canada, United States, Noctuoidea, Erebidae, Eulepidotinae, Noctuidae, Dyopsinae, *Litoprosopus*

## Introduction

Continuing work on the taxonomy and systematics of New World Noctuoidea has resulted in 124 additional changes to the check list of North American Noctuoidea (Lafontaine and Schmidt 2010). These are in addition to the 115 changes made to the list in 2011 (Lafontaine and Schmidt 2011) and 64 changes made in 2013 (Lafontaine and Schmidt 2013). The new total of Noctuoidea species in North America north of Mexico is 3672 species.

## Materials and methods

### Repository abbreviations

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

- AMNH** The American Museum of Natural History, New York, NY, USA  
**ANSP** The Academy of Natural Sciences, Philadelphia, Pennsylvania, USA  
**BMNH** The Natural History Museum [statutorily: British Museum (Natural History)], London, UK  
**CNC** Canadian National Collection of Insects, Arachnids, and Nematodes, Ottawa, Ontario, Canada  
**CUIC** Cornell University Insect Collection, Ithaca, New York, USA  
**MNHN** Muséum National d' Histoire Naturelle, Paris, France  
**TLSC** Texas Lepidoptera Survey Collection, Houston, Texas, USA  
**JTTC** James T. Troubridge Collection, Hagersville, Ontario, Canada  
**USNM** National Museum of Natural History [formerly, United States National Museum], Washington, District of Columbia, USA

## Results

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

- p. 3 & p. 42 **Subfamily Dyopsinae Guenée, 1852** [insert after Family Noctuidae before Subfamily Plusiinae]  
 930098 *Schizura ipomaeae* Doubleday, 1841  
 930139 **Delete** *Scotura annulata* (Guérin-Méneville, 1844)  
 930142 *Gynaephora rossii* (Curtis, 1835)  
 930196 **Delete** *Propyria schausi* (Dyar, 1898)  
 930217 **Manulea bicolor** (Grote, 1864)  
 930227.1 **Crambidia xanthocarpa Lewis, 2014**

- 930314 *Spilosoma pteridis* H. Edwards, 1875  
**syn. *Spilosoma danbyi* (Neumögen & Dyar, 1893)**
- 930350 *Hypocrita celina* (Boisduval, 1870)  
**syn. *Hypocrita escuintla* (Schaus, 1920)**
- 930358 *Dysschema howardi* (H. Edwards, 1887)
- 930392 **Delete** *Neritos prophaea* (Schaus, 1905)
- 930402 *Cycnia collaris* (Fitch, 1856)  
**syn. *Cycnia inopinatus* (H. Edwards, 1882)**  
**syn. *Cycnia tenerosa* (Dyar, 1913)**
- 930440 *Cisseps fulvicollis* (Hübner, [1818])  
**syn. *Cisseps packardii* (Grote, 1865)**  
**syn. *Cisseps wrightii* (Stretch, 1885)**
- 930445 *Eucereon erythrolepsis* Dyar, 1910
- 930457 **Delete** *Cosmosoma teuthras* (Walker, 1854)
- 930462.1 *Syntomeida syntomoides* (Boisduval, 1836)
- 930581 *Hypena tenebrosa* (Walker, 1865)  
**syn. *H. annulalis* (Grote, 1876)**
- 930604 *Rusicada privata* (Walker, 1865)
- 930605 *Anomis impasta* **of authors, not Guenée, 1852**
- 930616 *Gonodonta fulvangula* Geyer, 1832
- 930631 *Psammathodoxa cochlidoides* Dyar, 1921  
**syn. *P. calligrapha* (Hampson, 1926)**
- 930703 *Hemeroplanis reversalis* (Smith, 1907)  
**syn. *H. cuernavacalis* (Dyar, 1912)**
- 930710 *Hemeroplanis immaculalis* (Harvey, 1875)  
**syn. *H. obliqualis* (H. Edwards, 1886)**
- 930727 *Hyperstrotia nana* (Hübner, 1818)  
**syn. *H. villificans* (Barnes & McDunnough, 1918)**
- 930769.1 *Catocala myristica* Kons & Borth, 2015
- 930846.1 *Catocala aestivalia* Kons & Borth, 2015
- 930907 *Drasteria maculosa* (Behr, 1870)  
**syn. *Drasteria nubicola* (Behr, 1870)**
- 930925.1 *Doryodes desoto* Lafontaine & Sullivan, 2015
- 930925.2 *Doryodes okaloosa* Sullivan & Lafontaine, 2015
- 930927 *Doryodes spadaria* Guenée, [1858]  
**syn. *D. spadaria* race *grandipennis* Barnes & McDunnough, 1918**
- 930927.1 *Doryodes fusselli* Sullivan & Lafontaine, 2015
- 930927.2 *Doryodes latistriga* Sullivan & Lafontaine, 2015
- 930927.3 *Doryodes broui* Lafontaine & Sullivan, 2015
- 930927.4 *Doryodes reinecke* Sullivan & Lafontaine, 2015
- 930970.1 *Lesmone aenaria* (Druce, 1890)  
**syn. *L. lampea* (Druce, 1890)**  
**syn. *L. detrahens* of authors, not (Walker, 1858)**

- 930982 *Heteranassa mima* (Harvey, 1876)  
 syn. *H. fraterna* (Smith, 1899)  
 syn. *H. minor* (Smith, 1899)
- 931000 *Toxonprucha excavata* (Walker, 1865)  
 syn. *T. minuscula* (Walker, 1865)  
 syn. *T. amoena* Möschler, 1890  
 syn. *T. diffundens* of authors, not (Walker, 1858)
- 931018 *Zale viridans* of authors, not (Guenée, 1852)
- 931019 **Delete** *Zale strigimacula* (Guenée, 1852)
- 931062 **Delete** *Amolita sentalis* (Kaye, 1901)
- 931096 –931100 **Move** *Litoprosopus* spp. to Subfamily Dyopsinae as 931160.1 –931160.5
- 931111 *Paectes abrostoloides* (Guenée, 1852)  
 syn. *Paectes delineata* (Guenée, 1852)
- 931156 *Collomena inflexa* (Morrison, 1875)  
 syn. *Collomena filifera* of authors, not (Walker, 1857)
- 931160.1 *Litoprosopus futilis* (Grote & Robinson, 1868)
- 931160.2 *Litoprosopus hatuey* (Poey, 1832)  
 syn. *L. haitiensis* of authors, not Hampson, 1926
- 931160.3 *Litoprosopus bahamensis* Hampson, 1926
- 931160.4 *Litoprosopus coachella* Hill, 1921
- 931160.5 *Litoprosopus confligens* (Walker, [1858])
- 931253 *Amyna stricta* (Walker, 1858)  
 syn. *Amyna axis* of authors, not Guenée, 1852  
 syn. *Amyna octo* of authors, not Guenée, 1852  
 syn. *Amyna flaviguttata* (Walker, 1858)  
 syn. *Amyna orbica* (Morrison, 1874)  
 syn. *Amyna tecta* (Grote, 1876)
- 931253.2 *Concana mundissima* Walker, [1858]
- 931254.1 *Cydosia majuscula* (H. Edwards, 1881)
- 931257.1 *Tripudia inquaesita* (Barnes & Benjamin, 1924)
- 931412 *Raphia frater* Grote, 1864  
 ssp. *frater* Grote, 1864  
 syn. *R. personata* (Walker, 1865)  
 ssp. *abrupta* Grote, 1864  
 syn. *R. flexuosa* (Walker, 1865)  
 ssp. *coloradensis* Putnam-Cramer, 1886  
 syn. *R. pallula* H. Edwards, 1886  
 ssp. *piazzi* Hill, 1927  
 ssp. *cinderella* Smith, 1903  
 ssp. *elbea* Smith, 1908
- 931442.1 *Acronicta fallax* (Herrich-Schäffer, 1854)  
 syn. *A. geminata* (Smith, 1903)

- 931477.1 *Acronicta menyanthidis* (Vieweg, 1790)  
 931496 *Chloronycta tybo* (Barnes, 1904)  
 931550 *Psaphida rolandi* (Grote, 1874)  
 931564 *Feralia comstocki* Grote, 1874  
 931606 *Emarginea percara* (Morrison, 1875)  
     **syn. *E. pallida* (Smith, 1902)**  
 931642 *Cropia connecta* (Smith, 1894)  
     **syn. *Cropia templada* (Schaus, 1906)**  
 931643.1 *Cropia indica* (Walker, [1858])  
 931767 *Catabenoides vitrina* (Walker, 1857)  
     **syn. *C. divisa* (Herrich-Schäffer, 1868)**  
 931773 *Pseudacontia crustaria* (Morrison, 1875)  
     **syn. *P. cansa* Smith, 1908**  
     **syn. *P. louisa* Smith, 1908**  
 931784 *Stylopoda groteana* (Dyar, 1903)  
     **syn. *S. anxia* Smith, 1908**  
 931906.1 *Sympistis forbesi* Zacharczenko & Wagner, 2014  
 932022.1 *Ogdoconta margareta* Crabo, 2015  
 932036 *Heliothodes diminutivus* (Grote, 1873)  
 syn. *H. fasciata* (H. Edwards, 1875)  
 932044 *Psectrotarsia hebardei* (Skinner, 1917)  
 932054 *Chloridea virescens* (Fabricius, 1777)  
 932055 *Chloridea subflexa* (Guenée, 1852)  
 932223 *Spodoptera eridania* (Stoll, 1782)  
 932236.1 *Elaphria trolia* (Dyar, 1914)  
 932278 *Acroria pulchra* (Möschler, 1886)  
     **syn. *A. terrens* of authors, not Walker, 1857**  
 932284 *Nedra stewarti* (Grote, 1875)  
     **syn. *N. dora* Clarke, 1940**  
 932361.1 *Cherokeea attakullakulla* Sullivan & Quinter, 2014  
 932480 *Papaipema insulidens* (Bird, 1902)  
     **syn. *P. birdi* (Dyar, 1908)**  
     **syn. *P. pertincta* Dyar, 1920**  
 932483 *Papaipema harrisii* (Grote, 1881)  
     **syn. *P. verona* (Smith, 1899)**  
 932552 *Lithophane viridipallens* Grote, 1877  
     **syn. *L. pruenae* (Dyar, 1910)**  
 932634 *Aseptis binotata* (Walker, 1865)  
     **syn. *A. paviae* (Strecker, 1874)**  
     **syn. *A. genitrix* (Grote, 1878)**  
     **syn. *A. genetrix*, misspelling of authors, not Grote, 1878**  
     **syn. *A. dilara* (Strecker, 1899)**  
     **syn. *A. bultata* (Smith, 1906)**

- syn. *A. cara* (Barnes & McDunnough, 1912)  
 932648.1 *Paraseptis adnixa* (Grote, 1880)  
 syn. *P. pausis* (Smith, 1899)  
 932749.1 *Viridiseptis marina* (Grote, 1874)  
 932756 *Stretchia plusiiformis* H. Edwards, 1874  
 syn. *S. plusiaeformis* H. Edwards, 1874, invalid emmendation  
 932810 *Nephelodes minians* Guenée, 1852  
 syn. *N. mendica* Barnes & Lindsey, 1921  
 syn. *N. adusta* Buckett, 1973  
 932823.1 *Anarta melanopa* (Thunberg, 1791)  
 932928 *Dargida diffusa* (Walker, 1856)  
 syn. *D. terrapictalis* (Buckett, 1969)  
 932934 *Mythimna yuconensis* (Hampson, 1911)  
 932938.1 *Leucania amygdalina* (Harvey, 1878)  
 933038 *Lacinipolia leucogramma* (Grote, 1873)  
 syn. *L. canities* (Hampson, 1905)  
 syn. *L. francisca* (Smith, 1910)  
 933042.1 *Lacinipolia acutipennis* (Grote, 1880)  
 syn. *Lacinipolia subalba* Mustelin, 2000  
 933042.2 *Lacinipolia sareta* (Smith, 1906)  
 933042.3 *Lacinipolia dimocki* Schmidt, 2015  
 933049 Delete *Lacinipolia perta* (Druce, 1889)  
 933115.1 *Protorthodes texicana* Lafontaine, 2014  
 933115.2 *Protorthodes perforata* (Grote, 1883)  
 syn. *P. constans* (Dyar, 1918)  
 933115.3 *Protorthodes rufula* (Grote, 1874)  
 933115.4 *Protorthodes ustulata* Lafontaine, Walsh & Ferris, 2014  
 933115.5 *Protorthodes alfkenii* (Grote, 1895)  
 933115.6 *Protorthodes antennata* (Barnes & McDunnough, 1912)  
 933116 *Nudorthodes texana* (Smith, 1900)  
 933117 *Nudorthodes variabilis* (Barnes & McDunnough, 1912)  
 933117.1 *Nudorthodes molino* Walsh, Lafontaine & Ferris, 2014  
 933331.1 *Euxoa bivittata* Lafontaine, 1987

## Notes

- p. 3 & p. 42 **Subfamily Dyopsinae** – Zahiri et al. (2013) showed through DNA sequence results that a number of subfamilies and genera formerly associated with the Erebidae were basal lineages of the Noctuidae, including the subfamily Dyopsinae. Recent molecular results by Zahiri and associates show a close relationship between *Dyops* Guenée and *Litoprosopus* Grote. [Contributed by Reza Zahiri].

- 930098** *Schizura ipomaeae* – The original spelling of the species name is *ipomaeae*, the author stating that the species name is from the plant genus *Ipomaea*, an incorrect spelling of the plant genus *Ipomoea* L. However, according to the ICZN rules the original spelling should be maintained, unless there is internal evidence for a typographical error.
- 930139** *Scotura annulata* – This species was added to the North American list in Franclemont 1983 as *Zunacetha annulata* and listed that way by Lafontaine and Schmidt (2010). It was transferred to the genus *Scotura* following Miller (2009) in Lafontaine and Schmidt (2011). We did not notice at the time that Miller, in the 2009 publication, had reviewed the report of *Scotura annulata* in Texas and concluded there was no evidence to support the record. Following this, we remove the species from the check list.
- 930142** *Gynaephora rossii* – This species was originally described in the genus *Laria* Schrank, 1802, a junior homonym of *Laria* Scolipi, 1763 in the Coleoptera, so the author's name and year of publication should be enclosed by parentheses. [Contributed by Lars Crabo].
- 930196** *Propyria schausi* – The origin of the supposed occurrence of this species in the United States traces a convoluted path through the historic literature. The syntype specimens of *schausi* came from the Henry Edwards collection, originating from Jalapa, Mexico. Two females, which are in the AMNH, were initially identified by Edwards as *Ptychoglene aequalis* Walker. Neumoegen and Dyar (1893) in their revision of North American Arctiinae reidentified the specimens as *Lycomorpha fulgens* (H. Edwards). Dyar (1898) later realized that these specimens were neither *L. fulgens* nor *P. aequalis*, and so described them as a new species, *Lycomorpha schausi*. Neumoegen and Dyar (1893) stated that *L. fulgens* was distributed in Mexico and Arizona, but their concept of *L. fulgens* must have included both true *L. fulgens* of Arizona (very similar in facies to *Propyria schausi*) and the Mexican *P. schausi*. Dyar (1903) did not include *P. schausi* in his North American list. Hampson subsequently documented *P. schausi* from both Mexico and Arizona, but must have based this solely on Neumoegen and Dyar's (1893) literature accounts as he states the species "...is unknown to me." (Hampson 1898). The Arizona record of *P. schausi* can therefore be traced to Hampson's oversight of Neumoegen and Dyar's confusion of *L. fulgens* and *P. schausi*. *Propyria schausi* disappeared from the North American checklists until Franclemont (1983) listed it again, possibly based on Hampson's account. No U.S. specimens of *P. schausi* were located by us in the major museums, and Ferguson et al. (2000) did not document it. We therefore conclude that Franclemont (1983) either repeated Hampson's error, or the record (re-)originated from a misidentification of another *Lycomorpha*. An additional complicating factor is its similarity to the zygaenid *Nealbertia constans* (Edwards), which is identical in size, wing shape and coloration – but differs structurally, for example in the antennae, wing venation, and presence of chaetosoma on the head. For the above reasons, *Propyria schausi* is removed from the North American list.

- 930217 *Manulea bicolor*** – This species was transferred from *Eilema* Hübner to *Manulea* Wallengren (subgenus *Setema* de Freina and Witt) by Dubatolov (2015).
- 930227.1 *Crambidia xanthocorpa*** – This species, recently described from eastern United States, was previously included in the concept of *Crambidia cephalica* (Grote & Robertson, 1870) (Lewis 2014).
- 930315 *Spilosoma pteridis*** – The name *Spilosoma danbyi* was informally raised from synonymy under *S. pteridis* to the status of a valid species by Ferguson et al. (2000). However, as already noted by Barnes and McDunnough (1917a), both *pteridis* and *danbyi* were described from Vancouver Island, BC and refer to the same taxon. The taxonomy of this group is complicated by extreme geographic (and local) variation in phenotypes and pronounced sexual dimorphism, but there is no morphological or molecular evidence that two different species (*pteridis* and “*danbyi*”) exist as depicted in Ferguson et al. (2000). *Spilosoma danbyi* is therefore revised back to the synonymy of *S. pteridis* (**stat. rev.**). Further work is needed to examine the relationship between *S. vagans* and *S. pteridis*, as it is possible that the latter is only a small, dark form of *S. vagans* that occurs in cooler, wetter climates.
- 930350 *Hypocrita celina*** – Synonymy proposed by Becker (2013) and Vincent and Laguerre (2013).
- 930358 *Dysschema howardi*** – Becker (2013) synonymized *howardi* (type locality: New Mexico) under *D. thetis* (Klug, 1836), described from “Mexico,” but as pointed out by Laguerre et al. (2014), the large DNA barcode divergences in this group indicate that these taxonomic changes are not supported, and that there are multiple species under the name *thetis* (*sensu* Becker). Arizona specimens of *howardi* differ from two other taxa under the name *thetis* (one from Michoacan and one from Sinaloa and Jalisco) by at least 2.5% (DNA barcode sequence), and we therefore re-instate *howardi* **stat. rev.** as a *bona species* until the group can be revised thoroughly.
- 930392 *Neritos prophaea*** – This species was listed as *Neritos prophaea* by recent North American authors, unaware that Toulgoët (1992) had transferred *prophaea* to *Haemanota* Hampson. It was first listed for North America by Franclemont (1983) (as *Trichromia prophaea*), who indicated that it was possibly a stray. There are no known vouchers or other details. Ferguson et al. (2000) did not map this species, nor are there any specimens in the Franclemont collection at CUIC. Given the lack of supporting data and the fact that *Neritos prophaea* belongs to a complex of closely related Neotropical species, we delete *Haemanota prophaea* from the North American list until voucher specimens are secured.
- 930402 *Cygnia collaris*** – *Cygnia tenerosa*, **syn. n.**, and *C. inopinatus*, **syn. n.**, have previously been recognized as separate species based largely on phenotypic differences and geographic distribution. In particular, the color of the wings and thorax can vary from white to gray, and the patagia from yellow to gray. Comparison of genitalic structure and DNA barcode variation shows that gray and white phenotypes represent the same species, with gray versus white phenotypes prevalent in spring and summer, respectively. The holotype of *inopinatus* rep-

resents the gray phenotype (described from Indian River, Florida) and is here synonymized with *C. collaris* (described from Mississippi). The name *Cycnia tenerosa* (described from Misantla, [Veracruz], Mexico) was applied to Texas and Florida specimens by Ferguson and Opler (2006), but as indicated above, western, southern and northern populations represent the same variable species. The *tenerosa* holotype (USNM; illustrated in Watson 1971) is structurally and phenotypically indistinguishable from the white form of *tenerosa*, and we therefore synonymize the two.

**930440** *Cisseps fulvicollis* – *Cisseps packardii* (Grote, 1865) and *Cisseps wrightii* (Stretch, 1885) were thought to be disjunct West Coast species related to the widespread *C. fulvicollis*, differing from that species by a paler yellow scape (*packardii*) and slightly smaller size (*wrightii*). It is now evident that scape color and size varies in many western populations, and the geographic distribution is more continuous than historical workers realized. Maximum DNA barcode variation among all three taxa is less than 0.5%. We therefore treat *packardii*, **syn. n.** and *wrightii*, **syn. n.** as synonyms of *C. fulvicollis*.

**930445** *Eucereon erythrolepis* – The spelling *erythrolepis* is an unjustified emendation of *erythrolepis* introduced by Hampson (1914) and repeated in Ferguson and Opler (2006), Schmidt and Opler (2008) and Lafontaine and Schmidt (2010).

**930457** *Cosmosoma teuthras* – Described from Venezuela, this taxon was first listed for the North American fauna by Barnes and McDunnough (1917b); however, there are no details of any records or vouchers. Because *Cosmosoma teuthras* is often confused with other *Cosmosoma*, we remove it from the North American list.

**930462.1** *Syntomeida syntomoides* – Recorded in 2013 from Bahia Honda, Florida by Jim Troubridge. Vouchers in JTTC and CNC.

**930581** *Hypena tenebrosa* – The barcodes were the first clue that *Hypena tenebrosa* (Walker, 1865), described from Venezuela, is conspecific with *H. annulalis* (Grote, 1876), **syn. n.**, described from Texas. They share similar forms throughout the species range.

**930604** *Rusicada privata* – In our check list (Lafontaine and Schmidt 2010) we retained a broad concept of the genus *Anomis* Hübner on the basis that Holloway's (2005) generic rearrangement for the Old World *Anomis* s.l. fauna excluded the New World taxa, accepting that a separate revision of New World generic limits in *Anomis* s.l. was needed first. However, the species *Anomis commoda* (Walker, 1865) is an introduced species that belongs to the Old World genus *Rusicada* Walker, so it seems reasonable to accept this generic transfer for consistency between Old World and New World names for shared species.

**930605** *Anomis impasta* – This species has remained on the North American list since it was added by Kimball (1965). Even then, the identity of a Floridian taxon was suspected to not be correctly associated with *Anomis impasta*, which was described from French Guiana. Comparison of specimens from Florida with the lectotype of the species in MNHN, Paris, confirms that the taxon in Florida is not *Anomis impasta*, so it is hereby referenced as *Anomis impasta* of authors, not Guenée, 1852.

- 930616 *Gonodonta fulvangula* – The species name was misspelled as *fulvangala* in Lafontaine and Schmidt 2010.
- 930631 *Psammathodoxa cochliidioides* – Examination of the type specimen of *Sudariophora calligrapha* Hampson, 1926 from Brownsville, Texas, shows it to be the same species as *Psammathodoxa cochliidioides*. The species was transferred to the genus *Phyprosopus* Grote when *Sudariophora* Zeller was placed into its synonymy, the two generic names sharing the same type species. Therefore, *Sudariophora calligrapha* Hampson, 1926 is now transferred to *Psammathodoxa* Dyar as *Psammathodoxa calligrapha* (Hampson, 1926), **comb. n.**, **syn. n.**
- 930703 *Hemeroplanis reversalis* – Examination of the type specimens of *H. reversalis* (type locality: Brownsville, Texas) and *H. cuernavacalis* (Dyar, 1912), **syn. n.** (type locality: Cuernavaca, Mexico) shows them to be the same species.
- 930710 *Hemeroplanis immaculalis* – The types of *Hemeroplanis immaculalis* and *H. obliqualis*, **syn. n.**, represent the same species. Previously, the name *H. immaculalis* was applied to pale specimens of *H. parallela* (Smith, 1907) from Texas. Poole (1989) incorrectly credits Morrison rather than Edwards as the author of the name and gives the type repository as MSU, whereas the holotype is in AMNH.
- 930727 *Hyperstrotia nana* – Two nominal species are confused in collections, *H. nana*, described from Florida by Hübner in 1818, and *H. aetheria*, described by Grote from Florida in 1879. The type specimen of *H. aetheria* is in the BMNH, however there is no type specimen for *H. nana*, so the identity of the name is based on the painting in Hübner 1818, which is a new senior synonym of *H. villicans* (Barnes & McDunnough, 1918), **syn. n.** Another species of *Hyperstrotia* in Florida related to *H. aetheria* remains undescribed.
- 930769.1 *Catocala myristica* – New species from Kons and Borth (2015a).
- 930846.1 *Catocala aestivalia* – New species from Kons and Borth (2015b).
- 930907 *Drasteria maculosa* – This name represents populations of *Drasteria* in the Sierra Nevada that may be disjunct populations of *Drasteria hudsonica* (Grote & Robinson) or a closely related species. However, the name *Drasteria nubicola* (Behr, 1870), **syn. n.**, represents a pale almost unmarked form of the Sierran taxon. The name *D. nubicola* has page priority over *D. maculosa* (by one page), but as first revisers we use the name *maculosa* for the taxon because it represents the more typical form for the *D. hudsonica* group.
- 930925.1 *Doryodes desoto* – New species from Lafontaine and Sullivan (2015).
- 930925.2 *Doryodes okaloosa* – New species from Lafontaine and Sullivan (2015).
- 930927 *Doryodes spadaria* – Revised synonymy of *Doryodes grandipennis* with *D. spadaria* from Lafontaine and Sullivan (2015).
- 930927.1 *Doryodes fusselli* – New species from Lafontaine and Sullivan (2015).
- 930927.2 *Doryodes latistriga* – New species from Lafontaine and Sullivan (2015).
- 930927.3 *Doryodes broui* – New species from Lafontaine and Sullivan (2015).
- 930927.4 *Doryodes reineckeii* – New species from Lafontaine and Sullivan (2015).
- 930970.1 *Lesmone aenaria* – This species was described from Mexico and Guatemala as *Bendis aenaria* and until now has been treated as a synonym of *Lesmone detra-*

*hens*. However, both the barcodes and numerous differences in the male genitalia show that *Lesmone aenaria*, **stat. rev.**, should be treated as a valid species distinct from *Lesmone detrahens*, the latter being widespread through eastern United States. *Lesmone aenaria* is known to occur from Costa Rica northward to southern Texas. The name *Metalectra lamprea* Druce, 1890, **syn. rev.**, described from Costa Rica, is a synonym of *Lesmone aenaria*, not a synonym of *L. detrahens*.

**930982** *Heteranassa mima* – New synonymy with *H. fraterna* and *H. minor* from Homziak et al. 2015.

**931000** *Toxonprucha excavata* – There are at least four species in southern United States that have been collectively associated with the name *Toxonprucha diffundens* (Walker, 1858). However the holotype of *Celaena diffundens* Walker, and its synonym *Pyralis? noctualis* Walker, [1866], both described from Venezuela, differ significantly in ways that suggest this species may not be correctly placed in the genus *Toxonprucha* Möschler (1890) [Type species: *Toxonprucha amoena* Möschler, 1890; type locality: Puerto Rico], and certainly not conspecific with any of the synonyms or specimens from other areas that have been associated with the name. In “*T.*” *diffundens* the hindwing is mainly pale and unpatterned, with some fuscous along the margin in both sexes, and the forewing pattern is reduced with the postmedial line forming an almost complete loop around the reniform spot, and the antemedial line forming a double-sided loop projecting from the costa, suggesting that *Celaena diffundens* does not belong in the genus *Toxonprucha*. We apply the name *Toxonprucha excavata* (Walker, 1865), **stat. rev.**, with its synonyms *T. minuscula* (Walker, 1865), **syn. n.**, and *T. amoena* Möschler, 1890, **syn. n.**, to populations that occur in southern Texas as suggested by similarity in barcodes from the Caribbean, Mexican, and Texan populations.

**931018** *Zale viridans* (Guenée, 1852) – Specimens from Florida identified as *Zale viridans* (Guenée, 1852) are an undescribed species in the *Zale strigimacula* species complex and are not closely related to *Zale viridans*.

**931019** *Zale strigimacula* (Guenée, 1852) – Specimens from Florida identified as *Zale strigimacula* (Guenée, 1852) represent the same species in the *Zale strigimacula* species complex as those misidentified as *Zale viridans*.

**931062** *Amolita sentalis* – *Amolita sentalis* was doubtfully added to the North American list by Kimball (1965) on the basis of material in the AMNH identified as this species by Grossbeck (1917). However, Grossbeck, in his list of the Lepidoptera of Florida, did not list *Amolita obliqua* Smith, 1903, which was described from Florida. Therefore, it seems more likely that Grossbeck was following the synonymy of the two names by Hampson (1901) rather than recognizing the occurrence of *A. sentalis* as a species distinct from *A. obliqua*. Kimball (1965) states that *A. sentalis* is much smaller than *A. obliqua*; however, it appears that there is too much variation in size for this to be used as an identification character. *Amolita obliqua* and *A. sentalis* [TL: Trinidad] cannot be identified by external characters, only by genital characters, which are diagnostically different.

- 931096–931100 *Litoprosopus*** – The genus *Litoprosopus* Grote has for many years been classified among the “quadrifid noctuids”, now the family Erebididae. Lafontaine and Schmidt (2010) placed them near the end of the Erebididae in the subfamily Eulepidotinae as “*insertae sedis* Group 2”. Recent nuclear gene research by Reza Zahiri has determined that, like several other lineages formerly classified in the Erebididae (Zahiri et al. 2013), *Litoprosopus* should correctly be included in the basal Noctuidae in the subfamily Dyopsinae. Accordingly, the subfamily Dyopsinae is inserted into the check list on page 42 after the heading “**Family Noctuidae**” and the check list numbers for the five species are changed to 931160.1 to 931160.5. [Contributed by Reza Zahiri].
- 931111 *Paectes abrostoloides*** – *Paectes delineata* (Guenée, 1852), **syn. n.**, has been treated as a valid species, mainly because there is no type material to deduce the synonymy. Like several other species described by Guenée, the description likely was based on a painting by John Abbot in the late 1700’s in the Savannah, Georgia area. Given that the description matches one of the known forms of *Paectes abrostoloides*, and no other similar species occur in the area, we treat *P. delineata* as a new synonym of *P. abrostoloides*.
- 931156 *Collomena inflexa*** – The species that occurs in Florida is *Collomena inflexa* (Morrison, 1875), **stat. rev.** (Type-locality: Jacksonville, Florida). It was treated as a synonym of *Collomena filifera* (Walker, 1857) (Type-locality: Santo Domingo, Dominican Republic). The two species differ in the configuration of the eversible antler-like coremata on the valves, and by 2.5% in their barcode sequences.
- 931253 *Amyna stricta*** – Barcoding was the original clue that New World populations of *Amyna stricta* (Walker, 1858), **stat. rev.**, are not conspecific with Old World populations, known as *Amyna axis* Guenée, 1852 [= *Amyna octo* Guenée, 1852]. Consistent differences in the pouches and spine clusters in the vesica support the separation of Old and New World populations as separate species. *Amyna flaviguttata* (Walker, 1858), **syn. rev.** [Type locality: Venezuela], *Amyna orbica* (Morrison, 1874), **syn. rev.** [Type locality: Texas], and *Amyna tecta* (Grote, 1876), **syn. rev.** [Type locality: Texas], are synonyms of *Amyna stricta* [Type locality: Honduras].
- 931253.2 *Concana mundissima*** – Nuclear gene research on the basal lineages of the Noctuidae (Zahiri et al. 2013) resulted in the genus *Concana* Walker being moved from the Nolidae, Collomeninae to the Noctuidae, Bagisarinae.
- 931254.1 *Cydosia majuscula*** – Barcode differences confirm that *Cydosia majuscula* (H. Edwards, 1881), **stat. rev.**, the all black “form” of *Cydosia aurivitta* Grote & Robinson, 1868, is a valid species confined to southeastern United States east of Texas. It was described from Georgia [type in AMNH]. *Cydosia aurivitta*, the “maculate form” is a separate species that occurs in Texas and Mexico. It occurs in two basic forms, one with black forewings and broad reddish-orange transverse bands and a similarly-colored square in between the two lines, and a second form covered with large white spots in addition to the orange bands and spot. *Cydosia aurivitta* and its synonym *C. imitella* Stretch were described from Texas; the types are in ANSP and USNM respectively. [Contributed by Hugo Kons, Jr., Gainesville, Florida].

- 931257.1 *Tripudia inquaesita* – Barcode differences and details in maculation show that the species of *Tripudia* Grote in the *T. damozela* complex (*T. inquaesita* (Barnes & Benjamin, 1924), **stat. rev.**) is a distinct species and occurs in southern Arizona and probably in the Sierra Madre Occidental in Mexico, and is different from *T. damozela*, which occurs from the State of Puebla in southeastern Mexico northward in the Sierra Madre Oriental to western Texas.
- 931412 *Raphia frater* – Revisions in synonymy and subspecies ranking from Schmidt and Anweiler (2014).
- 931442.1 *Acronicta fallax* – Generic combination, placement, and synonymy (syn. *A. geminata* (Smith, 1903)) from Schmidt et al. (2014).
- 931477.1 *Acronicta menyanthidis* – This species was first recorded for North America in Ferris et al. (2012). So far, it has only been found in Alaska.
- 931496 *Chloronycta tybo* – The genus *Chloronycta* Schmidt & Anweiler, and the generic combination, were proposed in Schmidt et al. (2014).
- 931550 *Psaphida rolandi* – This species was described in the genus *Eutolype* Grote, so parentheses should enclose the author and date to reflect the generic transfer.
- 931564 *Feralia comstocki* – This species was described in the genus *Feralia* Grote, so the parentheses around the author and date should be removed.
- 931606 *Emarginea percara* – The species formerly known as *Emarginea pallida* (Smith, 1902), **syn. n.**, is redefined as a very pale desert form of *E. percara* known from the deserts of southeastern California, southernmost Nevada, and western Arizona. The specimens are almost devoid of the black lines that define the forewing maculation in the typical form, but they differ neither in genitalia nor barcodes from specimens of *E. percara* from other areas.
- 931642 *Cropia connecta* – Rearing of *Cropia connecta* in Costa Rica (Janzen and Hallwachs 2015) and barcode results show that *Cropia templada* (Schaus, 1906), **syn. n.**, is a form of *Cropia connecta*.
- 931643.1 *Cropia indica* – Specimens of this Caribbean species collected on Key Largo, Florida are in the collections of CUIC, TLSC, and USNM. They were collected the same year so it may have been a temporary incursion.
- 931767 *Catabenoides vitrina* – Kimball (1965) recognized two species in southern Florida, *C. vitrina* [Type locality: Dominican Republic] and *C. divisa* [Type locality: Cuba] based on unpublished data credited to E. Todd. There are two species in southern Florida, one with a black streak in the female from the base of the forewing to just below the apex, and one with an entirely gray female. However, it is clear from the original descriptions that both names refer to the same species, so *C. divisa* (Herrich-Schäffer, 1868), **syn. n.**, is the same species as *C. vitrina* and the second species in Florida is undescribed.
- 931773 *Pseudacontia crustaria* – This is an uncommon species of the Great Plains and few specimens have been available for study. It occurs in three forms, a more northerly form with a mainly white forewing with dark shading in the basal, outer half of the subterminal, and the terminal areas (*P. crustaria*), a form with dark shading in the basal, medial and terminal areas (*P. louisiana* **syn. n.**), and a mainly

- dark form with a pale band between the basal and medial areas, and in the outer part of the medial area (*P. cansa* **syn. n.**). There are no differences in the genitalia nor barcodes.
- 931784 *Stylopoda groteana* – Smith (1908) described *Stylopoda anxia*, **syn. n.** from Ft Wingate, New Mexico, apparently unaware that Dyar (1903) described it from Williams, Arizona, as *Pseudacontia groteana* five years previously. There are no characters to support the recognition of two species in the range of *S. groteana*, which occurs from western New Mexico eastward through Arizona and southern Utah to the New York Mountains in eastern California. [Contributed by David Wikle].
- 931906.1 *Sympistis forbesi* – A new species related to *Sympistis chionanthi* (J.E. Smith, 1797) described in Zacharczenko et al. 2014.
- 932022.1 *Ogdoconta margareta* – New species from Crabo (2015).
- 932036 *Heliothodes diminutivus* – The species name was misspelled as *diminutiva* and synonym *fasciata* misspelled as *fasciatus* in Lafontaine and Schmidt 2010.
- 932044 *Psectrotarsia hebardii* – The species name described in the genus *Erythroecia* Hampson, so the author and date should be placed in parentheses. [Contributed by Lars Crabo].
- 932054 *Chloridea virescens* – Generic combination from Pogue (2013).
- 932055 *Chloridea subflexa* – Generic combination from Pogue (2013).
- 932223 *Spodoptera eridania* – The correct authorship and date for this species is Stoll, 1782 (Poole 1989). The confusion between the authorship of Cramer and Stoll was discussed by us previously (Lafontaine and Schmidt 2011: 150).
- 932236.1 *Elaphria trolia* – *Elaphria trolia* (Dyar, 1914), **stat. n.**, was described and previously treated as a Central American subspecies of *Elaphria exesa* (Guenée, 1852), but differs from it in barcodes (3.5%) and male genital characters. So, it is revised to the status of valid species. [Contributed by Jim Troubridge].
- 932278 *Acroria pulchra* – Barcode results show that *Acroria terreus* (Walker, 1857) [TL: Venezuela], and its synonyms *A. infensa* (Walker, 1857) [TL: Venezuela], and *A. villipes* Walker, 1858 [TL: Brazil], is a different species from *Acroria pulchra* (Möschler, 1886), **stat. rev.**, [TL: Jamaica], and *A. pulchra*'s synonym *A. niphandia* (Druce, 1889) [TL: northern Panama], **syn. rev.** *Acroria terreus* was barcoded from Venezuela, Brazil, Saint Lucia, and Puerto Rico. *Acroria pulchra* was barcoded from Costa Rica, Guatemala, Mexico, USA, Texas, Dominican Republic, and Jamaica.
- 932284 *Nedra stewarti* – The species *Nedra dora* was described as being similar to *N. stewarti*, but with the forewing a darker purplish fuscous with lighter lavender-gray area than *N. stewarti*. There is a great deal of variation in color from place to place and the genital characteristics given by Clarke (1940) do not hold up when more material is examined. Also, the barcodes are not differentiated from those of *N. stewarti*. So we place *Nedra dora* Clarke, 1940, **syn. n.** in synonymy.
- 932361.1 *Cherokeea attakullakulla* – The genus *Cherokeea* Quinter & Sullivan, 2014, and the species *Cherokeea attakullakulla* Sullivan & Quinter, 2014, were described in Quinter and Sullivan 2014.

- 932480 *Papaipema insulidens*** – *Papaipema insulidens* was described from Vancouver Island in southwestern British Columbia; *Papaipema pertinecta* Dyar, 1920, **syn n.**, was described from Forest Grove in northwestern Oregon; *Papaipema birdi* (Dyar, 1908), **syn n.**, was described from Rye, New York. We treat *Papaipema insulidens* as a widespread species that ranges across the southern boreal zone of Canada to connect the eastern and western parts of its range. Throughout this vast area specimens can range from a pale grayish yellow to a darker reddish brown with forms covering this variation sometimes from the same localities. There are no structural differences throughout this range and the barcodes are the same with one haplotype shared almost through the whole range from North Carolina to the Pacific Coast. For these reasons we treat *P. pertinecta* and *P. birdi* as synonyms of *P. insulidens*.
- 932483 *Papaipema harrisii*** – The taxon *Papaipema verona*, described from Winnipeg, Manitoba, Canada, refers to prairie populations of the species otherwise known from eastern North America as *Papaipema harrisii*. The specimens are indistinguishable from those of *P. harrisii* from farther east in appearance, genitalia, and barcodes, so we treat *Papaipema verona* (Smith, 1899), **syn n.**, as a synonym of *P. harrisii*.
- 932552 *Lithophane viridipallens*** – The species *Lithophane pruenae* **syn n.**, was described by Dyar (1910) from a single female from eastern Texas. The type specimen is lost, but *L. pruenae* is described as being similar to *L. viridipallens*, but the basal dash in *L. pruenae* is more prominent, there is more black shading between the reniform and orbicular spots, and the dark spots along the subterminal line are larger than in typical specimens of *L. viridipallens*. A specimen in the TLSC matches the original description of *L. pruenae* perfectly and its barcodes are identical to those of *L. viridipallens* from Georgia, North Carolina and New Jersey. Because there is considerable variation in the diagnostic features of *L. viridipallens*, we treat *L. pruenae* as a well-marked form of it. Although the type specimen is lost, the female genitalia slide of the type of *L. pruenae* is in USNM and is indistinguishable from those of other *L. viridipallens*.
- 932634 *Aseptis binotata*** – Revision of the genus *Aseptis* McDunnough, 1937, by Mustelin and Crabo (2015) resulted in *Aseptis paviae* (Strecker, 1874), *A. genitrix* (Grote, 1878), *A. dilara* (Strecker, 1899), *A. cara* (Barnes & McDunnough, 1912), and *A. bultata* (Smith, 1906), being placed into synonymy with *Aseptis binotata* as geographical forms. Mustelin and Crabo (2015) point out that the name *Aseptis genitrix* was misspelled as *Aseptis genetrix* by numerous authors including Franclemont and Todd (1983), Poole (1989), and Lafontaine and Schmidt (2010).
- 932648.1 *Paraseptis adnixa*** – In a revision of the genus *Aseptis*, Mustelin and Crabo (2015) proposed a new genus, *Paraseptis* Mustelin & Crabo, 2015, for *Hadena adnixa*, a species formerly included in *Aseptis*. In their revision, the species *Aseptis pausis* (Smith, 1899) is synonymized with *Paraseptis adnixa* as *Paraseptis pausis*.
- 932749.1 *Viridiseptis marina*** – The genus *Viridiseptis* Mustelin & Crabo, 2015, was proposed in Mustelin and Crabo (2015) for the species previously listed as 932649

*Aseptis marina* (Grote, 1874) in Lafontaine and Schmidt (2010). The species is highly divergent from other genera in the Xylenini, therefore Mustelin and Crabo (2015) recommended it be moved to Xylenini *incertae sedis*; this change in position is reflected in its revised check list number.

**932756** *Stretchia plusiiformis* – *plusiaeformis* is an unjustified emendation of the original spelling *plusiiformis*. Incorrect latinization of a name is not to be considered an incorrect original spelling (ICZN 1999, Article 32.5.1).

**932810** *Nephelodes minians* – On the basis of variability in genital characters, geographical variation, and shared barcode sequences, we treat *N. mendica* Barnes & Lindsey, 1921, **syn. n.**, and *N. adusta* Buckett, 1973, **syn. n.**, as part of the geographical variability of *N. minians*.

**932823.1** *Anarta melanopa* – *Anarta nigrolunata* Packard, 1867, was segregated from its Old World sister species by Schmidt and Anweiler 2010. The two species can be distinguished by genital characters and barcode sequences. Recently, specimens of *Anarta melanopa* were barcoded from Alaska and northern Yukon and represent new records of this species in North America. Curiously, the barcodes are identical with those from specimens from montane areas of southern Europe, but differ from those from Fennoscandia, suggesting a southern Siberian-Altai-Balkans-Alps connection to the Alaskan population, not a northern Russia-Fennoscandian connection as is seen in more arctic-occurring species like *Sympistis zetterstedtii* (Staudinger, 1857).

**932928** *Dargida diffusa* – Lack of consistent genital differences, identical barcodes with those of *D. diffusa* from various parts of Canada and the United States, and intermediate forms in Idaho and western Montana, result in us treating *D. terrapictalis* (Buckett, 1969), **syn. n.**, as conspecific with *D. diffusa*. *Dargida terrapictalis* is a dark form of the species that occurs from southern British Columbia to central California and could be treated as a subspecies if desired.

**932934** *Mythimna yuconensis* – We return this species to its original spelling. The name was emended by McDunnough (1938) to *yukonensis*, not accepting Hampson's use of a c in the name instead of a k. The ICZN rules allow the original spelling of a name to be "corrected" if the person or place the name is derived from is included in the original text, thus demonstrating the error. However, in the case of *yuconensis*, it was Hampson's habit to use traditional Latin letters for scientific names, including changing the species name in *Xestia wockei* to *voccei*. The spelling of *yuconensis* cannot be taken as an error, but was the spelling intended by Hampson.

**932938.1** *Leucania amygdalina* – Barcode results, and consistent differences in the genitalia between southern populations of *L. linita* [type-locality: St. John's Bluff, Florida] and those from farther north result in us treating the northern populations as *Leucania amygdalina* (Harvey, 1878), **stat. rev.**, [type locality: Orono, Maine] as a valid species. *Leucania linita* has a longer, more coiled vesica and a larger cucullus (40% as long as saccular region) in the male genitalia, whereas the vesica is shorter and straighter and the cucullus is 30% as long as the saccular region

in *L. amygdalina*. *Leucania linita* is known to occur from Maryland to Florida and Texas; *L. amygdalina* occurs from southern Canada and New England westward to Illinois and Indiana and southward probably to New Jersey.

**933038** *Lacinipolia leucogramma* – Two names formerly treated as valid species, *L. canities* (Hampson, 1905), **syn. n.** and *L. francisca* (Smith, 1910), **syn. n.**, are synonyms of *Lacinipolia leucogramma*. This result was reported in the unpublished 1975 thesis of Charles Selman, and the barcodes results also support this conclusion.

**933042.1** *Lacinipolia acutipennis* – New synonymy from Schmidt (2015).

**933042.2** *Lacinipolia sareta* – Revised status from Schmidt (2015).

**933042.3** *Lacinipolia dimocki* – New species from Schmidt (2015).

**933049** *Lacinipolia perta* – This Mexican species was added to the North American by Franclemont and Todd (1983), presumably from material collected by Franclemont in southern Arizona. Specimens of *L. lepidula* (Smith, 1888) from the southwestern United States with a darker medial area are a good match for the type of *L. perta*, described from Veracruz, Mexico. However, other species from southeastern Mexico, such as *Lacinipolia perfragilis* (Dyar, 1923), also added to the MONA list by Franclemont and Todd (1983), and *Abagrotis totonaca* (Schaus, 1894), have been shown to be similar but distinct species from their sister species in southwestern United States and the Sierra Madre Occidental in Mexico (Lafontaine and Schmidt 2010: 165; Lafontaine 1998: 217). For these reasons, we remove *Lacinipolia perta* from the list of North American Noctuidae north of Mexico. The type material of *L. perta*, was not located in the BMNH in 2007 or 2010 (JDL), therefore we do not know if *L. perta* is a valid species, or a synonym of *L. lepidula*.

**933115.1** *Protorthodes texicana* – Described by Lafontaine (2014) in Lafontaine et al. (2014).

**933115.2** *Protorthodes perforata* – Syn. *P. constans*; synonymy from Lafontaine et al. (2014).

**933115.3** *Protorthodes rufula* – Species renumbered to reflect change in phylogenetic position in Lafontaine et al. (2014).

**933115.4** *Protorthodes ustulata* – New species from Lafontaine et al. (2014).

**933115.5** *Protorthodes alfkenii* – Species renumbered to reflect change in phylogenetic position from Lafontaine et al. (2014).

**933115.6** *Protorthodes antennata* – Species renumbered to reflect change in phylogenetic position from Lafontaine et al. (2014).

**933116** *Nudorthodes texana* – Generic description and new combination from Lafontaine et al. (2014).

**933117** *Nudorthodes variabilis* – New combination from Lafontaine et al. (2014).

**933117.1** *Nudorthodes molino* – New species from Lafontaine et al. (2014).

**933331.1** *Euxoa bivittata* – Described as a subspecies of *Euxoa vallus* (Smith, 1900); however, barcode results, and male genital characters lead us to treat *Euxoa bivittata* Lafontaine, 1987, **stat. n.**, as a valid species. Superficially, the moths differ from those of *E. vallus* in having broad, fuzzy, almost straight, transverse lines,

whereas in *E. vallus* the antemedial line is zigzagged and the medial line is serrated and bends basally near the middle of the wing to pass between the reniform and orbicular spots. The vesica in *E. bivittata* has a stronger sub-basal twist, so the apical part of the vesica is farther above the basal part than in *E. vallus*, and the sub-basal diverticulum follows the direction of the aedeagus more closely. Curiously, the barcodes of *E. vallus* are more similar to those of *E. macleani* McDunnough than to those of *E. bivittata*.

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