

Contributions to the systematics of New World macro-moths III

Edited by

B. Christian Schmidt & J. Donald Lafontaine



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CONTRIBUTIONS TO THE SYSTEMATICS OF NEW WORLD MACRO-MOTHS III

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Contributions to the systematics of New World macro-moths III

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This special issue of ZooKeys, “Contributions to the systematics of New World macro-moths III” is the third volume in this series. The series was initiated in May 2009 (ZooKeys # 9), with the second volume published in March 2010 (ZooKeys # 39) (Schmidt and Lafontaine 2009, 2010). Fourteen authors contributed 13 manuscripts for this volume, covering taxa in the Noctuidae, Erebidae, Notodontidae, Geometridae and Crambidae. New taxa are described from Argentina, Bolivia, Canada, Chile, Costa Rica, Peru and United States. Taxonomic changes include the description of two new genera, eight new species, and a new subspecies. Also, 47 new or revised synonyms, six new or revised statuses, and 19 new or revised generic combinations are proposed herein.

Since its inception in 2009, the “Contributions” series collectively includes 37 taxonomic publications by 24 authors, containing 51 new species descriptions, 6 new genera, 119 new or revised synonymies, 22 new or revised statuses, and 143 new or revised generic combinations. Geographic coverage has focused on the North American fauna (Canada, United States and Mexico), but taxa from Central and South America are also covered. For reference, we include below the links to the two previous “Contributions ...” in ZooKeys.

Authors interesting in contribution to future “Contributions ...” are encouraged to contact us.

References

- Schmidt BC, Lafontaine JD (2009) Contributions to the systematics of New World macro-moths. ZooKeys 9: 1–134.
- Schmidt BC, Lafontaine JD (2010) Contributions to the systematics of New World macro-moths II. ZooKeys 39: 1–272.

Contents of previous volumes

For reference, we include below links to the two previous “Contributions ...” in ZooKeys.

ZooKeys 9 (2009) Contributions to the systematics of New World macro-moths

- 1 Schmidt BC, Lafontaine JD (2009) Contributions to the Systematics of New World Macro-Moths. In: Schmidt BC, Lafontaine JD (Eds) Contributions to the Systematics of New World Macro-Moths. ZooKeys 9: 1–2. doi: 10.3897/zookeys.9.183
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A new species of *Herpetogramma* (Lepidoptera, Crambidae, Spilomelinae) from eastern North America

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‡ [urn:lsid:zoobank.org:author:7D060A75-CD6A-4FB7-9DE2-5D57FCFF5D1C](https://doi.org/urn:lsid:zoobank.org:author:7D060A75-CD6A-4FB7-9DE2-5D57FCFF5D1C)

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Abstract

Herpetogramma sphingalis sp. n., a new species of Crambidae (Lepidoptera), is described from Québec, Canada. The species is included in the genus *Herpetogramma* Led., 1863, a genus in the subfamily Spilomelinae. Adults and genitalia of this species are described and illustrated, as well as those of *H. aeglealis* (Walker, 1859) and *H. thestealis* (Walker, 1859), and adults of the semi-melanic form of *H. aeglealis* are illustrated.

Keywords

Taxonomy, *Herpetogramma*, Crambidae, eastern North America, Dryopteridaceae, Christmas fern, *Polystichum*

Introduction

On the 21st day of July 2004, the authors were collecting moths at light on the slopes of Mont Rougemont at Rougemont, in the Province of Québec. We were surprised by

the significant numbers of a dark moth, which we identified readily as a pyraloid, but a pyraloid that was new to us. Though pyraloids were not our first goal, we decided to collect a few, considering their number and oddity.

One of the authors (LH) showed the moths to Eugene Munroe who identified them as a form of *Herpetogramma aeglealis* (Walker, 1859). We were still in doubt because the moths were much larger than normal *H. aeglealis* and because this form had never been found in Québec before, as confirmed by searching in our personal collections (DH, LH), and those of Ouellet-Robert (Université de Montréal), the Lyman Museum (McGill University), and the CNC at Ottawa. Collectively, these collections had more than 195 specimens of *H. aeglealis* collected between 1906 and 2000 in Québec, but the larger, dark form was not found in any of these collections.

Following that finding, we discovered on the Internet (Maryland moths, www.marylandmoths.com [accessed September 2011]) photographs of two moths looking very similar to our specimens. According to John Glaser, the specimens were a new species of *Herpetogramma* Lederer, in which the larvae feed on Christmas fern (Dryopteridaceae: *Polystichum acrostichoides* (Michx.) Schott). Dr Glaser wrote to the first author (LH, in litt., 11.viii.2008) that he based his conclusion on a note written to him by the late Douglas C. Ferguson.

We then decided to look further in that matter. The field season of 2008 permitted us to collect more than 75 specimens of both sexes. At the same time, we also collected 77 specimens of *H. aeglealis* from the same localities. We also found that Christmas fern was common in all the sites (Rougemont, Otterburn Park, Mont-Saint-Hilaire, etc.) where large dark specimens were found. Moreover, the moth was not seen in other sites where Christmas fern was absent, but where typical *H. aeglealis* occurred.

We were pleased that Don Lafontaine of the CNC showed some interest and decided to make genitalic dissections of both forms, including a rarely-seen semi-melanic form of *H. aeglealis*, and specimens of the closely related species *Herpetogramma thestealis* (Walker, 1859). The genitalia did not show significant differences, except for the aedeagus and vesica, which did show constant differences among the three species from various localities in Québec and eastern United States. This permitted us to confirm that the large, dark form was really a separate species from both *H. aeglealis* and *H. thestealis*, but it remained to be determined if there was an available name for this taxon. We also confirmed that the semi-melanic form was really a form of *H. aeglealis* and not a form of the dark species or a separate species.

On the basis of the male genitalia, the new species is more closely related to *H. aeglealis* than to *H. thestealis*. In both the new species and *H. aeglealis* the large spine-covered diverticulum is near the middle of the left side of the vesica, there is a double-pouched subbasal diverticulum on the right-ventral surface, and no subbasal diverticulum on the left. In *H. thestealis* the large spine-covered diverticulum is about one-third from the apex of the vesica on the dorsal surface, there is only a single subbasal diverticulum on the left-ventral surface, and there is an additional, spined, subbasal diverticulum on the right side. Other characters of the genitalia are similar in the three species.

Materials and methods

Repository abbreviations

Specimens were examined from the following collections:

- AMNH** American Museum of Natural History, New York, NY, USA
BMNH The Natural History Museum (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
DH Personal collection of Daniel Handfield, Saint-Mathieu-de-Beloeil, Québec, Canada
LH Personal collection of Louis Handfield, Mont-Saint-Hilaire, Québec, Canada
LMIC The Lyman Museum Insect Collection, McGill University, Ste-Anne-de-Bellevue, Québec, Canada
UMIC Ouellet-Robert collection, Université de Montréal, Montréal, Québec, Canada
USNM National Museum of Natural History (formerly, United States National Museum), Washington, District of Columbia, USA

Dissecting methods and genital terminology

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

History, names and synonyms

The first author to deal with the many names included under the genus *Herpetogramma* was Forbes (Forbes 1923). He included the genus within a broader concept of the genus *Pyrausta* Schrank. It is clear from his text (p. 567) that his concept of *aeglealis* is exactly what we now know under that name. He has also referred to the semi-melanic form of *aeglealis*, but does not refer to a larger black form. Moreover, an examination by Don Lafontaine (pers. comm. 2010) of the Lepidoptera collection of the Cornell University (New York) (where Forbes was a professor) did not reveal any specimen referable to *H. sphingealis*. After Forbes, more than a half century elapsed before Munroe (1983) transferred the species to *Herpetogramma* and reduced the many names to nine recognized species. Munroe listed only *H. quinquelinealis* (Grote, 1875) in the synonym of *H. aeglealis*. The original descriptions of both names (Walker 1859 and Grote 1875) have been consulted and it is evident that none refers to the black species herein

described. Also, photographs of the type specimens of both species in the Natural History Museum, London (BMNH) were examined and it is evident that these types only refer to *H. aeglealis* and not to the new species. Additionally, none of the European *Herpetogramma* species looks like the new species (Goater 1986; Slamka 2010), and no similar species exists in Japan (Esaki et al. 1970) or China (Pingyuan et al. 1981). The widespread occurrence of *H. sphingialis* in eastern North America, which essentially follows that of its native host plant, Christmas fern, makes it unlikely that the species is introduced from abroad.

In the USNM, there is one specimen reared by Wilton Everett Britton on Christmas fern in New Haven, Connecticut, that emerged 16 July 1900; the larva was collected near Maltby Lakes, New Haven County, Connecticut. Charles Henry Fernald recognized it as a new species, put a manuscript name with the specimen, but the name was never published.

In a recent paper by Alma Solis (Solis 2010), the types and identities of the species of *Herpetogramma* in Canada and the United States are discussed, but there are no remarks that might pertain to the undescribed species are given under *H. aeglealis*. However, a male of the new species is illustrated (Solis 2010, fig. 2) from Six Mile Creek near Ithaca New York, but without comment.

The new species will key out to *H. aeglealis* in Solis (2010), but can be distinguished from it by the characters given in the following diagnosis and description.

Taxonomy

Herpetogramma sphingialis Handfield and Handfield, sp. n.

urn:lsid:zoobank.org:act:C32535D3-10D1-4F5D-B4EE-9E6E5405B732

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

Figs 1, 2, 8, 11

Type material. **Holotype** ♂. Rougemont Mountain, Rougemont, Québec (45°28'026"N, 73°04'029"W), 29.vii.2008, Daniel Handfield, MDH006041, CNC type No. 23981. CNC. **Paratypes** 83 ♂, 24 ♀: Mont-Saint-Hilaire, Québec, 20.vii.2003 (1 ♂), 20.vii.2008 (1 ♂), Louis Handfield; Otterburn Park, Bosquets Hudson, Québec, 31.vii.2009 (2 ♂), 5.viii.2008 (2 ♂, 2 ♀), Louis Handfield; Rougemont, mountain, Québec, 11.vii.2008 (1 ♂), 16.vii.2008 (2 ♂), 19.vii.2009 (1 ♂), 21.vii.2004 (1 ♂), 21.vii.2008 (5 ♂), 23.vii.2009 (3 ♂), 24.vii.2008 (2 ♂, 2 ♀), 25.vii.2008 (13 ♂, 3 ♀), 27.vii.2008 (5 ♂, 5 ♀), 28.vii.2009 (3 ♂, 1 ♀), 29.vii.2008 (10 ♂, 5 ♀), 30.vii.2009 (3 ♂), 1.viii.2008 (3 ♂), 3.viii.2009 (5 ♂, 2 ♀), 5.viii.2009 (4 ♂, 1 ♀), 7.viii.2009 (1 ♂), Louis Handfield; 21.vii.2004 (4 ♂), Daniel Handfield, 29.vii.2008 (8 ♂, 2 ♀), Daniel Handfield, 21.vii.2008 (1 ♂), Norman Handfield; Roxton Falls, Québec, 24.vii.2008 (2 ♂), Norman Handfield; St-Armand, Québec, 20.vii.2004 (1 ♀), 21.vii.2004 (1 ♂), Claude Chantal, in coll. Léo-Paul Landry; Ste-Anne-de-Bellevue, Morgan Arboretum, Québec, 12.viii.2009 (2 ♂), Louis Handfield,



Figures 1–8. Adults of *Herpetogramma* species. **1** *H. sphingealis*, male (Rougemont, Québec) **2** *H. sphingealis*, female (Rougemont, Québec) **3** *H. aeglealis*, male, dark form (Mont-St-Hilaire, Québec) **4** *H. aeglealis*, female, dark form (Rougemont, Québec) **5** *H. aeglealis*, male, typical form (Rougemont, Québec) **6** *H. aeglealis*, female, typical form (Rougemont, Québec) **7** *H. thestealis*, male (Rougemont, Québec) **8** *H. thestealis*, female (Otterburn, Québec)

12.viii.2009 (1 ♂), Daniel Handfield; Varennes, Québec, 7.vii.2008 (1 ♂), Claude Chantal, in coll. Michel Pratte).

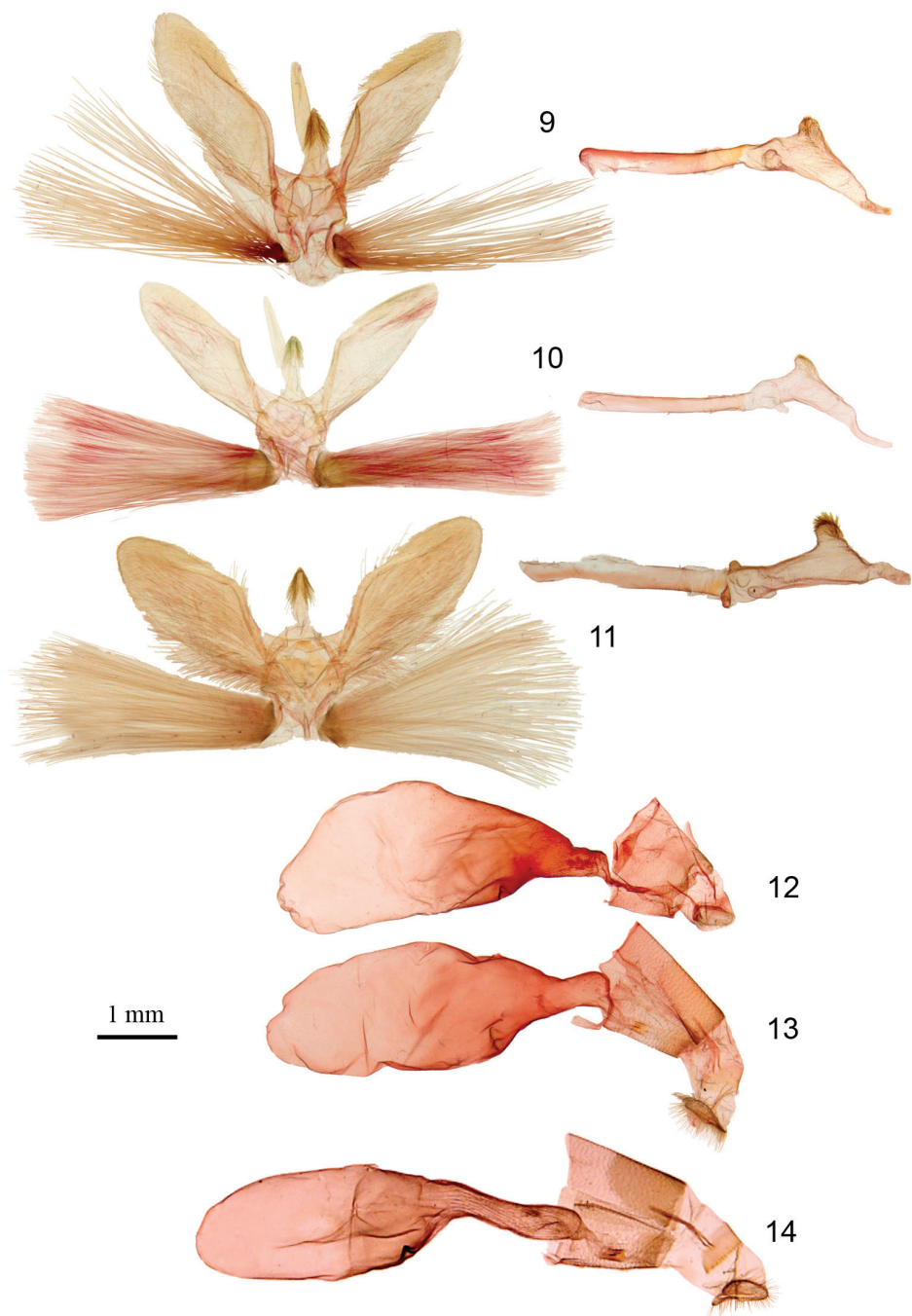
Other material examined. USA. Specimens were examined from the following states: Arkansas (USNM), Connecticut (AMNH, USNM), Delaware (USNM), Georgia (CNC), Kentucky (USNM), Louisiana (USNM), Maryland (USNM), Mississippi

(USNM), New Jersey (USNM), New York (USNM), North Carolina (USNM), Pennsylvania (USNM), Tennessee (USNM) and Virginia (USNM).

Etymology. The Latin name *sphingealis* refers to the sphingid-like appearance of the males.

Diagnosis. *Herpetogramma sphingealis*, like *H. aeglealis* and *H. thestealis*, is sexually dimorphic. The male of *H. sphingealis* is likely to be confused only with *H. aeglealis*, but can be distinguished from *H. aeglealis* by its nearly uniform dark-brown colour and large wingspan (34–37 mm versus 29–34 mm in *H. aeglealis*). The transverse lines are obscure whereas in *H. aeglealis* they are more sharply defined, usually with pale shading adjacent to them and with pale streaks between veins, especially in medial area. The hind wing is dark brown with a dark discal spot, but in *H. aeglealis* the hindwing is dirty white with dark-gray shading on discal spot, wing veins, subterminal area, and an irregular but contrasting postmedial line. The female is larger than that of *H. aeglealis* (31–34 mm versus 27–31 mm), has more apically-squared wings and is less uniformly dark coloured, so it resembles some females of *H. aeglealis*, but females *H. aeglealis* are paler, smaller, and always show a golden hue, never dark brown as in *H. sphingealis*. Rare specimens of a semi-melanic form of *H. aeglealis* have an overall dark coloring, as in *H. sphingealis*, but the transverse lines are very well marked and followed by a larger creamy band, and also have a more extensive cream-colored shading in the costal area of the hindwing. In the male genitalia, *H. sphingealis* differs from *H. aeglealis* in having a longer aedeagus ($10.0\text{--}10.6 \times$ as long as the medial width compared to $8.0\text{--}8.8 \times$ as long in *H. aeglealis*) and also in details of vesica. In the female genitalia, *H. sphingealis* has a longer ductus bursa ($0.27 \times$ as long as corpus bursae in *H. sphingealis*, but only $0.22 \times$ as long in *H. aeglealis*).

Description. Adult male: wingspan 34–37 mm (*H. aeglealis* 29–34 mm). Upper-side of head, palpi (excFept tufts at base), protothoracic collar, and upperside of thorax concolourous, chocolate brown, fading to a slightly paler brown with age; antennae filiform, finely ciliate on underside, each segment concolourous dorsally with upper surface of head; upperside of abdomen concolourous with wings, except for posterior brownish-yellow tuft covering valvae; maxillary palpi, legs, and underside of head, thorax, abdomen pure white; dark-brown band (nearly width of eye on side of head) and including the top of the maxillary palpi and chaetosema gives head appearance of having a longitudinal mask; eye black with greenish bands. Forewing chocolate brown, concolourous with upperside of head, thorax, abdomen, fading slightly to a paler brown; apex acutely angled; postmedian line slightly zigzagging from costa to halfway down wing, then turning abruptly inward at nearly right angle to position below reniform spot before turning downwards and zigzagging to posterior margin of wing; no other lines visible (except sometimes a vague trace of an outward-curved antemedian line); only other marks on forewing are a white patch on fringe at anal angle, two black dots at position of orbicular and the reniform spots, a cream-coloured rectangular patch between two black dots, and a dark terminal line at base of fringe; fringe concolourous with wing except for white anal patch and slightly darker shading on veins; fringes also fading with age. Hindwing concolourous with forewing, includ-



Figures 9–14. Genitalia of *Herpetogramma* species. **9** *H. aeglealis*, male genitalia (Rougemont, Québec) **10** *H. sphingealis*, male genitalia (Rougemont, Québec) **11** *H. thestealis*, male genitalia (Rougemont, Québec) **12** *H. aeglealis*, female genitalia (Rougemont, Québec) **13** *H. sphingealis*, female genitalia (Rougemont, Québec) **14** *H. thestealis*, female genitalia (Normandale, Ontario)

ing fringe, fringe with dirty-white shading at anal angle; no lines visible; a round (more like a lunar crescent in *H. aeglealis*) black discal dot with a creamy-white irregular patch toward wing base (nearly hidden by posterior margin of forewing). Fringes of all wings even, not crenate. Underside of all wings, including fringes, a dark grey, fading to a paler whitish grey toward wing base with white at base near pure-white thorax, especially along inner margin of hindwing; creamy patch and two black dots on forewing barely visible as is discal spot of hindwing. Legs mainly pure white, sometimes with brownish scales on upperside of anterior and posterior legs.

Adult female: wingspan 31–34 mm (*H. aeglealis* 27–31 mm). Essentially same as for male except forewing larger, less elongated, and more square at margin; colour of wings a paler chocolate brown, transverse lines more contrasting. Hindwings as for male, but colour fading near base, sometimes showing a vague trace of a postmedian line.

Genitalia. Male genitalia of *H. sphingealis* differ from those of *H. aeglealis* in length of aedeagus and the details of vesica. In *H. sphingealis* aedeagus long, 10.0–10.6 × as long as medial width compared to 8.0–8.8 × in *H. aeglealis*. Also, secondary pouch on subbasal diverticulum broad and rounded, but narrow and finger-like in *H. aeglealis*. Spinules on surface of the basal part of the vesica minute and difficult to see in *H. sphingealis* but larger and more conspicuous in *H. aeglealis*. Female genitalia similar to those of *H. aeglealis*, except for length of ductus bursae (0.27 × as long as corpus bursae in *H. sphingealis*, but only 0.22 × in *H. aeglealis*), this likely reflecting longer aedeagus of *H. sphingealis*. Genitalic dissections of specimens of dark semi-melanic forms allow specimens to be identified as *H. aeglealis*.

Biology and habitat. *Herpetogramma sphingealis* occurs in the darkest areas of rich xeric forests, with maples and oaks, especially rocky, hilly, maple groves where Christmas fern occurs commonly. Its dark-brown colour is well suited for hiding in these woods. The moth comes readily to light and flies at the beginning of the night; it is sometimes one of the first to come to light. Its flight is darting and rapid. The underside of the head, thorax and abdomen, including the legs, are pure white, so it is easily spotted when flying to the light. The moth is a beautiful cryptically-coloured creature well-adapted to hide in the darkest shadows of the woods.

According to the “Moths of Maryland” (www.marylandmoths.com) and to specimens collected by Doug Ferguson in USNM, the larvae feed on Christmas fern. Doug Ferguson collected two larvae on “Xmas Fern” at “Richard Russell Pkwy, Union County, Georgia, 25 April 1969” and reared them with success on this host plant (note by Doug Ferguson to John Glaser, in litt., sent to the author [LH] 11 August.2008).

An additional specimen was reared as a leaf roller on Christmas fern and deposited in USNM was reared by Wilton Everett Britton and emerged on the 16 July 1900. Philip Dowell (1911) noticed in 1908 in New York State that the fronds of Christmas ferns and some of woodferns (*Dryopteris* Adans.) were attacked by a leaf roller, most probably by this new species for Christmas fern.

Larvae of a species of *Herpetogramma* were reared on Christmas fern in Athens, Georgia (Ruehlman et al. 1988); the species was identified as *H. aeglealis*, but through the courtesy of Dr Matthews, one male specimen was loaned to the CNC, and a com-

plete dissection including the vesica was prepared by Don Lafontaine, and it proved to be a specimen of the new species. All specimens for that study were determined to be a single species, due to their larvae, habits, host plant, and appearance of the adults, we believe they all belong to *Herpetogramma sphingealis* and not to *H. aeglealis*. According to these authors, the larvae are solitary leaf rollers and live on the terminal leaflets of young fronds, passing the winter as eggs, emerging at the beginning of the spring and eating the fronds within a silk shelter for around a month, and then pupate to emerge about 12 days later.

David Wagner and his associates have reared two males and one female on Christmas fern in Connecticut. The males from Bridgewater, Litchfield Co., emerged on 12 June 1999 and 4 July 1999 and a female from Chaplin, Windham Co., emerged on 30 July 2009. The specimens were identified by the author (LH).

As a result of these data, Christmas fern is the host plant of *Herpetogramma sphingealis*. It is possible that the larvae might be found on other species of ferns, although only one other species of the hollyfern genus (*Polystichum* Roth) has a range that overlaps that of *H. sphingealis*. The range of the boreal species *Polystichum braunii* (Spencer) Fée, Braun's holly fern, overlaps that of *H. sphingealis* in Québec and New England.

In contrast to the restricted host plant records for *Herpetogramma sphingealis*, both *H. aeglealis* and *H. thestealis* appear to be more general feeders as larvae. *Herpetogramma aeglealis* has been reared on a variety of herbaceous plants including ragwort [Asteraceae] and ferns [Polypodiales] (D. Wagner, pers. comm.), goldenrod [Asteraceae] and raspberry [Rosaceae] (Solis 2010), pokeweed (Phytolaccaceae) [Forbes 1923], and mayapple [Berberidaceae] (Judd 1954). *Herpetogramma thestealis* appears to be associated with woody plants, such as basswood [Tiliaceae] and hazel [Betulaceae] (Forbes 1923), and Carolina silverbell [Styracaceae] and spikenard [Araliaceae] (D. Wagner, pers. comm. 2011).

Distribution. *Herpetogramma sphingealis* occurs from southern Québec southward in eastern United States to Georgia and Louisiana and as far west as Arkansas. Christmas fern occurs from southeastern Canada southward to northern Florida and west to eastern Iowa and eastern Texas. At present, *Herpetogramma sphingealis* is known to occur over most of its host plant's range, and may occur over all of it.

The species seems to be expanding its distribution, at least to the North. It is spreading to new localities in southern Québec, appearing in some places that are well collected by the authors and colleagues where it had never been seen previously. For example, Mont-Saint-Hilaire has been collected by the author (LH) since 1966, Otterburn Park (Les Bosquets Hudon) since 1970 (LH), Ste-Anne-de-Bellevue (Morgan Arboretum) since 1949 (A. C. Sheppard) and since 1971 (LH), Rougemont since 1971 (LH) and St-Armand since 1982 (LH) and *H. aeglealis* has been regularly found at these localities, but *Herpetogramma sphingealis* appeared for the first time in 2003 and in numbers since 2004, suggesting an invading species.

We have not seen any specimens from other provinces in Canada, even from Ontario, although a search of areas where Christmas fern is common may be productive.

Remarks. The genus *Herpetogramma* formerly comprised nine recognized species in North America (Solis 2010), now increased to 10 with *Herpetogramma sphingealis*. The methods used in the present study may prove helpful in future systematic work on the genus.

Acknowledgements

We thank firstly Don Lafontaine (CNC) for his support and generous help, especially in preparing genitalia (including the vesica) of specimens of the new species, *H. aeglealis*, the semi-melanic form of *H. aeglealis*, and *H. thestealis*, and to Jocelyn Gill (CNC) for preparing photographs of adults and genitalia. We thank Jean-François Landry (CNC) for recording data from specimens in the Smithsonian Institution (USNM), and to Don Lafontaine for recording data from specimens in the AMNH, and for photographing the type specimens of species of *Herpetogramma* in the BMNH, London. We thank Robert Matthews, of the University of Georgia, College of Agricultural and Environmental Sciences, Department of Entomology, for photographing his specimens and sending legs and specimens for analysis. Our thanks also extend to John Glaser (Berkeley Springs, West Virginia) and Larry Line (Clarksville, Maryland) for sharing their experiences with the new species and the written notes of Douglas C. Ferguson. We are grateful to David Wagner (University of Connecticut, Storrs, Connecticut) for the loan of reared specimens. Finally, we thank collectors who provided specimens from Québec, especially Norman Handfield (Mont-Saint-Hilaire, Québec), Léo-Paul Landry (Saint-Mathieu-du-Parc, Québec), Michel Pratte (Saint-Gérard-des-Laurentides, Québec), Claude Chantal (Varennnes, Québec) and Alain Charpentier (Saint-Hyacinthe, Québec). We are also very grateful to Élisabeth Lebarbé and Michael Kyprianou for their permission to collect on their property on the mountain at Rougemont (Québec). We thank Louis Desbiens for access to “Les Bosquets Hudon” in Otterburn Park (Québec).

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Two new species of the *Hagnagora anicata* complex (Geometridae, Larentiinae) from Costa Rica

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Abstract

Examination of the lectotype (here designated) reveals that *Hagnagora anicata* (Felder & Rogenhofer) does not occur in Costa Rica. Instead two new species are described, *H. elianne* sp. n. and *H. unnia* sp. n., and their distribution is discussed. The previous treatment of *H. anicata* as a single widespread species ranging from Jamaica and Mexico to Bolivia needs to be critically evaluated.

Keywords

Taxonomy, *Hagnagora*, Costa Rica, Colombia

Introduction

Six species of the larentiine genus *Hagnagora* Druce are recorded from Costa Rica, namely *H. mortipax* (Butler), *H. clustimena* (Druce), *H. ephestris* (Felder & Rogenhofer), *H. buckleyi* Druce, *H. anicata* (Felder & Rogenhofer) and *H. marionae* Brehm & Sullivan. The most recent addition, *H. marionae*, is found at high altitudes (2500–3300 m) where it is active both diurnally and nocturnally. It can be common in night collections but is variably found sparingly during the day. The wing pattern is a band of yellow on a field of dark brown, very similar to that of *H. ephestris*, a smaller species.

Both *H. anicata* and *H. mortipax* have a white wing band on the field of dark brown and again are separated by size (*H. mortipax* is smaller). Our description of *H. marionae* (Brehm and Sullivan 2005) included the ‘barcode’ sequence of the mitochondrial gene cytochrome oxidase (CO1). In order to understand the possible origin of *H. marionae* the same gene fragment was sequenced in four of the remaining five species (*H. mortipax*, *H. clustimena*, *H. ephestris*, and *H. anicata*). *Hagnagora buckleyi* in Costa Rica is known from two specimens (INBio) and no fresh material was available. These sequences showed that the closest relative of *H. marionae* was the species previously identified as *H. anicata*, a white banded species. More importantly, Costa Rican *H. anicata* separated into two haplotype groups differing in more than 5 % of their base pairs and which appeared to segregate by altitude. These findings have led to the structural and habitat characterization of the two haplotype groups and an assessment of whether or not *H. anicata*, a species described from Bogota, Colombia, was one of the two haplotype segregates.

Materials and methods.

Repository abbreviations

Specimens were examined from the following collections:

BMNH Natural History Museum, London, England, UK

INBio Instituto Nacional de Biodiversidad, Santo Domingo de Heredia, Costa Rica

JBS J. Bolling Sullivan, Beaufort, North Carolina, USA

USNM National Museum of Natural History, Washington, District of Columbia, USA

Photographic methods used herein are described in Sullivan and Adams (2009). Procedures for dissecting and preparing genitalia follow that of Lafontaine (2004). DNA sequencing of the barcode fragment of the COI gene was carried out at the Canadian Center for DNA barcoding in Guelph, Ontario. Barcode sequences were compared by nearest neighbor analyses as implemented on the Barcode of Life Data systems website (Ratnasingham and Hebert 2007).

Taxonomy

Hagnagora anicata (Felder & Rogenhofer, 1875)

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

Fig. 1

Heterusia anicata Felder & Rogenhofer, 1875, pl.130, fig. 13.



Figure 1. *Hagnagora anicata* (F. & R.), male lectotype **a** dorsal view **b** ventral view **c** genital capsule and **d** aedeagus (BMNH slide 22252).

Type material. Bogota, [Colombia]. A male specimen in BMNH labeled as 'type' is here designated as the lectotype (Fig. 1).

Description and diagnosis. The maculation of *H. anicata* is shown in Fig 1a. A cream white band originates on the costa near the midpoint and runs diagonally to-

ward a point $1/3$ above the tornus, rounds off and ends without touching the margin. Distal to this band is dark brown scaling to the wing apex. Proximal to the band is dark brown scaling which becomes brighter toward the wing base. At the terminus of the wing veins are small white crescents which are usually worn off in flown specimens. The hindwing is the brownish color of the forewing base and with larger marginal crescents at the vein termini. The underside (Fig. 1b) is repeated with some slight variation in most *Hagnagora* species. This maculation pattern is seen over almost the entire range (Jamaica and Mexico to Bolivia and Venezuela), with minor modification of the width of the white band. All have been referred to as *H. anicata*.

The male genitalia are similar to those of *H. marionae* (Brehm and Sullivan 2005) and several characters are important. The uncus tapers evenly ending in a slight hook. Large hair brushes on the inner face of the valva (Fig. 1b) often obscure details of the valva, as often seen in species of another larentiine genus, *Hydriomena* Hübner. However, in *H. anicata* the costal edge of the valva is sclerotized and terminates in a well-defined point extending dorsad at the distal margin of the valva. The anal edge of the valva is swollen, stippled with small dots but not well sclerotized. The median area of the valve is unsclerotized and serves as the anchor point for the large hair brush. A smaller hair brush originates subterminally just below the costa. The juxta appears as a broad, slightly sclerotized plate and the anellus is broadened but not medially joined. The saccus is unsclerotized and u-shaped. The aedeagus is similar to that of *H. marionae* and the vesica has two dorsal, granulated wing-like projections but no cornutus.

Beside the lectotype there is a female from Bogota in the collections at the BMNH but its wing length is only 18 mm, i.e. smaller than that of the male lectotype. Because all known females of *Hagnagora* species are larger than their respective males, this female is not considered to be a female of *H. anicata*. Because there are at least two other species occurring in Colombia with maculation extremely similar to *H. anicata* (Sullivan, unpubl. data), it would be best to obtain fresh male and female specimens from near Bogota for barcode sequencing to be sure of correctly associating a female as *H. anicata*.

Hagnagora elianne Sullivan, sp. n.

urn:lsid:zoobank.org:act:A72D314A-4993-4840-B54B-756A7C79C4A1

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

Figs 2, 4

Type material. Holotype male: **Costa Rica**, Poas Volcano National Park, Alajuela Province, 2500 m, 7–8 August 2007, J. Bolling Sullivan, DNA voucher no. 07-CRBS-1029 (INBio). **Paratypes** 9 males, 30 females: **Costa Rica**. Same data as holotype (8 males, 21 females), DNA voucher nos. 07-CRBS-383, 07-CRBS-387, 07-CRBS-389, 07-CRBS-1041, 07-CRBS-393, 07-CRBS-381, 07-CRBS-382, 07-CRBS-1042, 07-CRBS-1026, 07-CRBS-1027, 07-CRBS-1028, 07-CRBS-1031, 07-CRBS-1032, 07-CRBS-1033, 07-CRBS-1034, 07-CRBS-1035, 07-CRBS-1036, 07-CRBS-1037,

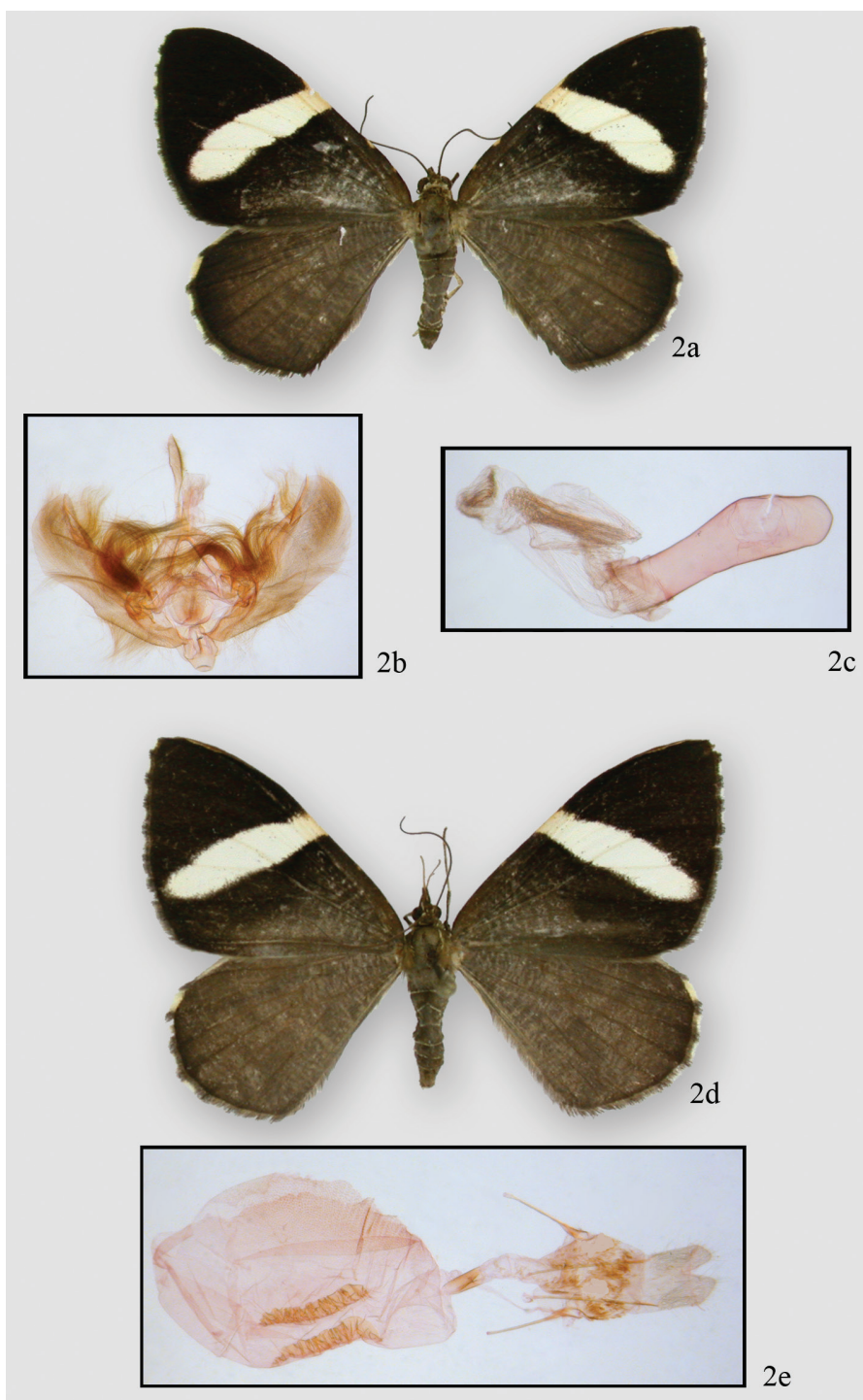


Figure 2. *Hagnagora elianne* Sullivan **a** adult male, holotype **b** genital capsule **c** aedeagus **d** adult female **e** female genitalia.

07-CRBS-1038, 07-CRBS-1046, 07-CRBS-1047, 07-CRBS-1048, 07-CRBS-1049, 07-CRBS-1050, 07-CRBS-388, 07-CRBS-391, 07-CRBS-1052, 07-CRBS-1053, 07-CRBS-1054; San Jose Province, San Gerardo de Dota, 2230 m, 16–27 March 2004, J. Bolling Sullivan, J. Donald Lafontaine, (4 females), DNA voucher nos. 06-CRBS-0050, 06-CRBS-0051, 06-CRBS-0052; Cartago Province, Villa Mills, 2841 m, J. Bolling Sullivan, (5 females), DNA voucher / GenBank accession nos. 10-CRBS-546 / HM879259, 10-CRBS-547 / HM879260, 10-CRBS-549 / HM879262, 10-CRBS-551 / HM879264, 10-CRBS-552 / HM879265; Alajuela Province, La Paz Waterfall, 1480 m. J. Bolling Sullivan (1 male). Paratypes deposited in INBio, USNM, JBS.

Etymology. *Hagnagora elianne* is named for Eli-Anne Lindstrom, a scientist and friend whose biological studies of freshwater algae have contributed significantly to water quality monitoring in Norway.

Diagnosis. Very similar to *H. anicata* and *H. unnia*. Males are slightly larger than those of *H. unnia* (by 2 mm on average but with overlapping ranges) but otherwise indistinguishable. They may be distinguished from *H. anicata* by the swollen distal half of the uncus (as opposed to gently tapered) and the absence of a moderately large, upcurved spine at the end of the costa. Females may be distinguished from females of *H. unnia* by their longer, more complex signa (Fig 4). The female of *H. anicata* is undescribed. The geographical ranges of *H. elianne* and *H. anicata* are currently not known to overlap.

Description. Male. *Head* – palps porrect, cream with brown scaling on lateral and dorsal sides of segments 2 and 3. Middle segment 2–3 x as long as other segments. Eyes round. Frons scaling slightly raised near base of tongue, brown, square, bordered with cream scales. Head brown with intermingled cream scales, particularly on edges. Collar mostly brown with scattered cream scales. Scape brown laterally and dorsally, ventral cream. Antennae simple, no visible setae, orange tan ventrally with dorsal scaling dark brown, often 70 segments. *Thorax and abdomen* – thorax brown dorsally, tegulae brown with thin cream scaling at outer edges. Abdomen brown with distal scaling on each segment forming a thin cream ring. Ventral abdomen similar, but with extensive cream scaling on basal segments. Legs mixed brown and cream scales becoming pure cream on proximal segments. Spurs on 2nd and 3rd tibiae small. Epiphysis reaching distal end of femur. *Wings* – forewing (average length 19.44 mm, 18–21 mm (N=9)) with cream-white band from middle of costa traversing diagonally almost to anal angle. Distal color almost black. Proximal to diagonal band as dark as outer third of wing, then becoming brownish to base. Wing margins with thin cream crescents. Hindwing uniformly brown with terminal cream crescents at very tips. Leading edge of costa with two yellow spots evenly spaced between base and white band. Cream band on underside of forewing similar to that on upperside. Outer third of wing rust colored becoming blackish in tornal half near wing band. Basal of white band black, crossed by thin white lines. Retinaculum thumb-like, distinct, rusty. Hindwing rusty crossed by thin cream-white lines. Median area of wing (corresponding to white band on forewing) lighter, distinct. Veins distinct, orange scaled. Anal edge of forewing with white scaling. **Female.** No maculation differences from male except antennal segments

thinner, retinaculum smaller, lower and more diffuse, and white scaling at ventral base of scape extends onto antennal shaft. Forewing averages 21.33 mm (20–23 mm, N=24). **Male genitalia** – terminal half of moderately long uncus distinctly swollen; tip slightly pointed but not hooked. Tegumen broad, sclerotized on lateral and proximal edges, which fuse below base of uncus, often forming a distinct X-shaped structure. Vinculum moderately broad, rather uneven on edges. Vinculum fused to segment via its proximal sclerotized edge; distal edge ends in a circular flap. Arms of anellus project finger-like to medial area but do not fuse. Juxta a large circular structure. Saccus with a broad, almost diamond-shaped structure, but often folded behind valves during slide preparation. Valva moderately broad, curves upward toward apex. Costa sclerotized but edge not well defined; ends in a small slightly upcurved spine. Valva with pronounced, swollen, medial ridge; saccular area lightly sclerotized. Medial area of valva largely unsclerotized; large hair brushes anchored near base. Medial ridge and saccular region with additional hairs. Aedeagus sclerotized to manica with out third unsclerotized, but with striations. Ductus emerges subbasally. Aedeagus with no sclerotized ridges or projections. Vesica expanded basally and forms two dorsal striated “wings.” Ventral vesica slightly striated. Vesica narrows toward terminus with dorsal surface crinkled and striated, but separate from striations of dorsal “wings.” **Female genitalia** – anal papillae gently pointed and striated toward distal tips. Posterior apophyses $1\frac{1}{2}$ x length of anterior apophyses. Apophyses end proximally in a terminally-rounded paddle-like structure. Segment surfaces unsclerotized, but with tightly adhering scales. Ostial area poorly defined and unsclerotized; opening expanded laterally and tapered to moderately long and thin ductus with a proximal collar at base. Bursa an expanded sac, stippled dorsally and with two, ventral ladder-like signa. Signa look like corrugated pipes, tapering anteriorly. Length of longest sclerotized signum best character for distinguishing *H. elianne* (1.3–1.7 mm, N=8) from *H. unnia* (0.9–1.2 mm, N=4). No distinct structures on pelt. Tympanum with ansa swollen distally for half its length then narrows before expanding at proximal end to form a T-like structure with a swollen base.

***Hagnagora unnia* Sullivan sp. n.**

urn:lsid:zoobank.org:act:6D9F2D75-F2BA-43D3-A056-249ED36135F6

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

Figs 3, 4

Type material. Holotype male: **Costa Rica**, Tapanti National Park, Cartago Province, 1275 m, 12–17 February 2005, J. Bolling Sullivan, DNA voucher no. 06-CRBS-0049 (INBio) **Paratypes** 13 females: **Costa Rica**. Same data as holotype (1 female), DNA voucher no. 0305-CRBS-0011; Alajuela Province, Volcan Poas, 2500 m, 7–8 August 2007, J. Bolling Sullivan, (6 females), DNA voucher nos. 07-CRBS-1040, 07-CRBS-1051, 07-CRBS-384, 07-CRBS-385, 07-CRBS-386, 07-CRBS-390; Cartago Province, Villa Mills, 2841 m, J. Bolling Sullivan, (6 females), DNA voucher / GenBank

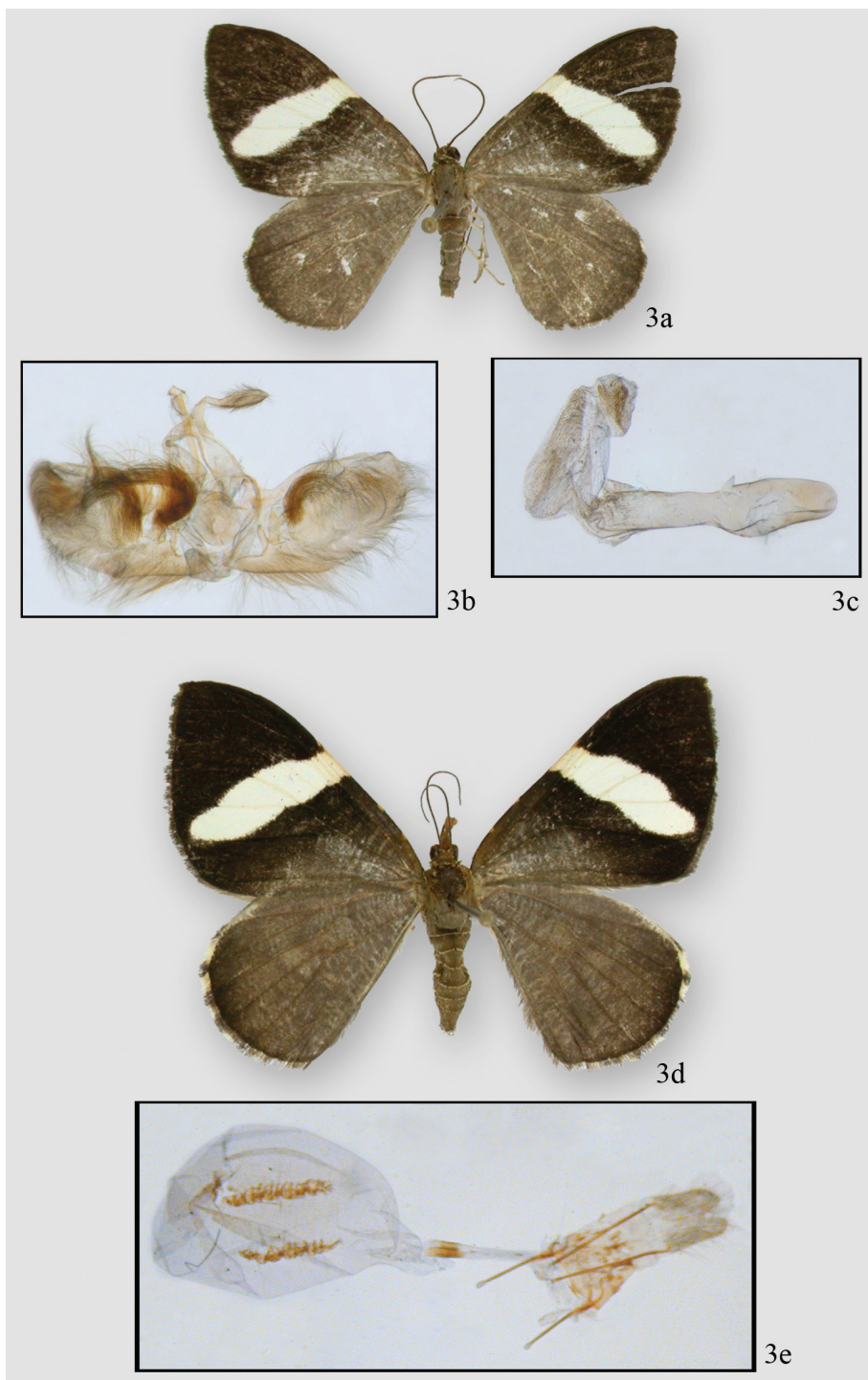


Figure 3. *Hagnagora unnia* Sullivan **a** adult male holotype before dissection **b** genital capsule **c** aedeagus **d** adult female **e** female genitalia.

accession nos. 10-CRBS-1845 / JF856991, 10-CRBS-545 / HM879258, 10-CRBS-548 / HM879261, 10-CRBS-550 / HM879263, 10-CRBS-553 / HM879266, 10-CRBS-554 / HM879267. Paratypes deposited in INBio, USNM, JBS.

Etymology. This species is named for Unni E. H. Fyhn, a postdoctoral student in my laboratory in the 1970s and who continued to work on the genetic control of fish hemoglobins until her untimely death from cancer.

Diagnosis. Males are usually smaller but otherwise are indistinguishable from those of *H. elianne*. They may be distinguished from *H. anicata* by the swollen distal half of the uncus (as opposed to gently tapered) and the absence of a moderately large, upcurved spine at the end of the costa. Females may be distinguished from those of *H. elianne* by their shorter, less complex signum. The female of *H. anicata* is undescribed.

Specimens from higher altitudes are larger (see Sullivan and Miller 2007) as are most *H. elianne*. Specimens from lower altitudes are smaller as are most *H. unnia*. Although size alone cannot always be used to distinguish the species, it is often an excellent indicator, particularly where both species occur together. The expanse of the male valves (open and flattened) is often much smaller in *H. unnia*; however, this character is not always definitive. In females, the lengths of the ladder-like signa do not overlap for the two species and the sample size was larger than for males (only a single barcoded male of *H. unnia* was available). Additionally, the structure of the signum in *H. elianne* is broader and more complex.

Description. Male. *Head* – palps porrect, cream with black scaling on lateral and dorsal sides of segments 2 and 3. Middle segment 2–3 x as long as other segments. Eyes round. Frons scaling slightly raised near base of tongue, brown, square, bordered with cream scales. Head brown with intermingled cream scales, particularly on edges. Collar mostly brown with scattered cream scales. Scape brown laterally and dorsally, ventral cream. Antenna simple, no visible setae, orange tan ventrally with dorsal scaling dark brown, often 70 segments. *Thorax and abdomen* – thorax brown dorsally; tegulae brown with thin cream scaling at outer edges. Abdomen brown with distal scaling on each segment forming a thin cream ring. Ventral abdomen similar, but with extensive cream scaling on basal segments. Legs with mixture of brown and cream scales, becoming pure cream on proximal segments. Spurs on 2nd and 3rd tibiae small. Epiphysis reaching distal end of tibia. *Wings* – forewing (16 mm) with cream-white band from middle of costa traversing diagonally almost to anal angle. Distal color almost black. Wing color proximal to diagonal band as dark as outer third, then becoming brown to base. Wing margins with thin cream crescents. Hindwing uniformly brown with terminal cream crescents at very tips. Leading edge of costa with two yellow spots evenly spaced between base and white band. Cream band on underside of forewing similar to that upperside. Outer third of wing rust colored becoming blackish in tornal half near wing band. Wing surface basal to white band black, crossed by thin white lines. Retinaculum thumb-like, distinct, rusty. Hindwing rusty, crossed by thin cream-white lines. Medial area of wing (corresponding to white band on forewing) lighter, distinct. Veins distinct, orange scaled. Anal edge of forewing with white scaling. **Female.** No differences from male except antennal segments thinner, retinaculum absent, and



Figure 4. Comparison of female genitalia of *H. elianne* (left) and *H. unnia* (right) illustrating differences in length and complexity of the signa.

white scaling at ventral base of scape extends onto antennal shaft. Forewing length 19.33 mm (16–21 mm, N=12). **Male genitalia** – terminal half of moderately long uncus distinctly swollen; tip slightly pointed but not hooked. Tegumen broad, sclerotized on lateral and proximal edges that fuse below base of uncus, often forming a distinct X-shaped structure. Vinculum moderately broad, rather uneven along its edges. Vinculum fused to tegument via its proximal sclerotized edge; distal edge ends in a circular flap. Anellar arms project finger-like to medial area but do not fuse. Juxta a large circular structure. Saccus with broad, almost diamond-shaped structure, but it often is folded behind valves during slide preparation. Valva moderately broad and curves upward toward apex. Costa sclerotized but edge is not well defined; ends in a small slightly upcurved spine. Valva with pronounced, swollen, medial ridge; sacular area lightly sclerotized. Medial area of valva largely unsclerotized, but with large hair brush anchored at base. Additional hairs are on medial ridge and saccular region. Aedeagus sclerotized to manica with out third unsclerotized, but with striations. Ductus emerges subbasally. Aedeagus without sclerotized ridges or projections. Vesica expanded basally into two dorsal striated “wings.” Ventral vesica slightly striated. Vesica narrowed toward terminus with dorsal surface crinkled and striated, but separated from striations of dorsal “wings.” **Female genitalia** – anal papillae slightly pointed and striated toward distal tips. Posterior apophyses $1\frac{1}{2} \times$ length of anterior apophyses; apophyses end proximally in a terminally rounded, paddle-like structure. Segment surfaces unsclerotized, but with tightly adhering scales. Ostial area poorly defined and unsclerotized. Ostial opening expanded laterally, tapered to ductus, which is moderately long and thin with a proximal collar at base. Bursa an expanded sac, stippled dorsally and with two, ventral ladder-like signa. Signa look like corrugated pipes, tapering anteriorly. Length of longest sclerotized signum is best character for distinguishing *H. elianne* from *H. unnia*. No distinct structures on pelt. Tympanum with ansa swollen distally for half its length then narrowed before expanding at proximal end to form a T-like structure with a swollen base.

Discussion. The *H. anicata* complex in Costa Rica illustrates a frequently occurring example in barcode work with neotropical Lepidoptera. Species with large geographical distributions are frequently a complex of species, often seemingly identical in maculation. When genitalic examination is applied to distinct barcode clusters, they usually resolve these genetic clusters, reinforcing the concept of distinct species. Additionally, other characteristics such as elevational or geographical distributions, food plant usage, and behavior, often also support the distinctness of these clusters. In the case of the *H. anicata* complex in Costa Rica, initial barcoding revealed one species above 3000 m and another below 2200 m, the species differing in more than 5% of their sequences and with little intraspecific sequence variability. When additional sampling was done at intermediate altitudes the results still supported two species. Although additional sampling needs to be done, *H. elianne* continues to occur at higher altitudes and *H. unnia* occurs at lower altitudes with the two species overlapping between 1400 and 3000 m. Based on genitalic characters, both species are distinct from each other and from *H. anicata*, which may not extend north of Colombia. Material

from western Colombia (Valle province) differs in genital characters from *H. anicata* (Sullivan, unpubl. data) and barcoded samples from Ecuador (Brehm, unpubl. data) reveal at least two species there, both genetically distinct from the Costa Rican species. Barcoding of hundreds of species of the montane geometrid fauna from Ecuador and Costa Rica demonstrates that very few species are actually common to both regions (Brehm and Sullivan, unpubl. data).

We know little about the biology of either new species, although, based on observations at 3300 m, presumed *H. elianne* do fly diurnally, which may be true of all *Hagnagora* species (Brehm and Sullivan 2005). Known food plants used by *Hagnagora* are in the Boraginaceae (e.g., *Cordia* L.) and the Clethraceae (e.g., *Clethra* L.) (Brehm 2002) and the *H. anicata* complex likely uses the same groups of plants. Recently, King and Parra (2011) reported captive larvae of *Hagnagora vittata* (Philippi) that were reared on *Fuschia magellanica* Lamarck (Onagraceae).

The *Hagnagora anicata* complex extends from Mexico to Bolivia and east into western Venezuela paralleling the Andes. A population occurs on Jamaica. While traditionally considered a single species, barcode and genitalic analyses indicate that five or more species are probably involved in the complex. It is not unreasonable to assume that because such complexes are common in the neotropics, the estimated number of geometrid species described from there will likely continue to increase, perhaps dramatically.

Acknowledgements

I would like to thank Jocelyn Gill, Don Lafontaine, and Chris Schmidt at the Canadian National Collection; Jocelyn for preparing the illustrations, Don and Chris for suggestions regarding the manuscript. Paul Hebert of the University of Guelph, Guelph, Canada allowed the use of unpublished barcode data. Dan Janzen, Winnie Hallwachs and Gunnar Brehm graciously shared their barcode data. John Chainey at the British Museum and Patricia Gentilli-Poole at the Smithsonian Institution provided data on collections in their care. The manuscript was read by Gunnar Brehm and Isidro Chacon.

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Pterospoda nigrescens (Hulst), a synonym of *Ixala klotsi* Sperry (Lepidoptera, Geometridae, Ennominae)

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Abstract

Comparison of the types of *Ixala klotsi* (Sperry) and *Pterospoda nigrescens* (Hulst) shows that they are the same species, with *I. klotsi* a synonym of *P. nigrescens*. A lectotype of *Selidosema nigrescens* is designated, and the types of *S. nigrescens* and *I. klotsi* are illustrated. Male and female habitus and genitalia of *P. nigrescens* are illustrated.

Keywords

Arizona, Caberini, Ennominae, Geometridae, *Ixala*, Lepidoptera, Mexico, nomenclature, *Pterospoda*, taxonomy, Texas

Introduction

Hulst (1898) described *Selidosema nigrescens* based on an unknown number of female specimens from San Antonio, Texas. Dyar (1903) subsequently placed *Selidosema nigrescens* in *Pterospoda*. Sperry (1940) described *Ixala klotsi* from two males and a female that he and his wife collected in the Baboquivari Mountains, Pima County, Arizona. We have examined the type material of both taxa and compared contemporary specimens from Texas and Arizona to each other and to the types,

and conclude that both names refer to the same species. The purpose of this note is to synonymize *Ixala klotsi* under *Selidosema nigrescens*, designate a lectotype for the latter, and discuss the generic concepts in the *Pterospoda* group of genera.

Repository abbreviations:

- AMNH** American Museum of Natural History, New York, NY, USA
CNC Canadian National Collection of Insects, Arachnids, and Nematodes, Ottawa, Ontario, Canada
CDF Personal collection of Clifford D. Ferris, Laramie, Wyoming, USA

Systematics

Pterospoda nigrescens (Hulst)

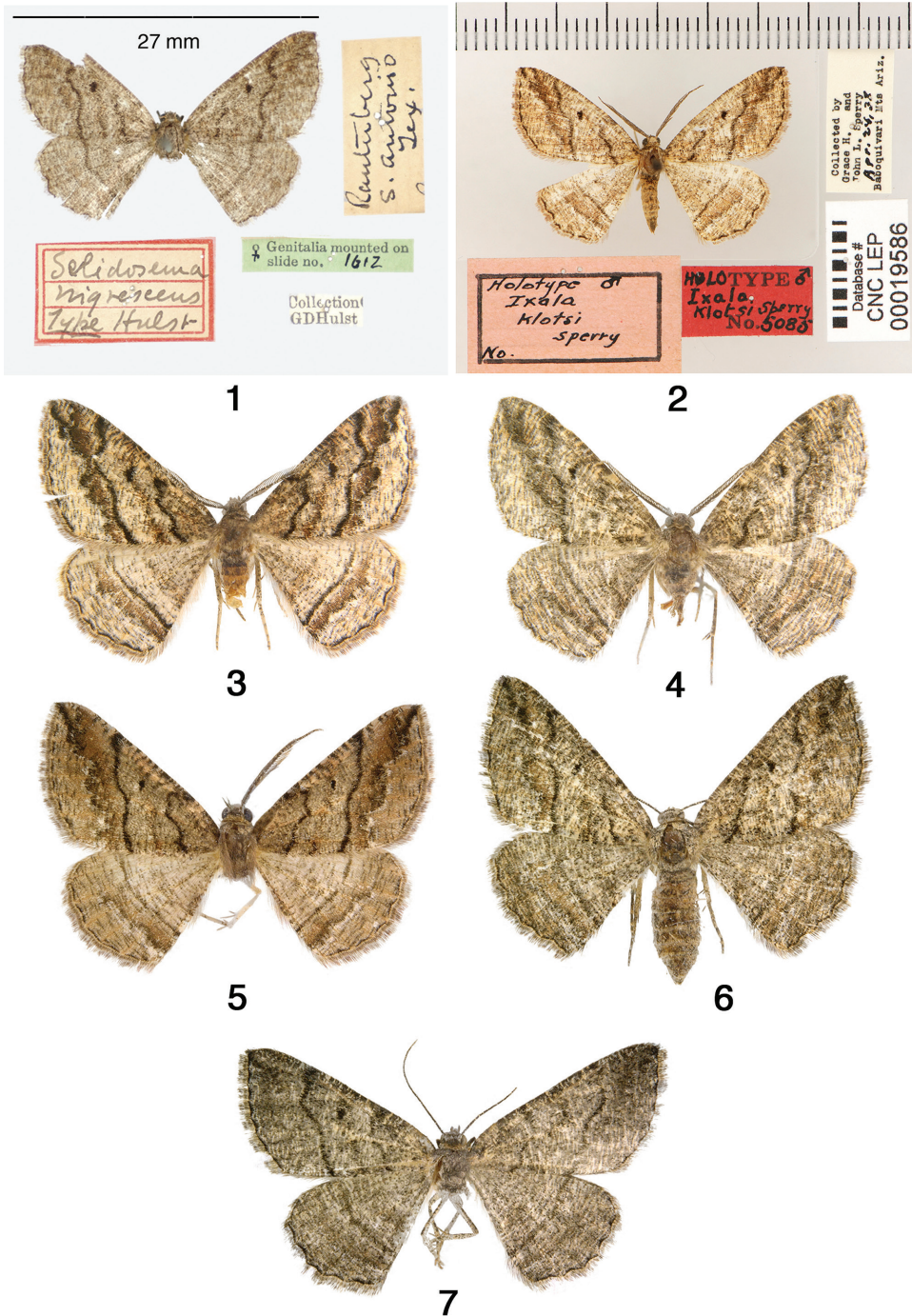
http://species-id.net/wiki/Pterospoda_nigrescens

Selidosema nigrescens Hulst, 1898:214.

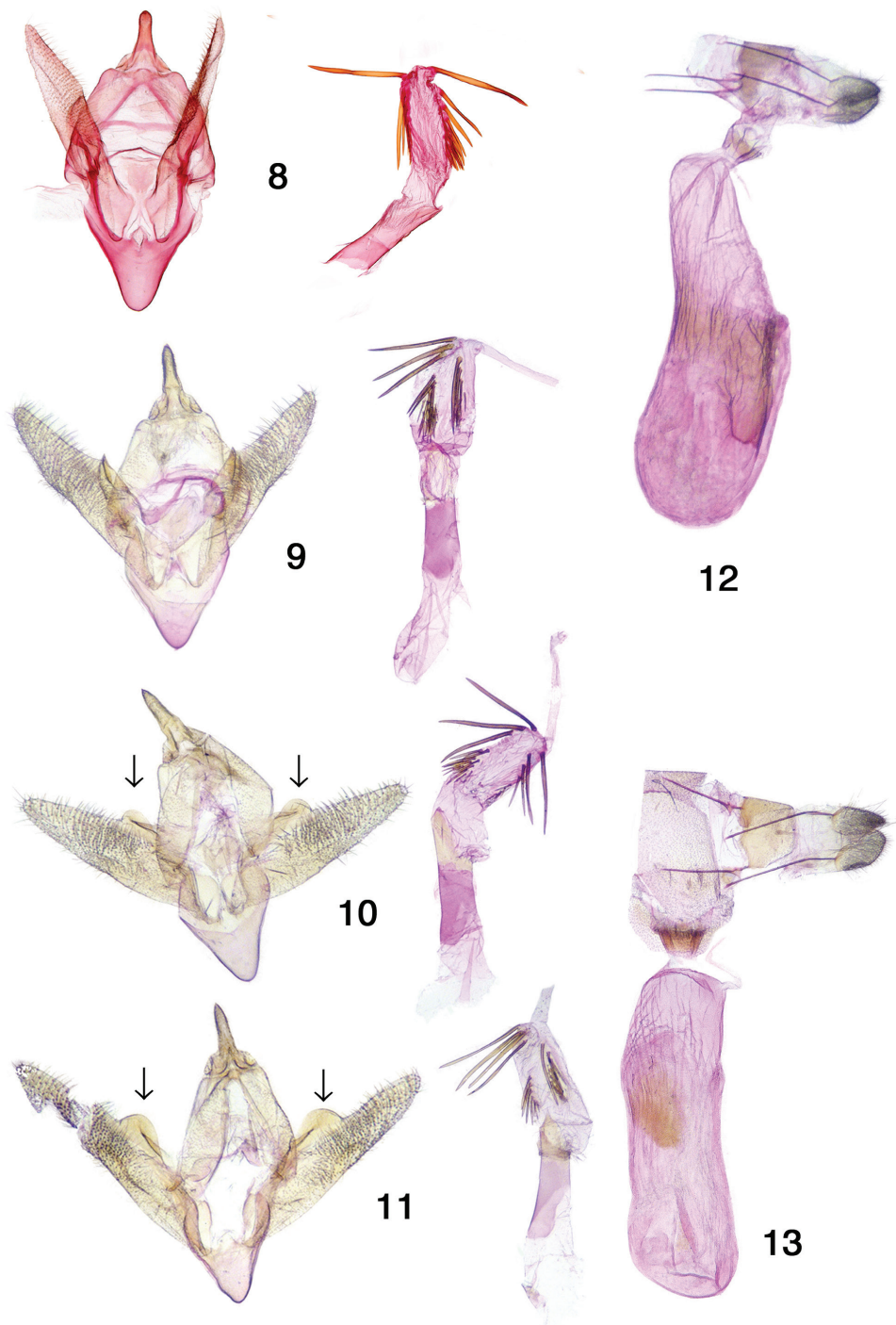
Ixala klotsi Sperry, 1940: 146. syn. n.

Type material. *Selidosema nigrescens*. Female lectotype [here designated], Texas, [Bexar Co.], San Antonio [AMNH] (Fig. 1). A label for the lectotype will be added as follows: “Lectotype / *Selidosema nigrescens* Hulst, 1898 / Ferris & Schmidt 2011.” *Ixala klotsi*. Male holotype, Arizona, [Pima Co.], Baboquivari Mts. 24 April, 1938, Grace H. and John L. Sperry [CNC] (Fig. 2).

Other material examined. USA. Arizona. Cochise Co.: Forest Road 42B, Coronado Nat. For., 1525m, 19.viii.1981, C. D. Ferris (1m); Guadalupe Canyon, 8.viii.1979, C. D. Ferris (1m); Gray Hawk Nature Preserve, 1235 m, 10.ix.2010, C. D. Ferris (1f). Pima Co.: Baboquivari Mtns., 15. iv [no year], S.E. Cassino (2m); Baboquivari Mts., Brown Canyon, 1183 m, 18.viii.2006, C. D. Ferris (1m), 27.vii.2007, C. D. Ferris (8m, 2f); Baboquivari Mtns., Brown Cyn., 22.iv.2006, B. Walsh (3m); 10.vii.2005 (1m); 2.viii.2008, B. C. Schmidt (2m); base of Tortolita Mts., 888 m, all C. D. Ferris, 4–8.iv.2003 (1m, 1f), 27–28.ix.2003 (2m, 2f), 24.x.2003 (1f), 4.x.2004 (1f), 4–11.iv.2005 (1m, 1f), 24.x.05 (1m), 9.x.2006 (1f). Santa Cruz Co., all C. D. Ferris. Patagonia, 1235 m, 8.viii.2009 (1f); Peña Blanca Canyon, 1200 m, 8.ix.2010 (6m, 1f). **Texas.** Brewster Co. Green Gulch, Big Bend N. P., 6–10.ix.2008 (1f), B[ordelon]/K[nudson]. Sinton Co., Welder Refuge 4.iv.1981 (1f). Uvalde Co., Concan, Neal’s Lodges, 9.iv.1990, N. McFarland (1m, 1f); Concan, 25.iii.1985, E. Knudson (1m). Val Verde Co., Del Rio, 25.iv.1959, M.R. MacKay (1m, 1f), 4.x.1994 (1m), E. Knudson. **MEXICO.** Durango: 25 mi. W. of Durango, 7500’ 6.v.1961, H. Howden & J.E.H. Martin (1m); 10 mi. W. of Durango, 7500’, 15.v.1964, W.C. McGuffin (1m, 1f); 5 mi. W. of Durango, 6500’ 11.vi.964, J.E.H. Martin (1f).



Figures 1–7. *Pterospoda nigrescens*. **1** Lectotype of *Pterospoda nigrescens* **2** Holotype of *Ixala klotsi* **3** male AZ Cochise Co. **4** male AZ Pima Co. **5** male TX Val Verde Co. **6** female AZ Santa Cruz Co. **7** female TX Brewster Co.



Figures 8–13. *Pterospoda nigrescens* genitalia. **8** genitalia of **1** **9** genitalia of **4** **10** male AZ Pima Co. **11** genitalia of **5** **12** female AZ Pima Co. **13** genitalia of **7**

Discussion. The type specimen of *Selidosema nigrescens* in AMNH does not bear a holotype label. Hulst stated in his description: "...all the specimens before me are females." The specimen label data agree with Hulst's description, and we therefore consider this specimen to be a syntype. The locations of the other syntypes are unknown. In order to ensure stability of the name, we designate this specimen as the lectotype (Fig. 1). The holotype of *I. klotsi* and additional specimens of *P. nigrescens* are illustrated in Figs 1–7.

Genitalia structure (Figs 8–13). The orientation and degree of flattening of the male genital capsule produces different aspects. The natural position is shown for the holotype of *Ixala klotsi* (Fig. 8). A partially flattened preparation is shown in Fig. 9, and strongly flattened preparations in Figs 10–11, in which the approximately semicircular projections (indicated by arrows) at the base of the costa become evident. The number and positions of the spines on the everted vesicae are somewhat variable, suggesting that the spines are partially deciduous. The balsam genitalia slide of the female lectotype of *Pterospoda nigrescens* was made in 1950 without use of stains, and the tissues were strongly cleared. There is very little contrast between the preparation and the now yellowed balsam, and we were unable to obtain a photograph suitable for publication. The form of the genitalia is consistent with specimens from Texas (Fig. 13) and Arizona (Fig. 12). The corpus bursae of the Texas specimen (Fig. 13) appears slightly smaller than that of the Arizona specimen (Fig. 12). Upon dissection, it was found to be only partially expanded, and was mechanically manipulated into the position shown.

Ixala Hulst and *Pterospoda* Dyar were placed in the Caberini along with 11 other genera by Ferguson (1983), the most recent tribal classification for this primarily North American tribe. Only *Pterospoda* and *Sericosema* Warren enter the Neotropical region in Mexico (Pitkin 2002). Rindge (1949) revised the *Drepanulatrix* group of genera, but the remaining genera in Caberini are in need of revision. For example, preliminary data suggest that both *Ixala* and *Pterospoda* as currently defined are not natural groups; *Pterospoda opuscularia* (Hulst), the type-species of *Pterospoda*, is more closely related to *Apodrepanulatrix litaria* (Hulst), and the remaining species in *Ixala* and *Pterospoda* have little in common in both facies and genitalic structure.

Pterospoda nigrescens occurs at moderate elevations in arid scrub and open woodland habitat, ranging from south-eastern Arizona and the Edwards Plateau of west-central Texas south to at least Durango, Mexico (Fig. 14). It is not known from New Mexico, but should occur there. Collection dates indicate at least two annual flights, primarily in April and August in Arizona. In Pima Co., AZ, Ray Nagle (Tucson, AZ) has reared the moth on a *Condalia* species, probably *C. warnockii* var. *kearneyana* M. C. Johnson (Rhamnaceae).

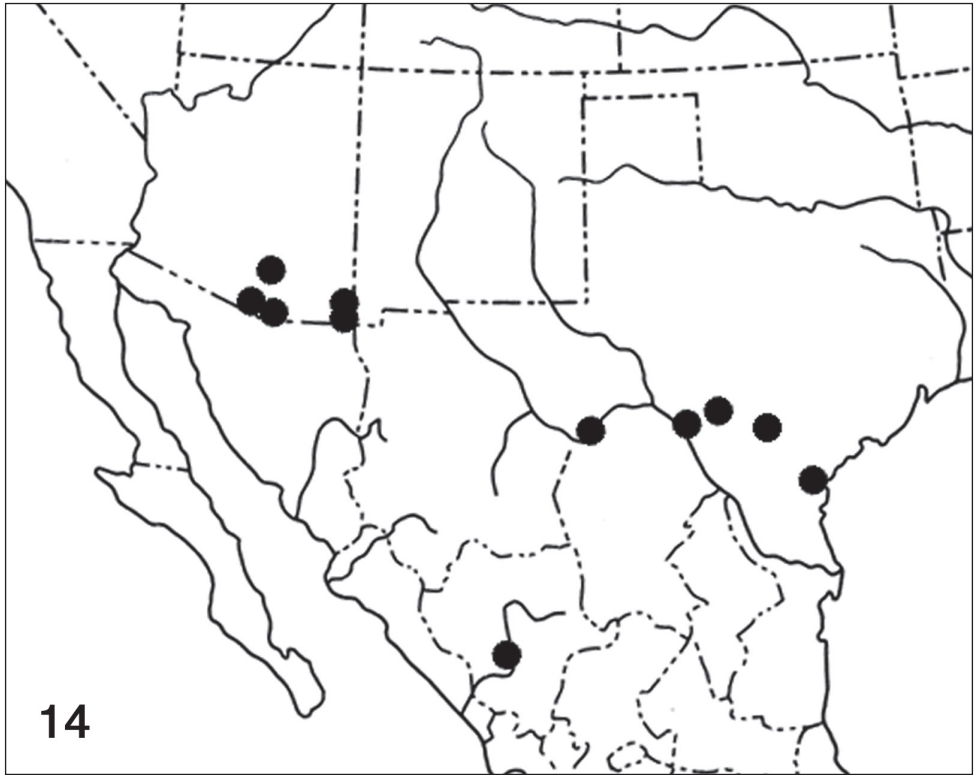


Figure 14. Distribution map for *Pterospoda nigrescens*.

Acknowledgments

We thank Suzanne Rab Green (AMNH) for photographs and loan of the genitalia slide of *Pterospoda nigrescens*, and Jocelyn Gill (CNC) for technical support. Bruce Walsh (Tucson, AZ) kindly provided additional specimens and Ed Knudson (Houston, TX) made available Texas material for study. As external reviewers, G. G. Anweiler, Edmon-ton, AB, and J. B. Sullivan, Beaufort, NC provided helpful suggestions.

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The genus *Neotherina* Dognin (Geometridae, Ennominae) in Costa Rica

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Abstract

So far, two species of *Neotherina* Dognin have been recorded in Costa Rica. *N. imperilla* (Dognin) occurs primarily at altitudes between 1100 and 1700 meters and *N. callas* (Druce) which is widely distributed above 1100 meters. A third, new species, *N. xanthosa* Sullivan and Chacón is described from altitudes above 2400 meters. Heterogeneity of the genus is discussed.

Keywords

Taxonomy, Ourapterygini, Nephodiini, *Neotherina*, *Nephodia*, Costa Rica

Introduction

The neotropical ennomine genus, *Neotherina* Dognin, contains eight species, four of which were recently moved into the genus from other genera (Pitkin 2000). One additional species appears to be misplaced in the genus but so far, no apomorphic characters have been defined for *Neotherina*. Superficially, the species look like species currently placed in *Nephodia* Hübner and *Lambdina* Capps, both of which likely are

paraphyletic assemblages. Pitkin (2002) figures the adult male and female genitalia of *N. callas* (Druce), and the male genitalia of *N. imperilla* (Dognin) from the Central Cordillera of Colombia. The latter is currently considered to be the senior subjective synonym of the type species, *Neotherina inconspicua* Dognin, described from Lino, Panama. Pitkin et al. (1996) list the species of *Neotherina* occurring in Costa Rica (*callas*, *imperilla*) and state that there is a third, possibly undescribed, species there too. It is this latter species that we describe here, and also discuss the generic relationships of the species currently placed in *Neotherina*.

Materials and methods

Photographic methods used herein are described in Sullivan and Adams (2009). Procedures for dissecting and preparing genitalia follow those of Lafontaine (2004). DNA sequencing of the barcode fragment of the COI gene was carried out at the Canadian Center for DNA Barcoding, Guelph, Ontario. Barcode sequences were compared by nearest neighbor analyses as implemented on the Barcode of Life Data systems website (Ratnasingham and Hebert 2007).

Repository abbreviations

Specimens were examined from the following collections:

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

Systematics

Neotherina Dognin

<http://species-id.net/wiki/Neotherina>

Neotherina Dognin, 1914: 402. Type species, *Neotherina inconspicua*, Dognin, 1914.

Remarks. Pitkin (2002) indicated that *Neotherina* has no apomorphies that adequately define it and that it is closely related to *Evita* Capps, *Lambdina* and *Nepytia* Hulst. She transferred four species into the genus from other genera (*Trygodes* Guènee, *Eusarca* Hübner) based in large part on the structure of the aedeagus (pointed, sinuous, posterior process and usually with a subterminal process as well). She considered the transfer provisional based on the uncertainty of the monophyly of *Neotherina*. One species,

N. noxiosa Dognin, was removed from the genus by Pitkin because it lacks a furca, a process originating near the dorsal margin of the juxta that defines the Ourapterygini into which *Neotherina* has been placed. Superficially, *Neotherina* species are similar to species placed in *Lambdina* and *Nephodia* (Nephodiini), but the monophyly of those genera is uncertain. The monophyly of the Ourapterygini versus Nephodiini is also questionable, since characters separating the two tribes are based largely on characters of the furca (Pitkin 2002, see also Sihvonen et al. 2011).

***Neotherina imperilla* (Dognin, 1911)**

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

Figure 1

Remarks. Two specimens in the INBio collections were identified as *N. imperilla* by Linda Pitkin during her work on the Ennominae of Costa Rica (Pitkin et al. 1996). Superficially they resemble the type (USNM) except that the type is quite faded. The species looks very much like those currently placed in the genus *Lambdina*. The ground color is orange brown with distinct medial and postmedial lines crossing the forewings. The scaling on the head, thorax and abdomen is orange with the region between the antennal bases and collar being brighter in color. There is no dorsal tuft on the metathorax. Notable characters include the male bipectinate antennae and small orange spots distal of the junction of the postmedial line and the anal edge of the forewing and proximal to the medial line and anal edge of both wings. There is a very small extension at vein M3 of both wings. The genitalia of a male from the INBio collection (Fig. 1b, c) closely resembles that of the male figured in Pitkin (2002) but there appear to be slight differences in the shape of the uncus and perhaps in the structures of the vesica (not everted in Pitkin (2002)). The female genitalia (Fig. 1e) are figured for the first time but there is no female from the type locality at the USNM for comparison. Since few geometrid species are shared between the Costa Rican and South American fauna (Janzen, Brehm and Sullivan, unpubl. data), the taxonomic status of Costa Rican *N. imperilla* should be re-evaluated when more study material becomes available.

Diagnosis. The wing pattern of *N. imperilla* is similar to many species in *Lambdina*, *Nephodia*, and unplaced species that occur at similar altitudes. It may be distinguished by the rounded apex and orange-brown color of the forewings. Similar (probably undescribed) species have a more pointed apex and the ground color is reddish or purplish.

Distribution and biology. Nothing is known about the life history of this species. It has been collected on the western slope of the Cordillera Volcánica de Guanacaste, the western slope of the Cordillera de Tilaran, both western and eastern slopes of the Cordillera Volcánica Central and both slopes of the Cordillera de Talamanca and the Fila Costeña. Most specimens at INBio (44) come from 1100–1700 m on the western slopes but this may reflect the absence of collecting access to eastern slopes above 900 m.

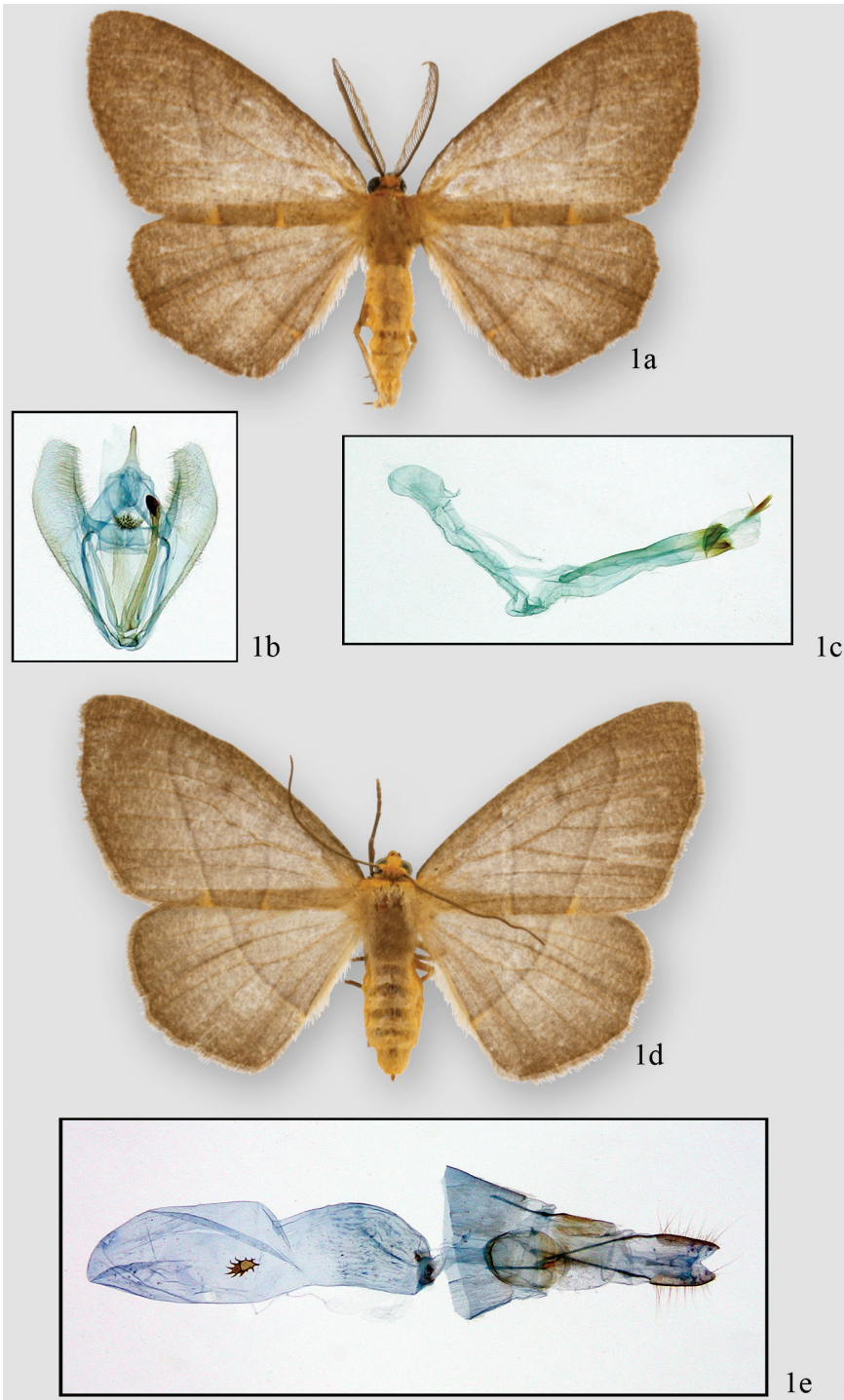


Figure 1. *Neotherina imperilla* male adult **1a** genital capsule **1b** aedeagus **1c** female adult **1d** and female genitalia **1e**

***Neotherina callas* (Druce, 1892)**

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

Figures 2a, 2b, 3, 5a, 5b, 5d

Remarks. This moderately common species is found at altitudes between 1100 and 2800 meters throughout Costa Rica. The forewing appears to be truncated at the tip because there are well-developed extensions of vein M3 in both wings; Females are noticeably larger than males. Adults of this and the following species are shown in Fig. 2. The female genitalia were figured by Pitkin (2002) and are shown in Figs 3c, 5a, 5b. There is a well-defined collar on the ductus and a distinctive signum on the bursa. The male genitalia (Figs 3a, 3b, 5d) are typical for the tribe Ourapterygini in having a well-developed furca, but have few other distinguishing characters for tribal classification.

Diagnosis. This species is unlikely to be confused with any other species in Costa Rica except *N. xanthosa* because of the characteristic wing shape. The wings are diaphanous and overlaid by a distinct pattern seen only in this species and in *N. xanthosa* (Fig. 2). It can be separated from the latter by the darker more grayish color and its smaller size, with a male forewing length of 18.95 mm (18–22 mm; $n = 64$) compared to 22.03 mm in *N. xanthosa*; females average 21.64 mm (range 19–24 mm; $n = 64$) versus 23.15 mm in *N. xanthosa*. Genitalic differences are given under the *N. xanthosa* diagnosis.

Distribution and biology. Nothing is known about the life history of this species. There are over 100 specimens in collections (INBio, USNM, JBS) and it occurs throughout Costa Rica at altitudes between 1100 m and 2800 m along all slopes. At higher altitudes the specimens are larger (see Sullivan and Miller 2008).

***Neotherina xanthosa* Sullivan & Chacón, sp. n.**

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

Figures 2c, 2d, 4, 5c, 5e

Type material. Holotype male: Costa Rica, Rio Macho. Est. Ojo de Agua. Send. A Torre 47, Cartago Province 2960 m, 26 March 1998, leg. E. Alfaro, B. Gamboa (INBIOCR1002526641) (INBI). **Paratypes:** (male) same data as type (INBIOCR1002603341); (male) same data as type but 24–28 Feb. 1998 (INBIOCR1002526656); (2 females) Costa Rica, Macizo de la Muerte, Sector de la Esperanza, Cartago Province, 2650 m, Nov. 2002, leg. R Delgado (INB0003534645, 0003554631); (male) same as previous but Sept. 2002, INB0003536193); (male) Costa Rica, San Gerardo de Dota, San Jose Province, 2430 m, 23 Dec. 1981, leg. DH and WH Janzen (INB0004269188); (male) Costa Rica, 4.6 Km E. de Villa Mills, Cartago Province, 2600 m, 21–26 Sept. 1995 (INBIOCR1002435795); (2 females) Costa Rica, Estac. Barva, Braulio Carillo N. P., Heredia Province, 2500 m, G. Rivera (INBIOCR1000089203, 1000089215); (2 females) same, Jan. 1990 (INBIOCR1000121385; 1000206721); (female) same, Feb. 1990 (IN-

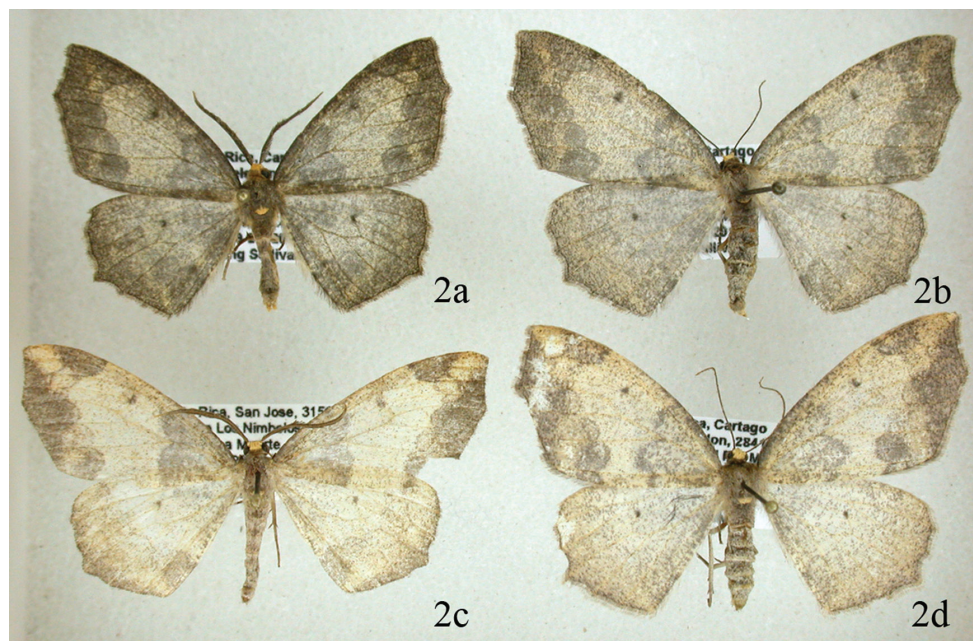


Figure 2. Comparison of *Neotherina callas* male **2a** and female **2b** and *N. xanthosa* male **2c** and female **(2d)** adults.

BIOCR1000157034); (female) same but leg. A. Fernandez, Nov. 1989 (INBIOCR1000156409); (female) same, Feb. 1990 (INBIOCR1000125703); (female) same, Apr. 1990 (INBIOCR1000169281) (5 females) same but leg. B. Apu & G. Varela, June 1990 (INBIOCR100220347, 100225846, 1000225866); (male, female) Costa Rica, Est. Los Nimbolos, Cerro de la Muerte, San Jose Province, 3150 m, 24–27 Jul. 2008, J.B. Sullivan, (female) Costa Rica, Villa Mills, Cartago Province, 2841 m 19–21 Mar 2010, J.B. Sullivan (GenBank accession number JF855656)(INBio, JBS, USNM).

Etymology. The name refers to the yellowish-brown ground color of the maculation.

Diagnosis. The species is similar only to *N. callas*, which it can be distinguished from by its yellowish-brown color and larger size (Fig. 2). Certain identification is best made by dissection of a male and examination of the spinulose terminal portion of the furca. In *N. xanthosa* it is about half the length of the furca (Fig. 5e), whereas in *N. callas* it is approximately one fourth as long as the furca (Fig. 5d). The female signa on the bursae differ in shape as well (compare Figs 5a, 5b, 5c). *N. xanthosa* also differs from *N. callas* (GenBank accession numbers JF855657; JF855658; JN268704; HM878904) by 5.6% in its DNA barcode.

Description. Male. Fig. 2c, 4a,b,c, 5e. *Head* – Palps very small, barely extending above middle of eye, scaling straw colored basally becoming chocolate on 2nd and 3rd segments. First segment more than 2 × length of second segment which is more than 2 × length of third segment. Frons brown yellow, square, yellow

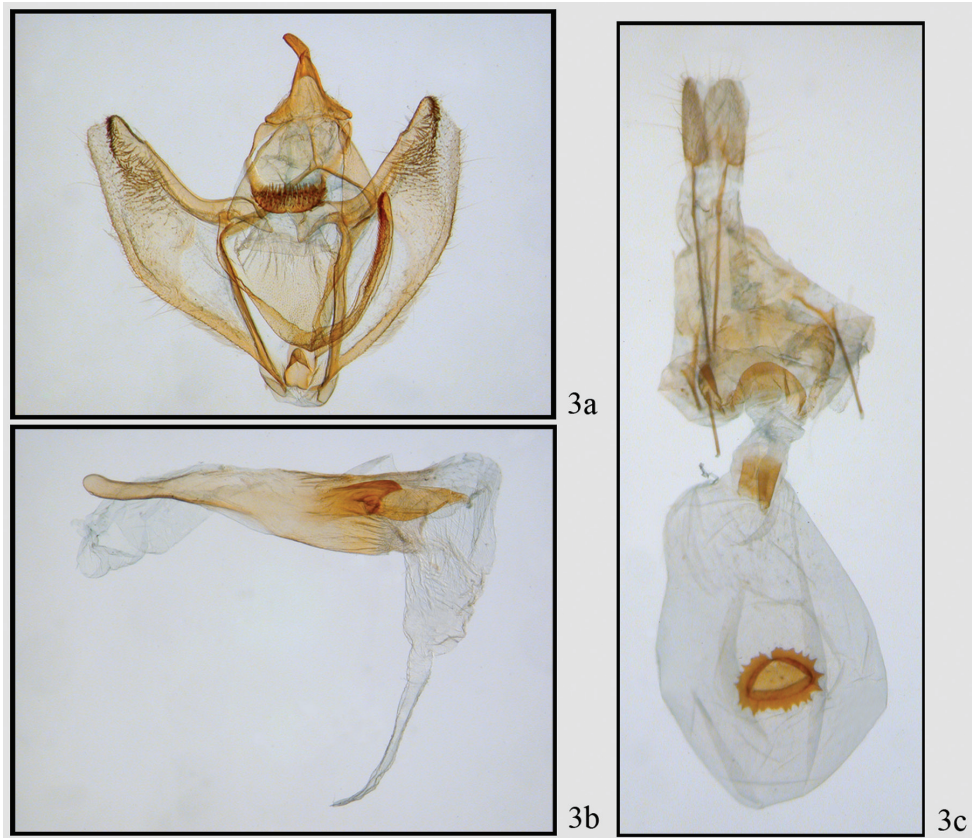


Figure 3. *Neotherina callas* male **3a,b** and female **3c** genitalia.

extending to collar; eyes hemispherical; ocellus absent; tongue normal. Antennae bipectinate, pectinations long at base ($5 \times$ shaft width) tapering distally to unpectinated discs in last 8 segments (56–58 segments); bipectinations toward apex with rami swollen distally, more basal bipectinations tubular, not swollen distally. Rami almost chocolate brown, dorsal shaft with scaling brown. Rami originate ventrally just lateral of midline. Scape brown yellow. *Thorax and abdomen*—Scaling slender, brown and off-white, distinct pad of yellow-brown scales at distal end of metathorax. Dorsal abdominal scaling off white and brown, shorter, thicker scales with multiple points distally (usually 3). Underside similar. Terminal scales on each segment brownish forming poorly-differentiated rings. Legs covered with tightly adhering band and brown scales, those of spurs darker, spurs short, epiphysis slender, long but slightly shorter in length than femur and extending slightly past distal end of femur. Leg scaling extremely difficult to remove. Proportions of leg segments typical. *Wings*—Forewing venation with two areoles beyond cell, WL 22.03 mm (21–22 mm, $N=7$). Wing pattern very similar to that of *N. callas* but ground color in *N. callas* gray, whereas in *N. xanthosa* it is brownish yellow.

Forewing tip appears scalloped because M3 is extended and there is a similar but smaller extension at M3 on hindwing. Wings of *N. callas* similar. *Male genitalia* (Fig. 4b,c, 5e) – Uncus slightly hooked, pencil-like, tapering to a broad base and forming an inverted T. Tegumen very broad, vinculum narrow. Gnathos with arms poorly defined but expanding medially to a broad medial area supporting three or more rows of well-defined spines, extending in height to width of medial pad. Small spines along lateral edge of pad. Furca deflects to right bearing hair-like bristles on inner 20–30%. Furca curves medially, rounded tip. Juxta small, basal area with posterior point. Area medial to furca arm granulated. Valva bulging medially, tapering to tip. Costa sclerotized, broad forming blade-like process at tip of valva. Medial 40% of valve with moderately long setae. Anal edge of valve with bulge medially then tapering to subapical tip. Anellar extensions of costa do not join medially. **Female.** Figs 2d, 4d,e, 5c. Antenna filiform, otherwise similar to male but slightly larger (WL 23.15 mm; 22–25 mm; n = 22). *Female genitalia* (Fig. 4e, 5c) – Anal papillae slightly pointed and rounded terminally. Posterior apophyses long, 2 × longer than anterior apophyses. Posterior vaginal plate sclerotized and broadly rounded posteriorly. Anterior plate unsclerotized at base. Ductus bursae short with sclerotized plate dorsally forming collar-like structure. Ductus moderately short. Corpus bursae sac-like with well-defined signum. Dorsal signum round, hollow with star-like basal collar of 13 prongs or points. Center deeply invaginated. Ductus ejaculatorius originates on upper part of corpus bursae below collar on ductus bursae.

Distribution. Known from above 2400 m in the Talamanca and the Central Volcanic ranges in Costa Rica. In flight throughout the year.

Remarks. Nothing is known about the biology of this species, or that of any other *Neotherina* species. Its range probably extends into the other mountain ranges in Costa Rica and northern Panama.

Discussion

The three species of *Neotherina* now known from Costa Rica form a heterogeneous assemblage. Wing shapes for *N. callas* and *N. xanthosa* are identical, but very different from those of *N. imperilla*. Of the remaining species, *N. melia* (Druce), *N. simplissima* (Dyar) and *N. atomeria* (Schaus), currently a synonym of *N. callas*, are extremely similar to *N. callas* and may be conspecific. *Neotherina axona* (Druce), *consequens* (Prout), *inconspicua* (Dognin) (currently a synonym of *N. imperilla*), *nomia* (Druce) and *carbania* (Druce) seem to be a heterogeneous assemblage but we have not dissected nor barcoded most of them. The genitalia examined to date do not present characters apomorphic for *Neotherina*. Barcoding of geometrid specimens from Costa Rica and Ecuador (Janzen, Sullivan, Brehm, unpubl. data) has revealed very few shared species. Likewise, genital dissections show little overlap between apparent conspecific specimens from western Colombia and Costa Rica (Sullivan,

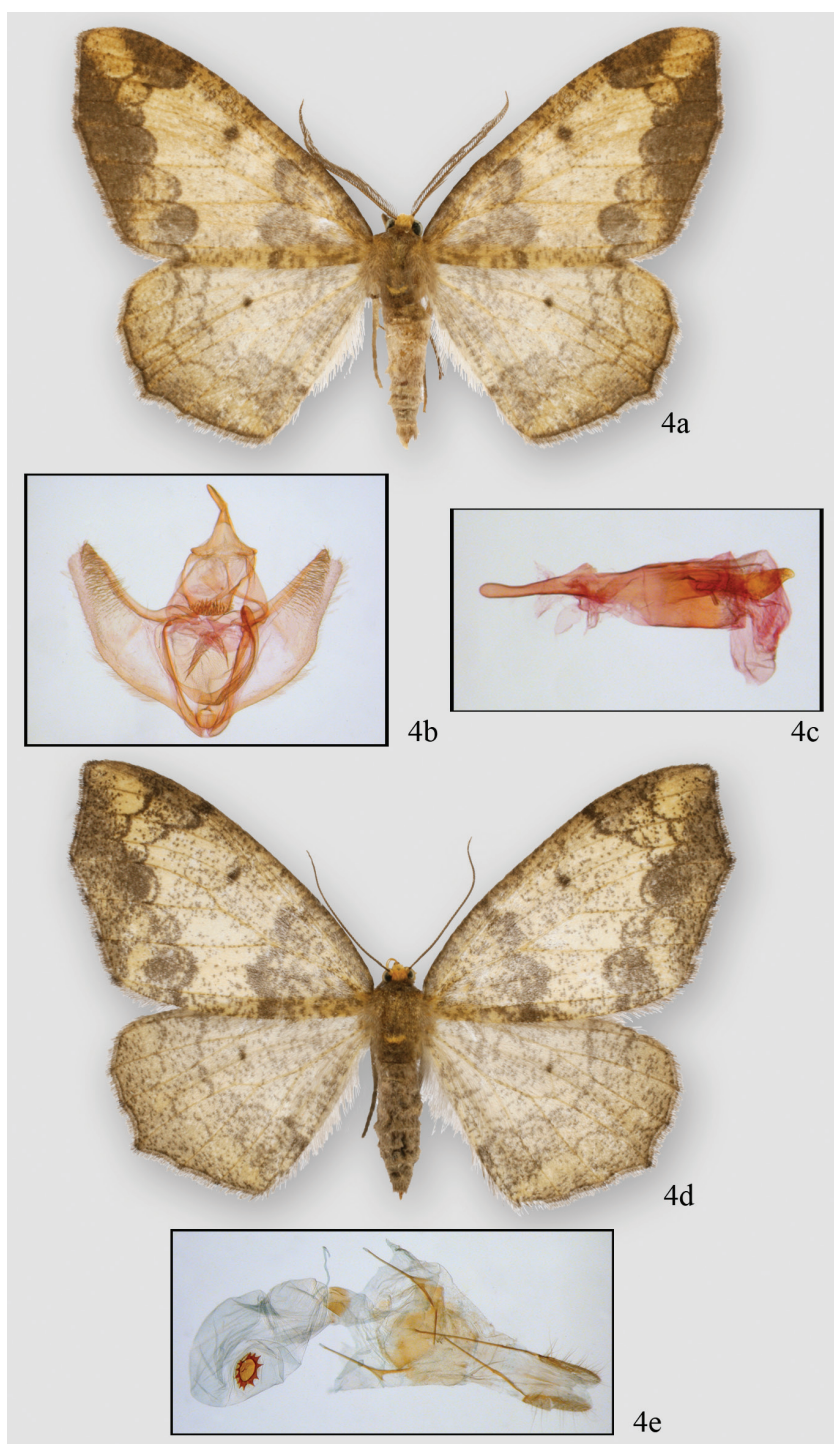


Figure 4. *Neotherina xanthosa*, male holotype **4a** and male genitalia, **4b, c** female paratype **4d** and female genitalia **4e**.

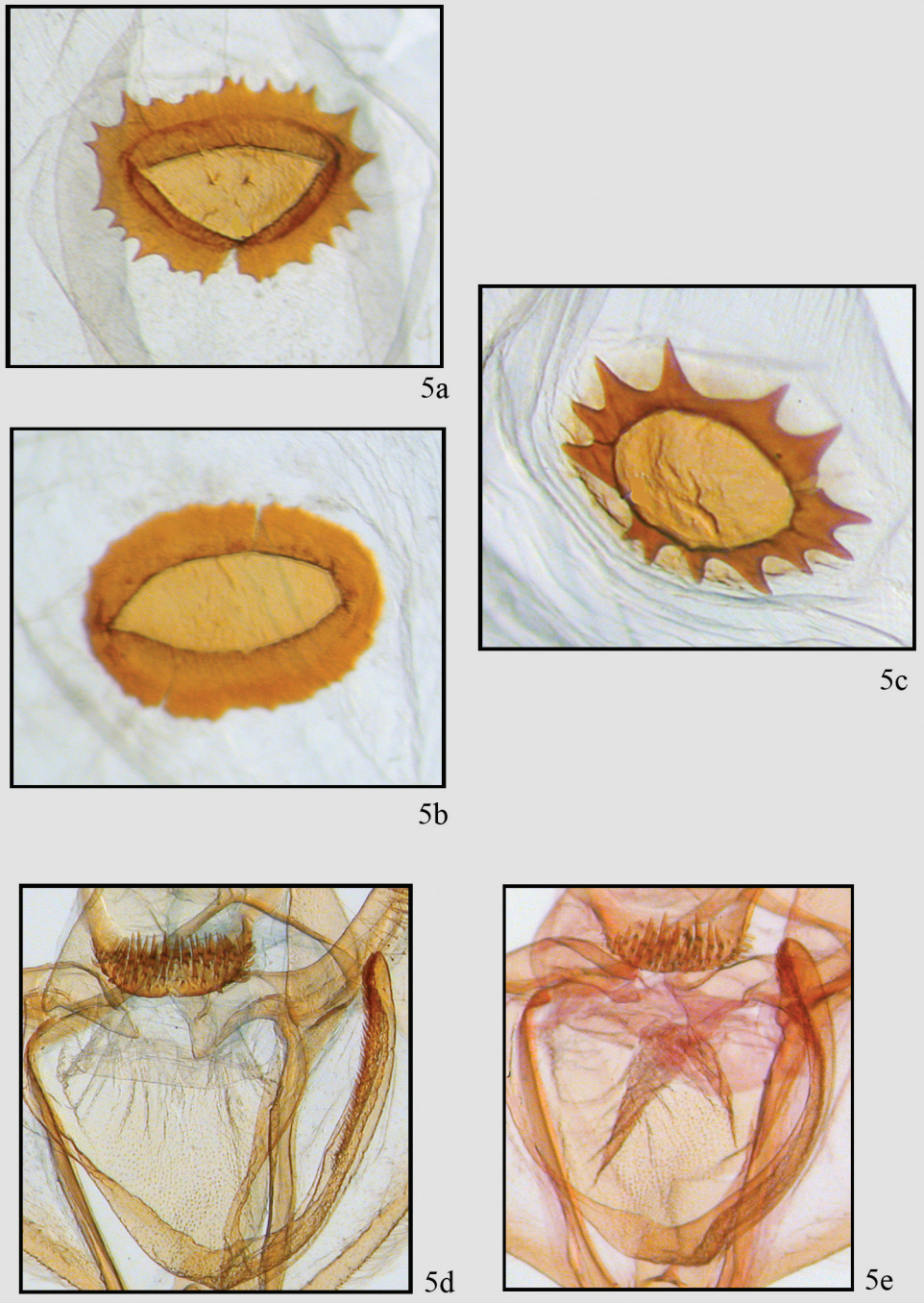


Figure 5. Comparison of genitalic structure in *Neotherina callas* and *N. xanthosa*. Two extremes of female signum **5a, b** of *N. callas* compared to *N. xanthosa* **5c** detail of male gnathos and furca of *N. callas* **5d** and *N. xanthosa* **5e**.

unpubl. data). Additional collections are needed to determine if populations of supposed *N. imperilla* from Costa Rica are conspecific with those from the type locality, Mt. Tolima, in Colombia.

Neotherina callas and *N. xanthosa* together with *N. melia*, *N. atomaria*, and *N. simplissima* seem to form a natural group. When additional data on food plants, barcodes, and genitalia of the remaining species currently placed in *Neotherina* are available, the “*callas* complex” may require a new genus.

Acknowledgements

We would like to thank Jocelyn Gill, Don Lafontaine, and Chris Schmidt at the Canadian National Collection; Jocelyn for preparing the illustrations, Don and Chris for suggestions regarding the manuscript. Paul Hebert of the University of Guelph, Guelph, Canada allowed the use of unpublished barcode data. Dan Janzen, Winnie Hallwachs and Gunnar Brehm graciously shared their barcode data. Bernardo Espinosa prepared and photographed genitalia preparations at INBio.

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A new species of *Elasmia* Möschler from New Mexico and Texas, and a new subspecies of *Elasmia mandela* (Druce) from Texas and Oklahoma (Lepidoptera, Notodontidae, Nystaleinae)

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Abstract

Hippia packardii (Morrison) and *Hippia insularis* (Grote) are moved to the genus *Elasmia* Möschler as **comb. n.** *Elasmia cave* Metzler, **sp. n.** is described from New Mexico and Texas, and *Elasmia mandela santaana* Metzler & Knudson, **ssp. n.** is described from Texas and Oklahoma. A key to the species of *Elasmia* of southwestern U.S. is provided. Adult male and female moths of *Elasmia* from southwestern U.S. and their genitalia are illustrated.

Keywords

Lepidoptera, Notodontidae, Nystaleinae, Arizona, Oklahoma, New Mexico, Texas, Kansas, *Hippia*, *Elasmia*, Carlsbad Caverns National Park, Santa Ana National Wildlife Refuge

Introduction

Lafontaine and Schmidt (2010) listed two species of *Hippia* Möschler, 1878 (Notodontidae: Nystaleinae) for North America north of Mexico: *H. packardii* (Morrison, 1875), described from Texas; and *H. insularis* (Grote, 1866), described from Cuba. They listed no species of *Elasmia* Möschler, 1886 (Notodontidae: Nystaleinae). Our investigations show that *H. packardii* and *H. insularis* belong in the genus *Elasmia*, and that *H. insularis*, reported from Texas (Knudson and Bordelon 1999), is an error. United States specimens thought to be *H. insularis* instead represent an undescribed species described here as *E. cave*. Our investigations further show an undescribed subspecies of *Elasmia mandela* (Druce, 1887) from the United States. *Elasmia mandela santaana* is described here from Texas and Oklahoma.

Methods

Adult moths were collected in U.S.D.A. type black-light traps and at black light and sheet as described in Covell (1984).

Genitalia were examined following procedures outlined in Clarke (1941), Hardwick (1950), Lafontaine (2004), and Pogue (2002). Abdomens were removed, wetted in 95% ethyl alcohol, and soaked in 10% KOH for 1.5 hours at 50°C. Genitalia were dissected in 5% ethyl alcohol, stained with Safranin O in ethyl alcohol and Chlorozol Black in water, dehydrated in 100% ethyl alcohol, cleared in oil of cloves, rinsed in xylene, and slide mounted in Canada balsam.

The aedeagus of species of *Elasmia* is held firmly in place by membranes within the genital capsule, and the aedeagus is nearly always broken into two pieces during the process of removal. The anterior portion is short and abruptly flared out. The posterior portion with the everted vesica is illustrated in this paper (Figs 13, 16, 19).

Wing pattern terminology came from Lafontaine (1987, 2004) and Mikkola et al. (2009). Morphological structure terminology came from Common (1990) and Forbes (1954), Genital structure terminology came from Lafontaine (1987, 2004), Franclemont (1946), Forbes (1954), Klots (1970), Miller (1991), and Weller (1995). Forewing lengths, from the base to the apex excluding fringe, were measured to the nearest mm, using a stereo-microscope. Nearly all specimens from New Mexico were collected as part of a long-term faunal study of Lepidoptera at Carlsbad Caverns National Park.

Specimens of Lepidoptera from this study are deposited in the following collections:

AMNH American Museum of Natural History, New York, New York

BMNH Natural History Museum, London, England

CMNH Carnegie Museum of Natural History, Pittsburgh, Pennsylvania

CUIC	Cornell University, Ithaca, New York
EHM	Eric H. Metzler, Alamogordo, New Mexico, for subsequent transfer to MSU
JBS	J. Bolling Sullivan, Beaufort, North Carolina
JBW	J. Bruce Walsh, Tucson, Arizona
MSU	Albert J. Cook Arthropod Research Collection, Department of Entomology, Michigan State University, East Lansing, Michigan
MCZ	Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts
ORU	Oral Roberts University, Tulsa, Oklahoma
OSU	Oklahoma State University, Stillwater, Oklahoma
TAM	Texas A&M University, College Station, Texas
TLSRC	Edward C. Knudson, Texas Lepidoptera Survey, Houston, Texas
UFL	McGuire Center for Lepidoptera and Biodiversity, University of Florida, Gainesville, Florida
UNM	Museum of Southwestern Biology, University of New Mexico, Albuquerque, New Mexico
USNM	United States Museum of Natural History (Smithsonian Institution) Washington, DC

Results

Key to the species of *Elasmia* in Arizona, Kansas, New Mexico, Oklahoma, and Texas

- 1 Forewing gray and/or blue gray, sides of uncus convex, evenly curved (Fig. 11), forewing length = 13–16 mm *packardii*
- Forewing brown or gray, sides of uncus flared outward (Figs 14, 17), forewing length = 14–18 mm 2
- 2 Forewing brown gray (Fig. 5), apex of costulae swollen and bent *cave*
- Forewing gray brown (Fig. 9), apex of costulae straight and not bent *mandela santaana*

In south central Texas, larvae of the genus *Elasmia* (not identified to species) feed on *Ungnadia speciosa* Endl. (Mexican buckeye) and *Sapindus saponaria* var. *drummondii* (Hook. & Arn.) L. Benson (soapberry tree) (both Sapindaceae) (Val Bugh pers. comm. 2010).

Systematics

Hippia Möschler, 1878

Discussion. We examined the illustration of the type and the male and female genitalia of *Hippia mumetes* (Cramer, [1775]), the type species of *Hippia* Möschler (1878). Those examinations show that the North American species, placed in *Hippia*, are not congeneric with *H. mumetes*.

Elasmia Möschler, 1886

Discussion. We examined the illustration of the type of *Elasmia lignosa* Möschler, 1886, the type species of *Elasmia*. The North American species, previously placed in *Hippia*, are determined to be congeneric with *Elasmia*.

Elasmia insularis (Grote, 1866), comb. n.

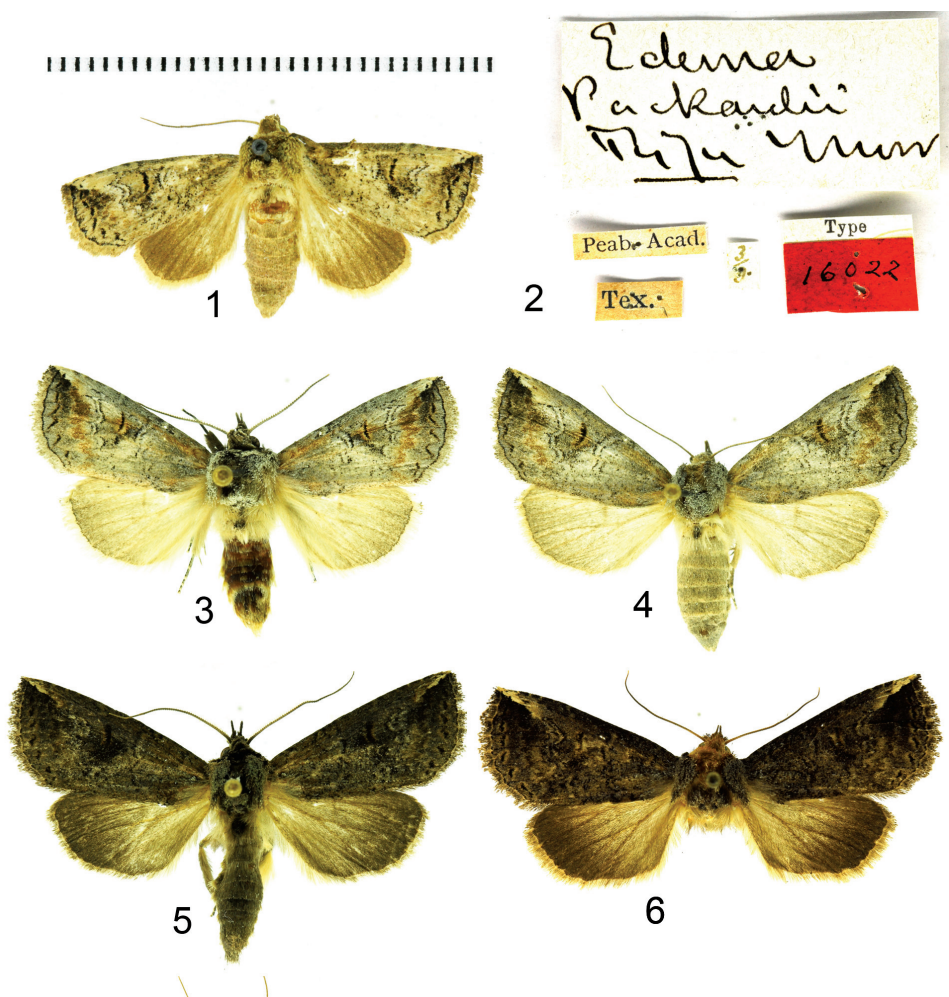
Discussion. The adult and genitalia of *E. insularis* were illustrated in Torre and Alayo (1959). We examined male specimens, and their genitalia, of *E. insularis* from Cuba. *Elasmia insularis* is not known to occur in Florida (Heppner 2003), and it is doubtful that it occurs in the U.S. Inclusion of *E. insularis* in Lafontaine and Schmidt (2010) was based on erroneous reports from Texas (Knudson and Bordelon 1999).

Elasmia packardii (Morrison, 1875), comb. n.

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

Figs 1–4, 11–13, 20, 23, 26

Description. Overall color light gray blue to gray with obscure transverse forewing markings, sometimes showing slight brownish shadings over reniform spot and in postmedial and subterminal areas. Males and females similar in appearance; male antenna narrowly bipectinate in basal $\frac{3}{4}$, with dense setae on ventral surface. Female antenna filiform for entire length, with sparse setae. Apex of forewing marked with a diagonal white and dark shade. Forewing length in males 12–15 mm (mean = 14 mm, n = 72), and in females 13–16 mm (mean = 14 mm, n = 25). Male genitalia (Figs 11–13) distinguished by a helmet-shaped uncus with gradually widening sides. Female genitalia (Fig. 20) with membranous papilla anales partially hidden from view. Ductus bursae broad and short, dorso-ventrally compressed; corpus bursae, round in profile, with a single shark tooth-shaped signum, also with a heavily sclerotized, perpendicular, thumb-like projection ventrally and a sclerotized finger-like pocket appressed to corpus bursae dorsally. Deciduous cornuti from male vesica may be found in corpus bursae.



Figures 1–6. *Elasmia* adults. 1 *E. packardii* female holotype 2 *E. packardii* holotype labels 3 *E. packardii* male 4 *Elasmia packardii* female 5 *Elasmia cave* male holotype 6 *Elasmia cave* female paratype.

Remarks. Morrison (1875) described *Elasmia packardii* from Waco, Bosque County, Texas (Fig. 2) based on a single female specimen (Fig. 1). Adults are on the wing from April through early October.

Distribution and Biology. *Elasmia packardii* occurs in Texas, Arizona, New Mexico, Oklahoma, and Kansas (Fig. 26); it is common at Carlsbad Caverns National Park. Its distribution in Mexico is unknown. The larvae feed on *Ungnadia speciosa* Endl. (Mexican buckeye) (R.O. Kendall specimens in TAM) and *Sapindus saponaria* var. *drummondii* (Hook. & Arn.) L. Benson (soapberry tree) (both Sapindaceae) (R.O. Kendall specimens in AMNH and TAM).



Figures 7–10. *Elasmia* adults. **7** *E. mandela* male **8** *E. mandela* female **9** *E. m. santaana* male holotype **10** *E. m. santaana* female paratype.

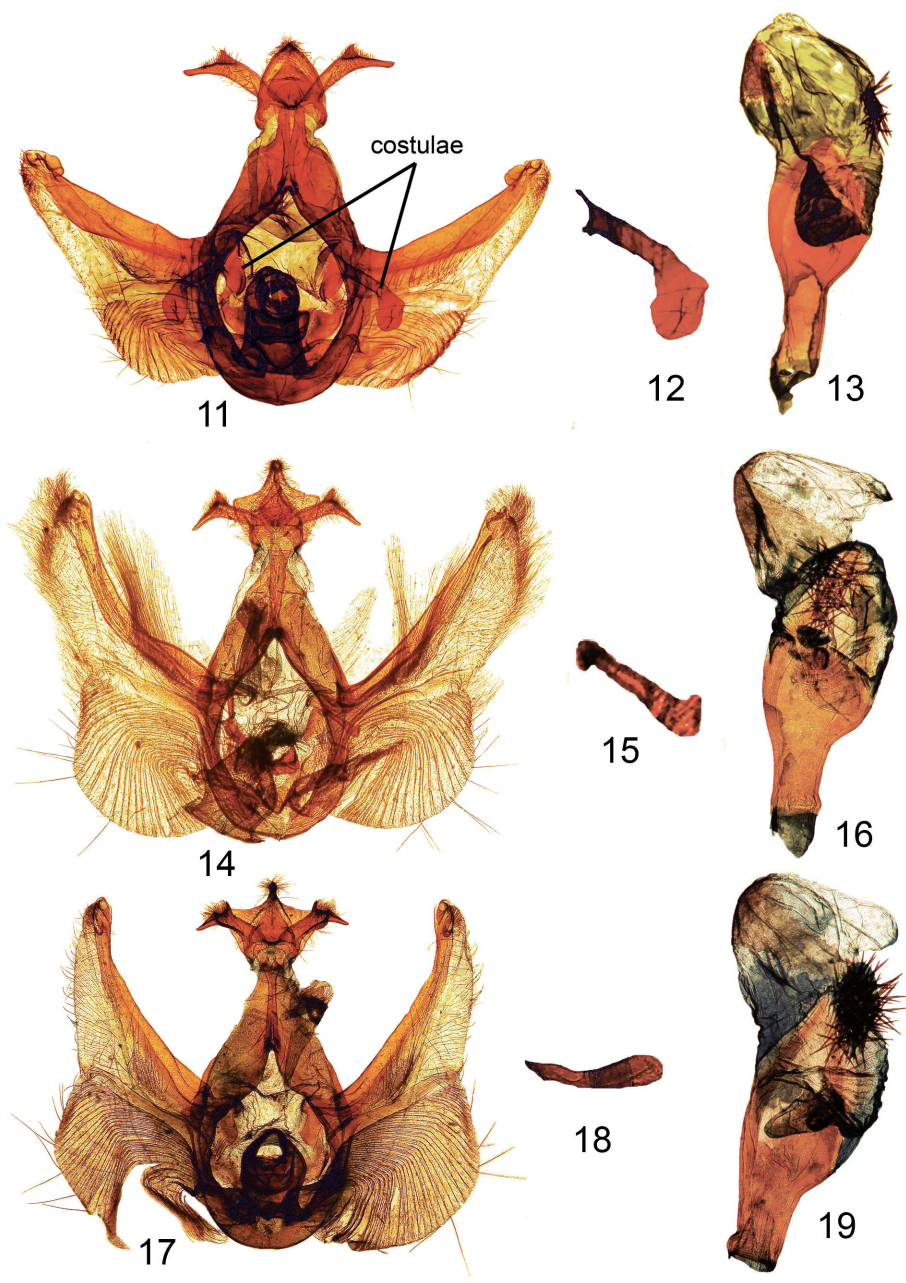
***Elasmia cave* Metzler, sp. n.**

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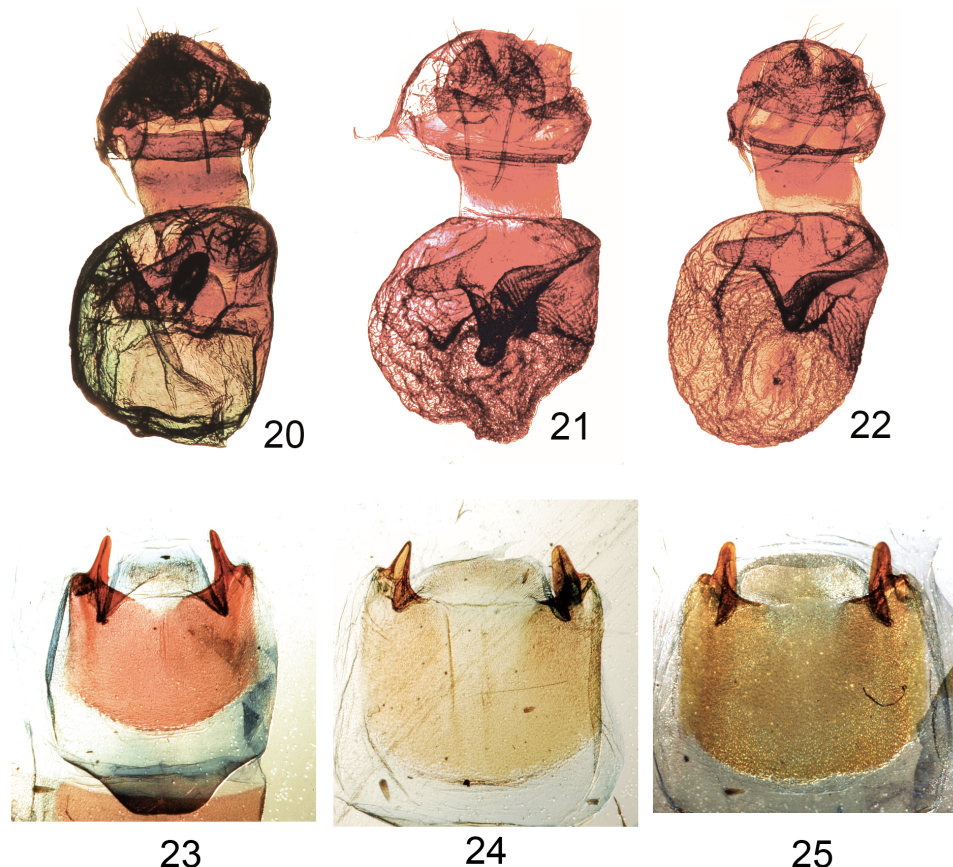
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Figs 5–6, 14–16, 21, 24, 27

Type material. Holotype male: “USA: NM: Eddy Co. Carlsbad Caverns N[ational] P[ark], riparian habitat, 32°06.566' N 104°28.257' W, 29 August 2006, Eric H. Metzler, CCNP4, uv trp Accsn #: CAVE - 02263”, “HOLOTYPE USNM *Elasmia cave* Metzler” [red handwritten label] (USNM). Paratypes: 19 males; 14 females: NEW MEXICO: USA: NM: Eddy Co. Carlsbad Caverns NP, arroyo habitat 32°05.98'N 104°33.57'W, 5 September 2010, Eric H. Metzler, CCNP2 uv trp Accsn #: CAVE - 02263. TEXAS: Alpine, Tex., 1–7 May 1926, 8–14 May 1926, 1–7 July 1926, 8–14 July 1926, 15–21 July 1926, 1–7 Aug. 1926, 15–21 Aug. 1926, O.C. Poling, Coll[ector]. Barnes Collection (USNM), Texas, Uvalde Co. Concan, 12-V-90, leg. E.C. Knudson. 14-X-93, Concan, Uvalde Co., TX, Coll C. Bordelon. TX: Brewster Co., Big Bend N.P., Green Gulch/5400' 5–7-V-97/ECK. Big Bend, Tex. Brewster Co., 6–7000 ft., Poling, F. Johnson donor, 8-1-26. USA: Texas: Jeff Davis Co. Davis Mountains, Limpia Canyon, elev: 4920', 30°30.0'N 103°52.5'W, 8 August 1991, Eric H. Metzler. TEXAS: Jeff Davis Co., 25-VI-81, Davis Mt. St. Pk., Jeff Davis Co. TX: Ft. Davis, 3-x-94, leg. E. Knudson. 24 Aug 1995. Jeff Davis Co. Texas, 5-V-78, Kokernaut Creek, leg. E.C. Knudson.



Figures 11–19. *Elasmia* male genitalia. **11** *E. packardii* male genitalia genital capsule slide E.H.M. 343 **12** *E. packardii* male genitalia detail of terminus of costulae slide E.H.M. 343 **13** *E. packardii* male genitalia aedeagus slide E.H.M. 343 **14** *E. cave* male genitalia paratype genital capsule slide E.H.M. 355 **15** *E. cave* male genitalia detail of terminus of costulae slide E.H.M. 355 **16** *E. cave* male genitalia paratype aedeagus slide E.H.M. 355 **17** *E. m. santaana* male genitalia paratype genital capsule slide E.H.M. 359 **18** *E. m. santaana* male genitalia detail of terminus of costulae slide E.H.M. 359 **19** *E. m. santaana* male genitalia paratype aedeagus slide E.H.M. 359.



Figures 20–25. *Elasmia* female genitalia and male eighth sternites. **20** *E. packardii* female genitalia slide E.H.M. 347 **21** *E. cave* female genitalia paratype slide E.H.M. 409 **22** *E. m. santaana* female genitalia paratype slide E.H.M. 410 **23** Eighth sternite of male of *E. packardii* slide E.H.M. 343 **24** Eighth sternite of male of *E. cave* paratype slide E.H.M. 355 **25** Eighth sternite of male of *E. m. santaana* paratype slide E.H.M. 359.

Jeff Davis Co., TX, Ft. Davis, 10,11-IX-10 Bordelon & Knudson coll. Jeff Davis Co., TX, Ft. Davis, 24–26-V-07 Bordelon & Knudson coll. TX: Culberson Co., Guadalupe Mts. N.P., Lamar Cyn., Coll. C. Bordelon. TEXAS: Culberson Co., Guadalupe Mts. N.P., Pine Spring, 6–8-IX-91, leg. E.C. Knudson. Green Gulch 5400' Big Bend Natl. Park Brewster Co., Texas 4 May 1972 J. G. Franclemont ♂ Genitalia slide 6419 J. G. Franclemont. Alpine, Brewster Co. Texas 15–21 Aug. 1926 O.C. Poling ♂ Genitalia slide 2535 J. G. Franclemont. (EHM, MSU, CUC, TLSRC, USNM).

Etymology. CAVE is the acronym, used by the U.S. National Park Service, for Carlsbad Caverns National Park. The specific name of this species, *cave*, treated as a noun in apposition, refers to the type locality, Carlsbad Caverns National Park.

Diagnosis. *Elasmia cave* is a dark brown-gray moth with obscure transverse markings. *Elasmia cave* looks like brown example of *E. mandela*; *E. mandela* is dark

gray brown. The brown color of the imago and its genitalia will separate *E. cave* from *E. packardii*, which is gray blue to gray. The uncus of *E. packardii* (Fig. 11), narrow at its apex, gradually widens with evenly curved sides. The uncus of *E. cave* (Fig. 14) is wide, like a manta ray, and narrows immediately before the apex. The distal end of the costulae of *E. insularis*, $n=3$, are narrow, straight or slightly sinuous, and without bend or swelling apically (illustrated by Torre and Alayo 1959); the costulae of *E. mandela*, $n=3$, are nearly identical to *E. insularis*. In comparison to *E. insularis* and *E. mandela*, the costulae of *E. cave* (Fig. 15) are broader, and they are abruptly bent upward and swollen at the distal end.

Description. Adult male (Fig. 5): *Head*: smoky gray, scales strap-like, erect, a fuscous line between eyes below antennae. Labial palpus erect, extending upward to slightly beyond base of antenna, smoky brown gray with a fuscous lateral stripe, extends to slightly beyond base of antenna, ventral scales on 1st and 2nd segments long, not shaggy, 3rd segment closely scaled. Haustellum coiled between labial palpi. Antenna narrowly bipectinate for basal $3/4$, each ramus tipped with long setae, apical $1/4$ ciliate with short setae, dorsal surface alternating fuscous and smoky, closely scaled, ventral surface naked, brown. *Thorax*: collar black, sometimes preceded by brown, dorsum smoky brown gray, longitudinal narrow black lines anteriorly, posteriorly, and laterally, tegula smoky brown gray, scales strap-like; underside smoky dark gray brown, laterally smoky, scales erect long hair-like or narrowly forked. Legs: dark smoky gray brown, closely scaled, except lateral margin with shaggy scales, tarsomere apex yellow. Forewing: length 14–18 mm, mean 16 mm, $n = 16$; dorsal surface ground color smoky gray brown, sometimes slightly hoary; antemedial line obscure, pale basally, black mesally, sinuous; postmedial line vague, sinuous, black basally outer element pale; subterminal line a series of fuscous bars; terminal line narrow, black; orbicular spot absent or vaguely pale; reniform spot inconspicuous, dark with pale outline; costa brown except white shade at apex; subreniform spot fuscous, contrasting; dark line from apex running obliquely toward reniform spot; fringe smoky gray. Ventral surface: smoky dark gray black, apical markings similar to dorsal surface, fringe concolorous. Hindwing dorsal surface: dark smoky gray, slightly paler basally, markings absent, fringe pale smoky. Ventral surface: apex to tornus dark smoky gray, tornus pale gray along inner margin, base pale gray, markings absent, fringe pale gray. *Abdomen*: dorsum smoky gray, with fuscous tufts on first and second segments, elsewhere closely scaled, underside pale smoky gray. *Genitalia* (Fig. 14): Uncus broad, flattened, setose, apex bluntly pointed, dorsally with narrow ridge, ventrally with two short cornutus-like spines; socii broad, setose, bent at approximately 90° , with one ear-like dorsal projection; tegumen flattened; saccus short, broadly U-shaped; juxta shield shaped, dorsal margin a half circular cutout; diaphragma bearing two sclerotized processes (costulae) near bases of valvae costa, bent at 90° , bent and swollen club-like apically (Fig. 15), valve setose, dorsally sclerotized, ventrally membranous, Barth's Organ large, with many chevron-shaped parallel pleats, cucullus not well differentiated, with three narrow, curved ridges, corona with weak, mesally-directed curved setae. Aedeagus (Fig. 16) straight, anterior end

abruptly flared out, posteriorly flattened, spoon-shaped; vesica lightly sclerotized, subbasal diverticulum with a nipple-shaped cornutus; a patch of deciduous (may be dislodged during mating) stellate (like a starfish) spicule-shaped cornuti; basal diverticula lightly sclerotized, with two finger-like subbasal diverticulae.

Adult female (Fig. 6). Similar to male except; antenna filiform, without long setae, top of head yellow to orange, collar to disc of thorax yellow to orange. Forewing length 15–18 mm, mean 17 mm, $n = 11$. *Genitalia* (Fig. 21). Papilla anales membranous, setose, partially hidden from view between sclerotized extensions of ninth abdominal segment. Posterior apophyses slender. Anterior apophyses slender. Ductus bursae short, broad. Corpus bursae round, with a single shark tooth-shaped signum; sclerotized ventral wall forming a thumb-like extension with bulbous terminus; sclerotized dorsal wall with a pock-marked, finger-like extension appressed to surface of corpus bursae.

Remarks. *Elasmia cave* was mistakenly identified in the U.S. as *E. insularis*. The costulae of the male genitalia, Figured in (Torre and Alayo 1959) from Cuba and noted in the diagnosis, separate the species. *Elasmia cave* is placed in the genus *Elasmia* Möschler, 1886, because the imago is closely similar to *E. lignosa*, and the male genitalia are closely similar to those of *E. mandela*.

Distribution and biology. *Elasmia cave* occurs in the U.S. in New Mexico and Texas; its distribution in Mexico is not known. Three specimens were collected in riparian habitats in Texas and New Mexico. Two specimens from Alpine, Texas and one from Big Bend, Texas, leg. Poling, have additional handwritten labels that say “Buckeye” or “bred Buckeye” respectively. The type locality was selected because it will be protected by the U.S. National Park Service into perpetuity.

Elasmia mandela (Druce, 1887)

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

Figs 7, 8

Description. Overall color dark gray brown with obscure transverse forewing markings. Males and females similar in appearance. Male antenna narrowly bipectinate in basal $\frac{3}{4}$, with dense setae on ventral surface. Female antenna filiform for entire length, with sparse setae. Apex of forewing with a diagonal white mark. Reniform spot outlined with pale-orange scales, not contrasting. Forewing length in males 17.0–18.0 mm (mean = 17.2 mm, $n = 5$), and in females 18.0–20.0 mm (mean = 19.3 mm, $n = 7$). Male genitalia distinguished by uncus with abruptly widening sides, like a manta ray, and robust saccular area (Barth’s Organ). Female genitalia with membranous papilla anales that are partially hidden from view. Ductus bursae broad and short, dorso-ventrally compressed; corpus bursae round in profile, with a single shark tooth shaped signum, also with a heavily-sclerotized, perpendicular, thumb-like projection ventrally and a sclerotized finger-like pocket appressed to corpus bursae dorsally.

Remarks. Druce (1887) described *Elasmia mandela* from Presidio, Mexico, based on a single female specimen. We examined a photograph of the type and its genitalia. We also examined specimens from Vera Cruz and Yucatan, Mexico (AMNH), and from Costa Rica (JBS).

Distribution and biology. *Elasmia mandela* occurs in Mexico and Costa Rica. Its distribution in other Central American countries is unknown. The larval hosts in Costa Rica are one species of Rhamnaceae and 22 species of Sapindaceae (Janzen and Hallwachs 2009).

***Elasmia mandela santaana* Metzler & Knudson, subsp. n.**

urn:lsid:zoobank.org:act:9B30138B-9B92-4B81-9797-82B59ABE417F

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

Figs 9, 10, 17–19, 22, 25, 28

Type material. Holotype male: “Hidalgo Co. Texas 31-X-83 Santa Ana Refuge leg. E.C. Knudson” “HOLOTYPE USNM *Elasmia mandela santaana* Metzler & Knudson” [red handwritten label] (USNM). Paratypes: 13 males; 10 females: TEXAS: Harris Co: TX. Houston, Leg. E.C. Knudson, 9-VIII-75. Hidalgo Co. TX. Santa Ana NWR, 6-IX-92, leg. E.C. Knudson. Texas: Uvalde Co. Concan, 15-V-10, B/K. Tarrant Co. Texas Benbrook, 30-IV-78, leg. E.C. Knudson. Terrel Co. Tex. Sanderson, 25-IV-81, leg. E.C. Knudson. Kerrville. Texas, Barnes Collection. Kerrville, Texas. VIII 1904. Kerrville, TX. H. Lacy Collector. Kerrville, 4-23-08, TX. F.C. Pratt Collector. Texas, San Patricio Co. Welder Wildlife Refuge near Sinton, Texas, 14-16-VI-85, leg. E.C. Knudson. Hidalgo Co., TX, Bentsen State Park, 6-VIII-94, E. Knudson coll. Montgomery Co. Tex. Sawdust Rd. & I.S. 45, leg. E.C. Knudson, 20-VI-75. Brownsville, Tex III-10-29, F.H. Benjamin collr, Barnes Collection. Alpine, TX. 8–14 May, 8–14 July, 15–21 Aug. 1926, O.C. Poling, Coll[ector]. TEXAS: Smith Cany., Guadalupe Mountains, Culberson Co., 5750' May 22, 1973, Douglas C. Ferguson. OK: Caddo Co. Methodist Youth Camp 1 October 1994 J.M. Nelson Coll. OK: Tulsa Co. Sand Springs 145th & W. 19th St. Aug 27 - Sept 1, 2008 J.F. Fisher, Collr. at black light. OK: Tulsa Co. Sand Springs 145th & W. 19th St. September 12, 2008 J.F. Fisher, Collr. at black light. (TLSRC, ORU, USNM).

Etymology. The name of this subspecies, *santaana*, refers to its type locality, Santa Ana National Wildlife Refuge in Texas. The name is treated as a noun in apposition.

Diagnosis. *Elasmia mandela santaana* is gray overall. The adult resembles a large example of *E. packardii*; *E. m. santaana* has a contrasting dark scale patch in the reniform/subreniform area. *Elasmia m. santaana* (mean forewing length = 16 mm) is larger than *E. packardii* (mean forewing length = 14 mm) and *E. m. santaana*'s Barth's Organ is relatively larger. The lateral margin of the uncus in *E. packardii* has a slight shoulder immediately below the apex, whereas in *E. m. santaana* the lateral margin of the uncus is flared outward. *Elasmia m. santaana* is a gray moth, and *E. cave* is a

brown moth. The male and female genitalia of *E. m. santaana* are similar to those of *E. cave*. The costulae of *E. cave* are abruptly bent and swollen apically (Fig. 15); the costulae of *E. m. santaana* may be slightly swollen but not bent apically (Fig. 18).

Description. Adult male (Fig. 9): *Head*: smoky gray, scales strap-like, erect, a vague fuscous shade between eyes below antennae, a vague fuscous shade behind antennae. Labial palpus erect, extending to base of antenna, smoky brown gray with two dark-brown lateral lines, ventral scales on 1st and 2nd segments long, not shaggy, 3rd segment closely scaled. Haustellum coiled between labial palpi. Antenna narrowly bipectinate for basal 3/4, each ramus tipped with long setae, apical 1/4 ciliate, with short setae, dorsal surface smoky, closely scaled, ventral surface naked. *Thorax*: pale brown behind head; collar narrow, black, dorsum smoky with blackish brown-tipped scales on disc; tegula pale smoky, edged with black scales, scales strap-like; underside dark smoky gray with pale-tipped scales, smoky laterally, hair-like. *Legs*: smoky dark gray brown, closely scaled, each segment and each tarsomere apex ringed with pale. *Forewing*: length 15–17 mm, mean 16 mm, $n = 7$. Dorsal surface ground color smoky gray; basal line pale at costa, finely lined with black; antemedial line pale, sinuous, finely lined with black; postmedial line sinuous, pale, finely lined with black; subterminal line a series of fuscous black bars; terminal line a fine fuscous line; orbicular spot inconspicuous; reniform spot a black bar outlined with pale, dark blackish shade in lower part; subreniform spot contrasting black and fuscous; costa apex pale gray tan to white; dark line with dark shade from apex oblique to subreniform spot. Ventral surface smoky; terminal line black; fringe smoky. *Hind wing*. Dorsal surface ground color smoky gray, darker distally; fringe pale. Ventral surface ground color smoky, with scattered fuscous scales; fringe smoky. *Abdomen*: smoky, basal tuft blackish, underside smoky. *Genitalia* (Fig. 17): Uncus flattened, flared outward laterally, with narrow shoulders immediately below apex, apex setose, pointed; socii large, setose, bent at approximately 90°, each arm with an ear-like ridge; tegumen flattened; saccus U-shaped, short; juxta shield shaped, dorsal margin a half circular cutout; diaphragma bearing two sclerotized processes (costulae) near bases of valvae costa, bent at 90°, apex slightly swollen (Fig. 18); valve setose, sclerotized dorsally, membranous ventrally, Barth's Organ robust, with numerous chevron-shaped parallel pleats, cucullus poorly defined with three narrow curved ridges, corona with weak, mesally-directed, curved setae. Aedeagus (Fig. 19) straight, abruptly flared out anteriorly, flattened, spoon shaped; vesica lightly sclerotized, with a patch of deciduous stellate (like a starfish) spicule-shaped cornuti; subbasal diverticulum with a nipple-shaped cornutus; apex lightly sclerotized, one large basal diverticulum with two subbasal lobes.

Adult female (Fig. 10). Similar to male except; antenna filiform without long setae; top of head yellow to orange; collar to disc of thorax yellow to orange. Fore-

wing length = 16–18 mm, mean 17 mm, $n = 9$. *Genitalia* (Fig. 22). Papillae anales membranous, setose, hidden from view between sclerotized extensions of ninth abdominal segment; posterior apophyses slender; anterior apophyses slender; ductus bursae short, broad; corpus bursae round, with a single shark tooth-shaped signum; dorsal wall of corpus bursae sclerotized, forming a thumb-like extension, without bulbous terminus; sclerotized ventral wall with a pock-marked, finger-like extension appressed to surface of corpus bursae.

Remarks. We make this a subspecies of *E. mandela* because the color of the forewings is different from *E. m. mandela*, it is slightly smaller, and it is geographically separated from *E. mandela*. The male and female genitalia, however, are indistinguishable from those of *E. m. mandela*. Some specimens from Oklahoma were previously misidentified as *E. insularis*.

Distribution and biology. In the U.S., *E. m. santaana* has been recorded from Texas and Oklahoma; its distribution in Mexico is unknown. A larval host (R. O. Kendall specimens in TAM) is *Unganadia speciosa* Endl. (Mexican buckeye) (Sapindaceae). The type locality was selected because the U.S. Fish and Wildlife Service will protect it into perpetuity.

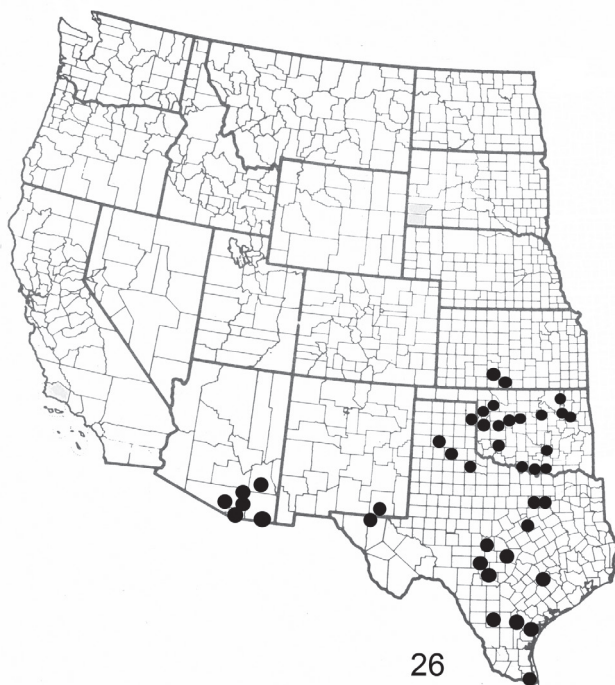


Figure 26. Distribution map for *Elasmia packardii* in United States.



Figure 27. Distribution map for *Elasmia cave* in United States.



Figure 28. Distribution map for *Elasmia mandela santaana* in United States.

Discussion

For all characters, except those we noted in the key and diagnoses, the species are closely similar in appearance.

The details of the shape of the costulae, in combination with the color and size of the adults, is important in defining the species. The costulae can be slightly variable within a species, thus all the characters should be consulted in making an identification.

The female genitalia of *E. m. mandela*, *E. m. santaana*, *E. insularis*, *E. packardii*, and *E. cave* are nearly identical. The male genitalia of *E. packardii* are distinct. The differences between the male genitalia of *E. mandela*, *E. insularis*, and *E. cave* are more subtle; the most reliable character we found was the shape of the terminal portion of the costulae (Figs 12, 15, 18). The costulae of *E. insularis* and *E. mandela* are closely similar; the superficial appearance of the adults are different. The costulae of *E. m. santaana* and *E. cave* are similar (see the key and Figs 15 and 18 for differences); most adults can be identified by external appearance, but a few specimens require examination of the male genitalia for positive identification.

The specimens from Carlsbad Caverns National Park were collected by Metzler as part of a 10-year study of the Lepidoptera of the Park initiated by the Park in 2006. This is the second in a series of papers (Metzler et al. 2010) detailing the moths of Carlsbad Caverns National Park.

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for the purpose of identifying specimens. She contributed financially to the study. Maurice Klapwald, New York City Library, J. Donald Lafontaine, and Michael Pogue helped with literature searches. Conversations with, and a thorough review by, James S. Miller were especially helpful. We thank two anonymous reviewers for reading the paper and offering valuable suggestions.

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Generic placement of the Neotropical species of “*Phragmatobia*” (Erebidae, Arctiinae), with a remarkable matrivorous species from the Peruvian Andes

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Abstract

Phragmatobia Stephens is briefly reviewed and a diagnosis is provided. The South American species currently placed in *Phragmatobia* Stephens are revised to two new genera, *Andesobia* Schmidt and De Freina, **gen. n.**, and *Patagobia* Schmidt and De Freina, **gen. n.** (subtribe Spilosomina). Both *Andesobia* and *Patagobia* exhibit adaptations to high altitude habitats, including micropterous females in *Andesobia* (*Patagobia* females are unknown) and diurnal flight of males. The adults, immature stages, and mating behaviour of *Andesobia jelskii* (Oberthür, 1881) are described. Males of *A. jelskii* enter the female cocoon to mate, and the micropterous, flightless females remain in the cocoon following oviposition where newly hatched larvae feed initially on the female's body.

Four species are included in *Andesobia*, *A. jelskii* **comb. n.** (= *Paracles imitatrix* Rothschild, 1922, **syn. n.**), *A. flavata* (Hampson, 1901), **comb. n.**, *A. boliviana* (Gaede, 1923), **comb. n.** (= *Turuptiana flavescens* Rothschild, 1933, **syn. n.**), and *A. sanguinea* (Hampson, 1907), **comb. n.** *Patagobia* includes only *P. thursbyi* (Rothschild, 1910), **comb. n.**, and *P. thursbyi pluto* Toulgoët is relegated to its synonymy. *Patagobia* shows affinities to *Phaos* Walker, 1855 of Australia, *Metacrias* Meyrick, 1886 of New Zealand, and *Pseudophragmatobia* Krüger, 2009 of South Africa, suggesting a common ancestry of circumantarctic origin. *Phragmatobia karsholti* Toulgoët, 1991 is transferred to *Venedictoffia* Toulgoët, **comb. n.**, an

unrelated genus that is removed from subtribe Arctiina and provisionally placed in the Phaegopterina. *Phragmatobia oberthueri* Rothschild, 1910, described from Tibet, is a synonym of *Lachana alpherakii* (Grum-Grzhimailo, 1891) [Erebidae: Lymantriinae], **syn. n., comb. n.**

Keywords

Microptery, flightlessness, matrivory, biased sex ratio, Spilosomini, Spilosomina, Arctiidae, Neotropics, taxonomy, *Lachana*, *Metacrias*, *Phaos*, *Pyrrharctia*, Gondwana, circumantarctic

Introduction

Although the Arctiinae are most diverse in the Neotropical realm with 55% of the approximately 11,000 described species globally (Heppner 1991), diversity of the subtribe Spilosomina¹ is relatively low compared to the Oriental and Ethiopian regions. However, large species radiations have occurred in the *Hypercompe* Hübner and *Paracles* Walker generic groups, which together contain about 60% of the Neotropical spilosomine species (Watson and Goodger 1986). Unlike most New World spilosomine genera, which have either predominantly temperate or tropical distributions, the Andean species currently placed in *Phragmatobia* are enigmatic in that they exhibit similarities to the Australian genus *Phaos* Walker, 1855 and Neozelandian genus *Metacrias* Meyrick, 1886 (Ferguson 1985). Ferguson (1985) suggested a common Gondwanan ancestry for Andean *Phragmatobia*, *Phaos*, *Metacrias* and the South African species recently placed in *Pseudophragmatobia* Krüger (Krüger 2009).

Here, we review the Andean species of *Phragmatobia*, and place most of these species in two new genera, *Andesobia* gen. n., and *Patagobia* gen. n. The life history of *Andesobia jelskii* (Oberthür, 1881), comb. n., is described, which shows several remarkable traits presumably in response to the high elevation environment they inhabit. *Phragmatobia karsholti* Toulgoët, 1991 is an unrelated species that is transferred to *Venedictoffia* Toulgoët, comb. n. *Venedictoffia* is neither in the Arctiina nor Spilosomina, and is provisionally transferred to the Phaegopterina.

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.

Repository abbreviations are as follows:

AMNH American Museum of Natural History, New York

1 Arctiini *sensu* Watson and Goodger 1986; for a review of Arctiinae subtribal classification, see Schmidt and Opler 2008.

BMNH	The Natural History Museum (formerly British Museum [Natural History]), London
CDFM	Collection J. De Freina, Munich
CNC	Canadian National Collection of Insects, Arachnids and Nematodes, Ottawa
CPG	Collection Pape, Grafenau, Germany
CSO	Collection Speidel, Olching, Germany
CTN	Collection Tannert, Nuernberg, Germany
NHMB	Natural History Museum, Berlin
USNM	National Museum of Natural History (formerly United States National Museum), Washington, D.C.
ZSM	Zoologische Staatssammlung, Munich
ZMUC	Zoologisk Museum, Universitets Copenhagen, Copenhagen

Description of the immature stages and life history was based on four successive generations of laboratory rearings in 2009 and 2010 by JJD, obtained from live material from Peru, Junin region, Huicuash E of Tarma, 11°23'S, 75°53'W, 4100 m. All rearings were conducted indoors at ambient temperatures between 10° C and 23° C. Mortality was extremely low up to F3, but F4 larvae had higher mortality rates and females exhibited reduced fertility, both presumably symptoms of inbreeding. To obtain matings, newly emerged females were placed individually in wooden boxes screened at the top to allow air circulation. Copulation was achieved only under sunny conditions, probably because males are active only during warm, sunny periods under natural conditions. Larvae accepted both dandelion foliage (*Taraxacum officinale* L.) and grass (*Poa* sp.), with a preference for the latter.

We used the 658 bp 'barcode' region of the first subunit of the cytochrome oxidase (*cox1*) gene (Ratnasingham and Hebert 2007) of *Andesobia jelskii* to compare to *Phragmatobia* species and other New World genera of Spilosomina. DNA was extracted from one leg removed from a dried specimen, sent to the University of Guelph in dry Eppendorf tubes, and processed as part of the "All Leps Barcode of Life Campaign" (www.lepbarcoding.org). DNA extraction, amplification and sequencing protocols for the Barcode of Life (BOLD) initiative are detailed in Hebert et al. (2003). Haplotypes of all *cox1* 'barcode' fragments were compared with phylograms constructed using the neighbour-joining method as implemented on the BOLD website.

Systematics

Phragmatobia Stephens, 1828

<http://species-id.net/wiki/Phragmatobia>

Type species. *Phalaena fuliginosa* Linnaeus, 1758 (by monotypy).

Type locality. [Europe].

Phragmatobia includes five species distributed in the Palaearctic and Nearctic regions (including one Holarctic species, *P. fuliginosa* (L.)), with the Neotropical species and one Asian species here transferred to other genera. As suggested by Forbes (1960), *Phragmatobia* is probably most closely related to the Nearctic genus *Pyr-rharctia* Packard; male genitalic and molecular characters strongly support these two as sister taxa (Schmidt 2007). We examined all *Phragmatobia* species, i.e. *Phragmatobia fuliginosa* (Linnaeus, 1758), *Phragmatobia amurensis* Seitz, 1910, *Phragmatobia placida* (Frivaldszky, 1835), *Phragmatobia lineata* Newman & Donahue, 1966 and *Phragmatobia assimilans* Walker, 1855. Examination of the type material (BMNH) of *Phragmatobia oberthueri* Rothschild, 1910, described from Kuku-Noor, Tibet, revealed that it is a junior synonym of *Lachana alpherakii* (Grum-Grzhimailo, 1891) [Erebidae: Lymantriinae], syn. n., comb. n., a group recently revised by Trofimova (2008). Two other species sometimes placed in *Phragmatobia* in the recent literature have been transferred to other genera, namely *Orontobia coelestina* Püngeler, 1904 (De Freina 1997) and *Epatolmis luctifera* ([Denis & Schiffermüller], 1775) (Kôda 1988). Watson and Goodger (1986) placed eight Neotropical species in *Phragmatobia*, three of which were transferred to other genera by Ferguson (1985). *Phragmatobia modesta* Maassen, 1890 was recently moved to *Amastus* Walker [Arctiini: Phaegopterina] by Vincent and Laguerre (2010), leaving four Neotropical species that are dealt with here.

Diagnosis. *Phragmatobia* is a fairly homogeneous group characterized by the following combination of characters: male antennae simple; wings fully developed in both sexes, forewing transverse lines diffuse or absent; wing colours varying from pinkish red to dark vinaceous red with darkbrown to blackish markings. Microtymbal of metepisternum well developed (*P. fuliginosa*) to obsolete (*P. assimilans*). Male genitalia with apical process of valve finger-like and ovoid in cross section; clasper spade-like, oriented transverse to longitudinal axis of valve, originating from inner surface of valve and directed mesad (divided into a ventral and costal lobe in *P. fuliginosa*); apex of aedeagus with spinose plates; paired, intersegmental coremata present between sternites 7–8. Females with ductus bursae heavily sclerotized, dorso-ventrally flattened, and nearly as wide as width of abdomen; corpus bursae globose, with two signa consisting of small flattened spicules; dorsal pheromone gland paired, each duct with 3–4 branches, the apices of which are rounded.

***Andesobia* Schmidt & De Freina, gen. n.**

urn:lsid:zoobank.org:act:BA7ACA8C-9856-4B81-AE99-A344DCED0CBC

<http://species-id.net/wiki/Andesobia>

Figs 1–3, 5–10, 12–18

Type species. *Andesobia jelskii* Oberthür, 1881

Etymology. The name is feminine in gender, formed by combining the words Andes and *-obia* from the generic name *Phragmatobia*.

Diagnosis. *Andesobia* is related to *Patagobia*, but is distinguished by the following combination of characters: eyes reduced and ellipsoid, $1.4\text{--}1.6 \times$ as high as wide, gena with broader unscaled area laterally; posterior antennal rami $1.2\text{--}1.5 \times$ and anterior rami $1.1\text{--}1.5 \times$ longer than segment length (longest anterior and posterior rami $3 \times$ as long as segment in *Patagobia*); 2nd labial segment short and stout, $1.1 \times$ as long as wide, $2 \times$ longer than apical segment; thoracic collar concolourous with dorsal thoracic vestiture (contrastingly paler ochre in *Patagobia*); thoracic vestiture sparse and shaggy, compared to dense and pilose vestiture in *Patagobia*; femur and tibia very stout, $3.0\text{--}3.5 \times$ longer than wide compared to $4.5\text{--}5.6 \times$ in *Patagobia*; metatibia of *Andesobia* with one pair of spurs, two pairs in *Patagobia*; medial line of forewing absent in *Andesobia*, present in *Patagobia*; postmedial line never double in *Andesobia*, often double in *Patagobia*; hindwing discal spot small and sharp or absent in *Andesobia*, diffuse and more elongate in *Patagobia*. *Andesobia* is endemic to the Puna grasslands of the high Andes of Peru and Bolivia.

Description. Male. **Head** – vestiture dark brown to black, shaggy appearance, setae long; antenna weakly bipectinate, ciliate ventrally; longest posterior rami $1.3\text{--}2.0 \times$ segment length, longest anterior rami $1.1\text{--}1.8 \times$ segment length; rami longest over middle third of antenna, decreasing in length toward base and apex; eye elliptical, $1.4\text{--}1.6 \times$ as high as wide; labial palps short, not extending beyond vestiture of frons; 2nd labial segment short and stout, $1.1 \times$ as long as wide, $2 \times$ longer than apical segment; haustellum reduced and poorly sclerotized, presumably non-functional. **Thorax** – vestiture of vertex and ventrum of thorax black brown; tegulae and patagia black brown; legs black brown, dorsum of femur ochre or dull pinkish red, co-varying with hindwing and abdomen ground colour; apex of prothoracic tibia with two subequal, blunt, triangular projections; two meso- and metathoracic tibial spurs, posterior spur slightly longer than anterior, length of spurs approximately equal to tibial width at apex; metepisternum with rounded ridge along anterior margin, metepisternal microtymbals absent. **Forewing** – relatively small for an arctiine, forewing length 8–13 mm, elongate with apex less rounded than in *Paracles* and *Spilosoma*, length:width ratio averaging 2.2; ground colour ochre yellow, whitish to pinkish red or brownish grey; markings varying from obsolete (*A. jelskii*) to well defined, grey-brown transverse bands; when present, darker pattern consisting of dark-brown basal area, sub-basal band, discal spot, postmedial band and marginal band; bands occasionally confluent along anal margin; ventrally with bands obsolete except for marginal band, and with a brighter yellowish or reddish ground colour. **Hindwing** – ground colour slightly richer yellowish or reddish than forewing, with dark-brown to grey-brown marginal band, varying from nearly obsolete (reduced to intermittent diffuse spots extending from apex halfway to anal angle), to broad and diffuse over distal third of wing; brownish, crescentic discal spot small but usually well defined, sometimes absent; ventrally with dark markings less saturated. **Abdomen** – Segments A1–A3 entirely brownish black, remaining segments ochre or reddish subdorsally, with brownish-black dorsal line, widest in *A. flavata*; ventrally, varying from entirely brownish black (*A. sanguinea*) to black with narrow ochre border on distal margin of

sternites (*A. flavata*) or entirely ochre (*A. jelskii*); coremata highly reduced to paired patches of sparse, deciduous setae. **Genitalia** – highly simplified overall with massive, triangular dorsoventrally flattened uncus characteristic of subtribe; uncus as long as width of base, broadly joined to wide, band-like tegumen; dorsal margin of tegumen caudally recurved; valve simple and digitate, lacking processes or claspers, $1\text{--}1.7 \times$ as long as uncus-tegumen complex; vinculum semicircular, saccus v-shaped, similar in length to uncus; juxta evenly convex and hemispherical, dorsal margin slightly narrowed; aedeagus relatively large and stout, $3 \times$ longer than wide, $1.5 \times$ as long as width of genital capsule, curving dorsad $25\text{--}30^\circ$, proximal end approximately $\frac{1}{3}$ narrower than apex; coecum $1/10$ length of aedeagus, directed slightly ventrad; vesica directed dorso-distad, globose, finely spiculate, with small basal and poorly differentiated apical diverticulum. **Female** (*A. jelskii* and *A. sanguinea* only; female of *A. boliviana* and *A. flavata* unknown). **Head** – antennae $0.5 \times$ as long as that of male, finely biserrate; proboscis atrophied; vestiture of closely appressed, ochre scales, lacking long, shaggy black scales present in males. **Thorax** – vestiture similar to that of head, notably lacking ‘shaggy’ appearance of males; legs reduced, $2/3$ as long as those of male. **Forewing and hindwing** – micropterous and highly reduced, forewing $1.5\text{--}2.5$ mm long, fully scaled and concouls with dull tan colour of thorax, but without any discernible wing pattern. **Abdomen** – light ochre gray with fine, short velvety hairs, tergites well sclerotized, black, giving dorsum of abdomen appearance of a broad, black medial band; ventrally with narrower, lighter grayish-black medial band; integument broad and membranous laterally, allowing for distension caused by ova. **Genitalia** (based on *A. jelskii*) – ostium and lamella antevaginalis membranous and poorly defined; lamella postvaginalis consisting of a broad, shallow sclerotized pouch; ductus bursae lightly sclerotized, dorsoventrally flattened, $2 \times$ as long as wide; corpus bursae pear shaped, and relatively small, $2 \times$ as long as ductus bursae; diameter of distal, globose chamber $2 \times$ width of ductus bursae; signum lacking; ductus seminalis wide and rugose, bulla seminalis large, diameter $1.5 \times$ that of corpus bursae; posterior apophysis equal in length to papillae anales, anterior apophysis $0.6 \times$ as long as papillae anales; each paired dorsal pheromone gland consisting of two tree-like subdivisions, each subdivision with 3–5 smaller diverticula.

Remarks. Structurally, *Andesobia* is quite homogeneous, the main species-level differences occurring in the length and shape of the male valve and the vesica. The highly simplified, digitate male valve and massive uncus-tegumen complex is shared with several other Neotropical genera including *Paracles*, *Patagobia*, *Caribarctia* Ferguson and *Leichosila* Schmidt. The mtDNA barcode sequence (*A. jelskii*) does not provide any additional resolution of relationships within this group, with minimum pairwise distances (uncorrected) between *Andesobia*, *Paracles*, *Phragmatobia*, *Leichosila*, *Caribarctia* and *Phaos* ranged from 6–8%. Sequences for *Patagobia* were not available.

Several Andean species are superficially similar to *Andesobia* and *Patagobia*, and require comment. *Paracles herbuloti* (Toulgoët), *Paracles minuta* Becker & Miller, and *Paracles diminuta* Becker & Miller are small species with a simple or highly reduced

forewing pattern. Females of all three are unknown, but the structurally similar and probably congeneric *Chilesia anguloi* Ruiz, *C. rudis* (Butler) and *C. watsoni* Ruiz have micropterous females (Ruiz 1989; Vargas and Parra 2003). Despite these similarities to *Andesobia* (and *Patagobia*), the broader, more rounded wings, shorter, rounder saccus, greatly elongated tegumen, very short valva, and small vesica are consistent with those of other *Paracles* species, and not with *Andesobia* or *Patagobia*.

Biology and distribution. Data on the biology of *Andesobia* is based primarily on *A. jelskii* and is discussed in more detail under the species account below. *Andesobia* is adapted to cold-temperate alpine habitats, males flying during sunny periods and the females being micropterous. Mating and oviposition occurs inside the female cocoon. The female-biased sex ratio of the broods reared during this study may indicate that females are capable of parthenogenesis, as in some other cold-adapted flightless Lepidoptera (Suomalainen 1962). Adults emerge during the middle of the four-month wet season in the otherwise xeric grassland habitat. *Andesobia* is endemic to the Puna grasslands of the high Andes, occurring from central Peru south to the Lake Titicaca region of southern Peru/Bolivia.

***Andesobia jelskii* (Oberthür, 1881), comb. n.**

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

Figs 1, 5, 12–16, 18

Arctia jelskii Oberthür, 1881: 33, pl. X, f. 3. Male holotype [BMNH]. Type locality: [Peru], Junin.

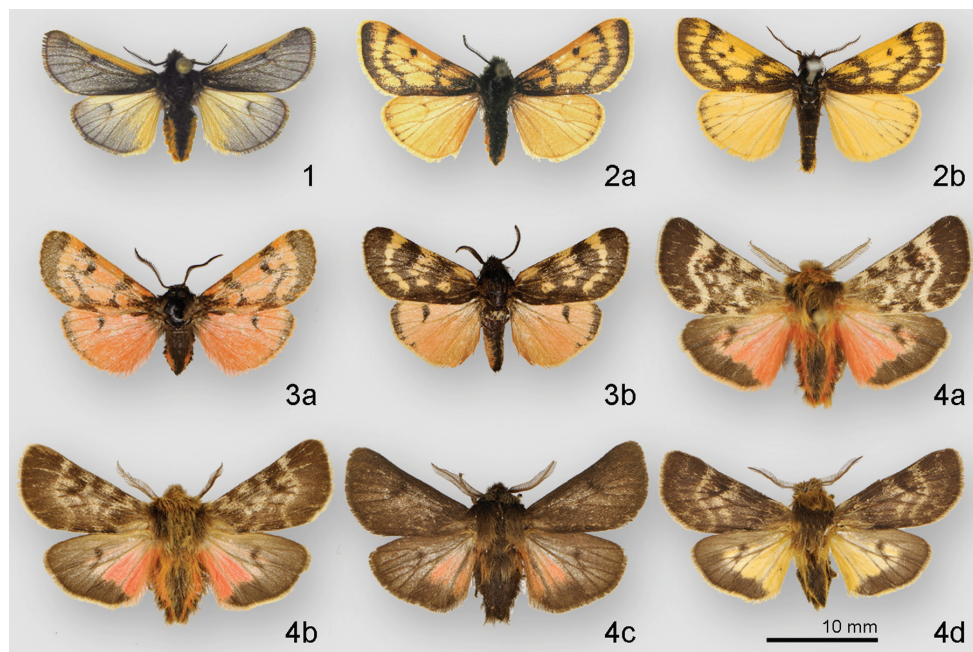
Mallocephala imitatrix Rothschild, 1922: 493, comb. n, syn. n. 16 male and 5 female syntypes [BMNH]. Type locality: Peru, Junin.

Mallocephala imitatrix ab. *griseola* Rothschild, 1922: 493, comb. n, syn. n. Holotype male [BMNH]. Type locality: Peru, Junin.

Mallocephala imitatrix ab. *luteola* Rothschild, 1922: 493, comb. n, syn. n. 7 female syntypes [BMNH]. Type locality: Peru, Junin.

Material examined. We examined over 150 specimens, obtained through four successive lab-reared generations originating from Peru, Junin region, Huicuash E of Tarma, 11°23'S, 75°53'W, 4100 m. Vouchers are deposited in CDFM, ZSM, CNC, CPG, CTN. Two specimens were included for DNA barcode analysis, voucher numbers CNC LEP 68032 (no GenBank accession number available) and CNC LEP 68033 (GenBank accession # HM416594) [CNC].

Diagnosis and re-description. *Andesobia jelskii* was omitted from the catalogue of Neotropical Arctiinae (Watson & Goodger 1982), probably because Hampson (1901) placed it in the Palaearctic genus *Ocnogyna*. This species is most similar to *A. flavata* and *A. boliviana*, but lacks any trace of transverse forewing lines and has an uninterrupted ochre costal band, which is interrupted by the antemedial and



Figures 1–4. Adult habitus of male *Andesobia* and *Patagobia* species **1** *Andesobia jelskii* **2** *A. boliviana* **2b** *A. boliviana* (holotype of *Estigmene boliviana* Gaede) **3a,b** *A. sanguinea* **4a,b,c,d** *Patagobia thursbyi*.

postmedial lines in other *Andesobia* species; the hindwing marginal band has a diffuse inner border and is much wider than in other species of *Andesobia*, extending at least to the discal area. Internally, the male valve is shorter and wider, approximately $6 \times$ longer than the narrowest diameter compared to $6.7\text{--}8.0 \times$ longer in *A. flavata*.

A detailed morphological description is given in the generic account of *Andesobia*, and the following description addresses characters specific to *A. jelskii*. **Male. Head** – antenna (Fig. 9a) with posterior rami $1.6\text{--}1.9 \times$ segment length, longest anterior rami $1.4\text{--}1.8 \times$ segment length; eye elliptical, $1.4\text{--}1.6 \times$ as high as wide. **Thorax** – vestiture and legs black brown, dorsum of femur ochre. **Forewing** – forewing length average 11 mm, range 8–12 mm; ground colour brownish grey with yellowish-ochre costal band varying to entirely dark brownish grey or plae ochre grey (type of *luteola*), indistinct black discal spot, other markings obsolete ventrally with paler yellowish ochre ground colour. **Hindwing** – ground colour yellowish ochre with broad, diffusely bordered grey-brown marginal band over distal third of wing, varying to entirely dark brownish grey; brownish, crescentic discal spot small but well defined; ventrally with dark markings less saturated. **Abdomen** – segments A1–A3 brownish black, remaining segments ochre subdorsally, with brownish-black dorsal line; ventrally entirely ochre. **Genitalia** (Figs 9b,c) – valve digitate, slightly flattened laterally and narrowing slightly medially; equal in length to uncus-tegumen complex; vinculum semicircular, saccus v-shaped, similar in length to uncus; aedeagus relatively large and stout, $3 \times$ longer than wide, 1.5



Figures 5–6. Adult habitus of female **5** *Andesobia jelskii* **6** *A. sanguinea*.

× as long as width of genital capsule, curving dorsad 25–30°, proximal end approximately $\frac{1}{3}$ narrower than apex; coecum $\frac{1}{6}$ – $\frac{1}{8}$ length of aedeagus, directed slightly ventrad; vesica directed dorso-distad, globose, finely spiculate, with poorly differentiated apical diverticulum. **Female** (Figs 5, 10, 13, 16). Described above in the genus account for *Andesobia*; differing externally from *A. sanguinea* by the lack of yellowish-orange flush present in *A. sanguinea*, particularly on the ventral and lateral surfaces of the abdomen.

Immature stages. *Egg* – almost spherical, poles only very weakly flattened; micropyle very weakly sculptured, barely visible; ivory white changing to dark greyish white prior to hatching. *Larva* – 1st instar larva initially translucent white, becoming opaque white; setae black, yellow orange prior to molting. 2nd instar integument black, more densely setose than 1st instar. 3rd instar with jet black setae, except rusty brown on A2–A5; spiracles white. 4th instar (Figs 15a, b) with verrucae more pronounced than in previous instar; setae jet black with silver sheen apically, somewhat lighter smoky grey subventrally; colour of setae polymorphic in last instar, either with A2–A5 yellowish orange and segments A6–A8 with subdorsal and lateral silvery-white setae mixed in (Fig. 15a), or with orange setae very dark brown to black (Fig. 15b); when mature, female larva about twice as large as male larva. *Pupa* – cremaster short, penicillate, head compact with short, stiff setae (Fig. 12). Cocoon spherical to ovoid, reddish brown to dull brown, consisting of a single, thin and flimsy layer with incorporated larval setae (Fig. 16).

Biology and distribution. Eggs whitish, turning dark grey three days prior to hatching, hatching in about 10 days. First instar larvae initially feed on the tissue of the dead or dying female, then leave the cocoon in search of plant material. Duration of the first instar is six days, second instar five to six days. *Taraxacum* F.H. Wigg. and lawn grass (*Poa* L.) are both acceptable food plants in captivity, suggesting that larvae are polyphagous in nature. Notably, larvae emit an unpleasant odour of decay when disturbed. In late instars, female larvae are twice as large as male larvae. During the first three instars, larvae avoided sunlight, but the last two instars showed increased tolerance to sunlight, possibly to accelerate development. Cannibalism was not observed even at higher densities. Males pupated sooner than females, but the pupal stage is shorter in females lasting only a few days, so emergence of both sexes is more or less synchronous. Cocoons (Fig. 16) were spun between leaves of the food plants near the ground. The moths emerge in the morning, with relatively fast expansion of the wings. Females remain in the loosely-spun cocoon, and presumably emit mating pheromones from within the thin cocoon soon after emerging from the pupa, because males dig through the loose silk webbing to enter and mate inside the cocoon (Fig. 16). The pair remains in copula for several hours, after which the male leaves the cocoon, and the female deposits about 50 eggs inside the cocoon. Males are diurnal and fly rapidly during sunny periods. Reared cohorts of *A. jelskii* displayed an unequal sex ratio of about 5 female: 3 male; female microptery and a female-biased sex ratio is associated with parthenogenesis in other families (Heterogynidae, Psychidae, Lymantriinae: *Teia* Hübner), and *Andesobia* may also be capable of parthenogenesis, which has not been documented in the Arctiinae. *Andesobia jelskii* is currently known only from the Junin region of Peru (Fig. 17), at 4100 m elevation in the Puna grassland ecoregion of the central Andes (Fig. 18). Like other members of the genus, the flight period is early in the year (January), in the middle of the four-month wet season.

***Andesobia flavata* (Hampson, 1901), comb. n.**

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

Maenas flavata Hampson, 1901: 512, pl. 51, f. 7. Male holotype [BMNH]. Type locality: Peru, Limbane [Limbaní], 6000 ft.

Diagnosis. Very few specimens of *A. flavata* are known, and it is closely related to or conspecific with *A. boliviana*. Externally, the holotype of *A. flavata* differs from *A. boliviana* only in having a slightly broader and more diffuse forewing marginal band, suggestive of minor intraspecific variation. However, the genitalic structure of the holotype (BMNH genitalia slide # ARCT:3421) reveals slight differences compared to *A. flavata*, namely a slightly shorter, wider valve and a lack of the fine spicules present on the vesica of *A. flavata*. Additional study material is needed to properly evaluate the status of these two taxa.

***Andesobia boliviana* (Gaede, 1923), comb. n.**

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

Figs 2, 8, 18

Estigmene boliviana Gaede, 1923: 20. Male holotype [NHMB] (Fig. 2b). Type locality: Bolivia, La Paz.

Turuptiana flavescens Rothschild, 1933: 188, syn. n. Male lectotype, here designated [BMNH]. Type locality: [Peru / Bolivia], Lake Titicaca.

Type material. The three examined male syntypes of *Turuptiana flavescens* exhibit variation in the extent of the forewing markings, two specimens closely approaching the appearance of the *A. flavata* holotype (see also Remarks under *A. flavata*). The third syntype labeled “type” with a round, red-bordered label and a blue label reading “genitalia slide no. 3422” is here designated as lectotype; it is an almost exact match to the two specimens illustrated here (Fig. 2).

Remarks. Subsequent to its description, *Estigmene boliviana* (Fig. 2b) disappeared from the literature. Although appearing in the print version of the Zoological Record for 1923, it is absent from the digital version of Zoological Record and the card index of the BMNH (Global Lepidoptera Names Index 2011). It was also omitted by Watson and Goodger (1986). The holotype label data is as follows: “La Paz / Bolivia / 95 Garlepp”; “als Puppe / Nov. 8. larva”; “1855a”; “Coll. / Staudinger”; “Estigmene / boliviana G. / E. Rschau [Entomologische Rundschau] B40 S20.”; “Type”.

***Andesobia sanguinea* (Hampson, 1907), comb. n.**

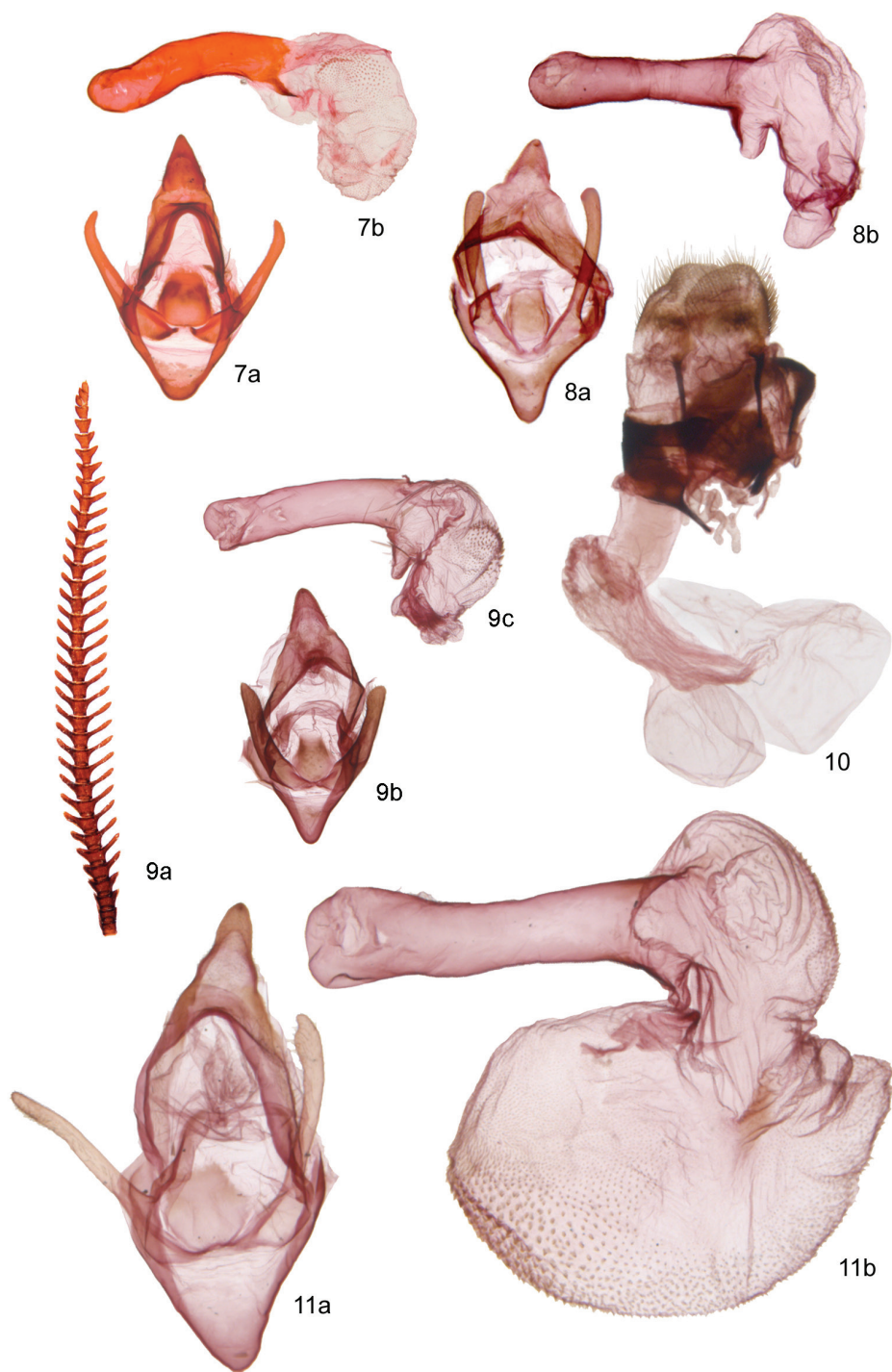
http://species-id.net/wiki/Andesobia_sanguinea

Figs 3, 6, 7, 18

Turuptiana sanguinea Hampson, 1907: 238. Type locality: Bolivia, La Paz, 9000'. Male lectotype, here designated [BMNH].

Type material. Hampson (1907) based his description on what he believed to be a male and a female, but both specimens (BMNH) are males. One syntype is in rather poor condition with rubbed, partially broken wings, lacking antennae and abdomen. The second syntype, in excellent condition, labeled “Type” with a round, red-bordered label and a blue label reading “genitalia slide no. 3423” is here designated as lectotype to ensure the stability of the name.

Diagnosis. *Andesobia sanguinea* is the only member of the genus with red colouration, prevalent on the hindwing and often the forewing, the latter varying from whitish pink (Fig. 3a) to whitish tan (Fig. 3b). Females are micropterous and are similar to *A. jelskii*, but with a more yellowish colour (Fig. 6). The biology is unknown. It appears to be sympatric with *A. boliviana*, and is known only from the Lake Titicaca region (Fig. 18).

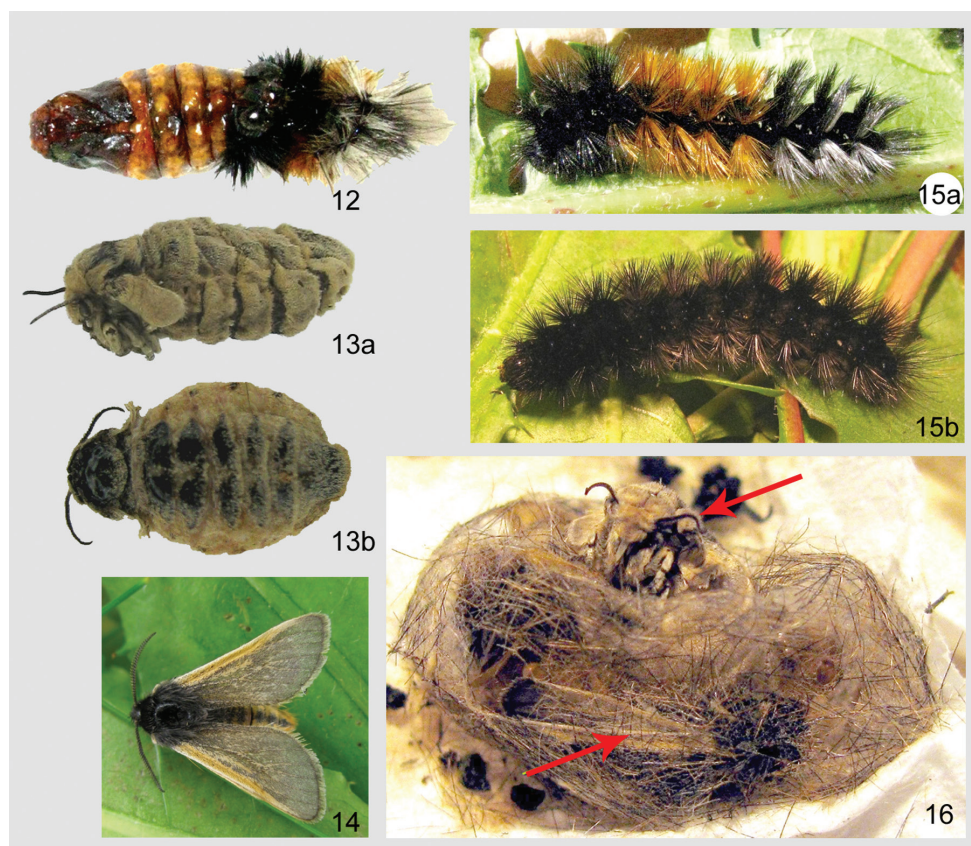


Figures 7–11. Genitalic and antennal morphology of *Andesobia* and *Patagobia*. **7** *Andesobia sanguinea* **8** *A. boliviana* **9** *A. jelskii* (male) **10** *A. jelskii* (female) **11** *Patagobia thursbyi*.

Patagobia Schmidt & De Freina, gen. n.

urn:lsid:zoobank.org:act:AE8678AA-E7C1-4A86-8C25-7E539E5998DB

<http://species-id.net/wiki/Patagobia>**Type species.** *Turuptiana thursbyi* Rothschild, 1910.**Etymology.** The name is derived from a combination of the words Patagonia and *Phragmatobia*.**Diagnosis.** Although *Patagobia* shows similarities to the Holarctic *Phragmatobia* in some external aspects, it differs in having longer, symmetrical rami of the male antenna, ochre thoracic collar, lack of a male clasper, pale tan forewing pattern (usually), and a restricted distribution to the Chilean Andes of South America. The wing colour and pattern is also similar to *Andesobia*, but structurally *Patagobia* has a more robust build with denser thoracic vestiture, equally long posterior and anterior male antennal rami (anterior rami shorter than posterior in *Andesobia*), male antennal rami up to $3 \times$ longer than antennal segment length (up to $2 \times$ in *Andesobia*); 2nd labial segment elongate, $1.8 \times$ as long as wide, $1.5 \times$ longer than apical segment; thoracic collar contrastingly paler ochre (conconcolourous with dorsal thoracic vestiture in *Andesobia*); thoracic vestiture dense and pilose (sparse and shaggy in *Andesobia*); femur and tibia elongate, $4.5\text{--}5.6 \times$ longer than wide (very stout, $3.0\text{--}3.5 \times$ longer than wide in *Andesobia*); metatibia with two pairs of spurs (one pair in *Andesobia*); forewing medial line present (absent in *Andesobia*); postmedial line usually double (absent in *Andesobia*); hindwing discal spot diffuse and elongate (sharp or absent in *Andesobia*). The male coremata between the 7th and 8th sternite are moderately developed in *Patagobia*, very reduced in *Andesobia*.**Description.** Male (female unknown). **Head** – vestiture dark brown to black, setae long; antenna bipectinate, ciliate ventrally; longest posterior rami $1.5\text{--}3.0 \times$ segment length, longest anterior rami $1.1\text{--}3.0 \times$ segment length; rami longest over middle third of antenna, decreasing in length toward base and apex; eye elliptical, $1.2\text{--}1.5 \times$ as high as wide; labial palp short, not extending beyond vestiture of frons; haustellum reduced and poorly sclerotized, presumably nonfunctional. **Thorax** – vestiture of vertex and ventrum of thorax black brown; tegulae entirely black brown or black brown edged with yellowish brown; patagia yellowish brown or rarely black brown; leg vestiture brownish ochre, dorsum of femur yellow or red, co-varying with hindwing and abdomen ground colour; apex of prothoracic tibia with two subequal, blunt, triangular projections; mesotibia with two apical and two subapical spurs, length of apical spurs $1.5 \times$ and supapical spurs $0.6 \times$ tibial width at apex; two metatibial spurs, posterior spur slightly longer than anterior; metepisternum lacking microtymbals. **Forewings** – forewing length 12.9–13.2 mm (mean 13.1 mm; $n = 4$), length:width ratio averaging 2.1; ground colour pale ochre yellow but with broad, sometimes entirely confluent dark-brown transverse bands (Fig. 4c); pattern elements consisting of dark basal area and sinuous, diffuse dark-brown transverse lines (Fig. 4a) discal spot indistinct dorsally, but well defined ventrally; ventrally with bands obsolete except for marginal band. **Hindwing** – ground colour pinkish red or rarely yellow (Fig. 4d),



Figures 12–16. *Andesobia jelskii*. **12** female pupa **13a** female, lateral aspect **13b** female, dorsal aspect **14** male **15a** mature larva **15b** mature larva, dark form **16** male (lower arrow) and female (upper arrow) in copulo inside cocoon of female.

with broad dark-brown marginal and costal band; well-defined brown, crescentic discal spot; similar ventrally but with discal spot better defined. **Abdomen** – Vestiture brownish black and pinkish red or yellow subdorsally, ventrally with segmental margins yellowish ochre; abdomen entirely dark brown in melanic specimens (Fig. 4c). Coremata between sternites 7–8 in shallow pockets, scent scales approximately $0.5 \times$ as long as sternite length. **Genitalia** – highly simplified, with large, triangular, dorsoventrally flattened uncus characteristic of subtribe; uncus $1.5 \times$ longer than width of base, broadly joined to wide, band-like tegumen; dorsal margin of tegumen caudally recurved; valve simple and digitate, lacking processes or claspers, $1.5 \times$ as long as uncus-tegumen complex; vinculum semicircular, saccus v-shaped, similar in length to uncus; aedeagus large, $5\text{--}6 \times$ longer than wide, $2 \times$ as long as width of genital capsule, curving dorsad slightly; coecum $1/10$ length of aedeagus, directed slightly ventrad; vesica extremely large, diameter when inflated $2 \times$ that of genital capsule; vesica directed right-laterad, globose, finely spiculate, with poorly differentiated basal chamber and large apical chamber (Fig. 11b).



Figure 17. Habitat of *A. jelskii* near the type locality, Junin region, Peru (photo J. Klir).

***Patagobia thursbyi* (Rothschild), comb. n.**

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

Turuptiana thursbyi Rothschild, 1910: 176, comb. n. Five male syntypes (BMNH).

Type locality: [Argentina], Patagonia, Chubut, Valley de Lago Blanco.

Phragmatobia thursbyi pluto Toulgoët, 1987: 241, syn. n.

Type material. Male holotype (ZMUC). Type locality: Argentina, Rio Negro, San Carlos de Bariloche, Colonia Suiza, 810 m.

Diagnosis. The taxon *pluto* Toulgoët has been treated as a subspecies distinct from nominate *thursbyi* based on the nearly unicolourous forewing, resulting from the confluence of the transverse bands. Genitalic structure of both taxa is identical (Toulgoët 1987). Examination of series of specimens from a single locality (Fig. 4b-d) shows that there is considerable variation in the extent of forewing banding, and also in the hindwing ground colour. We therefore treat *pluto* as a synonym of nominate *P. thursbyi*.

Remarks. No detailed habitat information is available for *Patagobia thursbyi*, but locality information shows that it occurs from about 800 m elevation at the southern range edge (46°S) to 2700 m farther north (33°S), corresponding to temperate montane woodlands and grasslands of Patagonia. This region is well known for its high level of endemic species, and circumantarctic tree genera such as *Araucaria* Juss. and



Figure 18. Distribution of *Andesobia* and *Patagobia*.

Nothofagus Blume (World Wildlife Fund 2001). Examined specimens and literature records (Fig. 18) are as follows **Chile** - Malleco Prov.: Cordillera las Raices, Lonquimay, 1050 m (CNC, ZSM); La Fusta, 1200 m (CNC, ZSM); Cordillera Lonquimay, Icalama 1000 m (AMNH, ZSM); Termas de Rio Blanco (Ruiz 1989, ZSM); Cautin region (Ruiz 1989); Nuble Prov.: Chillan, (Ruiz 1989); Santiago: Cantillana [highlands], [Laguna de] Aculeo (Toulgoët 1987). **Argentina** - Chubut Prov.: Valle del Lago Blanco (BMNH, ZSM); Neuquen Prov.: Pampa Tromen, Huayilon (Ruiz 1989, ZSM); San Martin de los Andes (ZSM); Aluminé, 1200 m (Toulgoët 1987); Rio Negro Prov.: San Carlos de Bariloche, Colonia Suisa, 810 m (Toulgoët 1987, ZSM); Paso Flores (ZSM); Mendoza region, 2750 m (Toulgoët 1987).

***Venedictoffia karsholti* (Toulgoët, 1991), comb. n.**

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

Phragmatobia karsholti Toulgoët, 1991: 18. Holotype male (ZMUC). Type locality: Peru, Ancash 35 km SE de Huaraz, Cerro Cahuish, 4100 m, Quebrada Pucavado.

Diagnosis. Toulgoët (1991) described this species in *Phragmatobia* without further elaboration of this generic placement. The wing shape, forewing pattern, and male genitalic structure (pedunculate uncus, bipartite valve) of *karsholti* is shared with *Venedictoffia* Toulgoët (Toulgoët 1977), so *karsholti* is transferred to *Venedictoffia* (comb. n.). Although the simple forewing pattern, reduced size, and bipectinate male antenna show some resemblance to *Andesobia* and *Patagobia*, male genitalic structure (see Toulgoët 1991) shows that *Venedictoffia* does not belong in the subtribe Spilosomina nor in the Arctiina. The caudally recurved dorsal margin of the tegumen and lateral lobes of the 8th sternite, autapomorphies of the Spilosomina (Schmidt 2007), are lacking. The unusual pedunculate uncus, scoop-shaped tegumen and bipartite valve are traits exhibited in numerous Neotropical Phaegopterina and some Pericopina. *Venedictoffia* is therefore provisionally transferred to the Phaegopterina.

Discussion

In his global review of Arctiina genera (as Arctiini), Ferguson (1985) divided the genera among five groups, namely "*Neoarctia-Grammia*", "*Holomelina*" (now *Virbia* Walker; Zaspel and Weller 2006), "*Arctia-Hyphoraia*", "*Spilosoma*" and "*Phragmatobia-Ocnogyna*". The latter two do not form natural groups, but are monophyletic as a whole and were treated as subtribe Spilosomina by Schmidt (2007), with the exclusion of *Kodiosoma* Stretch, which is related to the *Euchaetes* group (Schmidt 2007; Schmidt & Opler 2008). Ferguson considered the Andean "*Phragmatobia*" species to be closely related to and possibly congeneric with *Metacrias* Meyrick, 1887 of New Zealand. *Metacrias*

is probably congeneric with *Phaos* Walker, 1855 of Australia / Tasmania (Patrick et al. 2003). *Patagobia* is structurally more similar to *Metacrias*/*Phaos* than to *Andesobia*, the latter apparently representing a more ancient split from *Patagobia* + *Metacrias* / *Phaos* (PMP) lineage. This implies that the Andean group is not monophyletic, and that the PMP group has a circumantarctic distribution. The biology of the PMP group provides additional evidence for a common ancestry; all inhabit mesic, cool-temperate habitats, particularly grassland and tussock tundra, with specialized adaptations such as diurnal flight (males) and flightless females. Land connections between southern South America and Australia existed as late as the Late Eocene (~35 MYA) (McLoughlin 2001), but the biogeography of New Zealand *Metacrias* is more difficult to explain, since Zealandia separated from other Gondwanan landmasses about 80 MYA (McLoughlin 2001). Transoceanic dispersal events would be highly unlikely for the flightless females, and early instar larvae are not known to exhibit ballooning behaviour (wind dispersal by silk strands) (Gibbs 1962). The zoogeography of this fascinating group awaits further study.

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A new *Zanclognatha* from eastern North America and a preliminary key to the larvae of the genus (Lepidoptera, Erebiidae, Herminiinae)

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Abstract

The adult of a widespread but previously undescribed species of *Zanclognatha* Lederer is described from eastern North America. Images of the mature larva and life history data for *Zanclognatha dentata* sp. n. are included, along with a preliminary key to the larvae of ten eastern North American *Zanclognatha* species.

Keywords

detritus feeding, Herminiinae, larvae, *Zanclognatha*, species radiation

Introduction

More than a dozen species of *Zanclognatha* Lederer, 1857 occur in eastern North America, often with six or more species flying at a single location. Alpha diversity and abundance of *Zanclognatha* tend to be highest in mixed hardwood and conifer woodlands and forests with an accumulation of leaf litter. The Nearctic *Zanclognatha* fauna

bears earmarks of a recent radiation: several species are weakly differentiated or confused (e.g., *Z. gypsalis-minoralis-theralis* complex; genitalic diversity across the genus is modest in both sexes; and some species-level taxa occur mainly north of recent glacial maxima, e.g., *Z. lotalba* (Smith, 1906). In addition to the new species described here, which has long been confused with *Z. protumnusalis* (Walker, 1859), additional eastern *Zanclognatha* await recognition, e.g., the undescribed species near *Z. lituralis* (Hübner, 1818) mentioned by Rings et al. (1992).

The most recent revisionary study of *Zanclognatha* and its relatives is that of Owada (1987) based on his studies of the diverse Japanese herminiine fauna. In addition to *Zanclognatha*, his treatment includes all allied genera. Owada recognized both *Zanclognatha* and *Polypogon* Schrank (1802) as valid, with the former genus defined by having the labial palpus sickle-shaped and upcurved over the vertex; male antenna with a knot; M2, M3, and CuA1 not stalked in the forewing; hindwing with cell extending to nearly $\frac{1}{2}$ and M2 arising from above the anal angle (of cell); male foreleg with tibial sheath; and male foretarsus five-segmented with first segment lacking a projection. *Zanclognatha dentata* sp. n., sharing the above features, falls unambiguously within Owada's concept of the genus, despite the fact that the male genitalia of *Z. dentata* and other Nearctic members of the genus *Zanclognatha*, superficially resemble those of *Polypogon tentacularia* (L.), the type of *Polypogon*, in possessing a deeply emarginate valve with two primary lobes. The type-species of *Zanclognatha*, *Z. lunalis* Scopoli, and its Palearctic relatives, have a valve that is comprised of three lobes. Starting with Smith (1895), Lederer's *Zanclognatha* has been used for the Nearctic herminiines with an antennal knot and upcurved labial palpus. Poole (1989) transferred North American *Zanclognatha* into *Polypogon*, but later, moved all species back into *Zanclognatha* (Poole and Lewis 1996).

The new species was "discovered" while reviewing larval images of *Z. protumnusalis* and *Z. martha* Barnes, 1928. Larval images indicated that there were three species involved (see Figs 8–11 and key). Below we describe the adult, provide images of the last instar, and discuss the biology of *Z. dentata* sp. n. We also include a key to the larvae of ten species of *Zanclognatha* found in eastern North American.

Methods and materials

A cohort of larvae was reared from a female collected by Dale F. Schweitzer from New Jersey, Atlanta County: Egg Harbor Township, Absecon Creek on 15 July 2002, DLW Lot Number 2002G117. Larvae were reared on dead, browned, lightly moistened oak leaves. Surface as well as partially decayed leaves were provided (see Hohn and Wagner 2000). Specimens were examined from the collections listed below. In addition, several colleagues sent records, images, and observations from personal collections (see acknowledgments). We checked European and Asian literature to ascertain if *Z. dentata* might represent an Old World species. Larval images (both film and digital) have been deposited at the University of Connecticut. We prepared 29 genitalic dissections

of *Zanclognatha*: 12 of the *dentata-martha-protumnusalis* group (5 females, 7 males) and 17 dissections of five other species for comparison. In addition we examined 19 *Zanclognatha* genitalic preparations in Cornell University's insect collection. Martin Honey and Don Lafontaine secured images of the types of *Zanclognatha protumnusalis* and *Z. minimalis* Grote in the British Museum.

AMNH	American Museum of Natural History, New York, New York, USA
BMNH	Natural History Museum, London, England UK
CAES	Connecticut Agricultural Experiment Station, New Haven, Connecticut, USA
DH	Personal collection of Daniel Handfield, Saint-Mathieu de Beloeil, Québec, Canada
NYSM	New York State Museum, Albany, New York, USA
PMNH	Peabody Museum, Yale University, New Haven, Connecticut, USA
TLM	Personal collection of Timothy McCabe, Albany, New York, USA
UCMS	University of Connecticut, Storrs, Connecticut, USA

Systematics

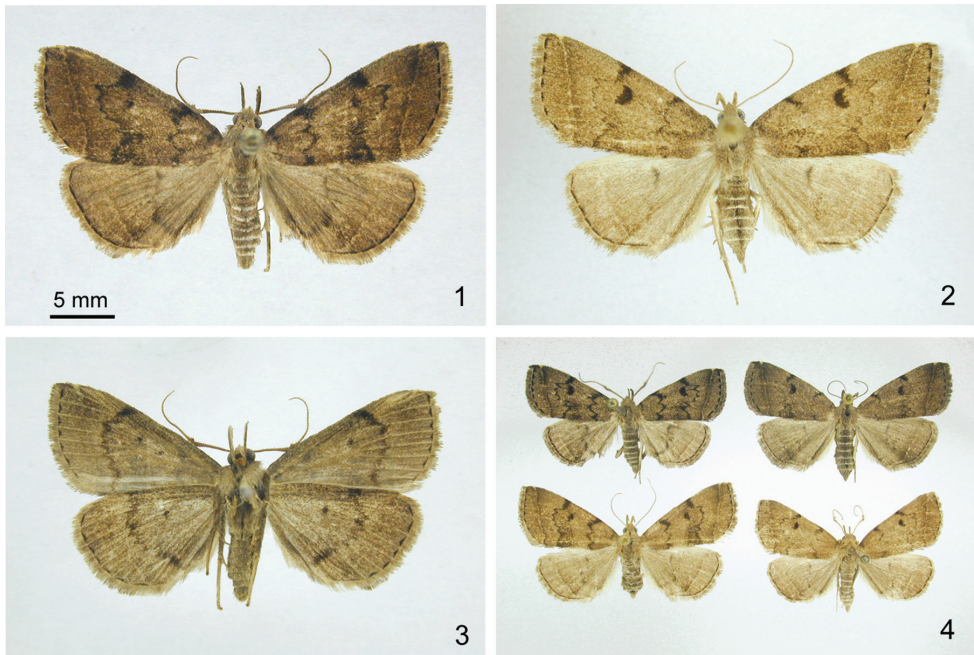
Zanclognatha dentata Wagner & McCabe, sp. n.

urn:lsid:zoobank.org:act:6C1EC0E9-2F9A-4A6B-AC61-7F712FC6C9B8

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

Figs 1–9

Type material. **Holotype** male (Fig. 1): USA, Connecticut, Tolland Co., Mansfield, Hunters Run, 41°46.18'N, 72°14.87' W, 4 July 2008, D. L. Wagner, mercury vapor light; DNA barcode voucher # CNCLEP 81920 (UCMS). **Paratypes** 54 males, 43 females. **Connecticut:** Litchfield County, Norfolk Great Mountain Forest, 13 July 1997, D. L. Wagner, (1 ♂) (UCMS) & 12 July 2008, D. L. Wagner, N. Proctor, A. Meleg (1 ♂) (UCMS); Middlesex County, East Haddam, Devil's Hopyard State Park, larvae 11 May 1994, 18 June, 1995, 20 June 1999, J. Fengler, J. Lozier, beaten from *Tsuga canadensis* (3 ♂) (CAES); New London County, Griswold, Hopeville Pond State Park, 9 July 1996, V. Giles (2 ♂) & 22 July 1997, F. Hohn (2 ♂) (UCMS); Tolland County, Mansfield, Hunters Run, 41° 46'11"N, 72°14'52" W, 4–18 July 1997–2008, D. L. Wagner (3 ♂, 1 ♀) (UCMS); Windham County, Hampton, 2 July 1984, D. L. Wagner (1 ♂) (UCMS); Hampton Reservoir, NW of bog, 25–26 July 1996, D. L. Wagner & B. D. Williams (1 ♀) (UCMS); Catden Swamp, 25–26 July 1996, D. L. Wagner & B. D. Williams (1 ♀) (UCMS); Sterling Junction Rt. 14/14A, larva 30 June 2007, D. L. Wagner, beaten from and reared on *Lonicera merrowii*, emerged 18 July 2007, DLW Lot 2007F90.1 (1 ♀) (UCMS). **Maine:** Oxford County, Magalloway Plantation, State Route 16, 3 km NNE New Hampshire stateline, larva 5 June 1995, C. T. Maier, beaten from *Abies balsamea* (1 ♂) (CAES). **Massachusetts:** Franklin County, Montague Plain, 11 July 1991, D. L.



Figures 1–4. *Zanclognatha dentata* sp. n. **1** Holotype male, dorsal. CT: Tolland Co., Mansfield **2** Female, dorsal. CT: Windham Co., Hampton Reservoir **3** Holotype male, ventral **4** Variation. NJ: Atlantic Co., Egg Harbor Township (upper left); CT: Windham Co., Sterling (upper right); CT: Windham Co., Hampton Reservoir (lower left); MA: Franklin Co., Montague, Plains Road (lower right).

Wagner, P. Z. Goldstein, & S. McKamey (1 ♂) (UCMS); Middlesex County, Concord, H.D. Thoreau's gravesite, 3–4 July 2009, D. L. Wagner (1 ♂) (UCMS). **Michigan:** Cheboygan Co., Pellston, Biological Douglas Lake, 7 July 2007, D. L. Wagner (1 ♂) (UCMS). **New Jersey:** Atlanta County, Egg Harbor Township, Absecon Creek, female 15 July 2002, D. F. Schweitzer, reared on dead oak leaves, emerged 13 Sept. 2002, DLW Lot 2002G117 (1 ♂) (UCMS); Atlantic County, Pomona, 6 July 1991, D. F. Schweitzer (1 ♂), gen. slide McCabe 2924 (TLM); Burlington County, Junction Route 563 & Wading River, 2 June 1999, D. L. Wagner, B. D. William, M. A. Volovski, & P. Mallard (1 ♂) (UCMS). **New Hampshire:** Coos County, Concord, 1 km NNE, North Concord, larva 4 June 1995, C. T. Maier, beaten from *Abies balsamea*, (1 ♂) (CAES); Pittsburg, Ildevide, west side of Second Connecticut Lake, larva 11 June 1996, C. T. Maier, beaten from *Abies balsamea*, JMF Lot 97–106 (1 ♂) (CAES). **North Carolina:** Haywood County, Cataloochee Campground, larva 10 June 2002, D. L. Wagner, beaten from *Hamelis virginiana*, emerged 3 Aug. 2002, DLW Lot 2002E83 (1 ♀) (UCMS). **New York:** Albany Co., Pine Bush, 42° 43.05' N, 73° 52.16' W, 100 m, 2 July – 6 Aug. 1987–1997, T. McCabe (7 ♂, 3 ♀) (NYSM, TLM); Clinton Co., Gadway Barrens, 44°56.59'N 73°45.17'W, 180 m, 2 Aug. 1997, T. McCabe (2 ♀) (TLM); Essex Co., Lake Stevens, 44°22.58'N, 73°54.15'W, 1055 m, 6 June 1986, T. McCabe (1 ♂) (TLM); Franklin Co., Bloomingdale bog, 44° 24.36'N, 74°07.24'W, 475 m, 2 Aug. 1997, T. McCabe (4

♀), gen. slide McCabe 4188 & 4186 (NYSM, TLM); Hamilton Co., 6 mi. E. Indian L, 43° 45.44' N, 74° 09.52' W, 555 m, 11 July–17 Aug. 1977–1980, T. McCabe (9 ♂, 6 ♀) (NYSM); Hamilton Co., 6 mi. E. Indian L, 43°45.44'N, 74°09.52'W, 555 m, 13 July 1977, T. McCabe (1 ♀, 1 ♂), gen. slide McCabe 1279 (NYSM); Orange Co., Cedar Pond bog, 44°56.59'N, 73°45.17'W, 180 m, 5 Aug. 2000, T. McCabe (1 ♂) (NYSM); Ulster Co., Lake Awosting, 41° 42.43' N, 74° 16.58' W, 550 m, 6 Aug. 1906, T. McCabe (1 ♀, 3 ♂) (NYSM); Ulster Co., Minnewaska St. Pk., 41°42.43'N, 74°16.58'W, 450 m, 6 Aug. 1906, T. McCabe (1 ♂) (NYSM). **Québec:** Val-Longue, 200 km north of Ottawa, 46°39.8'N, 75°45.1'W, 14 July 2004, D. Handfield (2 ♀) (DH); La Présentation, 30 km east of Montréal, 45°41.3'N, 73°05.3'W, 30 June 2006, D. Handfield (2 ♂, 4 ♀) (DH); Sainte-Christine, 65 km east of Montréal, 45° 39.0' N, 72° 26.8' W, 3 July 2006, 20 July 2006, 28 July 2006, D. Handfield (2 ♂, 4 ♀) (DH); Villeroi, 175 km north-east of Montreal, 46° 22.7' N, 71° 49.9' W, 7 July 2006, D. Handfield (2 ♂) (DH); Saint-Narcisse, 200 km north-east of Montreal, 46° 35.1' N, 73° 11.9' W, 13 July 2006, D. Handfield (1 ♂, 2 ♀) (DH); Manseau, 150 km north-east of Montreal, 46°18.3'N, 72°00.7'W, 24 July 2006, D. Handfield (3 ♂, 9 ♀) (DH). **Vermont:** Essex County, Victory, Victory State Forest, 2.5 km SW Granby, larva 10 June 1997, C. T. Maier, on *Abies balsamea* (1 ♀) (CAES); Windham Co., Marlboro, Banks Road, 489 m, larva 15 June 1994, C. Lemmon, on *Abies balsamea*, Chris Maier Lot 94–89 (1 ♂, 1 ♀) (CAES).

Etymology. The species name derives from the toothed antemedial and medial lines on the forewing.

Diagnosis (habitus). Dark tooth-like spots along costa, marking beginning of antemedial and postmedial lines, distinguish *Z. dentata* from all but *Z. lituralis*, *Z. martha*, and some *Z. protumnusalis*. The presence of a third (subapical) costal spot, (where the subterminal line meets the costa), usually present in *Z. lituralis*, is absent in *Z. dentata*; the grayer ground color and uneven subterminal line also distinguish *Z. lituralis* from *Z. dentata*. *Z. martha* is distinguished from *Z. dentata* by its darker ground color, weakened subterminal line, darkened distal ¼ of forewing, and its larger size. The discal spot of *Z. dentata* tends to be larger, more vertically elongate, and the distal side is often more concave than that of *Z. protumnusalis* and others. The antemedial line of *Z. dentata* is more toothed (zigzagged) than that of most other similarly-sized, brown North American *Zanclognatha* (but see discussion). The postmedial line is often abruptly-angled outward over the radial veins in *Z. dentata*, whereas in *Z. protumnusalis* and *Z. martha*, this part of the postmedial tends to be more evenly rounded. In *Z. protumnusalis* the subterminal line is more likely to be outwardly edged with pale scales (in both wings) and *Z. protumnusalis* tends to have more tan in the ground color, thinner and crisper costal spots, and lacks the blurry patch of fuscous scales based of the postmedial line, which extends from the inner margin to the cell, that is present in many *Z. dentata*. In most specimens of *Z. protumnusalis* the ground color of the hindwings tends to be noticeably paler than that of the forewings, especially through the radial area.

Diagnosis (genitalia). (Figs 5–7). **Male genitalia** of *Z. dentata* differ significantly from those of *Z. lituralis* – most notably *Z. dentata* has the upper process of the valve



Figures 5–7. *Zanclognatha dentata* sp. n. genitalia. **5** male, NY: Hamilton Co., Indian Lake, McCabe diss. no. 1279. **6** aedeagus, same data. **7** female, NY: Franklin Co., Bloomingdale bog, McCabe diss. no. 4188.

adorned with a small tooth, which is only half as long as the width of the costal lobe, whereas *Z. lituralis* has a large tooth that is as long as the costal lobe is wide. *Z. lituralis* has a valve that resists spreading during genitalic preparation and becomes badly skewed if forced. *Z. martha* resembles *Z. dentata* but is larger. The spread valves of *Z. martha* expand to 3.0 mm whereas those of *Z. dentata* expand to 2.7 mm. *Z. dentata* male genitalia appear indistinguishable from those of *Z. protumnusalis* to our eye. **Female genitalia** have similar internal spinules in the corpus bursa in *Z. dentata*, *Z. lituralis*, *Z. martha*, and *Z. protumnusalis*, but these extend farther on one side of the bursa in *Z. protumnusalis* and *Z. dentata*. In our dissections, length of the female genitalia in *Z. dentata* is ≥ 6 mm in total length, whereas those of *Z. protumnusalis* length measure circa 5 mm.

Description. Male. Forewing length: FWL 10.5–13 mm (n=30). **Head** – pale to deep brown with forward projecting tufts from vertex. Antenna with male androconial notch at 1/3. Labial palpus with third segment 1/2 length of second, with pale scales at apex; second segment with pale scales over mesal surface. **Thorax** – dorsum

concolorous with head. Forewing subtriangular, pale to chocolate brown, and usually well marked. Antemedial line toothed or scalloped; discal spot usually well developed sometimes with distal side concave; postmedial line toothed, thickened where it joins costa; often with diffuse medial patch of dark scales from inner margin to cell; subterminal line straight, sparsely edged outwardly with pale scales. Hindwing brown with weak discal spot and variously-developed postmedial and subterminal lines; the latter generally poorly differentiated to absent. If outwardly edged with pale scales, usually only over anal and cubital areas of wing. Underside of both wings usually with discal spot and well-expressed postmedial line. Procoxa elongate with yellow androconia. Profemur with (concealed) yellow hair pencil from distal end and fan of dark androconial scales from proximal end—both of which usually folded and covered by broad hood of chocolate colored scales from protibiae. Mesothoracic and metathoracic tibiae and tarsomeres lightened apically, appearing banded in dark individuals. **Abdomen** – Tan to brown with distal edge of each segment pale; abdomen appearing banded in well-marked individuals. **Male genitalia** (Figs 5, 6). **Valves** (Fig. 5) – Nearly symmetrical; uncus distally expanded compressed laterally, terminating in minute tooth; tegumen as long as valve; valve divided into two lobes for half its length; costal (upper) lobe with short mesal tooth halfway along length; costal lobe terminating in irregular apex crowned with setae, with apices of left and right valves differing in detail; lower lobe unadorned. **Aedeagus** (Fig. 6) – everted vesica covered with spinules; simple basal lobe; slightly curved mesal lobe; large distal lobe supports very small bulge without spicules. **Female genitalia** (Fig. 7) – Papillae anales unmodified, short; anterior and posterior apophyses subequal in length; distal half of ductus bursae lightly sclerotized, then heavily sclerotized and ribbed to beyond ductus seminalis; ductus seminalis short and twisted; caudal half of corpus bursae with relatively long, curved, internal spinules; spinules extend past middle of corpus bursae on side opposite ductus seminalis.

Remarks. Dark, boldly-marked individuals are commonly encountered southward. In some, the medial patch of dark scales extends across the wing. Adult phenotypes overlap with those of *Z. protumnusalis* to the extent that we cannot reliably assign about 15% of light-trapped adults to one species or the other. No diagnostic genitalic characters are known for either sex. COI barcodes for those individuals that we could reliably identify were diagnostic (see below). The holotype was submitted to BOLD for COI barcoding (CNCLEP 81920) and its sequence will be submitted to GenBank. Larval features are also diagnostic (for both species).

Distribution. So far as known, Ontario to Nova Scotia southward through the Great Lake states and in the Appalachians to northern Georgia. One moth from a sandhills area in central South Carolina appears to represent *Z. dentata*, but we exclude the moth from the type series.

Biology. Adults have been taken at lights and sugar bait from a broad range of habitats that includes bogs, swamps, marshes, Atlantic white cedar swamps, swales, and other wetlands, mesic hardwood and Appalachian cove forests, a variety of boreal (conifer) forest types, and pitch pine/scrub oak barrens. The species is essentially univoltine throughout most of its range with a single mid-summer flight from the end



Figures 8–11. Last instar *Zanclognatha*. **8** *Z. dentata* sp. n.: NC: Haywood Co., Great Smoky Mountain National Park, Catalochee Campground, DLW Lot 2002E83, larva and photo 10 June 2002. **9** *Z. dentata* sp. n.: NJ: Atlantic Co., Egg Harbor Township, Abescon Creek, female (mother) 15 July 2002; photo: 24 August 2002, DLW Lot 2002G117 **10** *Z. martha*. NY: Clinton Co., Clintonville, Dry Bridge Road, N44°28'14", W73°36'15", 660ft, larva 25 June, 2008, on *Pinus rigida*, DLW Lot 2008F200 **11** *Z. protumnusalis*. CT: New London Co., Griswold, Hopeville Pond State Park, female 10 August, 1997, image November 1997, Fred Hohn lot number F263.

of June through early August, with more than 80% of the adults from New Jersey northward taken in July. Records from early September in western North Carolina and northern Georgia by James Adams (pers. comm.) are indicative of a small second brood, as also occurs in *Z. protumnusalis* and others (Wagner et al. 2011).

Chris Maier, Jeff Fengler, and Carol Lemmon, made numerous collections of *Z. dentata* during their survey of conifer-feeding caterpillars of the Northeastern United States (Maier et al. 2004). Nine of their larval collections were reared to the adult stage; larval images for four additional collections are assignable to *Z. dentata*. Their host records include: *Abies balsamea* (L.) Mill. (n=7), *Tsuga canadensis* (L.) Carrière (n=3), and *Pseudotsuga menziesii* (Mirb.) Franco. We have taken singleton larvae in beating sheet samples on three occasions: from *Hamamelis virginiana* L., *Lonicera morrowii* A. Gray, and a third, unrecorded host. All of the above were taken in May and June as penultimate or final instars. Although *Zanclognatha* species are generally regarded to be litter dwellers (Crumb 1956; Hohn and Wagner 2000; Wagner 2005), at least three other members of the genus (in addition to *Z. dentata*) are known to feed above the ground: *Z. theralis* (Walker, 1859) in *Usnea* lichens (Sigal 1984); *Z. protumnusalis* in fir, spruce, pines, and other conifers (Prentice 1962 and reared specimens in the PMNH); and *Z.*

martha a hard pine associate (Wagner et al. 2011). We also have taken *Zanclognatha cruralis* (Guenée, 1854) and related species on occasion while beating low woody and herbaceous vegetation in forests, but mostly in the fall, before leaf fall, and not in the spring as has been the case with the four *Zanclognatha* listed above. Dale Schweitzer and DLW reared an ex ova cohort of *Z. dentata* through to maturity on a diet of dead oak leaves (DLW Lot 2002G117).

Larval Identification

The caterpillar is mottled in brown, red, and yellow with a conspicuous pale subdorsal spot on A7 (Figs 8–9). Below we expand Crumb's (1956) key to *Zanclognatha* larvae by including four new taxa: *Z. dentata*, *Z. martha*, *Z. protumnusalis*, and *Z. marcidilinea* (Grote, 1872). Given the confusing taxonomy of the genus (e.g., the possibility of misidentifications, especially in historic material), our small sample sizes, intraspecific (including ontogenetic) variability in larval phenotypes, our key should be considered preliminary. Development of the middorsal stripe, emphasized by Crumb (1956) and below, is variable. For example, our example of *Z. marcidilinea* had only a weak line, best expressed over the thoracic segments; conversely *Z. cruralis* sometime has the remnants of a middorsal line (broken between segments). Last instars of all ten species are figured in Wagner et al. (2011).

Preliminary key to *Zanclognatha* larvae

- 1 Ground color smoky to charcoal; body somewhat corrugated (constricted between segments); red reticulations inconspicuous; larva arboreal on pitch and perhaps other hard pines ***Z. martha***
- Ground color with variously developed red reticulations at least laterally and otherwise not as above **2**
- 2 Middorsal stripe usually present over abdomen; ground colors various..... **3**
- Middorsal stripe usually absent over abdomen; ground color with conspicuous red reticulations..... **8**
- 3 Middorsal stripe fuscous (dark), contrasting with adjacent dorsal coloration over abdomen **4**
- Middorsal stripe reddish, weakly contrasting with adjacent dorsal coloration, evident mostly over thorax..... **6**
- 4 Dorsum with red mottling that often joins into lines along inner side of creamy subdorsal stripe ***Z. protumnusalis***
- Not as above; mottling not coalescing into red lines and without a creamy subdorsal stripe; dorsal area reticulated in gray, brown, red, and yellow..... **5**

- 5 Ground color smoky; dorsal pinacula over abdomen slightly enlarged, diameter > than height of spiracle on A8; diffuse, dark oblique lines extending forward and upward from spiracle, especially on A2–A6 (A7) ... ***Z. pedipilalis***
- Ground color reddish; dorsal pinacula over abdomen slightly enlarged, diameter < than height of spiracle on A8; without set of well-developed, dark oblique lines extending forward and upward from spiracle, especially on A2–A6.....***Z. laevigata***
- 6 A7 with pale supraspiracular spot.....7
- A7 without pale supraspiracular spot; often with oblique, arching yellow line, between dorsal pinacula on A1–A7 ***Z. marcidilinea***
- 7 Dorsal abdominal pinacula wartlike, conspicuously wider and higher than those over thoracic segment, diameters > height of A8 spiracle; pale spot on A7 from (raised) supraspiracular swelling (bearing SD1).... ***Z. dentata* sp. n.**
- Dorsal abdominal pinacula flatter, diameters similar to those over thoracic segments, < height of A8 spiracle; subdorsal area of A7 not conspicuously swollen ***Z. lituralis***
- 8 Dorsal abdominal pinacula small; diameters equal to those over thoracic segment and diameter < height of A8 spiracle..... ***Z. theralis***
- Dorsal abdominal pinacula distinctly larger than those over thorax, diameters ≥ height of A8 spiracle **9**
- 9 Dorsal abdominal pinacula enlarged but diameter of D1 pinacula < 1/4 distance that separates them across midline; D1 pinaculum < 2 × diameter of D2 pinaculum **10**
- Dorsal abdominal pinacula larger with diameter of D1 pinacula about 1/3 distance of that separating them across midline; D1 pinaculum > 2 × that of D2 pinaculum ***Z. jaccusalis*** (= *Z. ochreipennis* of Crumb 1956)
- 10 D1 and D2 pinacula over abdominal segments subequal; southern US..... ***Z. obscuripennis***
- Diameters of D1 pinacula larger than those of D2 over abdominal segments; widespread (common) ***Z. cruralis***

Discussion

Zanclognatha dentata is widespread in Northeastern North America. In most collections it is intermixed with *Zanclognatha protumnusalis*. Less often specimens are sorted with those of *Z. lituralis* and *Z. martha*. Surprisingly, given the number of wing scaling characters that distinguish *Z. dentata* from other *Zanclognatha*, we did not find male or female genitalic differences that would reliably separate the new species from *Z. protumnusalis*. As noted above, genitalia are somewhat generalized across the genus (see Forbes 1954: 389 for illustrations of the valve and aedeagus for seven species). As

is suggested by the larval key, all of the aforementioned species of *Zanclognatha*, and others, can be distinguished based on larval characters (see also Crumb 1956).

Daniel Handfield had individuals of both *Z. protumnusalis* (n = 37) and *Z. dentata* (n = 31) from Quebec sequenced as part of the Bar Codes of Life Data System (<http://www.barcodinglife.org/views/login.php>). His *Z. dentata* (included as paratypes here) clustered in two haplotype groups, remote from those of *Z. protumnusalis* which clustered in a single group that included several haplotypes. In a larger *Zanclognatha* data set (n=251) that includes barcodes of all named eastern species, most *Z. protumnusalis* clustered with *Z. cruralis*, *Z. jaccusalis* (Walker, 1859) and *Z. obscuripennis* (Grote, 1872), whereas *Z. dentata* haplotypes clustered with *Z. martha*, *Z. theralis* (Walker, 1859) (in part) and *A. atrilineella* (Grote, 1873) (Don Lafontaine in litt.). That the two species were not each other's sisters is hardly surprising given the differences in larval phenotypes of the two: compare figures 8 and 9 with 11 and differences enumerated in the larval key.

The type of *Zanclognatha minimalis* Grote, 1878, currently regarded as a synonym of *Z. protumnusalis* (e.g., Franclemont and Todd 1983) (BMNH), is somewhat intermediate in character between *Z. dentata* and *Z. protumnusalis*. On the whole *Z. minimalis* aligns best with the latter, e.g., hindwings of *Z. minimalis* are too pale to fit comfortably within *Z. dentata* and the discal spot is small, round and almost free of dark scales. However, two features of the type give us pause: (1) the postmedial line is strongly expressed to the inner margin (it is nearly always vague below the cell in *Z. protumnusalis*). (2) Likewise the antemedial line is toothed and well expressed to the inner margin, and thus more reminiscent of *Z. dentata*.

The New York State Museum has no historical records of *Zanclognatha dentata*, and TLM did not find this species in Ithaca when he collected there at both light and bait from 1974–1975. The earliest specimens that we have been able to locate are a series in the American Museum of Natural History from Ocean County, New Jersey taken in 1936. And while the recency of discovery of what is now a widespread and common moth would suggest the species could be an introduction, its presence in northern bogs in Quebec, barrens in New Jersey (in the 1930s), and cove forests in the Great Smokies Mountains are indicative that *Z. dentata* is a native that escaped the attentions of early lepidopterists.

Zanclognatha is in need of revisionary study. The number of valid species in the *gypsalis-theralis-deceptricalis-inconspiculis* complex is unknown. *Zanclognatha lituralis* consists of at least two valid species (Rings et al. 1992). We are uncertain if what is being called *Zanclognatha martha* in the Great Lakes Region is conspecific with the pitch pine-feeding populations of the Eastern seaboard states. Likewise, *Z. protumnusalis* (even with *Z. dentata* removed) may not be a single entity, e.g., specimens from along the Gulf Coast may be nominally distinct. COI barcodes and other (nuclear) molecular data will be needed in many cases, as both genitalia and wing patterns are often of limited utility in the genus. Larvae of *Zanclognatha* are diverse in character given the modest differences in adult features (*Zanclognatha dentata* was initially recognized as

a distinct entity based on its larva). We encourage others to rear ex ova broods and to preserve and photograph larvae as circumstances permit—most *Zanclognatha* can be reared on dead oak, cherry, and birch leaves.

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***Gondysia* preceded *Neadysgonia* (Lepidoptera, Erebidae, Erebinae), a new generic synonymy from southeastern United States**

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Abstract

The recently proposed genus *Neadysgonia* Sullivan, 2010, was preceded in the literature by *Gondysia* Berio, 1955, a monotypic genus based on specimens without locality labels but presumed to be from Madagascar. The genus *Gondysia* replaces *Neadysgonia* and the species *G. pertorrida* Berio, 1955, becomes a junior synonym of *G. consobrina* (Guenée, 1852).

Keywords

taxonomy, *Dysgonia*, *Gondysia*, *Neadysgonia*, Madagascar, United States

Introduction

Recently, the genus *Neadysgonia* Sullivan was proposed for the North American species formerly placed in *Dysgonia* Hübner (Sullivan 2010). Berio (1955) described the monotypic genus *Gondysia* based on material presumed to be from Madagascar. Superficially, *G. pertorrida* Berio appears to be identical to specimens of *Neadysgonia consobrina* (Guenée). The purpose of this paper is to determine whether or not this possible synonymy is correct and, if so, to determine the taxonomic consequences of that finding.

Materials and methods

During a visit to the British Museum in September of 2010 the type specimens of *Gondysia pertorrida*, their attached labels, and dissected genitalia, were photographed using a Cannon G10 camera and light box.

Repository abbreviations

BMNH Natural History Museum [statutorially: British Museum (Natural History)], London, UK

Discussion

During a visit to the BMNH we were able to examine the type specimens on which the name *Gondysia pertorrida* Berio is based. Adults were photographed as well as a slide preparation of the male genitalia of the type. The male and female of *Gondysia pertorrida*, with their labels, and the genitalia of the male holotype, are shown in Figure 1. British Museum records indicate that these specimens were obtained from M. P. Mabille who had a large amount of material from Madagascar and described many species from the island (bibliography in Poole 1989). The two type specimens in question were apparently obtained by Mabille via Oberthür. A. Guenée described most of the species currently in *Neadysgonia* but the types of all four of Guenée's species are missing. There is no indication of a collecting locality on the labels of the two types of *G. pertorrida*, but if these are the missing types for *N. consobrina* as discussed in Sullivan (2010), the location was probably near Savanna, Georgia, USA.

Figures 6, 12 in Berio (1955) are line drawings of the uncus and tegumen of *G. pertorrida* and are based on the genitalic preparation from the holotype in the BMNH. These closely resemble Figure 8a in Sullivan (2010) and examination of the slide in the BMNH (*Agrotis* 1126; E. Berio 1339) leaves no doubt that the type specimen of *G. pertorrida* Berio is conspecific with our concept of *Neadysgonia consobrina* (Guenée). All of the key characters are present.

Ophiusa consobrina Guenée was described from an unknown number of specimens from an unknown locality. No type material was found in the BMNH collections or those of the Paris Museum (Sullivan 2010). *Neadysgonia consobrina* is a very uncommon species throughout most of its range and it is not unlikely that *G. pertorrida* was described from the lost Guenée types.

Gondysia pertorrida, syn. n., is conspecific with *Neadysgonia consobrina* and thus is a junior synonym. However, the generic name *Gondysia* Berio is available and replaces *Neadysgonia* Sullivan, which is 55 years its' junior. Therefore, the North American species are as follows:

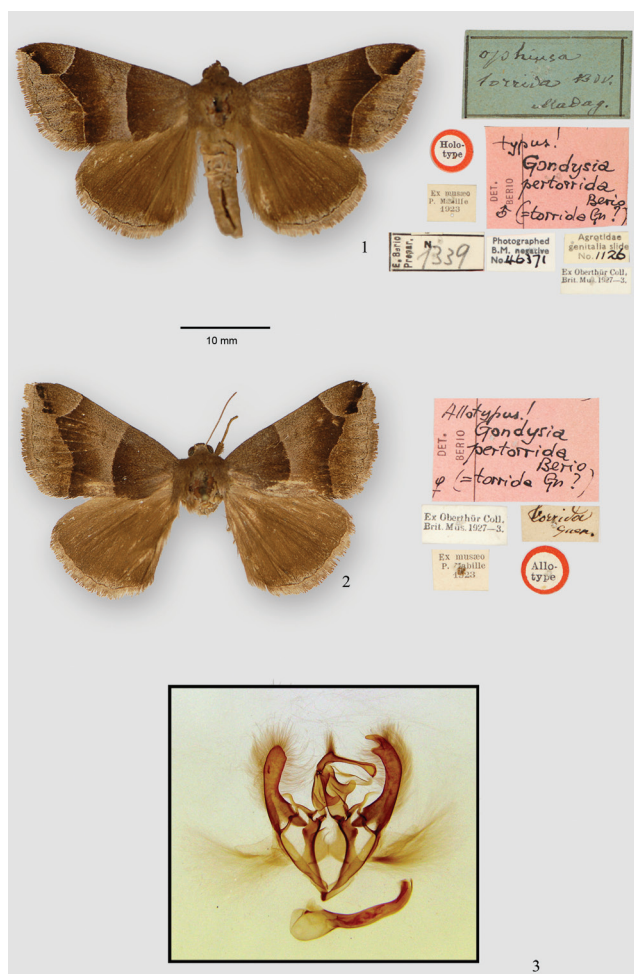


Figure 1. Male and female types of *Gondysia pertorrada* Berio and their affixed labels. Genitalia (BMNH slide: Agrotis 1126; E. Berio 1339) of male holotype of *G. pertorrada* Berio.

Gondysia Berio, 1955

Parallelia, Auct. nec Hübner, 1818

Neadysgonia Sullivan, 2010, syn. n.

consobrina (Guenée, 1852), syn. n.

redditura (Walker, 1858)

pertorrada Berio, 1955, syn. n.

similis (Guenée, 1852), syn. n.

apicalis (Guenée, 1852)

concolor (Grote, 1893)

smithii (Guenée, 1852), syn. n.

telma (Sullivan, 2010), syn. n.

Recent collecting and genitalic examination have extended the known range of *G. smithii* to northern Florida, *G. telma* to central Florida (Terhune Dickel pers. comm.), and of *G. smithii* to Virginia (Steve Roble, pers. comm.).

Acknowledgements

We would like to thank Jocelyn Gill and Don Lafontaine for help in preparing the figure and suggestions regarding the manuscript. Martin Honey graciously allowed us access to the collections under his care at the British Museum. Steve Roble and Terhune Dickel kindly provided additional data on the distribution of *Gondysia* based on their genitalic dissections.

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New synonymies and combinations in *Argyrostromis* Hübner (Lepidoptera, Erebidae, Erebinae, Poaphilini)

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Abstract

After examining the type specimens of species in the eastern North American genus *Argyrostromis* the number of known species in the genus is reduced from 10 to six through synonymy. A key to species is included along with illustrations of the adults and genitalia of each species. Three Neotropical species currently included in *Argyrostromis* (*Argyrostromis euryasces* Schaus, 1914; *Argyrostromis quadrata* Dognin, 1910; and *Celiptera surrufula* Dyar, 1913) are transferred to other genera as *Argyrostickia euryasces* (Schaus, 1914), **comb. n.** [Noctuidae: Bagisarinae], *Heterochroma quadrata* (Dognin, 1910), **comb. n.** [Noctuidae: Amphipyriinae], and *Ptichodis surrufula* (Dyar, 1913), **comb. n.** [Erebidae: Erebinae: Euclidiini].

Keywords

Argyrostromis, *Argyrostickia euryasces*, *Ptichodis surrufula*, *Heterochroma quadrata*, eastern North America

Introduction

Currently, there are 10 species of *Argyrostromis* Hübner listed by Lafontaine and Schmidt (2010). An additional three species listed by Poole (1989) from Mexico and South America are transferred to other genera, thereby restricting the geographic range of the genus to eastern and central North America. Examination of the type specimens, and the published illustrations associated with the original descriptions where the types have been lost or destroyed, shows that four of the names recognized as valid species

should be placed in synonymy with *A. flavistriaria* (Guenée). A key to species and adults and genitalia of each species are illustrated in order to facilitate identification.

Materials and methods

Repository abbreviations

Specimens were examined from the following collections:

- AMNH** American Museum of Natural History, New York, New York, USA
BMNH The Natural History Museum (statutorily, British Museum (Natural History)), London, UK
CNC Canadian National Collection of Insects, Arachnids, and Nematodes, Ottawa, Ontario, Canada
JBS Personal collection of J. Bolling Sullivan, Beaufort, North Carolina, USA
MNHN Muséum national d'histoire naturelle, Paris, France
USNM National Museum of Natural History (formerly, United States National Museum), Washington, District of Columbia, USA

Dissecting methods and terminology

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

Key to species of *Argyrostromis*

- | | | |
|---|---|-------------------------|
| 1 | Forewing with postmedial line straight or evenly curved, usually prominent.. | 2 |
| – | Forewing with postmedial line dentate, usually obscure | 5 |
| 2 | Forewing with postmedial line appearing to extend to apex and usually highlighted by yellow line or spots..... | <i>A. flavistriaria</i> |
| – | Forewing with postmedial line subapical and without yellow shading | 3 |
| 3 | Forewing with postmedial line curved toward wing base at costa; basal, medial, and terminal areas may be extensively dusted with white scales ... | <i>A. sylvarum</i> |
| – | Forewing with postmedial line straight; ground color brown | 4 |
| 4 | Postmedial line complete | <i>A. quadrifilaris</i> |
| – | Postmedial line incomplete | <i>A. anilis</i> |
| 5 | Forewing length 15–17mm; fringe with white scaling..... | <i>A. erasa</i> |
| – | Forewing length 10–13 mm; fringe rarely with white scaling and if so, scaling minute..... | <i>A. deleta</i> |

Systematics

Argyrostromis flavistriaria (Hübner, [1831])

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

Figs 1–4, 11–15, 20, 26

Crochiphora flavistriaria Hübner, [1831]: 35, pl. [96], figs 555, 556.

Poaphila herbicola Guenée, 1852: 301, syn. n.

Poaphila contempta Guenée, 1852: 302, syn. n.

Poaphila perplexa Guenée, 1852: 302.

Poaphila perspicua Walker, 1858: 1477.

Mocis? diffundens Walker, 1858: 1491, syn. n.

Phurys glans Grote, 1876b: 416.

Phurys carolina Smith, 1905: 68, syn. n.

Type material. The type material of *Crochiphora flavistriaria* is lost, but the illustrations (Hübner, 1831, pl. [96], figs 555, 556) are diagnostic and represent the form shown in Fig. 1. The type specimens of *Poaphila herbicola* and *P. contempta* are lost, but the original descriptions are diagnostic and represent the forms shown in Figs 2 and 3 respectively. The female lectotype of *Poaphila perplexa* in the MNHN labelled “Javana [Savannah] Georgia/ *perplexa*/ Type/ Museum Paris/ *Poaphila perplexa* Gn. Vol. 7, 1852, p. 302, n=1755” is shown in Fig. 11. The male holotype of *Poaphila perspicua* in the BMNH labelled “Type/ *A. perspicua*.” is shown in Fig. 12 and represents the same form as the original illustration of *Crochiphora flavistriaria*. The male holotype of *Mocis? diffundens* in the BMNH labelled “Type/ 8. *Mocis? diffundens*.” is shown in Fig. 13. A male syntype of *Phurys glans* in the BMNH labelled “Type/ Grote Coll. 82-54./ 3129/ *Phurys glans* Grote type” is shown in Fig. 14. The male lectotype of *Phurys carolina* in the AMNH labelled “*Phurys carolina* Smith % type/ Nth Car., August”/ Coll. J.B. Smith/ Lectotype by E.L. Todd” is shown in Fig. 15.

Distribution. North Carolina south to Florida and Texas.

Argyrostromis sylvarum (Guenée, 1852)

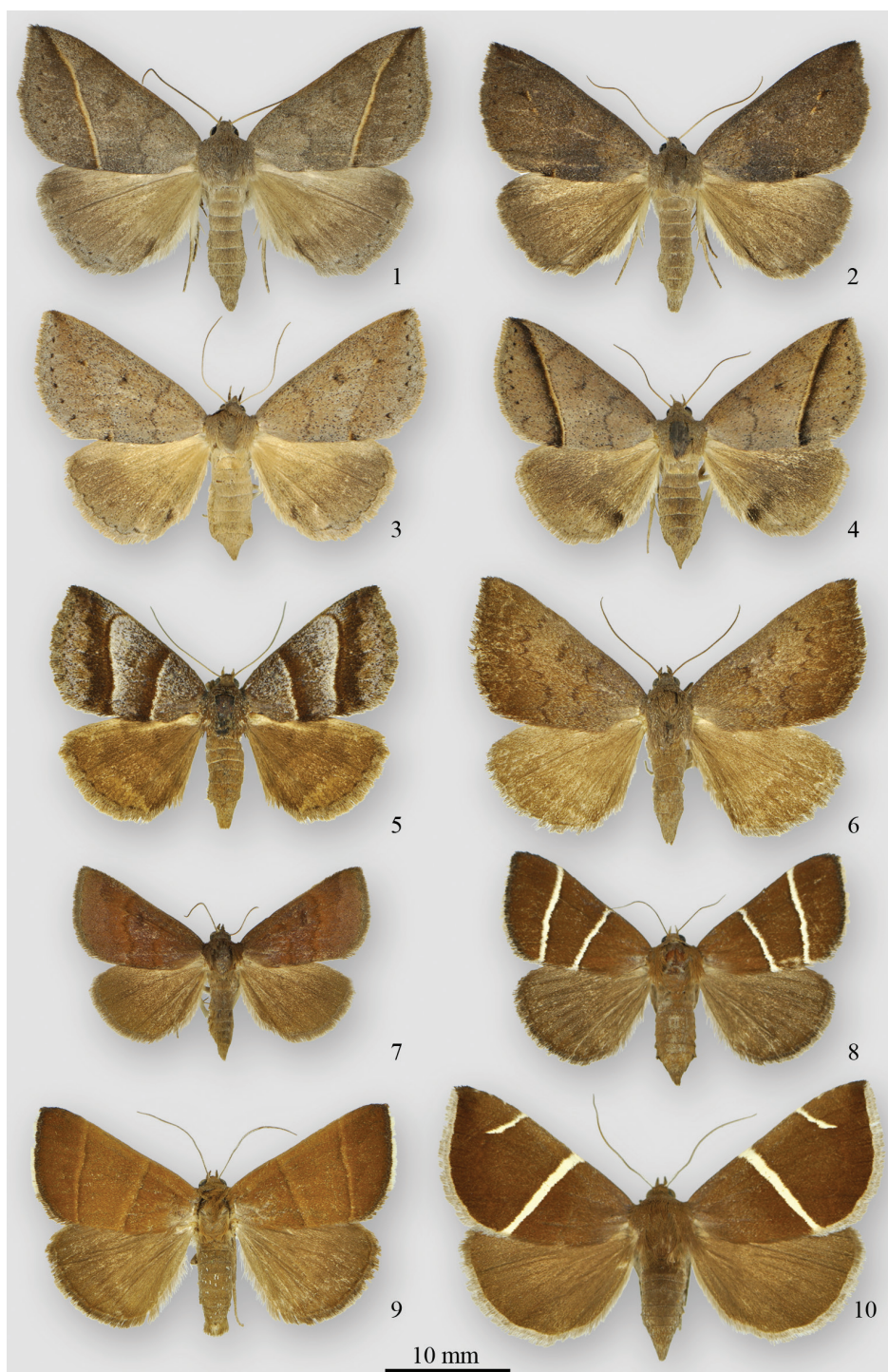
http://species-id.net/wiki/Argyrostromis_sylvarum

Figs 5, 21, 27

Poaphila sylvarum Guenée, 1852: 300, pl 23, fig 2.

Type material. The type material of *Poaphila sylvarum* is lost but the original description and associated illustration are diagnostic.

Distribution. Virginia south to Florida and Texas.



Figures 1–10. *Argyrostromis* adults **1–4** *A. flavistriaria* **5** *A. sylvarum* **6** *A. erasa* **7** *A. deleta* **8, 9** *A. quadrifilaris* **10** *A. anilis*.

***Argyrostromis erasa* (Guenée, 1852)**

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

Figs 6, 16, 22, 28

Poaphila erasa Guenée, 1852: 301.

Type material. The female lectotype of *Poaphila erasa* labelled “Javana [Savannah] Georgia/ *Poaphila erasa* Gn./ Type/ *Poaphila erasa* Gn. Vol. 7, 1852 p. 301, n=1751” in the MNHN is shown in Fig. 16 [forewing length 17 mm].

Distribution. North Carolina south to Florida and Texas.

***Argyrostromis deleta* (Guenée, 1852)**

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

Figs 7, 17, 18, 23, 29

Poaphila deleta Guenée, 1852: 300.

Poaphila placata Grote, 1878: 184.

Type material. The male lectotype of *Poaphila deleta* labelled “Javana [Savannah] Georgia/ *Poaphila deleta* Gn. Vol. 7, 1852, p. 300, n=1748” in the MNHN is shown in Fig. 17 [forewing length 13 mm]. A female syntype of *Poaphila placata* in the BMNH labelled “Georgia, Grote Coll. 82–54./ *Poaphila placata* Grote Type” is shown in Fig. 18.

Distribution. Virginia south to Florida and Texas.

***Argyrostromis quadrifilaris* (Hübner, [1831])**

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

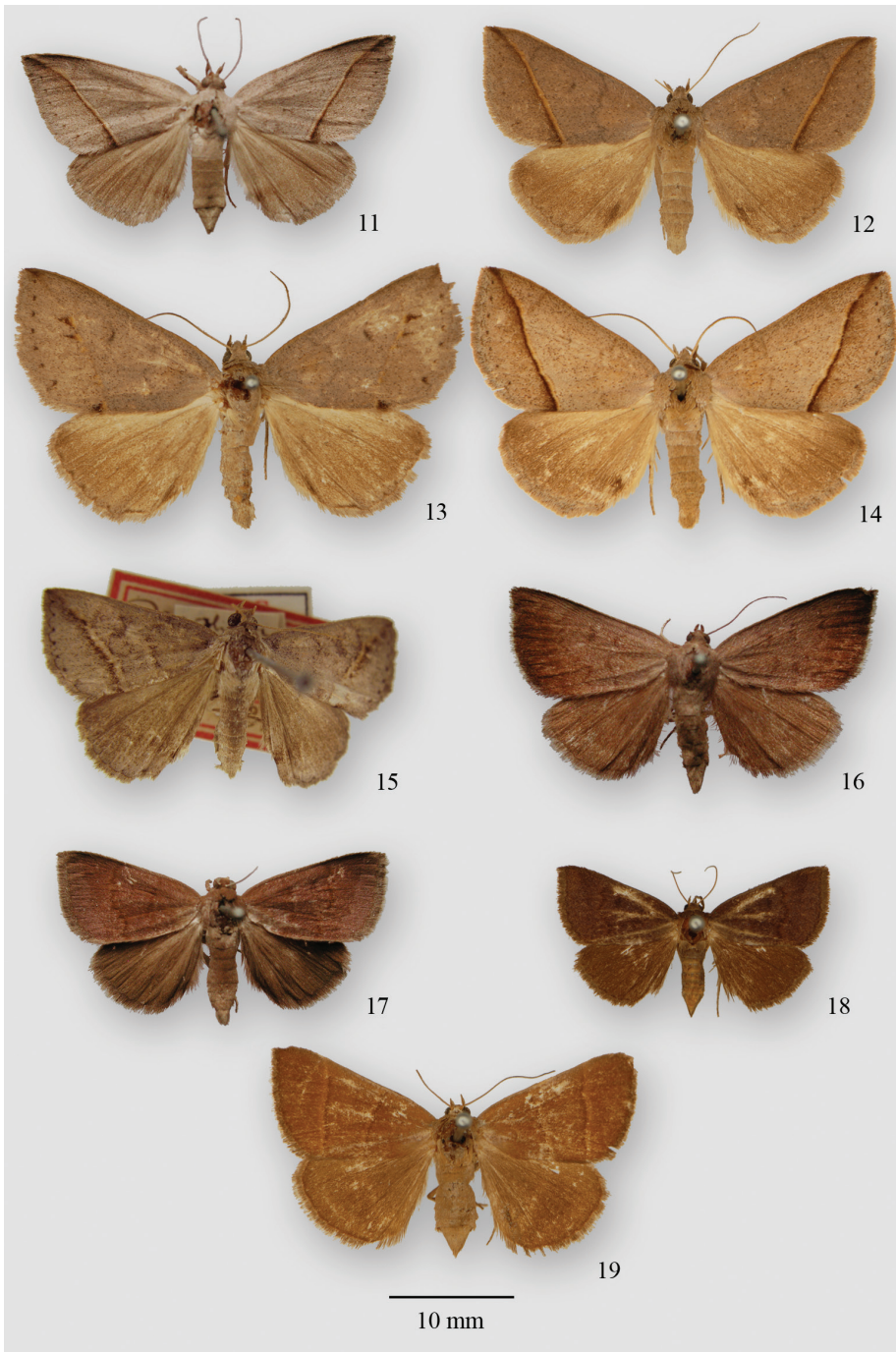
Figs 8, 9, 19, 24, 30

Agronomia quadrifilaris Hübner, [1831]: 37, pl. [98], figs 569, 570

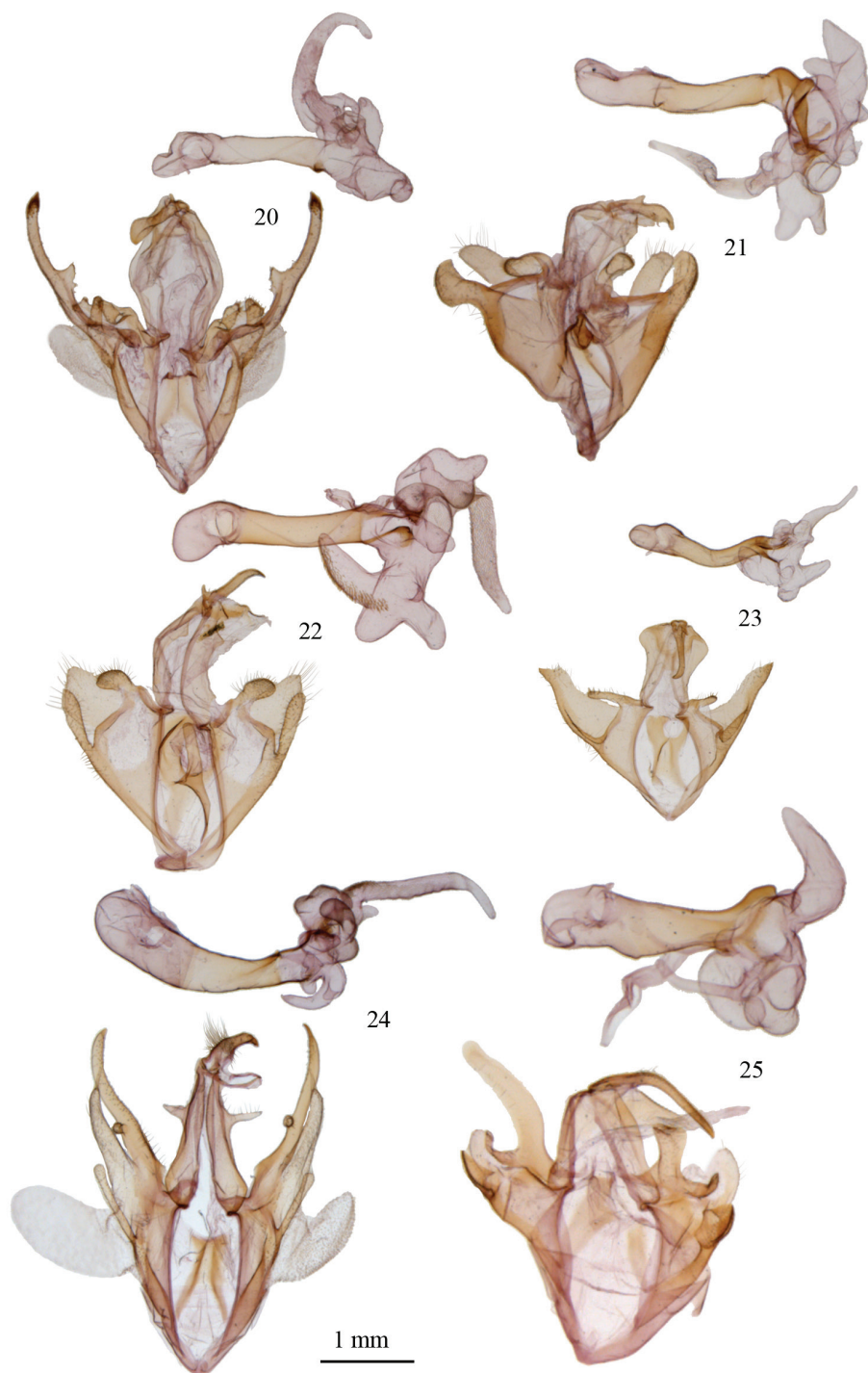
Poaphila obsoleta Grote, 1876a: 42.

Type material. The type specimen of *Agronomia quadrifilaris* is lost, but the illustrations (Hübner, 1831, pl. [98], figs 569, 570) are diagnostic and represent the form shown in Fig. 8. A female syntype of *Poaphila obsoleta* in the BMNH labelled “Enterprise, Florida, 12.V. Grote Coll. 82–54./ *Poaphila obsoleta* Grote Type” is shown in Fig. 19.

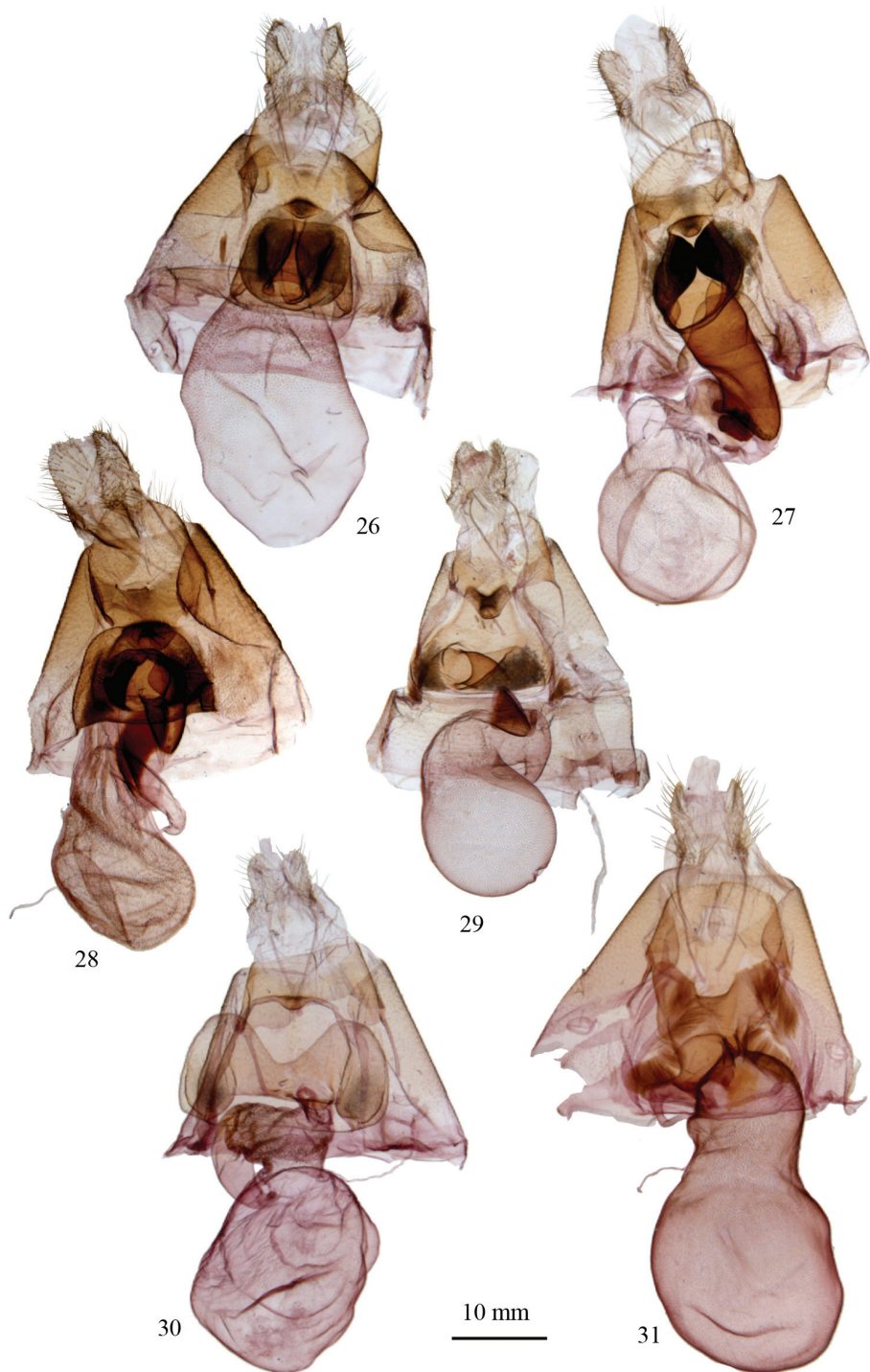
Distribution. New York and New Hampshire south to Florida and Texas.



Figures 11–19. Type material of *Argyrostromis* **11** *Poaphila perplexa* lectotype, MNHN **12** *Poaphila perspicua* holotype, BMNH **13** *Mocis? diffundens* holotype, BMNH **14** *Phurys glans* syntype, BMNH **15** *Phurys carolina* lectotype, AMNH **16** *Poaphila erasa* lectotype, MNHN **17** *Poaphila deleta* lectotype, MNHN **18** *Poaphila placata* syntype, BMNH **19** *Poaphila obsoleta* syntype, BMNH.



Figures 20–25. Male genitalia of *Argyrostromis* **20** *A. flavistriaria* **21** *A. sylvarum* **22** *A. erasa* **23** *A. deleta* **24** *A. quadrifilaris* **25** *A. anilis*.



Figures 26–31. Female genitalia of *Argyrostrotis*. **26** *A. flavistriaria* **27** *A. sylvarum* **28** *A. erasa* **29** *A. deleta* **30** *A. quadrifilaris* **31** *A. anilis*.

***Argyrostromis anilis* (Drury, 1773)**

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

Figs 10, 25, 31

Phalaena anilis Drury, 1773: 21, pl. 12, fig. 21.

Agronomia sequestriaris Hübner, [1831]: 10, pl. [73], figs 419, 420.

Type material. The type specimen of *Phalaena anilis* is lost, but the illustration in Drury (1773) is diagnostic, as are those of *Agronomia sequestriaris* in Hübner, [1831].

Distribution. Southern Canada (Quebec to Saskatchewan) south to Florida and Texas.

Excluded species

Three species included in *Argyrostromis* by Poole (1989) are hereby excluded from the genus.

Argyrostromis euryasces Schaus, 1914 is hereby transferred to the genus *Argyrosticka* Hübner, [1821] as *Argyrosticka euryasces* (Schaus, 1914), comb. n. [Noctuidae: Bagisarinae]. The two genera are not closely related and the association was more likely an error in confusing the two similar generic names by Schaus than an intended placement in *Argyrostromis*.

Argyrostromis quadrata Dognin, 1910 is hereby transferred to the genus *Heterochroma* Guenée as *Heterochroma quadrata* (Dognin, 1910), comb. n. [Noctuidae: Amphipyrae].

Celiptera surrufula Dyar, 1913, included in *Argyrostromis* by Hampson (1913) and maintained there by Poole (1989), is hereby transferred to the genus *Ptichodis* Hübner, 1818 as *Ptichodis surrufula* (Dyar, 1913), comb. n. [Erebidae: Erebiinae: Euclidiini].

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We thank Jérôme Barbut (Muséum national d'histoire naturelle, Paris), Terhune Dickel (Anthony, Florida), Martin Honey (Natural History Museum, London, UK), Jim Miller (formerly AMNH, New York), Michael Pogue (Systematic Entomology Laboratory, National Museum of Natural History, Washington, DC) for access to specimens and data. We thank Jocelyn Gill (CNC, Ottawa, Canada) for assistance with the preparation of the genitalia, photographs, and plates.

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The Lepidoptera of White Sands National Monument, Otero County, New Mexico, USA 2. Rediscovery and description of *Sparkia immacula* (Grote, 1883) (Noctuidae, Noctuinae, Hadenini)

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Abstract

In 2006 the U.S. National Park Service initiated a long term study of the Lepidoptera at White Sands National Monument, Otero County, New Mexico. *Sparkia immacula* (Grote, 1883), previously known only from historical specimens collected in Arizona and New Mexico, was discovered in the Monument in 2007 during the second year of the study. The adult moths and male and female genitalia are illustrated for the first time.

Keywords

Sparkia immacula, Tularosa Basin, biological diversity, white gypsum dunes, Noctuidae, White Sands National Monument, New Mexico, National Park, Otero County, Arizona

Introduction

In 2006 the U.S. National Park Service invited the author to initiate a long-term study of the Lepidoptera at White Sands National Monument, Otero County, New Mexico. A primary purpose of the study was to compile an inventory of moths in habitats within and immediately adjacent to the white gypsum sand dunes in the Monument.

White Sands National Monument preserves 285 km² (110 mi²), or about 40%, of the world's largest snow-white gypsum dune field. The remainder of the 712 km² (275 mi²) dune field is under the jurisdiction of the U.S. Army in the White Sands Missile Range. The dune field is located in the northern Chihuahuan Desert in southern New Mexico's Tularosa Basin (Schneider-Hector 1993). A complete description of the study site and some of its unique biological resources is in Metzler et al. (2009).

There is a dearth of research on the invertebrate fauna in the gypsum dune field in the Tularosa Basin of New Mexico. Details of previous research pertinent to insects is given in Metzler et al. (2009).

In the period extending from 9 February 2007 through 31 December 2010 we identified more than 430 species of Lepidoptera (Metzler et al. unpublished data) from the Monument. This is the fourth in a series of papers pertinent to a detailed study of the Lepidoptera at White Sands National Monument (Metzler et al. 2009, Metzler et al. 2010a, Metzler et al. 2010b).

Materials and methods

More than 250 samples of moths and other night flying insects were collected on 75 different nights in U.S.D.A. type black light traps, and at a black light or a mercury vapor light and sheet, as described in Covell (1984). A detailed description of the study methods is given in Metzler et al. (2009).

Genitalia were examined following procedures outlined in Clarke (1941), Hardwick (1950), Lafontaine (2004), and Pogue (2002). Abdomens were removed from the moths, wetted in 95% ethyl alcohol, and, using a dry bath, they were soaked in 10% KOH for 1.5 hours at 50°C. Genitalia were dissected in 5% ethyl alcohol, stained with Safranin O in 95% ethyl alcohol and Chlorazol Black E in water, dehydrated in 100% ethyl alcohol, cleared in clove oil, rinsed in xylene, and slide mounted in Canada balsam.

Terminology for elements of wing pattern, morphology, and genital structures follows Forbes (1954), Lafontaine (2004), and Mikkola et al. (2009). Forewing lengths were measured to the nearest ½ mm, from the base to the apex excluding fringe, using a stereo-microscope.

All specimens collected as part of a long-term study of Lepidoptera at White Sands National Monument are deposited in the following collections:

- | | |
|-------------|--|
| EHM | personal collection of Eric H. Metzler, Alamogordo, New Mexico, USA, for subsequent transfer to MSU |
| MSU | Albert J. Cook Arthropod Research Collection, Department of Entomology, Michigan State University, East Lansing, Michigan, USA |
| NMSU | New Mexico State University Arthropod Collection, Las Cruces, New Mexico, USA |

UNM	Museum of Southwestern Biology, University of New Mexico, Albuquerque, New Mexico, USA
WHSA	White Sands National Monument, New Mexico, USA

Results

Sparkia immacula (Grote, 1883)

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

Figs 1, 2, 5, 6, 7

Cea immacula Grote, 1883b: 78

Sparkia immacula; Nye 1975; Franclemont 1983.

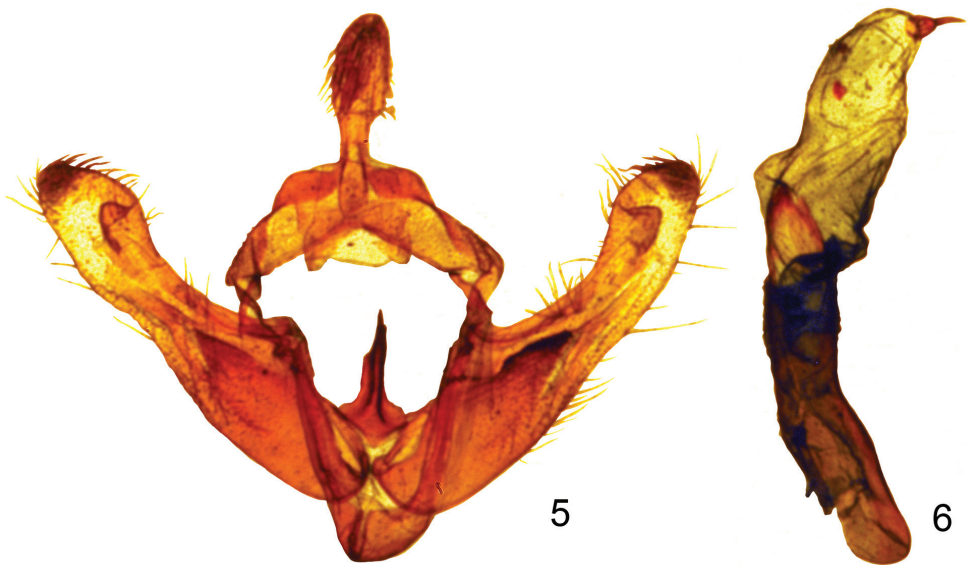
Type material. *Sparkia immacula* was described from “Arizona.” The male holotype is deposited in the U.S. National Museum, Washington, DC (USNM). The abdomen of the holotype is missing. Another short series of *S. immacula*, from Arizona, in the USNM, contains one male, also missing its abdomen.

Diagnosis. *Sparkia immacula* (figs 1–2) is a pale greenish-yellow noctuid moth without normal transverse markings or spots. The diagnostic features are 1) the pale yellowish-green color, and 2) lack of normal transverse markings and spots. *Sparkia immacula* might be mistaken for a species of *Schinia* Hübner, but *Schinia* have spines on the foretibia which are lacking in *S. immacula*. *Sparkia immacula* flies with and is the same size as *Trichocosmia inornata* Grote, 1883a (figs 3–4); *Trichocosmia inornata* is pale tan-ochre with faint transverse markings and a faint reniform spot. The frons is slightly rounded out.

Description. Adult male (fig. 1). Head - front bulging, closely scaled, pale yellow and white; vertex scales narrow strap-like, erect, pale yellow and white; labial palpus white and pale yellow, erect, scales strap-like, closely scaled laterally and mesally, longer scales form longer fringe ventrally and shorter fringe dorsally. Haustellum coiled between labial palpi. Antenna filiform, dorsally pale yellow, closely scaled, ventrally setose, naked, brown. Thorax - dorsum pale yellow, scales long hair-like or strap-like; underside white, scales erect long hair-like. Legs pale yellow, closely scaled with long hair-like scales on ventral surface forming a shaggy fringe. Forewing: Length 12.5 mm (variation: 11.4–13.5 mm, mean 12.7 mm, n = 17.) Pale greenish yellow, transverse lines and spots typical of noctuines are absent; fringe pale yellow; underside pale greenish yellow; fringe pale greenish yellow. Hindwing white; fringe white; underside white; fringe white. Abdomen - dorsum closely scaled, whitish; underside whitish, closely scaled. Genitalia (fig. 5): tegumen expanded laterally with lateral lobes, uncus short, setose, spoon shaped; saccus short, U shaped, apex rounded; juxta with high ridge pointed anteriorly; valve tear drop shaped, costa sclerotized, ventral margin membranous, editum sclerotized, larger on right valve than left valve, digitus a sclerotized ridge



Figures 1–4. 1 *Sparkia immacula* (Grote) male 2 *Sparkia immacula* (Grote) female 3 *Trichocosmia inornata* Grote male 4 *Trichocosmia inornata* Grote female.



Figures 5–6. 5 *Sparkia immacula* male genitalia capsule 6 *Sparkia immacula* male genitalia aedeagus.



7

Figure 7. *Sparkia immacula* female genitalia.

in a thumb-like projection, sacculus sclerotized, well developed, cucullus moderately developed, corona with many mesally directed setae. Aedeagus (fig. 6) sclerotized, apex with blunt point, vesica membranous, straight, slightly shorter (.9×) than aedeagus, no diverticula, apex with strong cornutus.

Adult female (fig. 2): similar to male. Forewing length 12.5 - 14 mm, mean 13.1 mm, n = 9. Genitalia (fig. 7): Papilla analis not sclerotized, setose; posterior apophysis extend anteriorly to posterior margin of eighth segment; anterior apophysis length similar to posterior apophysis; ductus bursa sclerotized at posterior end, else membranous, elongate; corpus bursa oblong with four round signa.

Remarks. *Sparkia immacula* is known from Arizona and New Mexico. Adult flight dates are 20 June through 25 August. The immature stages are unknown.

Discussion

The study of Lepidoptera at White Sands National Monument is projected to last approximately 10 years.

Acknowledgments

The Western National Parks Association, Tucson, Arizona contributed funding for travel for this study of Lepidoptera at White Sands National Monument. We are especially grateful for their financial support.

Several persons, Hildy Reiser, Diane White, Cliff Spencer, and Kevin R. Schneider, from the U.S. National Park Service were instrumental in arranging and promoting this study of the moths at White Sands National Monument. We especially thank David Bustos from White Sands National Monument for his assistance and support of our research. The National Park Service renewed the study for 2007 through 2011. Representatives from research collections provided insect pins, alcohol, identification services, research consultation, and storage space for specimens collected. We thank the following persons for offering support from their respective institutions: David B. Richman (NMSU) Kelly B. Miller, Sandra L. Brantley, and David C. Lightfoot (UNM), Frederick W. Stehr, Anthony I. Cognato, Gary L. Parsons, and Richard W. Merritt (MSU), Charles V. Covell, Jr., Jacqueline Y. Miller, and Thomas C. Emmel (UFL), J. Donald Lafontaine (CNC), Larry Berger Ohio Department of Agriculture, and David G. Furth (USNM). Patricia A. Metzler faithfully accompanied Metzler on his many collecting trips to the Monument, and she accompanied him on several long driving trips to Washington, DC for the purpose of identifying specimens. She contributed financially to the study. We thank Gary Parsons, John W. Brown, Clifford D. Ferris, J. Donald Lafontaine, and two anonymous reviewers for reading the paper and offering valuable suggestions.

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The Lepidoptera of White Sands National Monument, Otero County, New Mexico, USA 3. A new species of *Aleptina* Dyar, 1902 (Lepidoptera, Noctuidae, Amphipyryinae, Psaphidini)

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Abstract

In 2006 the US National Park Service initiated a long-term study of the Lepidoptera at White Sands National Monument, Otero County, New Mexico. *Aleptina arenaria* sp. n., described here, was discovered in 2008, the second year of the study. The adult moths and male and female genitalia are illustrated.

Keywords

Tularosa Basin, biological diversity, white gypsum dunes, Noctuidae, White Sands National Monument, New Mexico, National Park, Otero County

Introduction

The North American genus *Aleptina* Dyar (1902) was revised by Todd et al. (1984). In 2008, 2009, and 2010, adults of an unknown species of *Aleptina* were collected at White Sands National Monument, New Mexico. No specimens of this species were

known prior to this study of insects at the Monument. The lack of specimens can probably be attributed to a dearth of collecting in the gypsum dunes ecosystem of White Sands National Monument in New Mexico, which is under the jurisdiction of the U.S. National Park Service and the U.S. Army's White Sands Missile Range.

Methods

More than 250 samples of moths and other night flying insects were collected in U.S.D.A. type black light traps, and at black light, as described in Covell (1984), sometimes with mercury vapor light, and sheet on more than 75 different nights. A detailed description of the study methods is in Metzler et al. (2009). Genitalia were examined following procedures outlined in Metzler and Forbes (2011). Terminology for elements of wing pattern, morphology, and genital structures follows Todd et al. (1984), Lafontaine (2004), and Mikkola et al. (2009).

All specimens were collected as part of a long-term study of Lepidoptera at White Sands National Monument, and they are deposited in the following collections:

- EHM** Eric H. Metzler, Alamogordo, NM, for subsequent transfer to MSU
- MSU** Albert J. Cook Arthropod Research Collection, Department of Entomology, Michigan State University, East Lansing, MI
- UNM** Museum of Southwestern Biology, University of New Mexico, Albuquerque, NM
- USNM** United States Museum of Natural History (Smithsonian Institution), Washington, DC pending mutual resolution and agreement with the National Park Service regarding specimen deposition.

Results

Aleptina arenaria Metzler & Forbes, sp. n.

urn:lsid:zoobank.org:act:B2D5BDEB-3743-4C92-87EE-9899390FA809

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

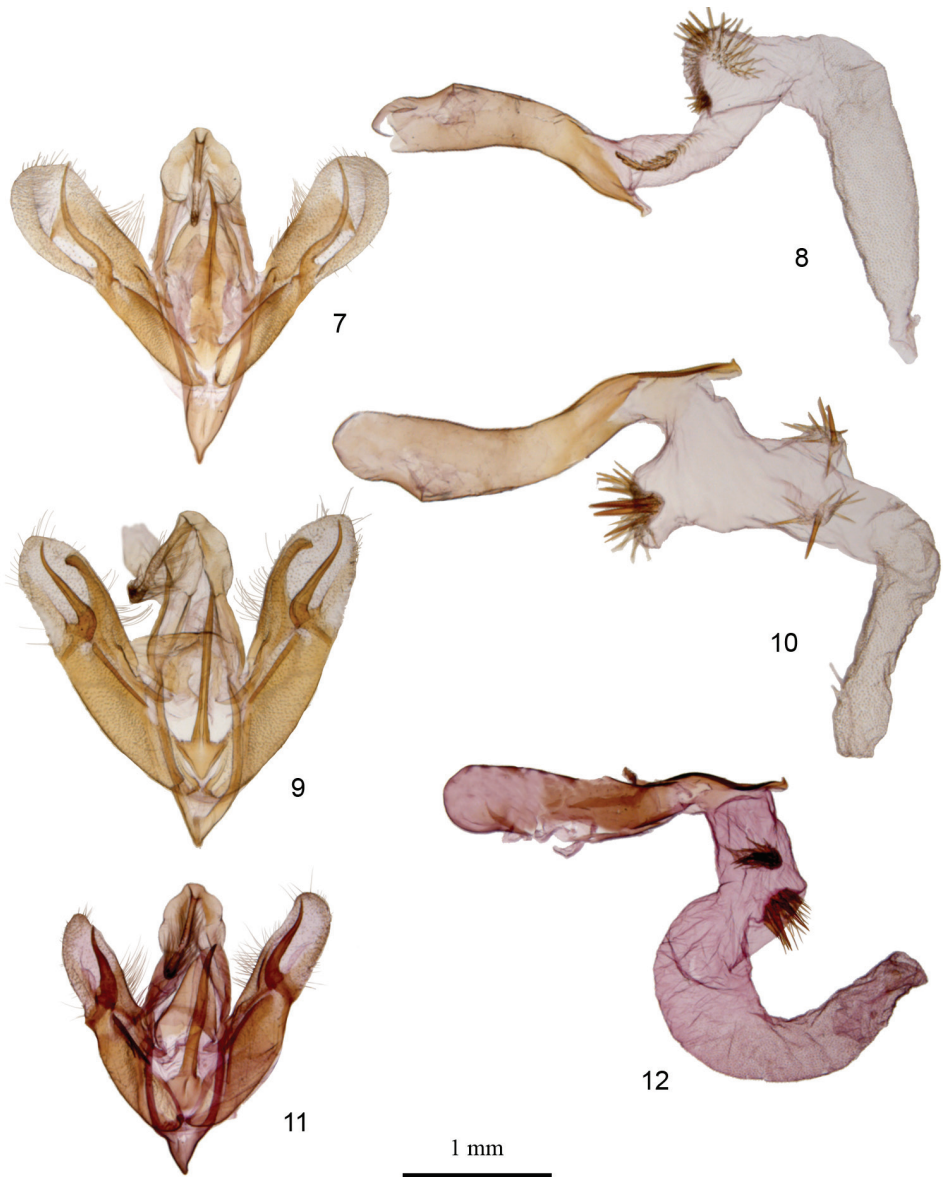
Figs 1, 2, 11, 12, 13, 14, 17, 18

Type Material. Holotype: male, pinned with labels as follows: “USA: NM: Otero Co. White Sands Nat[ional] Mon[ument], interdune habitat, 106°10.84'W, 32°46.64'N 4,008', 17 May 2010 WsnmF, Eric H. Metzler, uv tr[a]p, Accss #: WHSA - 00131” “HOLOTYPE USNM *Aleptina arenaria* Metzler & Forbes” [red handwritten label] (USNM). Paratypes: 5 males and 7 females: USA: NM: Otero Co. White Sands Nat[ional] Mon[ument] (hereafter WSNM), interdune habitat, 106°11.38'W, 32°46.69'N 4,000', 15 July 2009 WSNM8, Eric H. Metzler, uv tr[a]p, Accss #: WHSA - 00131. USA: NM: Otero Co. WSNM, interdune habitat,



Figures 1–6. *Aleptina* adults. 1 *A. arenaria* Metzler & Forbes, male holotype 2 *A. arenaria* Metzler & Forbes, female paratype 3 *A. inca* Dyar, male 4 *A. inca* Dyar, female 5 *A. clinopetes* Dyar, male 6 *A. clinopetes* Dyar, female.

106°10.84'W, 32°46.64'N 4,008', 12 Sept. 2010 WSNMF, Eric H. Metzler, uv tr[a]p, Accss #: WHSA - 00131. WSNM, interdune habitat, 106°11.38'W, 32°46.69'N 4,000', 11 June 2010 WSNM8, Eric H. Metzler, uv tr[a]p, Accss #: WHSA - 00131. WSNM, interdune habitat, 106°11.32'W, 32°45.72'N 4,000', 22 July 2008 WSNM9, Eric H. Metzler, uv tr[a]p, Accss #: WHSA - 00131. WSNM, interdune habitat, 106°11.32'W, 32°45.72'N 4,000', 17 May 2010 WSNM9, Eric H. Metzler, uv tr[a]p, Accss #: WHSA - 00131. WSNM, interdune habitat, 106°10.84'W, 32°46.64'N 4,008', 14 Sept 2009 WsnmF, Eric H. Metzler, uv tr[a]p, Accss #: WHSA - 00131. WSNM, interdune habitat, 106°10.82'W, 32°46.62'N 4,008', 15 July 2009 WSNMD, Eric H. Metzler, uv tr[a]p, Accss #: WHSA - 00131. Paratypes are deposited with UNM, MSU and EHM.



Figures 7–12. *Aleptina* male genitalia. **7** *A. inca* Dyar, male genital details **8** *A. inca* Dyar, male genital details of aedeagus **9** *A. clinopetes* Dyar, male genital details **10** *A. clinopetes* Dyar, male genital details of aedeagus **11** *A. arenaria* Metzler & Forbes, male genital details, paratype **12** *A. arenaria* Metzler & Forbes, male genital details of aedeagus, paratype.

Etymology. Gypsum sand is the substrate of the white dune field at White Sands National Monument. *Arena* means sand in Latin. The Latin suffix -aria means connected with something. The specific epithet of this species, *arenaria*, a singular adjective, calls attention to the specialized sandy habitat where *Aleptina arenaria* was discovered.

Diagnosis. *Aleptina arenaria* (Figs 1, 2) is a gray moth with normal noctuid transverse markings and spots. The diagnostic features are 1) male with gray hindwings, 2) antemedial and subterminal areas of the forewing are pale tan (chamois colored), 3) smoothly rounded apex of the male valve without process (Fig. 11), and 4) blunt posteriorly directed processes on female 8th sternite (Figs 13, 14). In White Sands National Monument *A. arenaria* flies with and might be mistaken for a washed-out specimen of *Aleptina inca* Dyar, 1913 (Figs 3, 4). The male hind wing of *A. inca* is white, the male hindwing of *A. arenaria* is gray. The clasper of the male genitalia of *A. inca* (Fig. 7) is half the length of the valve and slender; the clasper of *A. arenaria* is shorter and heavier, more like that of *Aleptina clinopetes* (Dyar, 1920) (Figs 5, 6, 9). The costal margin at the distal end of the valve of *A. clinopetes* (Fig. 9) has a finger-like process; the costal margin at the distal end of the valve of *A. arenaria* is without a process. The posteriorly directed processes of the female 8th sternite of *A. inca* (Fig. 15) are thin, long, and pointed; the processes of *A. arenaria* are stout and short. In *A. clinopetes*, the processes are stout and longer (Fig. 16). In the key to species in Todd et al. (1984), *A. arenaria* keys to *A. inca* in couplet 1 because both species have the front (frons) produced into a shelf-like prominence. The differences noted above will separate *A. arenaria*, *A. inca*, and *A. clinopetes*.

Description. Adult male (Fig. 1). Head - frons produced into a shelf, gray dorsad, pale tan (chamois colored) between the shelf and clypeus; vertex scales narrow strap-like, gray; labial palpus erect, scales spatulate, black laterally and dorsally, white ventrally, each segment pale tipped. Haustellum coiled between labial palpi. Antenna filiform, dorsally pale gray, closely scaled, ventrally naked, gray. Thorax - dorsum gray, mixture of pale and dark, scales spatulate; underside dirty white, scales erect long hair-like. Legs dark gray, closely scaled, sparse long hair-like whitish scales; tarsomeres dark gray and black, white tipped. Fore wing: Length 10 mm (no variation, n = 4). Gray with pale tan (chamois colored) in antemedial and subterminal areas. Basal line obscure, basal area pale gray; antemedial line double at costa, single at inner margin, antemedial area pale tan; postmedial line obscure, excurved beyond reniform, highlighted with dark dashes on veins, double at inner margin; subterminal line a white shade, postmedial area pale tan; terminal line black, subterminal area gray; orbicular spot a round black and white ring filled with gray; reniform spot a kidney shaped black and white ring filled with gray; costa at postmedial area pale gray; fringe gray with white bars; underside gray, darker along costal and terminal areas; fringe dark gray. Hind wing pale gray, darker in terminal areas, fringe pale gray; underside pale gray, costa darker, fringe pale gray. Abdomen - dorsum closely scaled, pale tan-gray; underside closely scaled, whitish. Genitalia (Fig. 11) - tegumen expanded laterally, bilobed, uncus nearly straight, lightly setose, terminally produced to a small bulb, three stout dorsal setae; saccus short, narrowly V-shaped; juxta with long thin spine

pointed anteriorly; valve strap-like, sacculus sclerotized, well developed, costa undulating, sclerotized basal 2/3 length, cucullus membranous, corona not developed, clasper sinuous, 1/3 length of valve, stout at base, produced to a point. Aedeagus (Fig. 12) sinuous, sclerotized, apex with thin blunt point, vesica with two patches of thin setae.

Adult female (Fig. 2): similar to male. Forewing length 10 mm, no variation, $n = 7$. Genitalia (Figs 13, 14): Papilla analis not sclerotized, setose; posterior apophysis extends anteriorly to mid-point of eighth segment; anterior apophysis short and stout; eighth segment anterior ventral margin with two posteriorly directed processes, broadly rounded, acute apices; ductus bursae sclerotized at extreme posterior end, else membranous, elongate directed to right; corpus bursae expanded to left, signa absent.

Remarks. This new species is placed in the genus *Aleptina* Dyar (1902) based on appearance of the adult and the structure of the male and female genitalia.

Distribution and biology. *Aleptina arenaria* occurs in White Sands National Monument, Otero County, New Mexico (Figs 17, 18). Adults were collected in black light traps placed within the white gypsum dunes, and interdunal areas. The immature stages and larval host plants are unknown.

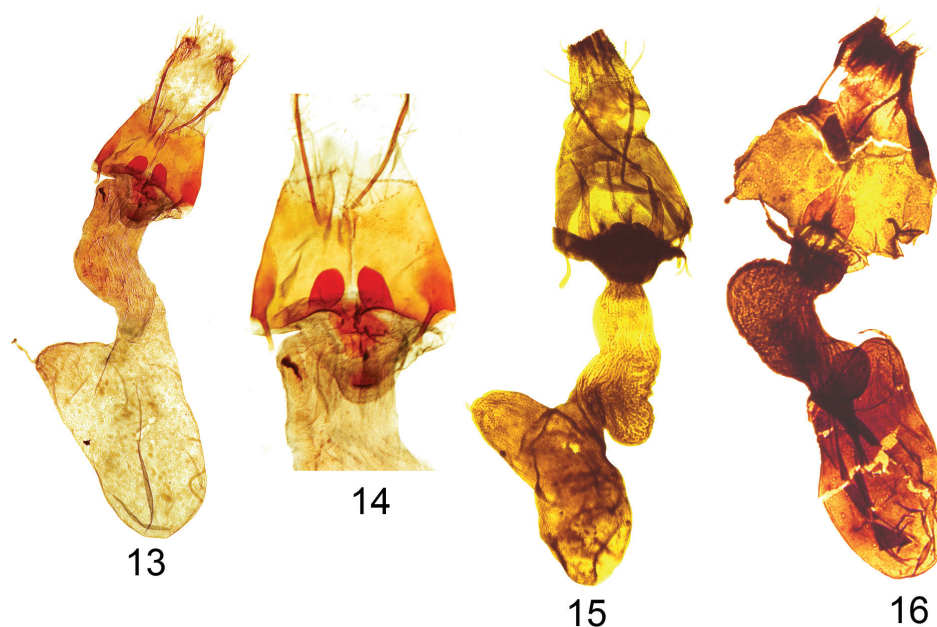
Discussion

In 2006 the U.S. National Park Service invited Metzler to initiate a long-term study of the Lepidoptera at White Sands National Monument, Otero County, New Mexico. A primary purpose of the study was to compile an inventory of moths in habitats within and immediately adjacent to the white gypsum dunes in the Monument.

White Sands National Monument preserves 285 km² (110 mi²), or about 40%, of the world's largest snow-white gypsum dune field. The remainder of the 275 square miles dune field is under the jurisdiction of the U.S. Army in the White Sands Missile Range. The dune field is located in the northern Chihuahuan Desert in southern New Mexico's Tularosa Basin (Schneider–Hector 1993). A complete description of the study site and some of its unique biological resources is in Metzler et al. (2009).

There is a dearth of research on the invertebrate fauna in the gypsum dune field in the Tularosa Basin of New Mexico. Details of previous research pertinent to insects is in Metzler et al. (2009).

In the period 9 February 2007 through 30 September 2010 Metzler and Forbes identified more than 430 species of Lepidoptera (unpublished data) from the Monument. Because of the unusual physical and biological qualities of the New Mexico white gypsum dunes, we were especially aware of the possibility of finding undescribed species of moths. This is the fifth (Metzler et al. 2009, Metzler et al. 2010a, Metzler et al. 2010b, Metzler and Forbes 2011) in a series of papers pertinent to a detailed study of the Lepidoptera at White Sands National Monument, and this is the third species of moth described as part of this study. The study of Lepidoptera



Figures 13–16. *Aleptina* female genitalia. 13 *A. arenaria* Metzler & Forbes, female genital details. paratype 14 *A. arenaria* Metzler & Forbes, female genital details of two eighth sternite processes. paratype 15 *Aleptina inca* Dyar, female genital details 16 *A. clinopetes* Dyar, female genital details.

at White Sands National Monument by Metzler and Forbes is projected to last approximately 10 years.

Acknowledgments

The Western National Parks Association, Tucson, Arizona contributed funding for travel for this study of Lepidoptera at White Sands National Monument. We are grateful for their financial support.

Several persons, Hildy Reiser, Diane White, Cliff Spencer, and Kevin R. Schneider, from the U.S. National Park Service were instrumental in arranging and promoting this study of the moths at White Sands National Monument. We especially thank David Bustos from White Sands National Monument for his assistance and support of our research. The National Park Service renewed the study for 2007 through 2010. Representatives from research collections provided insect pins, alcohol, identification services, research consultation, and storage space for specimens collected. We thank the following persons for offering support from their respective institutions: David B. Richman (NMSU) Kelly B. Miller, Sandra L. Brantley, and David C. Lightfoot (UNM), Frederick W. Stehr, Anthony I. Cognato, and Gary L. Parsons (MSU), Charles V. Covell, Jr., University of Florida, Gainesville FL, J. Donald Lafontaine, Canadian National



Figures 17–18. *Aleptina arenaria* habitat and distribution map. **17** White dunes habitat of type locality of *A. arenaria* **18** Distribution map for *A. arenaria*.

Collection, Ottawa ON, Larry Berger Ohio Department of Agriculture, and David G. Furth (USNM). Patricia A. Metzler faithfully assisted Metzler in many aspects of this study. We thank Sandra Brantley, Frederick W. Stehr, and two anonymous reviewers for reading the paper and offering valuable suggestions. Don Lafontaine assisted with dissections of male genitalia, and Jocelyn Gill assisted with layout of the color illustrations.

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The Lepidoptera of White Sands National Monument, Otero County, New Mexico, USA 4. A new species of *Schinia* Hübner, 1818 (Lepidoptera, Noctuidae, Heliothinae)

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Abstract

In 2006 the U.S. National Park Service initiated a long term study of the Lepidoptera at White Sands National Monument, Otero County, New Mexico. *Schinia poguei* sp. n., described here, was discovered in 2007, the second year of the study. The male and female adult moths and genitalia are illustrated.

Keywords

Lepidoptera, Noctuidae, White Sands National Monument, Tularosa Basin, New Mexico, biological diversity, white gypsum dunes, National Monument, Otero County

Introduction

The North American species of the genus *Schinia* Hübner, 1818 were revised by Hardwick (1996). In 2007, 2008, 2009, and 2010 adults of an undescribed spe-

cies of *Schinia* Hübner were collected at White Sands National Monument, New Mexico. No specimens of this species were known prior to this study of insects at the Monument. The lack of specimens can probably be attributed to the dearth of insect collecting in the gypsum dunes ecosystem in New Mexico which is under the control of the U.S. National Park Service and the U.S. Army's White Sands Missile Range.

Methods

More than 250 samples of moths and other night flying insects were collected in U.S.D.A. type black light traps, and at black light, sometimes with mercury vapor light, and sheet, as described in Covell (1984), on 75 different nights. A detailed description of the study methods is in Metzler et al. (2009). Genitalia were examined following procedures outlined in Metzler and Forbes (2011a). Terminology for elements of wing pattern, morphology, and genital structures follow Forbes (1954), Hardwick (1970), Lafontaine (1987, 2004), and Mikkola et al. (2009).

All specimens were collected as part of a long-term study of Lepidoptera at White Sands National Monument. Specimens are deposited in the following collections:

EHM	Eric H. Metzler, Alamogordo, NM, for subsequent transfer to MSU
MSU	Albert J. Cook Arthropod Research Collection, Department of Entomology, Michigan State University, East Lansing, MI
NMSU	New Mexico State University Arthropod Collection, Las Cruces, NM
UFL	McGuire Center for Lepidoptera and Biodiversity, University of Florida, Gainesville, FL
UNM	Museum of Southwestern Biology, University of New Mexico, Albuquerque, NM
USNM	provisionally deposited in United States Museum of Natural History (Smithsonian Institution), Washington, DC pending mutual resolution and agreement with the National Park Service regarding specimen deposition
WHSA	White Sands National Monument, NM

Results

Schinia poguei Metzler & Forbes, sp. n.

urn:lsid:zoobank.org:act:D14AE8E8-6FD4-4B1B-A822-FBCE07620690

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

Figs 1–4, 7, 8, 11, 13, 14

Type material. Holotype female, pinned with label as follows: “USA: NM: Otero Co. White Sands Nat[ional] Mon[ument], interdune habitat, 106°10.84'W, 32°46.64'N,



Figures 1–6. *Schinia* adults. **1** *S. poguei* Metzler & Forbes, female holotype **2** *S. poguei* Metzler & Forbes, male paratype **3** *S. poguei* Metzler & Forbes, female paratype **4** *Schinia poguei* Metzler & Forbes, male paratype **5** *S. walsinghami* Grote, female **6** *S. walsinghami* Grote, male.

4,008', 10 Oct[ober]. 2010, WsnmF, Eric H. Metzler, uv tr[a]p, Accss #: WHSA - 00131" "HOLOTYPE USNM *Schinia poguei* Metzler & Forbes" [red handwritten label] (USNM). Paratypes: 290 males and 107 females: NM: Otero Co. White Sands Nat[ional] Mon[ument] (hereafter WSNM) same data as Holotype. USA: NM: Otero Co. White Sands Nat[ional] Mon[ument], interdune habitat, 106°10.84'W, 32°46.64'N, 4,008', 4 Oct[ober]. 2010, WsnmF, Eric H. Metzler, uv tr[a]p, Accss #: WHSA - 00131 USA: NM: Otero Co. WSNM, interdune habitat, 106°11.49'W, 32°45.60'N, 4,000', 14 Sept[ember] 2009, WSNMB, Eric H. Metzler, uv tr[a]p, Ac-

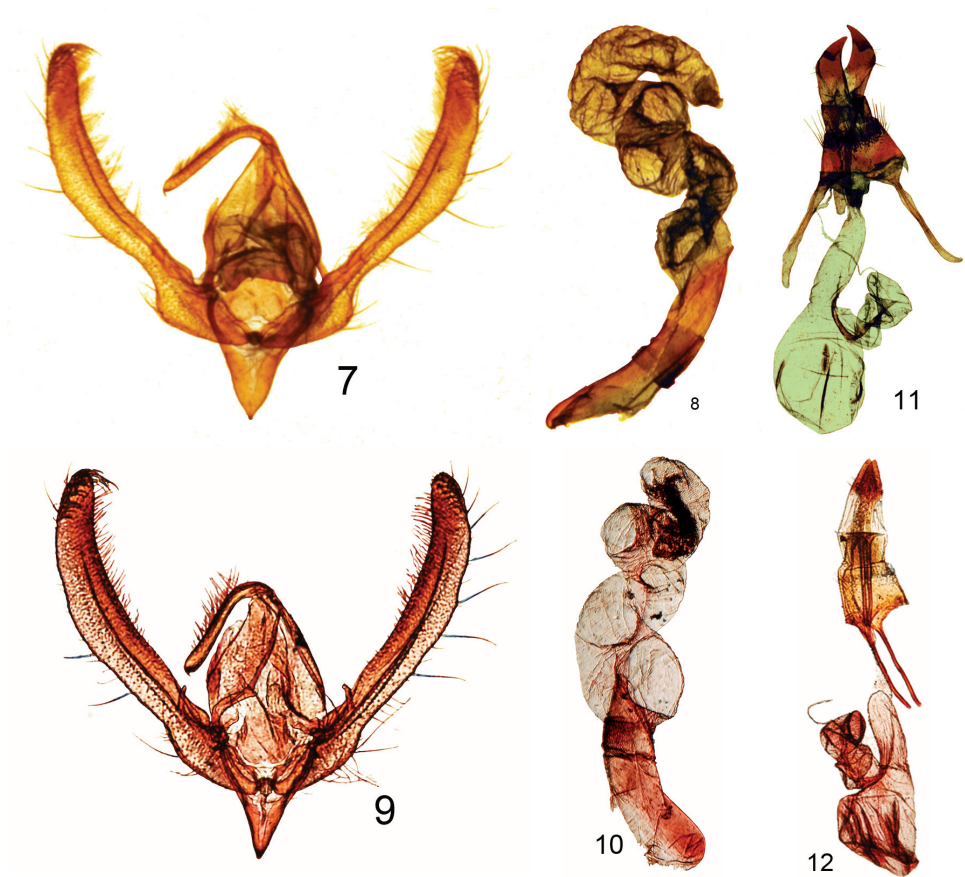
css #: WHSA - 00131. USA: NM: Otero Co. WSNM, interdune habitat, 106°11.38, 32°46.69'N, 4,000', 14 Sept[ember] 2009, WSNM8 Eric H. Metzler, uv tr[a]p, Accss #: WHSA - 00131. USA: NM: Otero Co. WSNM, interdune habitat, 106°11.32'W, 32°45.72'N, 4,000', 14 Sept[ember] 2009, WSNM9 Eric H. Metzler, uv tr[a]p, Accss #: WHSA - 00131. USA: NM: Otero Co. WSNM, 4000 ft. 32°45'41.4"N, 106°11'21.3"W, 5 X 2007, G. Forbes, 15w blacklight, interdune area with cottonwoods 2 mi SW Administration Bldg. ACCESSION NUMBER WHSA - 00131. USA: NM: Otero Co. WSNM, 4008 ft. Storage area W of Big Pedestal Rd. 23 IX 2008, G. Forbes, 15w blacklight, 32°46'42.3"N, 106°10'50.9"W, interdune scrub, ACCESSION NUMBER WHSA - 00131. USA: NM: Otero Co. WSNM, 4000 ft. 32°45'42.43"N, 106°11'18.57"W, 3 X 2008, G. Forbes, dune edge 50 m N of end Big Pedestal Rd. behind cottonwoods along road, ACCESSION NUMBER WHSA - 00131. USA: NM: Otero Co. WSNM, 4000 ft. 32°45'36.47"N, 106°11'28.22"W, interdune with cottonwoods 2 mi SW Admin Bldg, 15 bl[ac]kl[igh]t, 20 IX 2008, G. Forbes, ACCESSION NUMBER WHSA - 00131. USA: NM: Otero Co. WSNM, 4002 ft., Garton Pond, 2 mi. SE Vis. Ctr., 15 w blklight, 32°46'30.27"N, 106°08'42.96"W, 3 X 2008, G. Forbes, saltbush scrub, ACCESSION NUMBER WHSA - 00131. USA: NM: Otero Co. WSNM, 4008 ft., Storage area W of Big Pedestal Rd. 1 X 2008, G. Forbes, 15 w blacklight, 32°46'41.3"N, 106°10'50.9"W, interdune scrub, ACCESSION NUMBER WHSA - 00131. USA: NM: Otero Co. WSNM, 4008 ft., Storage area W of Big Pedestal Rd. 20 IX 2008, G. Forbes, 15 w blacklight, 32°46'41.3"N, 106°10'50.9"W, interdune scrub, ACCESSION NUMBER WHSA - 00131. USA: NM: Otero Co. WSNM, 3999 ft., 32°46'46.60"N, 106°10'26.70"W, 05 X 2007, G. Forbes, UV/MV lights, Admin. Bldg. Gypsum soil, Atriplex scrub, ACSN# WHSA - 00131. USA: NM: Otero Co. WSNM 3999 ft. 32°46'46.60"N, 106°10'26.70"W, 1 X 2008 G. Forbes 15w blacklight Admin bldg. Gypsum soil, Atriplex scrub Acsn# WHSA-00131. USA: NM: Otero Co. WSNM 4003 ft. 32°46'41.3"N, 106°10'50.9"W, 19 IX 2009 G. Forbes Boneyard storage area, Interdune scrub 15w blacklight trap Acsn# WHSA-00131. USA: NM: Otero Co. WSNM 4003 ft. 32°46'41.3"N, 106°10'50.9"W, 23 IX 2008 G. Forbes 15w blacklight, Boneyard storage area, Interdune Acsn# WHSA-00131. USA: NM: Otero Co. White Sands Nat[ional] Mon[ument], crest of dunes, 106°11.42'W, 32°45.69'N, 4,014', 4 Oct[ober]. 2010, WSNMC, Eric H. Metzler, uv tr[a]p, Accss #: WHSA - 00131. USA: NM: Otero Co. White Sands Nat[ional] Mon[ument], crest of dunes, 106°11.42'W, 32°45.69'N, 4,014', 10 Oct[ober]. 2010, WSNMC, Eric H. Metzler, uv tr[a]p, Accss #: WHSA - 00131. USA: NM: Otero Co. White Sands Nat[ional] Mon[ument], edge of dunes, 106°11.33'W, 32°45.70'N, 4,001', 4 Oct[ober]. 2010, WSNM3, Eric H. Metzler, uv tr[a]p, Accss #: WHSA - 00131. USA: NM: Otero Co. White Sands Nat[ional] Mon[ument], edge of dunes, 106°11.33'W, 32°45.70'N, 4,001', 10 Oct[ober]. 2010, WSNM3, Eric H. Metzler, uv tr[a]p, Accss #: WHSA - 00131. USA: NM: Otero Co. White Sands Nat[ional] Mon[ument], interdune vegetation, 106°10.82'W, 32°46.62'N, 4,008', 4 Oct[ober]. 2010, WSNMD, Eric H. Metzler, uv tr[a]p, Accss #: WHSA - 00131 Paratypes are deposited with NMSU, UNM, MSU, EHM, UFL, USNM, and WHSA.

Etymology. The specific epithet of this species, *poguei*, a noun in the genitive case, recognizes Michael G. Pogue's contributions to the study of Lepidoptera. Mike Pogue and Metzler share a personal friendship going back to the early 1990s. We are pleased to name this species for Mike Pogue.

Diagnosis. *Schinia poguei* (figs 1–4), a pale tan moth with white markings and darker accents, looks most like pale specimens of *S. walsinghami* (Henry Edwards, 1881) (figs 5, 6, 9, 10, 12). The diagnostic features are in the genitalia and the color of the maculation. In the female genitalia: 1) the papilla anales (ovipositor lobes) of *S. poguei* are curved upward, and the papilla anales of *S. walsinghami* are V shaped and not curved; 2) on the 9th abdominal segment the minute spiculation is less dense in *S. poguei*, and the spicules are wider in *S. poguei* than in *S. walsinghami*; 3) on the 8th segment the setae are long and dense in *S. poguei* and shorter and more sparse in *S. walsinghami*; and 4) the anterior and posterior apophyses are thicker in *S. poguei* than in *S. walsinghami*. In the male genitalia the ampulla of *S. poguei* is short and broad, and in *S. walsinghami* the ampulla is twice as long and one half as wide as *S. poguei*. At White Sands National Monument, where the two species are sympatric, *Schinia walsinghami*, which flies in August and September, is a gray-brown moth with white markings, whereas *S. poguei* flies in September and October and is a pale tan moth with white markings.

Description. Adult male (figs 2, 4): *Head*: front closely scaled, pale tan; vertex scales narrow, strap-like, rough, pale tan. Labial palpus pale tan; erect, scales hair-like and strap-like, closely scaled laterally and mesally, longer scales form longer ragged fringe ventrally and shorter fringe dorsally. Haustellum coiled between labial palpi with three complete loops. Antenna filiform, dorsally pale tan, closely scaled, ventrally naked, brown. *Thorax*: dorsum pale tan, scales long hair-like or strap-like; underside whitish, scales erect long hair-like. Legs: coxa and femur whitish, closely scaled with long hair-like scales on ventral surface forming a shaggy fringe; fore tibia pale tan, closely scaled, spine-like setae, stout on lateral margins, apex with one inner and one outer long stout spine-like seta; mid and hind tibia, tibial spines, and tarsomeres pale tan, closely scaled. Fore wing: Length 9.0–13.0 mm, mean 11.5 mm, n = 72, pale tan; antemedial line strongly excurved, white, lined with black and/or dark-brown scales basally; postmedial line strongly excurved over cell and recurved to inner margin, white, lined with black and/or dark-brown scales distally, vague basally; subterminal line a white shade; terminal line a series of small black spots; orbicular spot obscure; reniform spot crescent shaped, white, sometimes highlighted with a smudge of darker scales; fringe pale tan; underside whitish, upperside markings vaguely visible; fringe whitish. Hind wing: whitish, outer one-third from tornus to inner margin ranges from fuscous to pale tan, discal spot obscure; fringe whitish; underside white. *Abdomen*: dorsum closely scaled, pale tan; underside whitish, closely scaled. Genitalia (figs 7, 8): Tegumen expanded laterally, lateral lobes at junctures with valvae, narrowed at dorsum; uncus cylindrical, apex short, acutely pointed, turned downward, length = $0.34 \times$ length of valve; saccus short, V shaped, apex acute; juxta shield shaped, slightly cleft on anterior margin; valve elongate, narrow, width of valve at widest part = 0.12

\times length of valve, slightly curved, sacculus well developed, ampulla well developed, short and broad, length = $0.03 \times$ length of valve; cucullus not well differentiated, corona with 16–18 mesally directed curved strong setae. Aedeagus with sclerotized process directed anteriorly at approximate mid point, vesica with 3 coils, flattened subbasal diverticulum present. **Adult female** (figs 1, 3): similar to male. Forewing length 10.5–13.0 mm, mean 12.1 mm, $n = 46$. Genitalia (fig. 11): Papilla analis sclerotized, flattened, curved upward, broad at base, apex pointed, not fused; posterior apophysis flattened, widened, extending anteriorly to slightly beyond anterior margin of 8th abdominal segment; anterior apophysis flattened, widened, length similar to posterior apophysis; 8th abdominal segment ringed with elongate setae; ductus bursa lightly sclerotized near posterior end, elongate; corpus bursa ovate with 4 elongate signa; appendix bursae with 3 coils.



Figures 7–12. 7–10 *Schinia* male genitalia. 7 *S. poguei* Metzler & Forbes, male genitalia paratype 8 *S. poguei* Metzler & Forbes, male aedeagus paratype 9 *S. walsinghami* Grote, male genitalia 10 *S. walsinghami* Grote, male genitalia aedeagus; 11–12 *Schinia* female genitalia 11 *S. poguei* Metzler & Forbes, female genitalia paratype 12 *S. walsinghami* Grote, female genitalia.

Remarks. This new species is placed in the genus *Schinia* Hübner, 1818, based on the appearance of the imago and structure of the male and female genitalia. The spiculation on the 9th abdominal segment is best seen with a compound microscope. A female was selected as holotype because the differences in the papilla analis between *S. walsinghami* and *S. poguei* can be seen in situ without dissection. Individual specimens of *S. poguei* may be lighter or darker in color. Darker specimens appear to have more complete forewing patterns on upper and undersides. Abdomens tend to grease, and sometimes the grease invades the wings.

Distribution and biology. *Schinia poguei* occurs in White Sands National Monument, Otero County, New Mexico (figs 13, 14). Adults were collected in black light traps and at black light, or mercury vapor light, and sheet placed within or adjacent to the white gypsum dunes, and interdunal areas. The immature stages are unknown.

Discussion. In 2006 the U.S. National Park Service invited Metzler to initiate a long-term study of the Lepidoptera at White Sands National Monument, Otero County, New Mexico. A primary purpose of the study was to compile an inventory of moths in habitats within and immediately adjacent to the white gypsum dunes in the Monument.

White Sands National Monument preserves 284.9 km² (110 square miles), or about 40%, of the world's largest snow-white gypsum dune field. The remainder of the 275 square miles dune field is under the jurisdiction of the U.S. Army in the White Sands Missile Range. The dune field is located in the northern Chihuahuan Desert in southern New Mexico's Tularosa Basin (Schneider-Hector 1993). In 1950 Stroud



Figure 13. White dune habitat of type locality of *Schinia poguei*.



Figure 14. Distribution map for *Schinia poguei*.

reported twenty species of Lepidoptera from the Monument. In the period 9 February 2007 through 31 December 2010 Metzler and Forbes identified more than 430 species of Lepidoptera (unpublished data) from the Monument. A complete description of the study site and some of its unique biological resources is in Metzler et al. (2009).

This is the sixth in a series of papers (Metzler et al. 2009, 2010; Metzler and Forbes 2011a, 2011b) pertinent to a detailed study of the Lepidoptera at White Sands National Monument. This is the fourth species of moth, described as part of this study, and the third species that appears to be a white species (Kain 2000). The study of Lepidoptera at White Sands National Monument by Metzler and Forbes is projected to last approximately 10 years.

Acknowledgments

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Michael G. Pogue was very helpful with the identification and diagnosis of the new species. Several persons, Hildy Reiser, Diane White, Cliff Spencer, and Kevin R. Schneider, from the U.S. National Park Service were instrumental in arranging and promoting this study of the moths. We especially thank David Bustos from White Sands National Monument for his assistance and support of our research. The National Park Service

renewed the study for 2007 through 2011. Representatives from research collections provided insect pins, alcohol, identification services, research consultation, and storage space for specimens collected. We thank the following persons for offering support from their respective institutions: David B. Richman (NMSU) Kelly B. Miller, Sandra L. Brantley, and David C. Lightfoot (UNM), Frederick W. Stehr, Anthony I. Cognato, and Gary L. Parsons (MSU), Charles V. Covell, Jr., Jacqueline Y. Miller, and Thomas C. Emmel (UFL), J. Donald Lafontaine (CNC), Larry Berger Ohio Department of Agriculture, and David G. Furth (USNM). Patricia A. Metzler faithfully assisted Metzler on many aspects of this study. We thank Michael G. Pogue, Charles E. Harp, and two anonymous reviewers for reading the paper and offering valuable suggestions.

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- butions to the systematics of New World macro-moths III. *ZooKeys* 149: 117–123. doi: 10.3897/zookeys.149.1516
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Additions and corrections to the check list of the Noctuoidea (Insecta, Lepidoptera) of North America north of Mexico

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Abstract

A total of 115 additions and corrections are listed and discussed for the check list of the Noctuoidea of North America north of Mexico published in 2010. Thirty-two of these are changes in authorship and/or date of publication or spelling. Taxonomic changes are 33 new or revised synonymies, three new combinations, and six revisions in status from synonymy to valid species.

Keywords

Canada, United States, Notodontidae, Doidae, Erebiidae, Euteliidae, Noctuidae, Nolidae, distribution, faunistics

Introduction

Continuing work on the check list of Noctuoidea of North America north of Mexico has resulted in 115 changes to the list published last year (Lafontaine and Schmidt 2010). About one-third of these (32) are corrections in date, authorship or spelling, but the majority is the result from continuing taxonomic work in comparing species and generic concepts with type material and examination of genital characters. Sixteen species are added to the fauna: two were omitted previously; six were described

in the past year; five are newly reported from the United States, and three are former synonyms now recognized as valid species. Thirty species are deleted from the fauna through synonymy or re-identification, reducing the total number of species to 3679 (down from 3693).

Materials and methods

Repository abbreviations

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

BMNH	The Natural History Museum [statutorially: British Museum (Natural History)], London, UK
CNC	Canadian National Collection of Insects, Arachnids, and Nematodes, Ottawa, Ontario, Canada
FMNH	The Field Museum, Chicago, Illinois, USA
ODA	Oregon Department of Agriculture, Salem, Oregon, USA
TLSRC	Texas Lepidoptera Survey Research Collection, Houston, Texas, USA
USNM	National Museum of Natural History [formerly, United States National Museum], Washington, District of Columbia, USA
ZMHB	Museum für Naturkunde der Humboldt-Universität, Berlin, Germany

Results

Corrections, additions, and changes (highlighted in bold)

p. 2 & p. 14 Subfamily Lymantriinae Hampson

Tribe Nygmiini Holloway, 1999 [after Tribe Leucomini]

p. 3 & p. 39 Subfamily Eulepidotinae Grote, **1895**

p. 3 & p. 39 Tribe Eulepidotini Grote, **1895**

p. 4 & p. 64 Subfamily Agaristinae **Boisduval, 1833**

930067 *Macrurocampa marthesia* (Cramer, [1780])

930125 *Elasmia packardii* (Morrison, 1875)

930126 *Elasmia cave* Metzler, **2011**

syn. *Hippia insularis* of authors, not Grote, 1866

930126.1 *Elasmia mandela* (Druce, 1887)

ssp. *E. m. santaana* Metzler & Knudson, 2011

930130 *Symmerista suavis* (Barnes, 1901)

930139 *Scotura annulata* (Guérin-Méneville, 1844)

930370.1 *Lophocampa bicolor* Walker, 1855

930496.1 *Zanclognatha dentata* Wagner & McCabe, 2011930582 *Hypena degesalis* Walker, 1859930613 *Gonodonta sicheas* (Cramer, [1777])930615 *Gonodonta pyrgo* (Cramer, [1777])930617 *Gonodonta nutrix* (Stoll, [1780])930627 *Hypocala andremona* (Stoll, [1781])930633 *Goniapteryx servia* (Stoll, [1780])**930638.5 *Rhosologia porrecta* Walker, 1865**930641 *Gabara stygialis* (Smith, 1903)**syn. *G. infumata* (Hampson, 1926)**930758 *Thysania zenobia* (Cramer, [1777])930792 *Catocala ilia* (Cramer, [1775])930822 *Catocala californiensis* Brower, 1976930845 *Catocala grynea* (Cramer, [1779])930853 *Catocala clintonii* Grote, 1864930864 *Cissusa spadix* (Cramer, [1780])930880 *Melipotis novanda* (Guenée, 1852)**syn. *M. agrotipennis* (Harvey, 1875)**930924 *Caenurgina erechtea* (Cramer, [1780])930951 *Argyrostroma flavistriaria* (Hübner, [1831])**syn. *A. herbicola* (Guenée, 1852)****syn. *A. contempta* (Guenée, 1852)****syn. *A. diffundens* (Walker, 1858)****syn. *A. carolina* (Smith, 1905)**930954 *Argyrostroma quadrifilaris* (Hübner, [1831])930957 *Gondysia similis* (Guenée, 1852)930958 *Gondysia consobrina* (Guenée, 1852)**syn. *G. pertorrida* Berio, 1955**930959 *Gondysia smithii* (Guenée, 1852)930960 *Gondysia telma* (Sullivan, 2010)930994 *Metria celia* (Stoll, [1781])931004 *Zaleops umbrina* (Grote, 1883)**syn. *Z. paresa* (Smith, 1906)**931049 *Zale intenta* (Walker, [1858])**syn. *Z. woodii* (Grote, 1877)**931069.1 *Eulepidotis dominicata* (Guenée, 1852)931069.2 *Eulepidotis persimilis* (Guenée, 1852)931084 *Athyrra adjutrix* of authors, not (Cramer, [1780])931086 *Syllectra erycata* (Cramer, [1780])931138 *Nola involuta* Dyar, 1898**syn. *N. exposita* Dyar, 1898****syn. *N. aphyla* (Hampson, 1900)****= *Nola apera* of authors, not Druce, 1897**

- 931255 *Cydosia nobilitella* (Cramer, [1780])
 931314 *Ponometia candefacta* (Hübner, [1831])
 931329 *Ponometia fasciatella* (Grote, 1875)
 931392 *Spragueia margana* (Fabricius, 1794)
 syn. *S. cuviana* (Fabricius, 1798)
 931426 *Acronicta cyanescens* Hampson, 1909
 931427 *Acronicta vulpina* (Grote, 1883)
 931434.1 *Acronicta parallela* (Grote, 1879)
 931434.2 *Acronicta mansueta* (Smith, 1897)
 931450 *Acronicta theodora* of authors, not Schaus, 1894
 931467 *Acronicta increta* Morrison, 1874
 931611 *Oxycnemis advena* Grote, 1882
 syn. *O. gustis* Smith, 1907
 931617 *Oxycnemis grandimacula* Barnes & McDunnough, 1910
 syn. *O. erratica* Barnes & McDunnough, 1913
 931636.1 *Aleptina arenaria* Metzler & Forbes, 2011
 931663.1 *Plagiomimicus pyralina* (Schaus, 1904)
 931725.1 *Azenia procida* (Druce, 1889)
 syn. *A. nepotica* (Dyar, 1912)
 931993 *Condica mersa* (Morrison, 1875)
 syn. *C. lunata* (Barnes & McDunnough, 1916)
 931994.1 *Condica luxuriosa* (Dyar, 1926)
 931997 *Condica concisa* (Walker, 1856)
 syn. *C. proxima* (Morrison, 1876)
 932006 *Condica chardra* (Schaus, 1906)
 syn. *C. revellata* (Barnes & Benjamin, 1924)
 932011 *Condica egestis* (Smith, 1894)
 syn. *C. ignota* (Barnes & Benjamin, 1924)
 932014 *Condica cupentia* (Cramer, [1779])
 932087.1 *Schinia carrizoensis* Osborne, 2010
 932135.1 *Schinia psamathea* Pogue, 2010
 932154.1 *Schinia poguei* Metzler & Forbes, 2011
 932222 *Spodoptera androgea* (Stoll, [1780])
 932223 *Spodoptera eridania* (Stoll, [1781])
 932239.5 *Pseudomarimatha flava* Ferris & Lafontaine, 2010
 932249.50 *Chytonix palliatricula* (Guenée, 1852)
 932249.51 *Chytonix sensilis* Grote, 1881
 syn. *C. ruperti* Franclemont, 1941
 932328 *Apamea tahoeensis* Mikkola & Lafontaine, 2009
 932709 *Ufeus satyricus* Grote, 1873
 ssp. *U. s. sagittarius* Grote, 1883
 syn. *U. electra* Smith, 1908
 932711 *Ufeus hulstii* Smith, 1908

- 932819 *Trichocosmia inornata* Grote, 1883
syn. *T. drasteroides* (Smith, 1903)
- 932832 *Anarta inconcinna* (Smith, [1888])
syn. *A. castrae* (Barnes & McDunnough, 1912)
syn. *A. ultra* (Barnes & Benjamin, 1924)
syn. *A. montanica* (McDunnough, 1930)
- 932836 *Anarta obesula* (Smith, 1904)
syn. *A. subalbida* (Barnes & Benjamin, 1924)
- 932847 *Scotogramma submarina* (Grote, 1883)
syn. *S. addenda* Barnes & Benjamin, 1924
- 932849 *Scotogramma densa* Smith, 1893
syn. *S. megaera* Smith, 1899
- 932880 *Lacanobia radix* (Walker, [1857])
syn. *L. desperata* (Smith, 1891)
- 932909 *Hecatera dysodea* ([Denis & Schiffermüller], 1775)
- 933009 *Lasionycta sierra* Crabo & Lafontaine, 2009
- 933017 *Lacinipolia lustralis* (Grote, 1875)
syn. *L. selama* (Strecker, 1898)
- 933062 *Lacinipolia comis* (Grote, 1876)
syn. *L. lunolacta* (Smith, 1903)
- 933093.1 *Homorthodes euxoiformis* (Barnes & McDunnough, 1913)
- 933105 *Protorthodes incincta* (Morrison, 1874)
syn. *P. smithii* (Dyar, 1904)
- 933121 *Ulolonche fasciata* Smith, [1888]
syn. *U. marloffi* (Barnes & Benjamin, 1924)
- 933128 *Pseudorthodes vecors* (Guenée, 1852)
syn. *P. imora* (Strecker, 1898)
syn. *P. calceolaris* (Strecker, 1900)
- 933143 “*Orthodes*” *noverca* (Grote, 1878)
syn. “*O.*” *vauorbicularis* (Smith, 1902)
syn. “*O.*” *delecta* (Barnes & McDunnough, 1916)
- 933156.1 “*Hexorthodes*” *accurata* (H. Edwards, 1882)
- 933169 *Neleucania praegracilis* (Grote, 1877)
syn. *N. bicolorata* (Grote, 1881)
syn. *N. niveicosta* Smith, 1902
syn. *N. citronella* Smith, 1902
syn. *N. suavis* (Barnes & McDunnough, 1912)
- 933210 *Xanthopastis regnatrrix* (Grote, 1863)
syn. *X. timais* of authors, not Cramer, [1780])
- 933210.1 *Xanthopastis moctezuma* Dyar, 1913
- 933280 *Copablepharon spiritum* Crabo & Fauske, 2004
ssp. *C. s. spiritum* Crabo & Fauske, 2004
ssp. *C. s. lutescens* Crabo & Fauske, 2004

ssp. *C. s. bicolor* Crabo & Fauske, 2004933282 *Copablepharon canariana* McDunnough, 1932ssp. *C. c. contrasta* McDunnough, 1932933308 *Euxoa adumbrata* (Eversmann, 1842)ssp. *E. a. thanatologia* (Dyar, 1904)933596 *Xestia speciosa* (Hübner, [1813])ssp. *X. s. apropitia* (Benjamin, 1933)**Notes****p. 2 & p. 14 Subfamily Lymantriinae Hampson, Tribe Nygmiini Holloway, 1999 –**This tribe should be added to the check list for the Old World genus *Euproctis* Hübner, [1819]. *Euproctis* was listed in error in the tribe Leucomini.**p. 3 & p. 39 Subfamily Eulepidotinae –** The year of publication is 1895, not 1985.**p. 3 & p. 39 Tribe Eulepidotini –** The year of publication is 1895, not 1985.**p. 4 & p. 64 Subfamily Agaristinae –** The author and year are Boisduval, 1833, not Herrich-Schäffer, [1858].**930067 *Macrurocampa marthesia* –** The year of publication was deduced through external sources, so it should be shown in brackets. See note under 930617.**930125 *Elasmia packardii* –** New combination from Metzler and Knudson (2011).**930126 *Elasmia cave* –** This species was previously misidentified in North America as *Hippia insularis*, a species described from Cuba (Metzler and Knudson 2011).**930126.1 *Elasmia mandela* ssp. *santaana* –** Populations of *Elasmia mandela* occurring in south-central United States are segregated as a separate subspecies from the nominate form in Central America (Metzler and Knudson 2011).**930130 *Symmerista suavis* –** The species name was misspelled as *sauvis* in both Franclemont and Todd (1983) and in Lafontaine and Schmidt (2010).**930139 *Scotura annulata* –** This new generic combination was created when Miller (2009) synonymized the genus *Zunacetha* Walker, 1863 with *Scotura* Walker, 1854.**930370.1 *Lophocampa bicolor* –** The presence of this species in southern Texas has previously been overlooked, since it resembles washed-out specimens of *L. caryae*. It is currently known only from Big Bend NP, Brewster Co., TX (specimens in Canadian National Collection and Texas Lepidoptera Survey Collection).**930496.1 *Zanclognatha dentata* –** Addition (see Wagner and McCabe 2011).**930582 *Hypena degesalis* –** The species name was misspelled as *degasalis* in Lafontaine and Schmidt (2010) and Franclemont and Todd (1983).**930613 *Gonodonta sicheas* –** See note under 930617.**930615 *Gonodonta pyrgo* –** See note under 930617.**930617 *Gonodonta nutrix* –** The author of this species is Casper Stoll, who finished the last part of Pieter Cramer's work after Cramer's death, so the names are

credited to Stoll. The title pages of the first two volumes of Pieter Cramer's work are dated 1779, but were actually published in a series of parts between 1775 and 1777. The last two volumes are dated 1782 but were published between 1779 and 1782 and the title pages were added later when the series was completed. The 34 issues that made up the four volumes were published between 1775 and Cramer's death in 1776 and posthumously until 1780 by Casper Stoll. During 1780 the series was continued by Stoll and the names of the new species on plates 305 to 400 are credited to him. The dates are mostly deduced from external sources, so these should be shown in brackets. Only volume 4, pages 165 to 252 (plates 373 to 400) was actually published in 1782. The dates of publication of the 34 issues of texts and plates are taken from "AnimalBase – Early Zoological Literature On-line" maintained by the Zoological Institute of the University of Göttingen, Germany at (<http://www.animalbase.uni-goettingen.de> [accessed September 2011]).

930627 *Hypocala andremona* – See note under 930617.

930633 *Goniapteryx servia* – See note under 930617.

930638.5 *Rhosologia porrecta* – A specimen of this mainly Mexican species from Texas is in USNM with labels "Victoria, TX" "JD Mitchell Coll." Ed Knudson (pers. comm.) provided additional information: "Joseph Daniel Mitchell was a pioneer biologist in Texas (1848–1922). He lived in Victoria TX from 1891 to about 1920 and was known for collecting insects, mollusks, etc. No doubt the specimen is genuine."

930641 *Gabara stygialis* – *Gabara infumata* (Hampson, 1926), **syn. n.** [formerly # 930642], is a form of *Gabara stygialis* in which the dark streak along the middle of the forewing is greatly reduced.

930758 *Thysania zenobia* – See note under 930617.

930792 *Catocala ilia* – See note under 930617.

930822 *Catocala californiensis* – A nominate subspecies is listed for *C. californiensis*, but currently no other subspecies are recognized so the subspecies entry should be deleted.

930845 *Catocala grynea* – See note under 930617.

930853 *Catocala clintonii* – The correct original spelling is *C. clintonii*, not *clintoni*.

930864 *Cissusa spadix* – See note under 930617.

930880 *Melipotis novanda* – The name *Melipotis agrotipennis* (Harvey, 1875) is a synonym of *Melipotis novanda* (Guenée, 1852), **syn. n.**, not a synonym of *Melipotis agrotoides* (Walker, 1858).

930924 *Caenurgina erectea* – See note under 930617.

930951 *Argyrostromis flavistriaria* – The year of publication was deduced through external sources, so it should be shown in brackets. Synonymy with *A. herbicola* [formerly # 930947], *A. contempta* [formerly # 930948], *A. diffundens* [formerly # 930949], and *A. carolina* [formerly # 930950] from Sullivan and Lafontaine 2011.

- 930954 *Argyrostromis quadrifilaris* – The year of publication was deduced through external sources, so it should be shown in brackets.
- 930957 *Gondysia similis* – Generic combination from Sullivan and LeGrain 2011.
- 930958 *Gondysia consobrina* – Generic combination and synonymy with *G. pertorrida* from Sullivan and LeGrain 2011.
- 930959 *Gondysia smithii* – Generic combination from Sullivan and LeGrain 2011.
- 930960 *Gondysia telma* – Generic combination from Sullivan and LeGrain 2011.
- 930994 *Metria celia* – See note under 930617.
- 931004 *Zaleops umbrina* – The name *Zaleops paresa*, **syn. n.** [formerly # 931005], represents a dark form of *Zaleops umbrina* in which the forewing is mainly blackish brown with pale shading in the costal area and along the outer margin. The type specimens in AMNH (*paresa*) and USNM (*umbrina*) were both examined.
- 931049 *Zale intenta* – This revised synonymy, proposed by Schmidt 2010, was omitted from the check list.
- 931069.1 *Eulepidotis dominicata* – This species was inadvertently omitted from the 2010 check list. It was included in the 1983 MONA list (Franclemont and Todd 1983) on the basis of a report of the specimen from Texas published by Grote (1879) and discussed by Todd (1961). A recent specimen from Mission, Texas, 11 November 2002, by Leroy Koehn is in the TLSRC. A full report of the occurrence of this species and the next (*E. persimilis*) is being prepared by Ed Knudson and associates.
- 931069.2 *Eulepidotis persimilis* – A specimen of this species was collected at Mission, Texas, 17 October 2011, by Mike Rickard. The specimen is deposited in the TLSRC.
- 931084 *Athyra adjutrix* of authors – See note under 930617.
- 931086 *Syllectra erycata* – See note under 930617.
- 931138 *Nola involuta* – *Nola involuta* Dyar, 1898, **stat. rev.**, was described from California and occurs from southern California to southern Texas. It is consistently different in wing markings from *Nola apera* Druce, 1897, from Jalapa, Mexico, such as the presence of a black patch along the base of the forewing costa that is absent from *N. apera*, so we treat *N. involuta* as a valid species. *Nola exposita* Dyar, 1898, **syn. rev.** [Type locality: Phoenix, Arizona], is revised from the synonymy of *N. apera* to the synonymy of *N. involuta*. The holotype of *Nola aphylla* (Hampson, 1900), **syn. rev.** [formerly # 931134], is a badly rubbed specimen of *Nola involuta*; both names are based on southern Californian material.
- 931255 *Cydosia nobilitella* – See note under 930617.
- 931314 *Ponometia candefacta* – The year of publication was deduced through external sources, so it should be shown in brackets.
- 931329 *Ponometia fasciatella* – The year of publication is 1875, not 1975.
- 931392 *Spragueia margana* – The name *Pyrallis cuviana* Fabricius, 1798, has until recently been assigned to the Tortricidae as an unrecognized name. The type

- specimen has now been located in the Zoological Museum, University of Copenhagen, Denmark (ZMUC). *Pyrallis cuviana* Fabricius, 1798, **syn. n.**, is a synonym of (and a form of) *Pyrallis margana* Fabricius, 1794. The species is currently known as *Spragueia margana* (Fabricius, 1794) and the synonym is *Spragueia cuviana* (Fabricius, 1798), **comb. n.** The type locality was originally given as 'Habitat Kiliae' [Kiel in northern Germany], so this should be corrected to "the Americas." [Contributed by Ole Karsholt and Don Lafontaine].
- 931426 *Acronicta cyanescens* – The author and year are Hampson, 1909, not Guenée, 1852.
- 931427 *Acronicta vulpina* – The author and year are Grote, 1883, not Guenée, 1852.
- 931434.1 *Acronicta parallela* – Nearly identical externally to *A. falcula* and some populations of *A. mansueta*, and all three taxa were treated as conspecific by Lafontaine and Schmidt (2010). Additional study of specimens from key geographic areas, and re-examination of the type material, reveals that *Acronicta parallela*, **stat. rev.**, is a valid species and our previous concepts of the taxa were erroneously based on geographic variants of *A. mansueta*.
- 931434.2 *Acronicta mansueta* – Eastern Great Plains populations are nearly identical externally to *A. parallela*, with which it previously was treated as conspecific by Lafontaine and Schmidt (2010). As noted under 931434.1, *A. mansueta*, **stat. rev.**, is distinct from *A. parallela*.
- 931450 *Acronicta* sp. nr *theodora* – The species recorded in Arizona is an undescribed species related to *A. theodora*. *Acronicta theodora* is known only from Mexico.
- 931467 *Acronicta increta* – The year of publication is 1874, not 1974.
- 931611 *Oxycnemis advena* – *Oxycnemis gustis*, **syn. n.** [formerly # 931614] is a new synonym of *Oxycnemis advena* following Robert Poole (*Noctuidae of North America* – <http://www.nearctica.com/moths/noctuid/noctuidae.htm>) [accessed September 2011] [Contributed by Robert Poole].
- 931617 *Oxycnemis grandimacula* – *Oxycnemis erratica*, **syn. n.** [formerly # 931616] is a new synonym of *Oxycnemis grandimacula* following Robert Poole (*Noctuidae of North America* – <http://www.nearctica.com/moths/noctuid/noctuidae.htm>) [accessed September 2011] [Contributed by Robert Poole].
- 931636.1 *Aleptina arenaria* – Addition (see Metzler and Forbes 2011a in references).
- 931663.1 *Plagiomimicus pyralina* – Specimens of this species have recently been found in Sunnyside Canyon, Huachuca Mountains, Arizona by Bruce Walsh. We tentatively retain the species in *Plagiomimicus* Grote following Poole (1989). It differs from *Plagiomimicus*, and all other Stririini, in having a frontal tubercle with a large central carina projecting out like a shark fin; the vesica has a large, spined, subbasal diverticulum, and the clasper is very long and thin, projecting more than half way across the valve. For these reasons we place the species in the list at the end of *Plagiomimicus*. The identity of the species was confirmed by Robert Poole.
- 931725.1 *Azenia procida* – *Azenia procida* (Druce, 1889), **stat. rev.**, previously was treated as a subspecies of *Azenia edentata* Grote, 1883, by Franclemont and

Todd (1983), but differs in wing markings, male genitalia, and the shape of the frontal process. *Azenia edentata* has a clear-yellow forewing with tiny triangular costal dots and the outer margin of the frontal process is wavy, convex centrally and concave near the lateral margins. *Azenia procida* occurs in two color forms, one yellow and the other a dull yellowish brown. It differs from *Azenia edentata* in that the forewing has larger, more diffuse dark spots, the outer margin of the frontal process is evenly convex, and the DNA barcode is more than 4 % different from that of *A. edentata*. This taxon previously was treated as a form of *Azenia edentata* ssp. *procida* (Druce, 1889), but is now treated as a synonym of *Azenia procida* (*Azenia nepotica* (Dyar, 1912), **syn. n.**). The name *nepotica* represents the darker yellowish-brown form of *Azenia procida*. The male genitalia, shape of the frontal process, and DNA barcode are like those of the typical form of *Azenia procida*.

931993 *Condica mersa* – *Condica lunata*, **syn. n.** [formerly # 932009] is a new junior synonym of *Condica mersa* following Robert Poole (*Noctuidae of North America* – <http://www.nearctica.com/moths/noctuid/noctuidae.htm>) [accessed September 2011] [Contributed by Robert Poole].

931994.1 *Condica luxuriosa* – This mainly Mexican species is reported from Arizona by Robert Poole (*Noctuidae of North America* – <http://www.nearctica.com/moths/noctuid/noctuidae.htm> [accessed September 2011]). It is related to *C. albolabes* (Grote, 1880), but the forewing of *C. luxuriosa* has more black shading and the white speckling is more extensive, especially on the reniform spot and subterminal line. The genitalia of the two species also differ. [Contributed by Robert Poole].

931997 *Condica concisa* – *Condica proxima*, **syn. n.** [formerly # 932000], is newly synonymized with *C. concisa* to follow Robert Poole (*Noctuidae of North America* – <http://www.nearctica.com/moths/noctuid/noctuidae.htm> [accessed September 2011]). The unique holotype is lost, but the original description best fits that of *Condica concisa*. [Contributed by Robert Poole].

932006 *Condica chardra* – *Condica revellata*, **syn. n.** [formerly # 932006] is synonymized with *C. chardra* following Robert Poole (*Noctuidae of North America* – <http://www.nearctica.com/moths/noctuid/noctuidae.htm>). [Contributed by Robert Poole].

932011 *Condica egestis* – The holotype of *Condica ignota*, **syn. n.** [formerly # 932012], in the USNM is an unusually pale specimen of *Condica egestis*. It is not clear if the specimen is naturally pale or is bleached from being exposed to too much light.

932014 *Condica cupentia* – See note under 930617.

932087.1 *Schinia carrizoensis* – Addition (see Osborne 2010).

932135.1 *Schinia psamathea* – Addition (see Pogue 2010).

932154.1 *Schinia poguei* – Addition (see Metzler and Forbes 2011b).

932222 *Spodoptera androgea* – See note under 930617.

932223 *Spodoptera eridania* – See note under 930617.

- 932239.5 *Pseudomarimatha flava* – Inadvertently omitted from Lafontaine and Schmidt 2010. For description, see Ferris and Lafontaine (2010).
- 932249.50, 932249.51 *Chytonix Grote* – This genus belongs in the tribe Elaphriini. It has the divided sacculus and weakened area on the costa of the valve (e.g., see Lafontaine et al. 2010). With the move in position, the numbers of the two species change from 932713 and 932714 to 932249.50 and 932249.51.
- 932249.51 *Chytonix ruperti* – *Chytonix ruperti*, **syn. n.** [formerly # 932715], is a synonym of *C. sensilis*. The external characters (blackish in lower medial area, white dot by pm line, blackish basal area, black wedges on inner margin of subterminal line) are all variable and occur in varying combinations throughout. In the genitalia, the width of the tegumen and the form of clasper (a divided process versus a V-shaped sclerite), also are variable and both forms of clasper occur in the *ruperti* form (including the type series) and the typical *sensilis* form. A distinctive Florida form has a different barcode and may be a separate species, but structural characters are variable - just like in *sensilis/ruperti*.
- 932328 *Apamea taboensis* – The correct spelling of the specific name is ***taboensis*** not *tahoensis*.
- 932681 *Andropolia contacta* – See the correction to Note 506 for this species below.
- 932386 “*Oligia*” *divesta* – This species was returned to its longstanding position in the *Oligia* Hübner group of genera by Lafontaine and Schmidt (2010), without explanation, after having been transferred to the genus *Chytonix* by Franclemont and Todd (1983). Genital and larval characters indicate that “*Oligia*” *divesta* (Grote, 1874) belongs in the tribe Xylenini, subtribe Apameina, as does the *Oligia* group of genera. *Chytonix* Grote, however, belongs in the tribe Elaphriini (see Note 932249.1 above).
- 932709 *Ufeus satyricus* – The correct spelling of the subspecific name is ***sagittarius*** not *saggiatarius*. The lectotype of *Ufeus electra*, **syn. n.** [formerly # 932711], in AMNH is a western specimen (from Oregon) of *Ufeus satyricus*, so the name becomes a synonym of *Ufeus satyricus sagittarius*.
- 932711 *Ufeus hulstii* – The name for the western counterpart of *Ufeus plicatus* becomes *Ufeus hulstii*, **stat. rev.**, with the transfer of *Ufeus electra* to the synonymy of *Ufeus satyricus*. The correct spelling for the specific name is *hulstii*, not *hulsti*.
- 932819 *Trichocosmia inornata* – The lectotype of *Trichocosmia drasteroides*, **syn. n.** [formerly # 932820], in USNM is a more maculate form of *Trichocosmia inornata*.
- 932832 *Anarta inconcinna* – The holotype of *Anarta inconcinna*, **comb. n.** [formerly # 932861], is a senior synonym of *Anarta castrae*, **syn. n.** [formerly # 932829], *A. ultra*, **syn. n.** [formerly a subspecies of *A. castrae*], and *A. montanica*, **syn. n.** [# 932832], The holotype of *Anarta inconcinna* from New Mexico is a form of the species in which the reniform and medial areas are paler than other areas of the forewing. *A. ultra* represents the more typical, evenly-colored, orange-brown form of the species. *A. montanica* is a more northerly and westerly yellow-brown form. The placement of the species here, rather than in *Scotogram-*

ma, where *inconcinna* has previously been placed, is because the species is most closely related to *Anarta oregonica* and *A. alta*. The barcodes of populations in Alberta and British Columbia differ by less than 0.5% from those from New Mexico, whereas those of *A. montanica* differ from those of *A. oregonica* and *A. alta* by more than 1.5%.

- 932836 *Anarta obesula* – The holotype of *Anarta subalbida*, **syn. n.** [formerly # 932835], from Whitehorse, Yukon, in USNM, represents the same species as the lectotype of *Anarta obesula* from Calgary, Alberta, in AMNH.
- 932847 *Scotogramma submarina* – The holotype of *Scotogramma addenda*, **syn. n.** [formerly # 932852], from Colorado, represents the same species as *S. submarina* from Montana.
- 932849 *Scotogramma densa* – This species, described from the Argus Mountains of California, is the same species as *S. megaera*, **syn. n.** [formerly # 932854], described from Glenwood Springs, Colorado. Both lectotypes are in USNM.
- 932880 *Lacanobia radix* – Lafontaine and Schmidt (2010) followed Franclemont and Todd (1983) and Poole (1989) in listing *Mamestra desperata* Smith, 1891 [formerly # 932775], as a species of *Orthosia* Ochsenheimer. We had overlooked the synonymy of *Mamestra desperata* with *Lacanobia radix* by McCabe (1980), but follow it here. We have examined the lectotype of *Mamestra desperata* in USNM and agree with the synonymy by McCabe.
- 932909 *Hecatera dysodea* – Note 551 on the discovery of this Eurasian species in North America should be corrected as follows. The first collections of *Hecatera dysodea* in Oregon were made in 2003 at Dufur (Wasco Co.) [not in 2005 at The Dalles]. The species was first collected in Washington in 2008 at Stevenson (Skamania Co.). Additional vouchers are in ODA (Richard Worth, pers. comm.).
- 933009 *Lasionycta sierra* – The year of publication is 2009, not 2010.
- 933017 *Lacinipolia lustralis* – The holotype of *Lacinipolia selama*, **syn. n.** [formerly # 933034], in the FMNH is a typical specimen of *Lacinipolia lustralis*. The type locality of *L. selama* is nominally Dallas, Texas, but the species has never been collected there, so the holotype could be mislabelled as to locality.
- 933062 *Lacinipolia comis* – The holotype of *Lacinipolia lunolacta*, **syn. n.** [formerly # 933064], in the BMNH is a dark female of *Lacinipolia comis*.
- 933093.1 *Homorthodes euxoiformis* – This species [formerly # 933153] is transferred from the genus *Hexorthodes* McDunnough to the genus *Homorthodes* McDunnough as *Homorthodes euxoiformis*, **comb. n.** The genital characters and barcode results suggest a close relationship to *H. dubia* (Barnes & McDunnough, 1912).
- 933105 *Protorthodes incincta* – The syntypes of *Protorthodes smithii*, **syn. n.** [formerly # 933106], in USNM represent yet another form of the extremely variable species *Protorthodes incincta*.

- 933121 *Ulolonche fasciata* – The holotype of *Ulolonche marloffi*, **syn. n.** [formerly # 933122], represents the same species as *Ulolonche fasciata*. Both holotypes are in USNM and both types are from New Mexico.
- 933128 *Pseudorthodes vecors* – The holotype of *Orthodes imora*, **syn. n.** [formerly # 933130], is a pale reddish specimen of *Pseudorthodes vecors* from Wisconsin. The holotype of *Orthodes calceolaris*, **syn. rev.** [formerly # 933129], is a reddish specimen of *Pseudorthodes vecors* with white dusting on the transverse lines. It was described from Long Island, New York, and was raised to species status by Franclemont and Todd (1983), presumably on the basis of the discussion in Forbes (1954) that refers to populations from Long Island and south as having two rather than one generation a year. There is nothing in the genitalia or barcode results to suggest that southern populations are specifically distinct from northern ones. The types *O. imora* and *O. calceolaris*, are in the FMNH.
- 933143 “*Orthodes*” *noverca* – Additional research on this species has confirmed the suggestion in Lafontaine and Schmidt (2010, note 591) that “*O.*” *vauorbicularis*, **syn. n.** [formerly # 933144], and “*O.*” *delecta*, **syn. n.** [formerly # 933145], are geographic forms of a single species. Typical “*Orthodes*” *noverca*, a contrastingly-marked orange-brown form of the Great Basin and Rocky Mountains region, intergrades into the lightly-marked gray-brown forms of the Pacific Northwest (*vauorbicularis*) and California (*delecta*). Also, there are no differences in the genitalia or DNA barcodes to suggest that more than one species is involved.
- 933156.1 “*Hexorthodes*” *accurata* – The species number is changed from 933154 to associate the species with “*Hexorthodes*” *citeria* and “*H.*” *emendata*.
- 933169 *Neleucania praegracilis* – Although the holotype of *Neleucania praegracilis* is lost, the details of the original description — eyes hairy, resembling *Heliophila pallens* [*Mythimna pallens* (Linnaeus, 1758)], but with the forewing pale yellowish white and the slender habitus of *Senta defecta* Grote, 1874 [“*Photedes*” *defecta* (Grote, 1874)] — leave no doubt as to the identity of this species. The list of synonyms (*N. bicolorata* (Grote, 1881), **syn. n.** [formerly # 933167], *N. niveicosta* Smith, 1902, **syn. n.** [formerly # 933168], *N. citronella* Smith, 1902, **syn. n.**, *N. suavis* (Barnes & McDunnough, 1912), **syn. n.** [formerly # 933165], is due mainly to the variability of the forewing color. It varies from an even pale yellowish white to a dark orange brown; in darker forms the veins are streaked and the costa is white. There is no significant geographical variation in external appearance or genital characters that might suggest that any of the names in synonymy might represent a valid species. The species is unusual in that the male has a dark fuscous hindwing, whereas that of the female is almost white, the reverse of the usual situation in the Noctuidae. The only other species in the genus, *Neleucania patricia* (Grote, 1880), differs significantly in appearance and genitalia from *N. praegracilis* and should probably be moved to another genus.

- 933210** *Xanthopastis regnatrix* – The species known as *Xanthopastis timais* (Cramer, [1780]) is now recognized as a species complex consisting of at least six species. This is based on genital differences found by Tim McCabe (pers. comm.) and larval differences described by Dyar (1913a, 1913b, 1919). The name for the species in eastern United States is *Xanthopastis regnatrix* (Type locality: Pennsylvania). This species name was used for the species by Kimball (1965), Wagner (2005) and Wagner et al. (in press). It is characterized by the black patch of scales on the forewing that completely surround the reniform and orbicular spots, the relatively small process on the inner surface of the right valve, and the larval characters described by Dyar (1913a).
- 933210.1** *Xanthopastis moctezuma* – *Xanthopastis moctezuma*, **stat. rev.**, a mainly Mexican species (Type locality: Mexico), is characterized by the more broken black patch on the forewing, which forms an irregular series of dots on the outer side of the reniform spot, the much larger process on the inner surface of the right valve, and by the larval characters given by Dyar (1913b). It is known from as far north as Brownsville, Texas, but appears to be replaced by *X. regnatrix* elsewhere in Texas. A specimen labeled “New Mexico” belongs to *X. moctezuma*, but the occurrence of this species in the Southwest needs further confirmation.
- 933280** *Copablepharon spiritum* – Insert three subspecies of *C. spiritum* following Crabo and Fauske 2004.
- 933282** *Copablepharon canariana* – The subspecies name ***contrast***a was misspelled as *contras*a in the text and index.
- 933308** *Euxoa adumbrata* – Subspecies ***thanatologia*** was misspelled as *thantologia* in the text and index.
- 933596** *Xestia speciosa* – Subspecies ***apropitia*** was misspelled as *apropritia* in the text and index.
- p. 114 Note 11** – The reference to Ferguson (1973) should be corrected to Ferguson (1978). The reference is given below.
- p. 121 Note 75** – The reference to Wagner (2008) should be corrected to Wagner et al. (2008). The reference is given below.
- p. 130 Note 177** – The reference to Fibiger (2009) should be corrected to Fibiger et al. (2009).
- p. 132 Note 205** – The reference to Pogue (2009) should be corrected to Pogue (2009a).
- p. 152 Note 497** – This note incorrectly spells ***Lomilysis***, a generic synonym of *Brachylomia*, as *Lomolysis*.
- p. 153 Note 506** – This note incorrectly refers to *Andropolia contrast*a, a misspelling of *Andropolia contact*a.
- p. 156 Note 555** – The reference to Pogue (2009) should be corrected to Pogue (2009b).
- p. 160 Note 615** – The reference to Crabo et al. (2004) should be corrected to Lafontaine et al. (2004) and is given below.

- p. 161 Note 642** – The reference Lafontaine and Crabo (1997) should be corrected to Crabo and Lafontaine (1997).
p. 165 Note 715 – The reference Ferguson (1963) was omitted. It is given below.

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