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NOCTUOIDEA: NOCTUIDAE (PART) MIKKOLA, LAFONTAINE, AND GILL

FASCICLE
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The Moths of North America

FASCICLE 26.9

NOCTUOIDEA
Noctuidae (Part)

Kauri Mikkola
J. Donald Lafontaine
Jocelyn Gill

2009

THE WEDGE ENTOMOLOGICAL RESEARCH FOUNDATION

THE MOTHS OF NORTH AMERICA

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30 May 1983

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26 December 2007

The Moths of North America

INCLUDING GREENLAND

FASCICLE 26.9

NOCTUOIDEA

NOCTUIDAE (PART)

XYLENINAE (PART)

APAMEINI (Part—*Apamea* group of genera)

KAURI MIKKOLA

ZOOLOGICAL MUSEUM
UNIVERSITY OF HELSINKI, FINLAND

J. DONALD LAFONTAINE AND JOCELYN D. GILL

CANADIAN NATIONAL COLLECTION OF INSECTS AND ARACHNIDS
AGRICULTURE AND AGRI-FOOD CANADA, OTTAWA

COLOR AND MONOCHROME PHOTOGRAPHS, PLATES AND MAPS BY
JOCELYN D. GILL
CANADIAN NATIONAL COLLECTION OF INSECTS AND ARACHNIDS
AGRICULTURE AND AGRI-FOOD CANADA, OTTAWA

CONTRIBUTIONS BY
LARS G. CRABO AND ERIC L. QUINTER

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ABSTRACT

The species of the genera *Apamea* Ochsenheimer, *Loscopia* Beck, *Protapamea* Quinter, *Melanapamea* Lafontaine, and *Lateroligia* Zilli, Fibiger, and Ronkay (Noctuidae: subfamily Xyleninae: tribe Apameini) of North America are revised. A total of 71 species is included. Two new genera are described: *Melanapamea* Lafontaine (type species: *Hadena mixta* Grote) and *Protapamea* Quinter (type species: *Protapamea danieli* Quinter). Twelve species are described as new: *Apamea fergusoni* Mikkola and Lafontaine; *Apamea hemimena* Mikkola and Lafontaine; *Apamea ochromma* Mikkola and Lafontaine; *Apamea quinteri* Mikkola and Lafontaine; *Apamea siskiyou* Mikkola and Lafontaine; *Apamea tahoeensis* Mikkola and Lafontaine; *Apamea walshi* Lafontaine; *Apamea wikeri* Quinter and Lafontaine; *Apamea xylodes* Mikkola and Lafontaine; *Loscopia roblei* Quinter and Lafontaine, *Protapamea danieli* Quinter, and *Protapamea louisae* Quinter. Six new subspecies are described: *Apamea burgessi leucoptera* Mikkola; *Apamea commoda striolata* Mikkola; *Apamea inordinata olympia* Crabo; *Apamea sordens sableana* Mikkola; *Apamea zeta downesi* Mikkola; *Apamea zeta pelagica* Mikkola. One neotype and 44 lectotypes are designated. Adults of all species are illustrated in color; male and female genital structures are illustrated on monochrome plates.

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PREFACE

This is the first fascicle treating the large and poorly understood subfamily Xyleninae. The Xyleninae are dominated by two tribes: the Xylenini, with larvae that feed externally almost exclusively on woody plants, make up 40% of the subfamily; the Apameini, with larvae that feed mainly on grasses (some genera externally but most as borers), make up another 40% of the subfamily; the remaining 20% of the subfamily includes 10 small tribes, many of which are only tentatively associated with the Xyleninae. The tribe Apameini is well circumscribed as a monophyletic group, and most of the genera are structurally homogeneous; however, the phylogenetic relationships among the 66 genera are poorly understood. For more than 150 years the tribe now known as the Apameini has been arranged in two groups, one containing species with externally feeding cutworm larvae and the other containing species that feed as borers in stems and roots. This fascicle revises the externally feeding genera, mainly the genus *Apamea* Ochsenheimer.

Revision of the group began in 1985 when Kauri Mikkola spent a year at The Canadian National Collection of Insects, Arachnids, and Nematodes (CNC), Ottawa, working on the North American fauna of *Apamea* as part of a planned revision of the Holarctic fauna. The work continued when he returned to the CNC for a second year in 1992.

This is the first MONA fascicle that makes extensive use of molecular data to resolve complex species issues. Collaboration with the Canadian Centre for DNA Barcoding at the Biodiversity Institute of Ontario, University of Guelph (Hebert et al., 2003; Ratnasingham and Hebert, 2007), began in 2005 and more than 600 specimens of *Apamea* have been analyzed. The cytochrome c oxidase 1 (CO1) mitochondrial gene sequence data have been immensely helpful to discriminate among taxa, even though it became clear that a few species can not be distinguished using CO1 results, and other species show polymorphism in this molecule; so, these qualifications were considered in interpretation of data.

The label data used to generate the distribution maps from the specimens examined are available on-line at the web site of The Wedge Entomological Research Foundation [www.WEDGEFOUNDATION.ORG]. Specimens from the CNC used in the color plates are identified by the database code CNC Noctuoidea # 000.

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We thank Eric Quinter, who co-authored descriptions of genera and species that he had discovered and reviewed several other parts of the text. Matti Ahola provided data and insights on larval characters for *Apamea* and for the Xyleninae and Apameini. Martin Honey assisted with information on type material in the Natural History Museum, London. Henry Hensel respread most of the specimens for the color plates. Eugenie Krelina and Eric. W. Rockburne (deceased), both formerly from the Canadian National Collection of Insects, Arachnids, and Nematodes, prepared most of the genital dissections.

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THE MOTHS OF AMERICA NORTH OF MEXICO

SUPERFAMILY
NOCTUOIDEA (continued)

FAMILY
NOCTUIDAE (continued)

SUBFAMILY
Xyleninae (part)

TRIBE
Apameini Guenée, 1841

Type genus *Apamea* Ochsenheimer, 1816

Nonagridi Guenée, 1837, SUPPRESSED SENIOR SYNONYM
Type genus: *Nonagria* Ochsenheimer, 1816

Gortynidae Duponchel, [1845]
Type genus: *Gortyna* Ochsenheimer, 1816

Xylophasides Guenée, 1852
Type genus: *Xylophasia* Stephens, 1829

Septidini Forbes, 1954
Type genus: *Septis* Hübner, [1821]

Oxytrypiinae Gozmany, 1970, SUBTRIBE
Type genus: *Oxytrypia* Staudinger, 1871

Calamiina Beck, 1996
Type genus: *Calamia* Hübner, [1821]

Luperinina Beck, 1996
Type genus: *Luperina* Boisduval, 1828

Mesapameina Beck, 1996
Type genus: *Mesapamea* Heinicke, 1959

Eremobiina Beck, 1999
Type genus: *Eremobia* Stephens, 1829

Sesamiina Fibiger and Goldstein, 2005, SUBTRIBE
Type genus: *Sesamia* Guenée, 1852

HISTORICAL REVIEW OF THE XYLENINAE AND APAMEINI.

Apameini
Apameina Guenée, 1841
Oxytrypiina Gozmny, 1970
Sesamiina Fibiger and Goldstein, 2005

Most early workers in the Noctuidae did not create subdivisions in the family beyond the level of genera.

Guenée (1837) proposed a classification of the family Noctuidae, and a few unrelated groups with a similar habitus, and arranged the genera in 18 tribes, mainly based on larval characters. The genera belonging to Apameini were included in three tribes. The Nonagridi, which were restricted to genera with boring apameine larvae, included the present day genera *Arenostola* Hampson, *Capsula* Fibiger, Zilli, Ronkay, and Goldstein, *Gortyna* Ochsenheimer, *Helotropha* Lederer, *Hydraecia* Guenée, *Nonagria* Ochsenheimer, *Photedes* Lederer, and *Phragmatiphila* Hampson. The tribe Leucanidi was a more heterogeneous assemblage of genera, but it included the present day apameine genera *Amphipoea* Billberg, *Apamea* Ochsenheimer (part), *Lateroligia* Zilli, Ronkay, and Fibiger, *Litoligia* Beck, *Mesapamea* Heinicke, and *Oligia* Hübner, as well as a number of non-apameine genera, such as *Leucania* Ochsenheimer and *Mythimna* Ochsenheimer. The tribe Noctuelidi was comprised mostly of genera with typical cutworm larvae, especially noctuine genera, but did include many species of *Apamea*

scattered among several genera. A few years later, Guenée (1841) presented a reclassification of the Noctuidae and proposed the tribe Apameini (originally proposed as Apamidi Guenée, 1841: 237) that closely approximates the concept of the tribe today. Fibiger and Lafontaine (2005) preserved the name Apameini over the older name Nonagriini because of the lack of usage of the latter name since being synonymized by Guenée in 1852. Later, Guenée expanded the group into the family Apamidae (Guenée, 1852: 119), which was a broad concept that included a large number of unrelated genera from several subfamilies.

The tribe Apameini as recognized here was for many years a group of loosely associated genera, but the association of the group with a subfamily name has been highly variable. The group was included in the polyphyletic subfamily Acronictinae by Hampson (1908) and later in the similarly polyphyletic subfamily Amphipyrinae (sensu Franclemont and Todd, 1983), after the removal of the Acronictinae sensu stricto. Forbes (1954) was the first worker to delimit the Apameini as currently classified; the genera were arranged in two tribes in the subfamily Acronictinae, Septidini for the genera with externally feeding larvae, Apameini for the genera with larvae that are borers. Forbes' (1954) use of these tribal names was based on the use of the generic name *Septis* Hübner for species now included in *Apamea* and the generic name *Apamea* for species now included in *Amphipoea* Billberg. The correct type species designations and generic associations for *Apamea* and *Amphipoea* were established by Franclemont (1950). Structural uniformity within ''trifid'' Noctuidae (i.e., vein M_2 reduced or absent on the hindwing) in both adults and larvae resulted in Beck (1960) using a large and inclusive definition of the subfamily Noctuinae in which the genera of the Apameini were segregated into the tribe Zenobiini as an informal genus-group based on larval modifications associated with the boring feeding habits of the larvae of most genera. The Apameini were recognized as a tribe in the subfamily Amphipyrinae in the *Check List of the Lepidoptera of America North of Mexico* by Franclemont and Todd (1983). Poole (1995) used an inclusive definition of the Noctuinae, similar to that of Beck (1960), which combined the Noctuinae, Hadeninae, and most of the genera of the Amphipyrinae (sensu Franclemont and Todd, 1983), except for a small number of genera that were placed in the redefined subfamilies Amphipyrinae s.s., Psaphidinae, and Stiriinae. Kitching and Rawlins (1998) reinstated the subfamily Noctuinae in its more restricted traditional sense and combined the remaining genera, including the Apameini, in the subfamily Hadeninae. Fibiger and Lafontaine (2005) reinstated the Hadeninae in its traditional sense and used the subfamily name Xyleninae for the remaining genera, which were arranged in 12 tribes, one of which is the Apameini. The Xyleninae were modified slightly by Lafontaine and Fibiger (2006), still with 12 tribes but somewhat differently configured.

The European species of the Apameini were revised by Zilli et al. (2005), and their revision of *Apamea* and *Abromias* Billberg, combined here, was extensively consulted. Traditionally, the genera of the Apameini are arranged in two groups; the species that feed externally on roots, leaves, and flowers, mainly of grasses, are in the genus *Apamea,* and the species that feed internally as borers are placed in a large number of smaller genera. We have found it necessary to recognize several small genera for groups of species, which have traditionally been in *Apamea,* because of the highly divergent genital characters. It is possible that this group of genera will prove to be paraphyletic or polyphyletic (*Lateroligia* and *Melanapamea* are probably not sister groups to *Apamea* and *Protapamea*), but the issue will not be resolved until a phylogenetic analysis of the entire Apameini has been completed. The nature of the structural variation in adults and larvae of the tribe may mean that such a phylogeny will be possible only by analyzing several nuclear gene sequences. We consider *Abromias* to be a paraphyletic taxon with respect to *Apamea*; so, we do not recognize it as a valid genus or subgenus.

KEY TO GENERA OF APAMEINI

1. Male 2
— Female 7

2. Valves bilaterally asymmetrical, especially shape of sacculi 3
— Valves symmetrical, or with minute differences in detail 4

3. Cucullus differentiated and sclerotized with corona on posterior margin (plate N, figures 1–3) . . . . . *Loscopia* p. 103

— Cucullus a small, membranous lobe distal to digitus; corona absent (plate N, figures 4, 5) . . . . . *Protapamea* p. 108

4. Clasper with elongated dorsal ampulla; cucullus expanded apically with distinct neck; digitus projecting posteroventrally along anteroventral margin of cucullus 5

— Clasper rodlike, usually without differentiated dorsal ampulla; cucullus either without distinct basal constriction (neck), or digitus, if present, projecting posteriorly 6

5. Sclerotization of cucullus uniform throughout; vesica straight with two or three short basal or subbasal cornuti (plate M, figures 1–5) . . *Apamea* p. 17

— Ventral margin of cucullus heavily sclerotized into rodlike sclerite; vesica coiled with large, clubbed, apical cornutus (plate M, figure 6) . . . . . *Melanapamea* p. 116

6. Cucullus tapered ventrally into long, curving spine; vesica with three clusters of long cornuti (two at base, one at apex) (plate N, figure 6) . . . . . *Lateroligia* p. 118

— Cucullus rounded or tapered to wedge-shaped point ventrally; vesica with at most two clusters of cornuti . . . . . genera of Apameini not treated herein

7. Anal papillae triangular, tapered from base to apex; lateral margins often slightly convex or concave posterior to middle (plate P, figures 2–8) 8

— Anal papillae lyriform, with subbasal or basal constriction; posterior ⅔ rounded (plate S, figures 1–8) 11

8. Corpus bursae elongate, 2–3 × as long as wide 9

— Corpus bursae rounded or wider than long . . . . . genera of Apameini not treated herein (e.g., *Resapamea* Varga and Ronkay)

9. Lamella postvaginalis of ostium bursae membranous or lightly sclerotized; ventral margins of sclerotized wall of abdominal segment eight (A8) defining margins of membranous ventral area posterior to ostium bursae farther apart posteriorly than anteriorly, so membranous area posterior to opening of ostium V-shaped, narrowing anteriorly; sclerotized ridges on ductus bursae evenly irregular (plate V, figures 1–8) . . . . . *Apamea* p. 17

— Lamella postvaginalis of ostium bursae with sclerotized plate densely covered with field of spiniform setae pointing anteriorly into ostium (spiniform setae absent in *Protapamea louisae,* which has sclerotized appendix bursae); ventral margins of sclerotized wall of A8 parallel, or farther apart anteriorly than posteriorly, so membranous area posterior to opening rectangular or V-shaped, narrowing posteriorly; ductus bursae much more heavily sclerotized on left side than right 10

10. Corpus bursae pear shaped with ductus bursae arising on right side ¼ from posterior end (plate W, figures 1–3) . . . . . *Loscopia* p. 103

— Corpus bursae with prominent, rounded diverticulum on right side anterior to junction with ductus bursae (plate W, figures 4, 5) . . . . . *Protapamea* p. 108

11. Bursa copulatrix very long, 11–12 × as long as A8; corpus bursae gradually tapered posteriorly into ductus bursae (plate W, figure 6) . . . . . *Melanapamea* p. 116

— Bursa copulatrix less than 8 × as long as A8; corpus bursae clearly differentiated from ductus bursae with a posterior pouchlike appendix bursae on left side 12

12. Ductus bursae with heavily sclerotized plate on each side; corpus bursae with four prominent signa (plate W, figure 7) . . . . . *Lateroligia* p. 118

— Ductus bursae, if sclerotized, without sclerotization concentrated on sides; corpus bursae without signa or with signa reduced (except *Papaipema* Smith, *Hydraecia* Guenée, *Amphipoea* Billberg) . . . . . genera of Apameini not treated herein

GENUS

Apamea Ochsenheimer

Apamea Ochsenheimer, 1816, *Schmetterlinge Europa,* **4**: 75.
Type species: *Noctua basilinea* [Denis and Schiffermüller], 1775. Designated by Samouelle, 1819, *Entomologist's useful Compendium*: 251.

NOTE—*Noctua basilinea* is a junior subjective synonym of *Apamea sordens* (Hufnagel, 1766).

Abromias Billberg, 1820, *Enumeratio Insectorum in Museo G. J. Billberg,* (7) **6**: 312.
Type species: *Phalaena polyodon* Clerck, 1759, sensu Linnaeus, 1761 [=*Phalaena monoglypha* Hufnagel, 1766]. Designated by Berio, 1966. *Annali del Museo Civico Storia Naturale Giacomo Doria,* **76**: 47.

Septis Hübner, 1821, *Verzeichniss Bekannter Schmettlinge* [sic], 243.
Type species: *Phalaena polyodon* Clerck, 1759, sensu Linnaeus, 1761 [=*Phalaena monoglypha* Hufnagel, 1766]. Designated by Westwood, 1840, *Synopsis of genera of British Insects*: 94.

Xylophasia Stephens, 1829, *Illustrations of British Entomology* (*Haustellata*), **2**: 41.
Type species: *Noctua basilinea* [Denis and Schiffermüller], 1775. Designated by Westwood, 1840, *Synopsis of genera of British Insects*: 95.

Hama Stephens, 1829, *The nomenclature of British Insects,* 41.
Type species: *Noctua basilinea* [Denis and Schiffermüller], 1775. Designated by Westwood, 1840, *Synopsis of genera of British Insects*: 95.

Agrostobia Boie, 1835, *Entomologische Beiträge. Isis von Oken,* **19**: 325.
Type species: *Noctua basilinea* [Denis and Schiffermüller], 1775. Designated by Nye, 1975, *The generic names of the moths of the world.* **1**: 16.

Crymodes Guenée, 1841, *Annales de la Société Entomologique de France,* **10**: 238.
Type species: *Hadena groenlandica* Duponchel, [1838], *Histoire Naturelle de Lépidoptères ou Papillons de France. Suppl.,* **3**: 228. Designated by Guenée, 1852, *in* Boisduval and Guenée, *Histoire Naturelle des Insectes. Species Général des Lépidoptères,* **5**: 185.

NOTE—*Hadena groenlandica* is a junior subjective synonym of *Polia zeta* Treitschke, 1825.

Syma Stephens, 1850, *List of specimens of British animals in the collection of the British Museum,* **5**: 281.
Type species: *Noctua hirticornis* Haworth, 1812. Monotypy.

NOTE—*Noctua hirticornis* is a junior subjective synonym of *Apamea crenata* (Hufnagel, 1766).

NOTE—*Syma* Stephens, 1850, is a junior homonym of *Syma* Lesson, 1827.

Ommatostola Grote, 1873, *Bull. Buffalo Soc. Nat. Sci.,* **1**: 112. NEW SYNONYMY.
Type species: *Ommatostola lintneri* Grote, 1873. Monotypy.

Eurabila Butler, 1889, *Illustrations of typical specimens of Lepidoptera Heterocera in the collection of the British Museum,* **7**: 39.
Type species: *Eurabila lignea* Butler, 1889. Monotypy.

Eleemosia Prout, 1901, *Ent. Record and Jour. Variation,* **13**: 183.
Type species: *Noctua abjecta* Hübner, [1813]. Original designation.

NOTE—*Noctua abjecta* is a junior synonym of *Noctua oblonga* Haworth, 1809.

Protagrotis Hampson, 1903, *Catalogue of the Lepidoptera Phalaenae in the British Museum,* **4**: 655.
Type species: *Agrotis viralis* Grote, 1881. Original designation.

NOTE—*Agrotis viralis* is a junior synonym of *Agrotis niveivenosa* Grote, 1879.

NOTE—*Protagrotis* was synonymized with *Apamea* by Poole (1989).

Agroperina Hampson, 1908, *Catalogue of the Lepidoptera Phalaenae in the British Museum,* **7**: 398.
Type species: *Phalaena lateritia* Hufnagel, 1766. Original designation.

NOTE—*Agroperina* was synonymized with *Apamea* by Boursin (1964).

Trichoplexia Hampson, 1908, *Catalogue of the Lepidoptera Phalaenae in the British Museum,* **7**: 482.
Type species: *Hadena exornata* Möschler, 1860. Original designation.

NOTE—*Hadena exornata* is a junior primary homonym of *Hadena exornata* Walker, 1858. The objective replacement name is *Xylophasia contradicta* Smith, 1895.

NOTE—*Trichoplexia* was synonymized with *Apamea* by Poole (1989).

Heteromma Warren, 1911, *in* Seitz, *Die Gross-Schmetterlinge der Erde,* **3**: 180.
Type species: *Hadena alpigena* Boisduval, [1837]. Original designation.

NOTE—*Heteromma* Warren, 1911, is a junior homonym of *Heteromma* Menge, 1856.

Heterommiola Strand, 1912, *Ent. Rundschau,* **29**: 16.
Type species: *Hadena alpigena* Boisduval, [1837]. Replacement name for *Heteromma* Warren.

Apamea subgenus *Apaconjunctdonta* Beck, [1992], *Atalanta,* 22: 211.

Type species: *Noctua unanimis* (Hübner, [1813]). Original designation.

Abromias subgenus *Furvabromias* Beck, [1992], *Atalanta,* 22: 213.
Type species: *Noctua furva* [Denis and Schiffermüller], 1775. Original designation.

DIAGNOSIS OF THE GENUS *APAMEA*. Adults can be associated with the genus *Apamea* by four ventral rows of spiniform setae on tarsal segments 2–5, and on the form of the genitalia. The male genitalia are characterized by the bilaterally symmetrical valves; large, triangular cucullus with apical corona; digitus projecting along the anteroventral margin of the cucullus; elongated ampulla of the clasper; and relatively simple vesica with 1–3 short basal or subbasal cornuti. In the female genitalia the anal papillae are triangular, tapered from base to apex with lateral margins often slightly convex or concave posterior to middle; corpus bursae usually somewhat pear shaped, slightly constricted posterior to middle and with posterior pouchlike appendix bursae on left side.

Head: antenna of male usually slightly biserrate (individual segments diamond shaped), bifasciculate with setae forming slight tuft on each side of each segment (antenna filiform in *Apamea crenata*-group); antenna of female filiform, ciliate ventrally; haustellum unreduced; eye smooth, round in most species (slightly to markedly reduced and ellipsoid in arctic and alpine populations); labial palpus with second segment clothed with broad spatulate scales, these scales longer ventrally, forming ventral fringe; third segment smoothly scaled, slightly roughened ventrally, about 2½ × as long as wide when denuded (appearing about 2 × as long as wide with scales); frons smooth and rounded centrally; clothed with long straplike scales, these converging toward center of frons to form dense tuft; tuft of spatulate scales on occiput projecting forward between bases of antennae; row of hairlike scales posterior to eye but none anterior to eye nor at base of antenna. Thorax: prothoracic collar smoothly scaled with straplike scales; mesothorax and metathorax clothed with mixture of narrowly spatulate and hairlike scales that form raised, slightly to strongly divided mesoscutellar and metascutellar tufts; forewing venation typical of most Noctuidae, i.e., vein M_2 arising near M_3 so cubital vein appears quadrifid (plate A, figure 1); hindwing venation trifid (i.e., M_2 vestigial so cubital vein appears trifid (plate A, figure 2); typical wing pattern shown in plate A, figure 5. Prothoracic leg: tibia longer (1.5–2.0 ×) than first tarsomere of tarsus; tibia without spiniform setae; tarsus with three irregular rows of spiniform setae ventrally on first (proximal) tarsomere, four rows on tarsomeres 2–5. Mesothoracic and metathoracic legs: tibia without spiniform setae, except with 1–4 setae near apex of metatibia in *Apamea niveivenosa*; tarsae with three irregular rows of spiniform setae ventrally on first tarsomere, four rows on tarsomeres 2–5. Abdomen: base of abdomen with fully developed hair brushes with levers and pockets (plate A, figure 3) in most species; some species with brushes lost, and levers and pockets vestigial; some with brushes, levers, and pockets lost (plate A, figure 4); abdomen cylindrical; clothed with short, broad setae overlaid with layer of long hairlike setae; dorsal tuft on one to five basal segments, depending on species-group; tuft on segment two smaller than others; eighth tergum of male trapezoidal, slightly wider posteriorly than its length, and 3–4 × as wide posteriorly as anteriorly; central part of anterior ⅓ of tergum weakly sclerotized with margins more heavily sclerotized and rodlike; eighth abdominal sternum of male transversely rectangular with anterior margin more heavily sclerotized and produced laterally into apodemes; central part of sternum membranous with central tuft of long hairlike scales forming an anal brush. Seventh tergum of female rectangular, evenly sclerotized, slightly wider than long, sides often slightly convex. Seventh sternum of female evenly sclerotized or slightly more heavily sclerotized posteriorly with posterior margin slightly to markedly concave (centrally notched in *A. sordens*-group).

Male genitalia (plate B, figures 1, 2): uncus dorsoventrally flattened, tapered from base to pointed apex, or slightly to prominently enlarged subbasally or subapically, with tuft of long setae subbasally in some species-groups; peniculus enlarged laterally to form rectangular plate supporting tuft of hairlike setae; saccus

U-shaped or V-shaped, usually slightly wider than long; transtilla a narrow sclerotized band laterally; juxta shield shaped, usually about as wide as long and constricted laterally; valve with subapical ''neck'' defining cucullus; ventral margin of valve evenly convex to ¾ distance from base, then abruptly angled dorsally into deep notch at anteroventral edge of cucullus; dorsal margin of valve evenly concave to ¾ distance from base, then abruptly angled dorsally to form rounded or double-lobed process at anterodorsal edge of cucullus; cucullus trigonal, with corona of spiniform setae on outer margin; cucullus with hairlike to spiniform setae proximal to corona or on anteroventral margin of cucullus (sometimes reduced to a tuft or a few stout setae at ventral angle); sacculus about ½ × length of valve, more heavily sclerotized dorsally into a rounded, pointed, or multilobed dorsal process; clasper a narrow, V-shaped, posteriorly projecting sclerite extending from apex of sacculus ½–¾ distance to cucullus; clasper with narrow, setose ampulla projecting posterodorsally from dorsal arm of clasper; ampulla typically 12–15 × as long as wide; costal margin of valve heavily sclerotized, becoming free from surface of valve toward cucullus to form digitus; digitus abruptly angled near neck of cucullus to project posteroventrally along anteroventral margin of cucullus; editum a setose ridge near dorsal margin of valve basal to ampulla of clasper; aedeagus straight, about 3–4 × as long as wide; apex of aedeagus smooth usually covered with short spinules, these often concentrated on heavily sclerotized lobe at apex ventrally; vesica about as long as aedeagus, usually somewhat T--shaped with aedeagus forming 90 % of ''stem'' of T; vesica with 0–3 short, conical cornuti, these often arising from a heavily sclerotized plate; cornutus occasionally on short diverticulum; vesica frequently with rounded apical diverticulum.

Female genitalia (plate B, figure 3): corpus bursae elongate, 2–3 × as long as wide, usually somewhat pear shaped, constricted posterior to middle; corpus bursae with a posterior, short, rounded appendix bursae on left and sometimes a similar lobe on right; signa variable, depending on species-group, without signa, with four long signa, or reduced to two short signa; ductus bursae short, ¼–⅓ as long as corpus bursae, heavily sclerotized in longitudinal ridges, wider anteriorly than posteriorly and frequently with enlarged lobe on right near junction with corpus bursae; ostium bursae not differentiated from ductus bursae except for narrow membranous band between two areas; A8 usually about as long as anterior apophysis, but varying from ½–1½ × as long; posterior apophysis usually slightly longer than anterior apophysis, similar in thickness to anterior apophysis to much stouter, depending on species-group; papillae anales dorsoventrally flattened in most species-groups (conical in *A. remissa*-group) with two long sclerotized rods between anal papillae extending from anterior margin to ½–⅔ length of papillae; anal papillae triangular, widest anteriorly, tapered gradually or abruptly posteriorly with lateral margins convex, straight, or slightly concave, depending on species-group; apex of papillae rounded, pointed or truncated; surface of papillae covered with minute setae with several short, conical setae laterally at apex.

Mature larva: 20–40 mm long, 5–6 mm wide at the middle with smooth skin. Spinneret long and tubular with dorsal groove, 2–3 × as long as basal segment of labial palpus (Lps1). Labial palpus with apical seta (Lp2) 0.7–1.5 × as long as basal segment (Lps1) and 1.5–2.5 × as long as first seta (Lp1). Hypopharynx densely spined, with long, slender spines laterally and short spines on middle ⅓ of hypopharynx; spines ending before base of labial palpi by distance of 1.5–2.0 × length of basal segment (Lps1) of labial palpus. Mandible with base of ridges on inner surface swollen to form two often partially fused molar areas. Prothorax with seta SD2 on margin of prothoracic shield and seta SD1 well below shield and slightly anterior to SD2 (SD1 and SD2 close together in most other Apameini with SD1 anterior to SD2). Setae L1 and L2 on common pinaculum, as are setae SV1 and SV2. Larvae arranged in two groups by color pattern and feeding habits.

All species of *Apamea,* like those of all Apameini, pass the winter as partially grown larvae, and the adults are univoltine.

Group I larvae: *Apamea verbascoides-, crenata-, unanimis-, remissa-, cuculliformis-, sor-*

dens-, and *leucodon*-groups. Larva dark, usually gray or brown, often with pink or purple suffusion, and with darker reticulate pattern dorsally and laterally above lateral SD1 line; usually five pale, contrasting, longitudinal lines, a narrow middorsal line, a less distinct subdorsal line on each side, and a broad lateral line that includes spiracles. Prothoracic and anal shields most commonly black with three pale lines, but can be orange or yellowish brown in some forms. Pinacula flat and black but generally obscured by dark ground color. Head pale to dark brown, usually with dark submedial arcs and reticulation.

Group II larvae. *Apamea monoglypha-, occidens-, albina-, amputatrix-, maxima-, acera-, burgessi-,* and *zeta*-groups. Larva grublike, usually gray or brown, and without contrasting pattern; only contrasting areas are darker head, pinacula, spiracles, and prothoracic and anal shields.

Key to 16 North American species in Crumb (1956). Keys and illustrations of European species in Beck (1999, 2000) and Ahola and Silvonen ([2008]).

DISTRIBUTION AND CLASSIFICATION OF *APAMEA*. *Apamea* includes about 140 species of which 63 species occur in North America. The genus has a mainly Holarctic, north temperate distribution, occurring as far south in North America as central Mexico and in the Old World as far south as East Africa, Madagascar, northern India, and the mountains of Vietnam, Thailand (Zilli et al., 2005), and the Philippines (K. Mikkola, unpubl.).

Within the North American fauna, only one species, *Apamea zeta,* is adapted to extreme arctic and alpine habitats (*A. zeta* occurs as far north as northern Greenland). The largest number of species is in boreal zone habitats with 15 boreomontane species and 20 western montane species. The ranges of some of these species (*A. commoda, A. inficita, A. niveivenosa,* and *A. longula*) extend into more open, xeric habitats in the West, but usually still occur in treed areas, such as in aspen groves in river bottoms. Some mainly boreomontane species (*A. alia, A. impulsa, A. lignicolora, A. plutonia,* and *A. sordens*) extend southward into the eastern deciduous forest. Most of the montane species are restricted to the Rocky Mountain region or to the Cascades/Sierra Nevada, and two (*A. ochromma* and *A. hemimena*) are in the mountains of south-central Mexico. Seven species occur as far south as southeastern Arizona, but only three of them (*A. unita, A. burgessi* and *A. geminimacula*) have been recorded from Mexico. Seven species occur as far south as San Diego County, California, and one of them (*A. devastator*) has been recorded in northern Baja Peninsula, Mexico. One western species (*A. genialis*) is in West Coast scrub, and two (*A. maxima* and *A. robertsoni*) are restricted to dunes; *A. lintneri* is a dune species on the East Coast. Only five species of *Apamea* are mainly associated with open, xeric habitats, two being restricted to the West (*A. cinefacta* and *A. spaldingi*) and three with ranges that extend into the East (*A. burgessi, A. inordinata,* and *A. relicina*). Most of the 12 species occurring in the deciduous forests of eastern United States and southeastern Canada are quite rare and their larvae unknown, so they are probably restricted in their larval host plants to localized species of grasses in open forests (Handfield, 1999). Two eastern species of *Apamea* are wetland and riparian inhabitants, the introduced *A. unanimis,* associated with various reed grasses, and *A. apamiformis* on wild rice (*Zizania aquatica* L.). Only two species (*A. amputatrix* and *A. devastator*) are very widespread and occur in a wide variety of habitats.

Apamea can be arranged in two large groups that were treated as the genera *Apamea* and *Abromias* by Zilli et al. (2005), but the monophyly of these two groups is doubtful and the distinguishing characters sometimes inconsistent, so we recognize them informally as ''*Apamea* Group I'' and ''*Apamea* Group II.''

Apamea Group I, treated as the genus *Apamea* by Zilli et al. (2005), is defined by four character states: posterior apophyses stout, anal papillae narrow and tapered apically, signa in the corpus bursae reduced, and membranous connection between the anal papillae and A8 short. Of these characters, only the stout posterior apophyses are in all species in Group I. *Apamea apamiformis* and *A. cristata* have broad anal papillae, *A. apamiformis* has four promi-

nent signa in the corpus bursae, and *A. remissa* and all species in the *A. verbascoides*-group have a normal membranous area between the anal papillae and A8. The larvae of species in *Apamea* Group I are climbing cutworms that feed on the flower heads, seeds, and foliage at night and rest among litter on the ground during the day. Like most grass-feeding cutworms, the larva is dark with contrasting longitudinal pale lines that give it a cryptic pattern against the grass stems. The larvae are usually gray or brown, often with a pink or purple suffusion, and with a darker reticulate pattern on the back and sides above the lateral line. There are five pale lines along the body, a narrow middorsal line, a less distinct subdorsal line on each side, and a broad lateral line on each side. The prothoracic and anal shields are black with three pale lines. The eggs usually are laid in the flower heads, and the early instars feed on the flower heads and seeds but usually switch to foliage in later instars.

Apamea Group II, treated as the genus *Abromias* by Zilli et al. (2005), is characterized by primitive (plesiomorphic) character states typical of many other genera in the Apameini: posterior apophyses slender; anal papillae broad, tapered slightly to a blunt apex; signa (usually four) in the corpus bursae; membranous connection between the anal papillae and abdominal segment eight (A8) about as long as A8. The larva is a surface or subterranean cutworm that feeds on the roots or the stems at the base the host plants. The larva is grublike, usually gray or brown, and without a contrasting pattern, the only contrasting areas being the darker head, spiracles, and prothoracic and anal shields. The eggs usually are laid in the sheath bases, and the larva often feeds from nestlike chambers among the roots.

Stout posterior apophyses are not found elsewhere in the Apameini and are apomorphic for the species-groups in *Apamea* Group I, which is probably monophyletic. The species-groups included in *Apamea* Group II (*Abromias* in Zilli et al., 2005), however, are associated only on the basis of shared primitive features found widely in the Apameini. To avoid formally recognizing a paraphyletic taxonomic group (*Abromias*), we adopt an inclusive definition of *Apamea* and only recognize these two subgroups with the informal terms *Apamea* Group I and *Apamea* Group II.

Apamea Group I contains 25 species in seven species-groups in North America.

The *Apamea verbascoides*-group contains eight species, all exclusively North American, and is characterized by the large, flat, rounded platelike area near the base of the uncus that supports a plume of long hairlike setae, and by the very short ampulla of the clasper in the male genitalia.

The *Apamea crenata*-group contains 12 species of which six occur in North America and six in Eurasia. The uncus has a subbasal plate that is similar to that of species in the *A. verbascoides*-group, although it is much smaller, and the ampulla of the clasper is long and slender as in most other *Apamea.* The group is characterized by filiform male antenna (biserrate elsewhere in *Apamea*), Y-shaped digitus, and the shape of the vesica in which the subbasal diverticulum is replaced by two short pouches, each with an apical bulbous cornutus, and there is a third cornutus connected to the apex of the aedeagus by a sclerotized band.

The presence of the setose plate on the uncus, a uniquely derived character state of both the *A. verbascoides*- and *A. crenata*-groups, suggests a sister group relationship between these two species-groups.

The *Apamea unanimis*-group includes two Eurasian species, one of which has become established in North America. The group is characterized mainly by the massive, apically rounded digitus.

The *Apamea remissa*-group includes four species in North America of which one species also occurs in Eurasia. The species-group is unusual within *Apamea* in that none of the species has basal abdominal brushes and pockets in the male. The group is characterized by the serrated, rooster-comblike cornutus on the vesica near the apex of the aedeagus, and the female genitalia are unusual for the genus *Apamea* in that the anal papillae are cylindrical and cone shaped.

Apamea cuculliformis previously has been associated with the *A. verbascoides*-group, which it superficially resembles. Molecular

data, however, suggest a closer association with the *Apamea sordens*-group, but the vesica has a ''rooster comb'' cornutus more typical of species in the *A. remissa*-group, so we place it in its own species-group between the *A. remissa*- and *A. sordens*-groups.

The *Apamea sordens*-group includes four species, two of which occur in North America. The group is characterized by the heavily sclerotized, pointed process on the dorsal margin of the sacculus and the posterior bulge near the base of the digitus. In the female genitalia, the anal papillae are disproportionately large with the outer margins concave.

The overall similarity of species in the *A. unanimis-, A. cuculliformis-, A. remissa-,* and *A. sordens*-groups, in genital characters and the habitus of the adult, suggests that these four species-groups probably form a monophyletic group, but the relationships among the four groups are unknown.

The *Apamea leucodon*-group includes four species, three in North America and one in Eurasia. The group is characterized in the male genitalia by the relatively short, stout digitus, the thick clasper, and in the vesica the cornutus arises from a large, heavily sclerotized plate, and usually projects obliquely from this plate. In the female genitalia the corpus bursae is long, narrow, and shaped like a figure 8; the anal papillae are unique in that they taper abruptly from the base then are very narrow through the posterior ¾ with the apex abruptly truncated.

Apamea Group II contains 39 species in seven species-groups in North America. The first five species-groups (19 species in North America in the *A. monoglypha-, A. occidens-, A. albina-, A. amputatrix-,* and *A. maxima*-groups) have dorsal tufts on the basal four or five segments of the abdomen. The remaining three species-groups (20 species in North America in the *A. acera-, A. burgessi-,* and *A. zeta*-groups) have the dorsal tufting reduced to a large tuft on A1, usually a smaller one on A2, and a larger tuft on A3 in some species. The species-groups in Group II are structurally similar; only *A. occidens* is well set apart in characters of the uncus, vesica, and bursa, so we mainly follow the taxonomic sequence used in the Franclemont and Todd (1983) check list until phylogenetic studies include supporting data from multiple nuclear gene sequences suggest other groupings.

KEY TO SPECIES OF *APAMEA*

1. Tufts on dorsum of abdomen massive, forming black band continuous with dark shading in middle of thorax; forewing long and narrow, reminiscent of genus *Cucullia* Shrank (plate 2, figures 21, 22); southwestern Canada and western United States . . . . . *Apamea cuculliformis* p. 48
— Abdominal tufts small and separate; forewing broader 2

2. Hindwing white, or white basally with fuscous border 3
— Hindwing fuscous, sometimes pale fuscous or dirty white toward base 5

3. Forewing pale buffy brown with all maculation washed out except for a pale streak through position of reniform and orbicular spots (plate 8, figures 25–27); Atlantic Coast dunes . . . . . *Apamea lintneri* p. 102
— Forewing brown to blackish brown with maculation defined in black and contrasting with ground color; widely distributed 4

4. Forewing with transverse lines usually prominent and double; postmedial line even or slightly scalloped between veins on posterior ½ of wing (plate 5, figures 16–26); male genitalia with cucullus 1½ × as wide as valve (plate J, figure 5) . . . . . *Apamea burgessi* p. 76
— Forewing longitudinally streaked with transverse lines obscure; postmedial line deeply serrated and zigzagged on posterior ½ of wing; antemedial line vestigial (plate 5, figures 27–33); male genitalia with cucullus about as wide as valve (plate J, figure 6) . . . . . *Apamea relicina* p. 78

5. Forewing with postmedial line abruptly shifted basally below reniform spot to touch apex of claviform spot (plate 4, figures 28–31); western United States and Canada . . . . . *Apamea occidens* p. 69
— Forewing with postmedial line, if present, gently curved below reniform spot 6

6. Claviform spot a large elongated loop finely outlined in black, filled with ground color, and extending at least ⅔ of distance to postmedial line (plate 5, figures 10–15); western United States and Canada 7
— Claviform spot, if present, extending less than ½ way to postmedial line, or forming a dark dash in fold between transverse lines 9

7. Forewing pale gray with transverse lines essentially absent (plate 5, figures 14, 15); male genitalia with uncus slender and with two large cornuti in vesica (plate J, figure 4); Cascades, Sierra Nevada, and Great Basin ... *Apamea acera* p. 75

— Forewing dark gray, orange brown, or with orange-brown shading in medial area; transverse lines prominent; male genitalia with uncus broad and flat and with two minute cornuti in vesica; Pacific Coast dunes 8

8. Forewing orange brown, or with orange-brown shading in medial area; transverse lines prominent (plate 5, figures 10–12); male genitalia with digitus extending about ⅔ of distance to ventral margin of cucullus (plate J, figure 2); British Columbia to central California .... *Apamea maxima* p. 74

— Forewing dark gray (plate 5, figure 13); male genitalia with digitus extending to ventral margin of cucullus (plate J, figure 3); southern California (San Luis Obispo County) .... *Apamea robertsoni* p. 75

9. Abdomen with dorsal tufts of setae on basal four or five segments 10

— Abdomen with dorsal tuft of setae on one to three basal segments (usually large tuft on basal segment and a smaller tuft on second segment) 55

10. Forewing ground color velvety black with black wedge-shaped patch proximal to postmedial line (plate 2, figures 17, 18) .... *Apamea impulsa* p. 47

— Forewing ground color not black; if with black shading, then also with some paler coppery, brown, or red hues, and with a dark fuscous hindwing (e.g., plate 1, figure 26; plate 2, figures 15, 16; plate 6, figures 15, 21, 22) 11

11. Forewing with black patch in fold proximal to subterminal line adjacent to dark anal patch in terminal area (e.g., plate 1, figures 1–34) 12

— Forewing without black patch in subterminal area; if with dark streaks proximal to subterminal line, then streaks opposite reniform spot as dark or darker than those in fold (e.g., plate 2, figures 1–20, 23–44) 30

12. Forewing with diffuse frosty-white patch in subterminal area proximal to anal dash; reniform spot mainly white (plate 5, figures 6–9) 13

— Forewing with subterminal area similar in color throughout; reniform spot similar in color to medial area or darker 14

13. Forewing with a deep W-mark in subterminal line mesially; terminal area with blotches of dark shading (plate 5, figures 8, 9); southwestern Oregon and western California .... *Apamea albina* p. 73

— Forewing with even subterminal line; terminal area dark blackish gray (plate 5, figures 6, 7); eastern Arizona ..... *Apamea walshi* (part) p. 72

14. Forewing with three black streaks (at base, in fold, and at anal angle) forming a broken dark streak along posterior ⅔ of wing (plate 1, figures 1–6, 13–17); eastern North America to Colorado and Alberta 15

— Forewing with at most one or two dark streaks on forewing 19

15. Forewing longitudinally streaked with brown, yellow, and pale gray; transverse lines and reniform and orbicular spots vestigial 16

— Forewing gray brown to blackish brown; maculation defined in black 17

16. Forewing with white line on veins at pale line at fork of veins M_3 and CuA_1; reniform spot a pale yellow patch; area distal to reniform spot with veins black (plate 1, figures 1, 2) .... *Apamea verbascoides* p. 29

— Forewing without white on veins at pale line at fork of veins M_3 and CuA_1; reniform spot barely paler than ground color; area distal to reniform spot pale brown but with few veins marked with black (plate 1, figures 3, 4) .... *Apamea inebriata* p. 30

17. Forewing with basal and medial dashes partially fused to form a wide black dash; forewing length 18–22 mm (plate 1, figures 5, 6) ..... *Apamea nigrior* p. 31

— Forewing with basal and medial dashes short and separate; forewing length: 16–19 mm (plate 1, figures 13–17) 18

18. Forewing with basal area similar in color to medial and subterminal areas, subterminal line with a deep W-mark mesially; medial dash sharply defined (plate 1, figures 13–15); male genitalia with one or two stout setae at ventral angle of cucullus (plate D, figure 1) .... *Apamea cariosa* p. 34

— Forewing with basal area slightly paler (male) or much paler (female) than ground color and usually with yellow hue; subterminal line sinuate mesially with a shallow W-mark; medial dash not sharply defined (plate 1, figures 16, 17); male genitalia with band of stout cornuti

on ventral margin of cucullus (plate D, figure 2) . . . . . *Apamea quinteri* p. 35

19. Forewing dark brown with coppery suffusion; maculation obscure (plate 1, figures 25, 26) . . . . . *Apamea plutonia* p. 40

— Forewing paler brown or gray; some maculation prominent 20

20. Thorax blackish brown, contrasting with paler ground color of forewings (plate 1, figures 20–24) . . . . . *Apamea vultuosa* p. 38

— Thorax similar in color, or slightly darker, than forewing ground color 21

21. Forewing ground color and maculation appearing pale and washed out, in contrast to dark anal patch and dark patch in reniform spot (plate 1, figures 29–34) 22

— Forewing ground color darker gray or brown with maculation contrasting 23

22. Forewing with dark part of anal patch in subterminal area and dark shading in reniform spot darker than other areas of wing (plate 1, figures 31–34); widely distributed . . . . . *Apamea alia* p. 42

— Forewing with dark part of anal patch in subterminal area and dark shading in reniform spot similar to dark shading in terminal area (plate 1, figures 29, 30); southwestern United States from Colorado to New Mexico and Arizona . . . . . *Apamea xylodes* p. 41

23. Eastern North America (east of 100th Meridian) 24

— Western North America (west of 100th Meridian) 28

24. Forewing not longitudinally streaked; reniform with dark, contrasting patch 25

— Forewing longitudinally streaked; reniform without dark patch 26

25. Forewing narrow; reniform spot dark (plate 1, figures 18, 19) . . . . . *Apamea apamiformis* p. 37

— Forewing broad; lower part of reniform spot dark (plate 3, figure 12) . . . . . *Apamea smythi* p. 58

26. Posterior part of outer margin of forewing even; hindwing pale fuscous, at least basal to postmedial line (plate 3, figures 6–9) . . . . . *Apamea lignicolora* (part) p. 56

— Posterior part of outer margin of forewing scalloped; hindwing dark fuscous 27

27. Forewing uniformly brown; subterminal line forming a sharply defined W-mark extending to wing margin (plate 1, figures 7, 8) . . . . . *Apamea vulgaris* p. 31

— Forewing brown mottled with gray or yellow; subterminal line without a sharply defined W-mark (plate 1, figures 11, 12) . . . *Apamea cristata* p. 33

28. Large species (forewing length: 21–23 mm) with mainly blackish-purple forewing (plate 3, figures 24–26); central Mexico . . . . . *Apamea ochromma* p. 60

— Smaller species (forewing length: 15–22 mm) with a paler forewing ground color; western United States and Canada 29

29. Forewing fold filled with black between postmedial and subterminal lines (plate 1, figures 27, 28); southwestern United States from Colorado to Arizona and western Texas . . . . . *Apamea perpensa* p. 41

— Forewing fold with some dark shading in outer part of postmedial area but without long, black bar 30

30. Hindwing with basal ⅔ yellow or pale yellowish brown with contrasting dark fuscous band on outer ⅓ of wing (plate 2, figures 33–39) . . . . . *Apamea inordinata* p. 52

— Hindwing fuscous, becoming paler toward base in some species 31

31. Forewing with reniform spot orange or orange brown, often with color diffusing into medial area beyond reniform spot 32

— Forewing with reniform spot gray or speckled with white 43

32. Forewing ochre orange with dark orange-brown markings; no basal dash; contrasting, dark, blackish-blue patch in lower part of reniform spot (plate 3, figures 13–15); eastern and central North America . . . . . *Apamea helva* p. 58

— Orange-colored species with black basal dash or western distribution 33

33. Forewing pale orange brown with all maculation obscure (plate 4, figures 26, 27); coastal areas of central California . . . . . *Apamea genialis* p. 69

— Orange-colored species with black basal dash and contrasting maculation 34

34. Forewing with orbicular spot elongate, more than 2 × as long as wide 35

— Forewing with orbicular spot round or slightly oval, less that 1½ × as long as wide 40

35. Hindwing pale with darker fuscous outer band and postmedial line; southern Alberta, Utah, and Arizona eastward 36
— Hindwing fuscous, sometimes paler basally; north and west of Great Basin 37

36. Forewing with transverse lines sharply defined; dark anal patch barely evident in subterminal area (plate 3, figures 6–9); eastern North America west to Alberta and Colorado . . . . . *Apamea lignicolora* (part) p. 56
— Forewing with transverse lines barely evident; dark anal patch extended across subterminal area (plate 3, figures 27–30); Montana to western Texas, southern New Mexico, and southern Arizona . . . . . *Apamea atrosuffusa* p. 61

37. Postmedial line on forewing dentate on veins, evenly curved on posterior ½ of wing, outer edge lined with white in most specimens (plate 4, figures 9–14); boreal zone species in Canada and Alaska . . . . . *Apamea commoda* (part) p. 65
— Postmedial line on forewing with outward bulge at vein CuA_2, rarely with white on outer margin of line except in fold; southwestern Canada and western United States 38

38. Forewing broad, less than 2 × as long as width at outer margin; ground color yellow brown (plate 3, figures 10, 11); southwestern British Columbia to west-central Oregon . . . . . *Apamea atriclava* p. 57
— Forewing narrower, more than 2 × as long as wide, ground color gray brown or orange brown, usually heavily dusted with silvery gray 39

39. Forewing orange brown, usually with silvery-gray shading, especially in subterminal area; maculation generally well defined (plate 3, figures 16–20); British Columbia and southwestern Alberta to southern California . . . . . *Apamea antennata* p. 59
— Forewing dull brown, occasionally with silvery-gray shading; maculation muted (plate 3, figures 21–23); southern Washington and northern California . . . . . *Apamea siskiyou* p. 60

40. Postmedial line on forewing dentate on veins, evenly curved on posterior ½ of wing; forewing reddish brown to blackish brown in boreal zone and northern Rocky Mountains, gray or gray brown, longitudinally streaked in Prairies, Great Basin, and southern Rocky Mountains (plate 4, figures 9–22) . . . . . *Apamea commoda* (part) p. 65
— Postmedial line on forewing with outward bulge at vein CuA_2; forewing with blotchy pattern of orange, yellow brown, and gray brown 41

41. Forewing mainly yellow brown with orbicular spot relatively large (plate 3, figures 31–34; plate 4, figure 1); southern Montana south to northern New Mexico, southern Utah and east-central Nevada . . . . . *Apamea auranticolor* p. 62
— Forewing darker, reddish orange or shaded with gray; orbicular spot smaller (plate 4, figures 2–8); occurring north and west of range of *A. auranticolor* 42

42. Forewing light brownish gray to dark gray brown, usually with patches of orange brown and usually with a purplish sheen (plate 4, figures 2–5); western Canada southward to central Montana, central Idaho, and northeastern Oregon . . . . . *Apamea sora* p. 63
— Forewing bright orange brown (Sierra Nevada, plate 4, figures 6, 7), or a mixture of dull orange, brown, and gray, like a small form of *A. sora* (Cascades, plate 4, figure 8); Cascades and Sierra Nevada from west-central Oregon southward to south-central California . . . . . *Apamea tahoeensis* p. 63

43. Orbicular spot round or slightly oval, less that 1½ × as long as wide 44
— Orbicular spot elongate, more than 2 × as long as wide 54

44. Forewing yellowish gray with contrasting black patch in fold proximal to subterminal line (plate 1, figures 9, 10); eastern United States . . . . . *Apamea wikeri* p. 32
— Forewing fold with some dark shading in outer part of postmedial area but without long, black bar 45

45. Reniform spot mainly white with white central patch surrounded by series of white dots and dashes (plate 4, figures 32–34; plate 5, figures 1–7) 46
— Reniform spot without white shading or with white outline 47

46. Forewing with extensive wine-red shading in medial and basal areas (except dark blackish-brown form on West Coast); large species (forewing length: 20–24 mm) (plate 4, figures 32–34; plate 5, figures 1–5); widely distributed southward to western central Arizona (White Mountains) . . . . . *Apamea amputatrix* p. 70

— Forewing with blackish-gray shading in medial and basal areas; smaller species (forewing length: 16–18 mm) (plate 5, figures 6, 7); southeastern Arizona . . . . . *Apamea walshi* (part) p. 72

47. Hindwing dirty white basally with fuscous band on outer margin and veins; a pale patch in medial area below orbicular outlined in black and extending toward anal angle of wing almost to postmedial line (plate 2, figures 19, 20) . . . . . *Apamea unita* p. 48

— Hindwing fuscous, sometimes paler toward base; area below orbicular spot similar in color to other parts of medial area 48

48. Postmedial line black, contrasting, dentate on wing veins; orbicular spot with black central pupil; subterminal line with white W-mark at veins M_3 and CuA_1 projecting it to wing margin (plate 4, figures 23–25); mainly Cascades and Sierra Nevada . . . . . *Apamea centralis* p. 68

— Postmedial line mainly white, straight or faintly scalloped between veins; orbicular spot white filled or with slightly darker center 49

49. Small (forewing length: 14–16 mm); reniform spot longitudinally bicolored, outlined in black proximally, white distally and strongly indented, proximal ½ of spot similar in color to forewing, outer ½ pale yellow (plate 1, figures 35–37); hindwing with large, black discal spot; introduced into northeastern North America and spreading . . . . . *Apamea unanimis* p. 43

— Larger (forewing length usually: 16–19 mm); reniform spot more rectangular (outer margin slightly concave), essentially unicolorous, or with dark spot in lower ⅓; hindwing with discal spot slender, only slightly darker than ground color 50

50. Forewing in four basic forms, two of which have a contrasting black bar in fold between antemedial and postmedial lines; two other forms medium gray to dark blackish brown with all markings obscure, including a thin basal dash (plate 2, figures 1–16) 51

— Forewing relatively evenly colored pale gray to brown with contrasting black basal dash; terminal area similar in color to subterminal area or slightly darker (plate 2, figures 23–32); orbicular spot elongate, more than 2 × as long as wide 52

51. Male genitalia with digitus extending to or beyond ventral apex of cucullus (plate F, figures 3, 4); Holarctic; in North America from Newfoundland to Alaska south to South Carolina, Colorado, and northeastern Oregon . . . . . *Apamea sordens* p. 49

— Male genitalia with digitus extending ⅔ to ventral apex of cucullus (plate F, figure 5); northwestern Oregon southward to southern California . . . . . *Apamea digitula* p. 52

52. Pale, maculate forms with dark shading in subterminal area between reniform spot and terminal line (plate 2, figures 1, 2, 5); dark and unicolorous forms (plate 2, figures 3, 4, 6) similar to those of *A. indocilis*; mainly Palearctic; Alaska . . . . . *Apamea remissa* p. 44

— Darker forms with subterminal area unicolorous (plate 2, figures 7–10); dark and unicolorous forms (plate 2, figures 11–16) similar to those of *A. remissa*; southern Canada from Newfoundland to British Columbia and southward to South Carolina, New Mexico, and California . . . . . *Apamea indocilis* p. 45

53. Postmedial line even (plate 2, figures 40–44); western United States and southwestern Canada . . . . . *Apamea spaldingi* p. 55

— Postmedial line scalloped between veins 54

54. Postmedial line on forewing with outward bulge at vein CuA_2; terminal line on hindwing continuous (especially obvious on underside) (plate 3, figures 1–5); southwestern Canada West Coast states (text figure 24) . . . . . *Apamea cinefacta* p. 55

— Postmedial line on forewing evenly curved on posterior ½ of wing; terminal line on hindwing a series of dark dashes between veins (plate 4, figures 15–22); boreal zone species of Canada, Alaska, and Rocky Mountain states (text figure 36) . . . . . *Apamea commoda* (part) p. 65

55. Forewing orange with transverse lines thick and black; antemedial line evenly curved (plate 8, figures 22–24); widespread in boreal zone of Canada and in Colorado . . . . . *Apamea contradicta* p. 100

— Transverse lines on forewing not particularly contrasting; antemedial line, if present, forming three arcs 56

56. Hindtibia with 1–3 sclerotized spiniform setae between medial and apical pairs; forewing with orbicular spot narrow and barlike, and some or most veins white (plate 8, figures 10–16) in most of North American range; forewing orange brown with maculation obscure (plate 8, figures 17–21) in western United States . . . . . *Apamea niveivenosa* p. 100

— Hindtibia without spiniform setae; forewing with orbicular spot round or oval; forewing, if orange brown with maculation obscure, then with white around reniform spot, or with large blue-gray spot in lower part of reniform spot 57

57. Forewing with long, black, basal dash; black line in fold between claviform spot and postmedial line (plate 6, figures 1–6); western United States and Canada 58

— Forewing usually without basal dash or dark line in medial area fold (occasional in some *A. devastator* (e.g., plate 7, figure 17) 59

58. Forewing pale gray to brown; subterminal area without hoary-white shading (plate 6, figures 1–4); widespread in western United States and Canada and south in California to central Sierra Nevada . . . . . *Apamea longula* p. 80

— Forewing bright orange or reddish brown with hoary-white shading in subterminal area (plate 6, figures 5, 6); mountains of southwestern California . . . . . *Apamea bernardino* p. 80

59. Reniform spot large, mainly filled with pale reddish brown, contrasting with blackish-brown ground color; thorax with rusty-red posterior tuft (plate 8, figures 8, 9); mainly Palearctic; in North America in Alaska . . . . . *Apamea rubrirena* p. 99

— Reniform spot, if pale, mainly filled with white; thorax without contrasting posterior tuft 60

60. Forewing ground color mottled with dark and light gray or brown, obscuring most maculation; reniform spot dark except for two, contrasting, oblong, white dots in lower outer margin (plate 6, figures 23–25); northern Colorado to south-central Mexico . . . *Apamea geminimacula* p. 85

— Forewing ground color not particularly mottled; reniform spot dark, partially or completely filled with white, or with white line on outer margin 61

61. Medial area dark with reniform and orbicular spots pale and concolorous with subterminal area (plate 8, figures 6, 7); eye reduced, ellipsoid; diurnal species of alpine areas in Colorado and New Mexico . . . . . *Apamea alticola* p. 98

— Orbicular spot and subterminal area not pale orange or white and contrasting with darker medial area; nocturnal species except in far north 62

62. Forewing with transverse lines essentially absent, or faintly defined with pale shading; reniform spot mainly white or with white on outer margin of spot 63

— Forewing with transverse lines prominent or obscure, but if obscure, then reniform spot outlined in black or in ground color 66

63. Forewing dark brown; reniform spot blackish gray with white line on outer margin of spot; hindwing bicolored with fuscous on outer ⅓ and dirty white on basal ⅔ (plate 7, figures 6, 7); northern Mexico . . . . . *Apamea hemimena* p. 88

— Forewing reddish brown to blackish brown; reniform spot with extensive white shading or more complete white outline; hindwing evenly colored or gradually paler toward wing base 64

64. Reniform spot dark with white specks forming partial outline; forewing apex pointed (plate 6, figures 7–11); boreal zone of North America southward in western mountains to Arizona and southern California . . . . . *Apamea scoparia* p. 81

— Reniform spot mainly white; forewing apex blunt (plate 6, figures 12–22) 65

65. Forewing dark brownish black with copperybrown hue on transverse lines and in medial area (plate 6, figures 12–15); male genitalia with two large, bulbous cornuti in vesica (plate K, figure 4); southeastern Canada and eastern United States southward to northern Georgia and westward to Manitoba; disjunct (or introduced) at Fort Collins, Colorado . . . . . *Apamea dubitans* p. 82

— Forewing brick red or orange brown in most areas (plate 6, figures 16–19), including all populations within range of *A. dubitans*; some populations west of range of *A. dubitans* (plate 6, figures 20–22) best identified by locality or genitalia; male genitalia with two small and one large cornuti in vesica (plate K, figure 5); boreal zone of Canada and northern United States, southward in western mountains to Colorado, Utah, and southern California . . . . . *Apamea cogitata* p. 84

66. Forewing pale buffy pink, orange brown, or reddish brown; reniform spot obscure except for contrasting dark blue-gray patch in lower ⅓ of spot 67

— Forewing with transverse lines prominent or obscure, but if obscure, then reniform spot outlined in black or in ground color 68

67. Forewing yellow brown, reddish brown, or orange brown; transverse lines absent, or defined by pale shading; hindwing fuscous, paler toward wing base (plate 6, figures 26–35; plate

7, figures 1–5); dark lunule at position of reniform spot on underside of forewing with pale center; boreal zone of Canada, northern New England, and Alaska, southward in west to New Mexico and Arizona . . . . . *Apamea inficita* p. 85

— Forewing pinkish gray to yellowish gray, paler than in *A. inficita*; maculation defined in darker gray brown; hindwing pale buff with light fuscous submarginal band and discal spot (plate 7, figures 8–10); dark lunule at position of reniform spot on underside of forewing; southern Canada and northern United States southward to Virginia, Iowa, Kansas, and Washington . . . . . *Apamea lutosa* p. 88

68. Forewing outer margin curved inward near apex so apex appearing rounded; postmedial line closer to subterminal line than to reniform spot (plate 7, figures 11, 12); Colorado, Utah, and eastern Arizona . . . . . *Apamea fergusoni* p. 89

— Forewing outer margin straight near apex so apex appearing sharply angled; postmedial line closer to reniform spot than to subterminal line 69

69. Forewing light gray or light brown with maculation defined in darker gray or brown; postmedial line double, even or slightly sinuate, pale filled; subterminal line usually evenly curved at M_3 and CuA_1 (plate 7, figures 13–16), or very slightly dentate (plate 7, figures 17, 18); widely distributed in Canada and United States as far south as Virginia, northern Texas, southern New Mexico, central Arizona, southern California, and northwestern Mexico . . . . . *Apamea devastator* p. 90

— Forewing color and pattern highly variable; postmedial line single with black inner element dentate, projecting through white outer element on veins; subterminal line usually with trace of W-mark at veins M_3 and CuA_1 (plate 7, figures 19–36; plate 8, figures 1–5); arctic, subarctic, and subalpine; Greenland and Newfoundland westward to Alaska and Washington and south to Colorado . . . . . *Apamea zeta* p. 91

Apamea verbascoides-GROUP

The *Apamea verbascoides*-group includes eight species characterized by the large, flat, rounded platelike area near the base of the uncus that supports a plume of long hairlike setae. Other characteristics of the male genitalia are 1) ampulla of clasper short and rounded, only slightly longer than wide; 2) cucullus with field of setae near anteroventral margin tending to be stout and spinelike (reduced to two stout setae at ventral corner in *A. cariosa* and *A. cristata*), more prominent than setae forming corona; 3) digitus slender and appearing frail, curving anteriorly away from cucullus; 4) vesica T-shaped, extending almost as far to left as to right in most species; 5) vesica usually with two stout cornuti, one near (or attached to) apex of aedeagus and one at apex or base of left diverticulum; and 6) vesica with field of minute, slender cornuti toward apex of aedeagus (vestigial or absent in some species). In the female genitalia the anal papillae are unique in that the posterior ½ is narrow and flattened but the anterior ½ is inflated and rounded ventrally and devoid of setae.

The adults of species in the group are medium-sized to large species of *Apamea* and most have a longitudinally streaked forewing pattern. All species have a dark patch of scales near the anal angle of the wing (the outer posterior part of the subterminal area adjacent to the subterminal line), a character also present in the *A. crenata*-group. In most species the subterminal line has a deep W-mark where the pale-lined veins M_3 and CuA_1 project through it to the wing margin. There is relatively little variation in color or maculation in most of the species except for *A. cariosa* and *A. cristata,* which have both light and dark morphs. Basal abdominal hair brushes and pockets are fully developed in all species. Most specimens in collections are females.

The *Apamea verbascoides*-group is confined almost entirely to eastern North America with the ranges of a few species extending into the eastern edge of the Great Plains; only *A. cariosa* occurs as far west as the Rocky Mountains in Alberta and Colorado.

Apamea verbascoides (Guenée)
PL. 1, FIGS. 1, 2; PL. C, FIG. 1 (♂ gen.); PL. O, FIG. 1 (♀ gen.); TEXT FIG. 1 (map) (RWH 9326).

Xylophasia verbascoides Guenée, 1852, *in* Boisduval and Guenée, *Histoire Naturelle des Insectes. Species Général des Lépidoptères,* **5**: 141.
Type locality: New York State, USA. [BMNH]

NOTE—The lectotype of *Xylophasia verbascoides* was designated by Ferguson (1977: 58).

Apamea verbascoides and the next species, *A. inebriata,* have a cryptic forewing pattern that re-

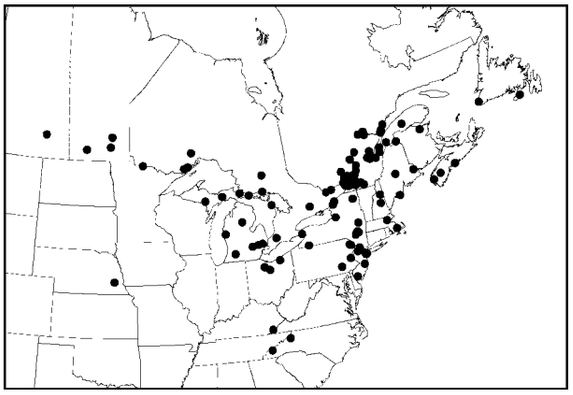


FIGURE 1: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA VERBASCOIDES*

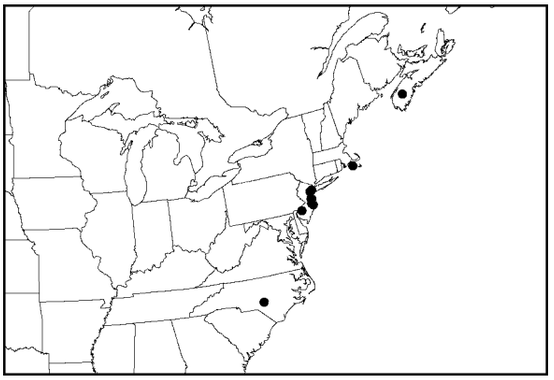


FIGURE 2: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA INEBRIATA*

sembles dead wood. In both species the forewing is pale brown with the normal lines and spots faint, appearing to have been blurred into longitudinal streaks. The costal margin of the wing is paler than the posterior margin. The postmedial line is marked with white through the fold. The basal, medial, and anal dashes form a broken streak from the wing base to the terminal line. The reniform spot is faintly outlined by a pale line with small black dots bordering the outline. The two species are superficially similar to *A. cuculliformis,* a western species that does not occur within the range of either *A. verbascoides* or *A. inebriata. Apamea cuculliformis* can most easily be distinguished from species of the *A. verbascoides*-group by the narrow *Cucullia*-like forewings with scalloped margins and the raised *Cucullia*-like hood formed by the prothoracic collar. Differences between *A. verbascoides* and *A. inebriata* are discussed under *A. inebriata.* Forewing length varies from 17 to 21 mm.

In the male genitalia of *A. verbascoides* the subbasal diverticulum of the vesica is longer than the apical part of the vesica and the cornutus is at the base of the diverticulum rather than at the apex.

The immature stages are unknown.

Apamea verbascoides occurs from Newfoundland westward to southern Saskatchewan and southward to Ohio and New Jersey and in the higher Appalachians to North Carolina. An isolated specimen is from Lincoln, Nebraska. The flight season extends from mid-June to late August.

Apamea inebriata Ferguson

PL. 1, FIGS. 3, 4; PL. C, FIG. 2 (♂ gen.); PL. O, FIG. 2 (♀ gen.); TEXT FIG. 2 (map) (RWH 9327).

Apamea inebriata Ferguson, 1977, *Jour. Lep. Soc.,* **31**: 58.
Type locality: Lake Kejimkujik, Nova Scotia, Canada. [USNM]

This species occurs along the Atlantic Coast between Nova Scotia and North Carolina. Adults are on average slightly smaller than *A. verbascoides* (forewing length: 15–19 mm, versus 17–21 mm for *A. verbascoides*) and superficially similar. The best diagnostic character to distinguish *A. inebriata* from *A. verbascoides* is the absence of a white line on the veins at the fork of veins M_3 and CuA_1. Also, *A. inebriata* can be recognized by the fine, black lines on the veins of the forewing distal to the reniform spot (in *A. verbascoides* this area is pale brown with few black streaks), and the reniform spot is defined by two black dots in a pale-yellow patch (the pale area is barely evident in *A. verbascoides*), and the basal dash is much smaller than that in *A. verbascoides* and sometimes even absent.

In the male genitalia the sacculus is lobed and only slightly extended dorsally in *A. inebriata,* being only slightly wider (1.3 ×) than the narrow middle part of the valve and not extending dorsally to the dorsal margin of the valve; in *A. verbascoides* the basal part of the sacculus is extended dorsally into a rounded lobe that extends to or beyond the dorsal margin of the valve and is much wider (1.8 ×) than the middle part of the valve. The vesica is T-shaped with the subbasal diverticulum shorter than the apical part of the vesica and has a bulbous cornutus at the apex of

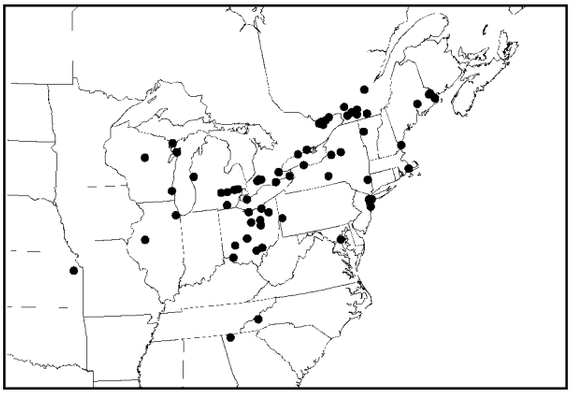


FIGURE 3: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA NIGRIOR*

the diverticulum (in *A. verbascoides* the subbasal diverticulum is longer than the apical part of the vesica and the cornutus is at the base of the diverticulum near the apex of the aedeagus). The female genitalia of the two species are similar, but in *A. inebriata* the ductus bursae is only slightly more heavily sclerotized than the posterior part of the corpus bursae but is distinctly more heavily sclerotized in *A. verbascoides.*

The immature stages are unknown.

Apamea inebriata is a localized species found along the Atlantic seaboard from Nova Scotia to North Carolina. The species occurs in mixed woodlands in the northern part of its range and in wetlands farther south. The flight season extends from late June until mid-August, but most records are from late July and early August.

Apamea nigrior (Smith)
PL. 1, FIGS. 5, 6; PL. C, FIG. 3 (♂ GEN.); PL. O, FIG. 3 (♀ gen.); TEXT FIG. 3 (map) (RWH 9328).

Xylophasia nigrior Smith, 1891, *Proc. U. S. Natl. Mus.,* **13**: 437.
Type locality: Kittery Point, Maine, USA. [MCZ]

Apamea nigrior is frequently confused with *A. verbascoides* but is distinguishable from it by the darker blackish-brown ground color, the dusting of contrasting white scales on the costa, more prominent transverse lines, and the black and white outline of the reniform and orbicular spots. The forewing ground color lacks the warm yellowish-brown hue of *A. verbascoides* and *A. inebriata,* and the wings appear to be broader. A longitudinal black streak extends from the wing base through the fold to subterminal line, being interrupted only by the postmedial line. The veins in the subterminal area are conspicuously black. Forewing length varies from 18 to 22 mm.

The male genitalia are most similar to those of *A. verbascoides,* but the uncus is narrower than in *A. verbascoides* and other species in the group because the subbasal swelling is two rather than three times as wide as the base of the uncus. The vesica is like that of *A. inebriata* but the basal cornutus is positioned well away from the aedeagus, but still connected to it by a sclerotized band, and the vesica has no distal patch of minute setae, unlike those of *A. verbascoides* and *A. inebriata.* The female genitalia are similar to those of *A. verbascoides* and *A. inebriata,* but the corpus bursae is pear shaped, lacking the prominent postmedial constriction.

The immature stages are unknown.

Most records of *Apamea nigrior* are from southeastern Canada and northeastern United States as far south as Ohio and New Jersey, but it occurs in the Appalachians as far south as northern Georgia and as far to the southwest as eastern Kansas. Adults occur from mid-June until mid-July.

Apamea vulgaris (Grote and Robinson)
PL. 1, FIGS. 7, 8; PL. C, FIG. 4 (♂ gen.); PL. O, FIG. 4 (♀ gen.); TEXT FIG. 4 (map) (RWH 9332).

Xylophasia vulgaris Grote and Robinson, 1866, *Proc. Ent. Soc. Philadelphia,* **6**: 18.
Type locality: ‘‘Middle States,’’ USA. [BMNH]

NOTE—The original description does not mention how many specimens were available. The female in the BMNH labeled ‘‘Type [round, red border]/ Buffalo Grote Coll. 81-116./ *Xylophasia vulgaris* G. & R. Type’’ is here designated LECTOTYPE to ensure the stability of the name.

The specific name of this species, meaning common, does not seem appropriate because the species is apparently uncommonly collected. The forewing is uniformly medium gray brown, with the maculation relatively weak. The reniform spot and longitudinally oval orbicular spot are outlined in yellow brown and partially in black. The most characteristic marking is the geminate postmedial line, the outer part of which forms a double series of black dots on the wing veins; the

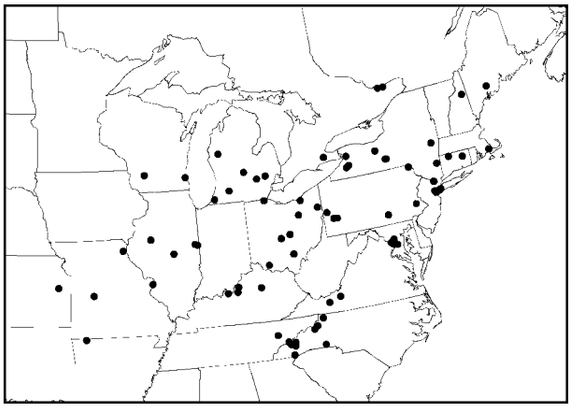


FIGURE 4: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA VULGARIS*

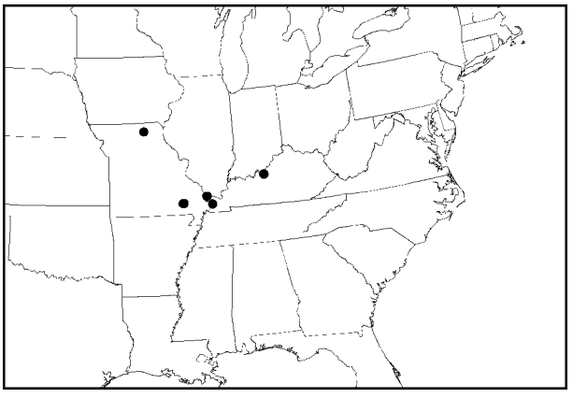


FIGURE 5: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA WIKERI*

subterminal line is mainly brown, but in the fold it is pale buff and forms a contrasting crescent. A series of fine black streaks form a broken series of dashes extending from the wing base through the fold to the subterminal line. The claviform spot is essentially absent. Adults are fairly large (forewing length: 18–22 mm).

The male genitalia are similar to those of *A. inebriata,* but the dorsal margin of the sacculus is much higher and extends over the dorsal margin of the valve, similar to that of *A. verbascoides* except that the dorsal margin is not as evenly rounded. The female genitalia are similar to those of *A. verbascoides,* but the posterior pouch on the left side is larger in *A. vulgaris.*

The immature stages are unknown except for a report by Tietz (1972: 683) that gives corn (*Zea mays* L.) as a larval food plant.

Apamea vulgaris is widespread in eastern United States, though infrequently collected. It occurs from southern Quebec and Ontario southward to southern North Carolina, Arkansas, and Kansas. A record from northern Florida needs further confirmation. The flight season extends from early May until late July, but most records are from June.

Apamea wikeri Quinter and Lafontaine, NEW SPECIES

PL. 1, FIGS. 9, 10; PL. C, FIG. 5 (♂ gen.); PL. O, FIG. 5 (♀ gen.); TEXT FIG. 5 (map).

Apamea wikeri Quinter and Lafontaine.

Type locality: 3 mi W of Tamms, Alexander Co., Illinois, USA. [CNC]

NOTE—We are pleased to name this species for James R. Wiker, who has contributed much to our understanding of this moth, as well as apameine biology in general through his extensive field experience.

This species is apparently confined to Mississippi and Ohio River floodplain forests. It is characterized by the yellowish-gray color of the forewing, the prominent black patch in the fold between the claviform spot and the postmedial line, the apparent blurring of the maculation, and the relatively narrow wings. These features combine to give *A. wikeri* a distinctive appearance, more like some species in the genus *Lithophane* Hübner, especially *L. patefacta* (Walker), than an *Apamea.* The male genitalia are most similar to those of *A. quinteri* and *A. vulgaris* but differ in characters of the uncus, cucullus, and vesica.

Antenna of male slightly constricted between segments and slightly bifasciculate (as in other species of group); antenna of female filiform, ciliate ventrally. Forewing brownish gray with a dusting of dark-gray scales along costa and in basal and medial areas; basal dash absent; antemedial line pale gray, projecting outward mesially with contrasting black patch between antemedial and postmedial lines; reniform and orbicular spots outlined in pale gray with pale-gray and dark-gray spots in center; postmedial line double but faint, most evident at distal end of medial black patch, defined mainly as a pale line but with minute black spots on veins representing tips of serrations of postmedial line; subterminal area appearing rather smooth, slightly paler than ground color due to lack of black speckling; subterminal line pale gray, sinuous, without W-shaped indentations characteristic of other

species in *A. verbascoides*-group; two or three small brownish-black wedges proximal to subterminal line on inner side beyond position of reniform spot; terminal area extensively shaded with dark charcoal gray, mainly confined to area beyond position of reniform spot and in fold; terminal line a series of black crescents between veins; fringe checkered with light and dark brownish gray; forewing length: 18–19 mm. Hindwing dark fuscous, slightly paler toward base; discal spot elongate, faint, slightly darker than ground color; fringe contrasting pale yellow.

Male genitalia generally as described for species-group but uncus unique in three characters: 1) subbasal plate of uncus continuous with tegumen, without prominent constriction between plate and tegumen at base of uncus; 2) apical part of uncus longer and more slender than in other species (about $\frac{1}{8}\times$ as wide as subbasal plate; $\frac{1}{3}$–$\frac{1}{6}\times$ as wide in other species); and 3) apex of uncus with broad diamond-shaped area $2\times$ as wide as mesial part of uncus. Other characters of male genitalia combine characteristics of *A. quinteri* and *A. vulgaris*: cucullus broad and digitus long, as in *A. vulgaris*; setae stout on ventral margin of cucullus, and peniculus rounded, as in *A. quinteri*; vesica with short subbasal diverticulum with large bulbous apical cornutus, unlike those of *A. vulgaris* and *A. quinteri.* Female genitalia most similar to those of *A. quinteri*; anal papilla very large, slightly longer than ductus bursae, heavily sclerotized with setae confined to apical $\frac{1}{3}$; ductus bursae relatively long, about $\frac{2}{3}\times$ as long as corpus bursae; corpus bursae pear shaped, evenly tapered on right side.

Despite much concerted effort to document the details of the life cycle of this species, its life history remains largely unknown, although some important inferences can be drawn from what little is known. The senior author (Quinter) has repeatedly observed adult females actively flying shortly after dusk in dense canebrakes of rich bottomlands where the rare grass *Diarrhena americana* Beauvois flourishes in association with giant cane (*Arundinaria gigantea* (Walter) Mühlenberg). Jim Wiker (pers. comm.) has followed female moths in canebrakes and observed them with a flashlight flying one or two feet above the ground over patches of *Diarrhena* until they encounter a flowering culm of the grass, when they immediately alight upon it. They then proceed to walk up the stalk toward the flower head until the weight of the moth causes the culm to bend toward the ground, whereupon the moth turns around so that it is facing head up, while inserting its ovipositor into the inflorescence. In spite of repeated collections of such flower heads, no eggs or larvae have been collected. Given the propensity for female *Apamea* species to oviposit in this manner, it seems a reasonable assumption that *Diarrhena* is the host plant; however, the alternative possibility, that *Arundinaria* is the host, cannot be ruled out. Adults of *Apamea wikeri* have only been found where both grasses grow together. *Arundinaria* is unusual among grasses in that it blooms synchronously at intervals of many years. Any moth requiring *Arundinaria* as a host, but also requiring inflorescences for oviposition, would be obliged to utilize another host for that purpose. It is also worth noting that no males have ever been observed flying in association with the females and are rarely collected at UV light. On a number of occasions, males were collected in Malaise traps in canebrakes where females had been observed, suggesting that males may be crepuscular, or even diurnal.

TYPES. **Holotype:** ♂. McCrite Farm woods just west of cemetery, 3 mi W of Tamms, T15S-R2W Section 3, Alexander Co., Illinois; 6–16 June 1999; Malaise trap; James R. Wiker; Genitalia CNC slide #13589 ♂. CNC. **Paratypes:** 13 ♂, 27 ♀. **Illinois.** Same locality and collector as for holotype; 13, 28 June 1997 (4 ♀); 6–30 June 1999; Malaise trap (8 ♂); 11 June 2002 (1 ♂, 1 ♀); 11–13 June 2003 (1 ♂, 6 ♀, pair in copula). Same locality as for holotype; 16 June 1999; Quinter, Wiker & Black (5 ♀). **Kentucky.** Sandy Branch, 5 mi SW Bardwell, Carlisle Co.; 18 June 1999; Quinter, Wiker & Black (3 ♀). Otter Creek Park, Meade Co.; 20 June 1981; Richard Henderson (1 ♂). **Missouri.** Junction rt. 49 & Black R., 400′, Browns Crossing, Mark Twain Nat'l. Forest, 2.7 mi W Williamsville, Wayne Co.; 21–22 June 1993; Eric L. Quinter (1 ♂, 7 ♀). Markham Spring Campground, Wayne Co.; J. R. Heitzman (1 ♂). Adair Co.; 7 July 1975; J. H. Shaddy (1 ♀). AMNH, CNC, ELQ, INHS, JRH, JRW, USNM, and the personal collection of Richard Henderson.

Apamea wikeri is known only from floodplain forests at five localities on the Ohio, Mississippi, Salt, and Black Rivers in western Kentucky, southern Illinois, and eastern Missouri.

Apamea cristata (Grote)

PL. 1, FIGS. 11, 12; PL. C, FIG. 6 (♂ gen.); PL. O, FIG. 6 (♀ gen.); TEXT FIG. 6 (map) (RWH 9331).

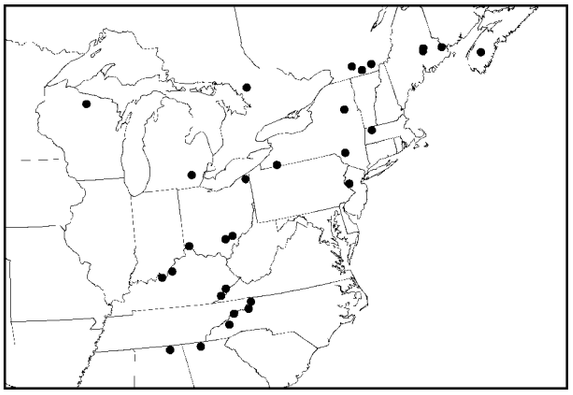


FIGURE 6: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA CRISTATA*

Hadena cristata Grote, 1878, *Bull. U. S. Geol. Surv.,* **4**: 176.
Type locality: Evans Center, New York, USA. [BMNH]

NOTE—In the BMNH there is a female labeled "Type [round, red border]/ Grote Coll. 81-116./ New York, Evans Center VII.1877/ *Hadena cristata* Harvey [blue border]/ *Hadena cristata* Type Harvey [red border]." Probably, this specimen was determined as *A. vulgaris* by Smith (1890: 140), but it is *A. cristata.* Indeed, the species was described from material named but not published by Harvey (Smith, 1891: 436; Grote, 1878: 176). The original description by Grote mentions that he had one or more males from Buffalo; this female is not a syntype, so it is designated as NEOTYPE of *Hadena cristata* Grote to ensure the stability of the name.

Apamea cristata is a broad-winged, relatively large *Apamea* (forewing length: 20–24 mm). The forewing ground color is typically pale luteous brown with a slight olive-colored hue to the darker shades, but darker brown forms also occur. The maculation appears to be longitudinally blurred with the reniform and orbicular spots and postmedial line defined mainly by pale lines. The most conspicuous markings are the black patches in the fold on the wing margin and the inner side of the postmedial line. The lower part of the outer margin of the wing is slightly concave.

The male genitalia are similar to those of *A. vulgaris* in most features. They differ from those of *A. vulgaris* in that the cucullus is narrower apically, the normal band of stout setae on the anteroventral margin of the cucullus is reduced to two stout setae at the anal angle of the cucullus, and the apical part of the uncus is short and broad; all three characters are shared with *cariosa.* The female genitalia are similar to those of *A. vulgaris* but the anal papillae are broad, unlike those of *A. vulgaris* and most other species of the *A. verbascoides*-group, and the corpus bursae is more swollen posteriorly, giving it a more figure eight appearance.

The immature stages are unknown.

Apamea cristata occurs from southern Canada (Nova Scotia to Ontario) and Minnesota southward to Georgia and Alabama. The moths fly in deciduous woodlands from early June to late July, but most records are from the latter half of June.

Apamea cariosa (Guenée)
PL. 1, FIGS. 13–15; PL. D, FIG. 1 (♂ gen.); PL. O, FIG. 7 (♀ gen.); TEXT FIG. 7 (map) (RWH 9329, 9330).

Xylophasia cariosa Guenée, 1852, *in* Boisduval and Guenée, *Histoire Naturelle des Insectes. Species Général des Lépidoptères,* **5**: 144.
Type locality: New York State, USA. [BMNH]

NOTE—Poole (1989) suggests that several syntypes could exist, but Guenée (1852: 144) expressly states that a female in poor condition was the only specimen available.

Hadena idonea Grote, 1882, *Can. Ent.,* **14**: 18.
Type locality: Texas, Kansas, and Wisconsin [lectotype not labeled as to locality]. [BMNH]

NOTE—Smith (1891: 438) considered *idonea* as a species distinct from *cariosa,* but later (Smith, 1893: 139) synonymized them after examining the types at the British Museum. We designate a male in BMNH labeled "*Hadena idonea* Grote Type/ Type/ Grote Coll. 81-116/ U. S. America/ 627" as LECTOTYPE to ensure the stability of the name. The lectotype represents the dark unicolorous form of *cariosa.*

Hadena cluna Strecker, 1898, *Lepidoptera, Rhopaloceres and Heteroceres indigenous and exotic,* Suppl. **1**: 7.
Type locality: near Chicago, Illinois, USA. (FMNH)

NOTE—A male in the Field Museum of Natural History, Chicago, labeled "Ill., 29, 237, *H. cluna* Type," is here designated LECTOTYPE to ensure the stability of the name.

Hadena dionea Smith, 1899, *Can. Ent.,* **31**: 258.

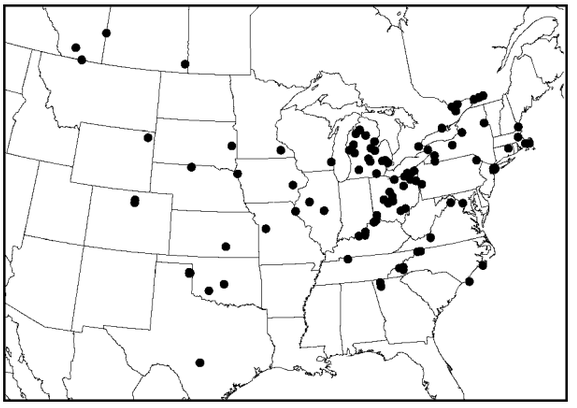


FIGURE 7: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA CARIOSA*

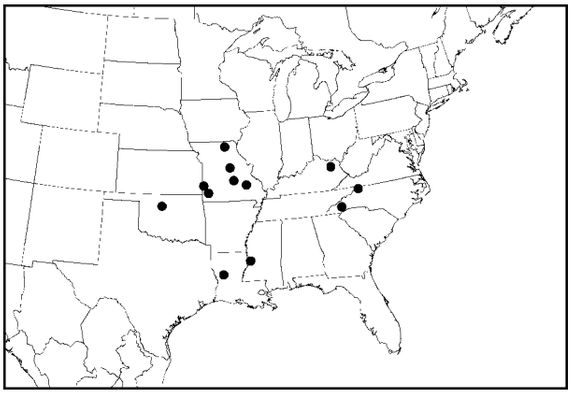


FIGURE 8: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA QUINTERI*

Type locality: Volga, South Dakota, USA. [USNM]

NOTE—Smith proposed the name *dionea* as a replacement for *idonea* after discovering that the types of *cariosa* and *idonea* were the same (Smith, 1899: 258). The lectotype of *dionea* was designated by Todd (1982: 65).

This species occurs in two color forms that have previously been treated as separate species; intermediate forms are rare. *Apamea cariosa* and *A. quinteri* are smaller than the other species in the *A. verbascoides*-group (forewing length: 16–19 mm) and the apex of the forewing is less pointed. The medial dash is typically prominent but separated from the basal dash by the antemedial line. In the nominate form the forewing is progressively darker toward the posterior margin, the costal area is pale gray brown, and the maculation contrasts with the yellowish-brown ground color. The dark form, described as *idonea,* is uniformly dark gray brown with the maculation defined by fine black lines.

The male genitalia share three distinctive characteristics with *A. cristata* (listed under *A. cristata*); they differ from those of *A. cristata* in four features: 1) the uncus is expanded and slightly diamond shaped apically (tapered in *A. cristata*); 2) the digitus is vestigial; 3) the subbasal diverticulum in the vesica is bilobed with the cornutus at the apex of the ventral lobe; and 4) the vesica has no distal patch of minute setae, unlike the vesica of most other species in the *A. verbascoides*-group. The female genitalia are unique in that A8 and the anterior apophyses are very heavily sclerotized and the anterior apophyses are unusually long and stout.

The larva was described by Crumb (1956: 234). The mature larva is dark purplish gray, about 30 mm long, with pale longitudinal lines consisting of a thin middorsal line, an indistinct subdorsal line, and a broad lateral line. The setal tubercles are flat and black with those of the D1 and D2 setae similar in size. The larva feeds on grasses, but a larva collected in forest leaf litter was reared for several weeks on dead oak leaves, suggesting a departure from the typical *Apamea* life history.

Apamea cariosa is widely distributed across southern Canada as far west as Alberta and as far south as Georgia, Texas, and Colorado. The flight season extends from late May to late July, but most records are from the latter half of June.

Apamea quinteri Mikkola and Lafontaine, NEW SPECIES

PL. 1, FIGS. 16, 17; PL. D, FIG. 2 (♂ gen.); PL. O, FIG. 8 (♀ gen.); TEXT FIG. 8 (map).

Apamea quinteri Mikkola and Lafontaine.

Type locality: Morehead, [Rowan Co.], Kentucky, USA. [CNC]

NOTE—This species is dedicated to Eric Quinter who first recognized it as new.

Apamea quinteri is a southern species known from relatively few specimens. It is most likely to be confused with *A. cariosa,* the forewing appearing somewhat intermediate between the light and dark forms of *A. cariosa,* but the subterminal line lacks the strong W-shaped mark characteristic of *A. cariosa,* the claviform spot extends no more than ½ way to the postmedial line, and in the female the basal area of the wing is paler than

the general ground color. The male genital capsule is not at all like that of *A. cariosa* but most closely resembles that of *A. inebriata* except that the uncus is shorter. The vesica is like that of *A. cariosa* with the subbasal diverticulum bilobed and with the cornutus at the apex of the ventral lobe, and there is no distal patch of minute setae on the vesica. *Apamea quinteri* exhibits a moderate degree of sexual dimorphism; the male is slightly larger than the female, and the forewing is more uniformly colored and darker gray.

Antenna of male slightly constricted between segments and slightly bifasciculate (as in other species of group); antenna of female filiform, ciliate ventrally. Forewing brownish gray with posterior part of medial area distinctly darker than ground color; basal area paler than ground color in female; costa similar to ground color except for dark-gray area between reniform and orbicular spots that extends between spots as a diffuse medial line; antemedial and postmedial lines outlined in black, weakly double and filled with pale gray; reniform and orbicular spots slightly paler than ground color, outlined in black; claviform spot extending no more than ½ distance to postmedial line; diffuse dark streaks in fold in medial, subterminal, and terminal areas; subterminal area with a series of brown wedge-shaped spots adjacent to subterminal line; subterminal line pale, irregular, slightly sinuate mesially with weak wedge-shaped marks instead of deep W-shaped mark; terminal area charcoal gray; terminal line a series of dark fuscous chevrons between veins; fringe checkered with dark brown and light brown; forewing length: 16–18 mm. Hindwing dark fuscous, slightly paler toward wing base; discal spot elongate, slightly darker than ground color; terminal line dark fuscous; fringe pale gray.

Male genitalia generally as described for species-group but band of setae near anteroventral margin of cucullus with setae stouter than those of most other species; cucullus broad and triangular; digitus slender and sinuate; uncus relatively short, about ¼ × longer than width of subbasal plate; uncus dorsoventrally flattened, tapered to a point with subapical area slightly wider than mesial area; vesica with subbasal diverticulum bilobed and with bulbous cornutus at apex of ventral lobe, which curves ventrolaterally to right; only two or three setae in subapical patch of minute cornuti. Female genitalia similar to those of *A. vulgaris* but not like those of *A. cariosa.* Ductus bursae heavily sclerotized and rugose, joined to posterior right side of corpus bursae; corpus bursae pear shaped; abdominal segment eight and anterior apophyses moderately sclerotized; anterior apophyses slender; anal papillae pointed posteriorly, inflated and rounded anteriorly.

The immature stages are unknown.

TYPES. **Holotype:** ♂. Morehead, [Rowan Co.], Kentucky; 25 June 1962; Freeman and Lewis; Slide *Apamea* ♂ CNC 9243. CNC. **Paratypes:** 3 ♂, 11 ♀. **Louisiana.** Red Dirt National Wildlife Refuge, Kisatchie National Forest, Natchitoches Parish; 18 May 2001; V. A. Brou (1 ♂). **Mississippi.** Vicksburg, Warren Co.; 17 June 1969; Bryant Mather (1 ♀). **Missouri.** Mill Creek Campground, Phelps Co.; 22 July l989; F. W. Stehr (1 ♂). Sarcoxie, Jasper Co.; 17 June 1975; Rae Letsinger (1 ♂). Prairie State Park, 4 mi S Liberal, Barton Co.; 9 July 1988 (4 ♀) and 23 July 1988 (2 ♀); Rae Letsinger. Johnson's Shut-Ins State Park, Reynolds Co.; 23 July 1984; J. R. Heitzman (1 ♀). Ashland Wildlife Area, Boone Co.; 11 July 1977; J. R. Heitzman (1 ♀). **North Carolina.** Balsam Mt., 6,000′, Richland, Jackson-Haywood Co.; 30 June 1967; D. C. Ferguson (1 ♀). **Oklahoma.** Garfield Co.; 11 July 1977; J. F. Reinert (1 ♀). AMNH, CNC, ELQ, USNM, and the personal collections of Vernon A. Brou, Jr., J. Richard Heitzman, and Rae Letsinger.

Apamea quinteri occurs in a limited area of southeastern United States from western North Carolina and eastern Kentucky westward to Missouri, Oklahoma, and southward to Mississippi and Louisiana in association with remnants of prairie habitat.

Apamea crenata-GROUP

The *Apamea crenata*-group includes 12 species, six Nearctic, and six Palearctic (*A. crenata* (Hufnagel), *A. aquila* (Donzel), *A. epomidion* (Haworth), *A. extincta* (Staudinger), *A. sodalis* (Butler), and *A. striata* Haruta), and possibly about ten more in southeastern Asia. The adults of species in the *Apamea crenata*-group are small to medium-sized moths and most have a longitudinally streaked forewing pattern. Species belonging to the group are most easily recognized by the dark patch in the outer lower part of the subterminal area next to the dark patch at the anal angle, usually the most conspicuous dark area of the wing. Also, the male antennae are unusual in being filiform and minutely ciliate, not slightly bifasciculate as in other *Apamea* species. The species in the *A. verbascoides*-group have a similar patch but they also have a dark streak in the

medial fold, a basal dash, and a deep W-mark where the pale-lined veins M_3 and CuA_1 project to the wing margin. Males of most species have fully developed basal abdominal brushes and pockets, but in *A. perpensa* and *A. plutonia* all that remains are traces of vestigial levers and pockets. As with the species in the *Apamea verbascoides*-group, most specimens in collections are females.

In the male genitalia the uncus has a subbasal expanded platelike area with a plume of long hairlike setae (usually yellow), as in the *Apamea verbascoides*-group, but the platelike structure usually is 1.5–2.0 × as wide as the basal width of the uncus, much smaller than in the *verbascoides*-group. *Apamea apamiformis* has a plate on the uncus as large as those in the *Apamea verbascoides*-group, so we treat it as the most primitive member of the *Apamea crenata*-group; we include it here because of the long ampulla of the clasper, filiform male antenna, and three cornuti in the vesica. The *Apamea crenata*-group differs from the *verbascoides*-group in that the ampulla is long (7–8 × as long as wide in *A. alia* and *A. xylodes,* 12–15 × as long as wide in the other species) (ampulla long but highly modified in *A. apamiformis*); the band of stouter setae near the anteroventral margin of the cucullus tends to be more concentrated toward the costal and anal angles of the cucullus; the subbasal diverticulum of the vesica is replaced by two short pouches, each with an apical bulbous cornutus, and there is a third cornutus connected to the apex of the aedeagus by a sclerotized band; the cucullus is large and triangular; and the digitus, instead of simply bending ventrally near the cucullus, is acutely angled near the middle of the valve in a Y-shape with the stem of the ''Y'' extended slightly posteriorly to give the digitus a distinctive wishbone shape (digitus vestigial in *A. apamiformis*). The form of digitus and shape of the vesica are diagnostic for the species-group. In the female genitalia the anal papillae are tapered posteriorly and dorsoventrally flattened, slightly inflated toward the base, and signa in the corpus bursae are reduced or absent (except *A. apamiformis*); in most species (except *A. apamiformis, A. crenata, A. epomidion,* and *A. vultuosa*) the corpus bursae is very long with the middle part greatly lengthened. *Apamea apamiformis* is unusual among species in the *Apamea crenata*-group in having broad, apically truncated anal papillae and four prominent signa in the corpus bursae.

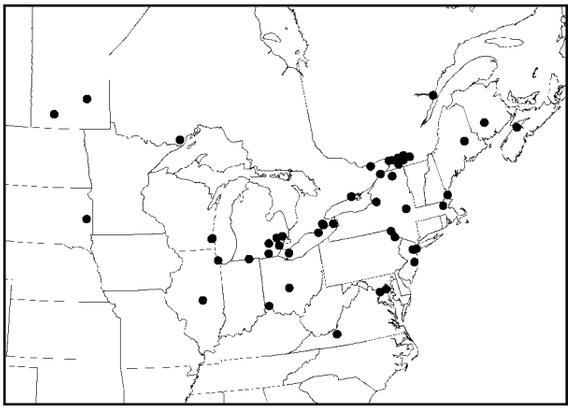


FIGURE 9: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA APAMIFORMIS*

The *Apamea crenata*-group is Holarctic in distribution.

Apamea apamiformis (Guenée)
PL. 1, FIGS. 18, 19; PL. D, FIG. 3 (♂ gen.); PL. P, FIG. 1 (♀ gen.); TEXT FIG. 9 (map) (RWH 9343).

Xylophasia apamiformis Guenée, 1852, *in* Boisduval and Guenée, *Histoire Naturelle des Insectes. Species Général des Lépidoptères,* **5**: 137.
Type locality: New York State, USA. [BMNH]

NOTE—Guenée (1852) did not mention how many specimens he had. A large male of the dark form in the Natural History Museum (London) labeled ''Type [round, red border]/ U. S. America, Doubleday 46-116./ *Xylophasia apamiformis* Gn.'' is here designated LECTOTYPE to ensure the stability of the name. The specimen is worn, the antennae are missing, and one hind leg is glued onto a label.

Hadena contenta Walker, 1857, *List of the Lepidopterous Insects in the Collection of the British Museum,* **11**: 754.
Type locality: Orillia, Ontario, Canada. [BMNH]

NOTE—*Hadena contenta* is a junior secondary homonym of *Mamestra contenta* Walker, 1856, a synonym of *Apamea devastator* (Brace).

Apamea apamiformis is a medium-sized to large species of *Apamea* (forewing length: 18–23 mm). Superficially it looks like a large, dark, narrow-winged form of *Apamea vultuosa.* The adults occur in two forms, one with a dark, grayish-brown forewing with the maculation obscured, and the

other with a pale-brown forewing with the pattern more contrasting. The dark form outnumbers the light form about 2:1. Curiously, all 11 specimens reared from eggs by MacKay and Rockburne (1958) were of the dark form. The reniform spot has white scales on the outer edge, and the claviform spot is large and prominent, outlined in black and filled with dark gray. Two blackish-brown patches are in the subterminal area adjacent to the subterminal line, one opposite the reniform spot and one near the anal angle of the wing.

The genitalia of *Apamea apamiformis* are atypical for the *A. crenata*-group in both sexes. In the male genitalia the ampulla is modified into a heavily sclerotized plate at the apex of the clasper with two spikelike processes projecting dorsally beyond the costal margin of the valve; the digitus is vestigial, barely projecting into the ventral notch at the base of the cucullus and obscured by the heavily sclerotized ampulla; the field of stout setae, normally restricted to a band along the anteroventral margin of the cucullus, is expanded to cover the anterior ½ of the cucullus. In the female genitalia the anal papillae are broad, flat, and apically truncated, and the corpus bursae has four long signa, characters unique to species in the *A. crenata*-group.

The egg and larval instars were described by MacKay and Rockburne (1958). The larva feeds on the wild rice (*Zizania aquatica* L.). The eggs are laid inside the florets in July. The early instars feed on the flower heads; those of the later instars on the developing seeds, within the leaf sheath, and also bore into the stalks. The larvae overwinter in the soil or in the stalks in the late instars, but apparently not as mature last instars; they feed briefly in the spring before moulting into the last instar and pupating. MacKay and Rockburne (1958) suggest that the preserved larvae described by Dyar (1898: 320) and Crumb (1956: 234) were misidentified; they are more likely descriptions of the larvae of *A. vulgaris.* The larva, commonly known as the wild rice worm, is a major pest of wild rice. In Minnesota, 70–100 % of the rice acreage is infested each year and losses with control programs range from 5–15 % but without control can be as high as 75 % (Nelson, 2000). Handfield (1999) suggests *Zizania palustris* L. as another probable host plant in the Northeast.

Apamea apamiformis occurs from Nova Scotia westward to Manitoba and eastern South Dakota and southward to Virginia, Ohio, and Illinois. The flight season extends from late June to early August.

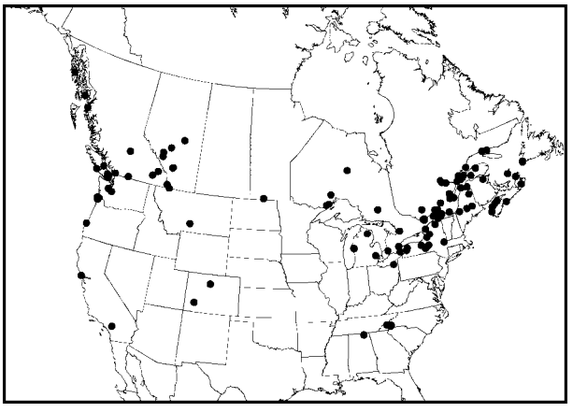


FIGURE 10: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA VULTUOSA*

Apamea vultuosa (Grote)

PL. 1, FIGS. 20–24; PL. D, FIG. 4 (♂ gen.); PL. P, FIG. 2 (♀ gen.); TEXT FIG. 10 (map) (RWH 9341, 9342).

Hadena vultuosa Grote, 1875, *Proc. Acad. Nat. Sci. Philadelphia,* **27**: 420.
Type locality: New York State, USA. [BMNH]

NOTE—Grote had several specimens of this species from ''Canada and New York.'' A female in good condition in the Natural History Museum, London, labeled ''Type [round, red border]/ Grote Coll. 81-116/ *Hadena vultuosa* Grote, Type, 81-116'' is here designated LECTOTYPE to ensure the stability of the name. The lectotype bears no locality information; so, we restrict the type locality to New York State because two distinctive subspecies occur in Canada but only the eastern form is found in New York.

Hadena multicolor Dyar, 1904, *Proc. Ent. Soc. Washington,* **6**: 103. NEW SYNONYMY, NEW STATUS, SUBSPECIES.
Type locality: Victoria, British Columbia, Canada. [USNM]

This is the sister species of the Palearctic *Apamea crenata,* from which it differs in having the hind margin of the forewing of the same color as elsewhere (the hind margin is paler in *A. crenata*), and the orientation of the two diverticula differ in the vesica of the male genitalia. The western subspecies *multicolor* was previously considered

a distinct species, but the genitalia are identical and intermediates occur.

Apamea vultuosa is a distinctively patterned species unlikely to be confused with any other species in North America except *A. apamiformis* and the much smaller *A. xylodes* from the southern Rockies. Probably the most distinctive feature is the blackish-brown color of the thorax, which contrasts sharply with the much paler forewing ground color. The middle part of the forewing is uniformly yellowish brown (occasionally pale gray) and the transverse lines are reduced to dark dots on the veins. Males are usually paler and more unicolorous than females. The costal and outer margins of the forewing are suffused with dark reddish brown and there are dark-brown patches in the subterminal area, one opposite the reniform spot and one near the anal angle that extends inward to the postmedial line. Specimens from the southern Appalachians (plate 1, figure 24) are darker and browner than those from farther north. Subspecies *multicolor,* formerly thought to be the widespread western sister species of *A. vultuosa,* seems to be confined to Vancouver Island and adjacent areas on the coast of British Columbia and northwestern Washington. A similar form, but even darker, occurs on the coast of California. This population may warrant recognition as a subspecies but only five specimens have been examined. In eastern and central North America *Apamea vultuosa* is most likely to be confused with *A. apamiformis,* but *A. vultuosa* is smaller, paler orange brown, and more triangularly winged than *A. apamiformis* (forewing length varies from 16 to 20 mm in *A. vultuosa* and from 18 to 23 mm in *A. apamiformis*).

The genitalia of *A. vultuosa* and *A. apamiformis* are abundantly different in both sexes; the anal papillae are tapered posteriorly in *A. vultuosa* but are truncated in *A. apamiformis,* a character that can be observed without dissection. *Apamea vultuosa* is most closely related to *Apamea crenata* (Hufnagel) from Eurasia but differs in the orientation of the two subbasal diverticula in the vesica, which correspond to differences in the ductus bursae in the female. In North America *A. vultuosa* is unique among members of the *A. crenata*-group in having an uncus with a broad diamond-shaped apex, and a corpus bursae that is short and broad, tapered anteriorly; the other North American species in the group have a slender uncus and a long, narrow corpus bursae.

The larva was described by Crumb (1956: 235) from a specimen collected from grasses (Poaceae). The mature larva is about 32 mm long. The head is brown with black submedial arcs and reticulation. The body is pale brown dorsally and laterally with a strong, black, reticulate pattern over the ground color. There is a prominent but broken pale middorsal line bordered with black, an indistinct pale subdorsal line (below the D2 setae) defined mainly by the reduced reticulate pattern over the paler ground color, and a faint but sharply defined lateral line that surrounds the brown spiracles. The pinacula are flat and black with those of the D1 and D2 setae similar in size and much smaller than the pinacula of the SD1 and L1 setae.

Apamea vultuosa occurs across Canada from Newfoundland to the West Coast of British Columbia and the Alaskan Panhandle. In the East it occurs as far south as New Jersey and northern Ohio, but as far south in the Appalachians as southwestern North Carolina. A record in MCZ labeled ''Florida,'' and listed in Heppner (2003), is believed to be a labeling error. In the Rocky Mountains *A. vultuosa* occurs as far south as Colorado and on the West Coast its range extends to southern California. The flight season extends from late April until mid-August.

Apamea vultuosa vultuosa (Grote)
PL. 1, FIGS. 20, 21, 24; PL. D, FIG. 4 (♂ gen.); PL. P, FIG. 2 (♀ gen.).

Hadena vultuosa Grote, 1875.
Type locality: New York State, USA. [BMNH]

The forewing of the nominate subspecies is an evenly pale brown or gray and the reniform spot is outlined by a pale yellowish-brown line. The dark-brown shading on the costa usually does not extend around the reniform spot. The claviform spot is obscure, if visible at all.

This subspecies occurs over almost the entire range of the species. Specimens from California are very dark and those from Colorado have more gray shading than those from elsewhere, but too few specimens have been seen to propose additional subspecific names. Populations on Vancouver Island and the adjacent coastal area of British Columbia and northwestern Washington are subspecies *multicolor.* Adults fly in most areas from early June until mid-August; the records from California are from late April.

Apamea vultuosa multicolor (Dyar, 1904), NEW STATUS
PL. 1, FIGS. 22, 23.

Hadena multicolor Dyar, 1904.
Type locality: Victoria, British Columbia, Canada. [USNM]

Apamea vultuosa subspecies *multicolor* occurs in a restricted area in southwestern British Columbia and northwestern Washington. The forewing of subspecies *multicolor* is more contrastingly marked and more heavily speckled with dark-brown scales than subspecies *vultuosa.* Also, the reniform is outlined by white scales that strongly contrast against the darker ground color. The claviform spot usually is prominent and the medial area more shaded with darker brown than in subspecies *vultuosa.*

Subspecies *multicolor* occurs in southwestern British Columbia, mainly on Vancouver Island, and in coastal areas in northwestern Washington. It is replaced inland by subspecies *vultuosa.* Adults have been recorded from early May until early August but most records are from June.

Apamea plutonia (Grote)
PL. 1, FIGS. 25, 26; PL. D, FIG. 5 (♂ gen.); PL. P, FIG. 3 (♀ gen.); TEXT FIG. 11 (map) (RWH 9344).

Hadena plutonia Grote, 1883, *Can. Ent.,* **15**: 9.
Type locality: Kelley Point, Maine, USA. [MCZ]

NOTE—In the original description Grote mentions a single locality, collector, and wing expanse, and notes the ochreous anal tuft of the male. Therefore, the interpretation of Smith (1891: 422) that this male is ''the unique type'' (i.e., the holotype) is accepted.

Apamea plutonia is a small to medium-sized moth (forewing length: 15–19 mm) with dark, blackish-brown forewings and paler bronze areas. It is unlikely to be confused with any other species in the *Apamea crenata*-group, even though the male genitalia are remarkably similar to those of *vultuosa. Apamea plutonia* is most likely to be confused with the dark form of *Apamea remissa,* and the two species are frequently misidentified in collections. In addition to the diagnostic differences in genitalia, *A. plutonia* can be distinguished from *A. remissa* by the more extensive white on the outer margin of the reniform spot and by the black spot in the lower outer part of the subterminal area near the anal angle (typical of species in the *A. crenata*-group) although the dark spot is not conspicuous because of the dark ground color. The hindwing is paler toward the wing base than in *A. remissa.* The only variable feature among specimens is the amount of bronzy hue on the forewing.

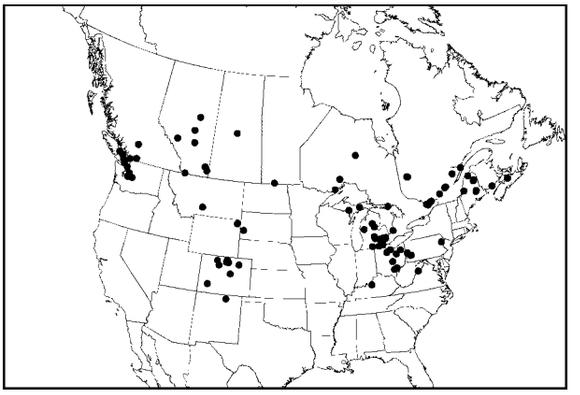


FIGURE 11: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA PLUTONIA*

In the male genitalia the uncus and digitus are longer and much more slender than in *A. vultuosa* and the three cornuti in the vesica are smaller. The female genitalia are most similar to those of *A. alia,* but the ductus bursae is ⅓ × as long as the corpus bursae in *A. plutonia* compared to ⅛ × as long in *A. alia.*

The larva was described by Crumb (1956: 233) on the basis of 15 larvae collected in the spring on grasses in Washington. The mature larva is about 30 mm long. The head is dark brown with a blackish suffusion obscuring the black submedial arcs and reticulation. The body is gray with a purplish tinge and with pale longitudinal lines; these are a broad, continuous, middorsal line, an indistinct subdorsal line (below the D2 setae) defined mainly by the reduced reticulate pattern over the paler ground color, and a sharply defined lateral line that surrounds the brown spiracles. The pinacula are large, flat, and black with those of the D1 setae larger than those of the D2 setae.

Apamea plutonia occurs across Canada from Nova Scotia to British Columbia and southward in the United States to Virginia and Kentucky in the East and northern New Mexico and central Washington in the West. The adults fly from late May to mid-August, but most records are from June and July.

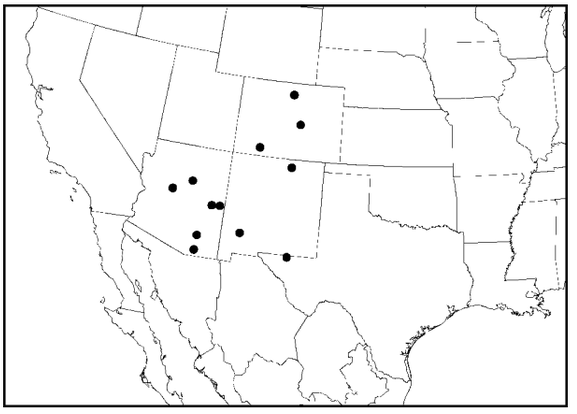


FIGURE 12: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA PERPENSA*

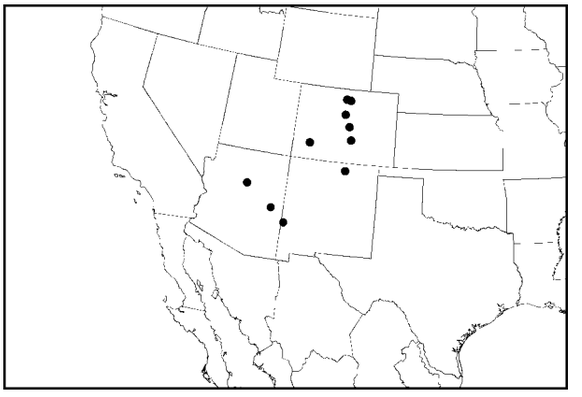


FIGURE 13: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA XYLODES*

Apamea perpensa (Grote)
PL. 1, FIGS. 27, 28; PL. D, FIG. 6 (♂ gen.); PL. P, FIG. 4 (♀ gen.); TEXT FIG. 12 (map) (RWH 9345).

Hadena perpenoa Grote, 1881, *Can. Ent.,* **13**: 229. INCORRECT ORIGINAL SPELLING
Type locality: Arizona, USA. [USNM]

NOTE—The spelling ''*perpenoa*'' in the original description does not mean anything in Latin whereas ''*perpensa*'' means ''well considered.'' Because the original label reads ''*perpensa*'' and Smith (1891: 433) also used *perpensa,* we agree with Franclemont and Todd (1983: 137) as first revisers, that ''*perpenoa*'' is a lapsus calami. Poole (1989: 108) used ''*perpenoa.*''

Apamea perpensa is one of the smallest North American *Apamea* species (forewing length: 15–17 mm). The forewing ground color is gray with some olive tinting, and the markings are defined in black. The most conspicuous features are 1) a series of three dark streaks along the posterior part of the wing from the base to the anal angle; 2) the reniform is pale gray, often with yellow shading; the transverse lines converge posteriorly so the medial area is constricted toward the hind margin of the wing; and 3) the hindwing is bicolored with the outer ½ fuscous and the basal ½ white so the discal spot and medial line contrast.

The male genitalia are most similar to those of *A. plutonia,* but the field of setae on the ventral margin of the cucullus is much more extensive, and the vesica is very small with both the diverticula and apical extension greatly reduced. The female genitalia are unique in the group in that the corpus bursae is somewhat triangular with a sharply angled lobe on the anterior left projecting anterolaterally.

The immature stages are unknown.

Apamea perpensa occurs from northern Colorado southward to western Texas and southern Arizona between the elevations of 5,500′ to 8,000′. The species is usually found in small numbers, but J. G. Franclemont collected 57 specimens in Arizona in a mixed pine-oak forest at the edge of a canyon (J. G. Franclemont, pers. comm.). The flight season extends from early July until early September.

Apamea xylodes Mikkola and Lafontaine, NEW SPECIES
PL. 1, FIGS. 29, 30; PL. E, FIG. 1 (♂ gen.); PL. P, FIG. 5 (♀ gen.); TEXT FIG. 13 (map).

Apamea xylodes Mikkola and Lafontaine.
Type locality: Mt. Evans, Colorado, USA. [CNC]

NOTE—The species name is from Greek *xylodes,* wood-like, and refers to the forewing color.

Apamea xylodes is a relatively small species of *Apamea.* It is reminiscent of *A. vultuosa,* but is smaller, narrower winged, and the forewing has more gray shading, especially in the female, but often has a flush of pale brown over the reniform and orbicular spots. The costal and outer margins are dark as in *A. vultuosa,* but unlike *A. vultuosa,* the anal dash extends only about ½ way to the postmedial line. *Apamea xylodes* is one of the few species of *Apamea* that show sexual dimorphism in that the male has much more yellowish-brown shading on the forewing than the female. In spite of the external similarities between *A.*

vultuosa and *A. xylodes,* the genital characters suggest that *A. xylodes* is most closely related to *A. alia.*

Antenna of male filiform, ciliate ventrally (as in other species of group); antenna of female filiform, ciliate ventrally. Forewing of male pale gray extensively suffused with pale brown; forewing of female with slight brown flush, especially in reniform spot; costal area slightly darker than ground color and with darker shading between reniform and orbicular spots that extends between spots as a diffuse medial line; antemedial and postmedial lines outlined in gray, weakly double and filled with pale ground color but lines faint; reniform and orbicular spots slightly paler than ground color, partially outlined in dark gray, usually filled with brown in both sexes; dark patch in subterminal area in fold gray in male, blackish gray in female; subterminal line not apparent because darker gray shading in terminal area suffuses into outer part of subterminal area, but still with a trace of a W-shaped subterminal line at veins M_3 and CuA_1; forewing length: 17–18 mm. Hindwing pale fuscous except for dark fuscous area on marginal ⅓ of the wing.

Male genitalia more similar to those of *A. alia* than of *A. vultuosa*; in both *A. xylodes* and *A. alia* uncus evenly tapered apically (diamond shaped in *A. vultuosa*), ampulla relatively short, 7–8 × as long as its medial width (12–15 × in *A. vultuosa*), cornuti in vesica on very short diverticula (long in *A. vultuosa*), and vesica with apical diverticulum (absent in *A. vultuosa*). *Apamea xylodes* differs from *A. alia* in shield-shaped juxta, 1.5 × as wide as long (broadly V-shaped in *alia,* 4 × as wide as long) and vesica evenly tapered (a prominent medial constriction in *A. alia*). Female genitalia of *A. xylodes* and *A. alia* also very similar and unlike those of *A. vultuosa*; corpus bursae long and narrow, 3.5–4.0 × as long as maximum width (globular in *A. vultuosa,* 1.5 × as long as wide) and anal papillae tapered but truncated at apex. Females of *A. xylodes* differ from those of *A. alia* in having a longer and narrower ductus bursae (4 × rather than 2 × as long as wide at ostium) and the anal papillae narrower.

The immature stages are unknown.

TYPES. **Holotype:** ♂. Doolittle Ranch, 9,800′, Mt. Evans, [Clear Creek Co.], Colorado; 13 July 1961; E. W. Rockburne. CNC. **Paratypes:** 7 ♂, 24 ♀. **Arizona.** 9 mi E McNary, Apache Co.; 14 Aug. 1971; R. Wielgus (1 ♀). Environs of Flagstaff, 6,500′–8,500′, Coconino Co.; 1 July–23 Aug. 1964 and 1965; J. G. Franclemont (3 ♂, 11 ♀). **Colorado.** Same locality and collector as for holotype; 13 July–2 Aug 1961 (5 ♀). Endovalley Picnic Area, R74W T5N, Sec 11, 8,600′, Rocky Mountain National Park, Larimer Co.; 14 July 1990; T. S. Dickel (2 ♀). Florissant, Teller Co.; 28 July 1960; T. C. Emmel (1 ♂). Gold Creek, Alta Lake, 10,700′, San Miguel Co.; 3 July 1977; D. C. Ferguson (1 ♂). Pole Hill, Larimer Co.; 3 and 5 Aug. 1983; T. McCabe (1 ♂, 1 ♀). 4 km NW Central City, 2,685 m, meadow near aspen/pine forest, [Gilpin Co.]; 13 July 1993; K. Mikkola (2 ♀). **New Mexico.** 18 mi E Alma, Catron Co.; 12–15 July 1961; F., P. & J. Rindge (1 ♂, 2 ♀). AMNH, CNC, CUIC, TLM, TSD, USNM, ZMH.

Apamea xylodes occurs at elevations of 6,500′ to 10,000′ in open, grassy, conifer forests of the southern Rocky Mountains, in Colorado, New Mexico, and Arizona. The flight season extends from early July to late August.

Apamea alia (Guenée)

PL. 1, FIGS. 31–34; PL. E, FIG. 2 (♂ gen.); PL. P, FIG. 6 (♀ gen.); TEXT FIG. 14 (map) (RWH 9351).

Taeniocampa alia Guenée, 1852, *in* Boisduval and Guenée, *Histoire Naturelle des Insectes. Species Général des Lépidoptères,* **5**: 352.
Type locality: New York State, USA. [BMNH]

Hadena suffusca Morrison, 1875, *Proc. Acad. Nat. Sci. Philadelphia,* **1875**: 61.
Type locality: Massachusetts, USA. [MSU]

NOTE—This species was described from material from Massachusetts, Connecticut, and Colorado, but of the type material only a male at MSU has been located. This specimen, labeled ''Massachusetts 216'' is here designated LECTOTYPE to ensure the stability of the name. The specimen is in poor condition and the abdomen is missing.

Xylophasia rorulenta Smith, 1904, *Psyche,* **11**: 55.
Type locality: Calgary, Alberta, Canada. [USNM]

NOTE—The lectotype from Calgary was designated by Todd (1982: 186).

Apamea alia is a medium-sized species of *Apamea* (forewing length: 16–20 mm). It is easily recognized by the blue-gray color of the forewing that becomes darker and more reddish brown toward the costal margin, and by the contrasting blackish-gray patch on the inner side of the subterminal line near the anal angle typical of species

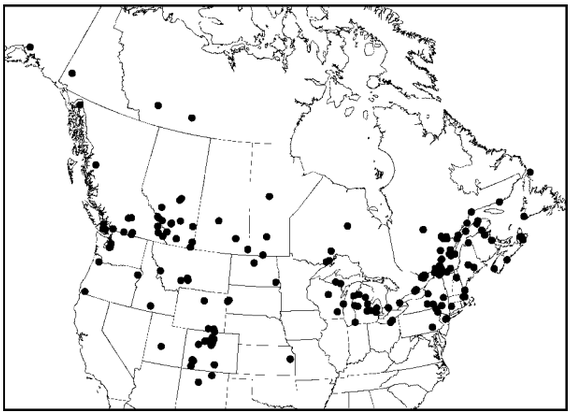


FIGURE 14: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA ALIA*

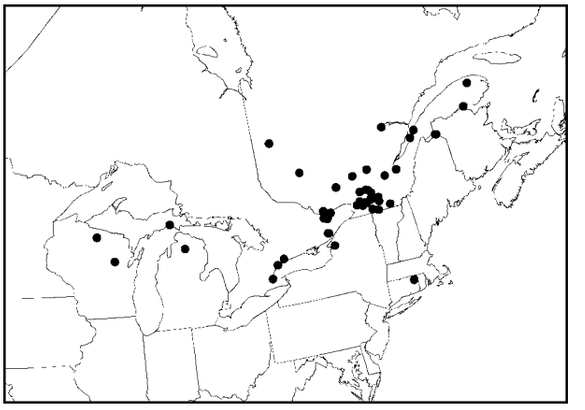


FIGURE 15: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA UNANIMIS*

in the *Apamea crenata*-group. The dark, contrasting reniform spot, dark gray becoming blackish gray posteriorly, is also characteristic. The hindwing is fuscous, paler basally. The species is dimorphic; a second form with a pale reddish-brown or yellow-brown forewing occurs in about ¼ of the specimens throughout the range of the species.

Characteristics of the genitalia are described under *A. xylodes.*

Crumb (1956: 234) described the larva from 16 caterpillars collected on grasses at Puyallup, Washington in the spring. The head is pale brown with a blackish suffusion obscuring the normal black submedial arcs and reticulation. The body is blackish purple above and below with a faint pale middorsal line, an even fainter subdorsal line (below D2) and a pale lateral line containing the brown spiracles. The black pinacula are relatively small with only that of seta SD1 large. Tietz (1972: 77) lists a number of herbaceous shrubs under ''*alia* Auct.'' but then refers these records to *Orthosia hibisci* (Guenée). Crumb (1956: 34) reared larvae on grasses.

Apamea alia occurs from Newfoundland westward through the southern Northwest Territories to Yukon, Alaska, and British Columbia. Its range extends as far south as New Jersey, Pennsylvania, Kansas, northern New Mexico, Utah, and Oregon. Adults occur from late May until mid-August, but most fly between mid-June and mid-July.

Apamea unanimis-GROUP

The *Apamea unanimis*-group includes two Eurasian species, *A. unanimis* (Hübner) and *A. illyria* Freyer. The group is characterized by the massive, apically rounded digitus, and by the vesica, which contains two small cornuti, one strongly connected to the aedeagus by a sclerotized band. *Apamea unanimis* has become established in northeastern North America.

Apamea unanimis (Hübner)

PL. 1, FIGS. 35–37; PL. E, FIG. 3 (♂ gen.); PL. P, FIG. 7 (♀ gen.); TEXT FIG. 15 (map).

Noctua unanimis Hübner, [1813], *Sammlung europäischer Schmetterlinge,* **4,** pl. 120, fig. 556.

Type locality: Europe. [NHMW]

NOTE—A rare Hübner syntype has been located in the Natural History Museum in Vienna, Austria. It is a male labeled ''Mazzola/ nov. sp. *unanimis* H. [red label, H = Hübner?]. Mazzola was one of the collectors who provided Hübner with specimens. The way the specimen is prepared and the color morph are consistent with the color figure 556 of Hübner; so, we designate this male as LECTOTYPE to ensure the stability of the name.

Apamea unanimis is the smallest species of *Apamea* in North America (forewing length: 14–16 mm). The forewing color varies from pale yellowish gray with the costal area darker, through a more contrasting reddish-brown form to a uniformly dark-brown form. The multicolored reniform spot is diagnostic; it is outlined in black proximally and white distally, and the proximal ½ of the spot is similar in color to the forewing and the outer ½ is pale yellow. The hindwing is dark fuscous with a large, diffuse central lunule that is particularly characteristic on the underside of the wing.

The male genitalia of *A. unanimis* are characterized by the apically spatulate uncus and the very large, broad digitus; males can easily be identified as *A. unanimis* by brushing away the scales from the end of the valve to expose the large digitus.

The larval description is based on Bretherton et al. (1979) and Beck (1999). The mature larva is about 30 mm long. The head is pale reddish brown with a trace of darker submedial arcs and reticulation. The body is yellow brown to reddish brown with a continuous whitish-ocher middorsal line, an indistinct subdorsal line, and a broad lateral line that is only slightly paler than the ground color except along its dorsal and ventral margins. The spiracles are brown. The pinacula are dark brown and small. The prothoracic and anal shields are dark brown with three pale lines, the lateral two being less well defined. The larva was illustrated by Beck (2000, fig. B507) and Ahola and Silvonen ([2008]: 632). The larva feeds on beach and marsh grasses like *Phragmites, Phalaris,* and *Glyceria.* The larva ties leaves together with silk and feeds in the enclosure (Mikkola and Jalas, 1979).

The species is Palearctic in origin, where it occurs from Fennoscandia southward to northern Portugal and northern Turkey and eastward to Azerbaijan and Chinese Turkestan (Zilli et al., 2005). In North America the first specimen was collected near Ottawa, Ontario in 1991; within 10 years it had become the most common species of *Apamea* across southern Quebec and Ontario and has spread as far east as New Brunswick and as far west as Wisconsin and as far south as Connecticut. It is an early flying species with adults occurring from early June until early July.

Mikkola and Lafontaine (1994) associated the introduction of *A. unanimis,* and other recent apameine introductions (*Lateroligia ophiogramma* (Esper), *Rhizedra lutosa* (Hübner), *Oligia strigilis* (Linnaeus), and *Oligia latruncula* ([Denis and Schiffermüller])) that feed on shoreline grasses, with the recent use of large shipping containers that are often stored on the shore before being loaded onto ships bound for North America. Large clumps of shoreline vegetation can become lodged on the underside of these containers, or rafted into ships with open ramps.

Apamea remissa-GROUP

The *Apamea remissa*-group includes three North American species and one Holarctic species. The adults of species in the *A. remissa*-group are medium-sized species of *Apamea* for which the only characteristic external feature is the tendency for the claviform spot to be extended into a dark bar connecting the antemedial and postmedial lines, but this is absent in the evenly colored gray forms of *A. remissa* and *A. indocilis.* The species-group is unusual for *Apamea* in that none of the species has basal abdominal brushes and pockets in the male. As with the *Apamea verbascoides*- and *A. crenata*-groups, most specimens in collections are females.

In the male genitalia the group is characterized by the serrated, rooster-comblike cornutus on the vesica near the apex of the aedeagus. There is a short subbasal diverticulum with a bulbous-based cornutus at its apex and a minute cornutus near its base. In the female genitalia the anal papillae are unusual for the genus *Apamea* in that they are cylindrical and cone shaped rather than dorsoventrally flattened.

The *Apamea remissa*-group is Holarctic in distribution.

Apamea remissa (Hübner)
PL. 2, FIGS. 1–6; PL. E, FIG. 4 (♂ gen.); PL. P, FIG. 8 (♀ gen.); TEXT FIG. 16 (map).

Noctua remissa Hübner, [1809], *Sammlung europäischer Schmetterlinge,* **4**: pl. 90, fig. 423.
Type locality: Europe. [lost]

Noctua obscura Haworth, 1809, *Lepidoptera Britannica,* **2**: 189.
Type locality: Europe. [lost]
NOTE—*Noctua obscura* Haworth is a junior primary homonym of six other proposals of *Noctua obscura* (Zilli et al. 2005: 117). The name is used for the dark form of *remissa.*

Noctua gemina Hübner, [1813], *Sammlung europäischer Schmetterlinge,* **4**: pl. 102, figs. 482, 483.
Type locality: Europe. [lost]

Hadena submissa Treitschke, 1825, *Die Schmetterlinge von Europa,* **5** (1): 346.
Type locality: Not given. [NHMH]
NOTE—The name *submissa* is used for the intermediate form of *remissa.*

Polia w-latinum var. *divitis* Bryk, 1942, *Deutsche Ent. Zeitschrift Iris,* **56**: 40.
Type locality: Kurilia. [NRS]

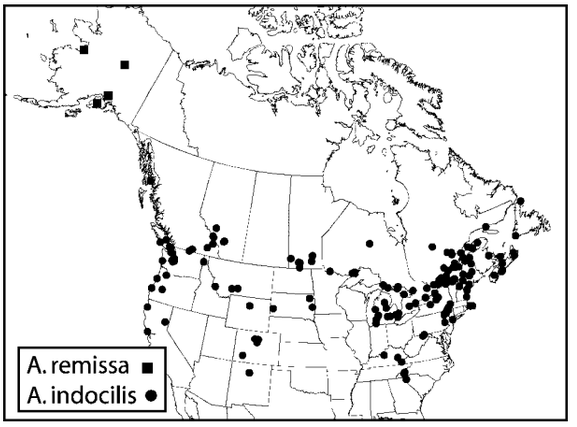


FIGURE 16: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA REMISSA* ■ AND *APAMEA INDOCILIS* ●

Apamea remissa is the mainly Palearctic counterpart of the North American species *A. indocilis.* It is slightly smaller (forewing length: 14–19 mm) and narrower winged than *A. indocilis* but occurs in a similar range of forms. The maculate form of *A. remissa* is less contrasting than the comparable form of *A. indocilis*; the subterminal area is not unicolorous as in *A. indocilis,* but there is some dark shading near the subterminal line and dark wedge-shaped marks by the W-shaped indentation in the subterminal line. The reniform and orbicular spots are relatively smaller than in *A. indocilis,* the orbicular spot is oval, more or less dark centered, and the reniform spot has a dark line on the outer margin. The costal area is also less contrasting. The darker forms of *A. remissa* can not reliably be distinguished from the comparable forms of *A. indocilis.*

The male genitalia are characterized by the broad, flat uncus and the long, slender digitus. In the female genitalia, the corpus bursae tapers posteriorly, without the postmedial constriction found in other species in the group.

The larval description is based on Bretherton et al. (1979) and Beck (1999). The mature larva is about 35 mm long and has gray and brown forms. The head has extensive black submedial arcs and reticulation over the reddish-brown or gray ground color. The body is pale brown or slate gray with a continuous whitish-yellow middorsal line, an indistinct pale-orange subdorsal line, and a broad, pale lateral line. The dorsum and sides are speckled with black flecks that tend to form a series of fine longitudinal lines that intensify laterally into a black line near the spiracles. A broad lateral line that is only slightly paler than the ground color except along its dorsal and ventral margins is below the spiracles. The spiracles are pale brown. The pinacula are black but small and inconspicuous. The prothoracic shield is black with three pale lines, the lateral two being less well defined; the anal shield is much paler than the prothoracic shield. The larva is illustrated by Beck (2000, fig. B503) and Ahola and Silvonen ([2008]: 630). The larva feeds on various grasses, e.g., *Calamagrostis, Festuca, Phalaris, Phragmites, Poa,* and *Secale*; the early instars live in a silken tube near the seed head (Mikkola and Jalas, 1979).

Apamea remissa occurs across Eurasia from western Europe to northeastern Siberia and into North America in Alaska. Specimens in the CNC represent all three of the forms of *A. remissa.* This contrasts with *A. indocilis* in which the variegated form is absent in western North America. In Alaska *A. remissa* flies from early July to early August. In Eurasia the flight period extends from late May to early August.

Apamea remissa is among a few dozen cases among the Noctuidae where a Palearctic species or subspecies occurs in the Beringian area of North America (i.e., Alaska and Yukon). This is interpreted to reflect distributional patterns arising during the last Ice Age when the massive Beringian Land Bridge connected Alaska to Asia while this ice-free area of the northwestern part of North America was separated from the rest of the continent by the Laurentian and Cordilleran Ice Shields that covered most of Canada and northern United States. Thus, Alaska and Yukon were part of the Palearctic Region during this period. During deglaciation, about 10,000 years ago, the sea level rose and isolated Alaska and Yukon from Eurasia.

Apamea indocilis (Walker)
PL. 2, FIGS. 7–16; PL. E, FIG. 5 (♂ gen.); PL. Q, FIG. 1 (♀ gen.); TEXT FIG. 16 (map) (RWH 9362, 9363).

Xylophasia indocilis Walker, 1856, *List of the Specimens of Lepidopterous Insects in the Collections of the British Museum,* **9**: 178.
Type locality: New York State, USA. [BMNH]

NOTE—Walker had six specimens available. The

slightly worn female in the BMNH labeled ''Type (green border, round)/ U. S. America, Doubleday 46-110./ *gemina* Var. B/ 19. *Xylophasia indocilis* (printed)'' is here designated LECTOTYPE to ensure the stability of the name.

Hadena separans Grote, 1881, *Bull. U. S. Geol. Geog. Survey Terr.,* **6**: 260. Infrasubspecific form.
Type locality: Evans Center, New York, USA. [BMNH]

NOTE—Grote (1881b) had at least two specimens, from New York and from Wisconsin. A relatively worn male in the BMNH labeled ''Type [round, red border]/ Grote Coll. 81-116./ New York Evan Center VI 1877/ *Hadena separans* Grote [blue border]/ *Hadena separans* ♂ Type Grote [red border]'' is here designated LECTOTYPE to ensure the stability of the name. The specimen represents the form of *A. indocilis* corresponding to form *submissa* Treitschke of *remissa.*

Hadena lona Strecker, 1898, *Lepidoptera, Rhopaloceres and Heteroceres, Indigenous and Exotic,* **1**: 7.
Type locality: Clyde, New York, USA. (FMNH)

Hadena (*Xylophasia*) *runata* Smith, 1898, *Can. Ent.,* **31**: 257.
Type locality: Winnipeg, Manitoba, Canada. [USNM]

NOTE—The male lectotype from Manitoba was designated by Todd (1982: 189). The original description also lists material from Pullman, Washington. The lectotype corresponds to *Apamea remissa* form *submissa* Treitschke.

Xylophasia ferens Smith, 1903, *Can. Ent.,* **35**: 134.
Type locality: Alberta, Calgary, Canada. [USNM]

NOTE—The male lectotype of *ferens* was designated by Todd (1982: 81) from the USNM but the type was not present in the type collection.

Xylophasia enigra Smith, 1904, *Psyche,* **11**: 54.
Type locality: Head of Pine Creek, Calgary, Alberta, Canada. [AMNH]

NOTE—Todd (1982: 74) designated the lectotype for *enigra* from the AMNH. It represents the unicolorously dark form of *A. indocilis* corresponding to *Apamea remissa* form *obscura* Haworth.

Septis ampliata McDunnough, 1940, *Can. Ent.,* **72**: 199. NEW SYNONYMY.
Type locality: Bozeman, Montana, USA. [CNC]

NOTE—The male holotype and female paratype are large specimens of the form *separans.* The male genital characters mentioned by McDunnough (1940) are variable in the genus *Apamea* and cannot serve to distinguish *ampliata* from *indocilis.*

Apamea indocilis is a small to medium-sized species (forewing length: 15–19 mm) that is structurally indistinguishable from the Old World and Alaskan species *A. remissa,* but differs in appearance. Molecular analysis of the cytochrome c oxidase 1 (CO1) mitochondrial gene sequence supports recognition of *A. indocilis* as a separate species. The species is polymorphic, occurring in three distinct forms, the appearance and proportions of which are geographically variable. In all three forms there is a shallow W-mark in the subterminal line, the hindwing is fuscous, and usually there is a dark bar in the fold connecting the antemedial and postmedial lines. The most distinctive form of *A. indocilis* is the nominate form (plate 2, figures 7–10) and this corresponds to the nominate form of *A. remissa.* This form is easily distinguished from the corresponding form of *A. remissa* by being larger, broader winged, and with a more contrasting pattern. The forewing ground color varies from pale brownish gray to a bright cinnamon brown. The dark-brown shading in the terminal area is concentrated into two patches, one opposite the reniform spot and the other in the fold, and these together with a corresponding black patch in the subterminal area form two blunt wedge-shaped marks that are characteristic of this form of *A. indocilis.* The reniform and orbicular spots are large and pale filled with extensive black shading between the spots, and there is a contrasting black bar in the cell between the antemedial and postmedial lines. The second form of *A. indocilis* (plate 2, figures 11–15) is much darker so the black markings, though usually present, are not as prominent, and the ground color is gray rather than brown. Some specimens (plate 2, figure 12) have no contrasting markings on the wing. The third form (plate 2, figure 16) has a very dark blackish-brown forewing with all markings obscured except for a small white area in the outer part of the reniform. The subterminal line has the characteristic shallow W-mark, made visible only by a thin, broken line of luteous scales and by the velvety-black, wedge-shaped marks in the subterminal area. This dark form

frequently is confused with *A. plutonia,* but the wing shape is more truncated, the wing lacks the bronze hue of *A. plutonia,* and it does not have the black patch in the fold proximal to the subterminal line.

The larva was described by Crumb (1956: 233) on the basis of larvae collected on ''coarse grasses and sedges'' in Oregon and Washington. The mature larva is about 30 mm long. The head is brown, not suffused with darker shading, so the black submedial arcs and reticulation are prominent; the submedial arcs curve laterally toward the ocelli isolating a clear brown patch above each antenna (the area above the antenna is black in *A. sordens*). The body is gray with a slight purple tinge dorsally and laterally and with a darker reticulate pattern over the ground color. The pinacula are flat and black, but small and inconspicuous; those of the D1 seta larger than those of D2. There is a narrow, continuous, pale middorsal line bordered with darker shading, an indistinct pale subdorsal line (below the D2 setae), and a broad, pale-gray lateral line suffused with pink. The spiracles are brown and, as in *A. sordens,* there is a pale sclerotized ring completely encircling the black rim of the spiracles; in other species of *Apamea,* the pale ring, if present, is restricted to the anterior edge of the spiracle.

Apamea indocilis occurs from Newfoundland westward to the Alaskan Panhandle and southward to New Jersey, Kentucky, South Dakota, Montana, and central California. Its range extends farther south in the Appalachians to South Carolina and in the Rocky Mountains to northern New Mexico. The species is mainly on the wing from mid-June to late July, but the flight in central California is about two months earlier than elsewhere.

Apamea impulsa (Guenée)
PL. 2, FIGS. 17, 18; PL. E, FIG. 6 (♂ gen.); PL. Q, FIG. 2 (♀ gen.); TEXT FIG. 17 (map) (RWH 9360).

Mamestra impulsa Guenée, 1852, *in* Boisduval and Guenée, *Histoire Naturelle des Insectes. Species Général des Lépidoptères,* **5**: 194.
Type locality: New York State, USA. [BMNH]

This small to medium-sized (forewing length: 15–19 mm) moth can be identified by the even black forewing color with the transverse lines visible as velvety black stripes. It is most likely to be confused with *Melanapamea mixta,* which also has a black forewing but differs in the details of the markings. The claviform spot is small (large in *M. mixta*); the reniform spot is mainly black with some yellow scales on the outer margin (extensive white shading in *M. mixta*); the transverse lines are relatively even (prominently dentate in *M. mixta*); there is no medial line evident as in *M. mixta*; and the base of the fringe is pale (a series of minute yellow dots in *M. mixta*). The hindwing in *A. impulsa* is pale, usually with only the outer ⅓ fuscous, whereas in *M. mixta* most of the hindwing is fuscous. *Apamea impulsa* could also be confused with the dark form of *A. remissa,* but can be recognized by the heavier black forewing markings and the paler hindwing.

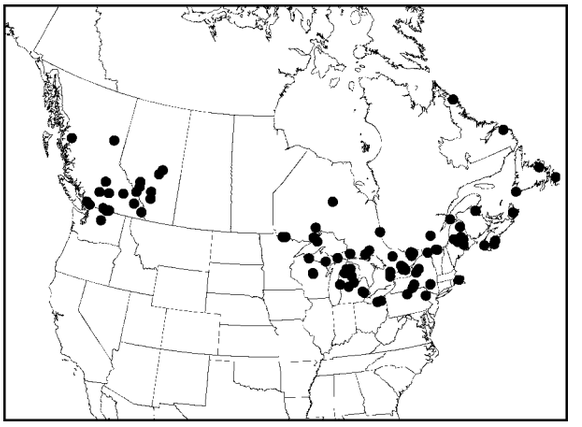


FIGURE 17: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA IMPULSA*

The male and female genitalia of the two species are abundantly different. The differences in the shape of the cucullus in the males and the anal papillae in females can be observed without dissection by brushing away some of the scales at the end of the abdomen.

The early larval life history was described by McCabe (1991). The eggs are laid on seed capsules of *Glyceria maxima* S. Wats. (Poaceae) in August. The first instars eat the seeds but drop to the ground and feed on the grass blades as the larvae grow larger; they overwintered as third instars.

Apamea impulsa apparently has disjunct eastern and western populations although the gap in the range in boreal Manitoba and Saskatchewan is an area not well collected. In the East it occurs

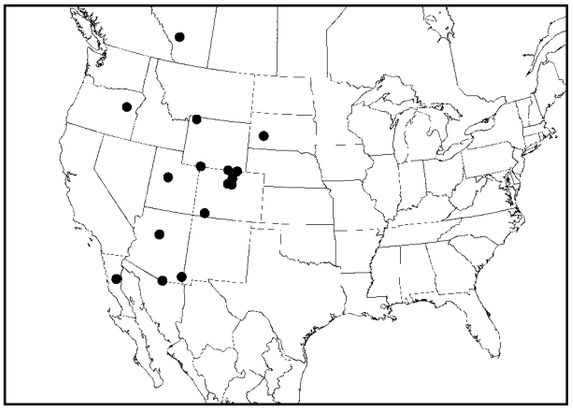


FIGURE 18: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA UNITA*

from Newfoundland and Labrador westward to western Ontario and southward to northern Pennsylvania, northern Ohio, central Wisconsin, and northern Minnesota. In the West, it occurs from central Alberta and British Columbia southward to northern Washington. The flight season extends from early June until late August.

Apamea unita (Smith)
PL. 2, FIGS. 19, 20; PL. F, FIG. 1 (♂ gen.); PL. Q, FIG. 3 (♀ gen.); TEXT FIG. 18 (map) (RWH 9355).

Xylophasia unita Smith, 1904, *Psyche,* **11**: 54.
Type locality: Head of Pine Creek, Calgary, Alberta, Canada. [AMNH]

This is an enigmatically uncommon western species. The forewing (length: 15–20 mm) is ash gray with the pattern complete and sharply defined, except the incomplete margins of the reniform and orbicular spots. It could be confused with other gray-winged species, especially *A. spaldingi* and *A. centralis* but differs from these species in the orbicular spot and the color of the area posterior to it. The orbicular spot is typically large, round or slightly oval, and pale gray; and there is a pale patch posterior and distal to the spot that looks like the color of the orbicular spot is bleeding out toward the anal angle of the wing and extends as a rounded lobe almost to the postmedial line. The moths from Arizona tend to be darker than those from farther north. Surprisingly, *A. unita* is most frequently confused with the superficially similar and much more common *Lacanobia subjuncta* (Grote and Robinson) in the Hadeninae. In *A. unita* the reniform and orbicular spots are not as sharply outlined in black as in *L. subjuncta,* the pale patch below the orbicular is more contrasting, and in *L. subjuncta* the outer margin of the forewing is very slightly falcate apically. With the aid of a microscope, *Lacanobia subjuncta* can readily be distinguished from an *Apamea* by the hairs on the surface of the eye, which is characteristic of the Hadeninae.

The immature stages are unknown.

Apamea unita is known from a large geographic area, considering that only about 25 specimens are known. It has been found in Alberta, Oregon, Wyoming, Colorado, Utah, Arizona, and Baja California, Mexico. Occurrence as far north as the single Alberta record, the type locality, needs to be confirmed by additional records. The flight season extends from mid-May to mid-August, but most records are from July. The habitat is open mixed forests in mountain meadows between the elevations of 6,400′ and 9,000′.

Apamea cuculliformis-GROUP

Apamea cuculliformis previously has been associated with the *A. verbascoides*-group, which it resembles in superficial appearance, but genital characters and molecular data suggest that it is more closely related to the *A. sordens*-group. The vesica, however, has a ‘‘rooster comb’’ cornutus more typical of species in the *A. remissa*-group, so we place it in its own species-group between the *A. remissa*- and *A. sordens*-groups.

Apamea cuculliformis (Grote)
PL. 2, FIGS. 21, 22; PL. F, FIG. 2 (♂ gen.); PL. Q, FIG. 4 (♀ gen.); TEXT FIG. 19 (map) (RWH 9325).

Hadena cuculliformis Grote, 1875, *Check list of the Noctuidae of America North of Mexico,* **1**: 24.
Type locality: Sauzalito, California, USA. [BMNH]

NOTE—Grote (1875) does not mention how many specimens he had from Sauzalito. There are three possible syntypes in the British Museum, two labeled Sauzalito and one unlabeled. The ♂ labeled ‘‘Type/ Grote Coll. 81-116./ California, Sauzalito 13.V./ *Hadena cuculliformis* G. Type’’ is here designated LECTOTYPE to ensure the stability of the name. One antenna is missing but otherwise the specimen is in good condition. In the description

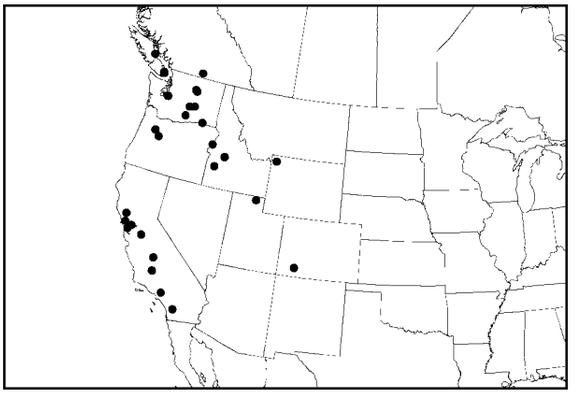


FIGURE 19: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA CUCULLIFORMIS*

Grote mentions ''11.V'' but the date on the lectotype is 13 May.

Apamea cuculliformis looks larger than it really is because of the unusually long forewings (forewing length: 19–22 mm). The specific name ''looking like a *Cucullia*'' refers to this ''long-winged'' feature combined with the hoodlike tufts on the thorax, and the uniform, longitudinally streaked forewing pattern. The yellowish-brown ground color extends into the dark terminal area as a deep W-mark where the pale-lined veins M_3 and CuA_1 project through the subterminal line to the wing margin. The moth is surprisingly similar to the distantly related species *Apamea verbascoides,* but the anal dash is bordered at the subterminal line by a white outwardly convex line, unlike that of *A. verbascoides,* in which the line is concave. The forewing of *A. cuculliformis* is narrower than that of *A. verbascoides,* and the outer margin is more deeply scalloped. Also, the hindwing is paler basally than species in the *A. verbascoides*-group.

In the male genitalia, *A. cuculliformis* has a broad, flat uncus, without the subbasal plate and large dorsal plume of scales characteristic of species in the *A. verbascoides*-group. Also, the clasper is long (8 × as long as wide); the vesica does not have a subbasal diverticulum; the basal cornutus in the vesica has multiple teeth (like a rooster comb); and the corpus bursae does not have a postmedial constriction like species in the *A. verbascoides*-group. Males have basal abdominal brushes and pockets.

The larva was described by Dyar (1898: 320) and Crumb (1956: 233), the latter from larvae found in the spring at Puyallup, Washington, on grasses, and from the Santa Cruz Mountains, California, on giant wild rye grass (*Elymus condensatus* Presl). The description is based on Crumb (1956). The head is grayish brown with a trace of dark speckles medially and dark reticulation laterally but without dark submedial arcs. The body is dark gray or blackish gray, darker laterally than dorsally with broken, obscure, middorsal and subdorsal lines and a prominent pale lateral line. The spiracles are dark brown. The dorsal and subdorsal pinacula are black but small. The skin is pavement granulose.

Apamea cuculliformis inhabits open arid woodlands from southern British Columbia southward to northern Wyoming, northern Utah, southern Idaho, and southern California; an isolated record is from southwestern Colorado. The flight season extends from early April to mid-August, but most records are from May.

Apamea sordens-GROUP

The *Apamea sordens*-group includes four species, one Holarctic species (*A. sordens* (Hufnagel)), one in North America (*A. digitula* Mustelin and Mikkola), and two in Eurasia (*A. anceps* ([Denis and Schiffermüller]), and *A. alpigena* (Boisduval)). The group is characterized by the heavily sclerotized, pointed process on the dorsal margin of the sacculus and the posterior bulge near the base of the digitus that gives the digitus almost a forked appearance in *A. anceps.* Males of all four species have basal abdominal brushes and pockets. In the female genitalia, the anal papillae are disproportionately very large and tapered to a point posteriorly so that the lateral margins of the anal papillae are concave.

Apamea sordens (Hufnagel)
PL. 2, FIGS. 23–29; PL. F, FIGS. 3, 4 (♂ gen.); PL. Q, FIG. 5 (♀ gen.); TEXT FIG. 20 (map) (RWH 9355).

Phalaena sordens Hufnagel, 1766, Berl. Mag., 3: 306.
Type locality: Berlin, Germany. [Type lost]

Noctua basilinea [Denis and Schiffermüller], 1775, *Ankündung eines systematischen Werkes von den Schmetterlinge der Wienergegend*: 78.
Type locality: Vienna, Austria. [Type lost]

Apamea finitima Guenée, 1852, *in* Boisduval and Guenée, *Histoire Naturelle des Insectes.*

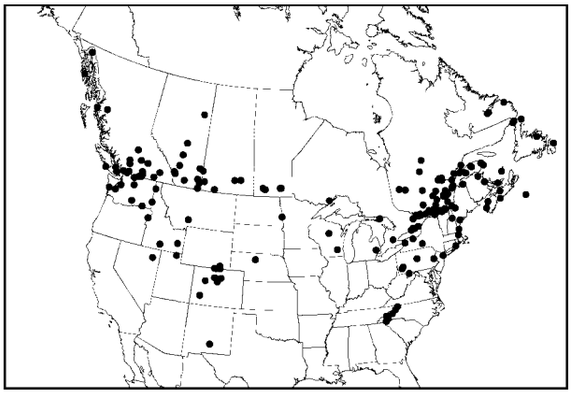


FIGURE 20: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA SORDENS*

Species Général des Lépidoptères, **5**: 206. NEW SYNONYMY, NEW STATUS, SUBSPECIES.

Type locality: New York State, USA. [Type lost]

NOTE—Guenée (1852) had two males. A syntype should be in the BMNH but could not be found. Smith (1891: 417) first believed the taxon to be ''only a local variety of the European *basilinea* [=*Apamea sordens*]'' but used the name *Xylophasia finitima* (Gn.) for it. Later, Smith (1903a: 134) expressly treated them as distinct species.

Hadena cerivana Smith, 1900, *Can. Ent.,* **32**: 220.

Type locality: Calgary, Alberta, Canada. [USNM]

NOTE: Todd (1982: 44) designated a male in the USNM lectotype.

Apamea sordens sableana Mikkola, NEW SUBSPECIES.

Type locality: Sable Island, Nova Scotia, Canada. [CNC]

This is a Holarctic species that is widely distributed in North America and Eurasia. The moth is a small to medium-sized (forewing length: 14–20 mm), but atypical appearing, species of *Apamea* even though it is the type species of the genus. The characteristic appearance is due to the relatively even forewing coloration, lack of a W-mark in the subterminal line, and only slightly crenulate transverse lines. The forewing ground color is pale brownish gray, often with a violet hue in fresh specimens, and the medial area is often shaded with reddish brown. The maculation is not particularly contrasting but is sharply defined. The most characteristic feature of the species is the contrasting basal dash that tends to fork apically. The hindwing is pale fuscous basally, darker on the outer ⅓.

In the male genitalia the dorsal margin of the sacculus is extended into a sharply pointed, heavily sclerotized spine; the aedeagus is broad with a heavily sclerotized spiny area at the apex. The digitus differs in length between the Eurasian and North American populations of *A. sordens*; in Eurasian populations (ssp. *sordens*) the digitus extends well beyond the ventral margin of the cucullus by ½ × its length, whereas in the North American populations (ssp. *finitima*) the digitus extends to the ventral margin of the cucullus (sometimes ending slightly before the ventral margin of the cucullus and sometimes extending slightly beyond it). In spite of this structural difference, specimens from these two regions show only subtle differences in appearance. There is more variation within each subspecies in the cytochrome c oxidase 1 (CO1) mitochondrial gene sequence than there is between the subspecies; so, we treat the difference in digitus length as a characteristic that separates two subspecies rather than as one indicating separate species status. In the female genitalia the anal papillae are abruptly narrowed posterior to the base, so the apical ¾ is narrow and sharply pointed. The ductus bursae is wider than in most other species of *Apamea* with the surface heavily sclerotized and rugose.

The larval description is based on Crumb (1956), Bretherton et al. (1979), and Beck (1999). The mature larva is about 35 mm long and is similar to that of *A. indocilis.* The head is dark brown with black submedial arcs and reticulation that includes black shading above the antenna (in *A. indocilis* there is a pale-brown patch above the antenna). The body is purplish gray or pale green with black specks and blotches on the back above the subdorsal line and on the sides around the spiracles. There is a prominent, white middorsal line and an indistinct pale subdorsal line (below the D2 setae). There is no pale lateral line because of the dark speckled area around the spiracles. The spiracles are dark gray or black and, as in *A. indocilis,* there is a whitish-gray ring completely encircling the black rim of each spiracle. The larva is illustrated by Beck (2000, fig. B501) and Ahola and Silvonen ([2008]: 631). Crumb (1956) lists wheat, wild rice, timothy (*Phleum pratense* L.), and corn as larval host

plants. Tietz (1972: 290) adds *Bromus inermis* Leyss. and *Carex* sp. Beirne (1971) reports an infestation in southern Manitoba in which the larvae attacked brome grass and rye late in the season when damage is rarely noticed; the larvae congregated in large numbers for hibernation under the grass sheaves. The larvae of the Eurasian subspecies *Apamea s. sordens* (Hufnagel) have sometimes destroyed 25 to 40 per cent of rye grain, and have also been destructive to seed cultivation of meadow fescue (*Festuca pratensis* Hudson) (Mikkola and Jalas, 1979).

Apamea sordens occurs in North America from Newfoundland and Labrador westward to northern British Columbia and the Alaskan Panhandle and southward to northwestern South Carolina, Wisconsin, Nebraska, New Mexico, northeastern Nevada, and northeastern Oregon. In the Old World it occurs across Europe and Asia as far south as southern Spain, Italy, Turkey, Afghanistan, and northern China (Zilli et al., 2005). The flight season extends from early May until late August, but most records are from June and July.

The species is arranged in three subspecies, subspecies *sordens* in Eurasia, subspecies *finitima* in most of North America, and a distinctively small, pale population isolated on Sable Island off the East Coast of Nova Scotia that is described as a new subspecies.

Apamea sordens sordens (Hufnagel)
PL. 2, FIG. 23; PL. F, FIG. 4 (♂ gen.).

Phalaena sordens Hufnagel, 1766.
Type locality: Berlin, Germany. [Type lost]

Noctua basilinea [Denis and Schiffermüller], 1775.
Type locality: Vienna, Austria. [Type lost]

Subspecies *sordens* is the Eurasian subspecies and differs from subspecies *finitima* in North America in that the digitus extends well beyond the ventral margin of the cucullus by ½ its length (in subspecies *finitima* the digitus extends to the ventral margin of the cucullus).

Subspecies *sordens* occurs across Eurasia from Great Britain and Ireland eastward to Japan and the Russian Far East.

Apamea sordens finitima Guenée
PL. 2, FIGS. 24–27; PL. F, FIG. 3 (♂ gen.); PL. Q, FIG. 5 (♀ gen.).

Apamea finitima Guenée, 1852.
Type locality: New York State, USA. [Type lost]

Hadena cerivana Smith, 1900.
Type locality: Calgary, Alberta, Canada. [USNM]

Subspecies *finitima* is found throughout the temperate areas of North America and is the most common *Apamea* species in most areas. There is some individual and geographical variation with a similar range of forms as occurs in subspecies *sordens.* In subspecies *finitima,* the forewing ground color tends to have more gray shading and the ornamentation is somewhat stronger than in subspecies *sordens*: the maculation is lined with blackish scales, and the transverse lines are well marked and clearly geminate. Specimens of *finitima* from the Great Plains tend to have more gray on the forewing (named as *cerivana*), but montane and West Coast populations from more mesic habitats look the same as those from eastern North America. The moths show more variation in the West than elsewhere. The moths of Vancouver Island and Washington often have a darkened medial area, or the whole wing is dark. Similar forms occur elsewhere but with a lower frequency, so the color variation is not appropriate for subspecies status. The moths fly from early May to late August.

Apamea sordens sableana Mikkola, NEW SUBSPECIES
PL. 2, FIGS. 28, 29.

Apamea sordens sableana Mikkola.
Type locality: Sable Island, Nova Scotia, Canada. [CNC]

NOTE—The name *sableana* is derived from the type locality.

Sable Island has been isolated from the continental North America since the last deglaciation, about 10,000 years ago. The island is separated from the continent by about 130 km, which means that insects without migratory behaviour are more or less isolated from continental populations. As the specimens of *A. sordens* from Sable Island differ consistently from those from adjacent mainland Nova Scotia, the difference must be genetic, and the population is described as a new subspecies.

Moth averages slightly smaller than that of subspecies *finitima* (forewing length: 14–17 mm versus 15–20 mm in ssp. *finitima*). Forewing col-

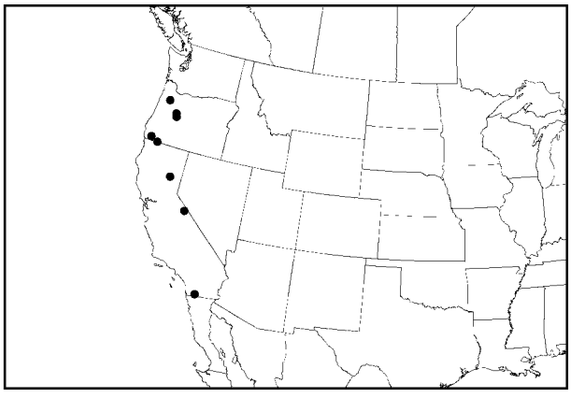


FIGURE 21: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA DIGITULA*

or washed out pale reddish brown with pale gray on posterior part of wing; maculation contrasting against pale ground color, especially reniform spot with a conspicuous, whitish geminate outline; wing margin more checkered. Hindwing with outer margin darker than in subspecies *finitima,* contrasting with pale buff fringe.

TYPES. **Holotype:** ♂. West end, Sable Island, Nova Scotia; 8 July 1967; J. E. H. Martin. CNC. **Paratypes:** 24 ♂ 44 ♀: **Nova Scotia.** Same locality and collector as for holotype; 1–16 July, 1967. CNC, MZH, USNM.

Apamea digitula Mustelin and Mikkola
PL. 2, FIGS. 30–32; PL. F, FIG. 5 (♂ gen.); PL. Q, FIG. 6 (♀ gen.); TEXT FIG. 21 (map).

Apamea digitula Mustelin and Mikkola, 2006, *Zootaxa,* **1278**: 31.
Type locality: Laguna Mountains, San Diego Co., California, USA. [SDNHM]

The name *Apamea digitula* was proposed for specimens from southernmost California that are darker than *A. sordens,* have more brown shading on the forewing, a wider medial area, a slightly smaller reniform spot, and a shorter digitus in the male genitalia. The species in now known to occur as far north as northern Oregon, but these more northern specimens are superficially indistinguishable from *A. sordens.* They can be identified by the shorter digitus and molecular differences of the cytochrome c oxidase 1 (CO1) mitochondrial gene sequence. Forewing length in *A. digitula* ranges from 16 to 19 mm.

In the male genitalia, *Apamea digitula* can be identified by the shorter digitus. In *A. digitula* the digitus extends to about ⅔ of the distance along the ventral margin of the cucullus; in *A. sordens* it extends to the anal angle of the cucullus or beyond it.

The immature stages are unknown.

This species occurs from northwestern Oregon southward in the Cascades and Sierra Nevada to the Laguna Mountains in southern California. Adults occur in grassy areas in open pine and oak forests at elevations of 3,300′–6,600′ from early May until late June.

Apamea leucodon-GROUP

The *Apamea leucodon*-group includes four species, three in North America and one, *A. leucodon* (Eversmann), in Asia and southeastern Europe. The group is characterized in the male genitalia by the relatively short, stout digitus, the thick clasper, and in the vesica the cornutus arises from a large, heavily sclerotized plate, and usually projects obliquely from this plate. In the female genitalia the corpus bursae is long, narrow, and shaped like a figure 8; the anal papillae are unique in that they taper abruptly near the base, are very narrow through the posterior ¾, and then are abruptly truncated at the apex. Males of three of the four species have basal abdominal brushes and pockets; they are absent in *A. cinefacta.*

The species of the group characteristically inhabit open steppe habitats.

Apamea inordinata (Morrison)
PL. 2, FIGS. 33–39; PL. F, FIG. 6 (♂ gen.); PL. Q, FIG. 7 (♀ gen.); TEXT FIG. 22 (map) (RWH 9352, 9353).

Hadena inordinata Morrison, 1875, *Proc. Acad. Nat. Sci. Philadelphia,* **1875**: 63.
Type locality: Massachusetts, USA. [MSU]
NOTE—Morrison does not mention how many specimens of *inordinata* he had. A female in MSU in good condition labeled ‘‘Mass./ Newtonville June 16. 74 [triangular]/ Type [rhomboid with black border]/ Holotype, *Hadena inordinata,* Morrison [red]/ Mich. State Coll., Entomology Mus., Type’’ is here designated LECTOTYPE to ensure the stability of the name.

Hadena semilunata Grote, 1881, *Papilio,* **1**: 58. NEW SYNONYMY, NEW STATUS, SUBSPECIES.
Type locality: Washington Territory, USA. [BMNH]
NOTE—Grote (1881a) had an unknown number of specimens. A worn female without antennae in the

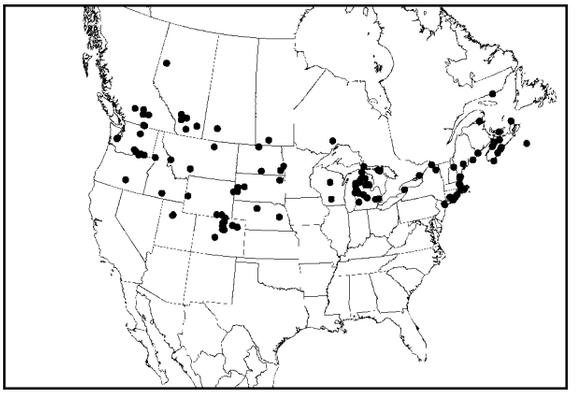


FIGURE 22: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA INORDINATA*

Natural History Museum, London, labeled ''Type [round, red border]/ Grote Coll. 81-116./ Washington Territory/ *Hadena semilunata* Grote, Type [red border]'' is here designated LECTOTYPE to ensure the stability of the name.

Xylophasia inordinata var. *montana* Smith, 1891, *Proc. U. S. Natl. Mus.,* **13**: 444. UNAVAILABLE, HOMONYM.
Type locality: Colorado, USA. [USNM]

NOTE—The name is a secondary homonym of *Polia montana* Herrich-Schäffer, [1852] (Poole, 1989).

NOTE—Todd (1982: 142) designated the lectotype of *montana.*

NOTE—This publication has frequently been cited as 1890, the year on the running header, but the cover page gives 1891 as the year of printing and Smith on page 419 refers to a specimen received from Bruce in February of 1891.

Apamea inordinata olympia Crabo. NEW SUBSPECIES.
Type locality: Mima Mounds, Thurston County, Washington. [CNC]

Apamea inordinata is a small moth (forewing length: 14–17 mm) and is the only *Apamea* species in which the basal area of the hindwing is yellow and contrasts with the dark fuscous marginal band and discal spot. The forewing is boldly patterned against a pale luteous-brown or gray ground with many of the veins lined with white giving the wing a streaked pattern; the subterminal line has a series of black wedge-shaped marks proximally and a contrasting W-mark where the pale-lined veins M_3 and CuA_1 project through it to the wing margin. *Apamea inordinata* is closely related to the Asian species *A. leucodon,* but in *A. leucodon* the basal part of the hindwing is fuscous, the sacculus is narrower, and the juxta is broader than in *A. inordinata.* Both species have a distinctive bilobed vesica with a large, oblique cornutus at the apex of each lobe. The two species differ by about 3 % in the cytochrome c oxidase 1 (CO1) mitochondrial gene sequence.

The immature stages are unknown.

Apamea inordinata occurs from Nova Scotia westward to southern British Columbia and southward to New Jersey, New York, Michigan, Wisconsin, Nebraska, Colorado, Utah and Oregon. The species can be found from sea level in the East to 8,000′ in the West. The flight season extends from late April to late August, tending to be earlier farther south.

The species is arranged into three subspecies. There is no variation in the cytochrome c oxidase 1 (CO1) mitochondrial gene sequence among five specimens ranging from Ontario to eastern Washington and Oregon, whereas the isolated population in northwestern Washington, described herein as subspecies *olympia,* differs from other populations by 0.75 %.

Apamea inordinata inordinata (Morrison) PL. 2, FIGS. 33–35.

Hadena inordinata Morrison, 1875.
Type locality: Massachusetts, USA. [MSU]

In the nominate subspecies of *A. inordinata* the forewing is gray with a nut brown hue, and the transverse lines are geminate, often prominently filled with white. The hindwing is dull yellow with a broad, fuscous marginal band, postmedial line, and discal spot. In some populations, especially in the eastern Great Lakes area, the basal part of the hindwing and the veins are suffused with dark brown. Populations in Michigan and Wisconsin resemble those in the prairies more than those from farther east.

Subspecies *inordinata* occurs mainly on the Atlantic Coast, probably because of its preference for sandy habitats, especially dunes. It occurs from Nova Scotia southward to New Jersey and westward through the Great Lakes region where it blends into subspecies *semilunata.* It is rare in collections, this probably reflecting the specialized and isolated habitats where it occurs. The adults fly from early May until late August, but most records are from the latter half of June.

Apamea inordinata semilunata (Grote)
PL. 2, FIGS. 36–38; PL. F, FIG. 6 (♂ gen.); PL. Q, FIG. 7 (♀ gen.).

Hadena semilunata Grote, 1881.
Type locality: Washington Territory, USA. [BMNH]

Xylophasia inordinata var. *montana* Smith, 1891. UNAVAILABLE, HOMONYM.
Type locality: Colorado, USA. [USNM]

Subspecies *semilunata* was listed as a distinct species by Franclemont and Todd (1983). The forewing ground color varies from pale brownish gray with a washed out pattern in Colorado to gray with bold markings in British Columbia. The hindwing is paler than in subspecies *inordinata* with the marginal band narrower and more sharply defined; the postmedial line is obscure or absent; and the discal lunule is smaller. Smith (1891: 444) noted that his species *montana* is somewhat intermediate between *inordinata* and *semilunata* in that the hindwing marginal band is often broad, and he suspected that ''probably eventually three species will be recognized.'' We consider *montana* to fall within the western variation as a geographical cline and do not recognize it as a subspecies.

Subspecies *semilunata* occurs from southern Canada (Manitoba to British Columbia) southward to Nebraska, Colorado, Utah, southern Idaho, and southern Oregon. It prefers open sandy forests. The flight season extends from late April to mid-July, flying several weeks earlier in the southern part of its range than in Canada.

Apamea inordinata olympia Crabo, NEW SUBSPECIES
PL. 2, FIG. 39.

Apamea inordinata olympia Crabo.
Type locality: Mima Mounds, Thurston County, Washington. [CNC]

NOTE—The subspecies name refers to the vicinity of the type locality to Olympia, Washington.

This subspecies is only known from gravelly glacial out-wash prairies near the southern end of Puget Sound, Washington. It is smaller (forewing length 12–13 mm), has a more uniform darker brown forewing, and is more vividly patterned than other populations of *A. inordinata,* including those that occur in xeric steppe habitat east of the Cascade Mountains in the Columbia Basin (forewing length 14–17 mm). Subspecies *olympia* is not known from other west-side prairie habitats, including those in the Willamette Valley of Oregon, nor near the Strait of Georgia in northwestern Washington. This subspecies is unlikely to be confused with any other *Apamea* species in western Washington. The moths occur in May.

The CO1 mitochondrial DNA sequence of subspecies *olympia* differs from those of other populations of *inordinata* by 0.75 %. No CO1 gene variation is present within other *inordinata* populations from across the range of the species, including eastern Washington. *Olympia* is treated as a subspecies of *inordinata,* despite the DNA differences, because of the similarity in wing pattern and the absence of genital differences between these taxa.

Forewing length: 12–13 mm. Eye normal. Palpus covered with dark gray, white, and light-ochre scales and hairs. Head, thorax, and abdominal tufts with a mixture of white and black-tipped, fuscous-gray scales. Forewing shape more rounded than nominate subspecies; ground color uniform dark gray with scattered brown and ochre scales in antemedial and medial areas and white scales above claviform spot; appearing darker and less mottled and streaky than subspecies *inordinata*; ordinary spots dark gray with contrasting white filling; reniform and orbicular spots with dark-gray centers; transverse lines similar in shape to those of subspecies *inordinata,* dark gray, evident mostly due to contrasting white filling; subterminal line preceded by dark chevrons in a few specimens. Hindwing rich ochre with blackish-gray shading on thin medial line, wide marginal band, large lunule, and veins. Fringe of forewing dark gray with weak checkering of lighter scales; hindwing fringe luteous mainly white with light gray toward base.

TYPES. **Holotype:** ♂: DNR [Department of Natural Resources] Mima Mounds [Natural Area Preserve], Thurston Co., 46.907°N 123.049°W; Elev 240 ft; 4 May, 1998; L. G. Crabo leg.;/ Databased for CNC LEP 031935/ Barcodes of Life Project, University of Guelph, DNA # Noctuoidea LEP 031935. CNC. **Paratypes:** 6 ♂, 2 ♀. **Washington.** Same locality, date, and collector as for holotype (6 ♂). Locality, date, and collector as for holotype/ Databased for CNC, LEP 031032/ Barcodes of Life Project, University of Guelph, DNA # Noctuoidea LEP 038032 (1 ♀). Fort Lewis, Thirteenth Division Prairie (E of Hwy), 94 m, Pierce County, 47.01°N 122.51°W; 21 May, 1995; J. P. Pelham leg; native prairie; daytime (1 ♀). (CNC, LGC, WSU).

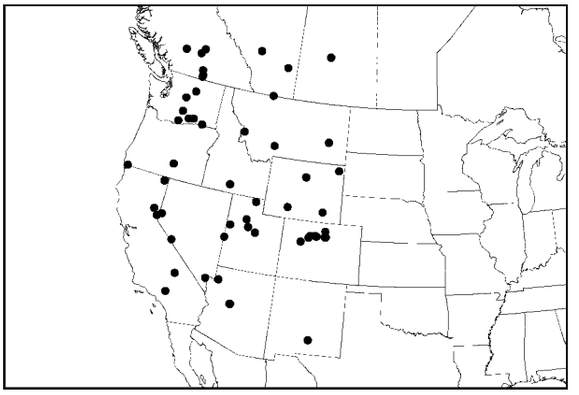


FIGURE 23: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA SPALDINGI*

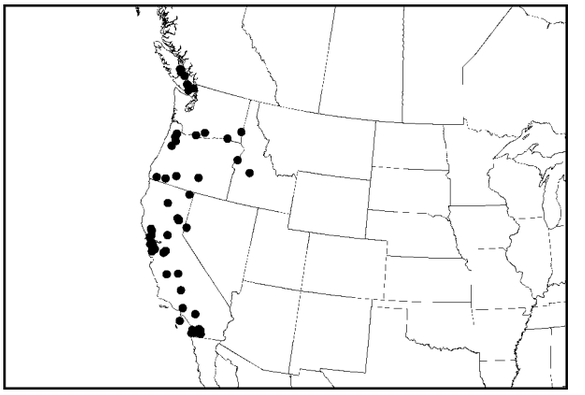


FIGURE 24: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA CINEFACTA*

Apamea spaldingi (Smith)
PL. 2, FIGS. 40–44; PL. G, FIG. 1 (♂ gen.); PL. Q, FIG. 8 (♀ gen.); TEXT FIG. 23 (map) (RWH 9356).

Hyppa spaldingi Smith, 1909, *Jour. New York Ent. Soc.,* **17**: 59.
Type locality: Stockton, Utah, USA. [AMNH]

Trachea umbrifacta Hampson, 1910, *Catalogue of the Lepidoptera Phalaenae in the British Museum,* **9**: 501.
Type locality: Stockton, Utah, USA. [BMNH]

Apamea spaldingi is a finely marked medium-sized moth (forewing length: 16–20 mm). The color of the forewing is gray, usually with some nut-brown shading, especially in the medial area; the orbicular spot is elongated, oval to almost barlike. It can be distinguished from all other gray species of *Apamea* by the wide medial area (due to the inward course of the posterior part of the antemedial line), the black line in the fold connecting the antemedial line with the even, non-dentate, evenly-curved postmedial line. The hindwing is pale basally with a fuscous marginal band on the outer ⅓ of the hindwing. This species was misidentified by Barnes and McDunnough (1913, plate 18, figures 19, 20) as *A. centralis.*

Apamea spaldingi can be distinguished from other similar species by the short, pointed digitus and the very small vesica with a large prostrate cornutus in the male genitalia and by the narrow, apically truncated anal papillae in the female genitalia.

The immature stages are unknown.

Apamea spaldingi is a local but relatively common species of dry pine forests. It occurs at elevations ranging from 1,000′ to 8,000′ from southern Saskatchewan, Alberta, and British Columbia southward to southern New Mexico, central Arizona, and southern California. The flight season extends from late April to late June; the peak season is mid-May.

Apamea cinefacta (Grote)
PL. 3, FIGS. 1–5; PL. A, FIG. 5 (wing pattern); PL. G, FIG. 2 (♂ gen.); PL. R, FIG. 1 (♀ gen.); TEXT FIG. 24 (map) (RWH 9357).

Hadena cinefacta Grote, 1881, *Papilio,* **1**: 76.
Type locality: Washington Territory, USA. [BMNH]

NOTE—Grote (1881a) mentions two collections as sources of material; there are syntypes in the BMNH and AMNH. A slightly worn, unicolored female without antennae in the BMNH labeled ‘‘Grote Coll. 81-116./ Washington Territory/ *Hadena cinefacta* Grote, Type’’ is here designated LECTOTYPE to ensure the stability of the name.

Apamea cinefacta is smaller (forewing length: 15–19 mm) than *A. spaldingi,* has a narrower medial area posteriorly, and a darker hindwing. The forewing is ash gray with some brown suffusion, particularly in the medial area. Other characters that distinguish *A. cinefacta* from similar species, especially *Apamea commoda parcata,* are 1) the antemedial line projects outward in the fold, constricting the medial area; 2) the postmedial line projects outwardly at vein CuA_2 rather than being evenly dentate; and 3) the terminal line on the hindwing is a continuous even line (especially

obvious on the underside), not a series of dark dashes between the veins. Many specimens have a contrastingly dark medial area, especially in the Pacific Northwest, but intermediates occur.

Three characteristics of the male genitalia are the small cucullus, the heavily sclerotized, rounded digitus, and the very large basal cornutus in the vesica that arises from a plate fused to the apex of the aedeagus. The female genitalia are similar to those of *A. spaldingi,* but the anal papillae are narrower, and the ductus bursae is wider anteriorly.

The immature stages are unknown.

Apamea cinefacta is most likely to be confused with *Apamea commoda parcata* but occurs mainly to the west and south of the range of *Apamea commoda* and flies in the spring, so most specimens can be identified by locality and date. It occurs at elevations ranging from sea level to 6,000′ from southwestern British Columbia southward through Washington and Oregon to southern California. Adults are spring fliers, flying mainly in April and May, but can occur as early as mid-February in California and as late as mid-June in Washington.

Apamea monoglypha-GROUP

The *Apamea monoglypha*-group includes 24 species, 10 in Eurasia (Zilli et al., 2004) and 14 in North America. The group is characterized externally by a combination of features: the abdomen has prominent dorsal tufts on the basal three segments; the forewings are relatively narrow and usually longitudinally streaked with a basal dash and dashes in the fold and anal angle of the wing; and the reniform and orbicular spots are mainly outlined in pale and appear blurry. The most obvious exception is *A. helva,* which is not longitudinally streaked, but is included here because of the abdominal tufting and genital characters.

In the male genitalia the uncus is relatively slender and tapers to a sharp point; the juxta is prominently constricted mesially, and the lower (anterior) part is heavily sclerotized; the sacculus is relatively large and projects as a rounded lobe over the dorsal margin of the valve; the digitus is twisted posteriorly so that it overlaps the anterior lobe of the cucullus, and the vesica projects to the right with a prominent bulge to the left and has two cornuti, one on the anterior surface of the bulge, and the other above the apex of the aedeagus. In the female genitalia, the corpus bursae is usually shaped like a figure 8 with the sclerotized ridges in the ductus bursae extending on to the right posterior lobe of the corpus bursae; two long and two short signa are usually present. Males have basal abdominal brushes and pockets.

Apamea lignicolora (Guenée)

PL. 3, FIGS. 6–9; PL. G, FIG. 3 (♂ gen.); PL. R, FIG. 2 (♀ gen.); TEXT FIG. 25 (map) (RWH 9333, part).

Xylophasia lignicolora Guenée, 1852, *in* Boisduval and Guenée, *Histoire Naturelle des Insectes. Species Général des Lépidoptères,* **5**: 140.

Type locality: New York State, USA. [BMNH]

NOTE—Guenée (1852) does not state how many specimens of *lignicolora* he had; there is one male and one female in the BMNH. The male labeled ‘‘Type [round, red border]/ U. S. America, Doubleday 46-110./ *Xyloph. lignicolor* [sic] Gn.’’ is here designated LECTOTYPE to ensure the stability of the name. The right antenna of the lectotype is missing and the posterior edges of the forewings are worn, otherwise it is in good condition.

Hadena quaesita Grote, 1876, *Can. Ent.,* **8**: 26, REVISED SYNOYMY.

Type locality: Racine, Wisconsin, USA. [BMNH]

NOTE—Grote (1876) does not mention how many specimens he had from Wisconsin. A dark female in good condition in the British Museum labeled ‘‘Type [round, red border]/ Grote Coll. 81-116./ Wisconsin, Racine/ *Hadena quaesita* Grote Type’’ is here designated LECTOTYPE to ensure the stability of the name.

Apamea lignicolora is a fairly large species (forewing length: 17–24 mm) with a mottled forewing pattern in which the darker reddish-brown color appears to bleed into longitudinal streaks over the paler yellow-brown ground color; the ground color is darker on the costal and outer margins of the wing than elsewhere. The transverse lines are indistinct, so the medial area is barely distinguishable. The orbicular spot is oblong, sometimes barlike, with a pale outline and darker center. The reniform spot is a diffuse pale area with an indistinct outline. The dark terminal area has a prominent W-mark projecting into it at veins M_3 and CuA_1. A diffuse, reddish-brown dash in the fold projects from the terminal area into the medial area but is interrupted by the postmedial

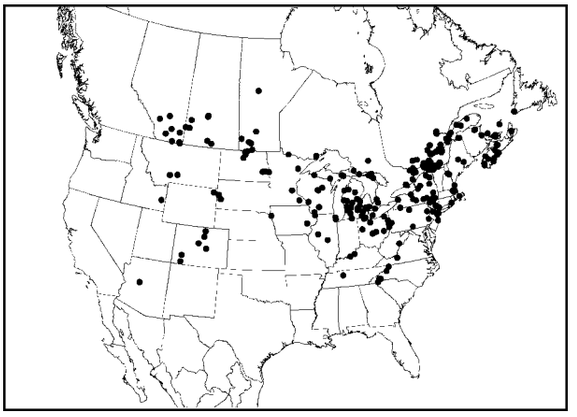


FIGURE 25: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA LIGNICOLORA*

line. Western specimens tend to have more dark shading than eastern specimens, so the medial area and maculation are more contrasting; some specimens are a unicolorous reddish brown. This darker form occurs with the paler typical form over a wide area in the Midwest; the frequency of darker specimens increases toward the West, so the subspecific name *quaesita* is not maintained.

In the male genitalia the uncus is slender, tapered to the apex, the cucullus extends as far dorsally from the ''neck'' as ventrally, and the vesica has two small cornuti, one near the end of the subbasal diverticulum and one posterior to the end of the aedeagus. In the female genitalia the ductus bursae is about 2 × as long as wide and the corpus bursae is shaped like a figure 8 with the right and left sides posterior to the postmedial constriction similar in size.

The immature stages were described by Crumb (1956: 231). Unfortunately, the description is based on larvae from Minnesota and Washington, so material of both *A. lignicolora* and *A. atriclava* may have been combined in the description. The larvae are mainly white without any definite pattern; the cervical and anal shields are pale brown, without the dark-brown shading of *A. devastator.* The host plant given by Crumb is referable to *A. atriclava.*

This is one of the most common species of *Apamea.* It occurs across southern Canada from Newfoundland to western Alberta and southward to New Jersey, Kentucky, southern Illinois, Nebraska, southern Colorado, and central Arizona. In the East its range extends farther south in the Appalachians to southwestern North Carolina.

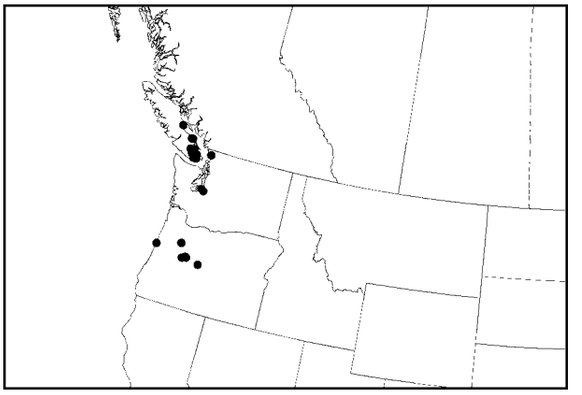


FIGURE 26: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA ATRICLAVA*

Reports from the Pacific Northwest are referable to *Apamea atriclava,* formerly treated as a western subspecies of *A. lignicolora.* The flight season extends from late May to mid-August, but most records are from late June and July.

Apamea atriclava (Barnes and McDunnough), NEW STATUS
PL. 3, FIGS. 10, 11; PL. G, FIG. 4 (♂ gen.); PL. R, FIG. 3 (♀ gen.); TEXT FIG. 26 (map) (RWH 9333, part).

Parastichtis lignicolora atriclava Barnes and McDunnough, 1913, *Contrib. Nat. Hist. Lep. N.* Amer., **2**: 111.
Type locality: Duncans, Vancouver Island, British Columbia, Canada. [USNM]

NOTE—Barnes and McDunnough described *atriclava* from four males and six females but did not designate a holotype. In the USNM there is a male and a female syntype that are labeled ''type'' of which the male labeled ''*P. lignicolora* v. *atriclava,* Type ♂ B. & McD. [red border]/ Duncans, Vanc. Is., Hanham/ 23.6.10/ Barnes Collection'' is here designated as LECTOTYPE to ensure the stability of the name.

This is the western counterpart of *A. lignicolora* and was originally described as subspecies of it. *Apamea atriclava* averages larger (forewing length: 19–23 mm), is broader winged, and more uniformly colored than *A. lignicolora.* Characteristics of the species are the pale luteous brown forewing with darker shading in the posterior part of the medial area, a thin black line in the fold connecting the antemedial and postmedial lines, and a pointed outward bulge in the postmedial line at vein CuA_2. The hindwing fringe is rust colored.

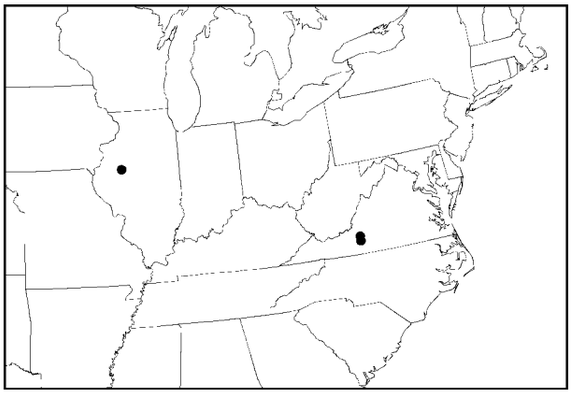


FIGURE 27: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA SMYTHI*

The male genitalia are similar to those of *A. lignicolora,* but the uncus is broader and more abruptly tapered near the apex, the cucullus extends much farther dorsally from the ''neck'' than ventrally, and the cornuti in the vesica are on larger, more heavily sclerotized plates. In the female genitalia the ductus bursae is shorter and wider than in *A. lignicolora,* about as long as wide, and in the corpus bursae the left posterior lobe is much larger than the right one.

The immature stages were described by Crumb (1956: 231), but as discussed under *A. lignicolora,* the description was based on specimens of both *A. lignicolora* and *A. atriclava.* The larvae are mainly white without any definite pattern; the cervical and anal shields are pale brown. The larvae were found in tunnels 5–8 cm under the ground among the roots of quack grass (*Elytrigia repens* (L.) Nevski).

Apamea atriclava occurs in the Pacific Northwest from southern Vancouver Island, British Columbia, southward in the Cascades and on the West Coast to central Oregon. The flight season extends from early June until mid-July.

Apamea smythi Franclemont
PL. 3, FIG. 12; PL. G, FIG. 5 (♂ gen.); PL. R, FIG. 4 (♀ gen.); TEXT FIG. 27 (map) (RWH 9350).

Apamea smythi Franclemont, 1952, *Bull. Brooklyn Ent. Soc.,* **47**: 135.
Type locality: Montgomery County, Virginia, USA. [USNM]

This large species (forewing length: 23–24 mm) is one of the least-collected moths in eastern North America in that it has been found only twice and yet occurs in areas of the country that are relatively well collected. The forewing is dark brown with a paler yellowish-brown flush, especially distal to the reniform and claviform spots. The maculation is diagnostic; the three spots are outlined in black and mainly filled with the ground color; the reniform spot is large with a dark-gray patch posteriorly; the orbicular spot is elliptical and has a black central dot; the claviform spot is a small rounded loop. The terminal area and outer part of the subterminal area are much darker brown than the ground color. The W-mark of the subterminal line is not prominent. The hindwing is dark fuscous, slightly paler basally.

The male genitalia are characterized by the narrow uncus, large cucullus, long slender digitus, and relatively small sacculus.

The immature stages are unknown.

Apamea smythi is only known from the type locality in Virginia and from western Illinois. The adults were collected in the latter half of July.

Apamea helva (Grote)
PL. 3, FIGS. 13–15; PL. G, FIG. 6 (♂ gen.); PL. R, FIG. 5 (♀ gen.); TEXT FIG. 28 (map) (RWH 9373).

Orthosia helva Grote, 1875, *Can. Ent.,* **7**: 84.
Type locality: East slope, USA. [BMNH]

NOTE—Grote described a male and a female, but reports having seen many specimens. A pale female in the BMNH in excellent condition (except that the abdomen is greasy) labeled ''Type [round, red outline]/ Grote Coll., 82-54 [printed]/ U. S. America [printed]/ *Orthosia helva* Type Grote [red frame]'' is here designated LECTOTYPE to ensure the stability of the name.

This species has previously been associated with the generic name *Agroperina* (now a synonym of *Apamea*) because of the less prominent tufting on the thorax, but we have placed it in the *Apamea monoglypha*-group because of the more extensive tufting on the abdomen, the vesica shape, and molecular data that consistently associate it with the *A. monoglypha*-group. It is easily recognized among North American *Apamea* by the bright yellow-ocher forewing color, the dark orange-brown maculation, and the large blackish-gray spot in the lower part of the reniform spot. The subterminal line lacks the W-mark found in most species in the *A. monoglypha*-group. The fore-

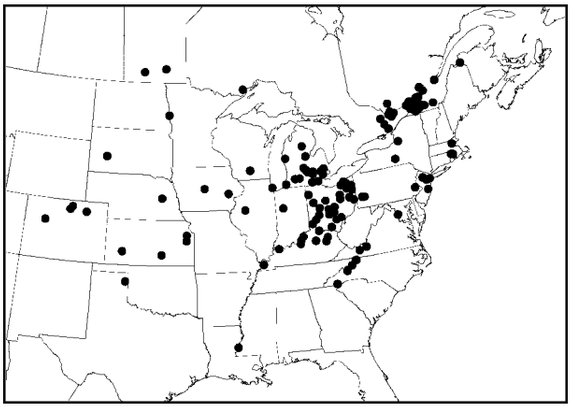


FIGURE 28: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA HELVA*

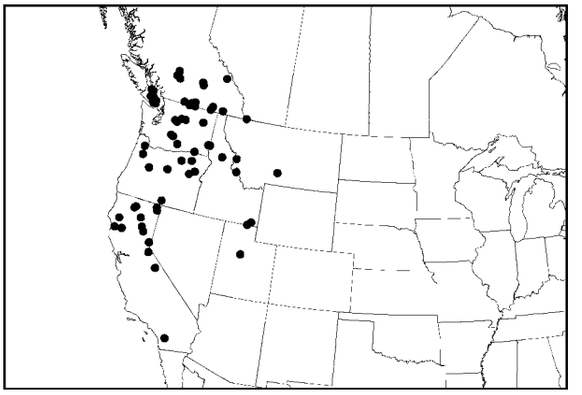


FIGURE 29: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA ANTENNATA*

wing length ranges from 16 to 20 mm, but the moth appears larger than it really is because of the stout body and the broad, apically blunt forewing.

The larva was described by Crumb (1956: 230) from specimens collected from sod in Iowa. The mature larva is about 30 mm long. The head is brown suffused with darker brown or black. The body is white without any definite pattern and with brown cervical and anal shields. The spiracles are brown and very narrow, almost 3 × as high as wide (about 2 × as high as wide in other species). The pinacula are black with those of the SD1 and L1 setae distinctly raised. The skin is pavement granulose.

Apamea helva occurs from southern Canada (Quebec to Manitoba) southward to South Carolina, Louisiana, the Texas Panhandle, and northern Colorado. Adults have been collected from mid-July to mid-September, but most records are from August.

Apamea antennata (Smith)
PL. 3, FIGS. 16–20; PL. H, FIG. 1 (♂ gen.); PL. R, FIG. 6 (♀ gen.); TEXT FIG. 29 (map) (RWH 9334).

Xylophasia antennata Smith, 1891, *Proc. U. S. Natl. Mus.,* **13**: 439.
Type locality: California, USA. [USNM]

Parastichtis purpurissata Barnes and McDunnough, 1913, *Contrib. Nat. Hist. Lep. N. Amer.,* **2**: 112.
Type locality: Duncan, Vancouver Island, British Columbia, Canada. [USNM]

NOTE—The type series of Barnes and McDunnough (1913) included three males and three females. A male in USNM labeled "*Parastichtis purpurissata,* Type ♂ B. & McD. [red border]/ Duncans [sic], Vanc. Is., Hanham/ Photogr. pl. 16, No. 1 [blue green]/ Genital Slide, By [left blank], USNM 39024 [green]/ ♂ Genitalia, Slide: USNM 811, J. G. Franclemont" is here designated LECTOTYPE to ensure the stability of the name.

Apamea antennata is a relatively large species (forewing length: 18–22 mm) of the Pacific Northwest and California. It is frequently confused with *Apamea atrosuffusa* (p. 61) but occurs mainly to the north and west of the range of *A. atrosuffusa,* and the wings are not as narrow as in *A. atrosuffusa.* The forewing ground color varies from pale yellowish brown to dark brown, characteristically with hoary or pale-violet shading on the posterior margin of the wing and in the subterminal area. The medial area is narrow in the fold where a dark dash usually connects the antemedial and postmedial lines. *Apamea antennata* is easily confused with the contrastingly marked form of *A. atrosuffusa,* but the forewing is broader, the dark streaks in the terminal area are more sharply defined and contrasting, and the hindwing is more uniformly fuscous. There is some geographical variation in the proportion of the polymorphic forms; dark forms predominate in British Columbia, whereas paler more contrasting forms predominate in California. The geographical differences are in the proportion of the forms, so no subspecies are recognized.

In the male genitalia the cucullus in *A. antennata* is much smaller than in *A. atrosuffusa,* the digitus is shorter and stouter, and the juxta is much longer. In the female genitalia the anal pa-

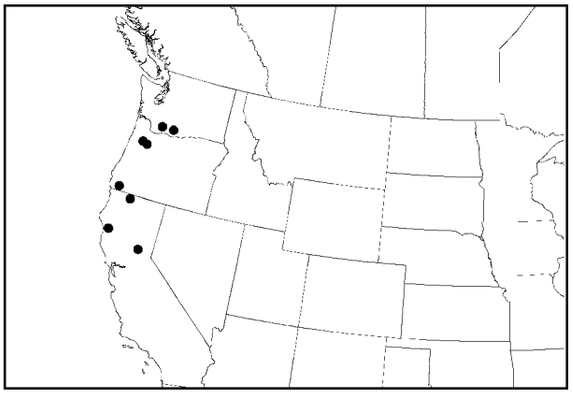


FIGURE 30: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA SISKIYOU*

pilla is much longer in *A. antennata* than in *A. atrosuffusa,* and the right side of the posterior lobe of the corpus bursae is more heavily sclerotized.

The immature stages are unknown.

Apamea antennata occurs from southern British Columbia and southwestern Alberta southward to southern Montana, central Utah, and southern California. It flies in forested areas to an elevation of 6,800′ in California. The flight season extends from early June until mid-August.

Apamea siskiyou Mikkola and Lafontaine, NEW SPECIES
PL. 3, FIGS. 21–23; PL. H, FIG. 2 (♂ gen.); PL. R, FIG. 7 (♀ gen.); TEXT FIG. 30 (map).

Apamea siskiyou Mikkola and Lafontaine. Type locality: Eight Dollar Mtn. Road, [Josephine Co.], Oregon. [CNC]

NOTE—The species name comes from the Siskiyou Mountains where the species was first discovered.

Apamea siskiyou is closely related to *A. antennata* and occurs with it in northern California, southern Oregon, and southern Washington. Most specimens can be distinguished from those of *A. antennata,* when they occur together, by their smaller size and darker forewing ground color.

Antenna of male slightly constricted between segments and slightly bifasciculate (as in other species of group); antenna of female filiform, ciliate ventrally. Forewing typically dark yellow brown, somewhat mottled, with a paler yellowbrown patch distal to reniform spot; maculation generally obscured by dark ground color, but postmedial and antemedial lines visible, especially in fold where dark shading connects them; black basal dash extends to postmedial line; orbicular spot longitudinally oval with pale outline; reniform spot darker gray than ground color with fuzzy yellow outline; terminal area darker than ground color with dark streaks extended into subterminal area; subterminal line with a deep W-mark at veins M_3 and CuA_1 where subterminal shade projects through terminal area to wing margin; forewing length 18–21 mm. Hindwing dark fuscous; fringe yellowish buff. A rare contrastingly marked form (plate 3, figure 23) resembles *A. antennata,* but can be recognized by smaller size, darker hindwing, occurrence with darker, more typical form of *A. siskiyou,* and genital characters.

Male genitalia similar to those of *A. antennata* but digitus longer, extending to or beyond ventral margin of cucullus, and apically swollen (tapered in *A. antennata*); shape of digitus easily observed without dissection by removing scales from end of valve. Female genitalia similar to those of *A. antennata* but posterior part of corpus bursae less heavily sclerotized.

The immature stages are unknown.

TYPES. **Holotype:** ♂. Eight Dollar Mtn. Road, 42° 14′ N, 122° 41′ W, 1,125′, Josephine Co., Oregon; 23 May 2001; J. Troubridge. CNC. **Paratypes:** 31 ♂, 9 ♀. **California.** Yreka, Siskiyou Co.; 4–6 June 1963, 6 July 1963; W. R. Bauer & J. S. Buckett; 6 June 1968; R. P. Allen (10 ♂, 4 ♀). **Oregon.** Same locality and collector as for holotype; 1,600′; 15 June 1999; 1,125′; 23 May 2001 (20 ♂, 2 ♀). Eight Dollar Mt, 400 m, 42.242° N, 123.676° W, Josephine Co.; 12 June 2007; Lars G. Crabo leg (1 ♂, 2 ♀). **Washington.** Major Creek, Klickitat Co.; 21 June 2007; John Davis (1 ♀). CNC, LGC, UCD. Two males from Grass Valley, Nevada Co., California are excluded from the type series because they are more unicolorous than the specimens from the Siskiyou Mountains.

Apamea siskiyou is known mainly from the Siskiyou Mountains in northwestern California, southwestern Oregon, and Klickitat County in southern Washington. Two specimens from Nevada County, California suggest that it may occur locally in the Sierra Nevada as well. Adults fly from mid-May until early July.

Apamea ochromma Mikkola and Lafontaine, NEW SPECIES
PL. 3, FIGS. 24–26; PL. R, FIG. 8 (♀ gen.); TEXT FIG. 31 (map).

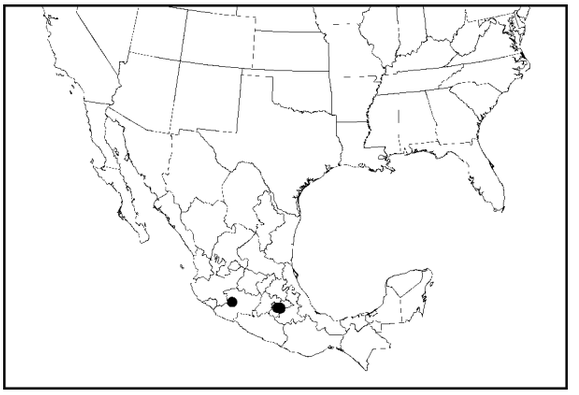


FIGURE 31: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA OCHROMMA*

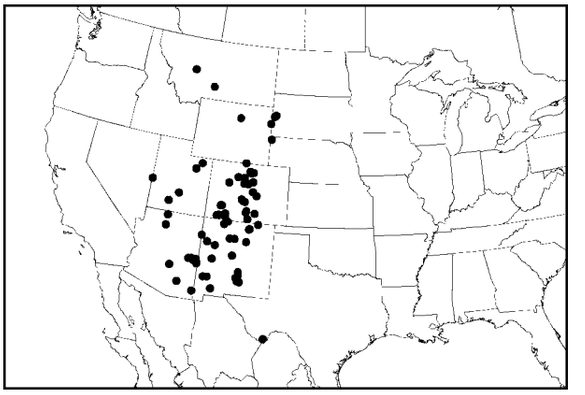


FIGURE 32: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA ASTROSUFFUSA*

Apamea ochromma Mikkola and Lafontaine. Type locality: 7 air km WSW Juchipetec, Mexico, Mexico. [EME]

NOTE—The name of this species is from the Greek for ''ochreous eye,'' and refers to the color of the maculation.

Apamea ochromma is a southern relative of *Apamea antennata* that occurs in the mountains of central Mexico. It differs from *A. antennata* in larger size (forewing length: 21–23 mm versus 18–22 mm in *A. antennata*), the forewing is blackish brown with a violet hue, and the ductus bursae is only ½ as long as in *A. antennata.*

Antenna of female (male unknown) filiform, ciliate ventrally. Head and thorax mainly shaded with blackish brown with paler reddish-brown shading on labial palps. Forewing shiny blackish brown with a violet hue in subterminal area; black basal dash with paler reddish-brown shading above it; reniform spot partially to mainly filled with reddish-brown shading that extends beyond reniform spot to postmedial line; orbicular spot longitudinally oval, usually slightly paler than ground color and outlined in black; claviform spot large, outlined in black, extending almost to postmedial line and connected to it by black bar; terminal area darker than ground color with black streaks that extend into subterminal area between veins; an indistinct W-mark in subterminal line at veins M_3 and CuA_1; margin of forewing scalloped; forewing length 21–23 mm. Hindwing fuscous, fringe reddish buff.

Male genitalia unknown. Female genitalia similar to those of *A. antennata* but ductus bursae about ½ as long as in *A. antennata.*

The immature stages are unknown.

TYPES. **Holotype:** ♀. 7 air km WSW Juchitepec, 2,750 m, Mexico, Mexico; 24 Aug. 1987; J. B. Brown & J. Powell. EME. **Paratypes:** 5 ♀. **Mexico. Puebla.** Same data as for holotype (4 ♀). Volcan Popocatepetl, 3,600–3,660 m, Tlamacas; 24 Aug. 1987; J. B. Brown & J. Powell (1 ♀). CNC, EME.

The species occurs in the States of Puebla and Mexico in the mountains of central Mexico.

Apamea atrosuffusa (Barnes and McDunnough)

PL. 3, FIGS. 27–30; PL. H, FIG. 3 (♂ gen.); PL. S, FIG. 1 (♀ gen.); TEXT FIG. 32 (map) (RWH 9335, 9336).

Parastichtis atrosuffusa Barnes and McDunnough, 1913, *Contrib. Nat. Hist. Lep. N. Amer.,* **2**: 113. REVISED STATUS.
Type locality: White Mts., Arizona, USA. [USNM]

NOTE—The type series included two females, one from Arizona and one from Poncha Springs, Colorado, both in USNM. The female labeled ''*Parastichtis atrosuffusa* B. & McD. Type ♀ [red border]/ White Mts., Ariz./ Photogr. pl. 3 No. 13 [blue-green label]'' is here designated LECTOTYPE to ensure the stability of the name. The lectotype is in excellent condition.

Parastichtis grotei Barnes and McDunnough, 1914, *Contrib. Nat. Hist. Lep. N. Amer.,* **2**: 199. NEW SYNONYMY.
Type locality: White Mts., Arizona, USA. [USNM]

Apamea atrosuffusa is a polymorphic western species with some forms that are easily confused with *Apamea antennata,* but it occurs mainly to

the south and east of the range of *A. antennata.* The name *atrosuffusa* is based on the dark form of the species although it represents only about 20 % of the population. The paler form, described the next year as *grotei,* previously was regarded as a separate species. *Apamea atrosuffusa* is a fairly large (forewing length: 18–23 mm) narrow-winged *Apamea* with indistinct transverse lines and an elongated orbicular spot. The dark form is easily recognized by the dark reddish-brown to blackish-brown forewing, often with a purple sheen, and usually with paler reddish-brown shading in the reniform and orbicular spots and with a pale streak distal to the reniform spot. The pale form is similar to *A. antennata,* but can be distinguished from it by the forewing shape, by the pale hindwing with a narrow fuscous marginal band and often a diffuse postmedial line, and by the prominent anal dash on the forewing that projects inward to the postmedial line.

The male genitalia are characterized by the broad cucullus with a straight posterior margin, a long, relatively slender digitus, and the short, broad juxta with a deeply convex posterior margin. The female genitalia have unusually short anal papillae that are only as long as the length of A8.

The immature stages are unknown.

Apamea atrosuffusa is mainly a species of the southern Rocky Mountains. It occurs from west-central Montana southward through Utah and Colorado to western Texas, southern New Mexico, and southern Arizona. An apparently disjunct population is in the Black Hills of South Dakota and adjacent Wyoming. It is locally common in oak and pine forests at elevations of up to 8,500′ in Arizona. The flight season extends from mid-June to mid-September, but most records are between late July and early September.

Apamea auranticolor (Grote)
PL. 3, FIGS. 31–34; PL. 4, FIG. 1; PL. H, FIG. 4 (♂ gen.); PL. S, FIG. 2 (♀ gen.); TEXT FIG. 33 (map) (RWH 9339, part).

Hadena auranticolor Grote, 1873, *Bull. Buffalo Soc. Nat. Sci.,* **1**: 109.
Type locality: Twin Lakes, Upper Arkansas Valley, Colorado, USA. [BMNH]

NOTE—Grote described *auranticolor* from two specimens. A male in the BMNH labeled ''Type [red border]/ Colorado, Grote Coll. 81-116/ *Hadena auranticolor* Grote, Type'' is here designated LECTOTYPE to ensure the stability of the name. The specimen is in worn condition but is otherwise undamaged.

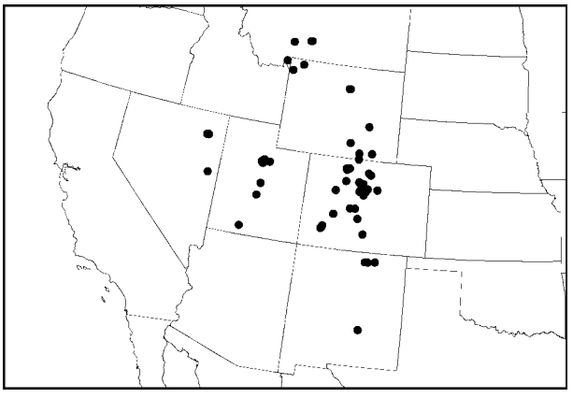


FIGURE 33: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA AURANTICOLOR*

Hadena (*Xylophasia*) *barnesii* Smith, 1899, *Can. Ent.,* **31**: 258. NEW STATUS.
Type locality: Yellowstone Park, Wyoming, USA. [USNM]

NOTE—The lectotype was designated by Todd (1982: 28). The type series included specimens from South Dakota, Wyoming, and Colorado. The taxon *barnesii* was treated as a subspecies of *auranticolor* by Franclemont and Todd (1983: 137).

Apamea auranticolor as treated here is one of three closely related, largely allopatric species formerly regarded as forms of *A. auranticolor.* We initially separated them on the basis of subtle differences in the genitalia; recent molecular analysis of the cytochrome c oxidase 1 (CO1) mitochondrial gene sequence also supports their recognition as separate species. *Apamea auranticolor* is a medium-sized (forewing length: 18–21 mm), broad-winged *Apamea* of the southern Rocky Mountains. As the species name ''golden-colored'' indicates, usually the forewing is yellowish brown, but the coloration is variable and may be relatively grayish and occasionally uniformly dark brown. The medial area has some darker reddish brown, the postmedial line has a small outward bulge at vein CuA_2, the posterior part of the subterminal area is shaded with hoary gray, and the terminal area is mainly dark fuscous to black. In the northern part of its range the moths tend to be darker with more gray shading (described as *barnesii*); these moths may be relatively evenly colored, or they may have a contrastingly dark medial area. It is difficult to sep-

arate the darkest specimens of *A. auranticolor* from the lightest ones of *A. sora,* except by examining the genitalia although the dark form of *A. auranticolor* usually has a more prominent yellowish-brown streak that extends from the reniform spot to or into the postmedial line. The two species can be identified by area of occurrence because their ranges are not known to overlap. An isolated population of *A. auranticolor* in the East Humboldt Range in Elko County, Nevada (plate 4, figure 1) resembles *A. tahoeensis* in smaller size and relatively smaller reniform and orbicular spots, but genital characters and DNA data associate this population with *A. auranticolor.*

In the male genitalia of *A. auranticolor* the digitus is shorter, more abruptly tapered and more strongly bent posteriorly than in *A. sora* or *A. tahoeensis,* the apex of the aedeagus is smooth (as in *A. sora*), and the apical cornutus in the vesica is at the apex of the dorsal lobe of the vesica. In the female genitalia the ductus bursae is wider than in *A. sora* or *A. tahoeensis,* especially posteriorly.

The immature stages are unknown.

Apamea auranticolor occurs in the Rocky Mountains and Great Basin from southern Montana and easternmost Idaho southward to central New Mexico, southern Utah, and eastern Nevada. It occurs at elevations ranging from 4,400′ in Montana to 11,000′ in Colorado. The flight season extends from late June to late August.

Apamea sora (Smith)

PL. 4, FIGS. 2–5; PL. H, FIG. 5 (♂ gen.); PL. S, FIG. 3 (♀ gen.); TEXT FIG. 34 (map) (RWH 9339, part).

Hadena (*Xylophasia*) *sora* Smith, 1903, *Can. Ent.,* **35**: 133. REVISED STATUS.

Type locality: Head of Pine Creek, Calgary, Alberta, Canada. [AMNH]

NOTE—The lectotype was designated by Todd (1982: 197).

Apamea sora is the northern relative of *A. auranticolor* and replaces it in western Canada and northwestern United States. It was previously treated as a subspecies of *A. auranticolor,* but is here reinstated as a distinct species because of consistent differences in the genitalia. Recently we have found that the three species in this complex, *A. auranticolor, A. sora,* and *A. tahoeensis,* can be identified by differences in the cytochrome c oxidase 1 (CO1) mitochondrial gene sequence. *Apamea sora* (forewing length: 18–21 mm) is similar in size to *A. auranticolor,* but usually is much darker than *A. auranticolor* and the most common forms of *A. sora* (plate 4, figures 4, 5) have a purplish sheen. The forewing ground color varies from light brownish gray (similar to the darkest specimens of *A. auranticolor*) to dark gray brown, and the medial area has more reddish shading. The terminal area is not as dark as in *A. auranticolor,* not contrastingly darker than the medial area, and the W-mark in the subterminal line is shallower than in *A. auranticolor.* Dark specimens usually are more unicolorous than in *A. auranticolor,* showing a yellow-orange hue mainly in the maculation. All specimens from Canada and Washington examined are *A. sora,* so only material from Oregon and Montana require examination of the genitalia for positive identification.

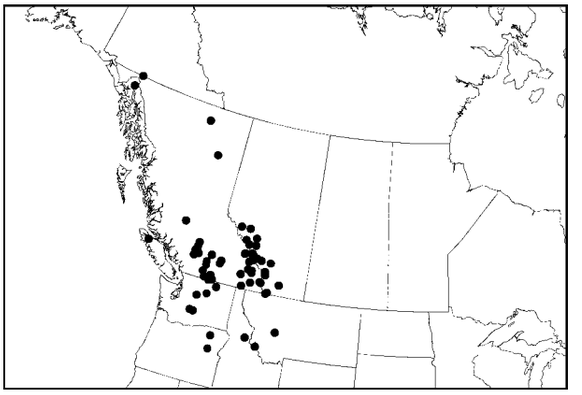


FIGURE 34: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA SORA*

The male genitalia are similar to those of *A. auranticolor,* but the digitus is longer and stouter than in *A. auranticolor,* and the apical cornutus in the vesica is farther from the apex than in *A. auranticolor.* In the female genitalia the ductus bursae is wider than in *A. auranticolor.*

The immature stages are unknown.

Apamea sora occurs from southern Yukon and the Alaskan Panhandle southward through British Columbia and western Alberta to west-central Montana, central Idaho, and southern Washington. A possibly disjunct population is in the Blue Mountains in northeastern Oregon. The flight season extends from early July to early September at elevations ranging from 2,000′ to 6,200′.

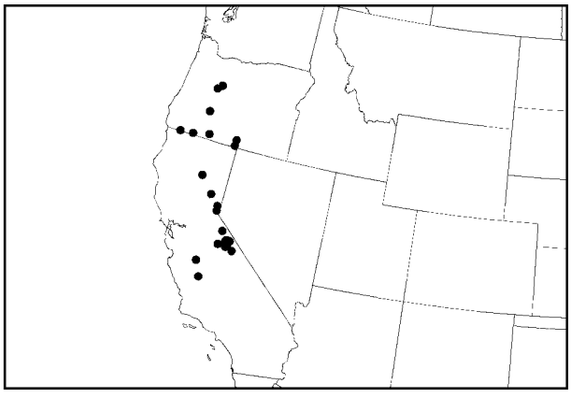


FIGURE 35: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA TAHOEENSIS*

Apamea tahoeensis Mikkola and Lafontaine, NEW SPECIES
PL. 4, FIGS. 6–8; PL. H, FIG. 6 (♂ gen.); PL. S, FIG. 4 (♀ gen.); TEXT FIG. 35 (map).

Apamea tahoeensis Mikkola and Lafontaine. Type locality: Truckee, [Nevada Co.], California, USA. [CNC]

NOTE—*Apamea tahoeensis* is named after Lake Tahoe, which is near the type locality.

This species occurs in the Sierra Nevada in California and the Cascades in Oregon, west of the range of *A. auranticolor* and south of the range of *sora.* The moths are slightly smaller than those of *A. auranticolor* and *A. sora,* the bulge in the postmedial line at vein CuA_2 is more prominent, and the posterior part of the medial area is narrow with the veins in the medial and subterminal areas black. Both sexes have diagnostic genital characteristics. The populations *A. tahoeensis* in the Sierra Nevada are more orange and resemble *A. auranticolor* more closely, whereas those from the Cascades have more gray and brown shading and resemble small specimens of *A. sora.* The genital characters, the occurrence of intermediate forms, and molecular analysis of the cytochrome c oxidase 1 (CO1) mitochondrial gene sequence, show that these two forms represent the same species; because of the differences in appearance, the description and type series are based on material from the Sierra Nevada.

Forewing pattern like that of *A. auranticolor,* but transverse lines more clearly crenulated; ground color yellow brown to reddish brown; basal dash short; antemedial line projecting outward at fold, so medial area narrower; postmedial line strongly toothed on veins and bulging outward at CuA_2; subterminal line with deep W-mark extending to wing margin; maculation and dash distal to reniform spot dark yellow; medial area with more brown than elsewhere and often darker posteriorly; antemedial and subterminal areas with hoary-gray hue; terminal area dark reddish brown, but not as contrasting as in *auranticolor*; fringe checkered yellow brown and reddish brown; forewing length: 17–20 mm. Hindwing paler than in *auranticolor* with pale buff basally and pale fuscous on wing margin, veins, postmedial line, and discal spot; fringe reddish buff.

Male genitalia with sacculus larger than in *auranticolor* or *sora*; dorsal part of cucullus smaller, digitus stout and arched posteriorly; sclerotized bulge at base of juxta stronger than in other species; apex of aedeagus with field of small spines on right side; vesica with dorsal cornutus more distal from apex than in *auranticolor.* Female genitalia with ductus bursae wide, as in *sora,* but left posterior lobe (appendix bursae) more curved dorsally.

Specimens from the Cascades in Oregon are darker and have more brown and gray shading than those from the central Sierra Nevada, so they resemble *sora* more than *auranticolor*; they can be separated from *sora* by smaller size, geographic range, genital characters, and the CO1 mitochondrial gene sequence.

The immature stages are unknown.

TYPES. **Holotype:** ♂. Truckee, [Nevada Co.], California; 1 July 1913; Ximena McGlashan, ex. Coll. Wolley-Dod. CNC. **Paratypes:** 19 ♂, 22 ♀. **California.** Same data as for holotype; 8 May–13 July 1913 (8 ♂, 9 ♀). Garnet Lake, [Madera Co.]; 27–31 Aug. 1945 (3 ♀). Lee Vining, 9,600′, [Mono Co.]; 12 Aug. 1967; D. F. Hardwick (1 ♀). Mineral, [Tehama Co.]; 23 Aug. 1967; D. F. Hardwick (2 ♀). Ward Creek, 6,050′, 2 mi S Tahoe City, Placer Co.; 8 July 1976 and 15 Aug. 1974 (3 ♂, 2 ♀). Convict Creek, Mono Co.; 16 July 1963 (1 ♀). Bishop Creek, 9,000′, Inyo Co.; 18 July 1941 (1 ♀). (LACM); June Lake, Mono Co.; 27 June 1984; E. Metzler (1 ♂, 2 ♀). June Lake 2,500 m, [Mono Co.]; 25 July 1998; L. Kaila and S. Timonen (1 ♂, 1 ♀). 15 km W Glacier Lodge, 2,600 m, [Inyo Co.]; 21 July1998; L. Kaila and S. Timonen (3 ♂). 2 mi N Devil's Postpile, 2,500 m, [Madera Co.]; 24 July 1998; L. Kaila and S. Timonen (2 ♂). 4 km E Dardanelle, 2,000 m, [Tuolumne Co.]; 27–28 July 1998; L. Kaila and S. Timonen (1 ♂). CNC, EHM, LACM, ZMH.

NOTE—The type series is restricted to the reddish-brown form of the species from California.

Apamea tahoeensis occurs at elevations that range from 6,000′ to 10,000′ in the Cascades and

Sierra Nevada from northern Oregon to central California. The flight season extends from early May to late August, but most records are from July.

Apamea commoda (Walker)
PL. 4, FIGS. 9–22; PL. I, FIG. 1 (♂ gen.); PL. S, FIG. 5 (♀ gen.); TEXT FIG. 36 (map) (RWH 9358, 9359).

Xylina commoda Walker, 1857, *List of the Specimens of Lepidopterous Insects in the Collection of the British Museum,* **11**: 760.
Type locality: United States (possibly Trenton Falls, New York, according to Forbes, 1954). [BMNH]

Hadena satina Strecker, 1898, *Lepidoptera, Rhopaloceres and Heteroceres, indigenous and exotic*: 8.
Type locality: Anticosti Island, Quebec, Canada. [FMNH]

Hadena (*Xylophasia*) *parcata* Smith, 1903, *Jour. New York Ent. Soc.,* **11**: 9. NEW SYNONYMY, NEW STATUS, SUBSPECIES.
Type locality: Yellowstone Park, Wyoming, USA. [AMNH]
NOTE—The lectotype was designated by Todd (1982: 165). This taxon was figured by Barnes and McDunnough (1913: pl. 18, fig. 12) as *A. cinefacta.*

Hadena (*Xylophasia*) *alberta* Smith, 1903, *Jour. New York Ent. Soc.,* **11**: 8.
Type locality: Calgary, Alberta, Canada. [AMNH]
NOTE—Todd (1982: 9) designated a male in the AMNH as lectotype.

Xylophasia illustra Smith, 1908, *Ann. New York Acad. Sci.,* **18**: 114.
Type locality: High River, Alberta, Canada. [AMNH]

Apamea commoda striolata Mikkola. NEW SUBSPECIES.
Type locality: Pole Hill, Larimer Co., Colorado, USA. [CNC]
NOTE—The name refers to the striated appearance of the forewing.

Apamea commoda is one of the most geographically variable species of *Apamea* and is arranged here into three subspecies. *Apamea commoda* was treated as two species by Franclemont and Todd (1983), *A. commoda* and *A. parcata.* The species is mainly boreomontane in distribution with evenly colored forms occurring in the boreal forests of Canada, a reddish-brown form in the East, and a blackish-brown form in the West. Increasingly gray, streaked forms occur southward in the Prairies and as disjunct populations in northwestern Canada and southeastern Alaska. The moths are small to medium sized (forewing length: 15–20 mm); a feature common to all populations is the single, straight, crenulate posterior part of the postmedial line, being typically oblique and margined outwardly with white scales. The maculation is weak, usually evident as pale spots on a darker ground color. The various forms of *A. commoda,* and the species most likely confused with them, are discussed under the subspecies.

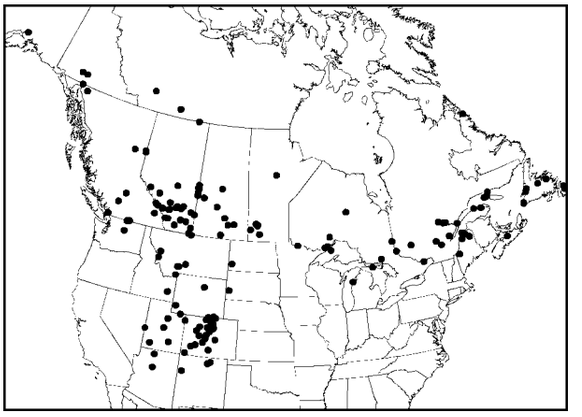


FIGURE 36: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA COMMODA*

The male genitalia are characterized by a combination of details: the digitus is usually bent near the middle to project posteriorly; the cucullus is relatively small, with less than 35 setae (as in *A. centralis*); and the everted vesica has two basal cornuti to the left of the aedeagus, a ventral one and a dorsal one (as in *A. centralis*). The genital similarities between *A. commoda* subspecies *parcata* and *A. centralis* are discussed below.

The immature stages are unknown.

The species is widely distributed, mainly in dry boreal habitats, from Newfoundland and Labrador westward to Alaska and British Columbia. Its range extends as far south as northern New England, Michigan, and northern Minnesota in the East, but occurs southward in the West to western South Dakota (the Black Hills), northern New Mexico, Arizona, and central Washington. In western United States it is generally found at elevations between 6,500′ and 10,000′. The flight season extends from mid-June to late August. The habitat varies, according to the subspecies, but

includes boreal forest, grasslands, and dry montane forests.

Populations of *A. commoda* are arranged in three subspecies belonging to two groups. Forewing color and pattern, male genitalia characters, and evidence from mitochondrial DNA reveal a complex relationship among these subspecies and the closely related *Apamea centralis.* Specimens of the boreal zone (ssp. *commoda*) have a weakly spined aedeagus (group 1), whereas those from xeric habitats in southeastern Alaska and the prairies (ssp. *parcata*), and in the southern Rocky Mountains (ssp. *striolata*) have a strongly spined aedeagus (group 2). There is extensive intergradation in both the wing markings and in the number of spines on the aedeagus between ssp. *commoda* and ssp. *parcata* where the ranges of the two meet in the northern prairies in Alberta and Saskatchewan. Here, the grassland habitat of subspecies *parcata* blends into the dry aspen-spruce forests where subspecies *commoda* occurs. In these areas all combinations of phenotypes between typical *parcata* and typical *commoda* occur. In subspecies *parcata* the bulb at the apex of the aedeagus is spined, typically with 80 to 110 minute spines; in subspecies *commoda* the apex is only weakly spined (occasionally unspined), typically with 20 to 40 spines; the intermediate specimens from the northern prairies in the zone of overlap between subspecies *parcata* and *commoda* typically have 60 to 80 spines.

Recently, we have collaborated with the ''Barcode of Life Initiative'' at the University of Guelph, Ontario, and obtained the molecular gene sequence of the cytochrome c oxidase 1 (CO1) mitochondrial gene for 72 specimens of the *A. commoda*/*A. centralis* species complex. The various gene sequences (haplotypes) form two relatively uniform groups that differ between 0.9 to 1.5 %, reflecting changes in six to ten of 658 base pairs. The degree of difference between the two groups is not as large as those between most species of *Apamea* but is comparable to the differences between some species pairs. An analysis of these two groups of haplotypes sheds light on the status of these taxa. The several haplotypes within each of these two groups show less differentiation than that between the groups, only 0.15–0.45 % different and involving a much smaller number of base pairs within each group. The haplotypes of group 1, mainly characteristic of the *A. commoda* subspecies *commoda* phenotype, consists of six haplotypes that vary from each other by one or two base pairs (0.15–0.30 % different) involving a total of six base pairs. Unfortunately, four of the six haplotypes of group one are known from single specimens. Group 2 haplotypes, mainly characteristic of *A. commoda* subspecies *striolata* and *parcata* and *A. centralis,* consist of three haplotypes: 1) one mainly representing populations from the Great Plains (*A. commoda* subspecies *striolata* and *parcata*), 2) one that is 0.15 % different from the previous haplotype (one base pair) and represents *A. commoda* subspecies *parcata* populations from southern British Columbia, Washington, and Oregon, and 3) one representing *Apamea centralis,* which is 0.30 % different from the British Columbia/Washington/Oregon haplotype of *A. commoda* subspecies *parcata* and 0.45 % different from the Great Plains haplotype of subspecies *parcata.* Where the ranges of subspecies *parcata* and subspecies *commoda* meet in the northern prairies, many intermediate forms of the moths occur, and the haplotypes characteristic of subspecies *commoda* and that of the prairie populations of subspecies *parcata* are randomly scattered among the intermediate forms, suggesting that there is extensive interbreeding in this area. Furthermore, both of the subspecies *commoda* haplotypes, which are known from more than singletons, are found far to the south of the range of subspecies *commoda* and into the range of specimens typical of subspecies *parcata* and even farther to the south into the range of subspecies *striolata* in southern Wyoming and Colorado. These results appear to corroborate the morphological evidence of intergradation between the boreal and prairie populations of *A. commoda.* Similarly, there is exchange in haplotypes between the prairie and British Columbia/Washington/Oregon populations of *Apamea commoda parcata.* By contrast, *Apamea centralis* is widely sympatric with *Apamea commoda* in southern British Columbia, Washington, and Oregon, but they maintain their distinctive appearance and haplotypes, which are 0.30 % different (three base pair substitutions in 658 base pairs of CO1), suggesting a lack of hybridization between *A. commoda* and *A. centralis.* A single specimen of *Apamea centralis* from southern Oregon has the haplotype of the British Columbia/Washington/Oregon population of *Apamea commoda,* suggesting either that the two taxa occasionally hybridize, or the presence of the *A. commoda* haplotype in *A. centralis* predates the split between these taxa.

Apamea commoda commoda (Walker)
PL. 4, FIGS. 9–14; PL. I, FIG. 1 (♂ gen.).

Xylina commoda Walker, 1857.
Type locality: United States. [BMNH]

Hadena satina Strecker, 1898.
Type locality: Anticosti Island, Quebec, Canada. [FMNH]

Hadena (*Xylophasia*) *alberta* Smith, 1903.
Type locality: Calgary, Alberta, Canada. [AMNH]

Xylophasia illustra Smith, 1908.
Type locality: High River, Alberta, Canada. [AMNH]

The forewing of the nominate subspecies varies from a dull brick red in the East to blackish brown in the West. These two color forms were formerly recognized as subspecies *commoda* and *alberta,* but we combine them because of an extensive area of intergradation in western Ontario and the Aspen Parkland north of the prairies. The transverse lines usually are black and contrast with the ground color in the lighter specimens, but are less obvious in darker ones. The postmedial line usually has some pale shading on its distal margin in the fold and some black shading on its inner margin representing the black streak in the fold in the medial area. The reniform and orbicular spots are slightly paler than the ground color. The terminal area is darker than the remainder of the wing. The hindwing is pale fuscous basally with a darker fuscous marginal band and postmedial line. Specimens from the Northwest Territories in northern Canada are considerably smaller than those from farther south. Subspecies *commoda* is likely to be confused only with *Apamea cogitata* in its northeastern range, but in *A. cogitata* the only contrasting marking on the forewing is the cream-colored reniform spot. Also the hindwing is much darker in *A. cogitata* than in *A. c. commoda.*

Subspecies *commoda* occurs in the boreal forest zone from Newfoundland and Labrador westward through Saskatchewan and Alberta (mainly north of the prairies) to British Columbia and as far north as the Northwest Territories. The flight season extends from late June to late August. The habitat is dry boreal forest.

Apamea commoda parcata (Smith)
PL. 4, FIGS. 15–19; PL. S, FIG. 5 (♀ gen.).

Hadena parcata Smith, 1903.
Type locality: Yellowstone Park, Wyoming, USA. [AMNH]

Apamea commoda parcata was formerly considered to be a species distinct from *A. commoda,* but we treat it as a subspecies of *A. commoda* because it intergrades with *A. commoda commoda* where their ranges meet and the evidence for genetic interchange extends well beyond the visible zone of intergradation.

In subspecies *parcata* the forewing is narrower than in the boreal subspecies (*commoda*); the ground color is buff or pale gray, the pattern is longitudinally streaked, and there is a deep W-mark in the subterminal line, so subspecies *parcata* is more likely to be confused with *Apamea cinefacta* or *A. spaldingi* than with other subspecies of *A. commoda. Apamea commoda parcata* differs from *A. spaldingi,* which occurs with it in many areas, in having a posteriorly narrow medial area, a dentate rather than even postmedial line, and a more extensively fuscous hindwing. Subspecies *parcata* differs from *A. cinefacta* in that the postmedial line is evenly dentate (projects outward at vein CuA_2 in *A. cinefacta*), and the terminal line on the hindwing is a series of dark dashes between the veins (continuous in *A. cinefacta* and most obvious on the underside of the hindwing).

Subspecies *parcata* occurs in the northern prairies from southern Alberta and Saskatchewan southward to Idaho and northern Wyoming. Disjunct populations are in sandy prairielike habitat in southeastern Alaska, southern Northwest Territories, and the northern extension of the Great Basin in Oregon, Washington, and southern British Columbia. The flight season extends from mid-June to mid-August.

Apamea commoda striolata Mikkola, NEW SUBSPECIES
PL. 4, FIGS. 20–22.

Apamea commoda striolata Mikkola.
Type locality: Pole Hill, Larimer Co., Colorado, USA. [CNC]

The southernmost subspecies of *A. commoda* has previously been confused with other species, mainly with *A. cinefacta* because the forewing color is similarly ash gray and streaked and the medial area is narrow posteriorly. It can be distinguished from *A. cinefacta* by the terminal line

on the hindwing, which is a series of dashes between the veins in *A. commoda striolata* but is a continuous line in *A. cinefacta.*

Forewing ground color typically ash gray usually with some brown shading, especially through the reniform and orbicular spots; transverse lines black, double, filled with white; basal streak black; medial area narrow posteriorly with black streak in fold connecting antemedial and postmedial lines; postmedial line evenly dentate; reniform and orbicular spots narrowly outlined in black; orbicular spot elongate, oval; subterminal area silvery gray with black wedge-shaped marks between veins along inner margin of subterminal line; terminal area darker gray than ground color and streaked into subterminal area; forewing length: 18–20 mm. Brown, more unicolored specimens occur with typical gray, streaked specimens of *striolata*; this brown form is not included in the type series. Hindwing pale fuscous basally, darker fuscous on marginal ⅓ of wing as well as on postmedial line and discal spot.

Male and female genitalia indistinguishable from those of *Apamea commoda* subspecies *parcata.*

TYPES. **Holotype:** ♂. Pole Hill, 2,590 m, 40° 21′ 42″ N, 105° 25′ 58″ W, Larimer Co., Colorado; 14 July 1982; T. McCabe. CNC. **Paratypes:** 96 ♂, 19 ♀: **Colorado.** Same locality and collector as for holotype; 14–22 July 1982. Pole Hill, 2,515 m, 40° 21′ 42″ N, 105° 27′ 12″ W, Larimer Co.; 4–7 Aug. 1983; T. McCabe (52 ♂, 10 ♀). Viestenz-Smith Mt. Park, 5,700′, U. S. Hwy. 34, 9.8 mi W of Loveland, Larimer Co.; 8 July 1996; T. S. Dickel (1 ♂). Intersection of Grand Co. Rd. 50 & Hwy. 40, 7,580′, SE of Hot Sulphur Springs, T1N R78W S16, Grand Co.; 27 June 2002; T. S. Dickel (1 ♀). Harpers Corner Road, near Stuntz Ridge, T5N R103W S5, Dinosaur Nat'l Monument, Moffat Co.; 9 June 1994; T. S. Dickel (1 ♂). Doolittle Ranch, Mt. Evans, 9,860′, [Clear Creek Co.]; 10 July–7 Aug. 1961; E. W. Rockburne (2 ♂, 2 ♀). Fairplay, 10,000′, [Park Co.]; 15 July 1961; E. W. Rockburne (6 ♂). Nederland, 8,300′, [Boulder Co.]; 1–2 July 1961; M. R. MacKay (14 ♂). 3 km S Nederland, 2,600 m, [Boulder Co.], 12 July 1993; K. Mikkola (1 ♂). Boulder, [Boulder Co.], 5,500′; 18 June 1961; M. R. MacKay (1 ♂). 3 mi NE Sargents, [Saguache Co.]; 14 July 1971; D. F. Hardwick (1 ♀). Florissant, Teller Co., 8,640′; 19 June–23 August 1960–1965; T. C. Emmel (17 ♂, 5 ♀). Estes Park, Larimer Co.; 10 July 1959; C. L. Hogue (1 ♂). CNC, LACM, TMC, USNM, ZMH.

NOTE—The type series is limited to specimens from Colorado.

Subspecies *striolata* occurs from southern Wyoming southward through Colorado, Utah, and eastern Nevada to northern New Mexico and central Arizona. It is mainly found in dry habitats at elevations between 5,500′ and 10,200′ from mid-June until early August. Specimens intermediate between subspecies *parcata* and *striolata* occur in a wide geographic area in southern Montana, Wyoming, and northern Colorado, indicating an extensive area of intergradation between these subspecies.

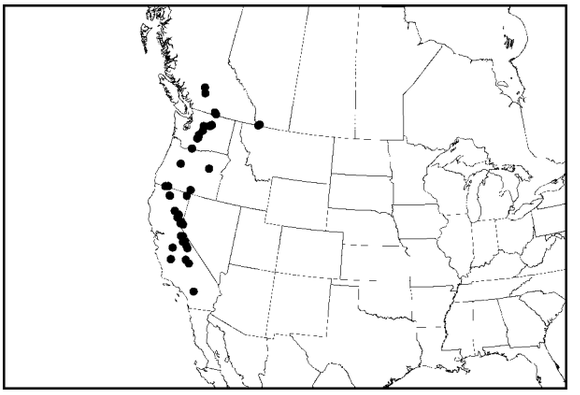


FIGURE 37: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA CENTRALIS*

Apamea centralis (Smith)

PL. 4, FIGS. 23–25; PL. I, FIG. 2 (♂ gen.); PL. S, FIG. 6 (♀ gen.); TEXT FIG. 37 (map) (RWH 9354).

Xylophasia centralis Smith, 1891, *Proc. U. S. Natl. Mus.,* **13**: 441.

Type locality: Sierra Nevada, California, USA. [AMNH]

NOTE—The lectotype of *centralis* was designated by Todd (1982: 43).

Apamea centralis is closely related to *A. commoda* and occupies a range mainly to the west and south of *A. commoda.* The structural similarities between *A. centralis* and *A. commoda paracta* are discussed under *A. commoda. Apamea centralis* differs from subspecies *parcata* in having a rounded rather than elongated orbicular spot, more sharply defined and contrasting transverse lines, and a more evenly fuscous hindwing. Specimens from the southern Sierra Nevada of California (plate 4, figure 25) have more brown and yellow shading than the primarily gray forms from northern California and the Northwest (plate 4, figures 23, 24). In some specimens the medial area is contrastingly dark (occasionally black),

this most often seen in the southern yellowish-brown forms. *Apamea centralis* differs from other gray western species by the more triangular medial area that is evenly tapering posteriorly. The posterior part of the postmedial line is straight, whereas it is indented in *A. commoda* and has a bulge in the fold in the three species in the *Apamea auranticolor*-complex.

The male genitalia are similar to those of *A. commoda,* and especially to those of *A. commoda* subspecies *parcata,* except that the uncus is stouter, the dorsal extension of the sacculus is wider, and the left diverticulum of the everted vesica is thicker. In the female, the indentation of the 8th segment is wider, the appendix bursae is smaller, and the corpus bursae is smaller and more rounded.

Apamea centralis and *A. commoda* occur sympatrically in southern British Columbia, southwestern Alberta, Washington, and Oregon, and there is no evidence of hybridization in most of this area of overlap; however, the discovery of an *Apamea commoda* CO1 haplotype in a specimen of *Apamea centralis* from southern Oregon suggests that the two taxa occasionally hybridize, or the presence of the *A. commoda* haplotype in *A. centralis* predates the split between these taxa.

The immature stages are unknown.

Apamea centralis occurs from southern British Columbia and southwestern Alberta southward through Washington and Oregon to southern California. The species occurs at elevations of 8,000′ to 10,000′ in the Sierra Nevada and 4,000′ to 8,000′ farther north. The flight season extends from mid-June to late August, but most records are between early July and mid-August.

Apamea genialis (Grote)

PL. 4, FIGS. 26, 27; PL. I, FIG. 3 (♂ gen.); PL. S, FIG. 7 (♀ gen.); TEXT FIG. 38 (map) (RWH 9340).

Hadena genialis Grote, 1874, *Bull. Buffalo Soc. Nat. Sci.,* **2**: 66.
Type locality: California, USA. [BMNH]

NOTE—There are two syntypes in the BMNH. A male without antennae but otherwise in good condition labeled ‘‘Grote Coll. 81.116/ U. S. America/ 7[red]/ *Hadena genialis* Grote, Type [red outline], 81416’’ is here designated LECTOTYPE to ensure the stability of the name.

Apamea genialis looks like a pale reddish-brown or orange-brown form of *A. commoda* with the forewing markings pale and washed out (forewing length: 20–22 mm). As for *A. commoda,* there is a characteristic white line on the outer margin of the postmedial line in the fold. A deep but faint W-mark in the subterminal line, a dark anal patch, a pale patch distal to the reniform spot, and genital characters all associate *A. genialis* with the *Apamea monoglypha* species-group. The male genitalia are similar to those of *A. commoda,* but the cucullus is more symmetrical, projecting almost as far ventrally as dorsally. The female genitalia are similar to those of *A. commoda,* but the ductus bursae is longer than wide (shorter than wide in *A. commoda*).

FIGURE 38: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA GENIALIS*

The immature stages are unknown.

Apamea genialis is a highly localized species occurring in scrubby heaths along the northern and central coast of California. Most records are from the San Francisco Bay area. The flight season extends from late April until late June.

Apamea occidens-GROUP

The *occidens*-group includes only *occidens,* so the characters are discussed under the species.

Apamea occidens (Grote)

PL. 4, FIGS. 28–31; PL. I, FIG. 4 (♂ gen.); PL. S, FIG. 8 (♀ gen.); TEXT FIG. 39 (map) (RWH 9346).

Hadena occidens Grote, 1878, *Bull. U. S. Geol. Survey,* **4**: 177.
Type locality: Nevada, USA. [BMNH]

NOTE—Grote (1878) had two specimens, a male with reddish-gray medial area and a gray female. The male in good condition in the Natural History

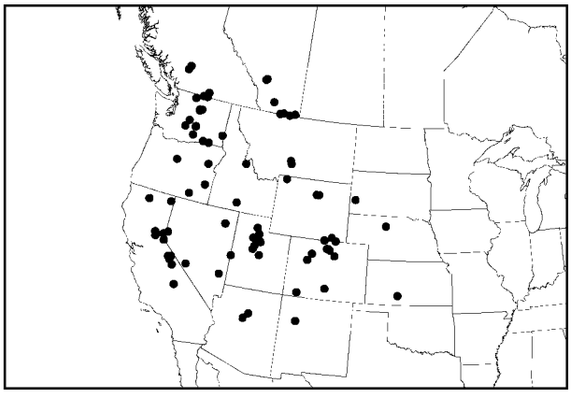


FIGURE 39: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA OCCIDENS*

Museum, London, labeled ''Type [round, red border]/ Grote Coll. 81-116./ U. S. America/ 34/ *Hadena occidens* Grote [blue border]; 81-116 [beneath]/ *Hadena occidens* Grote ♂ Type [red border]'' is here designated LECTOTYPE to ensure the stability of the name.

NOTE—The unavailable infrasubspecific name *coloradensis* Strand, 1916, was proposed for the gray form of *Apamea occidens.*

Apamea occidens is a uniquely isolated species both in the appearance of the moth and in the structure of the genitalia. The moth is fairly large (forewing length: 18–23 mm) with a gray forewing ground color. In about 10 % of the specimens, including the type specimen of *A. occidens,* the medial area and outer part of the subterminal area are reddish brown. In both forms the course of the postmedial line is diagnostic; it curves abruptly inward below the reniform spot, often all the way to the rounded claviform spot, so the medial area is very constricted in the fold; it widens again toward the posterior margin of the wing. The reniform and orbicular spots and the subterminal area tend to be a paler silvery gray than the rest of the wing. The subterminal line is evident because it contrasts with darker gray shading in the terminal area and interrupts blackish-gray wedges that project into the outer part of the subterminal area of which the anal patch is the most contrasting. The hindwing is pale fuscous, slightly darker toward the wing margin.

In the male genitalia the uncus bends abruptly downward at ⅓ from the base and then is gently upcurved through the apical ⅔, a shape seen otherwise only in the *A. crenata*-group. The vesica shape is unique in *Apamea* with the basal ⅔ of the vesica projecting posteriorly, then bending through 180° so the apical ⅓ projects anteriorly; there are three cornuti (a stout, thornlike basal cornutus and two small cornuti on heavily sclerotized plates). In the female genitalia the ductus bursae is very long, about ⅔ as long as the corpus bursae and joins the corpus bursae at the narrow constriction between the rounded anterior lobe and the elongated appendix bursae. The male has fully developed brushes and pockets at the base of the abdomen.

The larva was described by Crumb (1956: 229) from three specimens that were found in April ''in tunnels among grass roots.'' The larva is of the white grub type, about 40 mm long when mature, and almost devoid of markings except for a pale-brown head with dark submedial arcs and faint reticulation, a pale-brown prothoracic shield, and orange spiracles. The pinacula are suffused with brown but are not prominent. The skin is pavement granulose.

Apamea occidens occurs from southern Alberta and southern British Columbia southward to Kansas, central New Mexico, central Arizona, and central California. It is found mainly at elevations ranging from 6,500′ to 12,000′. The flight season extends from early June to late August, but most records are between late June and mid-July.

Apamea amputatrix-GROUP

The *amputatrix*-group includes only *A. amputatrix,* so the characters are discussed under the species.

Apamea amputatrix (Fitch) (Yellow-headed Cutworm*; Ver-gris à tête jaune, m., Fr.) PL. 4, FIGS. 32–34; PL. 5, FIGS. 1–5; PL. I, FIG. 5 (♂ gen.); PL. T, FIG. 1 (♀ gen.); TEXT FIG. 40 (map) (RWH 9348, 9349).

Hadena amica? Stephens, 1829, *Illustrations of British Entomology, Haustellata,* **2**: 180, nec Treitschke, 1825, *Die Schmetterlinge von Europa,* **5** (1): 332.

NOTE—*Hadena amica* was described and illustrated by Stephens (1829) as a British moth under the name *Hadena amica*? Treitschke. The name was credited to Stephens by Franclemont (1950) and is a primary homonym of *Hadena amica* Treitschke, 1825, now the type species of *Blepharita* Hampson. The name was first used in North America by Harris (1862: 451) who noted that the name had been pro-

posed mistakenly as a British species. The name *Hadena amica* was credited to Harris, 1862 by Franclemont and Todd (1983) and Poole (1989). Harris' book on pest insects was incorrectly cited as being published in 1863 by Poole (1989). The Editor's preface is dated January 1862, and the entry inside the front page states ''Entered according to Act of Congress in the year 1862.''

Hadena arctica Boisduval, 1840, *Genera et Index Methodicus Europaeorum Lepidopterorum,* **120**: (No. 947). Unavailable. NOMEN NUDUM.

NOTE—This name was listed by Boisduval in his European catalogue with a reference to the Icones, but the illustration was never published, so the name was listed by Franclemont (1950) as a nomen nudum. This specimen, originally in the Boisduval collection and now in the USNM, is *Apamea amputatrix.*

Hadena arctica Freyer, 1845, *Neuere Beiträge zur Schmetterlingskunde mit Abbildungen nach der Natur,* **5**: 19, pl. 394, fig. 1.
Type locality: Siberia and Lapland (by mistake). [Type material probably lost]

NOTE—*Hadena arctica* Freyer, 1845, is a junior primary homonym of *Hadena arctica* Zetterstedt, [1839], which is a junior synonym of *Xestia speciosa* (Hübner, 1813).

NOTE—The homonymy was published by Franclemont (1950). The date of Freyer's work is 1845, not 1842 as stated by Franclemont and Todd (1983) and Poole (1989).

Hadena amputatrix Fitch, 1856, Third report on the noxious and other insects of the state of New York. *Trans. New York State Agricultural Soc.,* **16**: 425.
Type locality: New York State, USA. [NYSM]

Eurois pluviosa Walker, 1865, *List of Lepidopterous Insects in the Collection of the British Museum,* **33**: 725.
Type locality: Vancouver Island, British Columbia, Canada. [BMNH]

Hadena castanea Grote, 1874, *Bull. Buffalo Soc. Nat. Sci.,* **2**: 156. NEW SYNONYMY.
Type locality: California, USA. [BMNH]

NOTE—Grote (1874) described *castanea* from three specimens. A male in good condition, but without antennae, in the Natural History Museum, London, labeled ''Type [round, red border]/ Grote Coll. 81-116./ California/ *Hadena castanea* Grote, Type [red border], 81-116 [beneath]'' is here designated LECTOTYPE to ensure the stability of the name. Another male syntype in the MSU collection is here designated paralectotype.

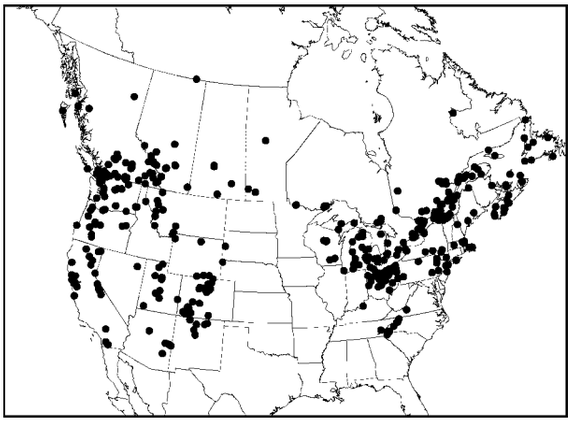


FIGURE 40: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA AMPUTATRIX*

Hadena cymosa Grote, 1881, *Papilio,* **1**: 34.
Type locality: Washington Territory, USA. [BMNH]

NOTE—Grote had an unknown number of specimens. According to the original description, two males were in his own collection, but he may also have had a syntype female from the Tepper or Graef collections. Therefore, a female in good condition, in the Natural History Museum, London, labeled ''Type [round, red border]/Grote Coll. 81–116./ Washington Territory/ *Hadena cymosa* Grote, Type [red border], 81–116 [beneath]'' is here designated LECTOTYPE to ensure the stability of the name.

Hadena formosus Ellsworth, 1918, *The Lepidopterist,* **2**: 22.
Type locality: Johnson City, New York, USA. [USNM]

NOTE—*Hadena formosus* was published as ''n. sp. or var.'' on the basis of one female.

Apamea amputatrix is a relatively large *Apamea* with a forewing length of 20 to 24 mm (occasionally as small as 17 mm) and in spite of considerable variation among several forms, it is easily recognized. In the most common and widely distributed form, the nominate one (plate 4, figures 32–34), the medial area is a mottled wine red that contrasts with yellow and white spots that partially fill the reniform spot and with hoary-gray shading in the subterminal area. A red line in the outer part of the subterminal area contrasts with the blackish-gray color of the terminal area. There are no black dashes at the wing base, in

the medial area, or at the anal angle as in *A. albina.* An uncommon dark form has the markings muted and obscured by an overall reddish-brown hue with a purple sheen that extensively (plate 5, figure 1) or partially (plate 5, figure 2) covers the ground color. Collection records indicate that the melanic form was extremely rare until the middle of the 20th century, but by the end of the century it occurred in about 20 % of the population in densely populated areas in northeastern United States and adjacent southeastern Canada; however, it is still rare elsewhere. A dark western form (plate 5, figure 5), described as *castanea,* occurs along the West Coast from British Columbia to California; the forewing is blackish brown with the only contrasting markings being the white and yellow specks in the reniform spot; another western form, described as *cymosa,* is similar but the subterminal area is pale (plate 5, figures 3, 4). These forms, occurring in varying proportions with the nominate form, and with many intermediate forms, constitute a polymorphism, so no subspecies are recognized.

The male genitalia are characterized by the very broad cucullus, the long, slender digitus, and the sharp 90° angle of the ventral margin of the valve where it bends dorsally toward the base of the digitus. The vesica is like those of species in the *Apamea monoglypha*-group but there is a small but well-defined apical diverticulum. The male has fully developed brushes and pockets at the base of the abdomen. The female genitalia have a relatively long ductus bursae, and a corpus bursae shaped like a figure 8 with four long signa and a rugose, sclerotized pouch posteriorly on the right.

The caterpillar, commonly called the yellow-headed cutworm, was described by Fitch (1856); it was amputating young shoots of currants (*Ribes*) and roses in late May—thus the name ''*amputatrix.*'' Crumb (1956: 232) described the larva from material collected in April and May at Puyallup, Washington. The mature larva is 35–40 mm long. The head is pale brown, sometimes with a faint darker reticulation laterally. The body is pale gray, sometimes tinged with pink or pale brown. The spiracles are dark brown. The prothoracic and anal shields are brown with blackish brown on the margin. The pinacula are slightly suffused with brown but are not prominent. The skin is smooth. The larva is most similar to that of *A. cogitata* but can be identified by the number of crochets on the anterior prolegs (8–12 in *A. amputatrix,* 14–18 in *A. cogitata*). Tietz (1972: 106) lists cabbage, corn, currants, grasses, lettuce, oats, roses, spinach, wheat, and young trees (often fruit trees) as host plants. According to Beirne (1971) the larvae have been injurious to tobacco in southern Ontario.

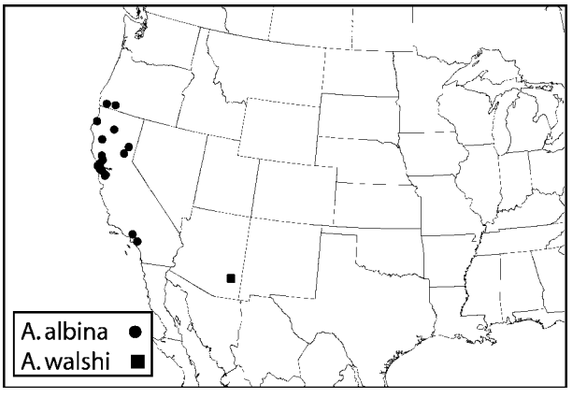


FIGURE 41: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA ALBINA* ● AND *APAMEA WALSI* ■

Apamea amputatrix occurs across Canada from Newfoundland to British Columbia and as far north as southern Northwest Territories. Its range extends southward in the United States to Georgia, Kentucky, Illinois, Nebraska, New Mexico, Arizona, and southern California. The flight season extends from early June to mid-September, but most records are between late June and early August.

Apamea walshi-GROUP

The *Apamea walshi*-group includes only *A. walshi,* so the characters are discussed under the species.

Apamea walshi Lafontaine, NEW SPECIES PL. 5, FIGS. 6, 7; PL. I, FIG. 6 (♂ gen.); PL. T, FIG. 2 (♀ gen.); TEXT FIG. 41 (map).

Apamea walshi Lafontaine.
Type locality: Soldier Creek Campground, 9,400′, Pinaleno Mts., Graham Co., Arizona, USA. [CNC]

NOTE—I am pleased to name this species for Bruce Walsh, who has contributed so much to our knowledge of Lepidoptera in southeastern Arizona in a remarkably short time.

This species looks like a small form of *Apamea amputatrix* but is structurally very different. It

also has a remarkable resemblance to the hadenine *Spiramater lutra* (Guenée). The most notable characteristics of the male genitalia are the short daggerlike digitus, the basal projection of the dorso-proximal angle of the cucullus, the enlarged dorsal lobe at the base of the sacculus, and the large bulbous cornutus on a short diverticulum in the vesica; those of the female genitalia are the large sclerotized lobe in the corpus bursae to the right of the anterior end of the ductus bursae, and the broad sclerotized plate of the ostium bursae.

Antenna of male constricted between segments, diamond shaped, slightly bifasciculate; antenna of female filiform, ciliate ventrally. Forewing blackish brown in medial and terminal areas, paler with extensive gray shading in basal and proximal half of subterminal areas, and rusty brown in outer part of subterminal area; basal dash absent; antemedial line black, double with paler gray-brown filling, projecting outward mesially; orbicular spot round, with black outline and central dot and gray around inner edge; reniform spot pale gray and contrasting, consisting of gray central lunule surrounded by series of small gray dashes and crescents forming outline of spot; postmedial line black, sharply defined, scalloped between veins, with faint, diffuse second line in proximal part of subterminal area; subterminal line a thin, diffuse, yellow line forming inner edge to dark terminal area; subterminal line without W-shaped indentations characteristic of many species of *Apamea*; terminal line a series of black crescents between veins; fringe concolorous with terminal area; forewing length: 18–20 mm. Hindwing dark fuscous on outer ⅓, postmedial line, veins and discal spot, pale fuscous on basal ⅔; fringe dark fuscous with yellow base.

Male genitalia with uncus dorsoventrally flattened, tapered from base to bluntly pointed apex; lower part of tegumen rectangular with ''wings'' not extended dorsally; cucullus triangular, with elongated process directed basally from dorso-proximal angle; corona with 34–36 setae; digitus short, stout, tapered from base to apex, extending about ¾ distance to anal angle of cucullus; ampulla of clasper long and slender, about 14 × as long as medial width; dorsal lobe on sacculus extended into narrowing, curved process; aedeagus 5 × as long as medial width and with spiny bulge apically on right extending onto vesica as narrow, spiculate band and ending in elongated, spinelike cornutus near middle of vesica; vesica ⅘ as long as aedeagus with large, bulbous, ridged cornutus on left, tapered abruptly into terminal spine; apex of vesica with short dorsal diverticulum. Female genitalia somewhat similar to those of *A. amputatrix,* but ostium bursae with heavily sclerotized rectangular plate, ductus bursae much shorter, sclerotized lobe of corpus bursae on left side much larger, and corpus bursae without a prominent mesial constriction.

The immature stages are unknown.

TYPES. **Holotype:** ♂. Soldier Creek Campground, 9,400′, Pinaleno Mts., Graham Co., Arizona; 12 July 2007; B. Walsh; ponderosa pine habitat. CNC. **Paratypes:** 4 ♀. **Arizona.** Cunningham Campground, 9,000′, Pinaleno Mts., Graham Co.; 12 July 2007, 30 July 2004, and 1 August 2005; B. Walsh; ponderosa pine habitat (3 ♀). Treasure Park, 9,000′, Pinaleno Mts., Graham Co.; 7 August 2001; J. B. Walsh (1 ♀). CNC, JBW, USNM.

Apamea walshi is known only from the Pinaleno Mountains, Graham Co., in southeastern Arizona where it was collected between mid-July and early August.

Apamea albina-GROUP

The *Apamea albina*-group includes only *A. albina,* so the characters are discussed under the species.

Apamea albina (Grote)
PL. 5, FIGS. 8, 9; PL. J, FIG. 1 (♂ gen.); PL. T, FIG. 3 (♀ gen.); TEXT FIG. 41 (map) (RWH 9347).

Hadena albina Grote, 1874, *Bull. Buffalo Soc. Nat. Sci.,* **2**: 157.
Type locality: Sauzalito, California, USA. [BMNH]

NOTE—Grote (1874) described *albina* from two females collected on 15 May 1874. Of them, the one in the BMNH labeled ''California, Sauzalito 15.V.74, Grote Coll., 81-116./ 78/ Syntype (green border)/ *Hadena albina* Grote [blue border]'' in good condition is designated as LECTOTYPE to ensure the stability of the name. The other female is in the MSU collection and is here designated paralectotype. A male in the BMNH labeled ''California, Sauzalito 16.V.74, Type [round, red border]'' is believed to be spurious due to its incorrect data and sex (Smith, 1893: 138).

Apamea albina has been associated with *A. amputatrix* because of the extensive white shading in the reniform spot and the hoary-gray shading in the subterminal area, but the structure of the

male and female genitalia isolate it from *A. amputatrix* and all other species-groups. The forewing (length: 20–22 mm) is dark brown with a pale-brown subterminal area shaded with hoary gray. It is likely to be confused only with some specimens of *A. amputatrix,* but can be recognized by the black dash in the medial area fold, the anal dash, which often extends into the subterminal area, and by the pale-gray center of the thorax, which contrasts with the dark-brown tegulae. The hindwing is pale with a fuscous discal spot and submarginal band; a narrow band of pale ground color is on the wing margin.

Diagnostic characteristics of the male genitalia are 1) the relatively narrow valve with only a small constriction at the base of the cucullus; 2) the stout, tapered digitus projects posteriorly; 3) the triangular juxta, tapers posteriorly; 4) the vesica curves abruptly to the right, without a subbasal diverticulum or cornuti; and 5) there is a large apical diverticulum. In the female genitalia the ductus bursae is about 2 × as long as wide, and the corpus bursae is oval without a postmedial constriction. The male has fully developed brushes and pockets at the base of the abdomen.

The immature stages are unknown.

Apamea albina occurs from southwestern Oregon southward to southern California. The flight season extends from mid-April to early July.

Apamea maxima-GROUP

The *Apamea maxima*-group includes two species, *A. maxima* and *A. robertsoni,* two of the largest species of *Apamea.* The male genitalia are characterized by the very broad cucullus, the sharp 90° angle of the ventral margin of the valve where it bends dorsally toward the base of the digitus, and the relatively broad, flat uncus. The vesica has an elongated subbasal diverticulum partially separated from the rest of the vesica by a basal constriction; the two cornuti are close to the apex of the aedeagus. Males of both species have fully developed brushes and pockets at the base of the abdomen. The group is confined to sandy areas on the West Coast of North America.

Apamea maxima (Dyar)

PL. 5, FIGS. 10–12; PL. J, FIG. 2 (♂ gen.); PL. T, FIG. 4 (♀ gen.); TEXT FIG. 42 (map) (RWH 9337).

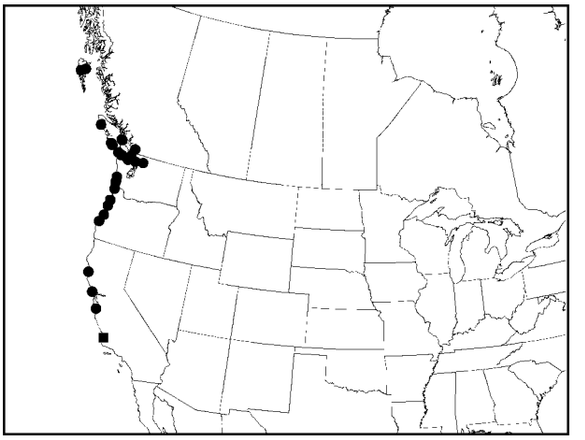


FIGURE 42: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA MAXIMA* ● AND *APAMEA ROBERTSONI* ■

Polia maxima Dyar, 1904, *Jour. New York Ent. Soc.,* **12**: 40.

Type locality: Eureka, California. [USNM]

NOTE—Dyar (1904a: 41) wrote that he had one male from Eureka, but the holotype is a very large female labeled "*Polia maxima* Dyar Type/ H. S. Barter Collector/ Eureka 5.6. Cal./ Genitalia Slide By, USNM 39032, ♀ genitalia on slide Apr. 14, 1937, J.F.G.C. #1129."

As the species name indicates, *A. maxima* is the largest *Apamea* in North America with a forewing length of 23 to 29 mm. The male is pale orange brown; the female is pale brownish gray with violet-gray shading in the antemedial and subterminal areas. The maculation is outlined in black and contrasts with the pale ground color. The most characteristic wing marking is the large claviform spot that extends to or almost to the postmedial line. The hindwing is buff basally with fuscous shading on the marginal ¼ of the wing and on the postmedial line; the veins are boldly marked in blackish brown. The male genitalia are similar to those of *A. robertsoni* in most characters, but the digitus is shorter and extends only about ⅔ of the distance to the ventral apex of the cucullus whereas in *A. robertsoni* it extends to or beyond the ventral apex of the cucullus.

The larva was described by Crumb (1956: 230) on the basis of mature larvae collected in mid-May. They were found several inches below the surface of the sand; they tunnelled into the hard stems of grasses like Pacific reed grass (*Calamagrostis nutkaensis* (J. Presl) J. Presl ex Steud.),

but do not remain inside the stem. The larva is of the white grub type; it is very pale gray, almost devoid of markings except for a pale-brown head and prothoracic shield, and black spiracles. The skin is covered with distinct coarse granules, unusual for an *Apamea.* The mature larva is about 37 mm long.

Apamea maxima is restricted to dunes and other sandy areas on the West Coast from the Queen Charlotte Islands, British Columbia, southward to central California. Females outnumber males in collections by about 20:1. The flight season extends from late April until early August, flying earlier in the southern part of its range than in British Columbia.

Apamea robertsoni Mikkola and Mustelin
PL. 5, FIG. 13; PL. A, FIG. 3 (abdomen); PL. J, FIG. 3 (♂ gen.); PL. T, FIG. 5 (♀ gen.); TEXT FIG. 42 (map).

Apamea robertsoni Mikkola and Mustelin, 2006, *Zootaxa,* **1278**: 30.
Type locality: Dune Lakes, 5 miles SE of Oceano, San Luis Obispo County, California, USA. [CNC]

Apamea robertsoni is a close relative of *A. maxima.* In spite of the two species having similar cytochrome c oxidase 1 (CO1) mitochondrial gene sequences, several characters support their status as separate species. *Apamea robertsoni* differs from *A. maxima* in having gray rather than orange-brown forewings, the claviform spot is shorter, and the maculation tends to be defined more by the whitish-gray shading adjacent to the lines than by the black lines characteristic of *A. maxima.* The hindwing is much darker than that of *A. maxima,* shaded in gray rather than fuscous. On the basis of the small number of specimens of *A. robertsoni,* the moths tend to be slightly smaller than those of *A. maxima*; the forewing length in *A. robertsoni* varies from 21 to 25 mm.

In the male genitalia, the digitus in *A. robertsoni* extends to the anal angle of the cucullus, whereas in *A. maxima* it extends ⅔ of the distance to the anal angle. In the female genitalia, the anal papilla is more evenly tapered posteriorly to a point than in *A. maxima.*

The immature stages of *Apamea robertsoni* are unknown, but like *A. maxima,* it probably bores in large-stemmed dune grasses.

Apamea robertsoni is known only from the type locality in San Luis Obispo County, California where it has been collected in May.

Apamea acera-GROUP

The *Apamea acera*-group includes only *A. acera.* It has generally been associated with the *Apamea maxima*-group and looks like a small gray form of *A. maxima*; however, we put it into its own species-group because it lacks most of the structural characters that define the *Apamea maxima*-group: the base of the abdomen has reduced tufting; in the male genitalia the uncus is slender and slightly expanded subapically; the valve is not sharply angled below the digitus; and there is no elongated subbasal diverticulum in the vesica. In the vesica the two cornuti are on large, heavily sclerotized plates that are close to each other on the dorsal wall of the vesica. In the female genitalia the appendix bursae leading to the ductus seminalis is very small, so the ductus bursae appears to be at the posterior end of the corpus bursae rather than on the right side near the end. The male has fully developed brushes and pockets at the base of the abdomen.

Apamea acera (Smith)
PL. 5, FIGS. 14, 15; PL. J, FIG. 4 (♂ gen.); PL. T, FIG. 6 (♀ gen.); TEXT FIG. 43 (map) (RWH 9338).

Polia acera Smith, 1900, *Proc. U. S. Natl. Mus.,* **22**: 472.
Type locality: Seattle, Washington, USA. [USNM]
NOTE—The lectotype was designated by Todd (1982: 5).

Apamea acera is the only large ash-gray *Apamea* in North America (forewing length: 20–25 mm). Usually, there is some yellow-brown shading around the orbicular and reniform spots. The basal dash is sharply defined in black and frequently extends almost to the postmedial line. The claviform spot is also outlined in black and extends about ¾ of the distance to the postmedial line. The transverse lines are obscure, defined by paler shades of the ground color or with some black toward the costa. The hindwing is pale fuscous basally and darker fuscous on the marginal ⅓ of the wing, much more evenly colored than those of *A. maxima* or *A. robertsoni.*

In the male genitalia the digitus is long and thin, often serpentine, and extends almost to the

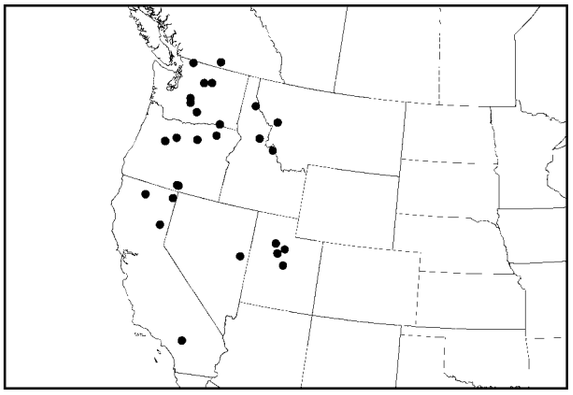


FIGURE 43: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA ACERA*

ventral margin of the cucullus. The apex of the aedeagus is heavily sclerotized, somewhat bulbous, and densely covered with spines. There are two cornuti on large, heavily sclerotized plates that are so close together that they are usually touching. In the female genitalia the corpus bursae is pear shaped, somewhat similar to those of *Apamea maxima,* but only half as long, and the pouch with the ductus seminalis is much smaller.

The immature stages are unknown.

Apamea acera occurs in montane forests from southern British Columbia southward in the Cascades and Sierra Nevada to the San Bernardino Mountains in southern California. Farther to the east, it occurs southward to northeastern Oregon and in the Rocky Mountains to southern Montana. Apparently disjunct populations are in the Wasatch Mountains in Utah, and in the Snake Range in eastern Nevada. The flight season extends from mid-June until mid-October.

Apamea burgessi-GROUP

The *Apamea burgessi*-group includes two species, *A. burgessi* and *A. relicina.* They are characterized by their boldly patterned forewings, mainly white hindwings, the size of the cucullus in the male genitalia, and the single cornutus is near the base of the vesica on a small dorsal diverticulum. Males of both species have fully developed brushes and pockets at the base of the abdomen. The group is confined to North America.

Apamea burgessi (Morrison)

PL. 5, FIGS. 16–26; PL. J, FIG. 5 (♂ gen.); PL. T, FIG. 7 (♀ gen.); TEXT FIG. 44 (map) (RWH 9378, 9379).

Luceria burgessi Morrison, 1874, *Bull. Buffalo. Soc. Nat. Sci.,* **2**: 109.
Type locality: Tuckernuck Island, near Nantucket, Massachusetts, USA. [MSU]

NOTE—Morrison (1874) had four specimens of which one male and one female are in the MSU and one male is in the BMNH. A slightly worn male with the tip of the left forewing missing in the MSU, labeled ''Type (rhomboidal with black border)/ Nantucket 43. (triangular; by Morrison)'' is here designated LECTOTYPE to ensure the stability of the name. Two unlabeled females and the male in the BMNH (labeled ''Massachusetts, Tuckernuck I., N. Nantucket'') are here designated paralectotypes. Poole (1989) refers solely to BMNH as the source of the type material.

NOTE—Morrison included the new species in the genus *Luceria* Heinemann and compared it with the European species *L. virens* (Linnaeus), now known as *Calamia tridens* (Hufnagel). In the text, however, he speaks about the generic characters of *Luperina* Boisduval, so the comparison with ''*Luceria*'' may be an error.

Luperina ona Smith, 1909, *Jour. New York. Ent. Soc.,* **17**: 58. NEW SYNONYMY, NEW STATUS, SUBSPECIES.
Type locality: Santa Catalina Mts., Arizona, USA. [AMNH]

NOTE—The lectotype of *ona* was designated by Todd (1982: 160).

Trachea stygia Dyar, 1914, *Proc. Boston Soc. Nat. Hist.,* **17**: 377. NEW SYNONYMY.
Type locality: Mexico City, Mexico. [USNM]

NOTE—*Apamea stygia* (Dyar) is listed as a synonym of *ona* (Smith) by Franclemont and Todd (1983) and Poole (1989).

Apamea burgessi leucoptera Mikkola, NEW SUBSPECIES.
Type locality: Canadian, Texas. [CNC]

Apamea burgessi was listed as two species by Franclemont and Todd (1983), *A. burgessi* and *A. ona,* but we treat it as a single species with three subspecies: typical *A. b. burgessi* on the East Coast; *A. b. leucoptera,* a new subspecies in most of central and western North America; and *A. b. ona* in southeastern Arizona and Mexico. The three subspecies share the following features: adults are generally medium sized, but there is a lot of individual variation (forewing length: 16–

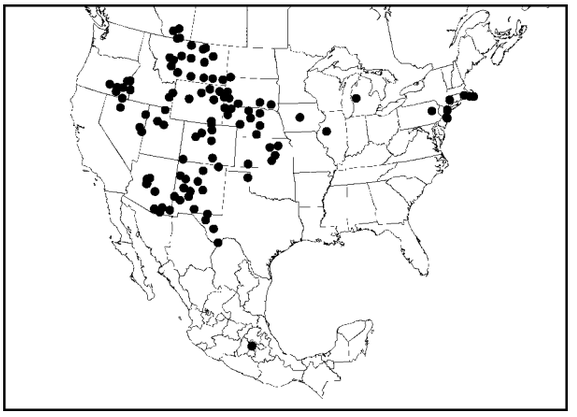


FIGURE 44: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA BURGESSI*

22 mm); the forewing ground color varies from sandy gray brown to dark brownish black; the subterminal line has a deep W-mark (not visible in the darkest specimens), and the antemedial line and postmedial lines are sharply defined and doubled (at least posteriorly) and connected to each other by a dark dash in the fold; the orbicular spot is round or slightly oval; the hindwing is white, sometimes with varying amounts of fuscous shading on the wing margin.

The male genitalia are characterized by the triangular cucullus with neither the dorsal or ventral margin deeply excavated, and by the relatively broad, apically diamond-shaped uncus. There is some geographical variation in the width of the uncus. Specimens from the Great Basin and Arizona have the subapical swelling of the uncus about 1½ × wider than the basal part, whereas in those from the Great Plains and eastern North America, the subapical swelling is about 2 × as wide as the basal part. This difference is also reflected in differences in the cytochrome c oxidase 1 (CO1) mitochondrial gene sequence, in which specimens from the Great Basin are about 2 % different from those from the Great Plains and the East. Exceptions in uncus width do occur, however, especially in specimens from the western Great Plains and Wyoming, so we treat these populations as a single species. The female genitalia are similar to those of *A. relicina,* but the ductus bursae is more abruptly constricted near its junction with the corpus bursae.

The immature stages are unknown.

Apamea burgessi is widely distributed in the West where it occurs from southern Alberta southward to Illinois, western Texas, Arizona, Nevada, and Oregon. An isolated record is in southern Mexico. In the East it is uncommonly collected and has been found from Massachusetts and New York southward to New Jersey. The moths fly from early August until late September. The species is arranged in three subspecies.

Apamea burgessi burgessi (Morrison)
PL. 5, FIGS. 16, 17; PL. J, FIG. 5 (♂ gen.); PL. T, FIG. 7 (♀ gen.).

Luceria burgessi Morrison, 1874.
Type locality: Tuckernuck Island, near Nantucket, Massachusetts, USA. [MSU]

Subspecies *burgessi* is characterized by the darker shading in the medial area, and there is a fuscous band on the margin of the hindwing. In the male this is a narrow border, extending farther in on the veins, but in the female it occupies the outer ⅓ of the wing.

This isolated taxon is localized in the dry coastal pine heaths from Massachusetts to New Jersey, and populations may be threatened by the loss of this specialized habitat. The moths fly from mid-August until late September.

Apamea burgessi leucoptera Mikkola, NEW SUBSPECIES
PL. 5, FIGS. 18–25.

Apamea burgessi leucoptera Mikkola.
Type locality: Canadian, Texas. [CNC]

Subspecies *leucoptera* occurs in central and western North America and occupies most of the range of the species. Specimens from open areas in the Great Plains and Great Basin tend to have a much paler ground color than those from forested habitats.

Forewing ground color evenly brown or gray brown, paler in open xeric habitats; postmedial line geminate; medial area similar in color to basal and subterminal areas; hindwing white with very little fuscous shading on margin (dark scales mostly near veins); some specimens from farther east, toward range of subspecies *burgessi,* have more fuscous on hindwing margin and have the veins darkened.

There is considerable geographical variation in the forewing color in subspecies *leucoptera,* and this appears to be related mostly to habitat. The palest moths are from the badlands in Alberta, South Dakota, and Wyoming; those from the short-grass prairie in Montana and Colorado are

somewhat darker, and those from more mesic prairie (Nebraska) or forested habitats (Colorado) are similar in color to subspecies *burgessi,* except that the medial area is not dark and the hindwing is white. Specimens from Oregon and west of the Continental Divide in Colorado (plate 5, figures 22–25) tend to have a streaked forewing ground color. In some areas specimens with more gray shading or more brown shading occur together (plate 5, figures 23, 24). Because of the extensive geographical variation, the type series of subspecies *leucoptera* is limited to specimens from Canadian, Texas.

TYPES. **Holotype:** ♂. 6 mi E Canadian, 2,000′, [Hemphill Co.], Texas, 28 Sept. 1968, D. F. Hardwick. CNC. **Paratypes:** 18 ♂, 16 ♀. **Texas.** Same locality and collector as for holotype; 27–28 Sept. 1968 (17 ♂, 16 ♀). Same locality as for holotype; 14 Sept. 1975, Lafontaine and Bowen (1 ♂). CNC, USNM.

Subspecies *leucoptera* occurs in the prairies from southern Alberta southward to New Mexico and Texas and eastward to Illinois and Michigan. West of the prairies it occurs from western Montana and eastern Oregon southward to southern New Mexico and central Arizona. The moths fly from late August to late September.

Apamea burgessi ona (Smith)
PL. 5, FIG. 26.

Luperina ona Smith, 1909.
Type locality: Santa Catalina Mts., Arizona, USA. [AMNH]

Trachea stygia Dyar, 1814.
Type locality: Mexico City, Mexico. [USNM]

Subspecies *ona* is characterized by the very dark brownish-black forewing and extensive dark-fuscous shading on the outer margin of the hindwing. It averages larger than other subspecies of *burgessi*; the forewing length varies from 20 to 22 mm. In exposure to light the ground color fades to dark brown but the black wing markings do not fade, so in time specimens of subspecies *ona* like the one illustrated (plate 5, figure 26) fade to look only slightly darker than the specimen of subspecies *leucoptera* illustrated from Prescott, Arizona (plate 5, figure 25). The type material of both *ona* and *stygia* are faded to dark brown.

Subspecies *ona* occurs from the mountains of southeastern Arizona southward to Mexico City, Mexico. The moths fly from early August until late September.

Apamea relicina (Morrison)
PL. 5, FIGS. 27–33; PL. J, FIG. 6 (♂ gen.); PL. T, FIG. 8 (♀ gen.); TEXT FIG. 45 (map) (RWH 9380, 9381).

Hadena relicina Morrison, 1875, *Proc. Boston Soc. Nat. Hist.,* **17**: 216.
Type locality: Waco, Texas. [MCZ]

NOTE—Morrison (1875b) possibly had only one specimen but this is not stated. A reddish-gray male in excellent condition in the MCZ labeled ''Tex./ (13/10)/ Peab. Acad./ Type, 1736 [red]/ *Hadena relicina* Morr. Type'' is here designated LECTOTYPE to ensure the stability of the name.

Luperina migrata Smith, 1903, *Jour. New York Ent. Soc,* **11**: 188. REVISED SYNONYMY; SUBSPECIES.
Type locality: ''Stockton, Utah,'' corrected to northeastern United States. [AMNH]

NOTE—The name *migrata* has generally been applied to the eastern North American taxon. Smith (1903b) described *migrata* from two females, one from Stockton, Utah, and one from New Jersey, although he suspected that the ''N. J.'' label was erroneous. Todd (1982: 139) knew of other specimens from New Jersey; however, he designated the Utah specimen as lectotype. The species does not occur west of the Great Plains and the supposedly Utah specimen is typical of other specimens from New Jersey and New York, not the western populations, so we believe the lectotype of *migrata* is mislabeled as to locality, so we restrict the type locality to northeastern United States where this form of the species is typical.

NOTE—Barnes and McDunnough (1916: 165) correctly noted that ''*migrata* Sm. is the same species as *relicina* Morr.'' and closely related to *burgessi.* McDunnough (1938: 86) listed *migrata* as synonym of *relicina.* In spite of this, Franclemont and Todd (1983) and Poole (1989) listed *migrata* as a separate species.

Apamea relicina, like *A. burgessi,* has previously been treated as two species, one on the East Coast (subspecies *migrata*) and the other in the West (subspecies *relicina*). *Apamea relicina* is, on average, larger than *A. burgessi* and longer winged (forewing length: 18–22 mm). The forewing ground color is gray, usually with reddish-brown or yellowish-brown tinge. *Apamea relicina* is most likely to be confused with light specimens of *A. burgessi,* but the forewing is more longi-

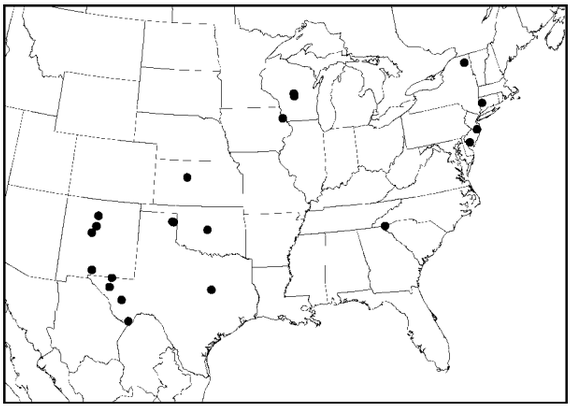


FIGURE 45: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA RELICINA*

tudinally streaked, the lower part of the postmedial line is strongly serrate, and the orbicular spot is oblong. The largest and darkest specimens occur in the East; specimens from the West are variable in size and forewing coloration.

The male genitalia are characterized by the small cucullus, the posteriorly curved digitus, and the vesica is less strongly bent posteriorly than in *A. burgessi,* a difference also reflected in the female genitalia in that the appendix bursae in *A. relicina* projects more laterad than posteriad.

The larva was described by Dyar (1898: 320), who listed the food plants as ''various.''

Apamea relicina has an extensive but spotty distribution in eastern and central United States. In the East it occurs from upper New York State to the Appalachians in South Carolina and on the East Coast from Connecticut to New Jersey. In the Midwest it occurs from Wisconsin southward to eastern Texas and westward to Kansas and New Mexico. Its reported occurrence in Utah, the type locality of *A. migrata,* probably is due to a labeling error. The moths fly from late August until and early October. The species is arranged in two subspecies.

Apamea relicina relicina (Morrison)
PL. 5, FIGS. 27–31; PL. J, FIG. 6 (♂ gen.); PL. T, FIG. 8 (♀ gen.).

Hadena relicina Morrison, 1875.
Type locality: Waco, Texas. [MCZ]

Subspecies *relicina* occurs with *Apamea burgessi* in the Great Plains and may be quite similar to pale specimens of *burgessi leucoptera.* The forewing is finely marked and streaked and has an *Acronicta*-like appearance. The postmedial line is faint or disappears in the middle of the wing (opposite the W-mark in the subterminal line). The female tends to be larger than the male, has more brown shading, and the hindwing margin has more fuscous, especially on the veins. Males from open areas have a reddish tint (plate 5, figures 27–29) (females are browner), whereas those from forested areas are dark grayish brown (plate 5, figures 30, 31).

Subspecies *relicina* occurs from Iowa southward through the prairies to east-central Texas and westward to New Mexico. The moths fly from early September to and early October.

Apamea relicina migrata (Smith)
PL. 5, FIGS. 32, 33.

Luperina migrata Smith, 1903.
Type locality: ''Stockton, Utah,'' corrected to northeastern United States. [AMNH]

Subspecies *migrata* is is much darker than subspecies *relicina.* The forewing is dark gray with a yellowish-brown tinge and a speckling of dark scales gives the wing a roughened, mottled texture (western specimens appear more silky and evenly streaked). Unlike in the western subspecies, the middle part of the postmedial line is clearly visible opposite the W-mark in the subterminal line.

Subspecies *migrata* occurs from New York to South Carolina. A specimen in the CNC from Wisconsin looks like subspecies *migrata* even though the locality is close to the Great Plains. It is likely that the two subspecies blend in relict prairie habitat in the western Great Lakes area. The moths fly from late August until late September.

Apamea zeta-GROUP

The *Apamea zeta*-group includes 25 species (eight Eurasian, 14 North American, and two Holarctic). The group could be further divided to segregate the structurally homogeneous members of the difficult *A. zeta* species-complex, but we use a single group name for all of them. If the group were divided, superficially similar species would be put in different species-groups on the basis of small differences in the genitalia. The most distinctive features of the *A. zeta*-group are the deep untufted thoracic vestiture and the reduction of the dorsal tufts on the basal segments

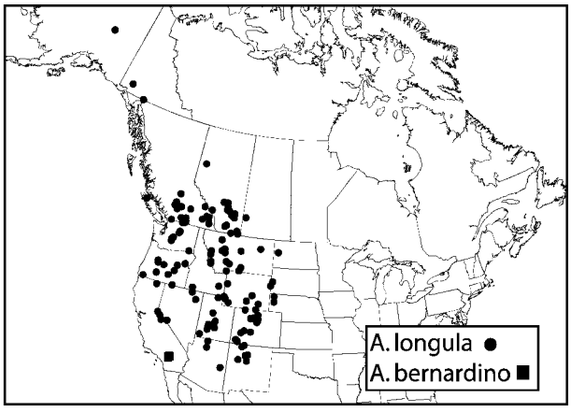


FIGURE 46: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA LONGULA* ● AND *APAMEA BERNARDINO* ■

of the abdomen. Basal abdominal brushes and pockets in the male are absent in most species in the *A. zeta*-group, but fully developed brushes and pockets in some species, and the presence of vestigial brushes or pockets in other species, are important for the identification of some species. In North America *A. scoparia, A. dubitans, A. cogitata,* and *A. contradicta* have brushes and pockets. In Eurasia, brushes and pockets are in *A. maillardi* (Geyer) only, but the apodemes that form the levers of the brushes persist in *A. michielii* Varga and *A. kaszabi* Varga.

Apamea longula (Grote)
PL. 6, FIGS. 1–4; PL. K, FIG. 1 (♂ gen.); PL. U, FIG. 1 (♀ gen.); TEXT FIG. 46 (map) (RWH 9383).

Hadena longula Grote, 1879, *Bull. U. S. Geol. Geog. Surv. Terr.,* **5**: 204.
Type locality: Nevada, USA. [BMNH]

NOTE—Grote (1879) does not mention how many specimens he had. A dark female with the right antenna missing but otherwise in quite good condition, labeled ''Type [round, red outline]/ 64/ Nevada [hand written]/ Grote Coll., 81-116./ *Hadena longula* Type [blue outline]/ *Hadena longula* Type Grote [red outline]'' is here designated LECTOTYPE to ensure the stability of the name.

Apamea longula is a medium-sized to large moth (forewing length: 16–22 mm) with an evenly pale brownish-gray forewing and maculation defined in black. Specimens from more mesic forested habitats are darker brown than those from open areas. The forewing often appears longitudinally streaked because of the black dashes in the subterminal area, the dark streaks in the terminal area, the black line in the medial area that extends between the transverse lines, and the black basal dash. The rounded or oval orbicular spot, sharply defined black wing markings, even gray-brown wing color, and lack of a dark dash at the anal angle, readily separate *A. longula* from other species with longitudinally streaked forewings. The hindwing is very light fuscous with darker fuscous on the marginal ¼ of the wing, postmedial line, and discal spot.

In the male genitalia the cucullus in *A. longula* and *A. bernardino* is relatively small, but still with a prominent ''neck,'' unlike *A. inficita* and *A. niveivenosa.* The sacculus is similar to those of most *Apamea* species, not disproportionately large, as in *A. bernardino.*

The immature stages are unknown.

Apamea longula is widely distributed in western Canada and United States from southwestern Saskatchewan, northwestern Alberta, and southern British Columbia southward to northern New Mexico, east-central Arizona (White Mountains), and the Sierra Nevada in east-central California. Apparently disjunct populations are in Alaska and southwestern Yukon. The species occurs mostly in open xeric habitats. The flight season extends from mid-July until mid-September.

Apamea bernardino Mikkola and Mustelin
PL. 6, FIGS. 5, 6; PL. K, FIG. 2 (♂ gen.); PL. U, FIG. 2 (♀ gen.); TEXT FIG. 46 (map).

Apamea bernardino Mikkola and Mustelin, 2000, *in* Mustelin et al., *Proc. San Diego Soc. Nat. Hist.,* **36**: 5.
Type locality: Barton Flats, San Bernardino Mts., San Bernardino Co., California. [LACM]

Apamea bernardino is a close relative of *A. longula* that is isolated from it in southwestern California. The forewing color and pattern of *A. bernardino* are more reminiscent of *A. atrosuffusa* than of *A. longula,* but details of the maculation and the structure of the genitalia show its relationship to *A. longula.* The forewing (forewing length: 17–20 mm) is narrower than in *A. longula,* and very differently colored. The medial and subterminal areas are orange brown with darker and lighter streaks and contrast with the light-gray basal and subterminal areas that have a slight violet hue. Unlike in *A. atrosuffusa,* the

postmedial line is sharply defined and scalloped throughout its length, and there is no dark dash at the anal angle.

The genitalia are similar to those of *A. longula* except that the male sacculus in *A. bernardino* is stouter and in the female genitalia the corpus bursae is much smaller.

The immature stages are unknown.

Apamea bernardino is known only from the San Bernardino Mountains in southwestern California where it occurs at elevations of 6,600′ to 7,000′ from late July until early September.

Apamea scoparia Mikkola, Mustelin, and Lafontaine
PL. 6, FIGS. 7–11; PL. K, FIG. 3 (♂ gen.); PL. U, FIG. 3 (♀ gen.); TEXT FIG. 47 (map) (RWH 9365).

Apamea scoparia Mikkola, Mustelin, and Lafontaine, 2000, *in* Mustelin et al., *Proc. San Diego Soc. Nat. Hist.,* **36**: 6.
Type locality: Ottawa, Ontario, Canada. [CNC]

Apamea lateritia of authors, not Hufnagel, 1766.

NOTE—*Apamea lateritia* is an Old World species that had been treated as a Holarctic species until the description of *Apamea scoparia* (Mustelin et al., 2000).

Apamea gabrieli Mikkola and Mustelin, 2000, *in* Mustelin et al., *Proc. San Diego Soc. Nat. Hist.,* **36**: 6. NEW SYNONYMY, NEW STATUS, SUBSPECIES.
Type locality: Big Pines Area, San Gabriel Mountains, Los Angeles Co., California, USA. [LACM]

NOTE—Walker (1858: 1683) described *Mamestra obliviosa* (now *Apamea*), from the Rocky Mountains, and noted that it had been presented by the late Earl of Derby. The female holotype in the BMNH was studied from a color photograph and from a genitalia slide (BM 11931♀) and found to represent a specimen of the Palearctic species *Apamea maillardi* (Geyer, [1834]), NEW SYNONYMY. The specimen appears to represent the reddish brown north European subspecies *schildei* (Staudinger, 1901), which was described from Kuusamo, Finland. However, *obliviosa* is not formally synonymized with *schildei* because of the difficulty of determining a subspecies based on a single specimen; similar reddish-brown specimens may occasionally occur in nominate (gray) *maillardi* in southern Europe. The specimen was probably mixed with the Rocky Mountain material of the Earl of Derby. Smith (1893: 155) incorrectly synonymized *obliviosa* with *Apamea lateritia* (Hufnagel), now called *A. scoparia* in North America, and this synonymy was followed by subsequent authors.

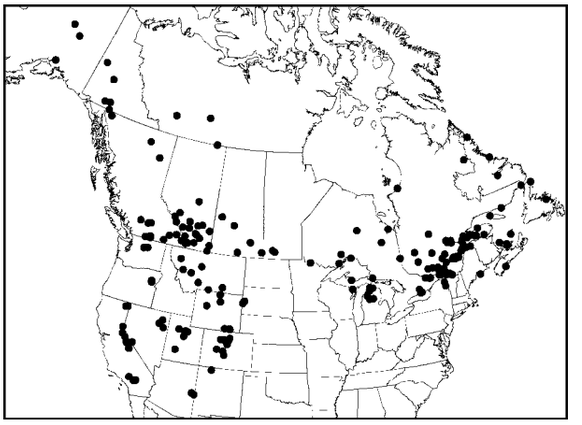


FIGURE 47: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA SCOPARIA*

Superficially, *Apamea scoparia* is hardly distinguishable from the Eurasian *A. lateritia* (Hufnagel) and was called *A. lateritia* until recently. In *A. scoparia* the forewing fringe is less checkered than in *A. lateritia,* and the outer part of the reniform spot has less white shading; however, *A. scoparia* can be positively distinguished from *A. lateritia* only by the presence of scent brushes and associated pockets and levers at the base of the abdomen of the male, and by differences in the cytochrome c oxidase 1 (CO1) mitochondrial gene sequence, which is about 2 % different from that of *A. lateritia.* In North America *A. scoparia* is most likely to be confused with *A. dubitans* (Walker) and *A. cogitata* (Smith). *Apamea scoparia* averages larger (forewing length: 19–24 mm) than *A. dubitans* or *A. cogitata* and the forewing apex is more sharply angled. The forewing is dull brick red, darker outwardly. In *A. dubitans* the forewing is blackish brown, and it occurs almost exclusively to the south and east of the range of *A. scoparia. Apamea cogitata* is more similar to *A. scoparia* in color, and the two species occur sympatrically over much of their ranges, but *A. scoparia* can recognized by larger size, more pointed forewings, less white in the reniform spot, and by genital differences noted herein.

In *Apamea scoparia* the uncus is broad, abruptly tapered toward the apex (slender and tapered

gradually in *A. cogitata* and *A. dubitans*), the digitus is about × as long as the ventral margin of the cucullus (reaching the ventral edge of the cucullus in *A. cogitata* and *A. dubitans*), the sacculus has a dorsal lobe subbasally (two-lobed in *A. cogitata* and *A. dubitans*), and the triangular vesica are diagnostic. In the female genitalia the ductus bursae is short and broad and the corpus bursae is only slightly constricted postmedially, whereas in *A. cogitata* and *A. dubitans* the ductus bursae is slender and the corpus bursae is prominently constricted postmedially. Some geographical variation is evident in *A. scoparia,* in addition to subspecies *gabrieli,* in that the moths from the southern and western parts of the range tend to be darker than those from the North and have a more conspicuous reniform spot and subterminal line.

The larva was briefly described by Forbes (1954: 185). It was said to feed on ''grass and other low plants.''

Apamea scoparia is a boreomontane species occurring across Canada and northern United States from Newfoundland and Maine to Alaska and British Columbia. In the East it occurs as far south as Maine, northern New York, central Michigan, and northern Wisconsin. In the West it occurs southward in the mountains to northern New Mexico, southern Utah, and east-central California. Isolated populations are in the Black Hills of South Dakota and the White Mountains of east-central Arizona. A third isolated population in southwestern California is treated as a separate subspecies. The flight season is mainly in July and August, but occasionally moths are recorded as early as mid-June and as late as mid-September.

Apamea scoparia scoparia Mikkola, Mustelin, and Lafontaine
PL. 6, FIGS. 7–9; PL. K, FIG. 3 (♂ gen.); PL. U, FIG. 3 (♀ gen.) (RWH 9365).

Apamea scoparia Mikkola, Mustelin and Lafontaine, 2000.
Type locality: Ottawa, Ontario, Canada. [CNC]

In subspecies *scoparia* the forewing is dull reddish brown with the terminal area and outer part of the subterminal area darker than the rest of the wing. The hindwing is pale fuscous basally with a dark fuscous band on the outer ⅓ of the wing.

The subspecies name *scoparia* applies to the entire range of the species except the populations in the mountains of southwestern California. The moths fly from mid-June to mid-September.

Apamea scoparia gabrieli Mikkola and Mustelin
PL. 6, FIGS. 10, 11.

Apamea gabrieli Mikkola and Mustelin, 2000.
Type locality: Big Pines Area, San Gabriel Mountains, Los Angeles Co., California, USA. [LACM]

Apamea scoparia gabrieli originally was described as a species because of its distinctive, pale, smooth coloration compared to *Apamea scoparia,* although there are no known structural differences between *gabrieli* and *A. scoparia.* Recent molecular research using cytochrome c oxidase 1 (CO1) also shows no differences in the haplotypes, so we treat *gabrieli* as a disjunct subspecies of *A. scoparia.* The forewing is pale brownish red, much paler and more evenly colored than the nominate subspecies *scoparia,* and the reniform spot is less well defined. The hindwing is pale pinkish buff, much paler than in subspecies *scoparia.*

Subspecies *gabrieli* is known only from the San Gabriel and San Bernardino Mountains in southwestern California at elevations of 6,700′ to 7,600′. The flight season extends from mid-July until late August.

Apamea dubitans (Walker)
PL. 6, FIGS. 12–15; PL. K, FIG. 4 (♂ gen.); PL. U, FIG. 4 (♀ gen.); TEXT FIG. 48 (map) (RWH 9367, part).

Mamestra dubitans Walker, 1856, *List of the Specimens of Lepidopterous Insects in the Collection of the British Museum,* **9**: 232.
Type locality: Trenton Falls, New York, USA. [BMNH]

NOTE—Walker (1856) described *Mamestra dubitans* from six specimens, three from New York and three from Nova Scotia. The male in the BMNH in excellent condition, except for a notch in the left hindwing, labeled ''U. S. America, Doubleday, 46.-110./ 342'' [green] [gen. slide BM Noct 11929 ♂], is here designated LECTOTYPE to ensure the stability of the name. The lectotype is labeled U. S. America, so the type locality is taken as Trenton Falls, New York and not Nova Scotia.

Apamea? *insignata* Walker, 1857, *List of the Specimens of Lepidopterous Insects in the Collection of the British Museum,* **11**: 729.
Type locality: United States. [BMNH]

NOTE—The female holotype in the BMNH was dissected and a study of its characters confirmed its association with *A. dubitans.*

Apamea insignata Walker, 1860, *Canadian Naturalist and Geologist,* **5**: 254.
Type locality: Montreal, Canada. [CNC]

NOTE—A female in the CNC in poor condition labeled ''Type *Apamea insignata* Walk. No. 2281 [red]/ 1552 [yellow]/ *Apamea insignata* [by Walker?]/ Ex D'Urban Collection'' is here designated LECTOTYPE to ensure the stability of the name. The identification of the specimen was confirmed by dissection.

NOTE—*Apamea insignata* Walker, 1860 is a junior primary homonym of *Apamea insignata* Walker, 1857, and junior subjective synonym of *A. dubitans* (Walker, 1856).

Hadena sputator Grote, 1873, *Bull. Buffalo Soc. Nat. Sci.,* **1**: 190.
Type locality: Buffalo, New York, USA. [BMNH]

NOTE—A female in the BMNH in good condition, labeled ''New York, Grote Coll.'' is here designated LECTOTYPE to ensure the stability of the name.

NOTE—*Hadena sputator* Grote is an objective replacement name for *Apamea insignata* Walker, 1857, which Grote considered to be a junior secondary homonym in the genus *Hadena* Schrank (Poole, 1989).

Agroperina amanda Swinhoe, 1901, *Annals and Magazine of Natural History, Series* 7, **7**: 494. NEW SYNONYMY.
Type locality: North America. [BMNH]

NOTE—A male in the BMNH in worn condition labeled Perak [Indonesia] is here designated LECTOTYPE to ensure the stability of the name. Poole (1989) believed *Agroperina amanda* Swinhoe to be a synonym of *A. lateritia* (Hugnagel) and suggested that the labeling is erroneous. The type locality is here corrected to North America.

Apamea dubitans is a medium-sized species (forewing length: 17–21 mm) that occurs mainly to the south and east of the ranges of *A. scoparia* and *A. cogitata.* The forewing is dark brownish black with a coppery-brown hue on the transverse lines and in the medial area. The reniform spot is the only conspicuous marking; it is outlined in white, usually with a pale-yellow patch inside this; the half-circle shape of the spot is also characteristic with the inner margin strongly convex, and the outer margin almost straight. *Apamea dubitans* can be distinguished from *A. scoparia* by the broader, more truncated forewing, and from both *A. scoparia* and *A. cogitata* by the dark brownish-black rather than reddish-brown forewing color. There is little geographical variation evident, but some specimens from Prince Edward Island in eastern Canada have lighter gray-brown forewings, those from the southern Appalachians and Colorado have the darkest forewings with less pale shading in the reniform spot, so it is possible that the Colorado population in Fort Collins is an introduction from the East.

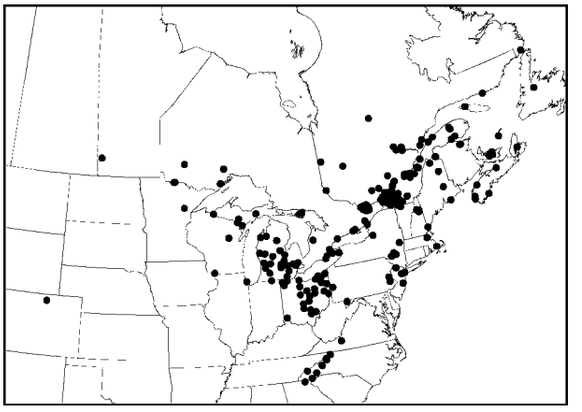


FIGURE 48: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA DUBITANS*

Males of *A. dubitans* can be identified by brushing the scales away from the end of the valve to expose the shape of the digitus; the digitus is long, slender, and tapered in *A. dubitans,* and extends almost to the ventral margin of the cucullus; in *A. scoparia* the digitus is short, extending only ⅔ of the distance to the ventral margin of the cucullus; in *A. cogitata* the digitus is long, like in *A. dubitans,* but it is stout and tapered abruptly near the apex. Additional genital differences are discussed under *A. cogitata.* The female genitalia of *A. dubitans* are similar to those of *A. cogitata,* but the lobe on the right at the junction of the ductus bursae and corpus bursae is much larger in *A. dubitans* to accommodate the larger spines and diverticula in the vesica. *Apamea dubitans* can be confused with specimens of *Apamea plutonia* because both species have dark forewings with a coppery hue, but *A. dubitans* has a darker hindwing, the forewing lacks the dark patch near the anal angle of the

wing characteristic of *A. plutonia,* and the genitalia are abundantly different; the most easily observed genital differences are the long digitus in the male of *A. dubitans* and the much broader anal papillae in the female.

The larva has not been described; those described by Crumb (1956: 232) as *A. dubitans* are from western North America and are referable to *A. cogitata.* The two species are closely related, so the larvae are probably similar. McCabe (1991) reared larvae in culture on *Glyceria canadensis* (Michx.) Trin.; they spent only a week in the pupa before the moths emerged.

Apamea dubitans is one of the most common species of *Apamea* in northeastern North America. It occurs from Newfoundland westward to southern Manitoba and southward to New Jersey, Ohio, and Illinois, and in the Appalachians to northern Georgia. An apparently disjunct population, possibly introduced, is in Fort Collins, Colorado. The flight season extends from late June until early October.

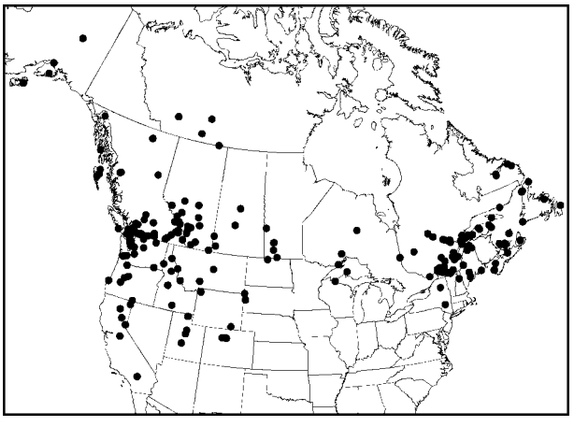


FIGURE 49: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA COGITATA*

Apamea cogitata (Smith), REVISED STATUS

PL. 6, FIGS. 16–22; PL. K, FIG. 5 (♂ gen.); PL. U, FIG. 5 (♀ gen.); TEXT FIG. 49 (map) (RWH 9367, part).

Xylophasia cogitata Smith, 1891, *Proc. U. S. Natl. Mus.,* **13**: 421.
Type locality: Sierra Nevada, California, USA. [USNM]

NOTE—Smith (1891) mentions specimens from Sierra Nevada, California and Colorado. Todd (1982: 50) designated a syntype from California as lectotype. The known type material does not include specimens from Colorado, so Smith's mention of Colorado may be erroneous.

NOTE—Forbes (1954) and Ferguson (1954) correctly considered *Apamea cogitata* to be a separate species from *A. dubitans.* The continuing synonymy of *A. cogitata* with *A. dubitans* in Franclemont and Todd (1983) and Poole (1989) was an oversight.

Apamea cogitata is a medium-sized species (forewing length: 16–21 mm) with much more variation in forewing color than in either *A. scoparia* or *A. dubitans.* The forewing is broad and apically squared, not long and apically pointed as in *A. scoparia.* The forewing color varies from bright brick red to a dusky blackish brown with the white in the reniform spot being the only conspicuous marking. The largest and brightest reddish-brown forms are in the Sierra Nevada in California. Reddish-brown specimens are easily separated from *A. dubitans* and only the reddish-brown form occurs in northeastern North America where the ranges of the two species narrowly overlap. There is a geographic cline across Canada with specimens becoming increasingly dark toward the West. The darkest forms are in Alaska and northern British Columbia and in the Rocky Mountains from Montana to Colorado. These dark forms are dark gray brown without any reddish hue and with little white in the reniform spot, so they are superficially almost indistinguishable from *A. dubitans,* and this has resulted in many reports of *A. dubitans* in the West. *Apamea dubitans* only occurs in proximity with the dark form of *A. cogitata* in Colorado and in this area the species must be identified positively by genital characters. At present, *A. dubitans* has been found in Colorado only at Fort Collins in the western Great Plains. All specimens examined from the Rocky Mountains are *A. cogitata.* No subspecies are proposed because of the clinal nature of the geographic variation.

The male genitalia differ from those of *A. dubitans* in the following characters: the cucullus is smaller; the digitus is flat and broader than in *A. dubitans,* and tapered toward the apex; the left diverticulum of the vesica is smaller and more bulbous than in *A. dubitans,* with dorsal and ventral cornuti; and the dorsal diverticulum is minute with an apical cornutus, whereas in *A. dubitans* the diverticulum is long and conical with a bulbous apical cornutus. In the female genitalia, the ductus bursae has only a small bulge anteriorly

on the right, and the corpus bursae is shorter than in *A. dubitans.* Genital differences are discussed further under *A. scoparia* and *A. dubitans.*

The larva was described by Crumb (1956: 232) as *A. dubitans,* but the material was from the State of Washington, so the identity of the material is corrected to *A. cogitata,* which was treated as a reddish form of *A. dubitans* at that time. The mature larva is about 35 mm long. The head is pale brown, sometimes with a faint darker reticulation laterally. The body is pale gray, often tinged with pink dorsally. The spiracles are brown. The prothoracic and anal shields are yellow, margined with black. The pinacula are dark gray. The skin is smooth. The larva feeds on grasses.

Apamea cogitata occurs from Newfoundland and Labrador westward to Alaska and southward to New Hampshire, New York, Wisconsin, Colorado, Utah, and southern California. The moths can be found from mid-June until late September, but most records are between mid-July and mid-August.

Apamea geminimacula (Dyar)
PL. 6, FIGS. 23–25; PL. K, FIG. 6 (♂ gen.); PL. U, FIG. 6 (♀ gen.); TEXT FIG. 50 (map) (RWH 9368).

Hadena geminimacula Dyar, 1904, *Proc. Ent. Soc. Washington,* **6**: 103.
Type locality: Pecos, San Miquel Co., New Mexico, USA. [USNM]

NOTE—Dyar (1904b) had 5 specimens from Pecos, New Mexico and Garfield Co., Colorado. The male in the USNM in good condition labeled "*Hadena geminimacula,* Type Dyar/ Pecos Aug. 14 at light/ New Mexico. Cockerell/ Type No. 762, U.S.N.M. [red]/ Genitalia Slide By-, USNM 39133 [green]/ ♂ genitalia on slide, March 30 1936, J.F.G.C. 117" is here designated LECTOTYPE to ensure the stability of the name.

Parastichtis stagmatipennis Dyar, 1920, *Insecutor Inscitiae Menstruus,* **8**: 190. NEW SYNONYMY.
Type locality: Mexico City, Mexico. [USNM]

NOTE—The holotype of *Parastichtis stagmatipennis* in the USNM is a worn specimen of *Apamea geminimacula* (Dyar).

Apamea geminimacula is a large (forewing length: 18–24 mm) unmistakable *Apamea.* The forewing is blackish gray or blackish brown, mottled with patches of paler gray or brown. The wavy subterminal line is marked by a series of yellowish scales. The reniform spot is diagnostic with two white oblong dots in the outer posterior corner. The hindwing is pale fuscous basally with a contrasting dark-fuscous band on the distal ⅓ of the wing.

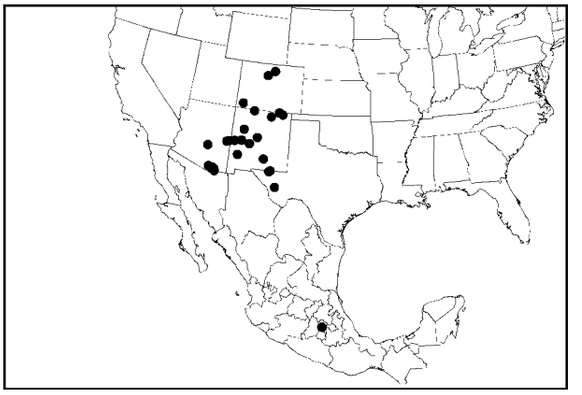


FIGURE 50: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA GEMINIMACULA*

The immature stages are unknown.

Apamea geminimacula occurs in southwestern United States from northern Colorado southward to western Texas, southern New Mexico, and southern Arizona, and in Mexico as far south as Mexico City. The flight season extends from early August until late October, but most records are from September.

Apamea inficita (Walker)
PL. 6, FIGS. 26–35; PL. 7, FIGS. 1–5; PL. L, FIG. 1 (♂ gen.); PL. U, FIG. 7 (♀ gen.); TEXT FIG. 51 (map) (RWH 9369, 9370, 9371).

Graphiphora inficita Walker, 1857, *List of the Specimens of Lepidopterous Insects in the Collections of the British Museum,* **11**: 746.
Type locality: Not given [North America]. [BMNH]

NOTE—The holotype in the BMNH, a male in good condition, belongs to the northern subspecies.

Orthosia belangeri Morrison, 1875, *Proc. Boston Soc. Nat Hist.,* **17**: 149.
Type locality: Quebec, Canada. [MSU]

NOTE—Morrison (1875a) does not mention how many specimens he had. A male in MSU in good condition, but with the right antenna missing, labeled "Canada [orange text, by Tepper]/ Type [rhomboidal with black border]" is here designated

LECTOTYPE to ensure the stability of the name. The specimen belongs to the northern subspecies.

Orthosia conradi Grote, 1879, *Bull. U. S. Geol. Geog. Surv. Terr.,* **5**: 203. NEW SYNONYMY, NEW STATUS, SUBPECIES.
Type locality: Colorado, USA. [BMNH]

NOTE—The female in the BMNH in good condition labeled ''U. S. America, Grote Coll.'' is here designated LECTOTYPE to ensure the stability of the name. It is a grayish specimen typical of Colorado populations.

Orthosia citima Grote, 1883, *Papilio,* **3**: 74.
Type locality: Arizona, USA. [USNM]

NOTE—The specimen in the USNM labeled ''Type No. 33897, USNM [red]/ Orthosia Type, *citima* Grote [red border]/ Arizona/ Col. B. Neumögen/ The abdomen is false! It is from a species of *Nephelodes* in the Hadeninae! JHS 1963'' is here designated LECTOTYPE to ensure the stability of the name. It is in good condition, except for the incorrectly associated abdomen.

Ommatostola popofensis Smith, 1900, *Proc. Washington Acad. Sci.,* **2**: 492. NEW SYNONYMY.
Type locality: Popof Island, Alaska, USA. [USNM]

NOTE—This taxon is considered an end point of a geographical cline that becomes darker and smaller toward the northwest. The holotype is a relatively pale specimen.

Agroperina indela Smith, 1910, *Jour. New York Ent. Soc.,* **18**: 144. NEW SYNONYMY, NEW STATUS, SUBSPECIES.
Type locality: Bozeman, Montana, USA. [AMNH]

NOTE—Smith (1910: 145) had specimens from Wyoming, Idaho, Colorado, Montana and Washington. Todd (1982: 105) designated lectotype from Bozeman, Montana.

Agroperina lineosa Smith, 1910, *Jour. New York Ent. Soc.,* **18**: 145.
Type locality: Calgary, Alberta, Canada. [AMNH]

NOTE—In addition to Calgary, Smith (1910: 145) had specimens from five localities in Manitoba. Todd (1982: 122) designated a specimen from Calgary, Alberta, as lectotype.

Agroperina pendina Smith, 1910, *Jour. New York Ent. Soc.,* **18**: 146.
Type locality: Calgary, Alberta, Canada. [AMNH]

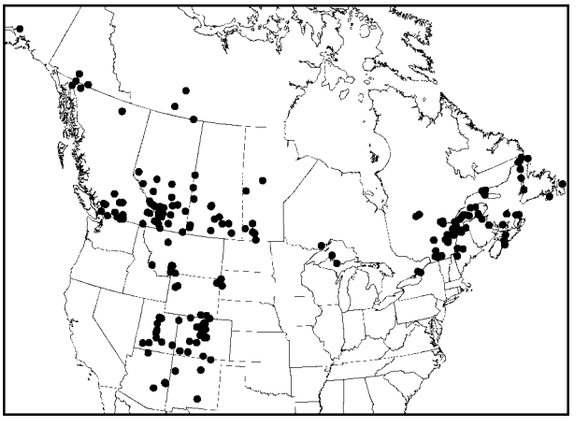


FIGURE 51: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA INFICITA*

NOTE—Smith (1910: 146) had specimens from Calgary, Alberta, from three localities in Manitoba, and from Olds, British Columbia [Olds, Alberta]. Todd (1982: 146) designated a specimen from Calgary, Alberta, as lectotype.

Apamea inficita is a polytypic species that was described eight times and was listed as three species (*A. inficita, A. conradi,* and *A. popofensis*) and two subspecies under *A. popofensis* (ssp. *indela* and ssp. *lineosa*) by Franclemont and Todd (1983). It is one of the few species of *Apamea* that occurs from Newfoundland to British Columbia and from Alaska to southern Arizona. The moth ranges from relatively small in Alaska to large in Arizona with a forewing ranging from 15 to 22 mm. The forewing varies from yellow brown to reddish brown and orange brown. The reniform and orbicular spots are not particularly contrasting except for a contrasting dark blue-gray spot in the lower part of the reniform spot. The hindwing usually is pale fuscous basally with a contrasting dark-fuscous band on the marginal ⅓ or ½ of the wing and on the discal spot. *Apamea inficita* is likely to be confused only with the Mexican species *A. hemimena,* which has an entirely dark reniform spot, and with *A. lutosa,* which has a much paler hindwing.

The immature stages are unknown.

Apamea inficita is a boreomontane species found most commonly in the northern prairies and open coniferous woodlands. It occurs from Newfoundland to Alaska, southward in the East to northern New England and the northern Great Lakes states, and southward in the West to North Dakota, southern New Mexico, south-central Ar-

izona, and northern Washington. The flight season of the moths extends from late June to mid-September.

The species is arranged in three subspecies; subspecies *inficita* is a yellow-brown, heavily speckled subspecies of the boreal zone; subspecies *indela* is a paler more evenly colored form that occurs in the prairies and in montane areas of northwestern United States; subspecies *conradi* is a large, orange-brown to gray-brown subspecies that occurs in the mountains of the Southwest. Molecular analysis of the cytochrome c oxidase 1 (CO1) mitochondrial gene sequence gives a difference of about 1.5 % between the haplotype of subspecies *conradi* and those of the other subspecies of *inficita,* a percentage difference similar to those between some species. However, both haplotypes are in the intermediate populations, and the haplotype of subspecies *conradi* has spread far into the geographic range of specimens that appear to be typical of subspecies *indela.* We believe these data support the treatment of *conradi* and *indela* as subspecies.

Apamea inficita inficita (Walker)
PL. 6, FIGS. 26–28; PL. L, FIG. 1 (♂ gen.).

Graphiphora inficita Walker, 1857.
Type locality: Not given [North America]. [BMNH]

Orthosia belangeri Morrison, 1875.
Type locality: Quebec, Canada. [MSU]

Ommatostola popofensis Smith, 1900.
Type locality: Popof Island, Alaska, USA. [USNM]

Subspecies *inficita* previously was thought to be the eastern counterpart of subspecies *indela,* but is now known to be transcontinental in boreal-zone habitats. The forewing is yellowish brown to grayish brown, strongly speckled with dark-brown scales. Usually the medial line is prominent and the veins in the subterminal area are black. The dark patch in the lower part of the reniform is more contrasting than in other subspecies. In general, subspecies *inficita* is duskier than subspecies *indela.*

Subspecies *inficita* occurs from Newfoundland and northern New England westward to Alaska and northern British Columbia. The moths fly from mid-July to mid-September.

Apamea inficita indela (Smith, 1910)
PL. 6, FIGS. 29–34.

Agroperina indela Smith, 1910.
Type locality: Bozeman, Montana, USA. [AMNH]

Agroperina lineosa Smith, 1910.
Type locality: Calgary, Alberta, Canada. [AMNH]

Agroperina pendina Smith, 1910.
Type locality: Calgary, Alberta, Canada. [AMNH]

Subspecies *indela* is more unicolorous than the other subspecies; most commonly the forewing is pale buffy brown with a rusty speckling, but brick-red and buffy-gray forms also occur. The maculation is obscure although the reniform spot is paler than the forewing and a thin, dark, dentate postmedial line usually is evident. The buffy-gray form becomes more frequent in the eastern parts of the range of subspecies *indela,* especially in the Prairie Provinces of Canada.

Subspecies *indela* occurs mainly in the northwestern United States and southwestern Canada from North Dakota and southern Manitoba westward to British Columbia and Washington. In the south *indela* forms an intergradation zone with subspecies *conradi* in southern Wyoming and northern Colorado. The moths fly from late June to late August.

Apamea inficita conradi (Grote)
PL. 6, FIG. 35; PL. 7, FIGS. 1–5; PL. U, FIG. 7 (♀ gen.).

Orthosia conradi Grote, 1879.
Type locality: Colorado. [BMNH]

Orthosia citima Grote, 1883.
Type locality: Arizona. [USNM]

Subspecies *conradi* is on average larger and darker than subspecies *indela* and has, until now, been treated as a separate species. There is much variation in *conradi,* but this appears to be related to habitat mainly because the darkest moths occur in the most mesic areas (e.g., the White Mountains of Arizona), paler reddish-brown forms occur in moderately dry fir forests in central Colorado, and lighter gray forms occur in open pine woodlands.

Subspecies *conradi* occurs in Colorado, Arizona, New Mexico, and southern Utah. It inter-

FIGURE 52: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA HEMIMENA*

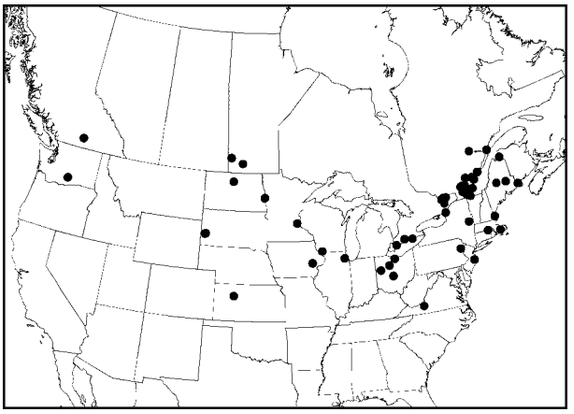


FIGURE 53: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA LUTOSA*

grades with subspecies *indela* in Utah, northern Colorado and southern Wyoming, but typical-looking *conradi* also can be found in southern Wyoming. It flies at elevations ranging from 7,000′ to 11,000′. The moths fly from late July to late August.

Apamea hemimena Mikkola and Lafontaine, NEW SPECIES
PL. 7, FIGS. 6, 7; PL. L, FIG. 2 (♂ gen.); TEXT FIG. 52 (map).

Apamea hemimena Mikkola and Lafontaine. Type locality: Creel, Chihuahua, Mexico. [UCD]

NOTE—The species name comes from the Greek for ''half-moon'' and refers to the appearance of the reniform spot.

Apamea hemimena looks like a large dark form of *Apamea inficita conradi,* but there is a white crescent mark in the outer margin of the reniform spot, the reniform spot is mainly dark, and the two taxa differ in the male genitalia.

Forewing dark gray brown; subterminal line pale buff with diffuse dark wedges along inner margin; transverse lines faint, geminate; orbicular spot small, oval, with a thin dark-gray outline and a dark-gray spot in center; reniform spot large, dark, except for concave white line on outer margin. Forewing length: 21 mm. Hindwing pale fuscous basally with contrasting dark-fuscous band on outer ⅓ and with darker fuscous shading on postmedial line, discal spot, and veins.

Male genitalia with sacculus broader and more evenly rounded dorsally than in *Apamea inficita* and cucullus wider; vesica large basally, markedly tapered toward apex with a prominent, rounded, subapical diverticulum. Female genitalia unknown.

The immature stages are unknown.

TYPES. **Holotype:** ♂. Creel, Chihuahua, Mexico; 9 Sept. 1968; T. A. Sears, R. C. Gardner, & G. S. Glaser. UCD. **Paratypes:** 2 ♂. **Mexico. Chihuahua.** Same locality and collector as for holotype; 5 Sept. 1968 (1 ♂). Cuiteco; 5 Sept. 1969; T. A. Sears, R. C. Gardner, & G. S. Glaser (1 ♂). CNC, UCD.

The species is known only from the type series from the state of Chihuahua in central Mexico.

Apamea lutosa (Andrews)
PL. 7, FIGS. 8–10; PL. L, FIG. 3 (♂ gen.); PL. U, FIG. 8 (♀ gen.); TEXT FIG. 53 (map) (RWH 9372).

Orthosia lutosa Andrews, 1877, *Can. Ent.,* **9**: 99.
Type locality: New Jersey, USA. [AMNH]

NOTE—Andrews (1877) had three specimens of which a syntype was found among unincorporated material in the AMNH. It is mentioned by Rindge (1955: 119) but not by Poole (1989). This female in good condition labeled ''[blue round label]/ 2435/ Type of W. V. Andrews n. sp./ W. V. A., n. sp./ J. B. Smith Collection, Rutgers/ Type of *O. lutosa* Andrews. rec. from M. R. F. Pearshall who got it from Ackhurst out of the Andrews Coll. [red border]'' is here designated LECTOTYPE to ensure the stability of the name. A second female mentioned by Rindge was not found.

Apamea lutosa could be confused with some light specimens of *A. inficita.* Where both species occur together, *A. lutosa* is smaller (forewing

length: 15–19 mm). The forewing is more pinkish gray to yellowish gray than in *A. inficita* with a speckling of dark-gray scales. The only conspicuous wing marking is the dark blue-gray patch in the lower part of the reniform spot. The species is most easily distinguished from *A. inficita* by the pale-buff hindwing with a light fuscous submarginal band and discal spot. On the underside of the forewing, there is a dark lunule at the position of the reniform spot; this lunule is pale-centered in *A. inficita.* In the male genitalia the digitus is much longer and wider than that of *A. inficita* and extends to the ventral margin of the cucullus.

The larva was described by Crumb (1956: 231) from 12 larvae collected from among the roots of quack grass (*Elytrigia repens* (L.) Nevski) in Ohio. The mature larva is about 30 mm long. The head is brown suffused with darker brown or black. The body is white without any definite pattern with brown cervical and anal shields. The spiracles are brown. The pinacula are pale blackish brown but are not conspicuous. The skin is finely pavement granulose.

Apamea lutosa is widely distributed but surprisingly uncommon. It occurs from Maine and southern Quebec westward to southern Manitoba and southward to New Jersey, western Virginia, Ohio, Iowa, and Kansas. Isolated records in south-central British Columbia and southern Oregon seem to be valid. The flight season of the moth is mainly July, but collection records range from mid-June to early August.

Apamea fergusoni Mikkola and Lafontaine, NEW SPECIES

PL. 7, FIGS. 11, 12; PL. L, FIG. 4 (♂ gen.); PL. V, FIG. 1 (♀ gen.); TEXT FIG. 54 (map).

Apamea fergusoni Mikkola and Lafontaine. Type locality: Gothic, Gunnison Co., Colorado, USA. [CNC]

NOTE—This species is dedicated to the late Douglas C. Ferguson.

Apamea fergusoni is a distinctive new species from the southern Rocky Mountains. Superficially it looks like a large, well-marked, brown form of *A. devastator,* but is abundantly distinct in genital structure.

Male antenna biserrate, unlike those of most *Apamea* species. Forewing rounded apically, dark brown to gray brown with maculation defined in black; transverse lines geminate; postmedial line far out on wing, closer to subterminal line than to reniform spot; subterminal area correspondingly narrow with black wedges on inner side of subterminal line and with black rectangular spot on fold connecting postmedial line with subterminal line; reniform and orbicular spots with a dark central spot followed by a pale line then outlined by black; small black patches partially filling area between reniform and orbicular spots and distal to reniform spot; claviform spot a black dash extending across ⅓ of medial area; subterminal line without distinct W-mark; forewing length: 19–21 mm. Hindwing buff with dark-fuscous band on outer ⅓–½ of wing.

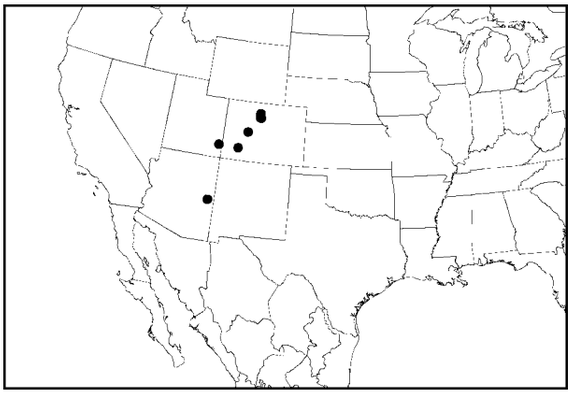


FIGURE 54: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA FERGUSONI*

Male genitalia with uncus broad and flat, tapered near apex to point; cucullus narrow, like *A. inficita*; digitus very short, tapered to point so nearly triangular in profile; vesica almost round, abruptly tapered to long, narrow apex. Female genitalia with corpus bursae very small and appendix bursae elongated, corresponding to shape of vesica.

The two areas of variation are that some specimens show a large amount of black speckling, and some specimens have more gray on the forewing.

The immature stages are unknown.

TYPES. **Holotype:** ♂. Gothic, Gunnison Co., Colorado; 14 July 1949; W. J. Reinthal. CNC. **Paratypes:** 21 ♂, 4 ♀. **Arizona.** 2 mi SE Greens Peak, 9,500′, White Mts., Apache Co.; 5 Aug. 1962; E. & I. Munroe (1 ♂). **Colorado.** Same data as for holotype (5 ♂). 23 mi N Cumbres, 10,000′, Conejo Co.; 5 and 6 Aug. 1961; F., P. and J. Rindge (2 ♂). 25 mi E Buford, 9,100′, Garfield Co.; 31 July 1963; F., P. & M. Rindge (1 ♀). Beaver Creek Road, 8,600′, Grand Co., T1S, R77W, Sec. 10; 8 July 1985; E. Metzler (2 ♂). Highway 50 (Beaver Creek Road), 4.8 mi

SE of Hwy 40, T1N R78W S25, 8,400′, Grand Co.; 1 Aug. 1999; T. S. Dickel (1 ♂). Highway 50 (Beaver Creek Road), 8,600′, Grand Co.; 23 July 1985; T. S. Dickel (1 ♀). Kauffman Creek & State Rd 125, T4N R78W, S36, 8,720′, Grand Co.; 13 July 1999; T. S. Dickel (1 ♂). Kauffman Creek, 9,720′, Grand Co.; 1 Aug. 1991; T. S. Dickel (2 ♂). Gothic, 9,500′, Gunnison Co.; F., P. & J. Rindge (1 ♂). Gothic; 7 Aug.1961; W. H. Howe (1 ♀). Biological Laboratory, Gothic, 9,500′, Gunnison Co.; 7–8 Aug. 1961; L. M. Martin (2 ♂). Avery Peak, Gunnison Co.; 1 Aug 1977; K. P. Bagdonas (1 ♂). Silverton Campground, State Road 110, San Juan Co.; 22 July 1986; E. Metzler (1 ♀). Telluride, 8,745′, San Miguel Co.; 5 and 7 July 1977; D. C. Ferguson (2 ♂). **Utah.** 7 mi W Monticello, 8,800′, San Juan Co.; 25 July 1960; F., P. and B. Rindge (1 ♂). AMNH, CNC, EHM, LACM, TLM, TSD, ZMH.

Apamea fergusoni flies at high elevations, 8,600′ to 10,000′, in the mountains of Colorado, Utah, and Arizona. The adults have been recorded from early July until early August.

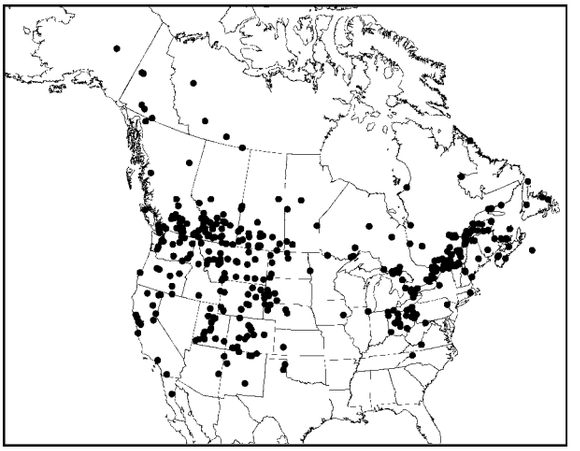


FIGURE 55: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA DEVASTATOR*

Apamea devastator (Brace) (Glassy Cutworm*; Ver-gris vitreux, m., Fr.)
PL. 7, FIGS. 13–18; PL. L, FIG. 5 (♂ gen.); PL. V, FIG. 2 (♀ gen.); TEXT FIG. 55 (map) (RWH 9382).

Phalaena devastator Brace, 1819, *Amer. Jour. of Sci.,* **1**: 154.
Type locality: Not mentioned [eastern North America]. [Types probably lost]

Mamestra ordinaria Walker, 1856, *List of the Specimens of Lepidopterous Insects in the Collections of the British Museum,* **9**: 232.
Type locality: Trenton Falls, New York. [BMNH]

NOTE—Walker (1856) described *Mamestra ordinaria* from six specimens. A male in the BMNH in good condition, except the fringes on the anal corners of the hindwing are rubbed off, labeled ‘‘Type [round, red outline]/ 2.6.37/ New York, Trenton Falls, Doubleday, 39-11-16, 211.; 23/ *Mamestra ordinaria* [printed]’’ is here designated LECTOTYPE to ensure the stability of the name.

Mamestra contenta Walker, 1856, *List of the Specimens of Lepidopterous Insects in the Collections of the British Museum,* **9**: 233.
Type locality: Nova Scotia, Canada. [BMNH]

NOTE—Walker (1856) described *Mamestra contenta* from four specimens. The male in perfect condition in the BMNH labeled ‘‘Type [round, red outline]/ Nova Scotia [printed], Redman/ 12 [green parallelogram]/ 24. *Mamestra contenta* [printed]’’ is here designated LECTOTYPE to ensure the stability of the name.

Polia speciosa Morrison, 1875, *Proc. Boston Soc. Nat. Hist.,* **17**: 137.
Type locality: Cambridge, Massachusetts. [USNM]

NOTE—Morrison (1875a) does not note the number of specimens used to describe *Polia speciosa.* The large female in the USNM labeled ‘‘Type No. 33899, U.S.N.M. [red]/ Col. B. Neumögen/ *speciosus* Morr., Type, Cambridge, Ma, July 17, 1874, 39.’’ is here designated LECTOTYPE to ensure the stability of the name. Poole (1989) refers to the MSU as the depository of the types, but no syntypes were found there.

NOTE—Poole (1989) lists *Agrotis marshallana* Westwood, 1851 (in Humphreys and Westwood, *British Moths and their Transformations,* **1**: 122) as a synonym of *A. devastator.* The synonymy is originally from Walker (see Smith, 1893: 136). The stated type locality is Kent, Charing, England, and the statement ‘‘on the stump of a tree’’ adds authenticity to the locality. The name might be a synonym of *Apamea furva* ([Denis and Schiffermüller], 1775), a Palearctic species with similar superficial appearance. Unfortunately, the holotype can not be located.

Apamea devastator is a relatively large species (forewing length: 16–21 mm) with a medium to dark-gray forewing (occasionally brown, especially in older, faded specimens). The maculation is margined with both black and white, so in dark specimens the maculation appears to be defined in white and in pale specimens it is defined in black. It usually can be distinguished from similar

species by the contrasting black and creamy-white subterminal line with little if any W-mark in the line (although pale streaks in the terminal area can give the impression of a W-mark (plate 7, figure 17). Other typical traits are the oval, dark-centered orbicular spot and the series of black, wedge-shaped spots on the inner side of the subterminal line. The darkness of the forewing ground color and the sharpness of the maculation vary considerably. Generally, specimens from open, dry areas, such as the prairies, tend to be much paler than those from wooded areas. A contrasting form, described by Morrison as *speciosa,* occurs throughout the range of the species but is most frequent in the prairies.

In the male genitalia the cucullus is relatively short and wide with the posterior margin slightly concave dorsally, and the vesica has an elongated subbasal diverticulum that is almost as long as the apical part of the vesica. Males can be identified without dissection by brushing some of the scales away from the end of the valve to reveal the shape of the digitus; in *A. devastator* the apex of the digitus bends mesially toward the aedeagus.

The larva, commonly called the glassy cutworm, is a well-known pest of sod grasses. It was described by Crumb (1956: 230). The larva is easily recognized by the combination of red head and orange-brown prothoracic shield on an otherwise translucent greenish-white body. The mature larva is 35–40 mm long when mature. The head and the thoracic legs are bright reddish brown and contrast with the pale body. The body is almost devoid of markings except for a diffuse dark dorsal line that appears to be under the skin. The spiracles are brown. The prothoracic and anal shields are light brown in the middle but blackish brown on the margins. The pinacula are slightly suffused with brown but are not prominent. The skin is finely pavement granulose. McCabe (1991) observed females ovipositing in the seed-heads of *Glyceria canadensis* (Michx.) Trin.; the first instars fed among the seeds, dropping to the ground in the second instar. The later instars are essentially subterranean sod feeders although, according to Crumb (1956: 231), in the absence of grasses they can be destructive to many other plants. Godfrey (1987: fig. 26.417) illustrates a young larva and gives a short description.

Beirne (1971) reports that severe infestations may occur in fields where crops are planted on newly ploughed sod, but that they rarely persist more than two or three years. Records of damage exist from Ontario in 1929 to 1937, from British Columbia in 1959 to 1961, and from the Prairie Provinces 1962 to 1966. Some damage has occurred also in the Maritime Provinces and in Quebec. Sometimes whole cereal fields of 30 acres have been destroyed, and on old meadows the larval populations may be 100 per square yard. In addition to sod grasses, damage to wheat, oats, barley, corn, and tobacco are mentioned. Tietz (1972: 240) adds *Alcea rosea* Linn., beets, *Elymus virginicus* Linn., strawberry, geranium, barley (*Hordeum jubatum* Linn.), lettuce, *Phleum pratense* Linn., *Poa annua* Linn., *P. pratensis* Linn., peach and *Raphanus sativus* Linn. Covell (1984) adds alfalfa, beans and cabbage.

Apamea devastator is without any doubt the most common and widespread species of *Apamea* in North America. It occurs from Newfoundland and Labrador westward across the Northwest Territories of northern Canada to Alaska and southward to North Carolina, Ohio, Iowa, northern Texas, and southern New Mexico, east-central Arizona, California, and northern Baja California, Mexico. Adults have been recorded from late June until late September.

Apamea zeta (Treitschke)
PL. 7, FIGS. 19–36; PL. 8, FIGS. 1–5; PL. A, FIG. 4 (abdomen); PL. B, FIG. 3 (♂ gen.); PL. L, FIG. 6 (♂ gen.); PL. V, FIG. 3 (♀ gen.); TEXT FIG. 56 (map) (RWH 9377, 9384, 9385, part).

Polia zeta Treitschke, 1825, *Die Schmetterlinge von Europa,* **5**(2): 35.
Type locality: Briel bei Modling [Austria]. [NHMH]

NOTE—Syntypes were found in the BMNH and NHMH. A male in good condition except the right antenna is missing and the left one is reduced to a stub, in the Treitschke collection in HNHM, labeled ''Treits. 1747/ Holotypus 1956.V. dr. Kovacs l. Boursin her. int. level [red border]'' is here designated LECTOTYPE to ensure the stability of the name.

Polia clandestina Boisduval, 1829, *Europaeorum Lepidopterorum Index Methodicus,* p. 75. Subspecies?
Type locality: Pyrenees, France. [BMNH]

NOTE—A unicolorously greenish male in the BMNH labeled ''Type [red on lower margin]/ Ex

Museo Drs Boisduval/ Ex Oberthür Coll., Brit. Mus. 1927-3/ *Polia clandestina* Boisd., Type ♂ = *zeta* Treit. [by Tams]/ 1959, 162 [prep. Exists]'' is here designated LECTOTYPE to ensure the stability of the name.

Noctua pernix Geyer, 1832, in Hübner, *Zuträge zur Sammlung exotischer Schmetterlinge,* **4**: 169. Subspecies?
Type locality: Western Alps [Switzerland]. [Probably lost]

NOTE—A revision of the status of the populations of *zeta* in the mountains of central and southeastern Europe might indicate that the names *clandestina* and *pernix* are worthy of subspecific status.

Hadena exulis Lefebvre, 1836, *Ann. Soc. Ent. France,* **5**: 392. Subspecies.
Type locality: Labrador. [MNHN]

Hadena gelata Lefebvre, 1836, *Ann. Soc. Ent. France,* **5**: 393.
Type locality: Labrador. [MNHN]

NOTE—*Hadena gelata* is a junior synonym of ssp. *exulis* Lefebvre.

Exarnis difflua Geyer, 1837, in Hübner, *Zuträge zur Sammlung exotischer Schmetterlinge*: 9.
Type locality: Labrador. [Probably lost]

NOTE—*Exarnis difflua* is a junior synonym of ssp. *exulis* Lefebvre.

Hadena groenlandica Duponchel, [1838], *Histoire naturelle des Lépidoptères ou Papillons de France,* **3**: 228. REVISED STATUS.
Type locality: Greenland. [USNM]

NOTE—*Apamea groenlandica* was treated as a valid species by Zilli et al. (2005), but we treat it as a synonym of subspecies *exulis.*

Hadena marmorata Zetterstedt, [1839], *Insecta Lapponica,* p. 938. Subspecies.
Type locality: Lapponia [western Scandinavia according to the appearance of the existing syntype]. [MZLU]

Mamestra cervina Germar, [1842], *Fauna Insectorum Europae,* **9**: 19.
Type locality: Iceland. [Unknown]

NOTE—*Mamestra cervina* is a junior synonym of ssp. *exulis* Lefebvre.

Hadena assimilis Doubleday, 1847, *Zoologist,* **5**: 194. REVISED STATUS, SUBSPECIES.
Type locality: Scotland. [BMNH]

NOTE—*Apamea assimilis* (plate 7, figures 23, 24) was treated as a valid species by Zilli et al. (2005), but we treat it as a subspecies of *A. zeta.* Typical specimens are dark reddish brown with the maculation defined in black.

Crymodes gelida Guenée, 1852, *in* Boisduval and Guenée, *Histoire Naturelle des Insectes. Species Général des Lépidoptères,* **5**: 186.
Type locality: Iceland. [MNHN]

NOTE—*Crymodes gelida* is a junior synonym of ssp. *exulis* Lefebvre.

NOTE—Viette (1951: 160) designated the lectotype of *Crymodes gelida* Guenée.

Crymodes borea Guenée, 1852, *in* Boisduval and Guenée, *Histoire Naturelle des Insectes. Species Général des Lépidoptères,* **5**: 186.
Type locality: North America; Lapland [probably in error]. [MNHN]

NOTE—*Crymodes borea* is a junior synonym of ssp. *exulis* Lefebvre.

NOTE—Guenée proposed the name *borea* on the basis of a male with pale-lined veins, and a darker female.

Crymodes poli Guenée, 1852, *in* Boisduval and Guenée, *Histoire Naturelle des Insectes. Species Général des Lépidoptères,* **5**: 187.
Type locality: Northern Europe. [MNHN]

NOTE—*Crymodes poli* probably is a synonym of subspecies *marmorata.* Poole (1989) lists it as a synonym of *Apamea maillardi* Geyer, but its small size (it is described as being smaller than *borea*) would eliminate this possibility. Here it is treated as a synonym of ssp. *marmorata* Zetterstedt.

Crymodes exulis var. *doubledayi* White, 1874, *Scottish Naturalist,* **2**: 375.
Type locality: Scotland. [unknown]

NOTE—*Crymodes exulis* var. *doubledayi* is a junior synonym of ssp. *assimilis* Doubleday.

Hadena maillardi var. *vicaria* Püngeler, 1902, *Deutsche Ent. Zeits. Iris,* **15**: 152, pl. 2, fig. 22. NEW SYNONYMY, NEW STATUS, SUBSPECIES.
Type locality: Aksu, Xinjiang, China. [MNHU]

NOTE—The similarity of the genitalia of *vicaria* to that of the *Apamea zeta*-complex was already noted by Zilli et al. (2005).

Protagrotis nichollae Hampson, 1908, *Can. Ent.,* **40**: 102. NEW SYNONYMY, NEW STATUS, SUBSPECIES.
Type locality: Simpson River, British Columbia, Canada. [BMNH]

Hadena ingloria Bang-Haas, 1912, *Deutsche Ent. Zeits. Iris,* **26**: 149. NEW SYNONYMY, NEW STATUS, SUBSPECIES.
Type locality: Sayan Mountains, Siberia, Russia. [MNHU]

NOTE—This subspecies is widely distributed in central and northeastern Siberia as far north as Wrangel Island in the Northeast.

Homoglaea murrayi Gibson, 1920, *Report of the Canadian Arctic Expedition 1913–18,* **3**: 36. NEW SYNONYMY, NEW STATUS, SUBSPECIES.
Type locality: Bernard Harbour, Northwest Territories. [CNC]

Homoglaea johanseni McDunnough, 1933, *Can. Ent.,* **65**: 203.

NOTE—Apparently some sort of lapsus for *Homoglaea murrayi* Gibson, 1920, because no type locality or type material is mentioned (Poole, 1989: 106).

NOTE—*Homoglaea johanseni* is a junior synonym of ssp. *murrayi* Gibson.

Abromias assimilis jenskjeldi Fibiger, Ronkay, and Zilli, 2005, *Noctuidae Europaeae,* **8**: 155. NEW SYNONYMY.
Type locality: Sandur, Faeroe Islands. [ZMUC]

NOTE—Fibiger et al. (2005) treat the taxon *jenskjeldi* as a subspecies of *Apamea assimilis,* which they treated as a species distinct from *Apamea zeta* because of the thicker, hairy, body vestiture, extreme amount of polymorphism in wing pattern, and differences in the cytochrome c oxidase 1 (CO1) mitochondrial gene haplotype (1 % different from *A. zeta zeta*). We interpret these characters as reflecting the isolation of this population in the North Atlantic; most other related species in the *Apamea zeta*-complex (e.g., *A. contradicta* (Smith), *A. euxinia* Hacker, *A. michielii* Varga, *A. niveivenosa* (Grote), and *A. rubrirena* (Treitschke)) are 2–3 % different from *Apamea zeta*; *A. maillardi* (Geyer) is 1.5 % different. As a result, we treat *jenskjeldi* as a synonym of *Apamea zeta,* and as a synonym of subspecies *assimilis,* which has an identical CO1 haplotype. The taxon *jenskjeldi* looks similar to subspecies *exulis,* except that the pale-veined form is more contrasting because of the darker ground color.

Apamea zeta downesi Mikkola. NEW SUBSPECIES.
Type locality: Hazen Camp, Ellesmere Island. [CNC]

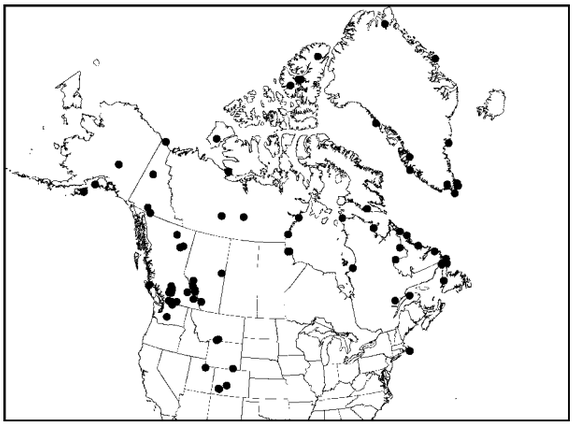


FIGURE 56: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA ZETA*

Apamea zeta pelagica Mikkola. NEW SUBSPECIES.
Type locality: St. Paul Island, Alaska. [CNC]

Apamea zeta is the most polytypic and polymorphic species in *Apamea.* The *Apamea zeta*-complex has had a varied taxonomic history, and the status of various forms and populations continues to be debated. Until relatively recently, *A. zeta* was thought to be a large, pale-gray species (plate 7, figures 19, 20) confined to the various mountain ranges of southern Europe. The northern Eurasian and North American forms were considered to be a separate species, *Apamea maillardi* (Geyer, 1834), with *exulis* classified as a subspecies occurring in Iceland, Greenland, and eastern Canada. This classification was used by Wolff (1971) and Morris (1980). When it was later discovered that *A. maillardi* had fully developed basal abdominal brushes and pockets and subspecies *exulis* did not have brushes or pockets (Birch, 1972; Mikkola and Lafontaine, 1986), *exulis* was raised to species status for the northern European and North American populations and listed as *Crymodes exulis* by Franclemont and Todd (1983) with *alticola* as a subspecies. There are slight differences between the valves of *Apamea zeta* and *A. maillardi*: the cucullus tends to be smaller in *A. zeta* than in *A. maillardi* and in the ventroanterior medial margin of the cucullus there is a spined ridge in *A. zeta,* whereas in *A. maillardi* the margin is mainly smooth except for a bulge with spines near the base of the digitus. On the basis of the lack of the brushes and pockets, and close similarity in the male and female genitalia, Mikkola and Lafontaine (1986) synonymized

Apamea exulis with *A. zeta* and treated *exulis* as a subspecies. Here, we include two other taxa listed as species in Franclemont and Todd (1983), *Crymodes murrayi* and *Protagrotis nichollae,* as subspecies of *Apamea zeta,* and treat subspecies *alticola* as a distinct species. Discovery of populations of the *A. zeta*-complex in the Balkan Peninsula, Asia Minor, southern Siberia, and Mongolia that have vestigial brushes and pockets at various stages of reduction led to the recognition of several additional species (e.g., *Apamea kaszabi* Varga, *A. michielii* Varga, and *A. euxinia* Hacker) because they occur sympatrically with either *A. zeta* or *A. maillardi.* Some of them were proposed as subspecies of *Apamea maillardi* before the significance of the basal abdominal structures were recognized. The slight structural differences among the species of the *A. zeta*-complex leads to the possibility that some disjunct populations might be unrecognized species.

Zilli et al. (2005) relied on preliminary results from molecular analysis of populations of the *Apamea zeta*-complex using cytochrome c oxidase 1 (CO1) mitochondrial gene haplotypes, commonly called ''barcodes,'' to arrange this complex into several species. A population in northern Quebec, thought to be referable to *exulis,* was 2 % different in its CO1 haplotype from any other population. Populations in Greenland, Iceland, northern Europe, and Russia were less than 0.5 % different from each other, and yet were 1.5 % different from populations in southern Europe, and also from those in the Faeroe Islands and Scotland. Zilli et al. (op. cit.) used these data, along with phenotypic differences in the appearance of moths from these areas, to arrange this complex into four species: *A. zeta* (plate 7, figures 19, 20) in southern Europe, *A. groenlandica* in northern Eurasia, *A. assimilis* (plate 7, figures 23, 24) in Scotland and the Faeroes, and *A. exulis* in eastern Canada. While analysis of many more populations of the *zeta*-complex has confirmed this basic pattern of CO1 haplotype differentiation, the population on the East Coast of Hudson Bay (Poste-da-la-Baleine) was found to be an anomaly; and although the individuals from this locality are indistinguishable from those from many other populations in northern Quebec and northern Canada, all other populations sampled are essentially like *A. groenlandica* in their CO1 haplotype. This anomalous situation, together with similar degrees of haplotype differentiation among subspecific, interbreeding populations of *Apamea commoda* and *A. inficita* in western North America, leads us to regard these CO1 data as a worthwhile area for further research, but not in themselves as indicative of specific differentiation in the absence of other compelling structural or behavioral characters. As a result, we treat *exulis* and *assimilis* as subspecies of the Holarctic species *Apamea zeta,* and *groenlandica* as a synonym of subspecies *exulis.* Many other distinctive populations in Eurasia and North America await further research to determine whether subspecific status or specific status is warranted. Research on nuclear DNA sequences, pheromone specificity, and immature stages, not just CO1 and genital characters, is required to resolve the taxonomic status of these populations.

In North America *Apamea zeta* occurs in so many forms, and the size varies so greatly (forewing length: 13–22 mm), that it is difficult to give a meaningful description of the species; this is done more effectively in the subspecific accounts. The few common features of the North American subspecies are 1) the W-mark in the subterminal line, if visible, is shallow; 2) the reniform spot usually has a white or buff outer margin; 3) the orbicular spot is small and rounded, or is obscure; and 4) the crenulate postmedial line usually is visible. The claviform spot may be lacking and usually no black dashes are on the forewing (sometimes a medial dash is in ssp. *pelagica*). The hindwing is relatively dark with a large central lunule, but the hindwing may be pale with a relatively contrasting marginal band, central lunule, and postmedial line, especially in northwestern North American populations.

The only *Apamea* species that occurs with *A. zeta* and is likely to be confused with it is *A. devastator.* The two species can be very similar in northern Quebec and Labrador, but *A. devastator* is longer winged, more evenly colored, and the subterminal line has an even arc or slight unevenness at the position where the shallow W-shaped mark is in *A. zeta.* Males can be separated easily by brushing the scales away to expose the digitus, which is straight in *A. zeta* but medially curved in *A. devastator.*

In the small-sized subspecies (*murrayi, downesi,* and *pelagica*) the male genitalia sometimes appear aberrant with some structures reduced in size, but dissection of a series of specimens shows that all of the characteristics of *A. zeta* can be found. Presence of intermediate forms be-

tween subspecies constitutes further evidence that these taxa are conspecific.

The larva of *Apamea zeta* was described by MacKay (1972) on the basis of caterpillars from northern Greenland and northern Ellesmere Island; those of the European subspecies were described by Bretherton et al. (1979) and Beck (1999). The larva is similar to that of *A. devastator* and is also characterized by a red head that contrasts with an orange-brown prothoracic collar and whitish-gray body. A larva of subspecies *exulis* from southern Greenland and one of subspecies *zeta* from Switzerland are illustrated by Beck (2000, figs. B515, B515′) and Ahola and Silvonen ([2008]: 635). On Ellesmere Island, remains of *A. zeta* caterpillars were found in the stomachs of Arctic Terns (*Sterna paradisaea* Pontoppidan). The caterpillars are easily found when they cross open ground as they are moving from one clump of grass to another (J. A. Downes, pers. comm.). The larva feeds on *Festuca* and *Calamagrostis.*

In North America, *Apamea zeta* occurs from Newfoundland, Labrador, and Greenland westward across northern Canada to Alaska. In the East it generally occurs as far south as eastern Quebec, Newfoundland, and northern Manitoba, but a surprisingly southern record came to light as this fascicle was going to press. It is a female from Donut Bog, a quaking sphagnum bog on Nantucket Island, Massachusetts, far to the south of the known range of *A. zeta exulis,* and suggests the occurrence of a highly isolated relict population. In the West it occurs southward in the mountains to Colorado, northern Utah, and Washington. In Eurasia, *zeta* occurs in Iceland, Spitzbergen, the Faeroes, Orkneys, and Shetlands, Scotland, western Fennoscandia, and from the Pyrenees, Alps, and the mountains of the Balkans eastward across Asia to Mongolia, northern China, and the Russian Far East. Adults have been recorded from late June until early September, although they fly only a few weeks in any one area. In most of the range the adults are nocturnal, but in the far north and in alpine areas, they fly during the day. In the high arctic, at Hazen Lake in northern Ellesmere Island, Canada, and in Pearyland, Greenland, the species occurs between 81° and 82° N, being one of five noctuid species (17 species of Lepidoptera) that occur this far north (Downes, 1966). It is the northernmost night-flying noctuid moth, although in the summer the sun shines 24 hours a day this far north; moths can be found on flowers in the afternoon (Downes, pers. comm.).

The North American populations of *Apamea zeta* are arranged in five subspecies; several populations might also be considered as subspecies but are not named due to lack of material.

Apamea zeta exulis (Lefebvre)
PL. 7, FIGS. 25–28; PL. V, FIG. 3 (♀ gen.).

Hadena exulis Lefebvre, 1836.
Type locality: Labrador. [MNHN]

Hadena gelata Lefebvre, 1836.
Type locality: Labrador. [MNHN]

Exarnis difflua Geyer, 1837.
Type locality: Labrador. [Probably lost]

Hadena groenlandica Duponchel, [1838].
Type locality: Greenland. [USNM]

Mamestra cervina Germar, [1842].
Type locality: Iceland. [Unknown]

Crymodes gelida Guenée, 1852.
Type locality: Iceland. [MNHN]

Crymodes borea Guenée, 1852.
Type locality: North America; Lapland [probably in error]. [MNHN]

In subspecies *exulis* the forewing ground color is brown with viable amounts of gray shading. Of the maculation, usually the buff-lined reniform spot and the pale-lined transverse lines are evident. Northern specimens have slightly reduced eyes and are smaller than those from farther south. The subspecies is highly polymorphic, the three most common forms being 1) a unicolorous form with a with weak pattern, often with extensive hoary-gray shading; 2) a strongly patterned form with contrastingly pale-lined transverse lines and a conspicuous reniform spot; and 3) a mainly strongly patterned form but with some of the wing markings inconspicuous. In Greenland, nearly half of the specimens have the forewing veins pale; this form decreases in abundance in Iceland, and even more so in Newfoundland and Labrador where only 5–10 % of the moths have pale veins. The hindwing is mostly a uniform fuscous with only a slight difference in shade between the basal and outer areas, but sometimes the basal area is pale, which leaves the central lunule and postmedial line visible.

There is considerable geographical variation in subspecies *exulis.* Specimens from coastal Lab-

rador, where *exulis* was originally collected, are brown with a hoary-gray dusting, and similar forms are in southern Greenland and Iceland. Specimens from tundra areas in northernmost Newfoundland (St. Anthony) close to Labrador are similar to those from Labrador, but isolated populations in alpine areas on the mountains in southern Newfoundland are dark brown with an olive-gray hue. Moths from inland Labrador are more monotonous gray and form a cline toward subspecies *murrayi* farther west in Quebec. In southeastern Labrador and adjacent easternmost Quebec, gray forms fly with blackish-brown specimens with yellowish markings reminiscent of the Scandinavian subspecies *marmorata* Zetterstedt. In the Gaspe Peninsula the moths are yellowish brown to brownish gray with weak markings, but the hindwing is pale with a distinct dark marginal band.

Subspecies *exulis* occurs in eastern Canada (Newfoundland, Labrador, southeastern Quebec), Nantucket, Massachusetts, southern and central Greenland, and Iceland in tundra areas and coastal heaths. The moths are mainly on the wing from mid-July to late August.

Apamea zeta downesi Mikkola, NEW SUBSPECIES
PL. 7, FIG. 29.

Apamea zeta downesi Mikkola.
Type locality: Hazen Camp, Ellesmere Island, Canada. [CNC]

NOTE—This subspecies is named in honor of the late J. A. Downes, a pioneer of research on the Lepidoptera of northern Canada and northern Greenland.

This is the northernmost taxon in the Noctuidae; all specimens were collected north of the 79th parallel. No other taxon of Lepidoptera is restricted to the High Arctic. The differences between subspecies *downesi* and other subspecies of *zeta* suggest a long period of isolation, so it is possible that this taxon is a relict population from the Pearyland Glacial Refugium in northern Greenland. Subspecies *downesi* is described, assuming that it is genetically more or less isolated from subspecies *exulis.* The deep water sounds around Devon Island in northern Canada, and the glaciated coasts of Greenland constitute a barrier between *downesi* and *exulis.* Specimens of *exulis* from central Greenland (Sondrestrom Air Base) differ clearly from *downesi* and belong to subspecies *exulis.*

Subspecies *downesi*: generally smaller (forewing length: 13–16 mm) than subspecies *exulis* (forewing length: 13–20 mm); material of *exulis* from central Greenland similar to *downesi* in size. Eye reduced, ellipsoid. Male antenna and palpi as in subspecies *exulis.* Forewing unicolorous, powdery, pale to dark brownish gray, maculation faint; transverse lines usually diffuse; subterminal line sometimes contrastingly paler than ground color; antemedial and postmedial lines visible only rarely as simple black crenulate lines, but not lined by buff scales; veins frequently paler than ground color. Hindwing mostly dark fuscous, but occasionally pale toward base.

TYPES. **Holotype:** ♀. 364/2/2 Hazen Camp, 81°49′ N, 71°16′ W, [Ellesmere Island, Canada]; 9 July 1962; J. A. Downes. CNC. **Paratypes:** 11 ♂, 8 ♀. **Canada.** Same locality as holotype; 30 June–20 July, 1961–1967; J. A. Downes, P. Kevan, R. B Madge, and D. Shorthouse. CNC, USNM.

Subspecies *downesi* is described from the northern part of the Ellesmere Island (Lake Hazen area), but also occurs on the Fosheim Peninsula in the western part of the island, on Axel Heiberg Island, and in Pearyland in northern Greenland. It mainly flies in July on arctic tundra. Collecting dates range from 24 June to 14 August. The moths were observed visiting flowers in mid-afternoon, but it is not known if they do this during the local ''night.'' Larvae were found when they were wandering across bare soil between the isolated clumps of grass (J. A. Downes, pers. comm.).

Apamea zeta murrayi (Gibson)
PL. 7, FIGS. 30–32.

Homoglaea murrayi Gibson, 1920.
Type locality: Bernard Harbour, Northwest Territories, Canada. [CNC]

Homoglaea johanseni McDunnough, 1933, lapsus.

This mainly gray subspecies occurs from Banks Island and the central parts of the Canadian arctic in Nunavut, southward to central Quebec, northern Manitoba, and mainland Northwest Territories at Bernard Harbour. Subspecies *murrayi* was listed as a species by Franclemont and Todd (1983), but with the accumulation of much additional material, it is clear that the type material

of *murrayi* is at the extreme end of a geographical cline that extends to eastern Quebec. The adult varies from small to medium-sized (forewing length: 14–18 mm). In the northern part of the range, the moth is smaller, more uniformly colored; the forewing tends to be narrower; and the eye is more reduced. The forewing ground color varies from light silvery gray through darker smoky gray to brownish gray, but always is much more gray than subspecies *exulis.* The maculation is more or less washed out, the transverse lines obscure or, if visible, represented by simple, dark, crenulate lines. On the northern coast of mainland Northwest Territories (Bernard Harbour), and on Banks Island, subspecies *murrayi* is uniformly brownish gray with faint markings. In the Hudson Bay area (e.g., Digges Island and Chesterfield Inlet, Nunavut, and Churchill, Manitoba), the forewing is pure gray with prominent black maculation and the hindwing is pale basally with a distinct fuscous marginal band and central lunule. The variable forewing coloration may be a response to the background color, so the gray color is probably related to the calcareous scree on which the moths rest. On the eastern coast of Hudson Bay (Poste-da-la-Grand-Baleine, Quebec), the moths have a more variegated appearance, and this trend continues eastward. The moths from central and northeastern Quebec (Schefferville, Indian House Lake, Fort Chimo) and northern Labrador (Nutak) are darker and more maculate, but still are devoid of brown hues characteristic of subspecies *exulis.* Nevertheless, the increase of maculation eastward appears to denote intergradation to subspecies *exulis.* On the Labrador coast, the moths from Nutak look like subspecies *murrayi,* whereas those from Hopedale farther south look like subspecies *exulis.*

Subspecies *murrayi* occurs from Banks Island and the northern Coast of mainland Northwest Territories eastward and southward to northern Manitoba, northern Quebec, and northern Labrador. Adults occur mostly in July, but dates range from 4 July to 16 August.

Apamea zeta pelagica Mikkola, NEW SUBSPECIES
PL. 7, FIG. 33.

Apamea zeta pelagica Mikkola.
Type locality: St. Paul Island, Alaska. [CNC]

NOTE—The subspecies name refers to the marine conditions of the type locality.

This small subspecies is known only from the St. Paul Island, Alaska, in the Bering Strait where it was collected over a period of nine years. From its external appearance it is most similar to subspecies *exulis* and *downesi,* but geographically it is widely isolated from them. In addition to small size, the moth is narrow winged, and the forewing veins are almost always a contrasting buff or pale gray.

Forewing length: 15–18 mm. Eye reduced. Palpus covered with buff and brown scales and hairs, often intermingled with dark scales, at least laterally. Forewing narrow, more so than any other taxon of *Apamea*; ground color pale brownish gray to dark blackish brown; wing pattern faint, only outer margin of reniform spot contrasting; transverse lines double and filled with buff in some specimens. Forewing veins lighter than ground color in more than half of moths. Hindwing mostly pale buff with darker marginal band. In dark specimens, hindwing also darker; in specimens with pale forewing veins, hindwing veins also pale. Fringe of forewing and hindwing pale creamy white, sometimes with slightly reddish tint.

TYPES. **Holotype:** ♂. St. Paul Island, Alaska; 8 July 1941; E. C. Johnston. CNC. **Paratypes:** 24 ♂, 3 ♀. **Alaska.** Same locality and collector as for holotype; 26 June–7 July 1940, 2–14 July 1941, 2 August 1946, 29 June 1947, 7 July 1948. CNC, LACM, MZH, UCD, USNM.

Subspecies *pelagica* is known only from St. Paul Island, Alaska.

Apamea zeta nichollae (Hampson)
PL. 7, FIGS. 34–36; PL. 8, FIGS. 1–5; PL. A, FIG. 4 (abdomen); PL. B, FIG. 3 (♀ gen.); PL. L, FIG. 6 (♂ gen.).

Protagrotis nichollae Hampson, 1908.
Type locality: Simpson River, British Columbia, Canada. [BMNH]

The name *nichollae* has been incorrectly associated with the *Apamea niveivenosa*-complex because Hampson believed that there were some sclerotized setae on the tibia as in *A. niveivenosa.* The moth is relatively large (forewing length: 16–21 mm), larger than other western subspecies. It most closely resembles *Apamea zeta* subspecies *ingloria* (Bang-Haas) (plate 7, figures 21, 22), which flies in the mountains of southern Siberian and Mongolia. The forewing is broadly triangular

and powdery in appearance. The ground color varies from pale yellowish gray, or olive gray, to dark gray speckled with black scales. The forewing pattern is a relatively faint. The outer margin of the reniform spot is buff, and the transverse lines are strongly crenulate; the fringe is gray with a yellow dot at the end of each vein. The hindwing is fuscous, slightly paler toward the base. There is some geographical variation in that specimens from western Alberta are mainly pale yellowish gray, whereas those from southwestern British Columbia are dark gray with a yellowish tint.

Most records of this subspecies are from southwestern Alberta and southern British Columbia, mostly at elevations of 5,000′ to 7,500′, but it occurs as far north as Alaska and as far south in the Cascades to northern Washington, and in the Rocky Mountains to Utah and southern Colorado, where it flies above 11,000′.

Two deviant specimens from Yukon are tentatively assigned to subspecies *nichollae.* The forewing is rusty brown, and the markings are a faint dark brown (plate 7, figure 36). Among specimens of subspecies *nichollae* from Pink Mountain in north-central British Columbia, some approach these Yukon specimens in color and pattern, so a cline may exist in northern British Columbia. Another unusual form occurs at Mt. McKinley National Park, Alaska (plate 7, figure 34). It is reddish brown, like the Yukon specimens, but is larger, the wing shape is more broadly triangular, and the reniform spot is more conspicuous. More material is needed from northwestern North America before the status of these forms can be addressed. The moths fly from late June to mid-August.

Apamea alticola (Smith)
PL. 8, FIGS. 6, 7; PL. B, FIGS. 1, 2 (♂ gen.); PL. M, FIG. 1 (♂ gen.); PL. V, FIG. 4 (♀ gen.); TEXT FIG. 57 (map) (RWH 9385, part).

Xylophasia alticola Smith, 1898.
Type locality: Gibson Mts., Colorado, USA. [USNM]

We debated at length whether to treat *alticola* as a high elevation subspecies of *A. zeta* or as a species. The molecular data were inconclusive, with *alticola* differing from populations of *A. zeta* from farther north in the cytochrome c oxidase 1 (CO1) mitochondrial gene sequence by about

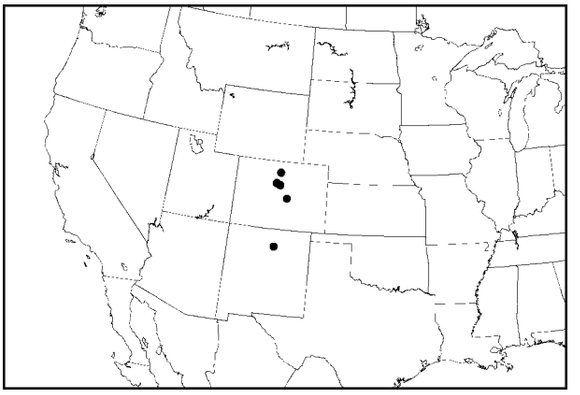


FIGURE 57: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA ALTICOLA*

1.2 %, a comparable difference to that among three of the subspecies of *A. zeta* in Europe, namely ssp. *marmorata, assimilis,* and *zeta.* We opted for species status for *alticola* because specimens typical of *A. zeta* subspecies *nichollae* occur elsewhere in Colorado, at or above treeline, as for *alticola,* and yet look like typical *nichollae.* The CO1 barcodes of these Colorado "*nichollae,*" are as different from those of *alticola* as are some highly disjunct populations of *zeta,* suggesting a genetic isolation of the Colorado *nichollae* from populations farther north, but also from *alticola.* The differences between the Colorado *alticola* (plate 8, figures 6, 7) and Colorado *nichollae* (plate 8, figure 5) are very striking both in pattern and size (forewing length: *alticola* 15–17 mm; Colorado *nichollae* 20–21 mm). Typical *Apamea alticola* (plate 8, figure 6) is characterized by small size, the extensive white shading in the reniform and orbicular spots, the postmedial line, and often in the subterminal area, and the olive-gray ground color of the forewing. A population on Pike's Peak has an orange forewing with pale orange in the basal and subterminal areas and reniform and orbicular spots and darker orange in the medial and terminal areas (plate 8, figure 7). The eye is reduced and ellipsoid as for high altitude and high arctic populations of *Apamea zeta.*

Apamea alticola occurs mainly in Colorado at altitudes of 10,000′ to 13,000′; one specimen is known from northern New Mexico. The flight season extends from mid-July to early August. It flies during the daytime above tree line keeping close to the ground over low alpine vegetation.

Apamea rubrirena (Treitschke)
PL. 8, FIGS. 8, 9; PL. M, FIG. 2 (♂ gen.); PL. V, FIG. 5 (♀ gen.); TEXT FIG. 58 (map).

Mamestra rubrirena Treitschke, 1825, *Die Schmetterlinge von Europa,* **5** (2): 159.
Type locality: Thrnau, Hungary. [HNHM]
NOTE—The lectotype of *rubrirena* was designated by Koch (1965).

Hadena feisthamelii Boisduval, 1833, *Ann. Soc. Ent. France,* **2**: 375.
Type locality: Chamouny Region, France. [BMNH]

Mamestra sylvicola Eversmann, 1843, *Bull. Soc. Impériale Naturalistes Moscou,* **16**: 547.
Type locality: Urals, Russia. [ZIN]

Hadena rubrirena var. *hercyniae* Staudinger, 1871, *in* Staudinger and Wocke, *Catalog Lepidopteren Europaeischen Faunengebiets,* p. 100.
Type locality: Germany. [MNHU]

Crymodes shibuyae Matsumura, 1925, *Jour. College Agric. Hokkaido Imperial University, Sapporo,* **15**: 140.
Type locality: Sakhalin, Russia. [EIHU]

Hadena rubrirena ssp. *abnoba* Guth, 1932, *Internationale Ent. Zeits.,* **26**: 365.
Type locality: Black Forest, Germany. [unknown]

Hadena rubrirena form *intermedia* Guth, 1932, *Internationale Ent. Zeits.,* **26**: 366.
Type locality: Black Forest, Germany. [unknown]

Hadena rubrirena ssp. *fennica* Guth, 1932, *Internationale Ent. Zeits.,* **26**: 367.
Type locality: Kuusamo, Finland. [unknown]

Crymodes shibuyae kurilirena Bryk, 1942, *Deutsche Ent. Zeits. Iris,* **56**: 48.
Type locality: Uruo, Kurile Islands, Russia. [NRS]

Crymodes rubrirena ssp. *miriquidoi* Koch, 1963, *Reichenbachia,* **2**: 51.
Type locality: Osterzgebirge [Osterz Mountains], Germany. [unknown]

Crymodes rubrirena ssp. *rhaetonorica* Koch, 1965, *Reichenbachia,* **4**: 262.
Type locality: Pontresina, Switzerland. [unknown]

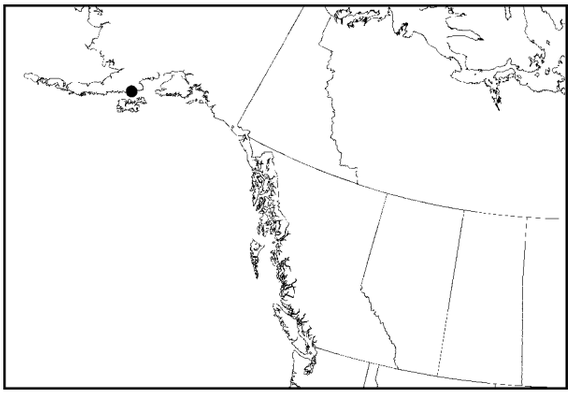


FIGURE 58: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA RUBRIRENA*

Crymodes rubrirena ssp. *asciburgensis* Koch, 1965, *Reichenbachia,* **4**: 263.
Type locality: Riesen Mountains, Czech Republic. [unknown]

Apamea rubrirena ssp. *marginipicta* Varga, 1973, *Acta Biologica Debrecina,* **10–11**: 204.
Type locality: Vitosa, Bulgaria. [HNHM]

Apamea rubrirena ssp. *pacifica* Sugi, 1982, *in* Inoue et al., *Moths of Japan,* **1**: 740.
Type locality: Mt. Chausu-dake, Akaishi Range, Honshu, Japan. [Sugi Coll., Tokyo]

Apamea ontakensis Sugi, 1982, *in* Inoue et al., *Moths of Japan,* **1**: 740. NEW SYNONYMY.
Type locality: Ontakesan, Honshu, Japan. [Sugi Coll., Tokyo]

Apamea wasedana Sugi, 1982, *in* Inoue et al., *Moths of Japan,* **1**: 740. NEW SYNONYMY.
Type locality: Iide-san, Honshu, Japan. [Sugi Coll., Tokyo]

This large-sized *Apamea* (forewing length: 19–24 mm) is easily recognized by the reddish-yellow or yellowish-buff reniform spot (and often orbicular spot) that contrasts with the darker orange-brown to black ground color of the forewing. According to Zilli et al. (2005) numerous attempts to arrange the local and geographical variation into subspecies has been unsuccessful, so no subspecies are recognized. In spite of its distinctive appearance, *A. rubrirena* is surprisingly close to *A. zeta* in both structural characters and in molecular similarity.

The immature stages of *A. rubrirena* were described and illustrated by Beck (1999, 2000, figs. B517, B517′) and Ahola and Silvonen ([2008]: 635). The larva is very similar to that of *A. zeta* (illustrated by Beck, 2000, fig. B515) and *A. devastator,* although it also has a form with a dark head, prothoracic collar, and pinacula (Beck, 2000, fig. B517) and Ahola and Silvonen ([2008]: 635).

Apamea rubrirena occurs across Eurasia from the mountains of central Europe and the lowlands of Fennoscandia eastward across northern Asia to the Russian Far East, Japan, and Korea (Zilli et al., 2005). In North America it has been recorded only at Kukak Bay, Alaska, where it was found by the Harriman Expedition on July 4, 1899 [USNM]. The flight season in Eurasia is from late June until early September. The species is usually found at high elevations at or near treeline in the southern parts of its range, but in the North it flies in lowland forests.

Apamea contradicta (Smith)
PL. 8, FIGS. 22–24; PL. M, FIG. 3 (♂ gen.); PL. V, FIG. 6 (♀ gen.); TEXT FIG. 59 (map) (RWH 9394).

Hadena exornata Möschler, 1860, *Wiener Ent. Monats.,* **4**: 364.
Type locality: Labrador. (MNHU, Berlin)

NOTE—Möschler (1860) had two pairs (not one pair as stated by Poole, 1989) from Labrador. A large female in good condition in MNHU (Berlin) labeled ‘‘Type, Wien Mts., 1860, 364, t. 9.5./ Labrador n. F. 64 [green]/ Origin [red]/ Coll. Möschl.’’ is here designated LECTOTYPE to ensure the stability of the name. Poole (1989) noted that *Hadena exornata* Möschler, 1860, is a junior primary homonym of *Hadena exornata* Walker, 1858, and replaced it with *contradicta* Smith.

Xylophasia contradicta Smith, 1895a, *Ent. News,* **6**: pl. 15, fig. 13.
Type locality: Calgary, Alberta. [USNM]

NOTE—Todd (1982: 56) refers to Smith’s (1895b: 28) words ‘‘Mr. Dod says this is a unique . . .’’ and considers the specimen in the USNM to be a holotype. Poole (1989) follows Todd in referring to the type as a holotype. Actually, Smith’s sentence continues with the phrase ‘‘and it certainly is a very pretty species,’’ suggesting that the appearance of the species could be unique and not the specimen. Accordingly, a male in the USNM with the left forewing missing labeled ‘‘Type, No. 12, U.S.N.M. [red]/ *Xylophasia contradicta* Type Smith [white, red border]/ Calgary 22/VI/94, Treacle/ 12/ Genitalia Slide By-, USNM 39189/ male genitalia on slide Dec. 7, 1936, J.F.G.C. #856’’ is here designated LECTOTYPE to ensure the stability of the name. Apparently, Smith (1895b) determined the sex of this specimen incorrectly. Smith, 1895a, refers to the figure; the taxon was described in Smith, 1895b: 28.

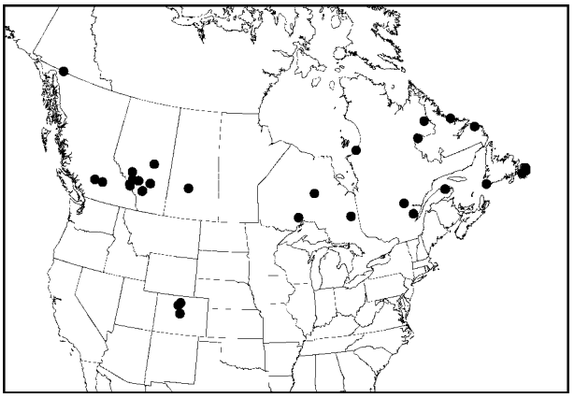


FIGURE 59: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA CONTRADICTA*

Apamea contradicta is a robust and relatively large species (forewing length: 17–21 mm) with a very distinctive forewing pattern The forewing is orange brown, darker in the medial and terminal areas, with the transverse lines black and contrasting and with only slight indentations. The reniform and orbicular spots are mainly defined as pale spots or as pale-outlined spots. The hindwing is fuscous with a darker postmedial line and discal spot and a reddish-orange fringe. Specimens from the northern part of the range tend to be smaller and paler than those from farther south.

The immature stages are unknown.

Apamea contradicta is a boreal zone species occurring in conifer forests, peat bogs, and alpine meadows. It occurs from Newfoundland and Labrador westward to southeastern Alaska and southern Yukon southward to south-central Quebec, northern Ontario, south-central Alberta, and south-central British Columbia. Populations in Colorado appear to be disjunct. The adults have been recorded from late June until late August.

Apamea niveivenosa (Grote)
PL. 8, FIGS. 10–21; PL. M, FIG. 4 (♂ gen.); PL. V, FIG. 7 (♀ gen.); TEXT FIG. 60 (map) (RWH 9374, 9375, 9376).

Agrotis niveivenosa Grote, 1879, *Bull. U. S. Geol. Geog. Surv. Terr.,* **5**: 206.
Type locality: Colorado, USA. [AMNH]

NOTE—The holotype is not in the BMNH as stated by Poole (1989), but in the AMNH. It probably came there with Graef's collection (Smith, 1893: 131).

Agrotis viralis Grote, 1880, *Bull. U. S. Geol. Geog. Surv. Terr.,* **6**: 260.
Type locality: Nebraska, USA. [BMNH]

NOTE—The lectotype of *Agrotis viralis* was designated by Hampson (1903: 656). This is the pale form of *niveivenosa* that occurs in drier areas of the western Great Plains and eastern Great Basin.

Luperina extensa Smith, 1905, *Jour New York Ent. Soc.,* **13**: 203. NEW SYNONYMY.
Type locality: Regina, Saskatchewan, Canada. [AMNH]

Perigea flavistriga Smith, 1905, *Jour New York Ent. Soc.,* **13**: 204.
Type locality: Lethbridge, Alberta, Canada. [AMNH]

Protagrotis obscura Barnes and McDunnough, 1911, *Jour New York Ent. Soc.,* **19**: 154.
Type locality: Reno, Nevada, USA. [USNM]

NOTE—*Protagrotis obscura* is a junior secondary synonym of *Noctua obscura* Haworth, 1809, which is a junior synonym of *Noctua remissa* Hübner, [1809].

Apamea obscuroides Poole, 1989, *Lepidopterorum Catalogus,* **118**: 1085. NEW SYNONYMY, NEW STATUS, SUBSPECIES.

NOTE—*Apamea obscuroides* ia a replacement name for *obscura* Barnes and McDunnough.

NOTE—A male in the USNM in good condition labeled "*Protagrotis obscura* B. & McD. Type ♂/ Reno, Nevada/ Barnes Collection" is here designated lectotype of *Apamea obscuroides* Poole.

NOTE—The genus *Protagrotis* Hampson, 1903 was synonymized with *Apamea* Ochsenheimer, 1816 by Poole (1989: 107). Of the four species included in the genus *Protagrotis* by Franclemont and Todd (1983), three are synonymized with *Apamea niveivenosa* (Grote), and one, *nichollae* Hampson, is synonymized with *Apamea zeta* (Treitschke) and treated as a subspecies.

Apamea niveivenosa is a small to medium-sized (forewing length: 16–19 mm) polymorphic species. The wing shape is characteristic because of the relatively straight costal margin and the rounded outer margin. It has been treated as three species with the eastern melanic form (*extensa*), and a pale, obscurely marked, western form (*obscura,* recently changed to *obscuroides*) thought to be separate species. The nominate form is the most common and widespread form (plate 8, figures 10, 11); it has a blackish-brown forewing with the veins, costa, and the reniform and orbicular spots white or pale buff; a black streak in the fold between the antemedial and postmedial lines is darker than the ground color. This form and the melanic form (plate 8, figure 12) that lacks most of the pale streaking on the veins, but still has the darker streak in the fold, are unlikely to be confused with any other *Apamea.* The melanic form constitutes about 10 % of the populations in the East and probably even more in the West. The pale form (plate 8, figures 20, 21) occurs from southern British Columbia southward to central California and western Nevada; but there is a wide area to the east of this where the two subspecies blend together, and moths typical of both subspecies occur with a wide range of intermediates (plate 8, figures 13–19). These western specimens can be confused with *Apamea inficita,* which occurs mainly to the north and east of the range of subspecies *obscuroides,* but *A. niveivenosa* lacks the contrasting dark spot in the lower part of the reniform spot characteristic of *A. inficita.* Pale specimens of *A. niveivenosa* can be very difficult to distinguish from some specimens of *Resapamea innota* (Smith) and pale western forms of *Resapamea passer* (Guenée) (both were in the genus *Luperina* Boisduval until recently). The reniform spot in species of *Resapamea* Varga and Ronkay is broader and more

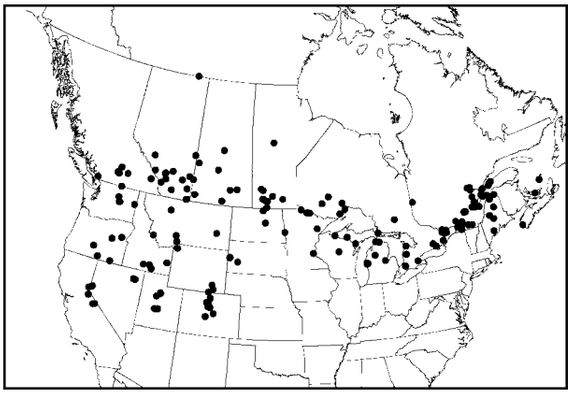


FIGURE 60: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA NIVEIVENOSA*

kidney shaped than in *A. niveivenosa,* and usually there is a trace of a claviform spot, but none of a dash in the fold. In *A. niveivenosa* the reniform spot is narrower, more rectangular; and if there is a streak in the fold, it is in the outer part of the medial area and not at the position of the claviform spot. Also, *A. niveivenosa* has 1–3 sclerotized spiniform setae between the medial and apical pairs of tibial spurs on the hindtibia; these spinelike setae are absent in species of *Resapamea.* Males of *Resapamea* lack the long digitus that projects ventrally from the valve in *Apamea niveivenosa*; the presence or absence of a digitus can be seen be brushing away some of the scales covering the end of the valve. The male of *A. niveivenosa* has a biserrate antenna, whereas males of species of *Resapamea* have filiform antennae.

The immature stages of *A. niveivenosa* are unknown.

Apamea niveivenosa occurs from Nova Scotia and Quebec westward across central and southern Canada to the West Coast of British Columbia. An apparently disjunct population is in the southern Northwest Territories. The range of *A. niveivenosa* extends southward to Maine, New York, Michigan, Minnesota, North Dakota, the Black Hills of South Dakota, and the mountains of Colorado, Utah, Nevada, and east-central California. Adults have been recorded from early July to mid-August in the East, but in the West, they fly as early as early June and occasionally late April at lower elevations, and as late as the end of August at high elevations. Populations of *A. niveivenosa* are arranged in two subspecies.

Apamea niveivenosa niveivenosa (Grote)
PL. 8, FIGS. 10–16; PL. V, FIG. 7 (♀ gen.).

Agrotis niveivenosa Grote, 1879
Type locality: Colorado, USA. [AMNH]

Agrotis viralis Grote, 1880.
Type locality: Nebraska, USA. [BMNH]

Luperina extensa Smith, 1905.
Type locality: Regina, Saskatchewan, Canada. [AMNH]

Perigea flavistriga Smith, 1905.
Type locality: Lethbridge, Alberta, Canada. [AMNH]

Apamea niveivenosa niveivenosa can be recognized by the pale streaking on the veins that contrasts with the darker ground color. This streaked pattern is most obvious in the typical eastern form (plate 8, figures 10, 11), but is also evident in the melanic form (*extensa,* plate 8, figure 12) and in paler specimens from the zone of intergradation with subspecies *obscuroides* (plate 8, figures 13–16).

The nominate subspecies occupies most of the geographical distribution of the species, except the far West, where subspecies *obscuroides* occurs. The moths fly from early July to late August.

Apamea niveivenosa obscuroides Poole
PL. 8, FIGS. 17–21; PL. M, FIG. 4 (♂ gen.).

Protagrotis obscura Barnes and McDunnough, 1911. UNAVAILABLE, HOMONYM.
Type locality: Reno, Nevada. [USNM]

Apamea obscuroides Poole, 1989.
Type locality: Reno, Nevada. [USNM]

Apamea niveivenosa obscuroides has a pale-orange or yellow-brown forewing with the maculation, if present, appearing pale and washed out. Darker specimens show traces of the pattern elements of subspecies *niveivenosa.* In some specimens the wings may be longitudinally streaked. A wide zone of intergradation with subspecies *niveivenosa* is in south-central British Columbia, Idaho, eastern Nevada, and western Utah.

The subspecies *obscuroides* occurs from southwestern British Columbia southward through Washington and Oregon to Nevada and east-central California. The moths fly from early June to mid-August.

Apamea lintneri (Grote), NEW COMBINATION
PL. 8, FIGS. 25–27; PL. M, FIG. 5 (♂ gen.); PL. V, FIG. 8 (♀ gen.); TEXT FIG. 61 (map) (RWH 9395).

Ommatostola lintneri Grote, 1874, *Bull. Buffalo Soc. Nat. Sci.,* **1**: 112.
Type locality: New York. [BMNH]

NOTE—The male in good condition labeled ''Syntype [round, blue border]/2/30/2588/ U. S. America/ Grote Coll. 81-116./ *Ommatostola lintneri* Grote Type [red border]/ Type status verified, M. R. Honey 1992'' is here designated LECTOTYPE to ensure the stability of the name.

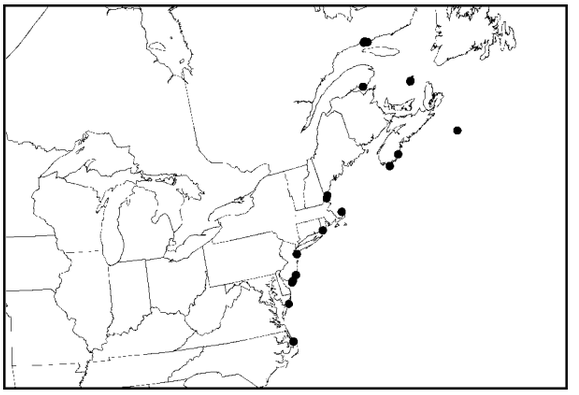


FIGURE 61: DISTRIBUTION OF MATERIAL EXAMINED OF *APAMEA LINTNERI*

Apamea lintneri is a medium-sized species (forewing length: 17–20 mm) of East Coast dunes and until now, has been in the monotypic genus *Ommatostola* Grote. It looks more like a species of *Mythimna* Ochsenheimer or *Archanara* Walker than an *Apamea* because of the pale, longitudinally streaked forewing. The white hindwing of *A. lintneri* distinguishes it at glance from most other similar species. The forewing is straw colored with a light olive hue; the veins are white, often lined with dark scales, especially in the terminal area; the reniform and orbicular spots are barely discernible as slightly paler patches; in some specimens a row of tiny black dots represents the postmedial line. Usually a pale streak extends through the orbicular and reniform spots into the subterminal area and a darker streak is immediately below this along the cubital vein; this pattern is unique and diagnostic for *A. lintneri.* The hindwing is white, unlike that of most species of *Apamea,* sometimes with a pale-buff wash, especially on the veins.

The male genitalia are unusual in several features; the cucullus is relatively narrow with only a slight ''neck''; the digitus is abruptly tapered to a sharp, down-curved point; the base of the sacculus is broadly rounded dorsally; and the vesica has an elongated subbasal diverticulum and a subbasal cornutus may be present or absent. The female genitalia are similar to those of *A. niveivenosa.*

Apamea lintneri occurs in beach dune habitats from the Gulf of St. Lawrence, Quebec, southward along the Atlantic Seaboard to northern North Carolina. The flight season extends from early August until mid-September.

IMMATURE STAGES AND LIFE HISTORY OF *APAMEA LINTNERI* (by Eric L. Quinter). The larva is a subterranean cutworm specializing on *Ammophila breviligulata* Fernald (American beach grass, or marram grass). Forbes (1954: 188) refers to a larva frequently found in its habitat and believed to be that of *Apamea lintneri* that is ''white with yellowish chitinized parts, and has totally lost the prolegs, travelling by wiggling through the sand.'' This description by Forbes (1954) applies to some other species, perhaps *Euxoa detersa* (Walker). Tietz (1972: 390) lists the host as *Arenaria* L. (sandwort) without any reference, and K. Neil (1991: 204) likewise reports *Arenaria* as the host on Sable Island, Nova Scotia. Both records are almost certainly incorrect. The confusion likely results from earlier botanical treatments of the host grass under the name *Ammophila arenaria* (L.), a closely related European grass which has been introduced on occasion into North America in attempts to stabilize dunes. I have found larvae in abundance on Sable Island, in the absence of sandwort, feeding 5–10 cm below the surface on the culms of *Ammophila breviligulata,* which is the dominant grass on the dunes there. The larvae reach maturity on Sable Island by early to mid-July, and pupation occurs in a compact cell formed in moist sand at least 5 cm below the surface. Adult emergence follows in three to four weeks.

GENUS

Loscopia Beck

by E. L. Quinter and J. D. Lafontaine

Loscopia Beck, [1992], *Atalanta,* **22**: 212.
Type species: *Phalaena Noctua scolopacina* (Esper, [1788]). Original designation.

Sinapamea Rakosy, 1996, *Die Noctuiden Rumäniens* (*Lepidoptera, Noctuidae*).
Type species: *Phalaena Noctua scolopacina* (Esper, [1788]). Original designation.

NOTE—*Sinapamea* Rakosy, 1996 is a junior objective synonym of *Loscopia* Beck, [1992].

The genus *Loscopia* was proposed by Beck for the enigmatic species *Phalaena scolopacina* Esper, which had been associated with *Apamea* for many years. It was retained in *Apamea* by Zilli et al. (2005), but we reinstate *Loscopia* and include two North American species in it. Like *Apamea,* adults of *Loscopia* have four ventral rows of spiniform setae on tarsal segments 2–5.

The most significant differences between *Loscopia* and *Apamea* are 1) the asymmetrical valves with enlarged process on the dorsal and posterior margins of the sacculi; 2) long juxta; 3) long, curved aedeagus; 4) vesica without basal cornuti but with subapical spined area; 5) dorsal ''throat'' of ostium bursae spined; and 6) apical seta on labial palpus of larva short. In addition to *Loscopia scolopacina,* the only Eurasian species in the genus, we associate *Loscopia velata,* recently included in *Amphipoea* Billberg, with the genus *Loscopia* and describe *Loscopia roblei,* a new species from eastern United States. The genitalia of *Loscopia scolopacina* are illustrated for comparison (plate N, figure 1; plate W, figure 1). The genus *Loscopia* includes some but not all of the derived character states of the genus *Protapamea* Quinter, described below, so including *Loscopia* within *Apamea* would make *Apamea* a paraphyletic group.

DIAGNOSIS OF THE GENUS *LOSCOPIA*. Adults of the genus *Loscopia* are superficially similar to those of *Apamea* in most characters; they are most easily distinguished from *Apamea* by genital characters, and the distinctive habitus of the three species. The male antennae of two species (*L. scolopacina, L. velata*) are filiform and setoseciliate, like species in the *Apamea crenata*-group. In one species (*L. roblei*) the antenna is slightly beadlike and setose-bifasciculate, with the segments of the antenna very slightly swollen mesially. The forewing shape differs slightly among the three species; the apex is squared off in *L. roblei,* slightly produced in *L. scolopacina,* giving it a long-winged appearance, and slightly concave in *L. velata,* with the apex slightly falcate. The reniform spot on the forewing is strongly constricted mesially, giving it a somewhat figure 8 shape, and the spot is partially to completely outlined by a thin white line. The moths are relatively small (forewing length: 14–17 mm). The abdomen has dorsal tufts on the basal five segments with those on 1, 3, and 4 the largest, the one on segment 2 slightly smaller, and the one on segment 5 small. As in most species of *Apamea,* the abdomen of the male bears a central tuft of long hairlike scales forming an anal brush on the eighth sternum, and in two species there are fully developed brushes and pockets at the base of the abdomen; the brushes and pockets are absent in *L. scolopacina.* The seventh sternum in females of *Loscopia* differs from those of *Apamea* species in having a deep central cleft on the posterior margin. Further, the ventral margins of the eighth sternite defining the opening to the ostium bursae in *Loscopia* females are subparallel, and form an acute angle with respect to the lamella antevaginalis; those of *Apamea* are likewise subparallel, but instead form an obtuse angle.

The male genitalia differ from those of *Apamea* in five features: 1) the valves are bilaterally asymmetrical with respect to the shape of the sacculi (the dorsal process and the posterior process of the sacculus differs between the right and left valves); 2) the juxta is much longer than in *Apamea,* about 2 × as long as wide; 3) the aedeagus is longer and more curved than in *Apamea* and the sclerotization extends onto the basal ⅓ of the vesica; 4) there are no cornuti near the base of the vesica; and 5) the spinules on the surface of the vesica are enlarged into a cluster of slender spines near the apex of the vesica in the two North American species. The female genitalia are characterized by the dense field of sharp spines on the lamella postvaginalis pointing into the throat of the ostium bursae, and the ductus bursae is much more heavily sclerotized on the left side than on the right side.

Male genitalia (plate N, figures 1–3): uncus dorsoventrally flattened, sharply down-curved near base, swollen subapically, about 1.5 × wider than subbasal width; apical part of uncus slightly recurved dorsally in *L. scolopacina* and *L. velata*; peniculus enlarged laterally to form rectangular plate supporting tuft of hairlike setae; juxta elongated, 2 × as long as basal width; valve with subapical ''neck'' defining cucullus; ventral margin of valve evenly convex to ¾ distance from base, then abruptly angled dorsally into deep notch at anteroventral edge of cucullus; dorsal margin of valve evenly concave to ¾ distance from base, then abruptly angled dorsally to form rounded or pointed process at anterodorsal edge of cucullus; cucullus triangular with full apical corona in *L. roblei,* cucullus slightly reduced with corona on dorsal ½ of outer margin in *L. scolopacina* and *L. velata*; valves bilaterally asymmetrical with respect to shape of sacculus; process on dorsal margin of sacculus much larger than in *Apamea* and larger and more rounded on right valve than on left one; posterior extension on sacculus larger on right valve than on left in *L. scolopacina* and *L. velata,* larger on left valve than on right valve in *L. roblei*; clasper a narrow, barlike sclerite extending from apex of sacculus

⅔ of distance to cucullus; clasper with narrow, setose ampulla projecting posterodorsally from dorsal arm of clasper; ampulla 7–10 × as long as wide; costal margin of valve heavily sclerotized, becoming free from surface of valve toward cucullus to form digitus; digitus abruptly angled near neck of cucullus to project posteroventrally along anteroventral margin of cucullus; cucullus broad and apically slightly spatulate in *L. scolopacina* and *L. velata,* slender and tapered in *L. roblei*; editum a setose ridge near dorsal margin of valve basal to ampulla of clasper; aedeagus curved ventrally, 5–6 × as long as wide with sclerotized band extending onto basal ⅓ of vesica on left; apex of aedeagus covered with short spinules, these often concentrated on heavily sclerotized apical lobe or process on right; vesica about ¾ as long as aedeagus, curving to right through 180° to project anteriorly; vesica without basal or subbasal cornuti but with spinules on surface of vesica enlarged near apex to form subapical field of slender spines on dorsal surface in *L. velata* and *L. roblei*; vesica with rounded apical diverticulum.

Female genitalia (plate W, figures 1–3): corpus bursae elongate, 2–3 × as long as wide, usually somewhat pear shaped, slightly to moderately constricted posterior to middle; corpus bursae with a short rounded appendix bursae posteriorly on left; signa variable, absent in *L. scolopacina,* with four moderately long signa in *L. velata* and *L. roblei*; lamella postvaginalis at opening of ostium bursae with dense field of sharp spines projecting anteriorly into ostium; ductus bursae relatively long, 0.40–0.45 × as long as corpus bursae and much more heavily sclerotized on left side than right, even in width or wider posteriorly than anteriorly; A8 1.0–1.5 × as long as anterior apophyses; posterior apophyses 1.5 × as long as anterior apophyses, similar in thickness to anterior apophyses; papillae anales dorsoventrally flattened with two long sclerotized rods between anal papillae extending ⅔ length of papillae from anterior margin; anal papillae triangular, widest anteriorly, tapered gradually posteriorly with lateral margins slightly convex posterior to middle; apex of papillae rounded; surface of papillae covered with minute setae.

Mature larva similar to that of *Apamea,* except for length of apical seta on labial palpus and shape of inner surface of mandible. Spinneret long and tubular with dorsal groove, about 2 × as long as basal segment of labial palpus (Lps1) and 5 × as long as medial width. Labial palpus with apical seta (Lp2) relatively short 0.4–0.5 × as long as basal segment (Lps1) (Lp2 0.7–1.5 × Lps1 in *Apamea*); Lp2 about 1.5 × as long as first seta (Lp1). Spines on hypopharynx similar to those of *Apamea.* Mandible with three inner ridges, and base of ridges, swollen, creating two deep pockets between ridges on inner surface of mandible. Prothorax with seta SD2 on margin of prothoracic shield and seta SD1 well below shield and slightly anterior to SD2. In *L. scolopacina* and *L. velata* pinacula small and inconspicuous except for those of SD1 setae that form part of black lateral line; pinacula large and conspicuous in *L. roblei.*

KEY TO SPECIES OF *LOSCOPIA*

1. Forewing apex slightly falcate (plate 8, figures 28, 29); male genitalia with digitus broad and apically spatulate; cucullus reduced with corona on apical ½ of outer margin (plate N, figure 2); female genitalia with posterior ½ of ductus bursae 2 × as wide as anterior ½; corpus bursae membranous (plate W, figure 2) . . . *Loscopia velata* p. 105

— Forewing apex squared off (plate 8, figures 30–32); male genitalia with digitus slender and tapered; cucullus triangular with full corona on outer margin (plate N, figure 3); female genitalia with ductus bursae parallel sided; posterior part of corpus bursae sclerotized (plate W, figure 3) . . . . . *Loscopia roblei* p. 106

Loscopia velata (Walker), NEW COMBINATION

PL. 8, FIGS. 28, 29; PL. N, FIG. 2 (♂ gen.); PL. W, FIG. 2 (♀ gen.); TEXT FIG. 62 (map) (RWH 9454).

Apamea velata Walker, 1865, *List of Lepidopterous Insects in the Collection of the British Museum,* **32**: 671.
Type locality: Canada. [USNM]

Hydroecia sera Grote and Robinson, 1868, *Trans. Amer. Ent. Soc.,* **1**: 345.
Type locality: New York, Pennsylvania, Canada. [unknown; not ANSP]

Loscopia velata previously has been associated with the genus *Amphipoea* Billberg because of the slightly falcate forewing apex and similar wing pattern. In structural characters, *L. velata* is very similar to the Eurasian species *Loscopia scolopacina* (plate N, figure 1), which only recently has been removed from the genus *Apamea.*

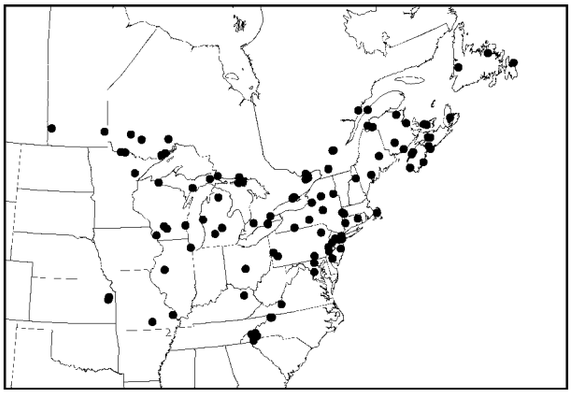


FIGURE 62: DISTRIBUTION OF MATERIAL EXAMINED OF *LOSCOPIA VELATA*

FIGURE 63: DISTRIBUTION OF MATERIAL EXAMINED OF *LOSCOPIA ROBLEI*

Loscopia velata is more likely to be confused with a species of *Amphipoea* or *Papaipema* Smith than with a species of *Apamea,* but the combination of small size (forewing length: 14–17 mm), dark reddish-brown shading over a gray-brown ground color, crenulate forewing margin, and reniform hourglass shaped with a fine white line on the outer margin, is diagnostic. Species of *Amphipoea* and *Papaipema* commonly have the reniform spot broad and kidney shaped and broken into a series of small spots. The shape of the reniform spot is typical of the two other species of *Loscopia* even though they look very different from *L. velata* in color and pattern.

The larva is gray green, darker laterally than dorsally with a black lateral line extending through the SD1 setae. There are five pale longitudinal lines: a narrow middorsal line bordered with black, a less distinct subdorsal line on each side (below the D2 setae), and a broad spiracular line with the spiracles in the middle. The prothoracic shield is orange yellow with paler middorsal and subdorsal lines. Pinacula are minute or absent, except for prominent SD1 pinacula that form part of the black lateral line. The head is orange with a black, tear-drop shaped patch on each side extending from below seta P2 down to and including the ocelli. The European species *L. scolopacina* is similar to *L. velata,* but the lateral margin of the prothoracic shield is dark blackish green below the subdorsal line, and the head has black submedial arcs instead of black lateral patches. The larva of *L. velata* was reared at the CNC on quack grass (*Elytrigia repens* (L.) Nevski). Quinter has found larvae abundantly by sweeping *Uniola* L. in Missouri, where they were resting by day on the grass, but obviously were feeding on other grasses as well, because pupae were frequently encountered while excavating beneath mixed grasses in canebrakes. The pupa is formed in a cell just below the soil line under leaf litter and other detritus.

Loscopia velata occurs in Canada from Newfoundland westward to southern Manitoba and southward in the United States to Georgia, Kentucky, Missouri, and Kansas. The flight season extends from late June to late August, but within this range the season is later in the North than in the South.

Loscopia roblei Quinter and Lafontaine, NEW SPECIES

PL. 8, FIGS. 30–32; PL. N, FIG. 3 (♂ gen.); PL. W, FIG. 3 (♀ gen.); TEXT FIG. 63 (map).

Loscopia roblei Quinter and Lafontaine.
Type locality: Croatan National Forest Road, Craven Co., North Carolina, USA. [CNC]

NOTE—The species is named for Dr. Steven M. Roble of the Division of Natural Heritage, Virginia Department of Conservation and Recreation. Without his repeated and gracious assistance in studying this moth at the Great Dismal Swamp National Wildlife Refuge, we would know nothing of its bionomics.

Loscopia roblei is a rarely collected southeastern species known only from few specimens of extremely limited geographical distribution. Adults occur in two forms, a reddish-brown form with the maculation generally muted, and a pale luteous-brown form with contrasting black shading on the basal dash, the lower ⅓ of the reniform spot, and streaks in the terminal area. Only the darker form is likely to be confused with any oth-

er species; it somewhat resembles *Loscopia velata,* but the squared off forewing apex (slightly falcate in *L. velata*) is diagnostic.

In the male genitalia, the large, ventrally produced cucullus, long, tapered digitus, and shape of the sacculi, are diagnostic. The female genitalia are characterized by the long, parallel-sided ductus bursae that bends abruptly through 90° at the anterior end, and the posteriorly sclerotized corpus bursae.

Antenna of male slightly beadlike, segments very slightly swollen mesially, setose-bifasciculate; antenna of female filiform, setose-ciliate ventrally. Forewing ground color reddish brown, or pale luteous brown; ground color tending to be mottled with slightly darker hue, especially in medial area and toward costa; antemedial and postmedial lines thin, defined in black, contrasting in pale form, but obscured by mottled ground color in dark form; postmedial line scalloped between wing veins; basal dash black, apically forked at position of basal line, more boldly marked in pale form than in dark form; orbicular spot variable; nearly round to distinctly ovate in some individuals, finely outlined in black with central color similar to forewing ground color or very slightly paler; reniform spot with fine white outline (obscure in pale form) with contrasting black patch in posterior ⅓ of spot; claviform spot usually obscure; when expressed, outlined in black, and extending ⅓ distance to postmedial line, concolorous with forewing; subterminal line evident mainly due to dark shading in terminal area; subterminal area slightly paler than ground color in dark form; terminal area dark gray (with darker black streaks in pale form); terminal line a series of dark fuscous chevrons between veins; fringe checkered with dark gray and buff; forewing length: 15–16 mm. Hindwing mottled with dark fuscous, uniform in some individuals and paler toward wing base and pale near outer margin toward anal angle in others; discal spot elongate, slightly darker than ground color; terminal line dark fuscous; fringe buff.

Male genitalia: generally as described for genus, but uncus evenly down curved to apex; peniculus enlarged with posterodorsal corner sharply angled (60°); juxta 2 × as long as basal width, narrow mesially, expanded basally and apically; valve with narrow subapical ''neck'' defining cucullus; cucullus triangular, extending about 2 × as far ventrally as dorsally from midpoint of ''neck''; apical corona on entire posterior margin of cucullus; cucullus with clusters of heavily sclerotized setae at each end of ventral margin; valves bilaterally asymmetrical; sclerotized process on dorsal margin of sacculus on right valve high and apically rounded, ⅓ × as long as width of valve; dorsal process on left valve similar in size, evenly tapered to point; apex of right sacculus ending at base of clasper sclerite and well before ampulla of clasper; apex of left sacculus extending posteriorly to base of ampulla; ampulla of clasper about 8 × as long as wide; digitus very long, broad basally but tapered abruptly with apical ¾ long and slender, pointed apically, extending slightly below ventral margin of cucullus; aedeagus curved ventrally, 6 × as long as wide with sclerotized band extending onto basal ⅓ of vesica on left; apex of aedeagus extended into heavily sclerotized spine on right; vesica about ¾ × as long as aedeagus, generally tapered from base to apex, but slightly enlarged subbasally and with diverticulum subapically; spinules on surface of vesica enlarged into subapical cluster of slender spines beside subapical diverticulum.

Female genitalia: corpus bursae about 2 × as long as anterior width with four moderately long signa (⅛–¼ × as long as corpus bursae); appendix bursae posterior to junction with ductus bursae and heavily sclerotized; dense field of sharp spines on lamella postvaginalis tending to form two clusters; ductus bursae ½ × as long as corpus bursae, evenly wide throughout, heavily sclerotized on right side; A8, apophyses, and papillae anales as described for genus.

The larva is quite different in appearance from those of *L. velata* and *L. scolopacina,* which probably reflects a fundamental difference in its mode of feeding and resting, but otherwise generally agrees with the morphological features given for the genus. The apical seta on the labial palpus is short, as in other *Loscopia.* Instead of being basically green and striped like the other two species, which rest exposed by day on their host plants, the larva of *L. roblei* is dull purplish brown and devoid of distinctive patterning. The usual longitudinal lines are indistinct or lacking. The prothoracic shield is orange yellow with paler middorsal but no subdorsal lines. The anal shield is similar in color to the prothoracic shield, but much more heavily sclerotized than those of *L. velata* or *L. scolopacina.* Pinacula are large, being among the most prominent external features and of the same coloration as the prothoracic and anal shields. The head is darker orange

than the prothoracic shield but devoid of black pigmented areas characteristic of the other *Loscopia.* From this combination of features, it is very likely that the larva of *L. roblei* is either a subterranean cutworm or perhaps a nocturnal-feeding climbing cutworm that burrows into the soil to hide during day. The host plant remains unknown, but adults consistently have been collected at mercury vapor lights operated in close association with *Arundinaria* and several other native grasses occurring together at the Great Dismal Swamp National Wildlife Refuge. A female moth collected there on May 16, 1998 at mercury vapor light by Quinter and Roble, and confined with a selection of inflorescences from several of these grasses, deposited ova therein from which larvae emerged approximately 12 days later. These were reared on artificial diet in the laboratory, and exhibited a protracted development throughout the summer, fall, and winter similar to larvae of the genus *Apamea.* No adults were reared, but larvae were preserved. It is virtually certain that the species is univoltine and overwinters as a partially grown larva in the wild.

TYPES. **Holotype:** ♂. Croatan National Forest Road, Craven Co., North Carolina; 29 April 1997; J. Bolling Sullivan; barcoded; (CNC Noctuoidea # 12252). CNC. **Paratypes:** 10 ♂, 4 ♀. **North Carolina.** Faircloth Road, Bombing Range, Dare Co.; 10 May 1994; Steve Hall; barcoded; (CNC Noctuoidea # 12253) (1 ♂). Levee Forest, Bull Run Island, Martin Co.; 22 May 1996; Steve Hall (1 ♀). Ridge Road swale, Devil's Gut TNC [The Nature Conservancy] Preserve, Martin Co.; 21 May 1996; Steve Hall (1 ♀). Island Walk, Croatan National Forest, Jones Co.; 30 April 1997; J. Bolling Sullivan (1 ♂). NEA Bog, Fort Bragg, Cumberland Co.; 17 May 2002; J. Bolling Sullivan; 15 watt UV light trap (1 ♂). **Virginia.** Williamson Ditch, Great Dismal Swamp National Wildlife Refuge, City of Suffolk; 29 May 1997; Eric Quinter & Steve Roble; mercury vapor light (2 ♂). Same locality; 25 May 1999; Eric Quinter & Zheiwei Liu; UV & mercury vapor lights (5 ♂). Same locality; 7 June 1997; Steve Roble (1 ♀). Nature center (cane woods), ca. 1.1 km SSE jct. Oceana Blvd. & Bells Rd., Naval Air Station Oceana, City of Virginia Beach; 24 May 2001; K. L. Derge; UV light (1 ♀). CNC, ELQ, JBS, USNM.

Loscopia roblei is known only from pocosins and coastal plain wetland habitats in southeastern Virginia and eastern North Carolina. Adults have been collected between late April and early June.

GENUS

Protapamea Quinter, NEW GENUS

by E. L. Quinter

Gender: feminine.

Type species: *Protapamea danieli* Quinter, 2009.

NOTE—Generic name in allusion to the presumed phylogenetic relationship with *Apamea.*

Adults of *Protapamea* are similar to those of *Apamea* in most characters, both species of *Protapamea* having forms resembling *Apamea remissa* (Hübner). Like some species of *Apamea,* the males of both species of *Protapamea* lack paired lateral brushes and associated levers and pockets. The male genitalia of *Protapamea* differ markedly from those of *Apamea, Loscopia,* and related genera in bearing a greatly reduced, undifferentiated cucullus with no vestige of a corona, and with the digitus of the right and left valves asymmetrical with respect to both shape and orientation. Otherwise, *Protapamea* features include: 1) valves bilaterally asymmetrical with respect to the shape of the sacculi, as in *Loscopia,* but unlike *Apamea*; 2) juxta longer than in *Apamea,* but not as long as in *Loscopia*; 3) small cornuti present near the base of vesica, like *Apamea,* but unlike *Loscopia*; and 4) the spinules on the surface of the vesica are enlarged into a cluster of slender spines near the apex of the right side of the vesica in *P. louisae*; these spines are on the left side in *Loscopia,* and are absent in *P. danieli.*

DIAGNOSIS OF THE GENUS *PROTAPAMEA*. *Protapamea* can be distinguished from *Apamea* and related genera by genital characters, as well as by its highly specialized larval feeding mode and host plant requirements. The external body features of *Protapamea* are essentially the same as those given in the diagnosis for *Apamea.* Characters distinguishing *Protapamea* from *Apamea* and *Loscopia* include: 1) sacculus and digitus of right and left male valve asymmetrical; 2) cucullus reduced to a small membranous lobe distal to digitus; 3) corona absent; 4) male with an eversible corema bearing a prominent (5–6 mm), nondeciduous, ventral brush on eighth sternum, unlike smaller, deciduous, non-eversible brush of *Apamea* and *Loscopia*; 5) corpus bursae of female with prominent, rounded diverticulum on right side anterior to junction with ductus bursae

(absent in *Apamea* and *Loscopia*); 6) lamella postvaginalis of *A. danieli* with field of minute spines, as in *Loscopia* (secondarily lost in *A. louisae,* so membranous as in *Apamea*); 7) ductus bursae much more heavily sclerotized on left side than right, as in *Loscopia,* but unlike *Apamea* where the sclerotization is uniform; 8) mesial margins of eighth sternum defining opening to ostium bursae parallel or farther apart anteriorly than posteriorly, as in *Loscopia,* but unlike *Apamea* where the margins are farther apart posteriorly than anteriorly; and 9) posterior margin of the seventh sternum in female *Protapamea* is evenly concave or slightly notched (posterior margin straight or concave in *Apamea,* and deeply cleft in *Loscopia*).

Male genitalia (plate N, figures 4, 5): uncus narrow, dorsoventrally flattened, sharply downcurved near base, gradually and evenly tapered to apex; peniculus densely hairy, enlarged laterally to form acutely angled rectangular plate; juxta elongated, 1.2–1.5 × as long as basal width; valve with ventral margin more or less evenly convex from base to anteroventral edge of cucullus; dorsal margin of valve evenly concave from base to anterodorsal edge of cucullus; subapical ''neck'' defining cucullus absent; cucullus rounded or triangular, greatly reduced to small membranous lobe distal to digitus; corona absent; valves bilaterally asymmetrical with respect to shape of sacculus, process on dorsal margin of sacculus larger and differing in shape between right and left valve; posterior extension of sacculus larger on right valve than on left; clasper a barlike sclerite extending from apex of sacculus ⅔ of distance to cucullus; clasper with small, narrow, setose ampulla 5–6 × as long as wide and projecting posterodorsally from dorsal arm of clasper, less conspicuous than those typical of *Apamea* or *Loscopia* because it lies under extension of sacculus; costal margin of valve heavily sclerotized, becoming free from surface of valve toward cucullus to form digitus; digiti asymmetrical with respect to length and orientation; editum a setose ridge near dorsal margin of valve basal to ampulla of clasper; aedeagus curved ventrally, 7 × as long as wide, with sclerotized band extending onto base of vesica on left, and with heavily sclerotized subapical bulge dorsolaterally on right; apex of aedeagus with field of short spines; vesica about as long as aedeagus, curving to right through 150° to project anterolaterally; vesica with transverse subbasal bulge with diverticula projecting to left and right, with an apical cornutus on right diverticulum; middle or apical part of vesica swollen.

Female genitalia (plate W, figures 4, 5): corpus bursae elongate, 2.5–2.8 × as long as wide, somewhat pear shaped, slightly constricted posterior to middle, with two moderately long signa; appendix bursae arising posteriorly on left; ductus bursae on right side ⅓ from posterior end, ⅓ × as long as corpus bursae and somewhat more heavily sclerotized on left side than right, even in width or wider posteriorly than anteriorly; A8 about as long as anterior apophyses; posterior apophyses 1.3 × as long as anterior apophyses, similar in thickness to anterior apophyses; papillae anales dorsoventrally flattened with two long sclerotized rods between them extending 0.6 × their length from anterior margin; anal papillae triangular, widest anteriorly, with lateral margins convex posterior to middle; papillae with apex rounded, surface covered with minute setae.

Larva feeding externally on host plant with body and head patterned as in *Apamea* group I and *Loscopia.* Apical seta on labial palpus shorter than in *Apamea* (Lp2 0.4–0.6 × Lps1 versus 0.7–1.5 × Lps1 in *Apamea*); ridges and bases of ridges on inner surface of mandible swollen, creating two deep pockets on inner surface of mandible. Mature larva similar to that of *Loscopia* in most structural characters, but apical seta on labial palpus averages slightly longer than in *Loscopia.* Spinneret long and tubular with dorsal groove, about 2 × as long as basal segment of labial palpus (Lps1) and 5 × as long as medial width. Labial palpus with apical seta (Lp2) 0.4–0.6 × as long as basal segment (Lps1) and about 2 × as long as first seta (Lp1). Hypopharynx spines similar to those of *Apamea* and *Loscopia.* Prothorax with seta SD2 on margin of prothoracic shield and seta SD1 well below shield and slightly anterior to SD2. Head of mature larva honey orange with either positive (darker) or negative (lighter) reticulate pattern. Prothoracic shield paler orange brown with pale middorsal and subdorsal lines; lateral margins of prothoracic shield dark. Body coloration different between species and somewhat variable between instars, especially in *P. louisae*; body heavily mottled with dark pigmentation down to level of SD1 setae and intensified laterally to form a dark line through SD1 setae; body pale below SD1 setae. Setae with dark pinacula, those below spiracles paler than dorsal and lateral pinacula. Pinacula small and similar in

size, except those of SD1 and SD2 setae on thorax and SD1 setae on abdomen as large as spiracles and 2 × as large as other pinacula. Crochets of prolegs essentially in a straight line, typical of climbing cutworms, not in a semicircle like larvae that feed internally or underground; 32–48 crochets on each proleg, generally more on posterior prolegs than on anterior ones.

Protapamea eggs are deposited in rows totally concealed within the dead axillary shoot sheaths that persist until the following year on culms of the native bamboo host. Unlike *Apamea* and *Loscopia,* which overwinter as partially grown larvae, *Protapamea* apparently overwinter in the egg stage, because no appropriate food resources are available until new shoot development commences in early spring, and young larvae have not been observed until then. The larvae exhibit a highly specialized feeding mode, exclusively on species of *Arundinaria* Michaux (giant cane, switch cane). All instars feed solely on the developing axillary shoots of the culms, never on the fully expanded foliage. Early instars remain thoroughly concealed by day within the axillary shoot sheaths that commonly occur in dense clusters. More mature larvae are climbing cutworms that hide by day under the primary shoot sheaths of the first-year culms, in dried leaves or other detritus trapped among the upper branches of mature culms, or among detritus on the ground. On first-year culms, axillary shoot development proceeds from the terminal node downward; hence larvae must relocate feeding sites to maintain an appropriate food supply. Penultimate and final instars are most easily observed as they climb to feeding sites or graze on the shoots shortly after dark. It is in this manner that *Protapamea* are most readily obtained, because adults are rarely collected at lights, except when light is placed directly within well-established colonies in mature canebrakes. Pupation occurs in a cell formed beneath organic litter, at or near the soil line, in close proximity to the base of the host culm. Eclosion of adults occurs approximately 16–17 days after pupation. Species of *Protapamea,* like all Nearctic Apameini, are univoltine. Larvae of both species are frequently found parasitized at certain sites by as yet unidentified horse-hair worms (Phylum Nematomorpha), and a single instance of parasitism by the ichneumonid genus *Ophion* Fabricius has been recorded, but thus far no dipteran parasitoids have been observed.

Botanical treatments disagree with regard to the status of the three named entities of *Arundinaria* in North America, which are variously treated as forms of a single species, subspecies, or full species. I regard them as full species, recent botanical treatments regarding all North American *Arundinaria* as a single species notwithstanding. The indisputably distinct moth species of several as yet undescribed Apameini specializing on North American *Arundinaria* show clear geographic distributions precisely correlated with the so-called races or forms of their hosts.

KEY TO SPECIES OF *PROTAPAMEA*

1. Forewing coloration various shades of warm brown and gray (plate 8, figures 33–35); male genitalia with cucullus rounded, greatly reduced to a small membranous lobe distal to digitus; no spines near apex of vesica (plate N, figure 4); female genitalia with appendix bursae much less heavily sclerotized than ductus bursae, nearly as membranous as corpus bursae; corpus bursae slightly constricted posterior to middle (plate W, figure 4); larva brown . . . . . *Protapamea danieli* p. 110

— Forewing coloration evenly violet gray to nearly black (plate 8, figures 36–38); male genitalia with cucullus reduced to membranous lobe distal to digitus but larger, more triagonal than in *P. danieli*; prominent cluster of long spines near apex of vesica (plate N, figure 5); female genitalia with appendix bursae as heavily sclerotized as ductus bursae, strongly contrasting with membranous corpus bursae; corpus bursae more constricted than in *P. danieli* (plate W, figure 5); larva green . . . . . *Protapamea louisae* p. 114

Protapamea danieli Quinter, NEW SPECIES PL. 8, FIGS. 33–35; PL. N, FIG. 4 (♂ gen.); PL. W, FIG. 4 (♀ gen.); PL. X, FIGS. 1, 2, 5 (larva); TEXT FIG. 64 (map).

Protapamea danieli Quinter.

Type locality: Markham Spring Campground, Mark Twain National Forest, Wayne Co., Missouri, USA. [CNC]

NOTE—I am pleased to name this species for my son Daniel, who retains a keen eye for the natural world and who excelled from an early age at finding caterpillars including larvae of this moth and numerous other tiny creatures on our excursions into the field.

Adults of this species exhibit considerable variation in wing coloration and maculation, ranging across a continuum from nearly unicolorous chocolate brown with few contrasting features to well-marked individuals with contrasting patterns

and prominent stigmata. This range of variation occurs in all populations, and no discernible geographic variability is apparent. *P. danieli* is readily distinguished from *P. louisae* by genital characters and by larval features. However, the similar variability in forewing pattern of both species makes recognition of adults difficult, and genital dissection may be necessary for positive identification. Coloration of the forewings is the only external feature by which adults of the two species are likely to be distinguished. Forewings of *P. danieli* exhibit various shades of warm brown, often with contrasting gray areas; those of *P. louisae* are always darker, often with rather even, violet-gray areas, but ranging to nearly black. Stigmata range from contrasting white, pale buff, or brown to obsolescent in both species.

In the male genitalia the cucullus is rounded, greatly reduced to a small membranous lobe distal to the digitus (triangular and larger in *P. louisae*); there are no spines near the apex of the vesica (*P. louisae* with a prominent cluster of spines near the apex); and the right digitus is strongly curved posteroventrally to project posteriorly beyond the ventral margin of the cucullus (in *P. louisae* the right digitus projects ventrally).

In the female genitalia of *P. danieli,* the appendix bursae is much less heavily sclerotized than the ductus bursae and appears nearly as membranous as the corpus bursae, and the corpus bursae is slightly constricted posterior to the middle. In *P. louisae,* the appendix bursae is heavily sclerotized, as much so as the ductus bursae, strongly contrasting with the membranous corpus bursae, and the corpus bursae is more constricted than that of *P. danieli.*

The following larval features are diagnostic: 1) the head has a dark (positive) reticulate pattern and submedian arcs; 2) the apical seta on the labial palpus (Lp2) is longer than in *P. louisae,* about 0.6 × rather than 0.4 × as long as the basal segment (Lps1); 3) each side of the prothoracic shield has a black spot surrounded by white that gives an ''eye-spot'' effect; 4) the dorsum of the body is heavily speckled with dark brown, leaving a pale middorsal line; 5) the pinacula of the SD1 and SD2 setae on the meso- and metathorax are separated from each other by a space equal to about ½ their width, fused or partially fused in *P. louisae*; and 6) the SD1 pinacula are rounded and similar in size to the spiracles, the SD1 pinacula merge with dark shading around them to form large, irregular, dark patches along the body in *P. louisae.*

Antenna of male slightly beadlike, segments very slightly swollen mesially, setose-bifasciculate; antenna of female filiform, setose ciliate ventrally. Forewing shape as in *Apamea*; ground color warm chocolate brown, rather uniform in some individuals (plate 8, figure 35) but frequently with contrasting subterminal area (plate 8, figure 33), which may be smooth, light gray, lighter chocolate brown, or still paler wood brown, with every degree of intermediates; medial area similarly variable, with a blackish bar connecting antemedial and postmedial lines in some individuals (plate 8, figure 34) or with an additional black patch filling space between orbicular and reniform spots, or even with entire medial area darker than rest of wing. Antemedial and postmedial lines thin, doubled, defined in black and filled with reddish brown, wood brown, chocolate brown, or gray. Antemedial line scalloped and evenly convex; postmedial line sinuous, excurved beyond reniform, then nearly straight or slightly concave to posterior margin, scalloped between wing veins, a series of contrasting light and dark doubled points on veins beyond scallops in subterminal area in some individuals; basal dash, if present, black, apically forked at position of basal line; stigmata highly variable with respect to degree of expression and color; orbicular spot variable, nearly round to ovate, finely outlined in black with central color similar to forewing ground color or very slightly paler; reniform spot a slightly rounded rectangle, in some individuals solidly filled with either white or occasionally light wood brown, but more often having a fine white partial outline mostly on outer edge and a central lunule of variable color, often a shade of gray; claviform spot small, rounded, but usually obscure; when expressed, outlined in black and extending no more than ¼ of distance to postmedial line and concolorous with forewing; subterminal line sinuous, apparently doubled or at least bounded by darker color on each side, frequently filled with reddish brown or wood brown, usually at least somewhat paler than ground and usually preceded by a broken partial chain of darker dots of variable color extending from cubital veins often as far as tornal angle (chain of darker dots absent in *P. louisae*); terminal area shades of dark gray, always darker than subterminal area; terminal line a series of minute dark dots between veins immediately followed with a

series of minute light points between veins at base of fringe (not apparent in all specimens); fringe usually of same color as terminal area. Forewing length: 16.0–17.5 mm. Hindwing dark fuscous, uniform in some individuals but usually somewhat paler toward wing base; discal spot dark fuscous, faint except in individuals with paler wing base; terminal line dark fuscous; fringe contrasting, luteous to orange brown.

Male genitalia (plate N, figure 4) generally as described for genus; uncus narrow, dorsoventrally flattened, sharply down-curved near base, gradually and evenly tapered to apex; peniculus densely hairy, enlarged laterally to form a sharply angled rectangular plate; juxta somewhat elongated, 1.2 × as long as basal width; ventral margin of valve more or less evenly convex from base to anteroventral edge of cucullus; dorsal margin of valve evenly concave from base to anterodorsal edge of cucullus; subapical ''neck'' defining cucullus absent; cucullus rounded and greatly reduced to small membranous lobe distal to digitus; corona absent; valves asymmetrical with respect to shape of sacculus, process on dorsal margin of sacculus larger and of different shape on right valve than on left one; posterior extension of sacculus larger on right valve than on left one; clasper a barlike sclerite extending from apex of sacculus ⅔ of distance to cucullus; clasper with narrow, setose ampulla projecting posterodorsally from dorsal arm of clasper; costal margin of valve heavily sclerotized, becoming free from surface of valve toward cucullus to form digitus; digiti asymmetrical, right digitus longer than left one and strongly curved at base of cucullus to project posteroventrally along and beyond ventral margin of cucullus; left digitus slightly curved, projecting ventrally; editum a setose ridge near dorsal margin of valve basal to ampulla of clasper; aedeagus curved ventrally, 7 × as long as wide with sclerotized band extending onto base of vesica on left; aedeagus with a subapical necklacelike band of short spines (2–3 spines wide), and with thornlike spine at ventral apex of aedeagus; vesica about as long as aedeagus, curving to right through 150° to project anterolaterally to right; with cornutus on right subbasal diverticulum; vesica with ventral apical diverticulum.

Female genitalia (plate W, figure 4) with corpus bursae elongate, 2.5 × as long as wide, somewhat pear shaped, slightly constricted posterior to middle, with two moderately long signa; a somewhat elongated, rounded appendix bursae posteriorly on left, only slightly more sclerotized than corpus bursae; ductus bursae entering corpus bursae on right side approximately ⅓ distance from posterior end, ⅓ × as long as corpus bursae, even in width or wider posteriorly than anteriorly, and slightly more heavily sclerotized on left side than right; A8 about as long as anterior apophyses; posterior apophyses 1.3 × as long as anterior apophyses, similar in thickness to anterior apophyses; papillae anales dorsoventrally flattened with two long sclerotized rods between anal papillae extending 0.6 × length of papillae from anterior margin; anal papillae triangular, widest anteriorly, with lateral margins convex posterior to middle; apex of papillae rounded; surface of papillae covered with minute setae.

The larva of *P. danieli* is generally as described for the genus with the following specific characteristics. The head is a honey orange with a darker (positive) reticulate pattern and submedial arcs, which are much less prominent in some individuals than in others. Most of the central area of the prothoracic shield is pale yellowish brown, much paler than the margins, with a faint, pale middorsal stripe. Very striking features, especially of the living caterpillar, are the subdorsal stripes, which are bright white at their origin on the prothoracic shield, and bounded outwardly by broad, black-pigmented bands on the lateral margins of the shield. These create an ''eye-spot'' effect that is perhaps the single most prominent larval feature. The dark pigmentation of the longitudinal lines of the body combines with a pale ground color to produce the appearance of a striped, somewhat mottled, medium-brown larva. This pattern persists through the final instar. The darkest of the longitudinal lines is the lateral line running through the SD1 setae, below which the body is uniformly pale. The anal shield is uniformly of the same or slightly darker yellowish-brown color as the prothoracic shield, except where the pale dorsal and subdorsal lines continue across it. The dark patches on each side of the labrum shown in plate X, figure 5 are the mandibles, which are not visible in the head drawing of *P. louisae* (plate X, figure 6).

General bionomic details are as given for the genus. Larvae of *P. danieli* in southern Illinois, western Kentucky, and southeastern Missouri feed on *Arundinaria gigantea* (Walter) Mühlenberg, developing throughout early spring and maturing by mid- to late May. In this same area, females typically fly from mid- to late June, but

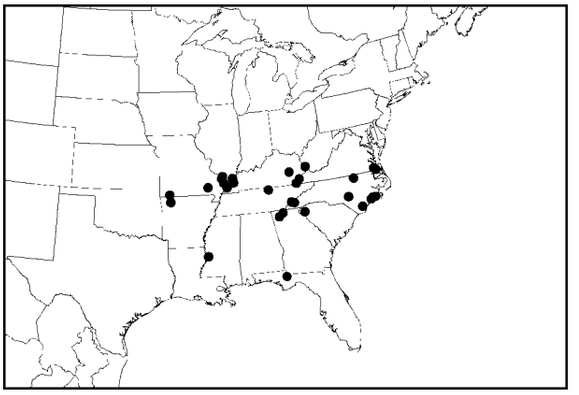


FIGURE 64: DISTRIBUTION OF MATERIAL EXAMINED OF *PROTAPAMEA DANIELI*

the few males captured were all from early to mid-June, suggesting a disparity in adult flight periods that has not been noted among reared specimens. The pupal duration averages 16.8 days (N = 129). On the mid-Atlantic coast, *Arundinaria tecta* (Walter) Mühlenberg is the available host, and adults may be on the wing a week or two earlier than in the Midwest, with captures being recorded from the third week of May onward. In the southern Appalachians, the relatively few captures suggest adults may fly considerably later in the season than elsewhere, presumably correlated with higher elevations. Adults have been recorded there as late as the third week of July.

TYPES. **Holotype:** ♂. Markham Spring Campground, Mark Twain National Forest, Wayne Co., Missouri, bred ex larva on *Arundinaria gigantea,* emerge: 6 June 1997, Eric L. Quinter (CNC). **Paratypes:** 110 ♂, 163 ♀. **Arkansas.** War Eagle Creek, 1,360′, junction Rts. 23 & 127, Madison Co.; 29 June 1993; Eric L. Quinter (1 ♂). **Florida.** Torreya State Park, Liberty Co.; 28 May 1984; H. David Baggett & Dale F. Schweitzer (1 ♂). **Georgia.** Cohutta Overlook, 720 m, Hwy. 52, 3 km. E Murray/Gilmer Co. line, Gilmer Co.; 22 July 1992; James K. Adams (1 ♀). End of Tate Bend Rd. along Oostanaula River, 34° 33′ 44″ N, 84° 57′ 54″ W, Calhoun, Gordon Co.; 4 June 2002; James K. Adams (1 ♀). **Illinois.** McCrite Farm, T15S-R2W Sec. 3, 3 mi W Tamms, Alexander Co.; 11, 28 June 1997; 16–30 June 1999; James R. Wiker (2 ♂, 6 ♀); James R. Wiker; bred ex larva on *Arundinaria gigantea*; emerge: 31 May–5 June 2003; James R. Wiker (2 ♂, 4 ♀). Cave Valley, old GM&O right of way, T10S-R2W Sec. 21, N Pomona, Jackson Co.; bred ex larva on *Arundinaria gigantea*; emerge: 17–18 June 1997, 5 June 2003; James R. Wiker (2 ♂, 2 ♀). Alcorn Creek, Pope Co.; 10 June 2000; William R. Black, Jr. (6 ♂). War Bluff Sanctuary, 5 mi N Golconda, Pope Co.; 16 June 1999; E. Quinter & J. Wiker (2 ♂); bred ex larva on *Arundinaria gigantea*; emerge: 24–28 May 2000; James R. Wiker; 2–3 June 2000; E. Quinter & J. Wiker (10 ♂, 6 ♀). Pine Hills Campground, T11S-R3W Sec. 34, Union Co.; 22, 27 June 1997; James R. Wiker (3 ♀); bred ex larva on *Arundinaria gigantea*; emerge: 13–19 June 1997, 4–7 June 1998, 28 June 1999; James R. Wiker (1 ♂, 8 ♀). **Kentucky.** Stovall Creek, Ballard Co.; 15 June 1999; E. Quinter, W. Black, & J. Wiker (1 ♂). Sandy Branch, E old GM&O right of way, Westvaco WMA, 5 mi SW Bardwell, Carlisle Co.; 14 June 1999; E. Quinter, W. Black, & J. Wiker (4 ♀); same locality; bred ex larva on *Arundinaria gigantea*; emerge: 1–4 June 1999; E. Quinter & W. Black (3 ♀). Big Black Mountain, Harlan Co.; 14 July 1979; Loran D. Gibson (1 ♂). 3 mi NE Booneville, Owsley Co.; 22 June 1984; Loran D. Gibson (1 ♀). **Mississippi.** Vicksburg, Warren Co.; 17 June 1988; Bryant Mather (1 ♂). **Missouri.** Roaring River State Park, 1,000′, Barry Co.; 28 June 1993; E. Quinter & R. Letsinger (3 ♀). Browns Crossing, 400′, junction Rt. 49 & Black River, 2.7 mi W Williamsville, Mark Twain National Forest, Wayne Co.; 21–22 June 1993; ex pupa found in soil, emerge 3 June 1994; bred ex larva on *Arundinaria gigantea*; emerge 4–14 June 1997, 24–31 May 2000; Eric L. Quinter (24 ♂, 55 ♀). Markham Spring Campground, Mark Twain National Forest, Wayne Co.; 2 June 1986; J. R. Heitzman (1 ♂); 18 June 1988; H. M. Webber (1 ♂); 19–23 June 1993; bred ex larva on *Arundinaria gigantea*; emerge: 13 May–1 June 1995, 4–8 June 1997; Eric L. Quinter (13 ♂, 36 ♀); 24–28 May 2000; James R. Wiker (4 ♂, 5 ♀). **North Carolina.** Greenbank Bluff, Brunswick Co.; 2 June 1995; J. Bolling Sullivan (2 ♂, 3 ♀). Croatan National Forest Road 147, Craven Co.; 6 June 1996, 30 May–2 June 1997; J. Bolling Sullivan (15 ♂, 7 ♀). Croatan National Forest Road 169, Little Deep Creek, Craven Co.; 9 June 1999; J. Bolling Sullivan (1 ♂). Fontana Dam, 1,200′–1,800′, Graham Co.; 8–9 July 1972; Dale F. Schweitzer (1 ♂). Fort Bragg, Jumping Run Creek at FB 12, Hoke Co.; 30 May 2001; J. Bolling Sullivan & Steve Hall (1 ♂). Haywood Landing, Croatan National Forest, Jones Co.; 21 May–11 June 1996; J. Bolling Sullivan (2 ♂, 3 ♀). Verona Loop Road, Camp Lejune, Onslow Co.; 30 May 1995; J. Bolling Sullivan (5 ♂). Fontana View Estates, 35.3844° N, 83.5679° W, 2,000′, Swain Co.; 13–14 June 2002; J. Bolling Sullivan (3 ♂). Henderson, Vance Co.; 13 July 1972; Dale F. Schweitzer (1 ♀). **South Carolina.** Clemson; 16 July 1968; J. A. Reinert (1 ♀). **Tennessee.** Big Bottom, Cordell Hull Lake, Jackson Co.; 23 June 1995; bred ex larva on *Arundinaria gigantea*; emerge 7 June 1996, 25 May 2000; Eric L. Quinter (3 ♀). **Virginia.** Dry Creek Barrens, The Cedars Natural Area, Lee Co.; 19, 22 June 2000; C. S. Hobson (5 ♂, 3 ♀). Suffolk; 4 June 1945; Otto Bucholz (1 ♀). Great Dismal Swamp National Wildlife Refuge, Suffolk; 29–30 May 2000; E. Quinter, P. Goldstein, & S. Roble (2 ♂). **West Virginia.** Tug River, N & WRR, 0.5 mi E of east end Glen Alum Tunnel,

Mingo Co.; 26 June 1999; William R. Black, Jr., Loran D. Gibson (3 ♀). AMNH, CNC, CUIC, DFS, ELQ, INHS, JBS, JKA, JRH, JRW, LDG, PZG, RLL, USNM, VADNH, WRB.

Protapamea danieli is widely distributed in canebrake habitats at varied elevations throughout the southeastern United States from southern Virginia, West Virginia, Kentucky, and Illinois southward to northwestern Florida and west-central Mississippi, apparently occupying the entire range of *Arundinaria.* Although the species is completely restricted to such habitats and rarely collected, it is relatively common therein and readily obtained when specifically sought.

Protapamea louisae Quinter, NEW SPECIES PL. 8, FIGS. 36–38; PL. N, FIG. 5 (♂ gen.); PL. W, FIG. 5 (♀ gen.); PL. X, FIGS. 3, 4, 6 (larva); TEXT FIG. 65 (map).

Protapamea louisae Quinter.
Type locality: Big Bottom, Cordell Hull Lake, Jackson Co., Tennessee, USA. [CNC]

NOTE—This species is named for my friend Liu Yi, or ''Louisa'' as her American friends know her, who assisted in the original discovery of the larvae of this exceptionally rare moth, in appreciation of her perpetually sunny disposition.

The appearance of *P. louisae* is that of a very dark *P. danieli.* The distinguishing features are given in the diagnosis of that species.

Antenna of male slightly beadlike, segments very slightly swollen mesially, setose-bifasciculate; antenna of female filiform, setose ciliate ventrally. Forewing shape as in *Apamea*; ground color rather even, violet gray, ranging to nearly uniform black (plate 8, figure 36), with subterminal area appearing rather smooth, usually of same ground color, but occasionally somewhat lighter (plate 8, figure 38); medial area often darker than basal and subterminal areas, with a black bar connecting antemedial and postmedial lines in some individuals, or with an additional black patch filling space between orbicular and reniform spots; antemedial and postmedial lines thin, doubled, defined in black, sometimes filled with slightly paler gray, often with outer doubling of postmedial line completely obscured by color of subterminal area; antemedial line scalloped, evenly convex; postmedial line sinuous, excurved beyond reniform spot, then nearly straight or slightly concave to inner margin; postmedial line scalloped between wing veins with series of contrasting light and dark doubled points on veins beyond scallops in subterminal area (obscure in most individuals but visible in some); basal dash black, not apically forked (basal dash obscure in some specimens); stigmata highly variable with respect to degree of expression and color; orbicular spot variable, nearly round to ovate, finely outlined in black with central color similar to forewing ground color but occasionally lighter and contrasting; reniform spot rectangular but with rounded corners, filled with white or light wood brown in some specimens, but more often with a gray central lunule and white limited to a fine white line on outer edge; claviform spot usually obscure, when expressed, a small, rounded spot, outlined in black, otherwise concolorous with forewing and extending no more than ¼ of distance to postmedial line; subterminal line sinuous, often obscure, but apparently doubled or at least bounded by darker color with paler wood-brown or gray shade filling in some individuals; terminal area usually concolorous with rest of forewing; terminal line generally obscure or a series of minute dark dots between veins; fringe concolorous. Forewing length: 15–16 mm (type series solely of laboratory reared specimens, which probably average slightly smaller than normal, so it may be incorrect to conclude that *P. louisae* is smaller than *P. danieli*). Hindwing dark fuscous, uniform in many individuals but sometimes paler toward wing base; discal spot dark fuscous, faint or obscure except in individuals with paler wing base; terminal line dark fuscous; fringe contrasting, luteous to orange brown.

Male genitalia (plate N, figure 5) generally as described for genus: uncus narrow, dorsoventrally flattened, sharply down curved near base, gradually and evenly tapered to apex; peniculus densely hairy, enlarged laterally to form a sharply angled rectangular plate; juxta elongated, 1.5 × as long as basal width; ventral margin of valve more or less evenly convex from base to anteroventral edge of cucullus; dorsal margin of valve evenly concave from base to anterodorsal edge of cucullus; subapical ''neck'' defining cucullus absent; cucullus trigonal, reduced to small membranous lobe distal to digitus, corona absent; valves asymmetrical with respect to shape of sacculus; process on dorsal margin of sacculus larger and of different shape on right valve than on left one; posterior extension on sacculus larger on right valve than on left; clasper a barlike sclerite extending from apex of sacculus ⅔ of distance to

cucullus; clasper with narrow, setose ampulla projecting posterodorsally from dorsal arm of clasper; costal margin of valve heavily sclerotized, becoming free from surface of valve toward cucullus to form digitus; digiti asymmetrical, right digitus similar in length to left one, or slightly longer, curved posteroventrally, whereas left digitus slightly sinuous and angled anteroventrally; editum a setose ridge near dorsal margin of valve basal to ampulla of clasper; aedeagus curved ventrally, 7 × as long as wide with sclerotized band extending onto base of vesica on left; aedeagus with heavily sclerotized rounded bulge dorsolaterally on right with part distal to bulge lightly sclerotized, necklacelike band of short spines reduced to row of three or four spines, thornlike spine at ventral apex in mainly membranous area; vesica about as long as aedeagus, curving to right through 150° to project anterolaterally, spinules on surface enlarged near apex to form subapical field of 25–30 long spines on right surface, transverse subbasal bulge with diverticula projecting to left and right, with an apical cornutus on right diverticulum; middle part of vesica swollen with spine field in swollen area and with a dorsal diverticulum proximal to swollen area.

Female genitalia (plate W, figure 5) with corpus bursae elongate, 2.8 × as long as wide and slightly more constricted posterior to middle than in *P. danieli,* membranous, with two moderately long signa; a short, rounded, heavily sclerotized appendix bursae posteriorly on left, sclerotization similar in degree to that of ductus bursae; ductus bursae entering corpus bursae on right side about ⅓ distance from posterior end, ⅓ × as long as corpus bursae, more heavily sclerotized on left side than right, even in width or wider posteriorly than anteriorly; A8 about as long as anterior apophyses; posterior apophyses 1.3 × as long as anterior apophyses, similar in thickness to anterior apophyses; papillae anales dorsoventrally flattened with two long sclerotized rods between anal papillae extending 0.6 × length of papillae from anterior margin; anal papillae triagonal, widest anteriorly, with lateral margins convex posterior to middle; apex of papillae rounded; surface of papillae covered with minute setae.

The larva of *P. louisae* is generally as described for the genus but differs considerably in appearance from that of *P. danieli* and characters that allow the two species to be differentiated are given under *P. danieli.* The head is honey orange

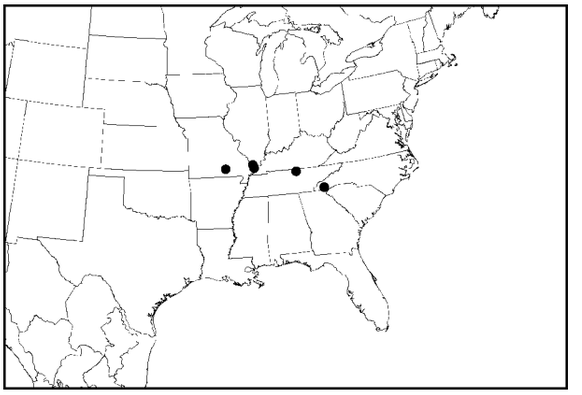


FIGURE 65: DISTRIBUTION OF MATERIAL EXAMINED OF *PROTAPAMEA LOUISAE*

with a negative (pale) reticulate pattern and no submedial arcs. The subdorsal stripes on the prothoracic shield are much less distinctly white, and the dark-pigmented bands on the lateral margins are not as dark as in *P. danieli,* rendering the ''eye-spot'' effect less dramatic. The dorsum of the body has less dark pigmentation, so the middorsal line is not well defined. The ground color above the lateral line is distinctly greenish gray, especially in the earlier instars. The anal shield is the same color, or slightly darker yellowish brown, as the prothoracic shield and the pale dorsal and subdorsal lines of the body do not continue across it. The appearance of the larva is much like that of the Palearctic species *Loscopia scolopacina* (Esper). This pattern persists only through the penultimate instar. In the final instar, the larva is transformed into a translucent, pale yellowish-brown, nondescript caterpillar of dramatically different appearance.

The mode of feeding and general bionomic details are as given in the generic description. *Protapamea louisae* is completely sympatric with *P. danieli,* and the two species can occur side by side on the same host plant. However, *P. louisae* larvae develop later than those of *P. danieli,* feeding in the second or third instar by the third week of April, whereas *P. danieli* larvae found at the same time and place are nearing maturity. Larvae of *P. louisae* have been found feeding on *Arundinaria gigantea* until the third week of May, and pupation occurs during the second half of that month. Pupal duration averages 16.2 days (N = 21). Reared adults emerged from June 3 to June 24 during several years of field and laboratory observation. In the wild, the species should be on

the wing later than, but overlapping, the flight period of *P. danieli.* With a single known exception, no adults have ever been observed or collected in the wild. John Franclemont once supplied me with a fine drawing of the female genitalia of a *Protapamea* specimen he collected in the vicinity of Highlands, Macon Co., North Carolina, which he presumed to be the female of the then little-known species here described as *P. danieli,* of which he had seen only one or two males from elsewhere. The drawing is unmistakably that of *P. louisae*; unfortunately, the specimen has been misplaced or lost. Tim McCabe (pers. comm.) was unable to locate it during his recent recuration of the Franclemont collection. All other existing specimens have been obtained by rearing wild-collected larvae.

TYPES. **Holotype:** ♂. Big Bottom, Cordell Hull Lake, Jackson Co., Tennessee; bred ex larva on *Arundinaria gigantea,* emerge: 19 June 1997; Eric L. Quinter. (CNC). **Paratypes:** 19 ♂, 6 ♀. **Kentucky.** Boatwright farm, old Mayfield Creek, 0.9 mi W Clinton Road (Highway 339), McCracken Co., final instar coll. on *Arundinaria gigantea* 10 May 2000, pupate 19 May 2000, emerge 3 June 2000; Eric L. Quinter (1 ♀). **Missouri.** Browns Crossing, 400′, jct. rt. 49 & Black River, 2.7 mi W Williamsville, Mark Twain Nat'l. Forest, Wayne Co., bred ex larva on *Arundinaria gigantea,* emerge: 20 June 1997; Eric L. Quinter (1 ♂, 1 ♀). Same locality, T27N-R4E, Sec. 23; ex larva on *Arundinaria gigantea,* emerge: 6–10 June 2000; James R. Wiker (2 ♂, 1 ♀). **Tennessee.** Same locality and host data as holotype; emerge: 21–24 June 1996 (2 ♂, 1 ♀); E. Quinter & Liu Yi. Same locality and host data as holotype; 15–23 June 1997 (8 ♂, 2 ♀), 10–18 June 1998; Eric L. Quinter (6 ♂s). CNC, ELQ, JRW.

Protapamea louisae has a very limited known range compared with that of *P. danieli.* The type locality lies in the Cumberland Plateau of central Tennessee. Franclemont's specimen was from the mountains of western North Carolina. The other records are from low elevations in the Mississippi River floodplain forests of southern Illinois, western Kentucky, and southern Missouri. The Illinois record is based on a single larva collected in Alexander County, from which no adult emerged. This species is strictly confined to canebrake habitats, where it should be sought but never expected.

GENUS

Melanapamea Lafontaine, NEW GENUS

by J. D. Lafontaine

Gender: feminine.

Type species: *Hadena impulsa* var. *mixta* Grote, 1881.

The species formerly known as *Apamea mixta* differs from other species of *Apamea* in many features of the genitalia. This could mean that it is simply a highly derived species arising from within *Apamea*; however, it shares several features characteristic of the *Oligia* group of genera such as the shape of the anal papillae in the female, and a heavily sclerotized ridge on the anteroventral margin of the cucullus. This combination of unique and *Oligia*-group characters demonstrates that *Melanapamea mixta* is not closely related to *Apamea,* so a new genus is proposed.

DIAGNOSIS OF THE GENUS *MELANAPAMEA*. Adults of the genus *Melanapamea* are superficially similar to those of *Apamea* in most external characters. The male antennae are slightly biserrate and beadlike. Unlike *Apamea,* the tarsi have three ventral rows of spiniform setae on segments 1–2 and four irregular rows on segments 3–5; in *Apamea* segments 2–5 have four rows. The male has fully developed brushes and pockets at the base of the abdomen, as do those of most *Apamea* species.

The male genitalia differ from those of *Apamea* in seven features: 1) a series of five or six long stout setae is on the ventral margin of the valve; 2) the ampulla of the clasper is club shaped, much stouter at the apex than at the base; 3) the digitus curves evenly from the dorsal margin of the valve toward the ventral margin, without the abrupt 90° angle in *Apamea*; 4) a heavily sclerotized ridge is on the anteroventral margin of the cucullus; 5) the aedeagus is very long, about 10 × as long as the mesial width (5–7 × as long in *Apamea*) and the dorsal margin is membranous; 6) the vesica is long and has a subbasal coil; and 7) a long, stout cornutus, enlarged at each end and with a preapical spine, is near the apex of the vesica. The female genitalia are characterized by the lyriform anal papillae and the very long bursa copulatrix.

Male genitalia (plate M, figure 6): uncus inflated at base, rounded and down curved beyond basal swelling, and dorsoventrally flattened and slightly upcurved through apical ¾; peniculus enlarged laterally to form rectangular plate supporting tuft of hairlike setae; juxta with basal ½ heavily sclerotized and diamond shaped, apical ½ a lightly sclerotized rectangular plate; valve with subapical ''neck'' defining cucullus; ventral margin of valve evenly convex to ¾ from base with

row of five or six long, stout setae beyond middle of ventral margin; dorsal margin of valve evenly concave to ¾ from base, then abruptly angled dorsally to form rounded process at anterodorsal edge of cucullus; cucullus triangular with full apical corona and with dense field of spiniform setae on posterior ½ of cucullus; valves bilaterally symmetrical; a rounded dorsal process on sacculus near base; clasper a prominent, heavily sclerotized barlike sclerite extending from apex of sacculus ⅔ of distance to cucullus; clasper with long, apically clubbed ampulla; ampulla 12 × as long as basal width, 5 × as long as apical width; digitus gently curving ventrally from dorsal margin of valve to project posteroventrally; editum a setose ridge at base ampulla of clasper; aedeagus long, straight, 9–10 × as long as wide with dorsal margin membranous; two short, spinulose, sclerotized bands extending onto base of vesica; vesica long, 1.7 × as long as aedeagus with subbasal 180° coil and gently curving apex project posteroventrally to right; vesica without basal or subbasal cornuti, but with large subapical cornutus ¼ × as long as aedeagus; cornutus swollen basally and apically with triangular preapical spine.

Female genitalia (plate W, figure 6): bursa copulatrix very long, 10–12 × as long as abdominal segment eight (A8), somewhat pear shaped anteriorly; ostium bursae heavily sclerotized, ¾ × as long as A8; ductus bursae lightly sclerotized, 2.5 × as long as A8; corpus bursae 8–9 × as long as A8, pear shaped anteriorly, gradually tapered posteriorly to ductus bursae with ductus seminalis at junction of corpus bursae and ductus bursae; anterior apophysis ¾ × as long as A8, posterior apophysis 2 × as long as A8; papillae anales dorsoventrally flattened, lyriform, inner margins spreading apart posteriorly; surface of papillae covered with minute setae set in middle of membranous circles.

Melanapamea mixta (Grote), NEW COMBINATION

PL. 8, FIGS. 39, 40; PL. M, FIG. 6 (♂ gen.); PL. W, FIG. 6 (♀ gen.); TEXT FIG. 66 (map) (RWH 9361).

Hadena impulsa var. *mixta* Grote, 1881, *Bull. U. S. Geol. Geog. Survey Terr.,* **6**: 264.
Type locality: Texas. [BMNH]

NOTE—Grote appears to have described this taxon from a single specimen received from Texas that was collected by Belfrage, so the type locality should be in eastern Texas; however, the species has not been recorded from Texas since that time, so its occurrence there is unconfirmed. The description, and the reference to specimen 628, suggest a unique specimen, so the specimen in the BMNH labeled "628/ var. *mixta* Type/ Grote Coll. 81-116./ U. S. America 1940, 142" is here treated as the holotype.

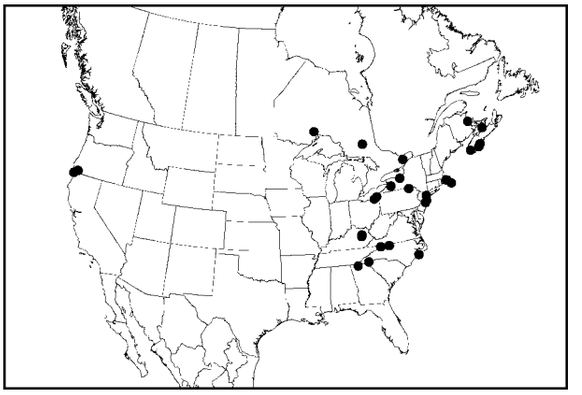


FIGURE 66: DISTRIBUTION OF MATERIAL EXAMINED OF *MELANAPAMEA MIXTA*

In spite of the many structural differences between this species and species of *Apamea, Melanapamea mixta* is frequently confused with the *Apamea impulsa. Melanapamea mixta* differs from *Apamea impulsa* in the following details: the moth is slightly smaller (forewing length: 15–18 mm); the forewing ground color is more mottled; the claviform spot typically is larger; the reniform spot is more extensively filled with white scales; the transverse lines are more obscure, often almost absent; the margin of the wing has a white dot at the end of each vein.

Melanapamea mixta can also be distinguished from *Apamea impulsa,* and all other *Apamea* species, by the genital characters listed in the generic diagnosis.

The immature stages are unknown, but the shape of the anal papillae suggests that the larva is probably a borer.

Melanapamea mixta occurs from Nova Scotia and New Brunswick westward to western Ontario and southward to northern Georgia. A highly disjunct western population is on the Pacific Coast of southern Oregon and northern California. Adults have been recorded from late June until early September.

GENUS

Lateroligia Zilli, Fibiger, and Ronkay

by J. D. Lafontaine

Lateroligia Zilli, Fibiger, and Ronkay, 2005, *Noctuidae Europaeae,* **8**: 157.
Type species: *Phalaena Noctua ophiogramma* Esper, [1794]. Original designation.

The genus *Lateroligia* was proposed for the enigmatic species *Lateroligia ophiogramma* that combines characters of *Apamea* with those of the *Oligia* Hübner group of genera. Its long association with *Apamea* is peculiar because the small size and slight build of the moth have always made it an anomaly in *Apamea.* Also, the larva is a stem borer, unlike *Apamea* species. The male genitalia are unlike those of *Apamea* but are too divergent to allow the species to be associated with any other genus.

DIAGNOSIS OF THE GENUS *LATEROLIGIA*. Adults of *Lateroligia* are superficially similar to those of *Apamea* in most characters; they are most easily distinguished from *Apamea* by the distinctive forewing pattern, slight build, three rather than four ventral rows of spiniform setae on the second tarsal segment, and the diagnostic genital characters. The male antenna is filiform, unlike most species of *Apamea* except those in the *A. crenata*-group. The abdomen has dorsal tufts on the basal five segments with those on 1, 3, and 4 the largest and those on segments 2 and 5 smaller; the tufts are brown and inconspicuous. As in most species of *Apamea,* the abdomen of the male has a central tuft of long hairlike scales forming an anal brush on the eighth sternum, and there are fully developed brushes and pockets at the base of the abdomen.

The male genitalia differ from those of *Apamea* in six features: 1) the ampulla of the clasper is essentially absent (there is a small pimplelike process on the dorsal part of the clasper with one or two setae); 2) the digitus projects posteroventrally across the valve to fuse with the anterior margin of the cucullus and extends in a spinelike process from the ventral angle of the cucullus (as in some genera of the *Oligia*-group); 3) a heavily sclerotized ridge is on the anteroventral margin of the cucullus that fuses with the digitus and extends ventrally as a spine; 4) the cucullus is differentiated from the remainder of the valve only by slight indentations on the dorsal and ventral margins; 5) a tuft of long, stout setae is on the dorsal margin of the valve at the base of the cucullus; and 6) the vesica has three large clusters of stout cornuti, one near the apex and two near the base (one on the left and one on the right). The female genitalia are characterized by the lyriform anal papillae, the more heavily sclerotized lateral walls of the ductus bursae, and the presence of four prominent signa in the corpus bursae.

Male genitalia (plate N, figure 6): uncus inflated at base, ¼ from base, and ¾ from base, constricted subbasally and toward apex; uncus down curved from base to apex; peniculus enlarged laterally to form rectangular plate supporting tuft of hairlike setae; juxta U-shaped with anterior rim heavily sclerotized; valve with slight subapical ''neck,'' so cucullus not well differentiated; ventral margin of valve slightly convex to ¾ from base; dorsal margin of valve deeply concave near base but almost straight from middle of valve to apex; cucullus defined only by slight notch in dorsal and ventral edge of valve and by heavily sclerotized ridge extending transversely across valve and into spine on anteroventral corner of cucullus; cucullus with full apical corona and tuft of long, stout setae on dorsal margin of valve at base of cucullus; valves bilaterally symmetrical; sacculus large with dorsal margin produced into rounded lobe extending over dorsal margin of valve; clasper a prominent, heavily sclerotized barlike sclerite extending from apex of sacculus ⅔ of distance to cucullus; ampulla of clasper essentially absent, a small rounded process on dorsal part of clasper with one or two setae; digitus a broad plate projecting posteroventrally across valve to fuse with anterior margin of the cucullus and forming a spinelike process at anteroventral angle of cucullus; editum a setose ridge anterior to base of ampulla; aedeagus as in *Apamea,* 5–6 × as long as wide with apex scobinate; vesica about as long as aedeagus, abruptly angled at ⅓ from base to project to right and curving to project anteriorly; vesica with large subbasal diverticulum and subbasal angle; vesica with three large clusters of stout cornuti, one near apex and two near base, one on left and one on right.

Female genitalia (plate W, figure 7): corpus bursae elongate, 2 × as long as wide; corpus bursae with a short, rounded, posteriorly sclerotized appendix bursae posteriorly on left; signa four, prominent, signum in dorsal wall 2 × as long as

other signa; ductus bursae about ½ × as long as corpus bursae, posterior ¼ membranous, anterior ¾ more heavily sclerotized on left and right sides than in middle; ostium bursae with heavily sclerotized transverse bar on ventral margin; A8 ⅔ × as long as anterior apophysis; posterior apophysis 2 × as long as anterior apophyses, similar in thickness to anterior apophyses; papillae anales dorsoventrally flattened with two sclerotized rods between anal papillae extending to middle of anal papillae; anal papillae lyriform, with lateral margins prominently constricted at ¼ from anterior end and broadly convex through posterior ¾; surface of papillae covered with minute setae set in small membranous circles.

The larva is a unicolorous pale gray, often with a red tint, and the head capsule, and prothoracic and anal shields are blackish brown (illustrated by Beck, 2000, fig. B511). It resembles some root feeding *Apamea* species, but the black pinacula are small and inconspicuous and the apical seta on the labial palpus (Lp2) is much shorter than in *Apamea,* about ⅓ × as long as the basal segment of the labial palpus (Lps1) (1.0–1.3 × as long in *Apamea*).

Mature larva: Spinneret long and tubular with dorsal groove, about 2.5 × as long as basal segment of labial palpus (Lps1). Labial palpus with apical seta (Lp2) relatively short ⅓ × as long as basal segment (Lps1) and about as long as first seta (Lp1). Spines on hypopharynx similar to those of *Apamea.* Mandible with three ridges on inner surface thin, without thickening on internal ridges in *Apamea.* Larva pale gray, frequently with red tint. Slight trace of paler middorsal line, otherwise unpatterned. Prothoracic and anal shields dark blackish brown, without paler middorsal line. Pinacula flat, small, dark gray. Head dark blackish brown, without pattern.

Lateroligia ophiogramma (Esper)
PL. 8, FIGS. 41–43; PL. N, FIG. 6 (♂ gen.); PL. W, FIG. 7 (♀ gen.); TEXT FIG. 67 (map) (RWH 9331).

Phalaena Noctua ophiogramma Esper, [1794], *Die Schmetterlinge in Abbbildungen nach der Natur mit Beschreibungen,* **4**: pl. 182, fig. 2.
Type locality: [Europe]. [unknown]

Noctua biloba Haworth, 1809, *Lepidoptera Britannica,* **2**: 209.
Type locality: Great Britain. [unknown]

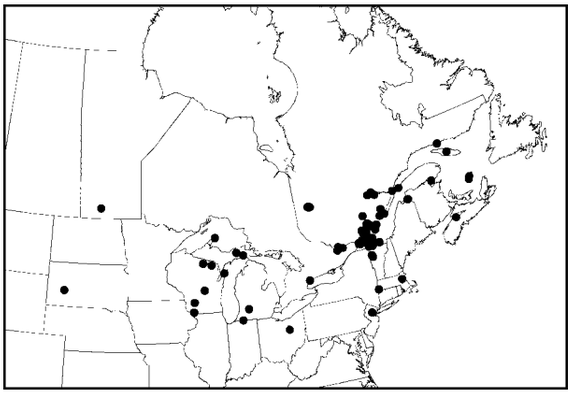


FIGURE 67: DISTRIBUTION OF MATERIAL EXAMINED OF *LATEROLIGIA OPHIOGRAMMA*

Miana ophiogramma ab. *maerens* Staudinger, 1901, *in* Staudinger and Rebel, *Catalog der Lepidopteren Palaearctischen Faunengebietes,* **1:** 164.
Type locality: Europe. [unknown]

This is a small (forewing length: 13–15 mm), relatively thin-bodied and narrow-winged species. The scientific name, ''snake-figure,'' refers to the contrasting wavy line between the dark shading along the costa and the pale shading on the posterior part of the wing. The medial area is dark blackish gray down to the level of the contrasting black dash in the fold formed by the claviform spot; the medial area is paler below the dash, giving the wing its distinctive pattern. Two color forms occur, one in which the pale areas of the wing are pale brown to rusty brown with some gray shading, and the other in which these pale areas are gray brown, not as dark as the shading in the medial area, but darker than the pale form. In both forms the reniform spot is the same color as the subterminal area, and there is a contrasting black anal dash extending from the postmedial line to the terminal area. The hindwing is pale fuscous basally, darker toward the wing margin. In Finland, rural samples of the species contain about 10 % of the melanic form, whereas in urban Helsinki the percentage is around 40 % (Mikkola and Jalas, 1979). In North America the dark and light forms are equally common in the East, but only the pale form has been found in the West.

The larva bores in the stem of shore and marsh grasses that have thick stems, like *Phalaris, Phragmites,* and *Glyceria* (Mikkola and Jalas,

1979). The larva was illustrated by Beck (2000, fig. B511) and Ahola and Silvonen ([2008]: 636).

Lateroligia ophiogramma is widely distributed in Eurasia from western Europe to Japan. It appears to have been introduced into North America twice (Troubridge et al., 1992). An introduction into the Vancouver area of British Columbia is exclusively of the pale form and is believed to have originated in eastern Asia. The introduction into eastern North America includes both forms of the species and likely originated in Europe. The western population still occurs mainly in the Vancouver area, but the eastern population now occurs from Nova Scotia westward to Manitoba and South Dakota and southward to New Jersey and Ohio, and continues to spread southward and westward. The flight season extends from mid-July until late August.

LITERATURE

AHOLA, M. and K. SILVONEN, [2008]. *Larvae of northern European Noctuidae.* Vol. 2. 672 pp. Vaasa, Finland: KuvaSeppälä Yhtiöt Oy.

ANDREWS, W. V. 1877. New species of Noctuidae. *Can. Ent.,* **9**: 98–99.

BARNES, W. and J. MCDUNNOUGH, 1913. Illustrations of rare and typical Lepidoptera. *Contrib. Nat. Hist. Lep. N. Amer.,* **2**: 1–44, 21 pls.

BARNES, W. and J. MCDUNNOUGH, 1916. Synonymic notes on North American Heterocera. *Contrib. Nat. Hist. Lep. N. Amer.,* **3**: 155–208, 4 pls.

BECK, H. 1960. *Die Larvalsystematik der Eulen* (*Noctuidae*). 406 pp. Berlin: Akademie Verlag.

BECK, H. 1999. *Die Larven der Europäischen Noctuidae.* Vol. **2**. 448 pp. Marktleuthen, Germany: Dr. Ulf Eitschberger.

BECK, H. 2000. *Die Larven der Europäischen Noctuidae.* Vol. **3**. 336 pp. Marktleuthen, Germany: Dr. Ulf Eitschberger.

BEIRNE, B. P. 1971. Pest insects of annual crop plants in Canada. I. Lepidoptera. II. Diptera. III. Coleoptera. *Mem. Ent. Soc. Canada,* **78**: 1–47.

BIRCH, M. C. 1972. Male abdominal brush-organs in British noctuid moths and their value as a taxonomic character. Part 1. *The Entomologist,* **105**: 185–205.

BOURSIN, C. 1964. Les Noctuidae trifinae de France et de Belgique (Contributions à l'étude des Noctuidae trifinae, 148. *Bull. Mensuel Soc. Linnéenne Lyon,* **33**: 204–240.

BRETHERTON, R. F., B. GOATER, and R. I. LORIMERN, 1979. Noctuidae. p. 120–278, pl. 7–13. *In* HEATH, J., and J. M. EMMET (Eds.), 1979. *The butterflies and moths of Great Britain and Ireland.* Vol. 9. London: Curwen Books.

COCKAYNE, E. A. 1950. The probable genetic relationship of three forms of *Apamea remissa* Hb., *Apamea oblonga* Haw. and *Celaena leucostigma* Hb. *Ent. Gazette,* **1**: 97–98.

COVELL, C. V. JR. 1984. *A field guide to the moths of eastern North America.* The Peterson Field Guide Series. xv + 496 pp., 64 pl. Boston: Houghton Mifflin Co.

CRUMB, S. E. 1956. The larvae of the Phalaenidae. *U. S. Dept. Agric. Tech. Bull.,* **1135**: 1–356, pl. 1–11.

DOWNES, J. A. 1966. The Lepidoptera of Greenland; some geographical considerations. *Can Ent.,* **98**: 1135–1144.

DYAR, H. G. 1898. Descriptions of the larvae of fifty North American Noctuidae. *Proc. Ent. Soc. Washington,* **4**: 315–332.

DYAR, H. G. 1904a. New species of North American Lepidoptera and a new limacodid larva. *Jour. New York Ent. Soc.,* **12**: 39–44.

DYAR, H. G. 1904b. Additions to the list of North American Lepidoptera, no. 2. *Proc. Ent. Soc. Washington,* **6**: 103–117.

FERGUSON, D. C. 1954. The Lepidoptera of Nova Scotia. Part 1, Macrolepidoptera. *Proc. Nova Scotian Inst. Sci.,* **23**: 161–375.

FERGUSON, D. C. 1977. A new North American species of *Apamea* formerly confused with *A. verbascoides* (Guenée) (Noctuidae). *Jour. Lep. Soc.,* **31**: 57–62.

FIBIGER, M., and J. D. LAFONTAINE. 2005. A review of the higher classification of the Noctuoidea (Lepidoptera)—with special reference to the Holarctic fauna. *Esperiana,* **11**: 6–85.

FIBIGER, M., L. RONKAY, and A. ZILLI, 2005. *Abromias assimilis jenskjeldi* Fibiger, Ronkay & Zilli, subsp. n., p. 155–156. *In* ZILLI, A., L. RONKAY, and M. FIBIGER. 2005. *Noctuidae Europaeae.* Vol. 8, *Apameini.* 1–323. Sorø: Entomological Press.

FITCH, A. 1856. Third report on the noxious and other insects of the state of New York. *Trans. New York State Agricultural Soc.,* **16**: 315–490.

FORBES, W. T. M. 1954. Lepidoptera of New York and neighboring states. Part 3 Noctuidae. *Cornell Univ. Agric. Experiment Station, Mem.,* **329**: 1–433, figs. 1–290.

FRANCLEMONT, J. G. 1950. Notes on some genera and species of eastern moths with descriptions of new species (Lepidoptera, Phalaenidae). *Bull. Brooklyn Ent. Soc.,* **45**: 144–155.

FRANCLEMONT, J. G., and E. L. TODD. 1983. *Noctuidae.* pp. 120–159. *In* HODGES, R. W. et al. *Check List of the Lepidoptera of America North of Mexico.* xxiv + 284 pp. London: E. W. Classey Ltd. and the Wedge Entomological Research Foundation.

GODFREY, G. L. 1987. Noctuidae (Noctuoidea). pp. 549–578. *In* STEHR, F. W. (Editor). *Immature insects.* xiv + 754 pp. Dubuque: Kendall/Hunt.

GROTE, A. R. 1874, Notes on American Lepidoptera with descriptions of twenty-one new species. *Bull. Buffalo Soc. Nat. Sci.,* **2**: 145–163.

GROTE, A. R. 1875. *Check List of the Noctuidae of America North of Mexico. 1. Bombyciae and Noctuelitae* (*Non-fasciatae*). 28 pp., 1 pl. Buffalo: Reinecke and Zesch.

GROTE, A. R. 1876. Descriptions and notes on certain moths. *Can. Ent.,* **8**: 25–29.

GROTE, A. R. 1878. Descriptions of Noctuidae, chiefly from California. *Bull. U. S. Geol. Surv.,* **4**: 169–187.

GROTE, A. R. 1879. On *Lithophane* and new Noctuidae. *Bull. U. S. Geol. Geog. Surv. Terr.,* **5**: 201–208.

GROTE, A. R. 1881a. New Noctuidae from Washington Territory. *Papilio,* **1**: 58–59.

GROTE, A. R. 1881b. North American moths, with a preliminary catalogue of the species of *Hadena* and *Polia. Bull. U. S. Geol. Geog. Survey Terr.,* **6**: 257–277.

GUENÉE, A. 1837. Essai pour servir a la classification des Noctuélites. *Ann. Soc. Ent. France,* **6**: 311–367.

GUENÉE, A. 1841. Essai sur la classification des Noctulides. *Ann. Soc. Ent. France,* **10**: 217–250.

GUENÉE, A. 1852. Vol. 5, *Noctuélites.* Tome 1. *In* BOISDUVAL, J. B. A. D. DE. and A. GUENÉE. *Histoire Naturelle des Insectes. Species Général des Lépidoptères.* [i]–xcvi + 1–407. Paris: Roret.

HAMPSON, G. F. 1903. *Catalogue of the Lepidoptera Phalaenae in the British Museum,* **4**: 1–689, pl. 55–77.

HAMPSON, G. F. 1908. *Catalogue of the Lepidoptera Phalaenae in the British Museum,* **7**: 1–709, pl. 108–122.

HANDFIELD, L. 1999. Le guide des papillons du Quebec. Version scientifique. Vol. I. 982 pp. + 123 pl. Boucherville, Quebec: Broquet.

HARRIS, T. W. 1862. *A treatise on some of the insects injurious to vegetation.* New Edition. 640 pp. Boston: Crosby and Nichols.

HEBERT, P. D. N., S. RATNASINGHAM, and J. R. DEWAARD. 2003. Barcoding animal life: cytochrome c oxidase subunit 1 divergences among closely related species. *Proc. Royal Soc. London, Series B,* **270**: S596–S599.

HEPPNER, J. 2003. *Arthropods of Florida and neighboring land areas.* Volume **17**: *Lepidoptera of Florida.* Part 1: *Introduction and catalog.* 670 pp. Gainesville: Florida Department of Agriculture & Consumer Services.

HODGES, R. W. et al. 1983. *Check List of the Lepidoptera of America North of Mexico.* xxiv + 284 pp. London: E. W. Classey Ltd. and the Wedge Entomological Research Foundation.

KITCHING, I. J., and J. E. RAWLINS. [1998] 1999. The Noctuoidea. pp. 355–401. *In* KRISTENSEN, N. P. (Ed.). Lepidoptera: Moths and Butterflies. Volume **1**: Evolution, systematics and biogeography.—*Handbook of Zoology/ Handbuch der Zoologie.* 491 pp. Berlin/New York: Walter de Gruyter.

KOCH, M. 1965. Neue subspecies von *Crymodes rubrirena* Tr. (Lepidoptera, Noctuidae). *Reichenbachia,* **4**: 261–270.

LAFONTAINE, J. D., and M. FIBIGER. 2006. Revised higher classification of the Noctuoidea (Lepidoptera). *Can. Ent.,* **138**: 610–635.

MACKAY, M. R. 1972. The larvae of Canadian Arctic Noctuidae (Lepidoptera). *Can. Ent.,* **104**: 859–872.

MACKAY, M. R., and E. W. ROCKBURNE. 1958. Notes on life-history and larval description of *Apamea apamiformis* (Guenée), a pest of wild rice (Lepidoptera: Noctuidae). *Can. Ent.,* **90**: 579–582.

MCCABE, T. L. 1991. Atlas of Adirondack caterpillars. *New York State Mus. Bull.,* **470**: 1–114.

MCDUNNOUGH, J. H. 1938. Check list of the Lepidoptera of Canada and the United States of America. Part 1. Macrolepidoptera. *Mem. South. California Acad. Sci.,* **1**: 1–275.

MCDUNNOUGH, J. H. 1940. Undescribed species and races of Phalaenidae (Lepid.). *Can. Ent.,* **72**: 191–201.

MIKKOLA, K., and B. GOATER, 1988. The taxonomic status of *Apamea exulis* (Duponchel) and *A. assimilis* (Doubleday) in relation to *A. maillardi* (Geyer) and *A. zeta* (Treitschke) (Lepidoptera, Noctuidae). *Ent. Gazette,* **39**: 249–257, 2 pl.

MIKKOLA, K., and I. JALAS, 1979. Suomen Perhoset Yökköset 2 [Finnish Lepidoptera: Noctuidae 2.] (In Finnish). 304 pp. Helsinki: Otava.

MIKKOLA, K., and J. D. LAFONTAINE, 1996. A preliminary note on the taxonomy of the *Apamea zeta* complex, with a first report of *A. zeta* from Fennoscandia (Lepidoptera, Noctuidae). *Notulae Ent.,* **66**: 91–95.

MIKKOLA, K., and J. D. LAFONTAINE, 1994. Recent introductions of riparian noctuid moths from the Palearctic Region to North America, with the first report of *Apamea unanimis* (Hübner) (Noctuidae: Amphipyrinae). *Jour. Lep. Soc.,* **48**: 121–127.

MORRIS, R. F. 1980. Butterflies and moths of Newfoundland and Labrador. The Macrolepidoptera. *Research*

Branch, Agriculture Canada Publication, **1691**: 1–407 + 34 pl.

MORRISON, H. K. 1874. Descriptions of new Noctuidae. *Bull. Buffalo. Soc. Nat. Sci.,* **2**: 109–122.

MORRISON, H. K. 1875a. Descriptions of new Noctuidae. *Proc. Boston Soc. Nat. Hist.,* **17**: 131–166.

MORRISON, H. K. 1875b. List of a collection of Texan Noctuidae, with descriptions of the new species. *Proc. Boston Soc. Nat. Hist..,* **17**: 209–221.

MÖSCHLER, H. B. 1860. Beiträge zur Lepidopteren-Fauna von Labrador. *Wiener Ent. Monat.,* **4**: 329–381.

MUSTELIN, T., R. LEUSCHNER, K. MIKKOLA, and J. D. LAFONTAINE, 2000. Two new genera and thirteen new species of owlet moths (Lepidoptera, Noctuidae), mainly from Southern California. *Proc. San Diego Soc. Nat. Hist.,* **36**: 1–18.

NEIL, K. 1991. The larva of *Ommatostola lintneri* (Noctuidae: Amphipyrinae). *Jour. Lep. Soc.,* **45**: 204–208.

NELSON, J. J. 2000. *Crop Profile for Wild Rice in Minnesota.* Minnesota Pesticide Impact Assessment Program (PIAP). http://www.ipmcenters.org/cropprofiles/docs/mnwildrice.html.

POOLE, R. W. 1989. *Lepidopterorum Catalogus* (*New Series*). Fascicle **118** Noctuidae, Parts 1–3: xii + 1–1314. New York: E.J. Brill.

POOLE, R. W. 1995. Noctuoidea: Noctuidae (part), Cuculliinae, Stiriinae, Psaphidinae (part). *In* Dominick, R. B. et al., *The Moths of America North of Mexico,* fasc. **26.1**: 1–249. Washington: The Wedge Entomological Research Foundation.

PRENTICE, R. M. (Compiler). 1962. Forest Lepidoptera of Canada recorded by the Forest Insect Survey, vol. 2. Nycteolidae, Noctuidae, Notodontidae, Liparidae. *Canada Dept. Forestry Bull.,* **128**: 75–281.

RATNASINGHAM, S., and P. D. N. HEBERT. 2007. Bold: The barcode of life data system. *Molecular Ecol. Notes,* **7**: 355–364.

RINDGE, F. H. 1955. The type material in the J. B. Smith and G. D. Hulst collections of Lepidoptera in the American Museum of Natural History. *Bull. Amer. Mus. Nat. Hist.,* **106**: 91–172.

SMITH, J. B. 1890. Contribution toward a monograph of the insects of the lepidopterous family Noctuidae of temperate North America.—Revision of the species of the genus *Agrotis. Bull. U. S. Natl. Mus.*, 38: 1–237.

SMITH, J. B. 1891. Contribution toward a monograph of the Noctuidae of temperate North America.—Revision of the species of *Hadena* referable to *Xylophasia* and *Luperina. Proc. U. S. Natl. Mus.,* **13**: 407–447

SMITH, J. B. 1893. Catalogue of the lepidopterous superfamily Noctuidae found in boreal America. *Bull. U. S. Natl. Mus.,* **44**: 1–424.

SMITH, J. B. 1895a. Descriptions of new species of Noctuidae. *Ent. News,* **6**: 332–340, 1 pl.

SMITH, J. B. 1895b. Descriptions of new species of Noctuidae. *Ent. News,* **7**: 26–31. [Volume 7, Number 1, was published in December 1895]

SMITH, J. B. 1899. Some new species of *Hadena. Can. Ent.,* **31**: 257–265.

SMITH, J. B. 1903a. New noctuids for 1903, no. 3—with notes on some undescribed species. *Can. Ent.,* **35**: 127–138.

SMITH, J. B. 1903b. New noctuids for 1903. No 5. *Jour. New York Ent. Soc,* **11**: 188–193.

SMITH, J. B. 1910. Notes on the American species of *Agroperina* Hampson. *Jour. New York Ent. Soc.,* **18**: 137–148.

TIETZ, H. M. 1972. *An index to the described life histories, early stages and hosts of the Macrolepidoptera of the Continental United States and Canada.* **1**: iv + 1–536; **2**: 537–1041. Sarasota, Florida: A. C. Allyn.

TODD, E. L. 1982. The noctuid type material of John B. Smith (Lepidoptera). *U. S. Dept. Agric. Tech. Bull.,* **1645**: 1–228.

TROUBRIDGE, J. T., S. M. FITZPATRICK, and J. D. LAFONTAINE. 1992. *Apamea ophiogramma* (Esper), a palearctic cutworm new to North America (Lepidoptera: Noctuidae). *Can. Ent.* **124**: 109–112.

VIETTE, P. E. L. 1951. Sur quelques noctuelles décrites par Guenée. *Bull. Mens. Soc. Linnéenne Lyon,* **20**: 159–162.

WALKER, F. 1856. *List of the Specimens of Lepidopterous Insects in the Collection of the British Museum,* **9**: 1–252. London: Edward Newman.

WALKER, F. 1858. *List of the Specimens of Lepidopterous Insects in the Collection of the British Museum,* **15**: 1521–1888. London: Edward Newman.

WOLFF, N. L. 1971. *The Zoology of Iceland,* 3: Part 45, Lepidoptera. 1–193, pl. 1–15. Copenhagen and Reykjavik: Munksgaard.

ZILLI, A., L. RONKAY, and M. FIBIGER. 2005. *Noctuidae Europaeae.* Vol. **8**, *Apameini.* 1–323. Sorø: Entomological Press.

MONOCHROME PLATES

NOTE—Male genitalia are shown with the genital capsule from a posterior view with the valves opened to the sides; the aedeagus is below or to the right of the genital capsule with the anterior end to the left and dorsal surface up with the vesica everted. CNC Noctuoidea # 000 in the figure captions refers to the database entry on The Wedge Entomological Research Foundation website.

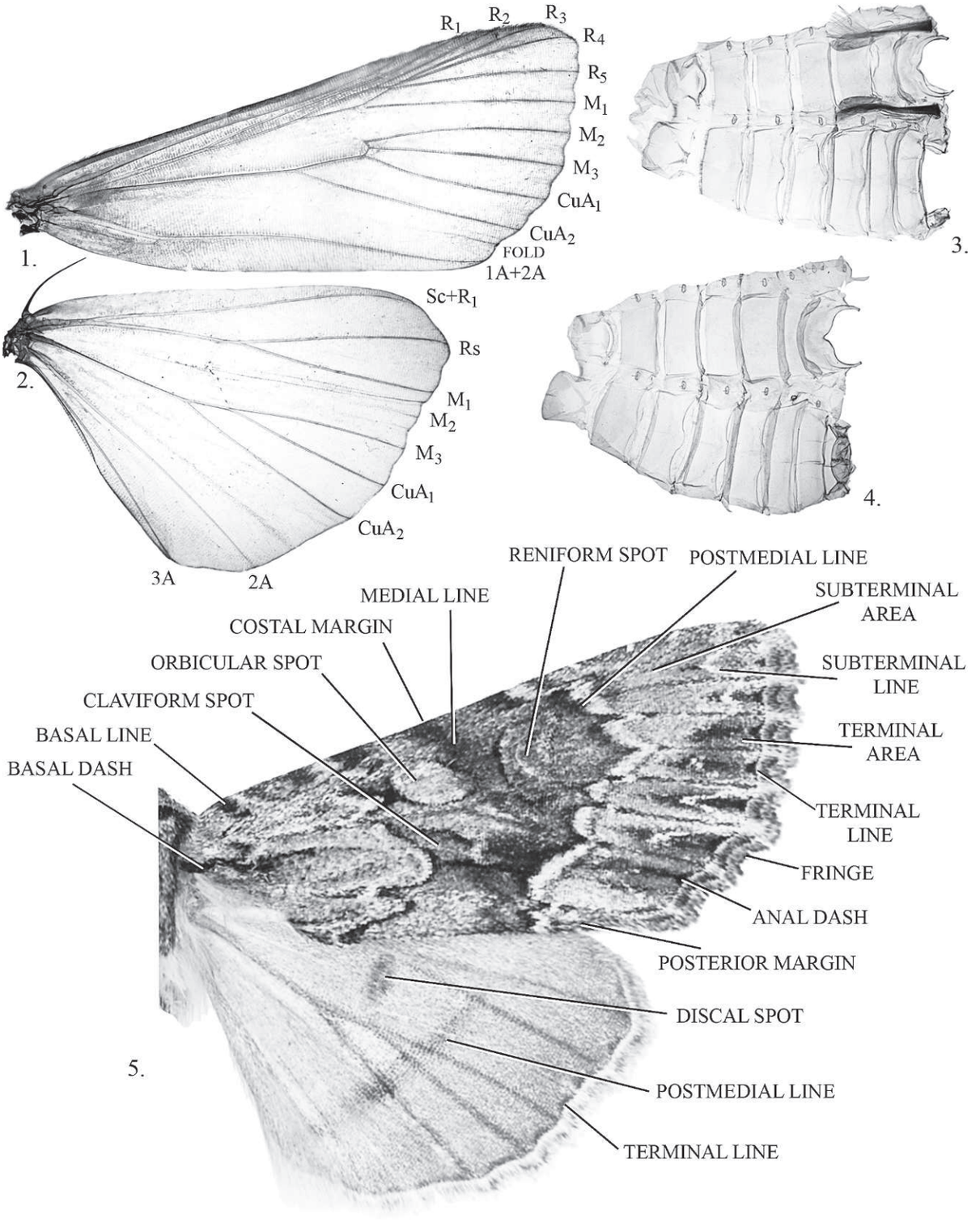


PLATE A. WING AND ABDOMINAL STRUCTURES

1. Venation of forewing (*Apamea cinefacta*) 2. Venation of hindwing. 3. Male abdomen of *Apamea robertsoni* showing fully developed brushes, pockets and levers. 4. Male abdomen of *Apamea zeta nichollae* without brushes and pockets. 5. Wing pattern.

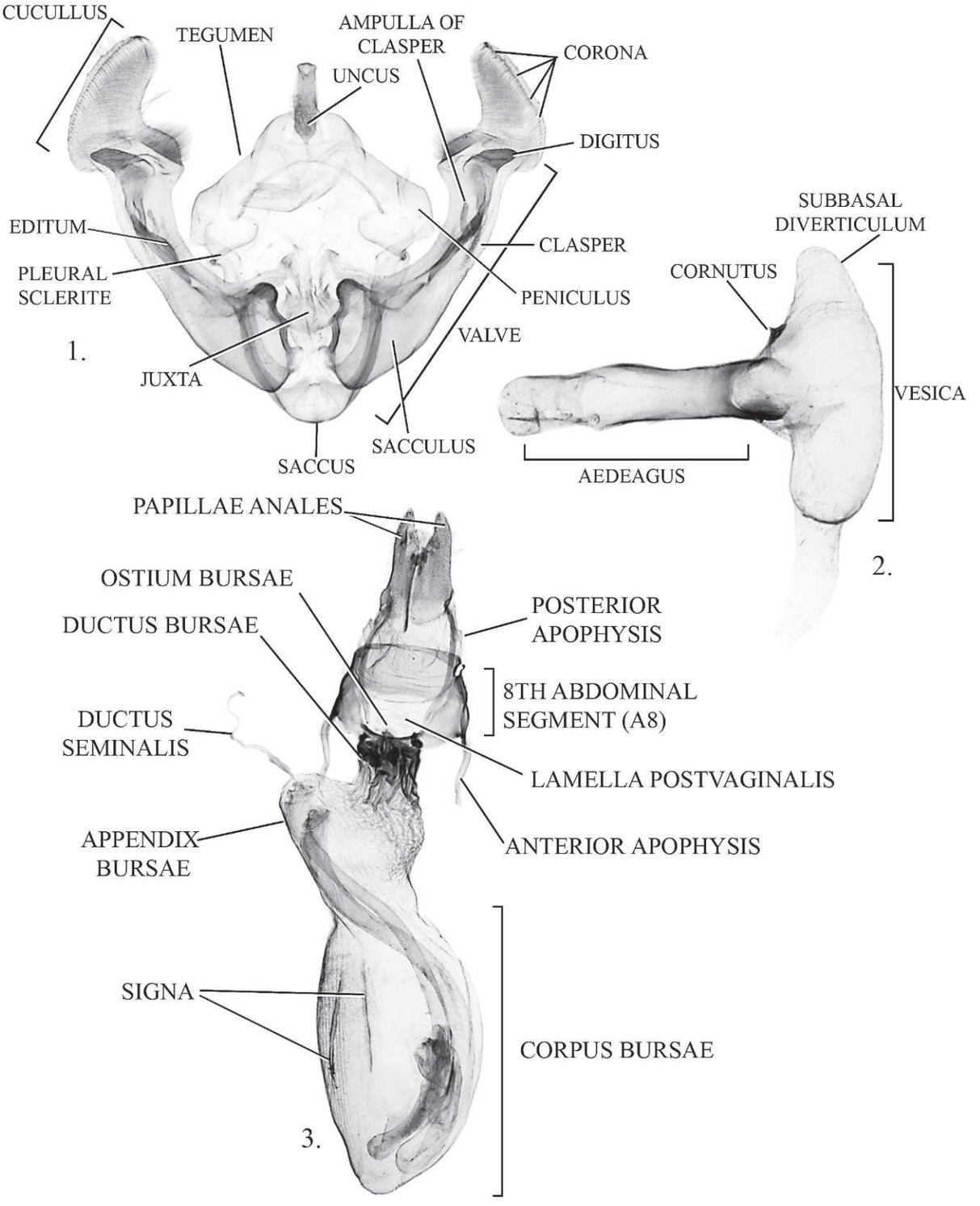


PLATE B. MALE AND FEMALE GENITALIA

1. Posterior view of male genital capsule of *Apamea alticola* with valves opened laterally. 2. Aedeagus of *Apamea alticola* with vesica everted. 3. Female genitalia of *Apamea zeta nichollae* with spermatophores.

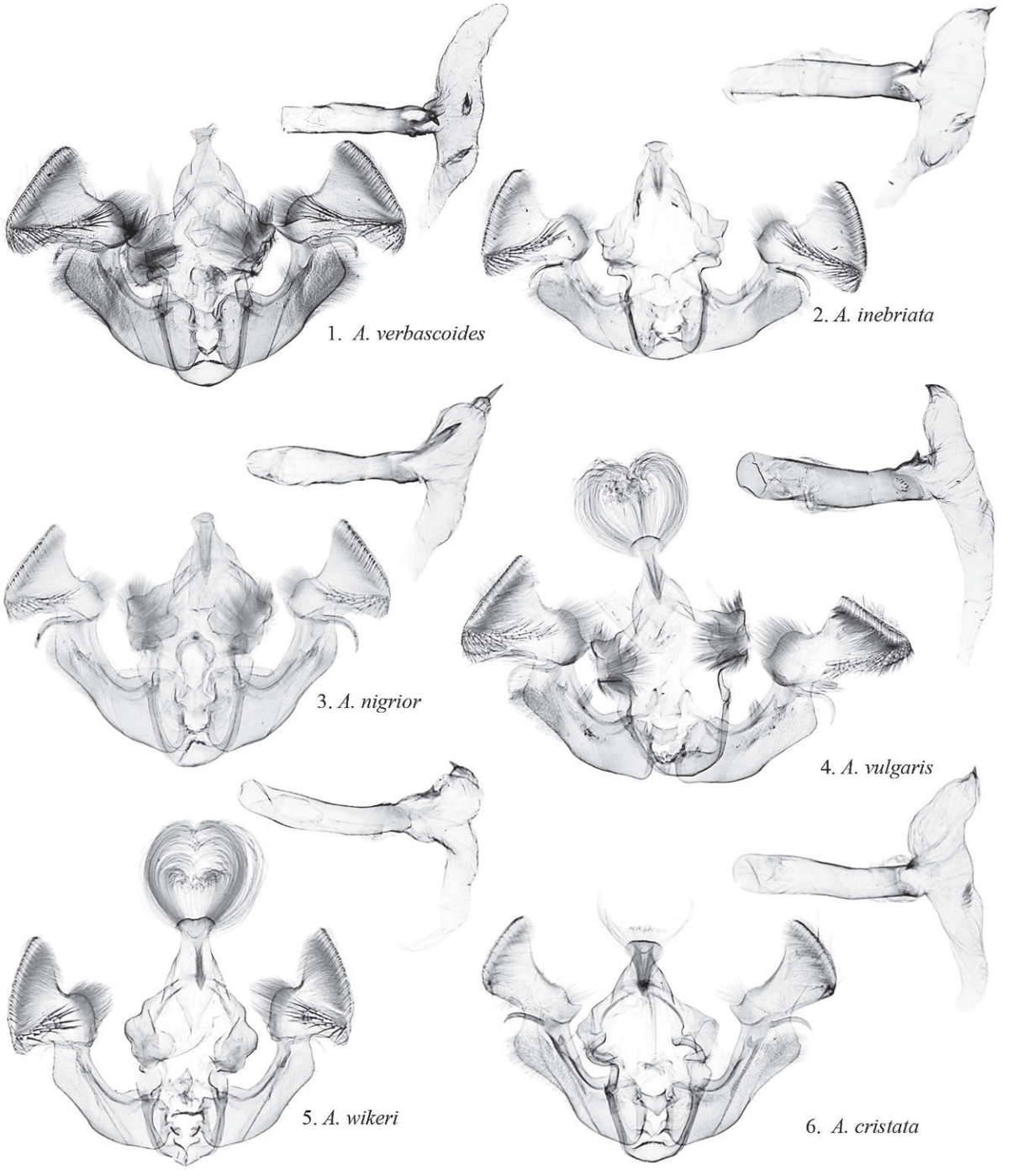


PLATE C. MALE GENITALIA

1. *Apamea verbascoides* (Guenée); Winnipeg, Manitoba; CNC 8554. (p. 29). 2. *Apamea inebriata* Ferguson; Ocean Co., New Jersey; CNC 9161. (p. 30). 3. *Apamea nigrior* (Smith); Varna, Tompkins Co., New York; CNC 8556. (p. 31). 4. *Apamea vulgaris* (Grote and Robinson); Varna, Tompkins Co., New York; CNC 8773. (p. 31). 5. *Apamea wikeri* Quinter and Lafontaine; holotype; 3 mi W of Tamms, Alexander Co., Illinois; CNC 13589. (p. 32). 6. *Apamea cristata* (Grote); Allegany State Park, New York; CNC 9242. (p. 33).

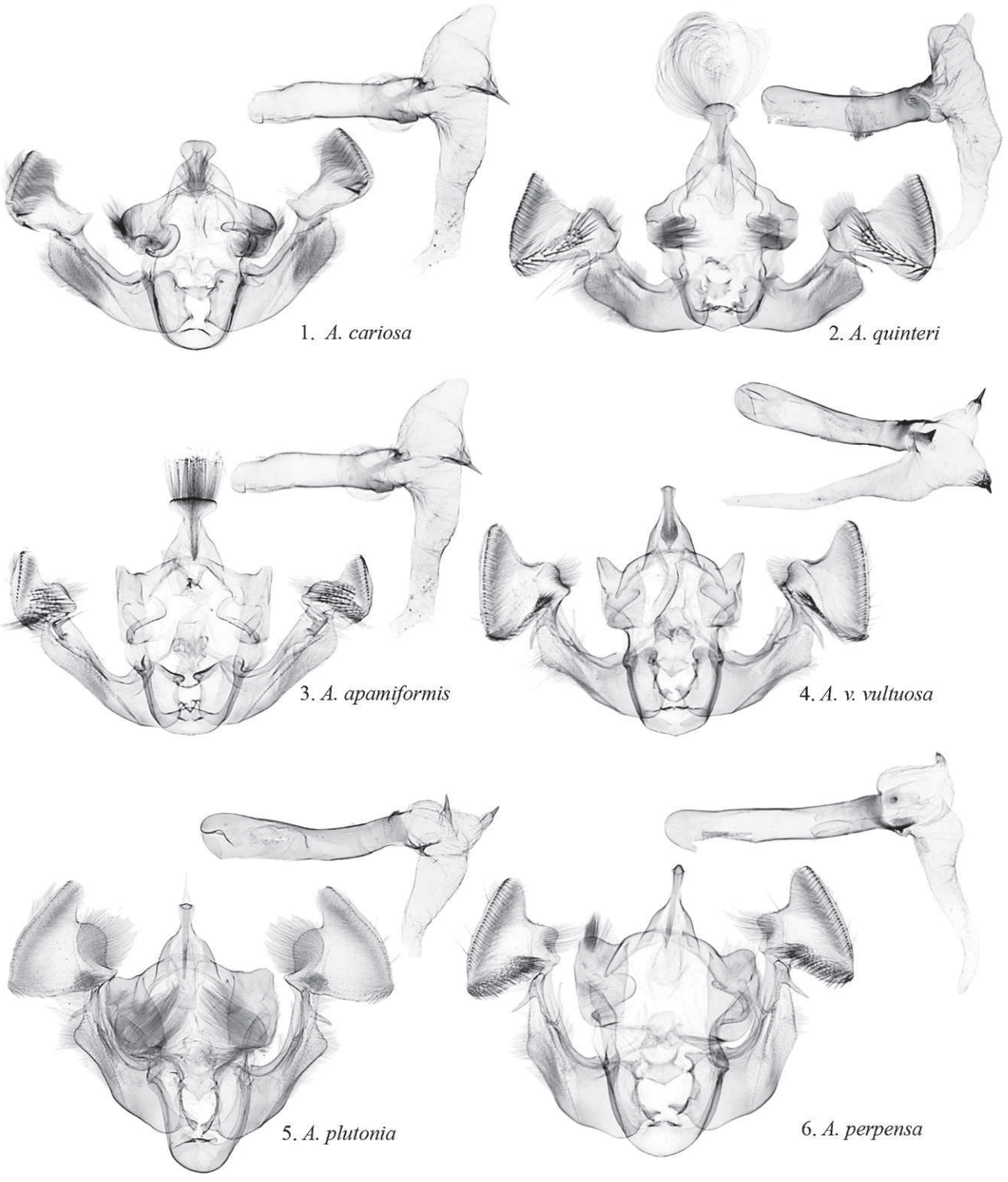


PLATE D. MALE GENITALIA

1. *Apamea cariosa* (Guenée); Ancaster, Ontario; CNC 8558. (p. 34). 2. *Apamea quinteri* Mikkola and Lafontaine; holotype; Morehead, Kentucky; CNC 9243. (p. 35). 3. *Apamea apamiformis* (Guenée); Aweme, Manitoba; CNC 8607. (p. 37). 4. *Apamea v. vultuosa* (Grote); 5 mi SW of Fraser, Grand Co., Colorado; CNC 9187. (p. 38). 5. *Apamea plutonia* (Grote); Cartwright, Manitoba; CNC 8701. (p. 40). 6. *Apamea perpensa* (Grote); Pole Hill, Larimer Co., Colorado; CNC 8807. (p. 41).

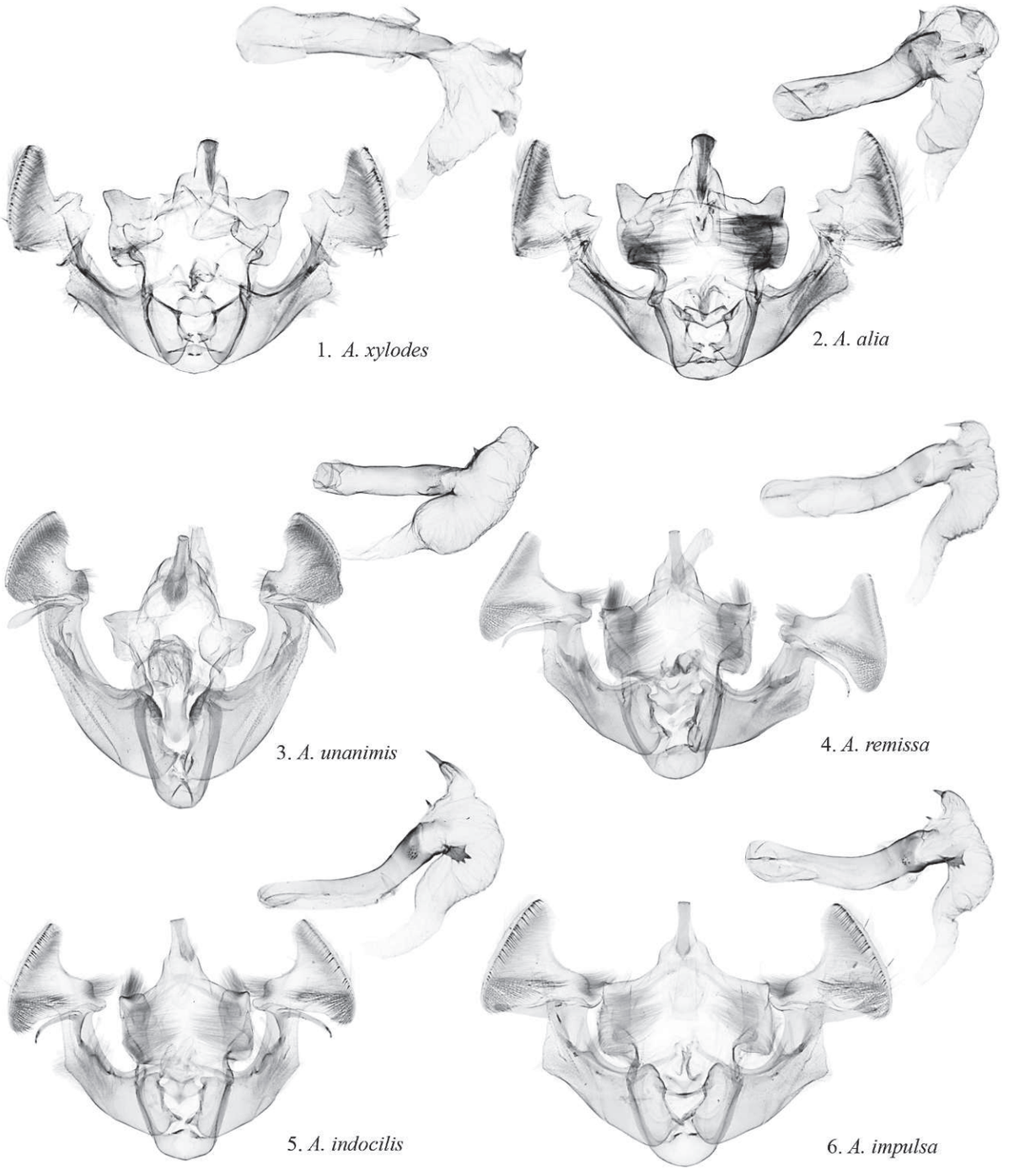


PLATE E. MALE GENITALIA

1. *Apamea xylodes* Mikkola and Lafontaine; paratype; Pole Hill, Larimer Co., Colorado; CNC 9199. (p. 41). 2. *Apamea alia* (Guenée); Calgary, head of Pine Creek, Alberta; CNC 8623. (p. 42). 3. *Apamea unanimis* (Hübner); Ottawa, Ontario; CNC 13583. (p. 43). 4. *Apamea remissa* (Hübner); England; CNC 8580. (p. 44). 5. *Apamea indocilis* (Walker); Sullivan Co., New York; CNC 8255. (p. 45). 6. *Apamea impulsa* (Guenée); near Doyle's, Newfoundland; CNC 8641. (p. 47).

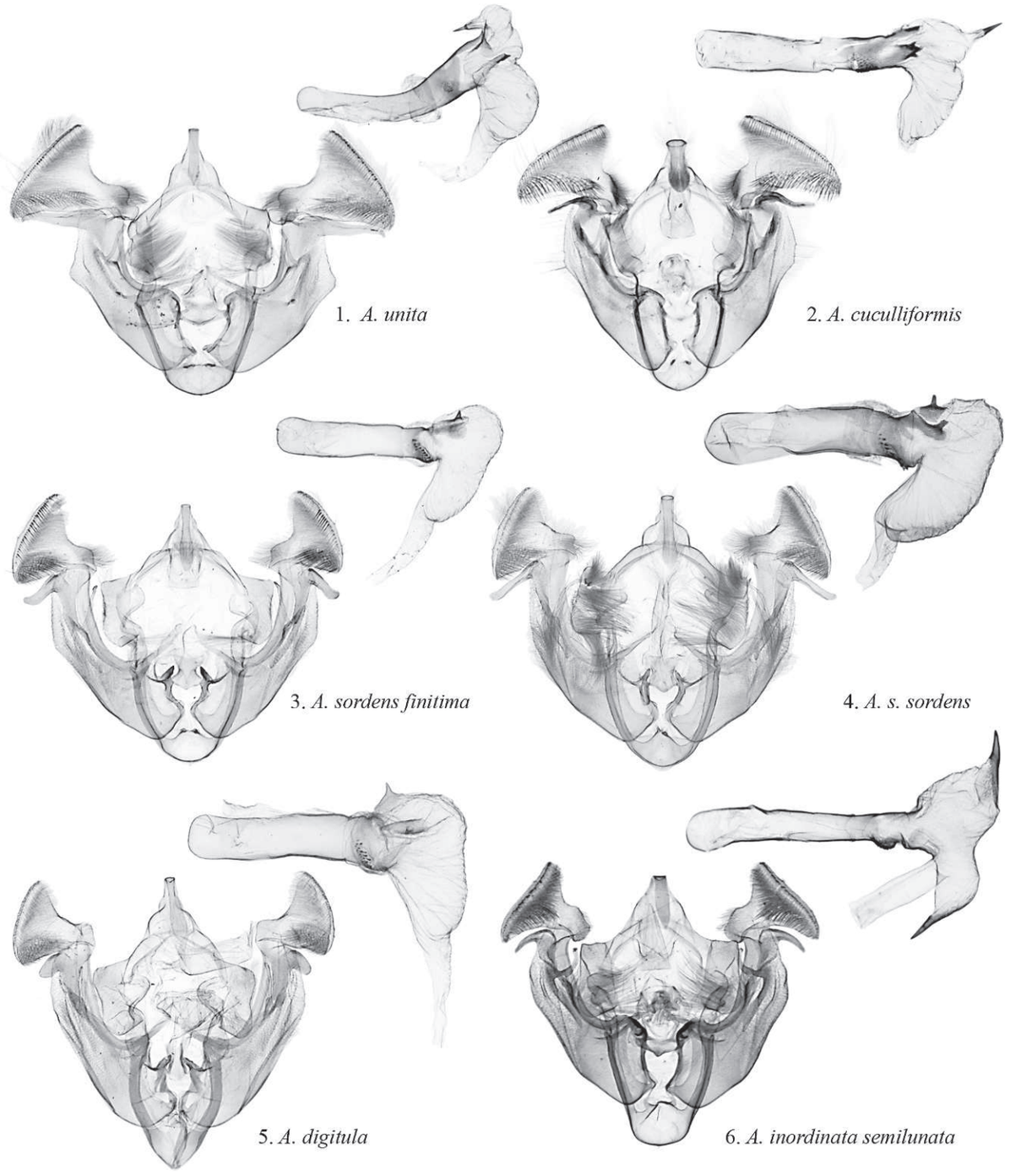


PLATE F. MALE GENITALIA

1. *Apamea unita* (Smith); Cochise Co., Arizona; CNC 8627. (p. 48). 2. *Apamea cuculliformis* (Grote); Modesto, California: CNC 8552. (p. 48). 3. *Apamea sordens finitima* (Guenée); Ottawa, Ontario; CNC 9184. (p. 51). 4. *Apamea s. sordens* (Hufnagel); Russia; CNC 9028. (p. 51). 5. *Apamea digitula* Mustelin and Mikkola; Mount Ashland, Jackson Co., Oregon; CNC 12850. (p. 52). 6. *Apamea inordinata semilunata* (Grote); Walla Walla, Washington; CNC 8625. (p. 54).

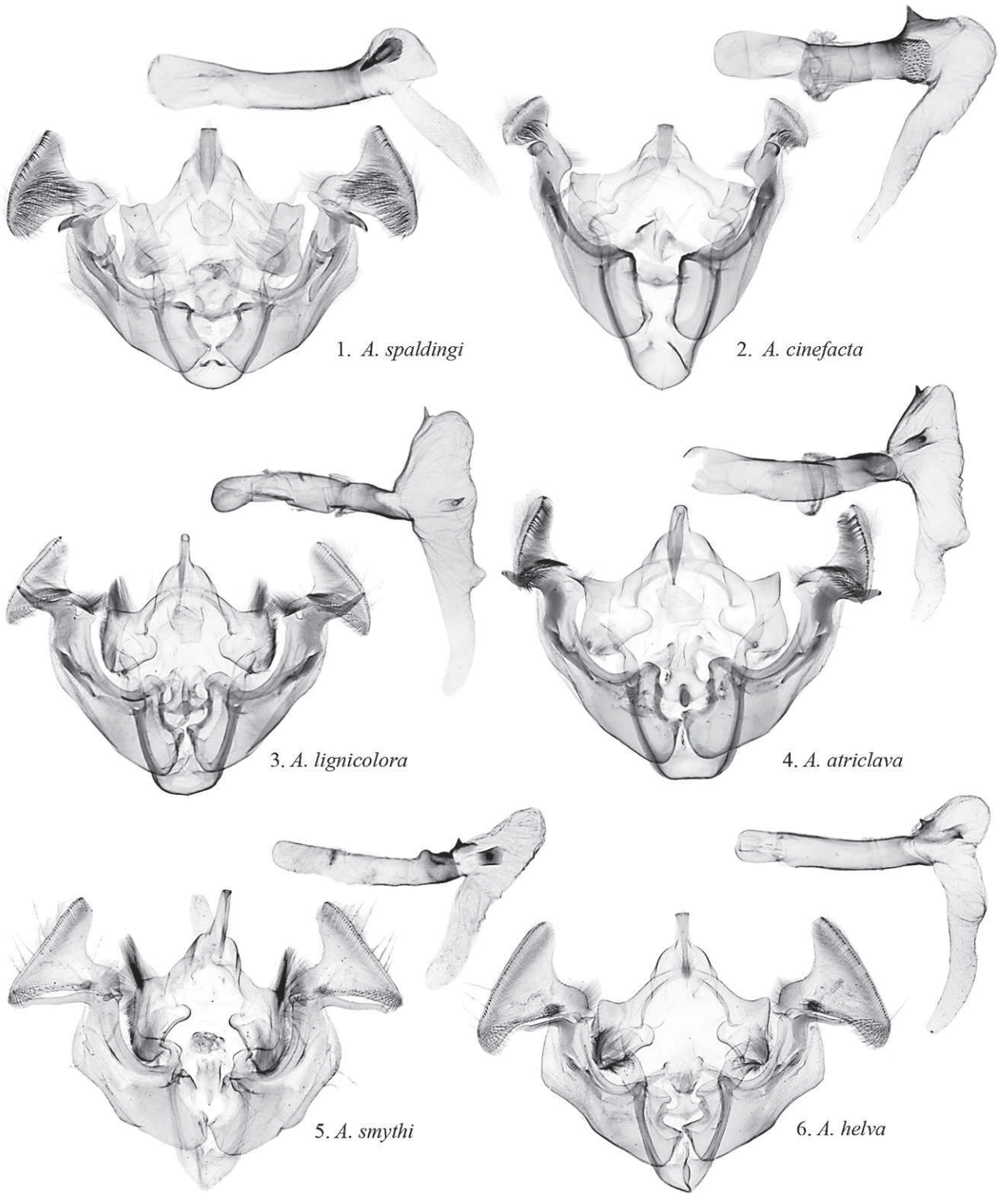


PLATE G. MALE GENITALIA

1. *Apamea spaldingi* (Smith); Prosser, Washington; CNC 8631. (p. 55). 2. *Apamea cinefacta* (Grote); Walla Walla, Washington; CNC 8684. (p. 55). 3. *Apamea lignicolora* (Guenée); Knowlton, Quebec; CNC 8573. (p. 56). 4. *Apamea atriclava* (Barnes and McDunnough); 9 mi W of Victoria, British Columbia; CNC 9188. (p. 57). 5. *Apamea smythi* Franclemont; holotype; Montgomery Co., Virginia; USNM 1507. (p. 58). 6. *Apamea helva* (Grote); Ottawa, Ontario; CNC 8672. (p. 58).

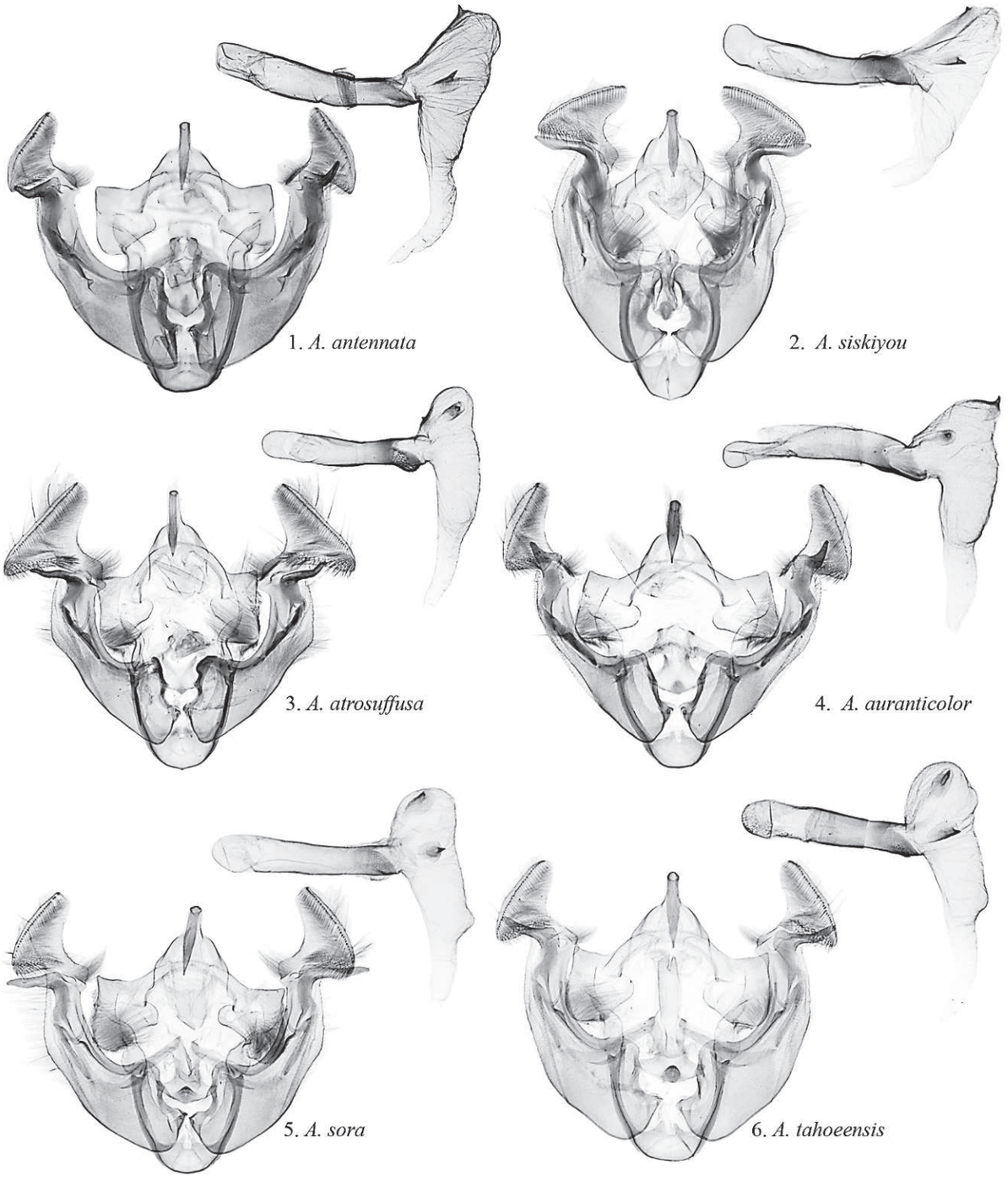


PLATE H. MALE GENITALIA

1. *Apamea antennata* (Smith); Walla Walla, Washington; CNC 8583. (p. 59). 2. *Apamea siskiyou* Mikkola and Lafontaine; Grass Valley, Nevada Co., California; CNC 9935. (p. 60). 3. *Apamea atrosuffusa* (Barnes and McDunnough); 2 mi W of Walsenberg, Colorado; CNC 9167. (p. 61). 4. *Apamea auranticolor* (Grote); 1.5 mi SE of Heber, Utah; CNC 9244. (p. 62). 5. *Apamea sora* (Smith); 5 mi E of Elliston, McDonald Pass, Montana; CNC 9248. (p. 63). 6. *Apamea tahoeensis* Mikkola and Lafontaine; paratype; Truckee, California; CNC 9274. (p. 63).

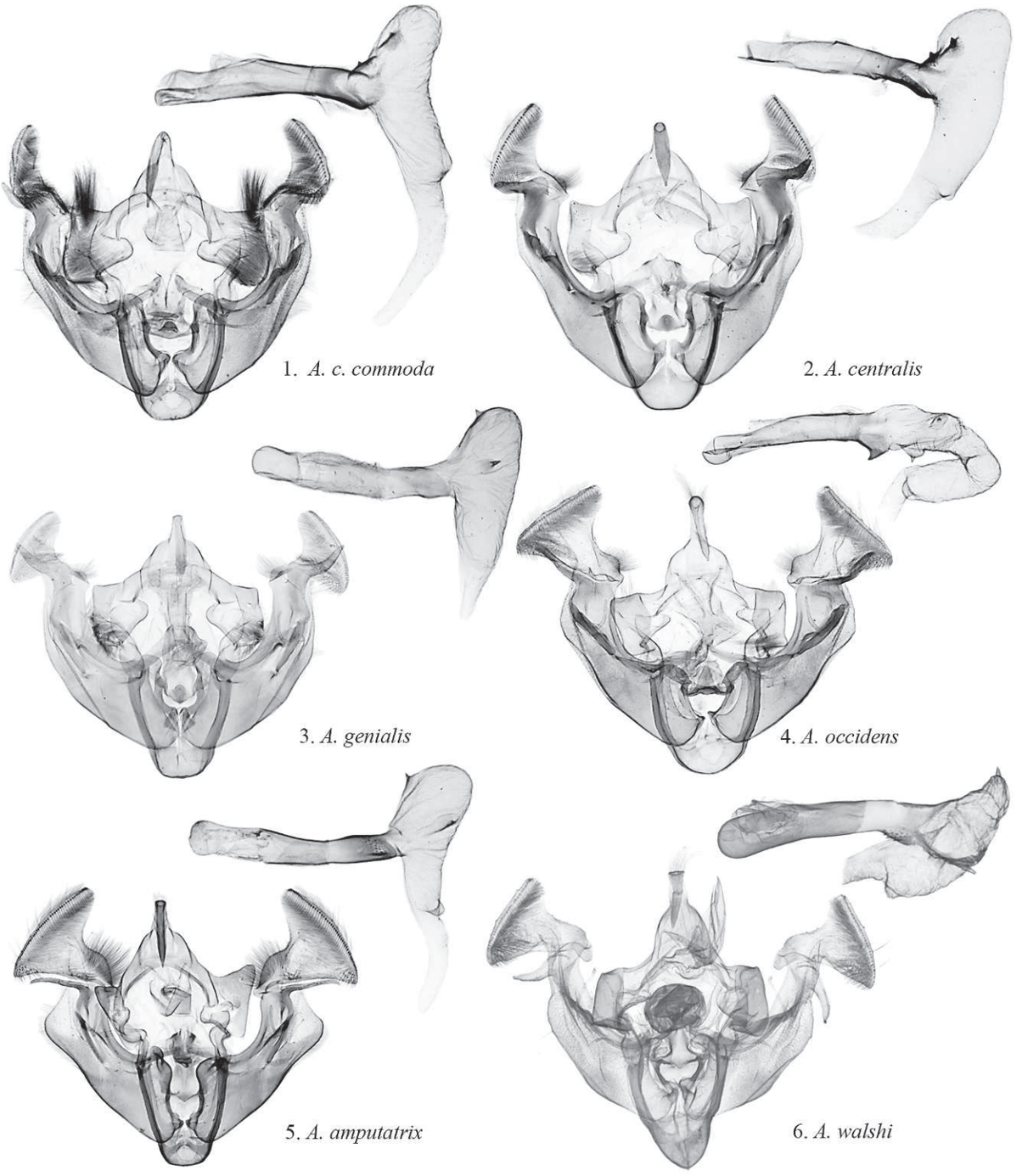


PLATE I. MALE GENITALIA

1. *Apamea c. commoda* (Walker); Truro, Nova Scotia; CNC 8637. (p. 65). 2. *Apamea centralis* (Smith); 6 mi ENE of Mount Shasta, California; CNC 9203. (p. 68). 3. *Apamea genialis* (Grote); Oakland, California; CNC S24. (p. 69). 4. *Apamea occidens* (Grote); Walla Walla, Washington; CNC 8611. (p. 69). 5. *Apamea amputatrix* (Fitch); Pinewoods (Allison Pass, Manning Park), British Columbia; CNC 8621. (p. 70). 6. *Apamea walshi* Lafontaine; holotype; Soldier Creek campground, Pinaleno Mts, Graham Co., Arizona; CNC 14382. (p. 72).

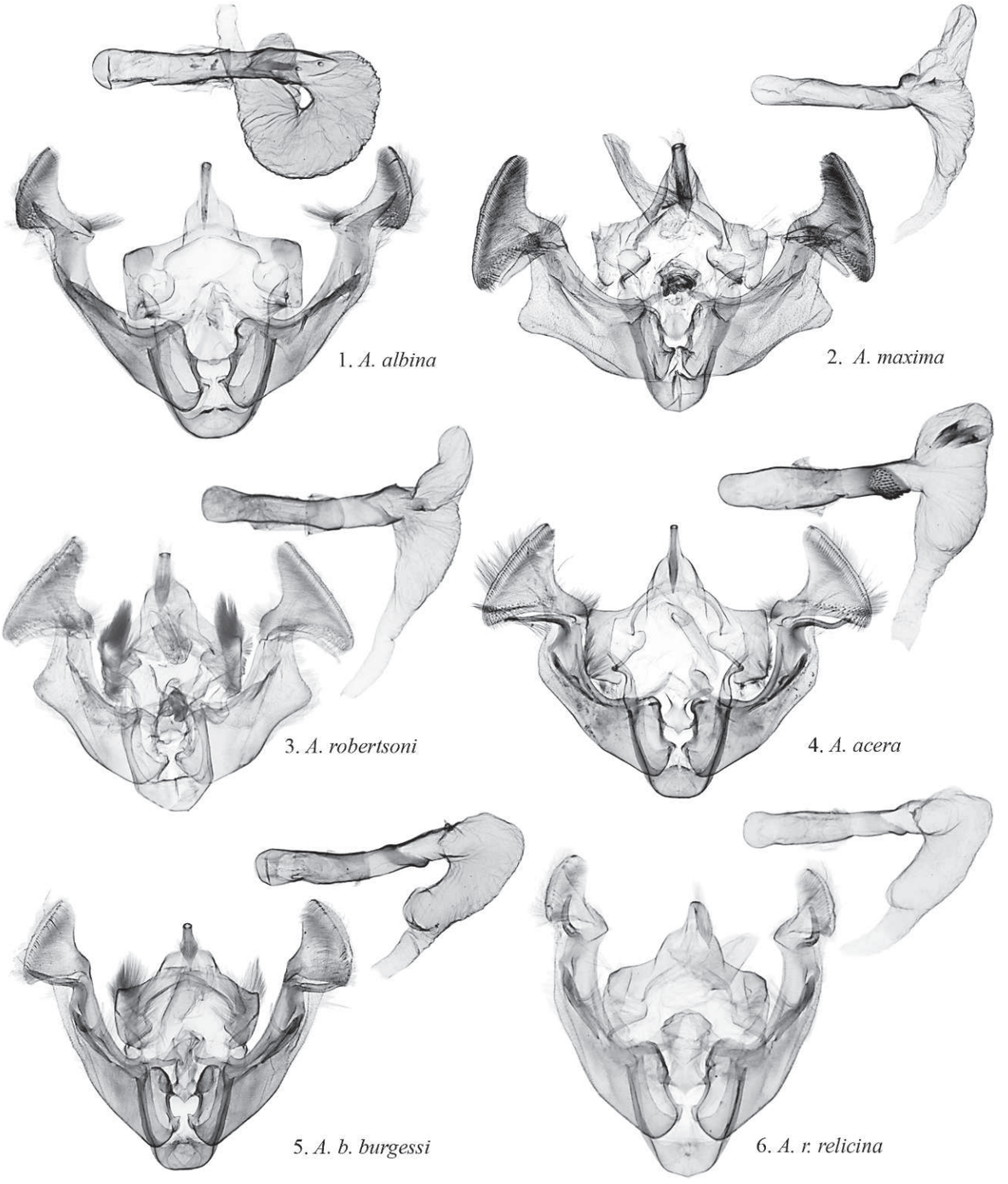


PLATE J. MALE GENITALIA

1. *Apamea albina* (Grote); Lucas Valley, Marin Co., California; CNC 8613. (p. 73). 2. *Apamea maxima* (Dyar); Schooner Cove, British Columbia; CNC 13600. (p. 74). 3. *Apamea robertsoni* Mikkola and Mustelin; holotype; Dune Lakes, 5 mi SE of Oceano, San Luis Obispo Co., California; CNC 11888. (p. 75). 4. *Apamea acera* (Smith); 17 mi SSE of Derby, Montana; CNC 9154. (p. 75). 5. *Apamea b. burgessi* (Morrison); Lakehurst, New Jersey; CNC 8759. (p. 76). 6. *Apamea r. relicina* (Morrison); Canadian, Texas; CNC 9031. (p. 78).

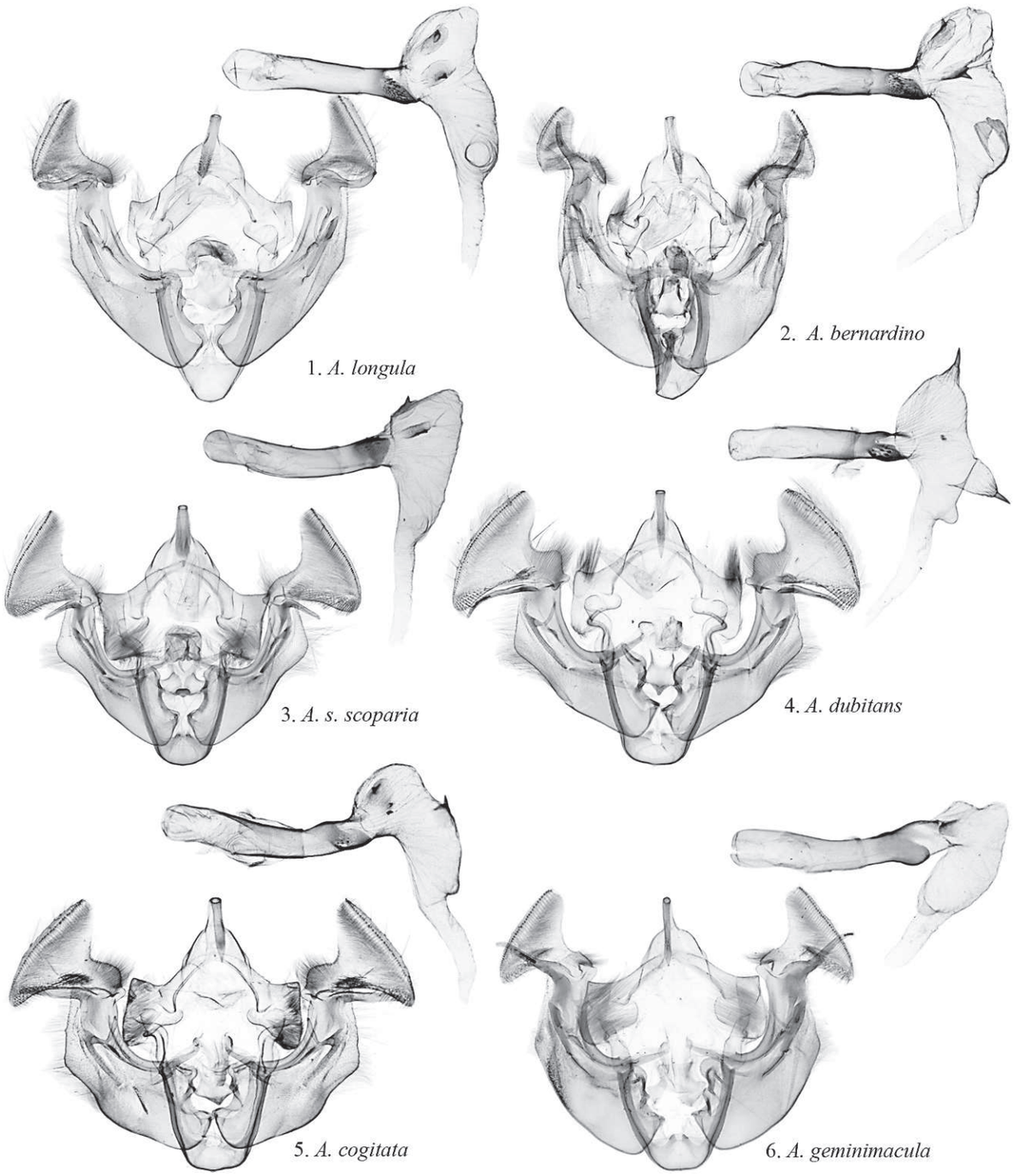


PLATE K. MALE GENITALIA

1. *Apamea longula* (Grote); Flagstaff, Arizona; CNC 9270. (p. 80). 2. *Apamea bernardino* Mikkola and Mustelin; paratype; San Bernardino, California; CNC 9923. (p. 80). 3. *Apamea s. scoparia* Mikkola, Mustelin, and Lafontaine; Thunder Bay, Ontario; CNC 9099. (p. 81). 4. *Apamea dubitans* (Walker); Annapolis Royal, Nova Scotia; CNC 8712. (p. 82). 5. *Apamea cogitata* (Smith); Saint Anthony, Newfoundland; CNC 8715. (p. 84). 6. *Apamea geminimacula* (Dyar); Arizona; CNC 8717. (p. 85).

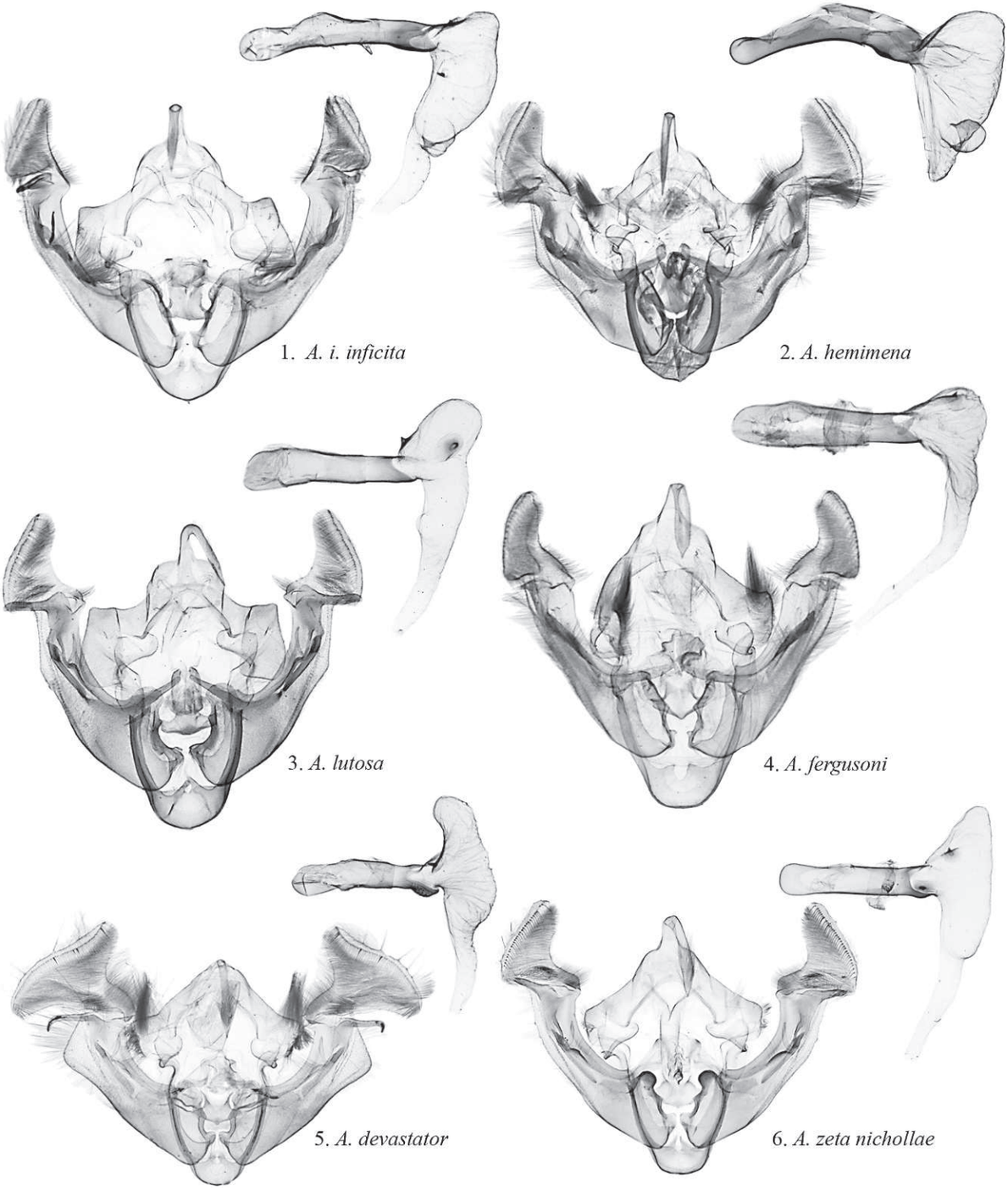


PLATE L. MALE GENITALIA

1. *Apamea i. inficita* (Walker); St. John's, Newfoundland; CNC 8662. (p. 85). 2. *Apamea hemimena* Mikkola and Lafontaine; paratype; Creel, Chihuahua, Mexico; CNC 9932. (p. 88). 3. *Apamea lutosa* (Andrews); Miniota, Manitoba; CNC 8676. (p. 88). 4. *Apamea fergusoni* Mikkola and Lafontaine; paratype; Gothic, Gunnison Co., Colorado; CNC 9033. (p. 89). 5. *Apamea devastator* (Brace); Smoky Falls, Mattagami River, Ontario; CNC 8772. (p. 90). 6. *Apamea zeta nichollae* (Hampson); Alaska; CNC 9228. (p. 91).

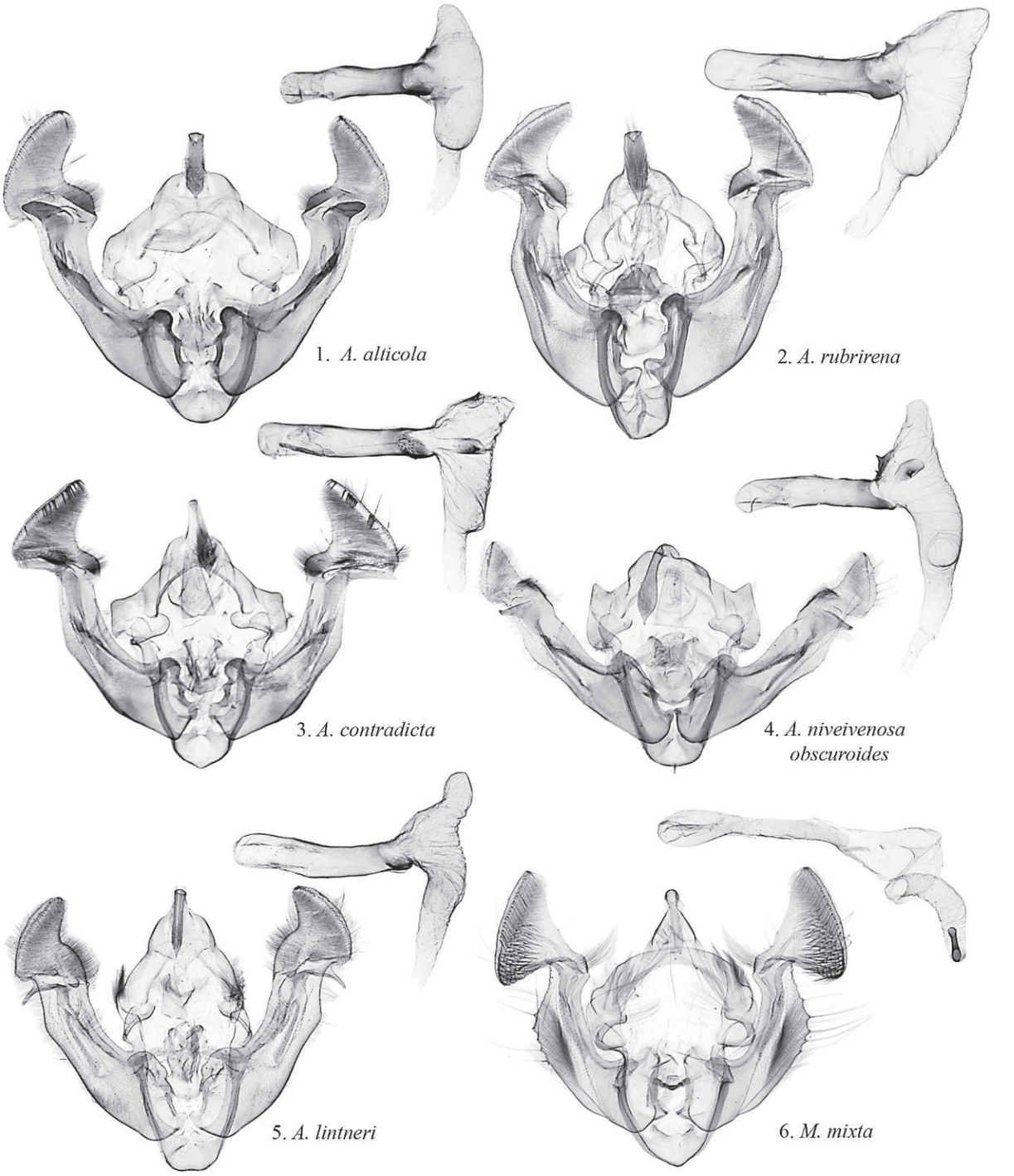


PLATE M. MALE GENITALIA

1. *Apamea alticola* (Smith); Mount Evans, Colorado; CNC 9268. (p. 98). 2. *Apamea rubrirena* (Treitschke); Pirin, Vihren, Bulgaria; CNC 13601. (p. 99). 3. *Apamea contradicta* (Smith); Cartwright, Labrador; CNC 8645. (p. 100). 4. *Apamea niveivenosa obscuroides* (Poole); 4.5 km NW of Seneca, Oregon; CNC 9272. (p. 100). 5. *Apamea lintneri* (Grote); White Point Beach, Nova Scotia; CNC 8453. (p. 102). 6. *Melanapamea mixta* (Grote); Black Sturgeon Lake, Ontario; CNC 8863. (p. 117).

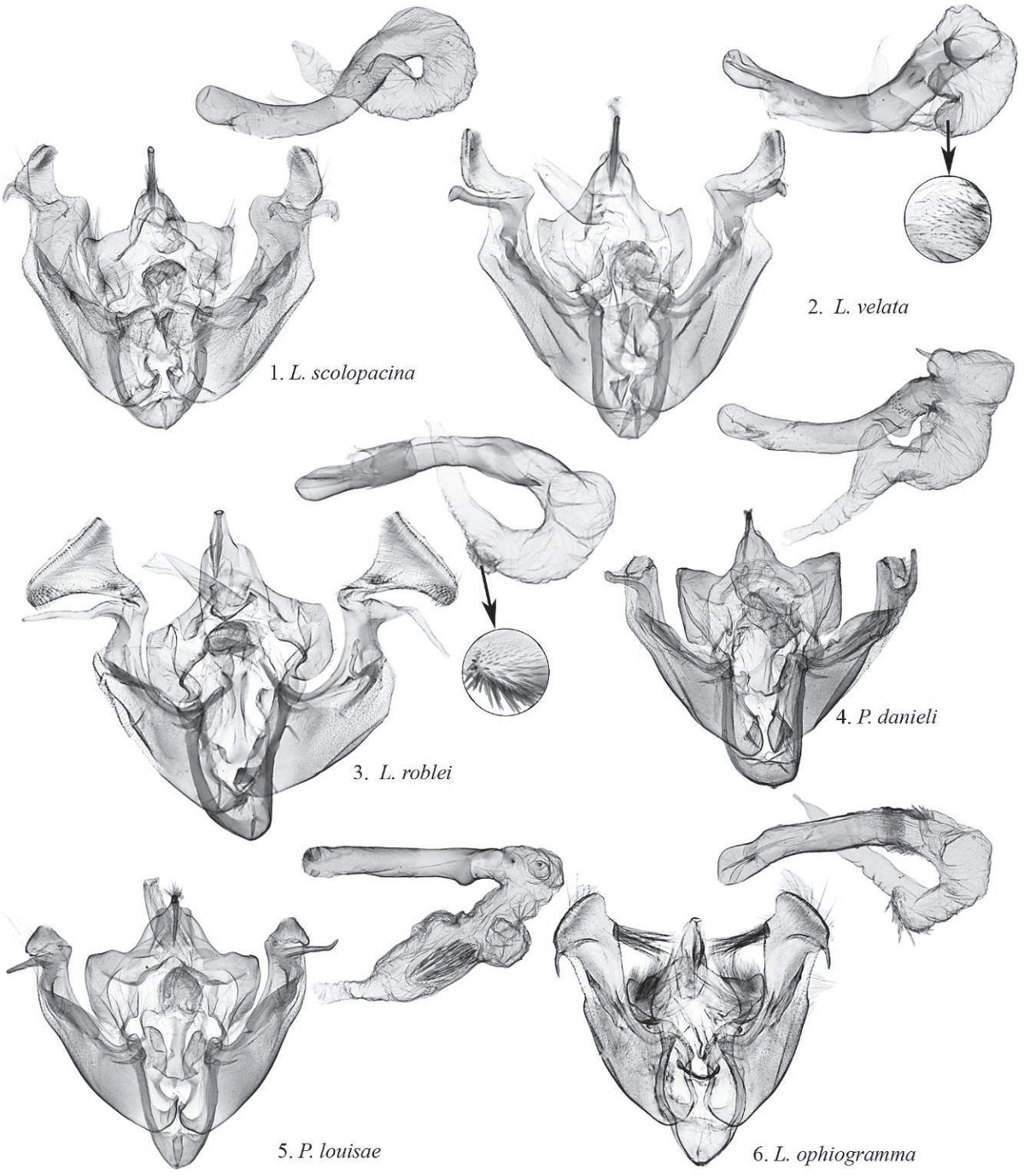


PLATE N. MALE GENITALIA

1. *Loscopia scolopacina* (Esper); Lauenburg, northern Germany; CNC 13626. (p. 104). 2. *Loscopia velata* (Walker); Strathroy, Ontario: CNC 13581. (p. 105). 3. *Loscopia roblei* Quinter and Lafontaine; paratype; Faircloth Rd, Dare Co., North Carolina; CNC 13584. (p. 106). 4. *Protapamea danieli* Quinter; paratype; Croatan Rd, Craven Co., North Carolina; CNC 13582. (p. 110). 5. *Protapamea louisae* Quinter; paratype; Cordell Hull Lk, Big Bottom, Jackson Co., Tennessee; CNC 13632. (p. 114). 6. *Lateroligia ophiogramma* (Esper); Helsinki, Finland; CNC 10189. (p. 119).

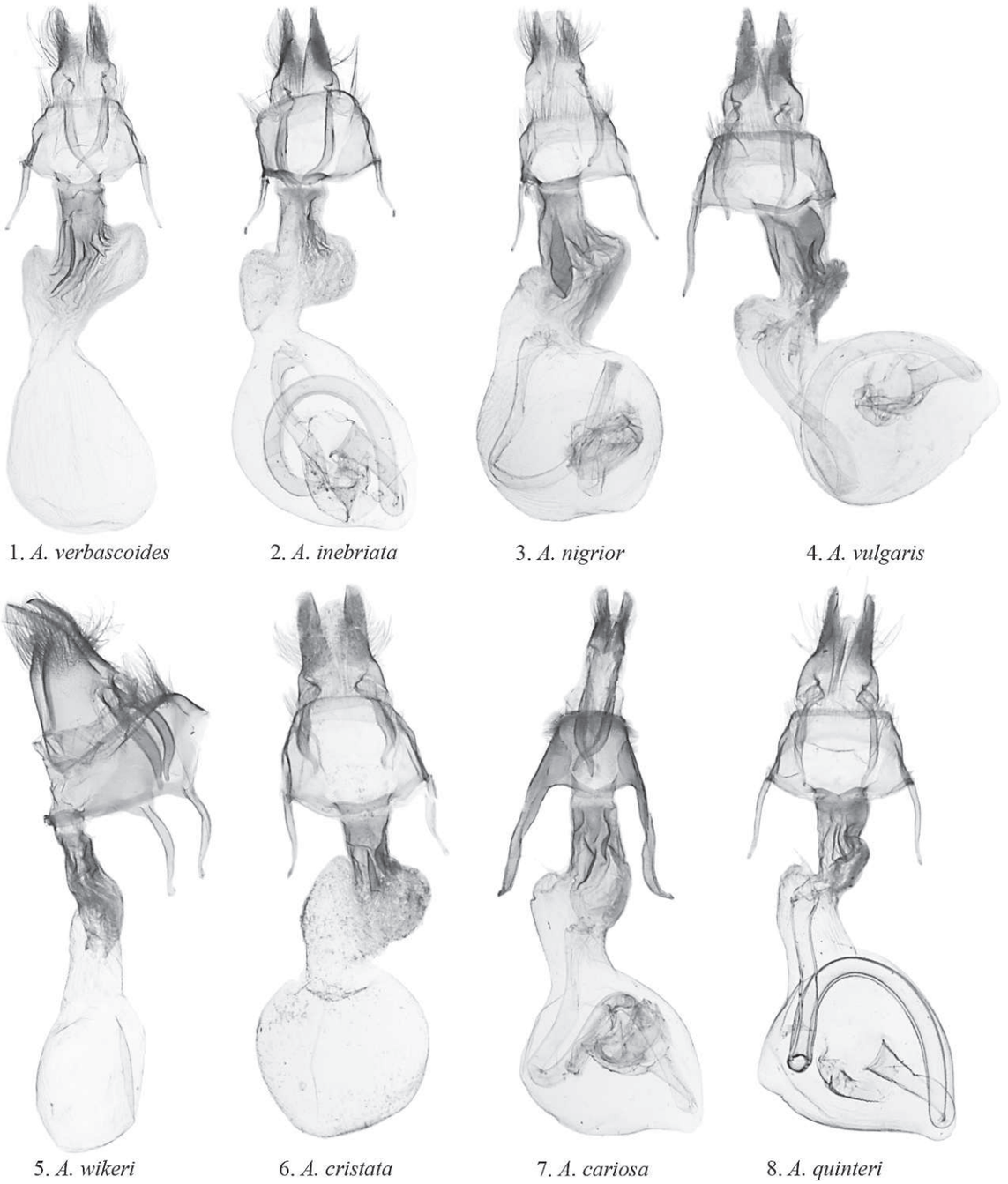
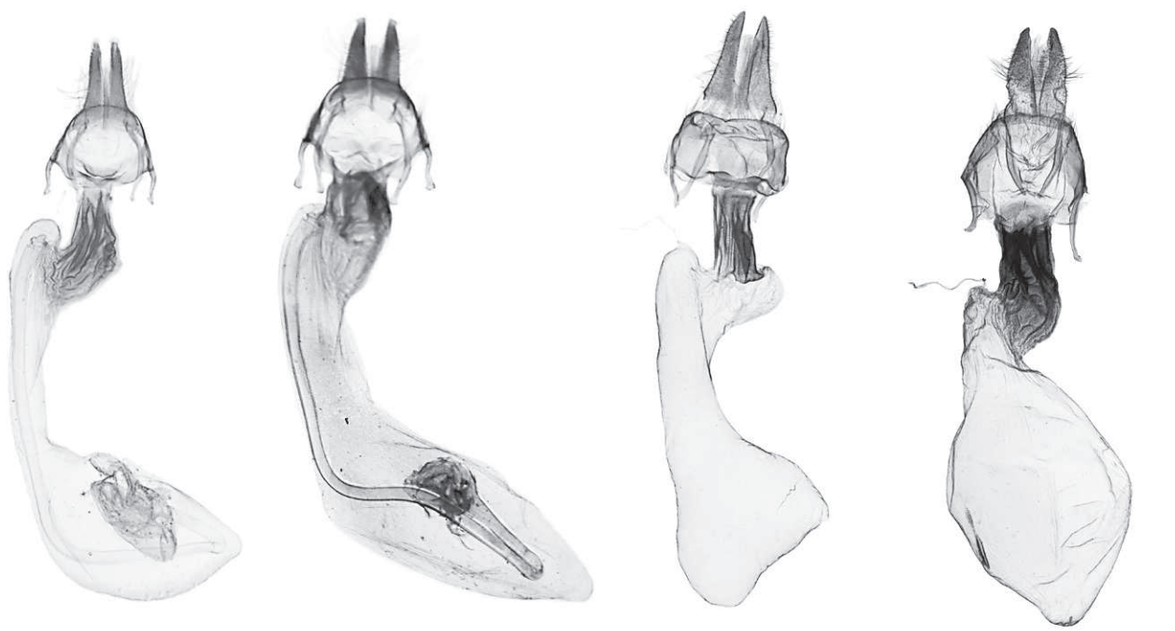


PLATE O. FEMALE GENITALIA

1. *Apamea verbascoides* (Guenée); Strathroy, Ontario; CNC 8692. (p. 29). 2. *Apamea inebriata* Ferguson; Lakehurst, New Jersey; CNC 8694. (p. 30). 3. *Apamea nigrior* (Smith); Normandale, Ontario; CNC 8557. (p. 31). 4. *Apamea vulgaris* (Grote and Robinson); Ithaca, New York; CNC 8572. (p. 31). 5. *Apamea wikeri* Quinter and Lafontaine; paratype; 2.7 mi W Williamsville, Wayne Co., Missouri; CNC 13606. (p. 32). 6. *Apamea cristata* (Grote); Woodland, Maine; CNC 8696. (p. 33). 7. *Apamea cariosa* (Guenée); Milwaukee Co. Wisconsin; CNC 8559. (p. 34). 8. *Apamea quinteri* Mikkola and Lafontaine; paratype; Garfield Co., Oklahoma; CNC 13588. (p. 35).

1. *A. apamiformis* 2. *A. v. vultuosa* 3. *A. plutonia* 4. *A. perpensa*



5. *A. xylodes* 6. *A. alia* 7. *A. unanimis* 8. *A. remissa*

PLATE P. FEMALE GENITALIA

1. *Apamea apamiformis* (Guenée); Ottawa, Ontario; CNC 8608. (p. 37). 2. *Apamea v. vultuosa* (Grote); Ottawa, Ontario; CNC 9269. (p. 38). 3. *Apamea plutonia* (Grote); Ogoki, Ontario; CNC 9221. (p. 40). 4. *Apamea perpensa* (Grote); Elgin, Arizona; CNC 9071. (p. 41). 5. *Apamea xylodes* Mikkola and Lafontaine; paratype; 18 mi E of Alma, Catron Co., New Mexico; CNC 9200. (p. 41). 6. *Apamea alia* (Guenée); Lethbridge, Alberta; CNC 8624. (p. 42). 7. *Apamea unanimis* (Hübner); Carp Ridge 43°23.05′ N 76°0.48′ W, Ontario; CNC 13608. (p. 43). 8. *Apamea remissa* (Hübner); Unalakleet, Alaska; CNC 13631. (p. 44).

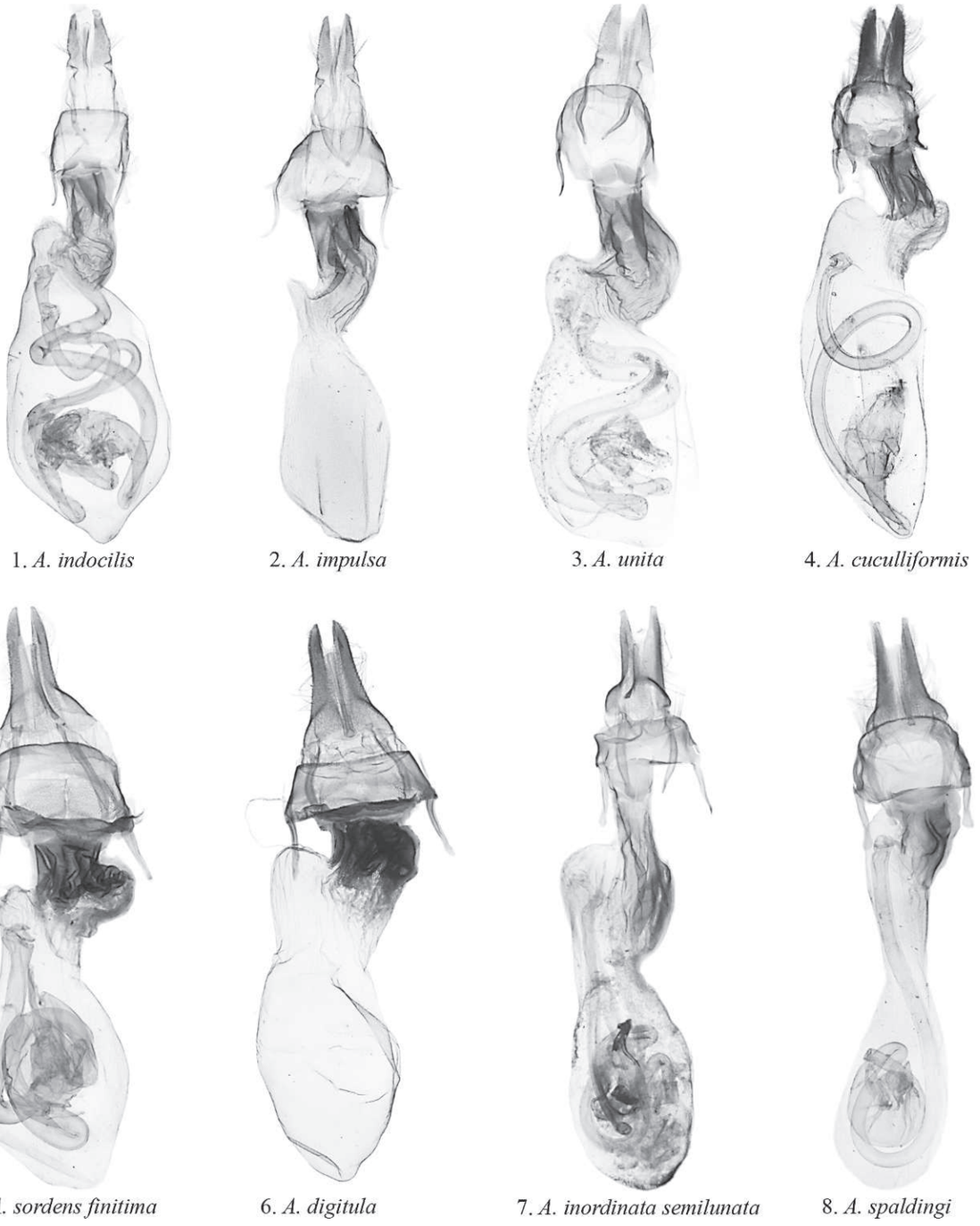


PLATE Q. FEMALE GENITALIA

1. *Apamea indocilis* (Walker); Ucluelet, British Columbia; CNC 9220. (p. 45). 2. *Apamea impulsa* (Guenée); Holyrood, Newfoundland; CNC 8642. (p. 47). 3. *Apamea unita* (Smith); Nogales, Arizona; CNC 9168. (p. 48). 4. *Apamea cuculliformis* (Grote); Walla Walla, Washington; CNC 8553. (p. 48). 5. *Apamea sordens finitima* (Guenée); New York, New York; CNC 9148. (p. 49). 6. *Apamea digitula* Mustelin and Mikkola; Eight Dollar Mountain Rd., Josephine Co., Oregon; CNC 13607. (p. 52). 7. *Apamea inordinata semilunata* (Grote); Bozeman, Montana; CNC 8629. (p. 52). 8. *Apamea spaldingi* (Smith); Seton Lake, Lillooet, British Columbia; CNC 8632. (p. 55).

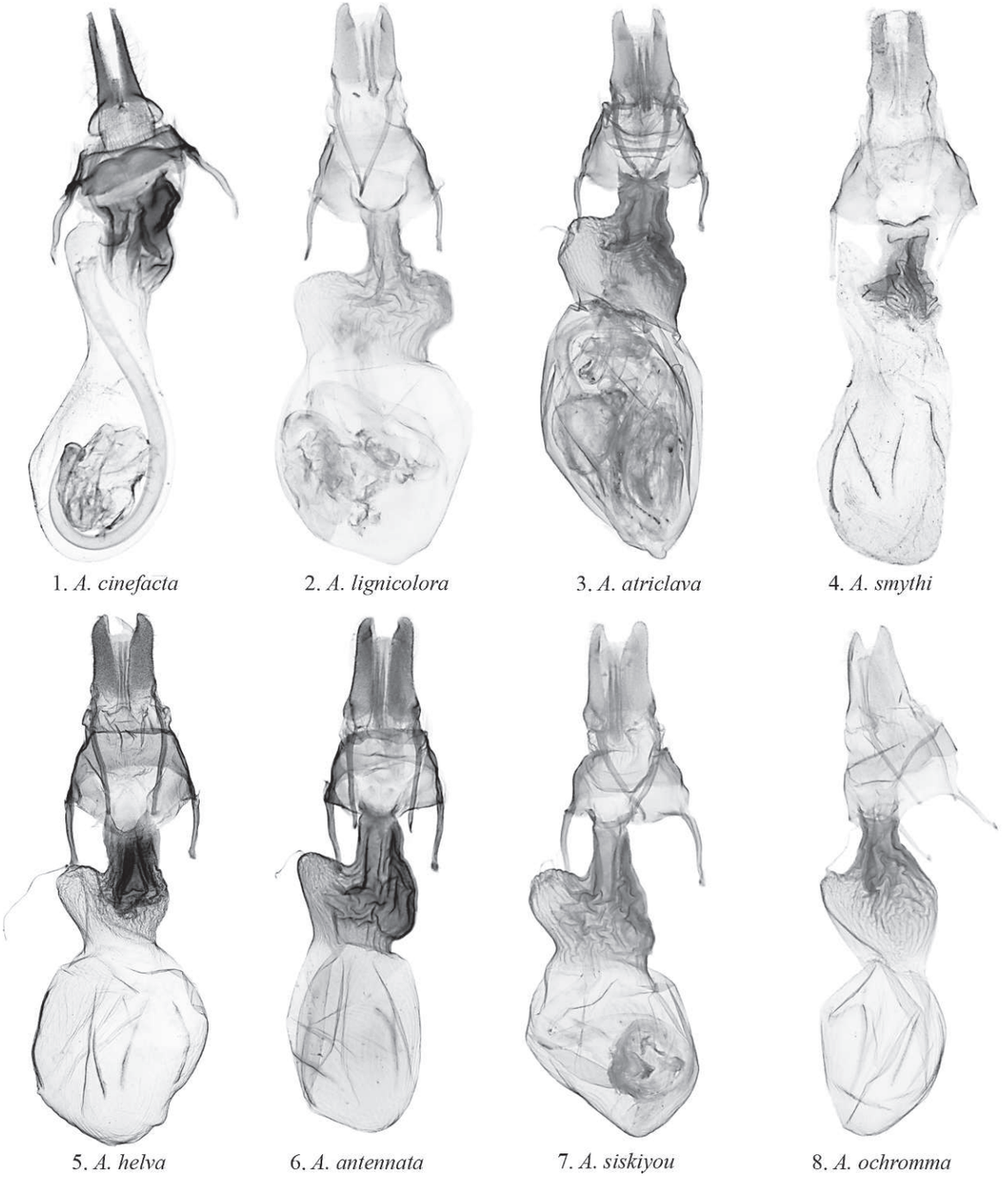
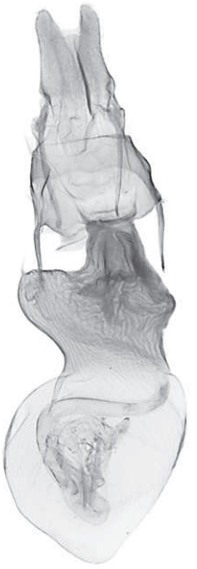


PLATE R. FEMALE GENITALIA

1. *Apamea cinefacta* (Grote); Reno, Nevada; CNC 8687. (p. 55). 2. *Apamea lignicolora* (Guenée); White Point Beach, Queens Co., Nova Scotia; CNC 8574. (p. 56). 3. *Apamea atriclava* (Barnes and McDunnough); Duncan, Vancouver Island, British Columbia; CNC 10379. (p. 57). 4. *Apamea smythi* Franclemont; paratype; Montgomery Co., Virginia; USNM 1508. (p. 58). 5. *Apamea helva* (Grote); Kinburn, Ontario; CNC 13628 (p. 58). 6. *Apamea antennata* (Smith); Duncan, Vancouver Island, British Columbia; CNC 8586. (p. 59). 7. *Apamea siskiyou* Mikkola and Lafontaine; Yreka, Siskiyou Co., California; CNC 10380. (p. 60). 8. *Apamea ochromma* Mikkola and Lafontaine; paratype; 7 air mi WSW of Juchitepec, Mexico, Mexico; CNC 9918. (p. 60).

1. *A. atrosuffusa*

2. *A. auranticolor*

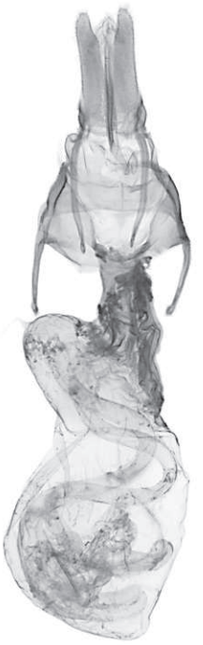


3. *A. sora*

4. *A. tahoeensis*

5. *A. commoda parcata*

6. *A. centralis*



7. *A. genialis*

8. *A. occidens*

PLATE S. FEMALE GENITALIA

1. *Apamea atrosuffusa* (Barnes and McDunnough); Arizona; CNC 8697. (p. 61). 2. *Apamea auranticolor* (Grote); Glenwood Springs, Colorado; CNC 13630. (p. 62). 3. *Apamea sora* (Smith); Keremeos, Shingle Creek Road, British Columbia; CNC 8595. (p. 63). 4. *Apamea tahoeensis* Mikkola and Lafontaine; paratype; Truckee, California; CNC 9202. (p. 63). 5. *Apamea commoda parcata* (Smith); Palmer, Alaska; CNC 8636. (p. 65). 6. *Apamea centralis* (Smith); 13 mi S Leavenworth, Washington; CNC 9152. (p. 68). 7. *Apamea genialis* (Grote); Oakland, California; CNC 8596. (p. 69). 8. *Apamea occidens* (Grote); Walla Walla, Washington; CNC 8612. (p. 69).

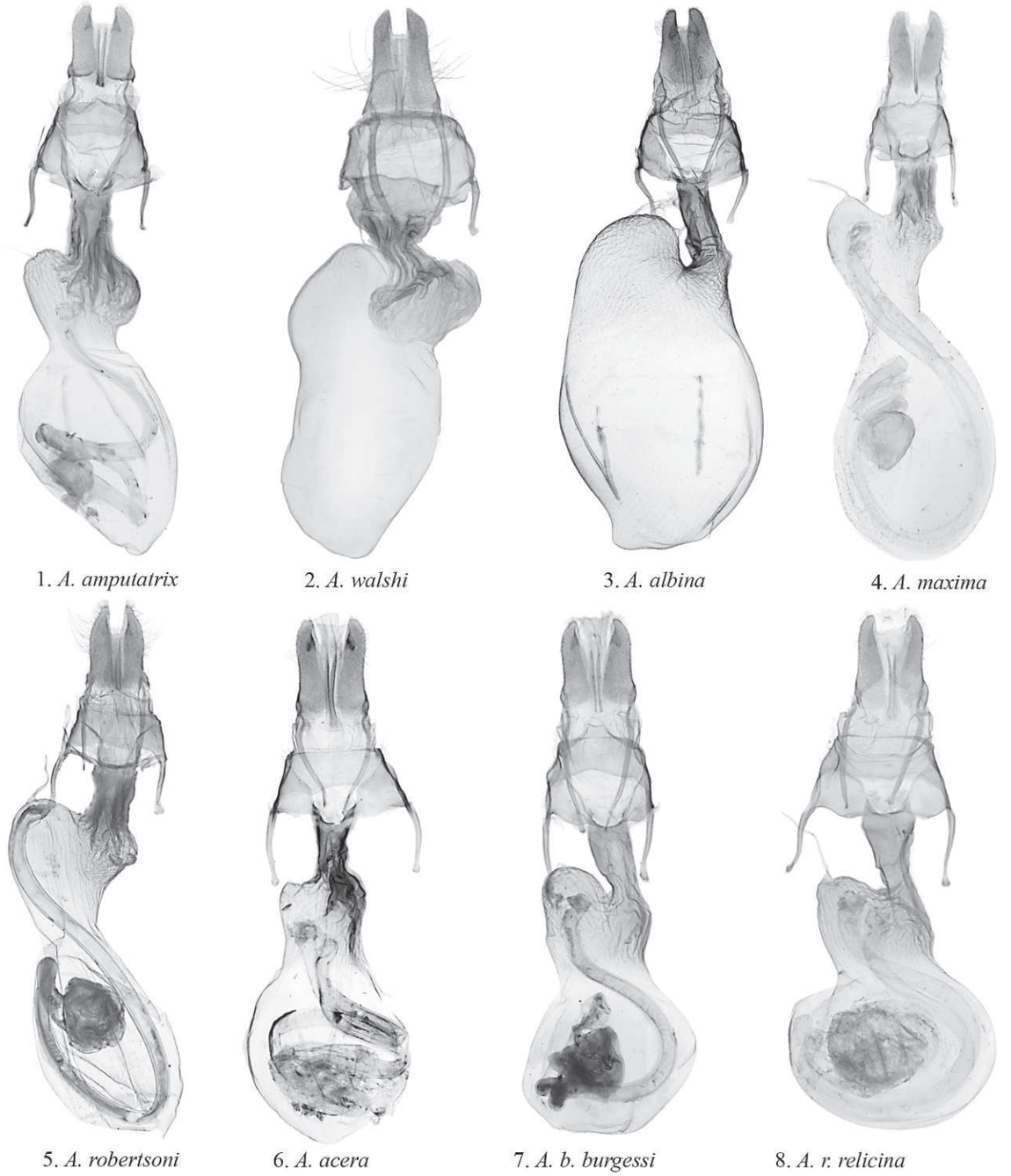


PLATE T. FEMALE GENITALIA

1. *Apamea amputatrix* (Fitch); Stanhope, Prince Edward Island; CNC 8616. (p. 70). 2. *Apamea walshi* Lafontaine; paratype; Treasure Park, Pinaleno Mts, Graham Co., Arizona; CNC 14388. (p. 72). 3. *Apamea albina* (Grote); Eel River, Mendocino Co., California; CNC 13609. (p. 73). 4. *Apamea maxima* (Dyar); Sidney, 3 mi S, British Columbia; CNC 8589. (p. 74). 5. *Apamea robertsoni* Mikkola and Mustelin; paratype; Dune Lakes, San Luis Obispo Co., California; CNC 11890. (p. 75). 6. *Apamea acera* (Smith); Toppenish, Washington; CNC 8591. (p. 75). 7 *Apamea b. burgessi* (Morrison); Lakehurst, New Jersey; CNC 8763. (p. 76). 8. *Apamea r. relicina* (Morrison); 6 mi E of Canadian, Texas; CNC 9036. (p. 78).

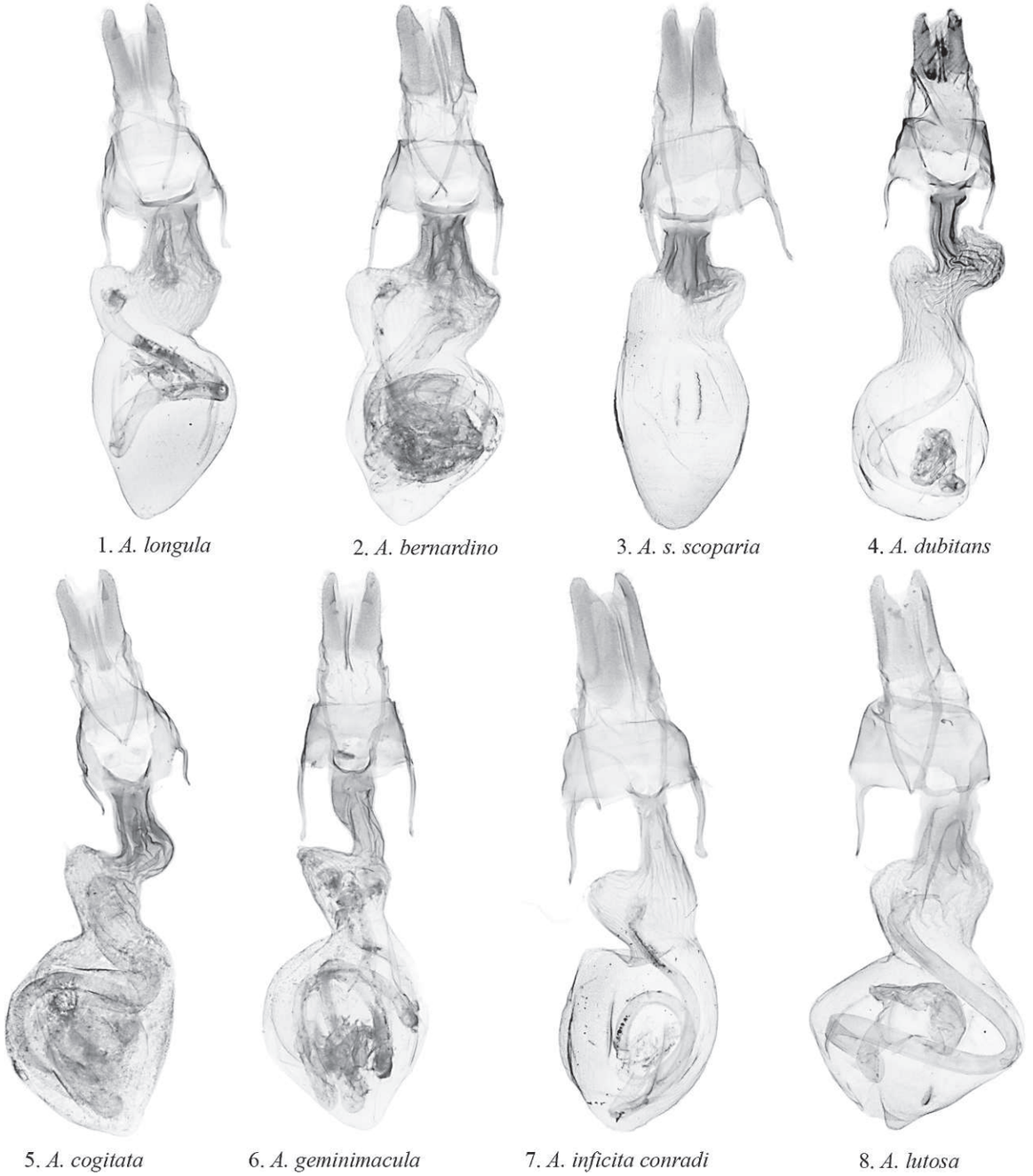


PLATE U. FEMALE GENITALIA

1. *Apamea longula* (Grote); Flagstaff, Arizona; CNC 9264. (p. 80). 2. *Apamea bernardino* Mikkola and Mustelin; paratype; San Bernardino Co., California; CNC 9122. (p. 80). 3. *Apamea s. scoparia* Mikkola, Mustelin, and Lafontaine; Lloydminster, Sunnydale, Alberta; CNC 8711. (p. 81). 4. *Apamea dubitans* (Walker); Meach Lake, Quebec; CNC 8713. (p. 82). 5. *Apamea cogitata* (Smith); 2 mi E of Golden, British Columbia; CNC 8716. (p. 84). 6. *Apamea geminimacula* (Dyar); Sierra Vista, Arizona; CNC 9153. (p. 85). 7. *Apamea inficita conradi* (Grote); Doolittle Ranch, Mount Evans, 9,800', Colorado; CNC 8718. (p. 84). 8. *Apamea lutosa* (Andrews); Aweme, Manitoba; CNC 8677. (p. 88).

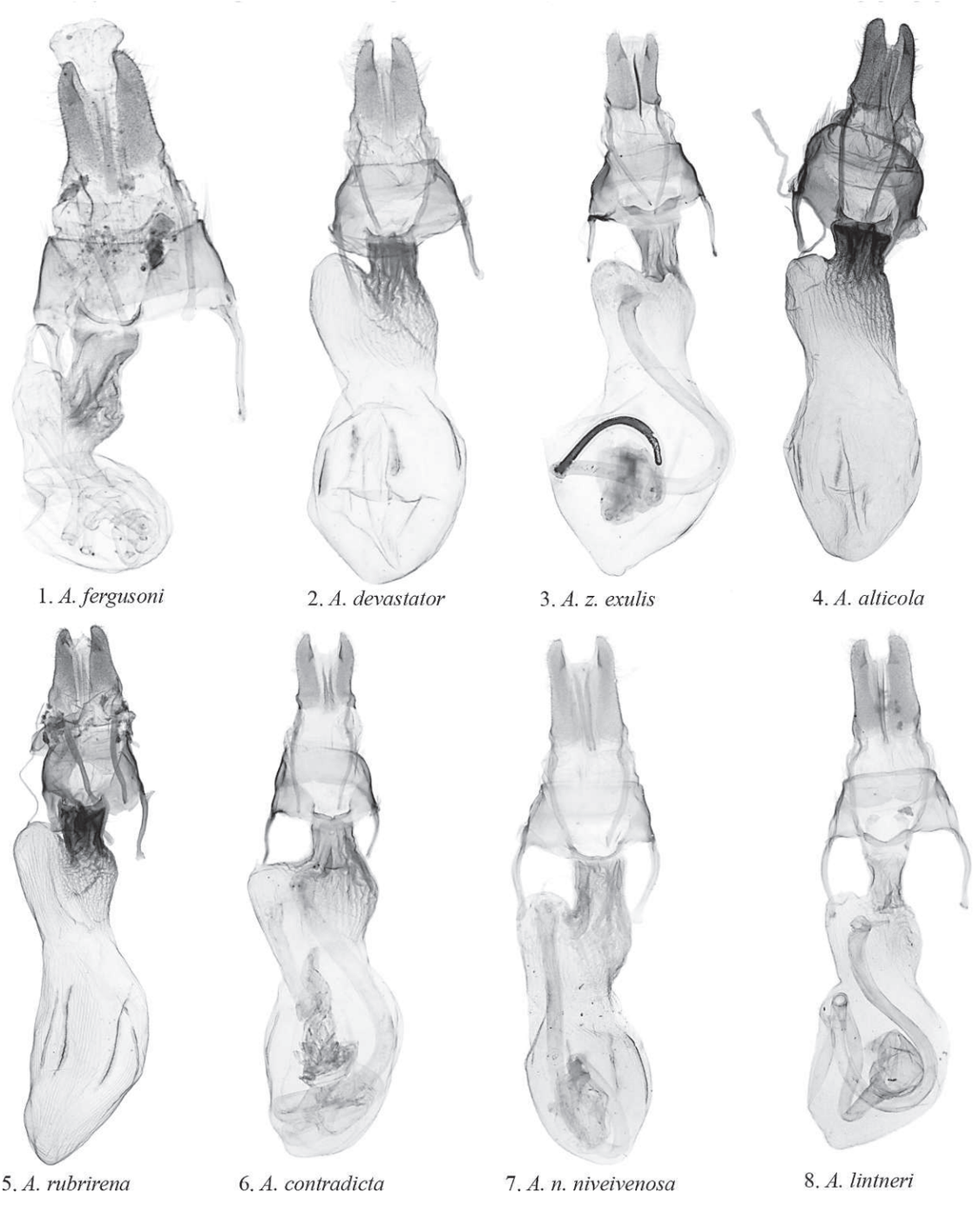


PLATE V. FEMALE GENITALIA

1. *Apamea fergusoni* Mikkola and Lafontaine; paratype; Silverton Campground off SR 110, San Juan Co., Colorado; KM 140494. (p. 89). 2. *Apamea devastator* (Brace); Lloydminster, Alberta; CNC 8775. (p. 90). 3. *Apamea zeta exulis* (Lefebvre); Nutak, Labrador; CNC 13610. (p. 91). 4. *Apamea alticola* (Smith); Mount Evans, Colorado; CNC 13629. (p. 98). 5. *Apamea rubrirena* (Treitschke); Alpes, Majastres, 900 m, France; CNC 13627. (p. 99). 6. *Apamea contradicta* (Smith); Cartwright, Labrador; CNC 8646. (p. 100). 7. *Apamea n. niveivenosa* (Grote); One-Sided Lake, Ontario; CNC 8277. (p. 100). 8. *Apamea lintneri* (Grote); Anglesea, New Jersey; CNC 8774. (p. 102).

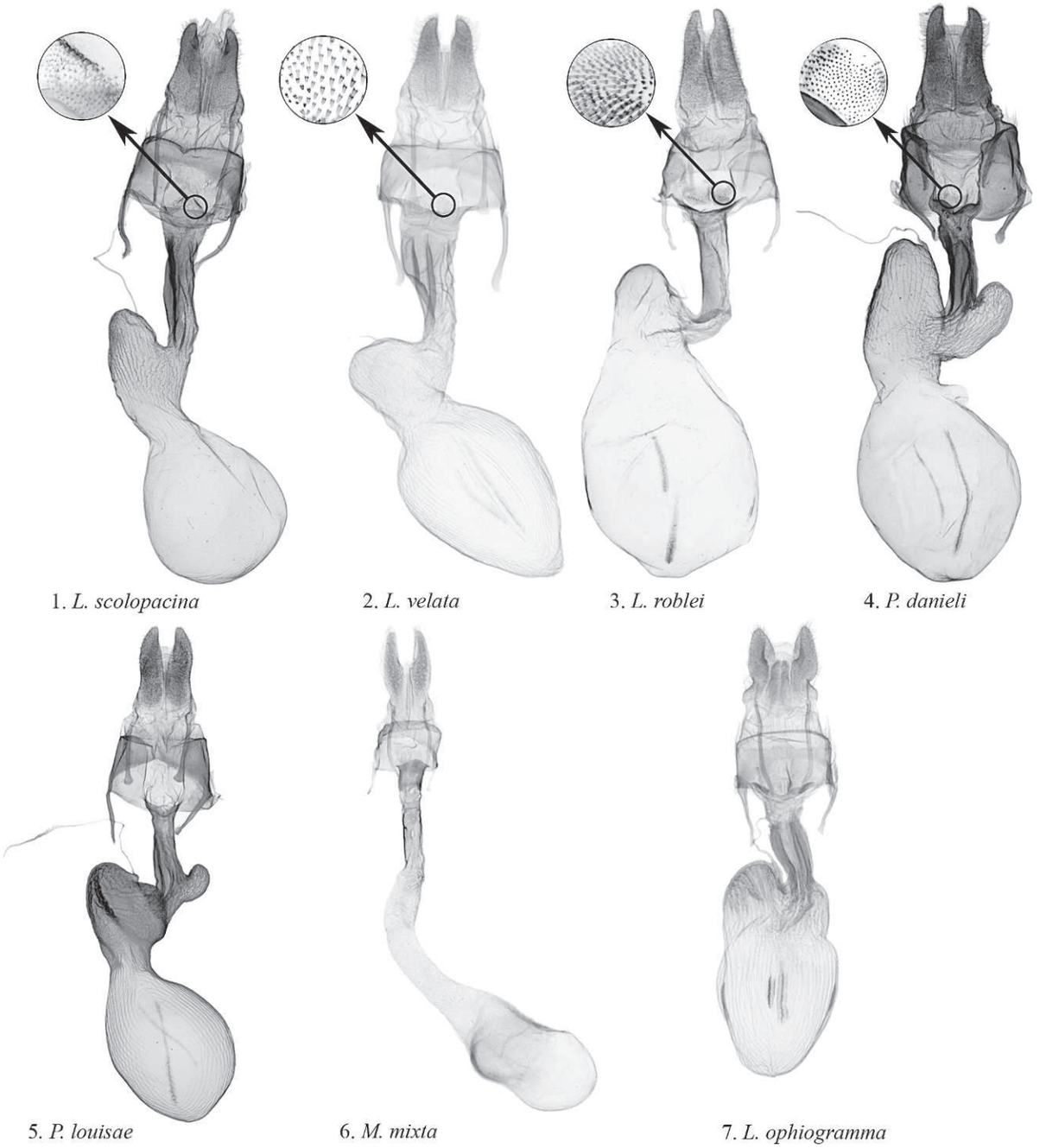


PLATE W. FEMALE GENITALIA

1. *Loscopia scolopacina* (Esper); Lauenburg Schwarzenbek, northern Germany; CNC 14171. (p. 104). 2. *Loscopia velata* (Walker); Sault Saint-Marie, Michigan; CNC 13604. (p. 105). 3. *Loscopia roblei* Quinter and Lafontaine; paratype; Bull Run Island, Levee Forest, Martin Co., North Carolina; CNC 13605. (p. 106). 4. *Protapamea danieli* Quinter; paratype; Pine Hills Campground, Union Co., Illinois; CNC 14170. (p. 110). 5. *Protapamea louisae* Quinter; paratype; Browns Crossing, Mark Twain National Forest, Wayne Co., Missouri; CNC 14220. (p. 114). 6. *Melanapamea mixta* (Grote); Tower Hill, New Brunswick; CNC 8644. (p. 117). 7. *Lateroligia ophiogramma* (Esper); St-Roch de l'Achigan, Quebec; CNC 13611. (p. 119).

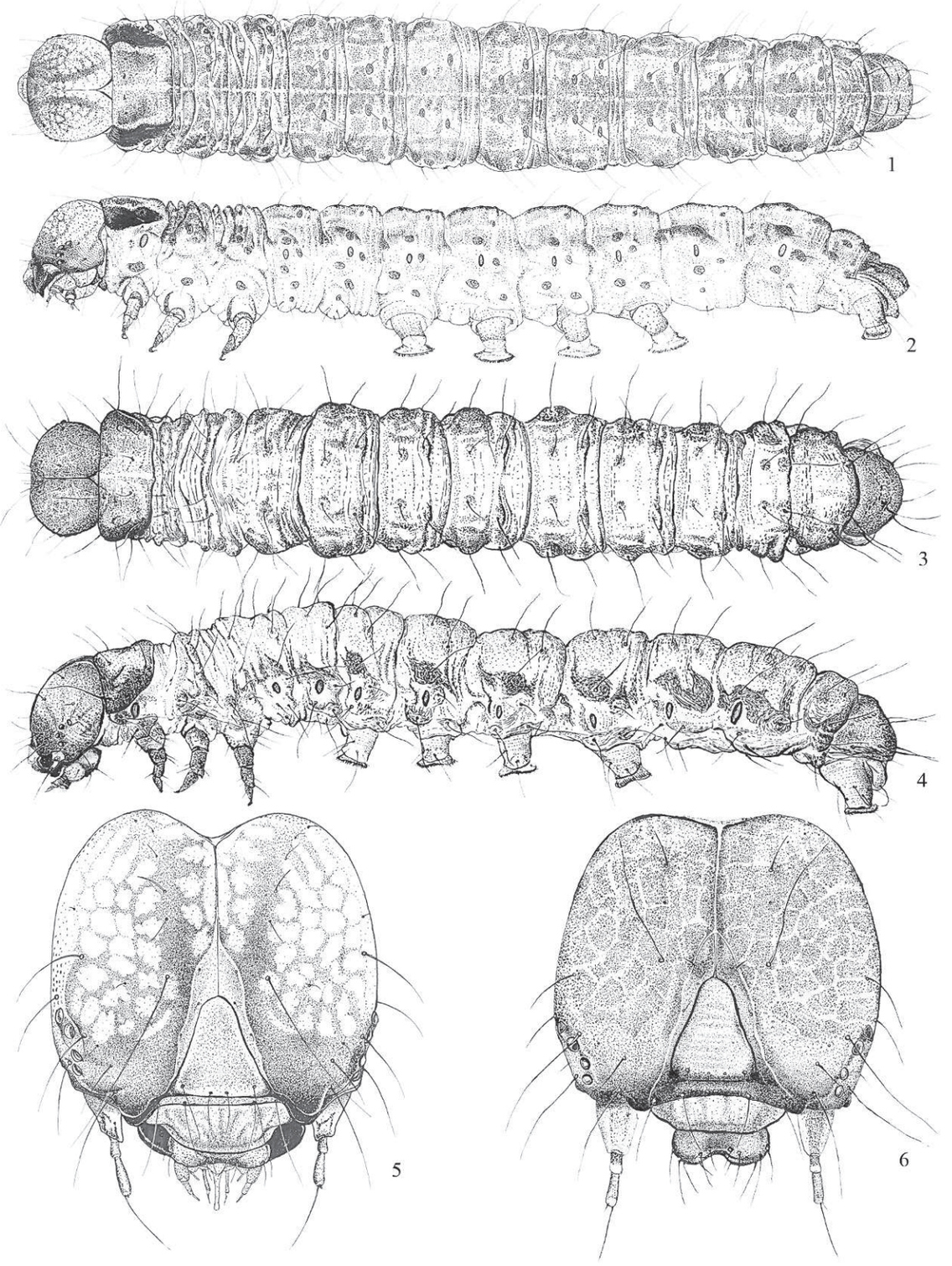


PLATE X. LARVAE OF *PROTAPAMEA*

1. *Protapamea danieli* Quinter, dorsal view. 2. *Protapamea danieli* Quinter, lateral view. 3. *Protapamea louisae* Quinter, dorsal view. 4. *Protapamea louisae* Quinter, lateral view. 5. *Protapamea danieli* Quinter, head. 6. *Protapamea louisae* Quinter, head.

COLOR PLATES

Noctuoidea

PLATE 1

Noctuoidea

NOCTUIDAE

figs. 1–37

NATURAL SIZE 1:1

1. *Apamea verbascoides* (Gn.), ♂. Ottawa, Ontario, 19 June 1900 (CNC Noctuoidea # 5269). (p. 29).
2. *Apamea verbascoides* (Gn.), ♀. Brooklyn, [Kings Co.], New York, 21 June 1902 (CNC Noctuoidea # 5270). (p. 29).
3. *Apamea inebriata* Fgn., ♂. Centre, [Albany Co.], New York, 8 July 1902, A. C. Weeks (USNM). (p. 30).
4. *Apamea inebriata* Fgn., ♀. Lakehurst Naval Air Station, Ocean Co., New Jersey, 5 July 1988, D. F. Schweitzer (USNM). (p. 30).
5. *Apamea nigrior* (Sm.), ♂. Ottawa, Ontario, 14 August 1902 (CNC Noctuoidea # 5275). (p. 31).
6. *Apamea nigrior* (Sm.), ♀. Brooklyn, [Kings Co.], New York, 12 June 1901 (USNM). (p. 31).
7. *Apamea vulgaris* (Grt. & Rob.), ♂. Putnam County, Illinois, 25 May 1941, M. O. Glenn (CNC Noctuoidea # 5279). (p. 31).
8. *Apamea vulgaris* (Grt. & Rob.), ♀. Arlington, [Arlington Co.], Virginia, 22 May 1951, J. G. Franclemont (CNC Noctuoidea # 5281). (p. 31).
9. *Apamea wikeri* Quinter & Laf., ♂. Holotype. McCrite Farm, T15S R2W sec 3, 3 mi W Tamms, Alexander Co., Illinois, 6–16 June 1999, J. R. Wiker (CNC Noctuoidea #11468). (p. 32).
10. *Apamea wikeri* Quinter & Laf., ♀. Paratype. Browns Crossing, 400′, Mark Twain National Forest, 2.7 mi W Williamsville, Wayne Co., Missouri, 21 June 1993, E. L. Quinter (CNC Noctuoidea # 12255). (p. 32).
11. *Apamea cristata* (Grt.), ♂. Mont Rougemont, Quebec, 28 June 2004, L. Handfield (CNC Noctuoidea # 9976). (p. 33).
12. *Apamea cristata* (Grt.), ♀. Ahmic Lake near Magnetawan, Parry Sound Co., Ontario, 7 July 1979, E. and I. Munroe (CNC Noctuoidea # 9977). (p. 33).
13. *Apamea cariosa* (Gn.), ♀. Meach Lake, Quebec, 20 June 1903, C. H. Young (CNC Noctuoidea # 5285). (p. 34).
14. *Apamea cariosa* (Gn.), ♀. New Brighton, [Beaver Co.], Pennsylvania, 6 July 1903, H. D. Merrick (USNM). (p. 34).
15. *Apamea cariosa* (Gn.), ♀. US Hwy 34, 5,700′, Viestenz-Smith Mountain Park, 9.8 mi W Loveland, Larimer Co., Colorado, 8 July 1996, T. S. Dickel (CNC Noctuoidea # 11169). (p. 34).
16. *Apamea quinteri* Mikkola & Laf., ♂. Paratype. Richland, 6,000′, Balsam Mountain, Jackson-Haywood Co. line, North Carolina, 30 June 1967, D. C. Ferguson (USNM). (p. 35).
17. *Apamea quinteri* Mikkola & Laf., ♀. New River State Park, 2,600′, Alleghany Co., North Carolina, 20 July 2001, J. B. Sullivan (JBS). Barcoded. (p. 35).
18. *Apamea apamiformis* (Gn.), ♂. Lakehurst, [Ocean Co.], New Jersey, July 1925, F. Lemmer (CNC Noctuoidea # 5327). (p. 37).
19. *Apamea apamiformis* (Gn.), ♀. Ottawa, Ontario, 1958, reared on wild rice, E. W. Rockburne (CNC Noctuoidea # 5328). (p. 37).
20. *Apamea vultuosa vultuosa* (Grt.), ♂. Digby, Nova Scotia, J. Russell (CNC Noctuoidea # 5329). (p. 39).
21. *Apamea v. vultuosa* (Grt.), ♀. Ottawa, Ontario, 6 June 1901, J. Fletcher (CNC Noctuoidea # 5330). (p. 39).
22. *Apamea vultuosa multicolor* (Dyar), ♀. Ucluelet, British Columbia, 14 June 1909, C. H. Young (CNC Noctuoidea # 5331). (p. 40).
23. *Apamea v. multicolor* (Dyar), ♀. 5 km E of Langley, British Columbia, 1–4 May 1991, J. Troubridge (CNC Noctuoidea # 5333). (p. 40).
24. *Apamea v. vultuosa* (Grt.), ♀. Waterrock Knob, 5,800′, Jackson Co., North Carolina, 22 June 1974, D. C. Ferguson (USNM). (p. 39).
25. *Apamea plutonia* (Grt.), ♂. Little Timber Creek, 5,743′, Crazy Mountains, Sweet Grass Co., Montana, 29 June 1966, D. C. Ferguson (USNM). (p. 40).
26. *Apamea plutonia* (Grt.), ♀. County Rd 11 and Blacktail Creek, 7,040′, T1S R82W sec 22, Radium State Wildlife Area, Grand Co., Colorado, 23 July 2000, T. S. Dickel (CNC Noctuoidea # 11161). (p. 40).
27. *Apamea perpensa* (Grt.), ♂. Walnut Canyon, 6.3 mi EESE Flagstaff, 6,500′, Coconino Co., Arizona, 1 August 1994, J. G. Franclemont (CNC Noctuoidea # 5342). (p. 41).
28. *Apamea perpensa* (Grt.), ♀. Pole Hill, 2,515 m, 40°21′42″ N, 105°27′12″ W, Larimer Co., Colorado, 7 August 1983, T. McCabe (CNC Noctuoidea # 5343). (p. 41).
29. *Apamea xylodes* Mikkola & Laf., ♂. Paratype. Gold Creek near Alta Lakes, 10,700′, San Miguel Co., Colorado, 3 July 1977, D. C. Ferguson (USNM). (p. 41).
30. *Apamea xylodes* Mikkola & Laf., ♀. Paratype. Doolittle Ranch, 9,800′, Mount Evans, [Clear Creek Co.], Colorado, 13 July 1961, E. W. Rockburne (CNC Noctuoidea # 5335). (p. 41).
31. *Apamea alia* (Gn.), ♂. Knowlton, Quebec, 2 July 1928, J. A. Adams (CNC Noctuoidea # 5338). (p. 42).
32. *Apamea alia* (Gn.), ♀. North Gower, Ontario, 20 June 1971, C. F. Hinks (CNC Noctuoidea # 5339). (p. 42).
33. *Apamea alia* (Gn.), ♂. North Gower, Ontario, 13 June 1971, J. R. Byers (CNC Noctuoidea # 5340). (p. 42).
34. *Apamea alia* (Gn.), ♀. North Gower, Ontario, 13 June 1971, J. R. Byers (CNC Noctuoidea # 5341). (p. 42).
35. *Apamea unanimis* (Hbn.), ♂. Carp Ridge, 45°23.05′ N, 76°04.80′ W, Ottawa, Ontario, 7 June 2005, J. Troubridge (UASM). (p. 43).
36. *Apamea unanimis* (Hbn.), ♀. Carp Ridge, 45°23.05′ N, 76°04.80′ W, Ottawa, Ontario, 16 June 2004, J. Troubridge (UASM). (p. 43).
37. *Apamea unanimis* (Hbn.), ♀. Hanko, Finland, 18 June 1983, Nupponen (CNC Noctuoidea # 10977). (p. 43).


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PLATE 2

Noctuoidea

NOCTUIDAE

figs. 1–44

NATURAL SIZE 1:1

1. *Apamea remissa* (Hbn.), ♂. Helsinki, Finland, 30 June 1987, E. Fransila (CNC). (p. 44).
2. *Apamea remissa* (Hbn.), ♀. Vantaa, Finland, 21–26 July 1982, J. Wettenhovi (CNC). (p. 44).
3. *Apamea remissa* (Hbn.), ♀. British Isles, South Wales, L. B. Prout (CNC). (p. 44).
4. *Apamea remissa* (Hbn.), ♀. British Isles, L. B. Prout (CNC). (p. 44).
5. *Apamea remissa* (Hbn.), ♂. Matamuska, Alaska, 23 June (CNC Noctuoidea # 5409). (p. 44).
6. *Apamea remissa* (Hbn.), ♀. Hope, Kenai Peninsula, Alaska, 15 July 1951, W. J. Brown (CNC Noctuoidea # 5411). (p. 44).
7. *Apamea indocilis* (Wlk.), ♂. Ottawa, Ontario, 1900 (CNC Noctuoidea # 5397). (p. 45).
8. *Apamea indocilis* (Wlk.), ♀. Ottawa, Ontario, 17 June 1902 (CNC Noctuoidea # 5398). (p. 45).
9. *Apamea indocilis* (Wlk.), ♂. Balsam, 3,200′, Jackson Co., North Carolina, 23 June 1974, D. C. Ferguson (USNM). (p. 45).
10. *Apamea indocilis* (Wlk.), ♀. Little Timber Creek, 5,743′, Crazy Mountains, Sweet Grass Co., Montana, 3 July 1966, D. C. Ferguson (USNM). (p. 45).
11. *Apamea indocilis* (Wlk.), ♀. Ottawa, Ontario, 11 June 1902 (CNC Noctuoidea # 5400). (p. 45).
12. *Apamea indocilis* (Wlk.), ♀. Ottawa, Ontario, 22 June 1900 (CNC Noctuoidea # 5401). (p. 45).
13. *Apamea indocilis* (Wlk.), ♂. Winnipeg, Manitoba, 19 June 1912, J. B. Wallis (CNC Noctuoidea # 5403). (p. 45).
14. *Apamea indocilis* (Wlk.), ♀. Ucluelet, British Columbia, 28 June 1909 (CNC Noctuoidea # 5404). (p. 45).
15. *Apamea indocilis* (Wlk.), ♀. Bowser, British Columbia, 21 June 1955, J. R. McGillis (CNC Noctuoidea # 5405). (p. 45).
16. *Apamea indocilis* (Wlk.), ♂. Inverness, Marin Co., California, 30 June 1940 (CNC Noctuoidea # 5406). (p. 45).
17. *Apamea impulsa* (Gn.), ♂. North Gower, Ontario, 6 June 1978, J. R. Byers (CNC Noctuoidea # 5377). (p. 47).
18. *Apamea impulsa* (Gn.), ♀. Harrington Lake, Gatineau Park, [Gatineau], Quebec, 9 June 1954, J. E. H. Martin (CNC Noctuoidea # 5379). (p. 47).
19. *Apamea unita* (Sm.), ♂. 1 mi S Jacob Lake, 8,200′, Coconino Co., Arizona, 24 July 1965, F. P. and M. Rindge (AMNH). (p. 48).
20. *Apamea unita* (Sm.), ♀. Southwestern Research Station, Chiricahua Mountains, Cochise Co., Arizona, 17 May 1960, C. W. Kirkwood (CNC Noctuoidea # 1984). (p. 48).
21. *Apamea cuculliformis* (Grt.), ♂. Walla Walla, [Walla Walla Co.], Washington, 6 June 1948, W. C. Cook (CNC Noctuoidea # 5267). (p. 48).
22. *Apamea cuculliformis* (Grt.), ♀. The Geysers, Sonoma Co., California, 9 May 1939, E. C. Johnston (CNC Noctuoidea # 5268). (p. 48).
23. *Apamea sordens sordens* (Hufn.), ♂. Hels Pit, Tammisto, Finland, 9 June 1968, K. Helomaa (CNC Noctuoidea # 11487). (p. 51).
24. *Apamea sordens finitima* (Gn.), ♂. Ithaca, [Tompkins Co.], New York, 25 May 1941, J. G. Franclemont (CNC Noctuoidea # 5412). (p. 51).
25. *Apamea s. finitima* (Gn.), ♂. Saint Basile, New Brunswick, 23 June 1991, M. Turgeon (CNC Noctuoidea # 5413). (p. 51).
26. *Apamea s. finitima* (Gn.), ♀. Ithaca, [Tompkins Co.], New York, 25 May 1933, J. G. Franclemont (CNC Noctuoidea # 5415). (p. 51).
27. *Apamea s. finitima* (Gn.), ♀. Transcona, Manitoba, 30 June 1950, Woodcock (CNC Noctuoidea # 5419). (p. 51).
28. *Apamea sordens sableana* Mikkola, ♂. Holotype. West end of Sable Island, Nova Scotia, 8 July 1967, J. E. H. Martin (CNC Noctuoidea # 5416). (p. 51).
29. *Apamea s. sableana* Mikkola, ♀. Paratype. West end of Sable Island, Nova Scotia, 1 July 1967, J. E. H. Martin (CNC Noctuoidea # 5417). (p. 51).
30. *Apamea digitula* Mustelin & Mikkola, ♀. Kitchen Creek Rd., 5,000′, Laguna Mountains, San Diego Co., California, 4 May 2000, T. Mustelin. (CNC Noctuiodea # 12222). Barcoded. (p. 52).
31. *Apamea digitula* Mustelin & Mikkola, ♂. Salem, [Marion Co.], Oregon, 8 May 1961, K. Goeden (CNC Noctuoidea # 5418). (p. 52).
32. *Apamea digitula* Mustelin & Mikkola, ♀. Lee Vining, 7,100′, [Mono Co.], California, 5 June 2002, Troubridge and Crabo (CNC Noctuoidea # 7855). Barcoded. (p. 52).
33. *Apamea inordinata inordinata* (Morr.), ♂. Riverhead, Long Island, [New York Co.], New York, 25 May 1937, R. Latham (CNC Noctuoidea # 5345). (p. 53).
34. *Apamea i. inordinata* (Morr.), ♂. Grand Gulf (Huntington Ravine), 3,000′, Mount Washington, [Coos Co.], New Hampshire, 25 July to 5 August 1914, L. W. Swett (CNC Noctuoidea # 5347). (p. 53).
35. *Apamea i. inordinata* (Morr.), ♀. Black Sturgeon Lake, Ontario, 25 June 1963 (CNC Noctuoidea # 5346). (p. 53).
36. *Apamea inordinata semilunata* (Grt.), ♀. Walla Walla, [Walla Walla Co.], Washington, 8 May 1958, W. C. Cook (CNC Noctuoidea # 5349). (p. 54).
37. *Apamea i. semilunata* (Grt.), ♂. Kamloops, British Columbia, 15 May 1957 (CNC Noctuoidea # 5350). (p. 54).
38. *Apamea i. semilunata* (Grt.), ♂. Lethbridge, Alberta, 25 June 1928, H. Seamans (CNC Noctuoidea # 5351). (p. 54).
39. *Apamea i. olympia* Crabo, ♀. Paratype. DNR Mima Mounds, 46.907°N, 123.049°W, 240′, Thurston Co., Washington, May 4 1998, L. G. Crabo (CNC Noctuoidea # 13984). (p. 54).
40. *Apamea spaldingi* (Sm.), ♀. 3 km above northeast corner of Vaseux Lake, British Columbia, 13–19 May 1990, J. Troubridge (CNC Noctuoidea # 5355). (p. 55).
41. *Apamea spaldingi* (Sm.), ♀. Silver Saddle Motel, Boulder, 5,500′, [Boulder Co.], Colorado, 11 June 1961, M. R. MacKay (CNC Noctuoidea # 5356). (p. 55).
42. *Apamea spaldingi* (Sm.), ♀. T1S R82W sec 22, 7,040′, Radium State Wildlife Area, County Rd 11 and Blacktail Creek, [Grand Co.], Colorado, 18 June 2003, T. S. Dickel (CNC Noctuoidea # 11167). (p. 55).
43. *Apamea spaldingi* (Sm.), ♂. T1S R82W sec 22, 7,040′, Radium State Wildlife Area, County Rd 11 and Blacktail Creek, [Grand Co.], Colorado, 5 June 1991, T. S. Dickel (CNC Noctuoidea # 5354). (p. 55).
44. *Apamea spaldingi* (Sm.), ♂. Red Canyon, Grasmere, 49°08′ N, 115°04′ W, 3,400′, British Columbia, 15 July 1999, J. Troubridge (UASM). (p. 55).


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PLATE 3

Noctuoidea

NOCTUIDAE

figs. 1–34

NATURAL SIZE 1:1

1. *Apamea cinefacta* (Grt.), ♀. The Geysers, Sonoma Co., California, 9 April 1940, E. C. Johnston (CNC Noctuoidea # 5358). (p. 55).
2. *Apamea cinefacta* (Grt.), ♀. Victoria, British Columbia, 1942, W. H. Dauby (CNC Noctuoidea # 5359). (p. 55).
3. *Apamea cinefacta* (Grt.), ♀. Kusshi Canyon, Yakima Co., Washington, 28 May 1949, E. C. Johnston (CNC Noctuoidea # 5360). (p. 55).
4. *Apamea cinefacta* (Grt.), ♂. Salem, [Marion Co.], Oregon, 2 May 1959, H. Foster (CNC Noctuoidea # 5361). CNC dissection # 8630. (p. 55).
5. *Apamea cinefacta* (Grt.), ♂. Walla Walla, [Walla Walla Co.], Washington, 28 May 1948, W. C. Cook (CNC Noctuoidea # 5357). (p. 55).
6. *Apamea lignicolora* (Gn.), ♂. Saskatoon, Saskatchewan, 27 July 1940, K. M. King (CNC Noctuoidea # 5290). (p. 56).
7. *Apamea lignicolora* (Gn.), ♀. North Gower, Ontario, 12 July 1977, J. R. Byers (CNC Noctuoidea # 5291). (p. 56).
8. *Apamea lignicolora* (Gn.), ♀. Brandon, Manitoba, 16 July 1958, N. B. Chillcott (CNC Noctuoidea # 5292). (p. 56).
9. *Apamea lignicolora* (Gn.), ♀. Joe Dollar Gulch, Hill City, Black Hills, [Pennington Co.], South Dakota, 22 July 1964, D. C. Ferguson (USNM). (p. 56).
10. *Apamea atriclava* (B. & McD.), ♂. Frissell Point, 4,900′, 44°13′ N, 122° 06′ W, Lane Co., Oregon, 26 July 2001, J. Troubridge (UASM). (p. 57).
11. *Apamea atriclava* (B. & McD.), ♀. Victoria, British Columbia, 28 June 1927, W. B. Anderson (CNC Noctuoidea # 5295). (p. 57).
12. *Apamea smythi* Franc., ♀. Putnam Co., Illinois, 12 July 1966, M. O. Glenn (CUIC). (p. 58).
13. *Apamea helva* (Grt.), ♂. Brooklyn, [Kings Co.], New York, 3 August, 1902 (CNC Noctuoidea # 5460). (p. 58).
14. *Apamea helva* (Grt.), ♂. Morehead, [Rowan Co.], Kentucky, 29 August 1962, T. N. Freeman (CNC Noctuoidea # 5261). (p. 58).
15. *Apamea helva* (Grt.), ♂. US Hwy 34, 5,700′, 9.8 mi W of Loveland, Viestenz-Smith Mountain Park, Larimer Co., Colorado, 13 August 1996, T. S. Dickel (CNC Noctuoidea # 11172). (p. 58).
16. *Apamea antennata* (Sm.), ♀. Kirby Flats, 2,000′–3,000′, 50°32′ N, 121°43′ W, British Columbia, 2 July 1998, J. Troubridge (CNC Noctuoidea # 7798). (p. 59).
17. *Apamea antennata* (Sm.), ♀. Mount Kobau, 6,040′, 49°06′ N, 119°39′ W, British Columbia, 16 July 1999, J. Troubridge (CNC Noctuoidea # 7797). (p. 59).
18. *Apamea antennata* (Sm.), ♀. Seton Lake, Lillooet, British Columbia, 29 June 1925, J. McDunnough (CNC Noctuoidea # 5300). (p. 59).
19. *Apamea antennata* (Sm.), ♀. East end of Seton Lake at the base of Mount McLean, British Columbia, 21 June 1996, J. Troubridge (UASM). (p. 59).
20. *Apamea antennata* (Sm.), ♀. Bunny and Sand Flats, 6,720′–7,680′, 41.35° N, 122.20–24° W, SSW slope of Mount Shasta Ski Bowl, Siskiyou Co., California, 30 July 1995, J. Troubridge and L. Crabo (CNC Noctuoidea 11463). (p. 59).
21. *Apamea siskiyou* Mikkola & Laf., ♂. Paratype. Yreka, Siskiyou Co., California, 4 June 1963, W. R. Bauer and J. S. Buckett (UCD). (p. 60).
22. *Apamea siskiyou* Mikkola & Laf., ♂. Grass Valley, Nevada Co., California, 17 May 1966, R. P. Allen (UCD). (p. 60).
23. *Apamea siskiyou* Mikkola & Laf., ♀. Paratype. Eight Dollar Mountain Road, 1,600′, Josephine Co., Oregon, 15 June 1999, J. Troubridge (CNC Noctuoidea # 11486). (p. 60).
24. *Apamea ochromma* Mikkola & Laf., ♀. Holotype. 7 air miles WSW of Juchitepec, 2,750 m, Mexico District, Mexico, 24 August 1987, J. Brown & J. Powell (EME). (p. 60).
25. *Apamea ochromma* Mikkola & Laf., ♀. Paratype. Tlamacas, 3,600–3,660 m, Volcan Popocatepetl, Puebla, Mexico, 24 August 1987, J. Brown & J. Powell (EME). (p. 60).
26. *Apamea ochromma* Mikkola & Laf., ♀. Paratype. 7 air miles WSW of Juchitepec, 2,750 m, Mexico District, Mexico, 24 August 1987, J. Brown & J. Powell (CNC Noctuoidea # 5395). (p. 60).
27. *Apamea atrosuffusa* (B. & McD.), ♂. Pole Hill, 2,515 m, 40°21′42″ N, 105°27′12″ W, Larimer Co., Colorado, 6 August 1983, T. McCabe (CNC Noctuoidea # 5302). (p. 61).
28. *Apamea atrosuffusa* (B. & McD.), ♀. Pole Hill, 2,515 m, 40°21′42″ N, 105°27′12″ W, Larimer Co., Colorado, 6 August 1983, T. McCabe (TLM). (p. 61).
29. *Apamea atrosuffusa* (B. & McD.), ♂. Pole Hill, 2,515 m, 40°21′42″ N, 105°27′12″ W, Larimer Co., Colorado, 19 July 1982, T. McCabe (TLM). (p. 61).
30. *Apamea atrosuffusa* (B. & McD.), ♀. Pole Hill, 2,515 m, 40°21′42″ N, 105°27′12″ W, Larimer Co., Colorado, 5 August 1983, T. McCabe (CNC Noctuoidea # 5305). (p. 61).
31. *Apamea auranticolor* (Grt.), ♂. Doolittle Ranch, 9,800′, Mount Evans, [Clear Creek Co.], Colorado, 6 August 1961, E. W. Rockburne (CNC Noctuoidea # 5312). (p. 62).
32. *Apamea auranticolor* (Grt.), ♀. 10 mi WSW of Georgetown, 11,000′, [Clear Creek Co.], Colorado, 1 August 1967, D. F. Hardwick (CNC Noctuoidea # 5313). (p. 62).
33. *Apamea auranticolor* (Grt.), ♂. 10 mi WSW of Georgetown, 11,000′, [Clear Creek Co.], Colorado, 1 August 1967, D. F. Hardwick (CNC Noctuoidea # 5314). (p. 62).
34. *Apamea auranticolor* (Grt.), ♀. 10 mi WSW of Georgetown, 11,000′, [Clear Creek Co.], Colorado, 1 August 1967, D. F. Hardwick (CNC Noctuoidea # 5315). (p. 62).


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PLATE 4

Noctuoidea

NOCTUIDAE

figs. 1–34

NATURAL SIZE 1:1

1. *Apamea auranticolor* (Grt.), ♂. Angel Lake, 2,550 m, 41°01′ N, 115°04′ W, Elko Co., Nevada, 23 July 2001, Lafontaine and Troubridge (UASM). (p. 62).
2. *Apamea sora* (Sm.), ♂. Summit Lake, Mile 392, 4,200′, Alaska Highway, British Columbia, 19–21 August 1959, E. E. MacDougall (CNC Noctuoidea # 5316). (p. 63).
3. *Apamea sora* (Sm.), ♀. Summit Lake, Mile 392, 4,200′, Alaska Highway, British Columbia, 19–21 August 1959, E. E. MacDougall (CNC Noctuoidea # 5317). (p. 63).
4. *Apamea sora* (Sm.), ♀. Shingle Creek Road, Keremeos, British Columbia, 8 July 1936, A. N. Gartrell (CNC Noctuoidea # 5318). (p. 63).
5. *Apamea sora* (Sm.), ♀. 4 mi SE Lake Louise, 5,000′, Alberta, 20 July 1960, D. F. Hardwick (CNC Noctuoidea # 5319). (p. 63).
6. *Apamea tahoeensis* Mikkola & Laf., ♂. Holotype. Truckee, [Nevada Co.], California, 1 July 1913, X. McGlashan (CNC Noctuoidea # 5320). (p. 63).
7. *Apamea tahoeensis* Mikkola & Laf., ♀. Paratype. Garnet Lake, [Madera Co.], California, 28 August 1945 (CNC Noctuoidea # 5321). (p. 63).
8. *Apamea tahoeensis* Mikkola & Laf., ♂. Mount Ashland, 6,400′, 42°04′ N, 122°42′ W, Jackson Co., Oregon, 2 August 1998, J. Troubridge (JTT). (p. 63).
9. *Apamea commoda commoda* (Wlk.), ♂. Larder Lake, Ontario, 10 June 1920, H. C. Cook (CNC Noctuoidea # 5362). (p. 67).
10. *Apamea c. commoda* (Wlk.), ♀. Clear Lake Region, Riding Mountain National Park, Manitoba. 13 July 1979, A. Mutuura (CNC Noctuoidea # 5363). (p. 67).
11. *Apamea c. commoda* (Wlk.), ♂. Harlan, Saskatchewan, 4 July 1940, P. F. Bruggemann (CNC Noctuoidea # 5367). (p. 67).
12. *Apamea c. commoda* (Wlk.), ♂. Lloydminster, Sunnydale, Alberta, 13 July 1943, P. F. Bruggemann (CNC Noctuoidea # 5364). (p. 67).
13. *Apamea c. commoda* (Wlk.), ♀. Waskesiu, [Prince Albert National Park], Saskatchewan, 22 July 1989, A. R. Brookes (CNC Noctuoidea # 5365). (p. 67).
14. *Apamea c. commoda* (Wlk.), ♂. 5417–49 Mountainview Road, Olds, Alberta, 30 June–1 July 1986, E. Mengersen (CNC Noctuoidea # 5366). (p. 67).
15. *Apamea commoda parcata* (Sm.), ♂. Palmer, Alaska, 4 July 1944, J. C. Chamberlin (CNC Noctuoidea # 5374) (CNC dissection # 8635). (p. 67).
16. *Apamea c. commoda* (Wlk.)/ *c. parcata* (Sm.) intermediate, ♂. Saskatoon, Saskatchewan, 20 June 1978, D. Z. (CNC Noctuoidea # 5378). (p. 67).
17. *Apamea c. parcata* (Sm.), ♂. Lethbridge, Alberta, 12 June 1949, C. E. Lilly (CNC Noctuoidea # 5368). (p. 67).
18. *Apamea c. parcata* (Sm.), ♂. Badlands, 735 m, 46°36′34″ N, 103°28′20″ W, Slope Co., North Dakota, 22 June 1979, T. L. McCabe (CNC Noctuoidea # 5369). (p. 67).
19. *Apamea c. parcata* (Sm.), ♂. Manyberries, Dominion Range Station, Alberta, 14 July 1951, D. F. Hardwick (CNC Noctuoidea # 5370). (p. 67).
20. *Apamea commoda striolata* Mikkola, ♂. Holotype. Pole Hill, 2,590 m, 40°21′42″ N, 105°25′58″ W, Larimer Co., Colorado, 14 July 1982, T. McCabe (CNC Noctuoidea # 5371). (p. 67).
21. *Apamea c. striolata* Mikkola, ♂. Paratype. Doolittle Ranch, 7,800′, Mount Evans, [Clear Creek Co.], Colorado, 7 August 1961, E. W. Rockburne (CNC Noctuoidea # 5372). (p. 67).
22. *Apamea c. striolata* Mikkola, ♀. Tensleep Preserve, 5,800′, 44°01′ N, 107°16′ W, Washakie Co., Wyoming, 28–29 June 2000, C. D. Ferris (CNC Noctuoidea # 12001). Barcoded. (p. 67).
23. *Apamea centralis* (Sm.), ♀. Mohawk, Plumas Co., California, 7 July 1946, W. R. Bauer (CNC Noctuoidea # 5322). (p. 68).
24. *Apamea centralis* (Sm.), ♀. Shingle Creek Road, Keremeos, British Columbia, 6 July 1936, A. N. Gartrell (CNC Noctuoidea # 5323). (p. 68).
25. *Apamea centralis* (Sm.), ♂. West slope of Quartz Mountain, 1,900 m, 47°07′ N, 121°07′ W, west end of Manastash Ridge, Kittitas Co., Washington, 14 July 1990, L. G. and A. Crabo (CNC Noctuoidea # 5263). (p. 68).
26. *Apamea genialis* (Grt.), ♀. Inverness, Marin Co., California, 30 April 1935, E. C. Johnston (CNC Noctuoidea # 5325). (p. 69).
27. *Apamea genialis* (Grt.), ♀. Inverness, Marin Co., California, 30 April 1935, E. C. Johnston (CNC Noctuoidea # 5326). (p. 69).
28. *Apamea occidens* (Grt.), ♂. Birch Creek, 33 mi SE Gilmore, Lemhi Co., Idaho, 4 July 1953, E. C. Johnston (CNC Noctuoidea # 5384). (p. 69).
29. *Apamea occidens* (Grt.), ♀. 12 mi WNW Estes Park, 11,600′, [Larimer Co.], Colorado, 27 July 1967, D. F. Hardwick (CNC Noctuoidea # 5383). (p. 69).
30. *Apamea occidens* (Grt.), ♂. Walla Walla, [Walla Walla Co.], Washington, 28 May 1954, W. C. Cook, E. C. Johnston (CNC Noctuoidea # 5385). (p. 69).
31. *Apamea occidens* (Grt.), ♀. West of summit saddle of Mount Ashland, 2,135 m, 42.08° N, 122.72° W, Siskiyou Mountains, Jackson Co., Oregon, 30 July 1991, L. G. Crabo (CNC Noctuoidea # 11464). (p. 69).
32. *Apamea amputatrix* (Fitch), ♂. Echo Lake, Mount Evans, [Clear Creek Co.], Colorado, 7 July 1961, E. W. Rockburne (CNC Noctuoidea # 5388). (p. 70).
33. *Apamea amputatrix* (Fitch), ♂. County Rd 11 and Blacktail Creek, 7,040′, T1S R82W sec 22, Radium State Wildlife Area, [Grand Co.], Colorado, 29 August 2005, T. S. Dickel (CNC Noctuoidea # 11180). (p. 70).
34. *Apamea amputatrix* (Fitch), ♀. Nederland, 8,300′, [Boulder Co.], Colorado, 2 July 1961, M. R. MacKay (CNC Noctuoidea # 5389). (p. 70).

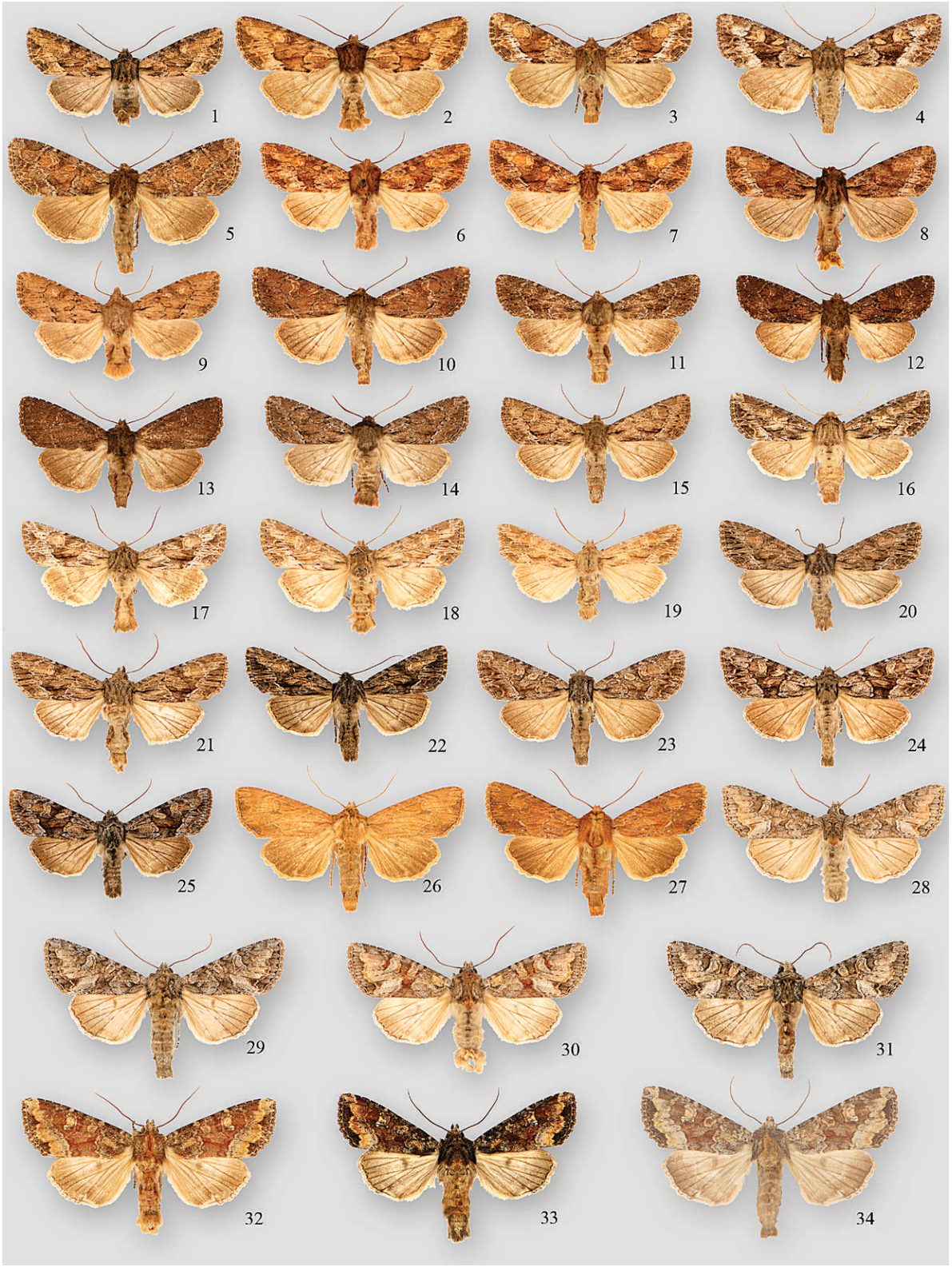
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PLATE 5

Noctuoidea

NOCTUIDAE

figs. 1–33

NATURAL SIZE 1:1

1. *Apamea amputatrix* (Fitch), ♀. Picton Island, Clayton, [Jefferson Co.], New York, 26 July 1964, B. Heineman (CNC Noctuoidea # 5391). (p. 70).
2. *Apamea amputatrix* (Fitch), ♀. Strathroy, Ontario, 27 June 1925, H. F. Hudson (CNC Noctuoidea # 5391). (p. 70).
3. *Apamea amputatrix* (Fitch), ♀. Guerneville, [Sonoma Co.], California, August 1913, J. Sinclair (CNC Noctuoidea # 5392). (p. 70).
4. *Apamea amputatrix* (Fitch), ♀. Mission Ridge NW of Mount McLean, 5,800′–6,900′, 50.76–77° N, 122.16–20° W, Chilcotin Range, Coast Range, British Columbia, 15–16 July 1994, L. Crabo & J. Troubridge (CNC Noctuoidea # 11461). (p. 70).
5. *Apamea amputatrix* (Fitch), ♂. Seattle, [King Co.], Washington, 4 August 1945, E. C. Johnston (CNC Noctuoidea # 5393). (p. 70).
6. *Apamea walshi* Laf., ♂. Holotype. Soldier Creek Campground, 9,400′, Pinaleno Mts., Graham Co., Arizona; 12 July 2007; B. Walsh (CNC Noctuoidea # 14045). (p. 72).
7. *Apamea walshi* Laf., ♀. Paratype. Cunningham Campground, 9,000′, Pinaleno Mts., Graham Co., Arizona; 12 July 2007; B. Walsh (CNC Noctuoidea # 53336). (p. 72).
8. *Apamea albina* (Grt.), ♂. Tocaloma, Marin Co., California, 8 April 1936, E. C. Johnston (CNC Noctuoidea # 5386). (p. 73).
9. *Apamea albina* (Grt.), ♀. Spring Mountain, Sonoma Co., California, 26 May 1938, E. C. Johnston (CNC Noctuoidea # 5387). (p. 73).
10. *Apamea maxima* (Dyar), ♂. Leadbetter Point, 5 m, 46.60° N, 124.04° W, North Beach Peninsula, Pacific Co., Washington, 29 June 1990, L. G. Crabo (CNC Noctuoidea # 5306). (p. 74).
11. *Apamea maxima* (Dyar), ♀. 3 mi S Sidney, 100′, British Columbia, 27 June 1979, J. D. Lafontaine (CNC Noctuoidea # 5307). (p. 74).
12. *Apamea maxima* (Dyar), ♂. Graham Island, 10 mi N Port Clements, Queen Charlotte Islands, British Columbia, 17 August 1988, J. F. G. Clarke & N. L. McIntyre (USNM). (p. 74).
13. *Apamea robertsoni* Mikkola & Mustelin, ♀. 5 mi SE of Dune Lakes, Oceano, San Luis Obispo Co., California, 29 May 1993, R. Robertson (CNC Noctuoidea # 5310). (p. 75).
14. *Apamea acera* (Sm.), ♂. 5 km SE Okanagan Falls, British Columbia, 3–9 July 1990, J. Troubridge (CNC Noctuoidea # 5308). (p. 75).
15. *Apamea acera* (Sm.), ♀. Bull Prairie Road at Route 207, 4,400′, 44.96° N, 119.70° W, Blue Mountains, Wheeler Co., Oregon, 15 July 1996, L. & E. Crabo (CNC Noctuoidea # 11467). (p. 75).
16. *Apamea burgessi burgessi* (Morr.), ♂. Lakehurst, [Ocean Co.], New Jersey, September 1912, F. Lemmer (CNC Noctuoidea # 5470). (p. 77).
17. *Apamea b. burgessi* (Morr.), ♀. Cisco, 5–10 m, Nantucket Island, [Nantucket Co.], Massachusetts, 15 September 2005, H. Reitz (CNC Noctuoidea # 12668). Barcoded. (p. 77).
18. *Apamea burgessi leucoptera* Mikkola, ♂. 5 mi W of Joliet, 4,100′, [Carbon Co.], Montana, 3 September 1964, D. F. Hardwick (CNC Noctuoidea # 5473). (p. 77).
19. *Apamea b. leucoptera* Mikkola, ♂. Gates of the Mountains, 46°49′ N, 111°59′ W, [Lewis and Clark Co.], Montana, 7 September 1999, J. Troubridge (CNC Noctuoidea # 12581). Barcoded. (p. 77).
20. *Apamea b. leucoptera* Mikkola, ♂. Holotype. 6 mi E of Canadian, 2,000′, [Hemphill Co.], Texas, 28 September 1968, D. F. Hardwick (CNC Noctuoidea # 5472). (p. 77).
21. *Apamea b. leucoptera* Mikkola, ♀. US Hwy 34, 5,700′, 9.8 mi W Loveland, Viestenz-Smith Mountain Park, Larimer Co., Colorado, 13 September 2004, T. S. Dickel (CNC Noctuoidea # 11170). (p. 77).
22. *Apamea b. leucoptera* Mikkola, ♀. County Rd 11 and Blacktail Creek, 7,040′, T1S R82W sec 22, Radium State Wildlife Area, [Grand Co.], Colorado, 7 September 2005, T. S. Dickel (CNC Noctuoidea # 11171). (p. 77).
23. *Apamea b. leucoptera* Mikkola, ♀. Sand Hollow, 2,500′, 43°48′ N, 117°22′ W, [Malheur Co.], Oregon, 27 September 1998, J. Troubridge (CNC Noctuoidea # 12582). (p. 77).
24. *Apamea b. leucoptera* Mikkola, ♂. Sand Hollow, 2,500′, 43°48′ N, 117°22′ W, [Malheur Co.], Oregon, 27 September 1998, J. Troubridge (CNC Noctuoidea # 12583). Barcoded. (p. 77).
25. *Apamea b. leucoptera* Mikkola, ♂. 6 mi NE Prescott, 5,400′, [Yavapai Co.], Arizona, 21 September 1971, D. F. Hardwick (CNC Noctuoidea # 5474). (p. 77).
26. *Apamea burgessi ona* (Sm.), ♀. 5354 Ash Canyon Road, 5,100′, Huachuca Mountains, Cochise Co., Arizona, 21 September 1992, N. McFarland (CNC Noctuoidea # 12584). Barcoded. (p. 78).
27. *Apamea relicina relicina* (Morr.), ♂. 6 mi E of Canadian, 2,000′, [Hemphill Co.], Texas, 28 September 1968, D. F. Hardwick (CNC Noctuoidea # 5476). (p. 79).
28. *Apamea r. relicina* (Morr.), ♂. McKittrick Canyon, 6,700′, Guadalupe Mountains National Park, [Culberson Co.], Texas, 11 September 1975, J. D. Lafontaine & B. Bowen (CNC Noctuoidea # 5477). (p. 79).
29. *Apamea r. relicina* (Morr.), ♂. Canadian, Hemphill Co., Texas, 30 September 1968, A. & M. E. Blanchard (USNM). (p. 79).
30. *Apamea r. relicina* (Morr.), ♂. Fort Davis, Jeff Davis Co., Texas, 23 September 1965, A. & M. E. Blanchard (USNM). (p. 79).
31. *Apamea r. relicina* (Morr.), ♂. Sierra Diablo Wildlife Management Area, 6,000′, Culberson Co., Texas, 30 August 1970, A. & M. E. Blanchard (USNM). (p. 79).
32. *Apamea relicina migrata* (Sm.), ♂. Bear Mountain, [Orange Co.], New York, 11–20 September, H. J. Erb (CNC Noctuoidea # 5479) (CNC Dissection # S19). (p. 79).
33. *Apamea r. migrata* (Sm.), ♂. Bear Mountain, [Orange Co.], New York, 21–30 September, H. J. Erb (USNM). (p. 79).


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PLATE 6

Noctuoidea

NOCTUIDAE

figs. 1–35

NATURAL SIZE 1:1

1. *Apamea longula* (Grt.), ♂. 13 mi N of Wolf Creek, 3,800′, [Lewis and Clark Co.], Montana, 1 August 1961, D. F. Hardwick (CNC Noctuoidea # 10943). (p. 80).
2. *Apamea longula* (Grt.), ♀. 15 mi N Helena, 3,800′, [Lewis and Clark Co.], Montana, 15 August 1961, D. F. Hardwick (CNC Noctuoidea # 10944). (p. 80).
3. *Apamea longula* (Grt.), ♀. Hedley, British Columbia, 22 July 1923, C. B. Garrett (CNC Noctuoidea # 10945). (p. 80).
4. *Apamea longula* (Grt.), ♀. Twin Owls Trailhead, 7,950′, 1.3 mi N of Estes Park, Rocky Mountain National Park, Larimer Co., Colorado, 28 August 1991, T. S. Dickel (CNC Noctuoidea # 10946). (p. 80).
5. *Apamea bernardino* Mikkola & Mustelin, ♂. Holotype. Barton Flats, 6,600′, San Bernardino Mountains, San Bernardino Co., California, 10 August 1967, C. Henne (LACM). (p. 80).
6. *Apamea bernardino* Mikkola & Mustelin, ♀. Paratype. Green Canyon SW Baldwin Lake, 7,600′, San Bernardino Mountains, San Bernardino Co., California, 30 August 1967, C. Henne (CNC Noctuoidea # 10948). (p. 80).
7. *Apamea scoparia scoparia* Mikkola, Mustelin, & Laf., ♀. Paratype. Marmora, Ontario, 26 July 1952, J. R. Vockeroth (CNC Noctuoidea # 5421). (p. 82).
8. *Apamea s. scoparia* Mikkola, Mustelin, & Laf., ♂. St. Louis Creek Road, T1S R76W sec 34, 8,900′, 3.9 mi SW of Fraser, [Grand Co.], Colorado, 15 June 1991, T. S. Dickel (CNC Noctuoidea # 5423). (p. 82).
9. *Apamea s. scoparia* Mikkola, Mustelin, & Laf., ♀. Gott Peak, Coast Range, 7,100′, 50.36° N, 122.14° W, British Columbia, 6 August 2005, L. G. Crabo (CNC Noctuoidea # 11465). (p. 82).
10. *Apamea scoparia gabrieli* Mikkola & Mustelin, ♂. Holotype. Big Pines Area, 6,800′, San Gabriel Mountains, Los Angeles Co., California, 21 July 1966, C. Henne (LACM). (p. 82).
11. *Apamea s. gabrieli* Mikkola & Mustelin, ♀. Paratype. Big Pines Area, 6,700′, San Gabriel Mountains, Los Angeles Co., California, 23 July 1963, C. Henne (CNC Noctuoidea # 5427). (p. 82).
12. *Apamea dubitans* (Wlk.), ♂. Stanhope, Prince Edward Island, 10 August 1947, R. H. Wigmore (CNC Noctuoidea # 5428). (p. 82).
13. *Apamea dubitans* (Wlk.), ♀. Stanhope. Prince Edward Island, 25 August 1947, R. H. Wigmore (CNC Noctuoidea # 5430). (p. 82).
14. *Apamea dubitans* (Wlk.), ♀. Knowlton, Quebec, 30 July 1929, L. J. Miller (CNC Noctuoidea # 5429). (p. 82).
15. *Apamea dubitans* (Wlk.),♀. Fort Collins, Larimer Co., Colorado, 24 August 1962 (CNC Noctuoidea # 5431). (p. 82).
16. *Apamea cogitata* (Sm.), ♀. Truckee, [Nevada Co.], California, 14 July 1913, X. McGlashan (CNC Noctuoidea # 5435). (p. 84).
17. *Apamea cogitata* (Sm.), ♂. Truckee, [Nevada Co.], California, 16 July 1913, X. McGlashan (CNC Noctuoidea # 5434). (p. 84).
18. *Apamea cogitata* (Sm.), ♀. Lethbridge, Alberta, 8 July 1956, E. E. Sterns (CNC Noctuoidea # 5439). (p. 84).
19. *Apamea cogitata* (Sm.), ♂. 25 mi W of Calgary, 4,300′, Alberta, 19 July 1960, D. F. Hardwick (CNC Noctuiodea # 5438). (p. 84).
20. *Apamea cogitata* (Sm.), ♂. 4 mi N Sequim, 200′, [Clallam Co.], Washington, 17 August 1960, D. F. Hardwick (CNC Noctuoidea # 5432). (p. 84).
21. *Apamea cogitata* (Sm.), ♀. Beaver Creek, Hot Sulphur Springs, [Grand Co.], Colorado, 11 August 1991, T. S. Dickel (CNC Noctuoidea # 11890). Barcoded. (p. 84).
22. *Apamea cogitata* (Sm.), ♂. Seward, Alaska, 18 July 1950, W. J. Brown (CNC Noctuoidea # 5433). (p. 84).
23. *Apamea geminimacula* (Dyar), ♀. US Hwy 34, Viestenz-Smith Mt. Park, 9.8 mi W of Loveland, Larimer Co., Colorado, 15 September 1996, T. S. Dickel (CNC Noctuoidea # 11909). Barcoded. (p. 85).
24. *Apamea geminimacula* (Dyar), ♂. Ramsey Canyon, 600′, 15 mi S of Sierra Vista, Huachuca Mountains, [Cochise Co.], Arizona, 4 October 1967, R. F. Sternitzky (CNC Noctuoidea # 5436). (p. 85).
25. *Apamea geminimacula* (Dyar), ♀. US Hwy 34, Viestenz-Smith Mt. Park, 9.8 mi W of Loveland, Larimer Co., Colorado, 15 September 1996, T. S. Dickel (CNC Noctuoidea # 11151). (p. 85).
26. *Apamea inficita inficita* (Wlk.), ♂. Saint Basile, New Brunswick, 11 August 1988, M. Turgeon (CNC Noctuoidea # 5440). (p. 87).
27. *Apamea i. inficita* (Wlk.), ♂. Saint Anthony, Newfoundland, 8 August 1951, B. J. Moore (CNC Noctuoidea # 5441). (p. 87).
28. *Apamea i. inficita* (Wlk.), ♂. Teslin, Yukon, 13–14 August 1948, Mason & Hughes (CNC Noctuoidea # 5442). (p. 87).
29. *Apamea inficita indela* (Sm.), ♂. 6 mi N Jasper, 3,400′, Alberta, 24 July 1961, D. F. Hardwick (CNC Noctuoidea # 5446). (p. 87).
30. *Apamea i. indela* (Sm.), ♂. Nordegg, Alberta, 25 July 1921, J. McDunnough (CNC Noctuoidea # 5445). (p. 87).
31. *Apamea i. indela* (Sm.), ♀. Banff, Alberta, 3 August 1922, C. B. D. Garrett (CNC Noctuoidea # 5448). (p. 87).
32. *Apamea i. indela* (Sm.), ♂. 28 mi S Radium Hot Springs, 2,600′, British Columbia, 23 July 1960, D. F. Hardwick (CNC Noctuoidea # 5447). (p. 87).
33. *Apamea i. indela* (Sm.), ♂. 5 mi NW Crow's Nest, 4,300′, British Columbia, 26 July 1960, D. F. Hardwick (CNC Noctuoidea # 5444). (p. 87).
34. *Apamea i. indela* (Sm.), ♀. 15 mi SE of Heber, 7,800′, [Wasatch Co.], Utah, 21 August 1965, D. F. Hardwick (CNC Noctuoidea #5449). (p. 87).
35. *Apamea inficita conradi* (Grt.), ♂. 11 mi SE of Cedar City, 8,300′, [Iron Co.], Utah, 29 August 1965, D. F. Hardwick (CNC Noctuoidea # 5450). (p. 87).


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PLATE 7

Noctuoidea

NOCTUIDAE

figs. 1–36

NATURAL SIZE 1:1

1. *Apamea inficita conradi* (Grt.), ♂. 3 mi NE of Sargents, 9,700′, [Saguache Co.], Colorado, 14 August 1971, D. F. Hardwick (CNC Noctuoidea # 5451). (p. 87).
2. *Apamea i. conradi* (Grt.), ♀. 10 mi WSW Georgetown, 11,000′, [Clear Creek Co.], Colorado, 1 August 1967, D. F. Hardwick (CNC Noctuoidea # 5452). (p. 87).
3. *Apamea i. conradi* (Grt.), ♂. Greer, White Mountains, 8,500′, Apache Co., Arizona, 3 August 1962, E. & I. Munroe (CNC Noctuoidea # 5453). (p. 87).
4. *Apamea i. conradi* (Grt.), ♂. 2 mi SE of Greens Peak, 9,500′, White Mountains, Apache Co., Arizona, 5 August 1962, E. & I. Munroe (CNC Noctuoidea # 5454). (p. 87).
5. *Apamea i. conradi* (Grt.), ♀. Hot Sulphur Springs, Pioneer Campground, [Grand Co.], Colorado, 25 August 1991, T. S. Dickel (CNC Noctuoidea # 11997). Barcoded. (p. 87).
6. *Apamea hemimena* Mikkola & Laf., ♂. Holotype. Creel, Chihuahua, Mexico, 9 September 1969, T. A. Sears, R. C. Gardiner, C. S. Glaser. (UCD). CNC Dissection # 9940. (p. 88).
7. *Apamea hemimena* Mikkola & Laf., ♂. Paratype. Creel, Chihuahua, Mexico, 5 September 1969, T. A. Sears, R. C. Gardiner, and C. S. Glaser (UCD). CNC Dissection # 9932. (p. 88).
8. *Apamea lutosa* (Andrews), ♀s. Mount Pocono, [Monroe Co.], Pennsylvania, 15 July 1965, T. N. Freeman (CNC Noctuoidea # 5459). (p. 88).
9. *Apamea lutosa* (Andrews), ♂. Saint Paul, [Ramsey Co.], Minnesota, 8 July 1927, C. T. Schmidt (CNC Noctuoidea # 5457). (p. 88).
10. *Apamea lutosa* (Andrews), ♂. Saint Paul, [Ramsey Co.], Minnesota, 6 July 1927, C. T. Schmidt (CNC Noctuoidea # 5458). (p. 88).
11. *Apamea fergusoni* Mikkola & Laf., ♂. Holotype. Gothic, Gunnison Co., Colorado, 14 July 1940, W. J. Reinthal (CNC Noctuoidea # 10967). (p. 89).
12. *Apamea fergusoni* Mikkola & Laf., ♂. Paratype. 2 mi E Greens Peak, 9,500′, White Mountains, Apache Co., Arizona, 5 August 1962, E. & I. Munroe (CNC Noctuoidea # 10968). (p. 89).
13. *Apamea devastator* (Brace), ♂. 12 mi E of Bozeman, 5,700′, [Gallatin Co.], Montana, 14 August 1964, D. F. Hardwick (CNC Noctuoidea # 10937). (p. 90).
14. *Apamea devastator* (Brace), ♂. Ottawa, Ontario, 17 August 1948, D. F. Hardwick (CNC Noctuoidea # 10938). (p. 90).
15. *Apamea devastator* (Brace), ♀. Swift Current, Saskatchewan, 15 September 1910, A. R. Brooks (CNC Noctuoidea # 10939). (p. 90).
16. *Apamea devastator* (Brace), ♂. Carmel, Monterey Co., California, 30 August 1937, E. C. Johnston (CNC Noctuoidea # 10940). (p. 90).
17. *Apamea devastator* (Brace), ♀. Calgary, head of Pine Creek, Alberta, 11 August 1903, F. H. Wolley-Dod (CNC Noctuoidea # 10942). (p. 90).
18. *Apamea devastator* (Brace), ♂. Lethbridge, Alberta, 14 August 1937, E. C. Johnston (CNC Noctuoidea # 10941). (p. 90).
19. *Apamea zeta zeta* (Tr.), ♂. Walliser Alpen, Tash Hutte, 2,800 m, Switzerland, 5 August 1992, M. Sommeret (CNC Noctuoidea # 11489). (p. 91).
20. *Apamea z. zeta* (Tr.), ♀. Südtirol Schnalstal, [South Tyrol, Italian Alps], 2,000 m, Kurzras, Italy, 9 August 1977, S. Greubel (CNC Noctuoidea # 11490). (p. 91).
21. *Apamea zeta ingloria* (Bang-Haas), ♂. Irkutskaja, 1,800 m, Hamar-Daban, Pik Tsherskogo, Russia, 21–22 July 1984, Mikkola and Viitasaari (CNC Noctuoidea # 11963). Barcoded. (p. 91).
22. *Apamea z. ingloria* (Bang-Haas), ♂. Irkutskaja Oblast' Hamar-Daban, Russia, 21 July 1984, Mikkola (CNC Noctuoidea # 11962). Barcoded. (p. 91).
23. *Apamea zeta assimilis* (Doubleday), ♂. British Isles, J. B. Prout (CNC Noctuoidea # 11492). (p. 91).
24. *Apamea z. assimilis* (Doubleday), ♀. British Isles, J. B. Prout (CNC Noctuoidea # 11491). (p. 91).
25. *Apamea zeta exulis* (Lef.), ♂. Sondrestrom Air Base, Greenland, 27 June 1952, W. J. Brown (CNC Noctuoidea # 10949). (p. 95).
26. *Apamea z. exulis* (Lef.), ♂. Hopedale, Labrador, 16 August 1932, W. W. Perrett (CNC Noctuoidea # 10950). (p. 95).
27. *Apamea z. exulis* (Lef.), ♂. L'Anse au Loup, 51°32′ N, 56°49′ W, Labrador, 8 June 1985, L. Crabo (CNC Noctuoidea # 11988). (p. 95).
28. *Apamea z. exulis* (Lef.), ♂. Lake Harbour, Baffin Island, [Nunavut], 20 July 1931, J. D. Sopen (CNC Noctuoidea # 10952). (p. 95).
29. *Apamea zeta downesi* Mikkola, ♀. Paratype. Hazen Camp, Ellesmere Island, [Nunavut], 3 August 1961, D. R. Oliver (CNC Noctuoidea # 10953). (p. 96).
30. *Apamea zeta murrayi* (Gibson), ♀. Bernard Harbour, Dolphin and Union Strait, [Nunavut], 3–10 July 1988, J. Troubridge (CNC Noctuoidea # 10957). (p. 96).
31. *Apamea z. murrayi* (Gibson), ♂. 24 km E of Churchill at Churchill Northern Studies Centre, 7 July 1991, H. Hensel (CNC Noctuoidea # 10955). (p. 96).
32. *Apamea z. murrayi* (Gibson), ♂. 24 km E of Churchill at Churchill Northern Studies Centre, Manitoba, 4 July 1991, H. Hensel (CNC Noctuoidea # 10956). (p. 96).
33. *Apamea zeta pelagica* Mikkola, ♂. Holotype. Saint Paul, Alaska, 7 August 1941, E. C. Johnston (CNC Noctuoidea # 10959). (p. 97).
34. *Apamea zeta nichollae* (Hamp.), ♀. McKinley Park, Alaska, F. W. Morand (USNM). (p. 97).
35. *Apamea z. nichollae* (Hamp.), ♂. Pink Mountain, 3,800′–5,400′, 57° 03′ N, 122° 51′ W, 28 June 1998, J. Troubridge (CNC Noctuoidea # 6807). (p. 97).
36. *Apamea z.eta nichollae* (Hamp.), ♂. Mile 87 Dempster Highway, Yukon, 1–4 July 1973, G. & M. Wood (CNC Noctuoidea # 10958). Barcoded. (p. 97).


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PLATE 8

Noctuoidea

NOCTUIDAE

figs. 1–43

NATURAL SIZE 1:1

1. *Apamea zeta nichollae* (Hamp.), ♂. Blowdown Pass near Duffy Lake, British Columbia, 7,100′, 1 August 1992, J. Troubridge (CNC Noctuoidea # 12567). Barcoded. (p. 97).
2. *Apamea z. nichollae* (Hamp.), ♂. Gott Peak, 7,100′, 50°21′ N, 122°08′ W, British Columbia, 10 August 2001, J. Troubridge (CNC Noctuoidea # 12566). Barcoded. (p. 97).
3. *Apamea z. nichollae* (Hamp.), ♂. Bald Mountain Pass, 10,700′, 40.686–698°N, 110.889–906°W, Duchesne Co., Utah, 22 July 2006, L. G. Crabo (CNC Noctuoidea # 13381). Barcoded (p. 97).
4. *Apamea z. nichollae* (Hamp.), ♀. Beartooth Plateau, 3,250 m, Carbon Co., Montana, 8 July 1988, J. Reichel (CNC Noctuoidea # 10975). (p. 97).
5. *Apamea z. nichollae* (Hamp.), ♂. Alta Lakes, 11,250′, San Miguel Co., Colorado, 10 July 1977, D. C. Ferguson (USNM). (p. 97).
6. *Apamea alticola* (Sm.), ♂. Arapaho National Forest slope, 3,400–3,500 m, Mount Evans, Clear Creek Co., Colorado, 16 July 1993, B. Landry (CNC Noctuoidea # 10969). (p. 98).
7. *Apamea alticola* (Sm.), ♂. E face Pike's Peak, 3,600 m, 38° 50.11′ N 105° 01.770′ W, El Paso Co., Colorado, 17 July 2007, S. A. Johnson (CNC Noctuoidea # 13893). (p. 98).
8. *Apamea rubrirena* (Tr.), ♀. Südtirol [South Tyrol, Italian Alps], 1,200 m, Pfossental [Mountain], Italy, 11 August 1972, B. Schafter (CNC Noctuoidea # 02). (p. 99).
9. *Apamea rubrirena* (Tr.), ♀. Riihimäki Hirvijävi, EH, Finland, 25–27 July 1968, A. Kulberg (CNC Noctuoidea # 10966). (p. 99).
10. *Apamea niveivenosa niveivenosa* (Grt.), ♂. Manyberries, Dominion Range Station, Alberta, 1 August 1951, D. F. Hardwick (CNC Noctuoidea # 5462). (p. 102).
11. *Apamea n. niveivenosa* (Grt.), ♀. Teeswater, Ontario, 20 July 1949, D. F. Hardwick (CNC Noctuoidea # 5463). (p. 102).
12. *Apamea n. niveivenosa* (Grt.), ♀. Lethbridge, Alberta, 2 August 1927, H. L. Seamans (CNC Noctuoidea # 5465). (p. 102).
13. *Apamea n. niveivenosa* (Grt.), ♂. Deeth, Starr Valley, [Elko Co.], Nevada, 13 August 1914 (CNC Noctuoidea # 5467). (p. 102).
14. *Apamea n. niveivenosa* (Grt.), ♂. 13 mi S of Salina, [Sevier Co.], Utah, 26 August 1965, D. F. Hardwick (CNC Noctuoidea # 5466). (p. 102).
15. *Apamea n. niveivenosa* (Grt.), ♂. Angel Creek Campground, 6,700′, 41°02′ N, 115°03′ W, Elko Co., Nevada, 22 July 2001, Lafontaine and Troubridge (CNC Noctuoidea # 11519). (p. 102).
16. *Apamea n. niveivenosa* (Grt.), ♂. Malta, Cassia Co., Idaho, 18 July 1954, T. P. O'Connor (CNC Noctuoidea # 5468). (p. 102).
17. *Apamea niveivenosa obscuroides* Poole, ♂. Cottonwood Creek, 4,300′, 42°09′ N, 118°36′ W, Harney Co., Oregon, 20 July 2001, Lafontaine and Troubridge (CNC Noctuoidea # 11520). (p. 102).
18. *Apamea n. obscuroides* Poole, ♂. Cottonwood Creek, 4,300′, 42°09′ N, 118°36′ W, Harney Co., Oregon, 20 July 2001, Lafontaine and Troubridge (CNC Noctuoidea # 11521). (p. 102).
19. *Apamea n. obscuroides* Poole, ♂. 1 mi NE Bridgeport, Okanagan Co., Washington, 12 July 1996, J. Troubridge (UASM). (p. 102).
20. *Apamea n. obscuroides* Poole, ♂. Cottonwood Creek, 4,300′, 42°09′ N, 118°36′ W, Harney Co., Oregon, 20 July 2001, Lafontaine and Troubridge (CNC Noctuoidea # 11522). (p. 102).
21. *Apamea n. obscuroides* Poole, ♂. Coulee City, 1,700′, [Grant Co.], Washington, 6 July 1961, R. E. Miller (CNC Noctuoidea # 5469). (p. 102).
22. *Apamea contradicta* (Sm.), ♂. Black Sturgeon Lake, Ontario, 26 June 1964 (CNC Noctuoidea # 10970). (p. 100).
23. *Apamea contradicta* (Sm.), ♂. Cartwright, Labrador, 28 July 1955, E. F. Cashman (CNC Noctuoidea # 10972). (p. 100).
24. *Apamea contradicta* (Sm.), ♂. Holland Lake near Murdochville, Gaspé Peninsula, Quebec, 3 July 2003, G. Hensel (CNC Noctuoidea # 9947). (p. 100).
25. *Apamea lintneri* (Grt.), ♂. White Point Beach, Queens Co., Nova Scotia, 20 August 1935, J. McDunnough (CNC Noctuoidea # 11015). (p. 102).
26. *Apamea lintneri* (Grt.), ♂. White Point Beach, Queens Co., Nova Scotia, 23 August 1935, J. McDunnough (CNC Noctuoidea # 11003). (p. 102).
27. *Apamea lintneri* (Grt.)., ♂. White Point Beach, Queens Co., Nova Scotia, 2 August 1935, J. McDunnough (CNC Noctuoidea # 10973). (p. 102).
28. *Loscopia velata* (Wlk.), ♂. Edmundston, New Brunswick, 26 July 2005, H. Hensel (CNC Noctuoidea # 11493). (p. 105).
29. *Loscopia velata* (Wlk.), ♀. South end of Pike Lake, Manitoulin Island, Ontario, 2 July 2006, J. K. Morton (CNC Noctuoidea # 11494). (p. 105).
30. *Loscopia roblei* Quinter & Laf., ♂. Paratype. Faircloth Road, Bombing Range, Dare Co., North Carolina, 10 May 1994, S. Hall (CNC Noctuoidea # 12253). Barcoded. (ELQ). (p. 106).
31. *Loscopia roblei* Quinter & Laf., ♂. Holotype. Croatan National Forest Road, Craven Co., North Carolina, 29 April 1997, J. B. Sullivan (CNC Noctuoidea # 12252). Barcoded. (CNC). (p. 106).
32. *Loscopia roblei* Quinter & Laf., ♀. Paratype. Levee Forest, Bull Run Island, Martin Co., North Carolina, 22 May 1996, S. Hall (CNC). (p. 106).
33. *Protapamea danieli* Quinter, ♀. Paratype. Markham Spring Campground, Mark Twain National Forest, Wayne Co., Missouri, bred ex larva on *Arundinaria gigantea,* emerge: 6 June 1997, E. L. Quinter (CNC) (p. 110).
34. *Protapamea danieli* Quinter, ♂. Holotype. Markham Spring Campground, Mark Twain National Forest, Wayne Co., Missouri, bred ex larva on *Arundinaria gigantea,* emerge: 6 June 1997, E. L. Quinter (CNC) (p. 110).
35. *Protapamea danieli* Quinter, ♂. Paratype. Markham Spring Campground, Mark Twain National Forest, Wayne Co., Missouri, bred ex larva on *Arundinaria gigantea,* emerge: 5 June 1997, E. L. Quinter (CNC) (p. 110).
36. *Protapamea louisae* Quinter, ♂. Paratype. Big Bottom, Cordell Hull Lake, Jackson Co., Tennessee, bred ex larva on *Arundinaria gigantea,* emerge: 15 June 1997, E. L. Quinter (CNC). (p. 114).
37. *Protapamea louisae* Quinter, ♀. Paratype. Boatwright farm, old Mayfield Creek, 0.9 mi W Clinton Road (Highway 339), McCracken Co., Kentucky; final instar coll. on *Arundinaria gigantea* 10 May 2000, pupate: 19 May 2000, emerge: 3 June 2000, E. L. Quinter (ELQ) (p. 114).
38. *Protapamea louisae* Quinter, ♂. Holotype. Big Bottom, Cordell Hull Lake, Jackson Co., Tennessee, bred ex larva on *Arundinaria gigantea,* emerge: 19 June 1997, E. L. Quinter (CNC) (p. 114).
39. *Melanapamea mixta* (Grt.), ♂. Brooklyn, Long Island, [New York Co.], New York, 28 June 1904 (USNM). (p. 117).
40. *Melanapamea mixta* (Grt.), ♀. White Point Beach, Queens Co., Nova Scotia, 14 August 1935, J. McDunnough (CNC Noctuoidea # 5381). (p. 117).
41. *Lateroligia ophiogramma* (Esp.), ♀. 5 km E of Langely, British Columbia, 4–10 July 1991, J. Troubridge (CNC Noctuoidea # 10979). (p. 119).
42. *Lateroligia ophiogramma* (Esp.), ♀. Edmundston, New Brunswick, 3 August 2002, H. Hensel (CNC Noctuoidea # 11052). (p. 119).
43. *Lateroligia ophiogramma* (Esp.), ♀. Tvärmiisne, Hanko, Finland, 9 August 1981, A. Järvela (CNC Noctuoidea # 10980). (p. 119).


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NOTES

1. ABBREVIATIONS FOR COLLECTORS AND COLLECTIONS

AMNH American Museum of Natural History, New York, USA
ANSP Academy of Natural Sciences, Philadelphia, Pennsylvania, USA
BMNH The Natural History Museum (statutorily: British Museum (Natural History)), London
CNC Canadian National Collection of Insects, Arachnids, and Nematodes, Ottawa, Canada
CSU Colorado State University, Fort Collins, USA
CUIC Cornell University Insect Collection, Ithaca, New York, USA
DFS Dale F. Schweitzer, Port Norris, New Jersey, USA
EHM Eric H. Metzler, Alamogordo, New Mexico, USA
EIHU Entomological Institute, Hokkaido University, Sapporo, Japan
ELQ Eric L. Quinter, Willimantic, Connecticut, USA
EME Essig Museum of Entomology, University of California at Berkeley, Berkeley, California, USA
FMNH Field Museum of Natural History, Chicago, Illinois, USA
HNHM Hungarian Natural History Museum, Budapest, Hungary
INHS Illinois Natural History Survey, Champaign-Urbana, Illinois, USA
JBS J. Bolling Sullivan, Beaufort, North Carolina, USA
JKA James K. Adams, Calhoun, Georgia, USA
JRH J. Richard Heitzman, Independence, Missouri, USA
JRW James R. Wiker, Greenview, Illinois, USA
JTT James T. Troubridge, Selkirk, Ontario, Canada
LACM Los Angeles County Museum of Natural History, Los Angeles, California, USA
LDG Loran D. Gibson, Florence, Kentucky, USA
LGC Lars G. Crabo, Bellingham, Washington, USA
MCZ Museum of Comparative Zoology, Cambridge, Massachusetts, USA
MNHN Muséum National d'Histoire Naturelle, Paris, France
MNHU Museum für Naturkunde der Humbolt-Universität, Berlin, Germany
MSU Michigan State University, East Lansing, Michigan, USA
MZLU Museum of Zoology, Lund University, Lund, Sweden
NHMW Naturhischesmuseum, Wien [Vienna], Austria
NRS Naturhistoriska Riksmuseet, Stockholm, Sweden
NYSM New York State Museum, Albany, New York, USA
PZG Paul Z. Goldstein, Martha's Vineyard, Massachusetts, USA
RLL Rae L. Letsinger, Sarcoxie, Missouri, USA
SDNHM San Diego Natural History Museum, San Diego, California, USA
TLM Timothy L. McCabe, Albany, New York, USA
TSD Terhune S. Dickel, Anthony, Florida, USA
UASM University of Alberta, Strickland Museum, Edmonton, Alberta, Canada
UCD Bohart Museum of Entomology, University of California at Davis, Davis, California, USA
USNM National Museum of Natural History (formerly United States National Museum), Washington, DC, USA
VADNH Virginia Division of Natural Heritage, Virginia Department of Conservation and Recreation, Richmond, Virginia, USA
WRB William R. Black Jr., Paducah, Kentucky, USA
WSU Washington State University, Pullman, Washington, USA
ZIN Zoological Institute Nauk, St. Petersburg, Russia
ZMUC Zoological Museum, University of Copenhagen, Copenhagen, Denmark
ZMH Zoological Museum, Helsinki, Finland

2. COMMON NAMES

The use of an asterisk ''*'' in the text denotes a name listed in *Common Names of Insects & Related Organisms* 1989, published by the Entomological Society of America.

French-language common names have been taken from Benoit, P. et al., 1975, *French Names of Insects in Canada* published for the Quebec Society for the Protection of Plants, Quebec. The abbreviation ''m'' after a name indicates that it is masculine, ''f'' that it is feminine.

3. CITATIONS OF AUTHORITIES

Authors' names without parentheses indicate that the specific name is associated with the genus in which it was described.

Authors' names in parentheses indicate that the specific name has been transferred from the genus in which it was described to another genus.

4. WING LENGTH

Wing length is the measurement in millimeters from the base to the apex of the forewing.

5. LOCATION OF TYPE SPECIMEN

The current location of the type specimen is given by the appropriate abbreviation in square brackets immediately following the type locality. The word ''lost'' indicates that it no longer exists.

6. NOMENCLATURE FOR LARVAL SETAE

Hinton's (*Trans. Royal Ent. Soc. London,* **97**: 1–37, 1946) terminology as modified by Stehr (Order Lepidoptera, *in* Stehr, F. W., *Immature Insects,* 288–304, 1987) is used to refer to larval setae.

CHECK LIST

Species recorded from Mexico but not from America north of Mexico are indicated by an asterisk (*).

XYLENINAE

Apameini Gn., 1841
Nonagridi Gn., 1837, suppressed senior synonym
Gortynidae Duponchel, [1845]
Xylophasides Gn., 1852
Septidini Forbes, 1954
Oxytrypiinae Gozmány, 1970, subtribe
Calamiina Beck, 1996
Luperinina Beck, 1996
Mesapameina Beck, 1996
Eremobiina Beck, 1999
Sesamiina Fibiger & Goldstein, 2005, subtribe

Apameina Gn., 1841, subtribe

APAMEA Ochs., 1816
ABROMIAS Billberg, 1820
SEPTIS Hbn., 1821
XYLOPHASIA Steph., 1829
HAMA Steph., 1829
AGROSTOBIA Boie, 1835
CRYMODES Gn., 1841
SYMA Steph., 1850, preocc. by *Syma* Lesson, 1827
OMMATOSTOLA Grt., 1873
EURABILIA Butl., 1889
ELEEMOSIA Prout, 1901
PROTAGROTIS Hamp., 1903
AGROPERINA Hamp., 1908
TRICHOPLEXIA Hamp., 1908
HETEROMMA Warren, 1911, preocc. by *Heteromma* Menge, 1856
HETEROMMIOLA Strand, 1912
APACONJUNCTDONTA Beck, [1992]
FURVABROMIAS Beck, [1992]
verbascoides (Gn., 1852, *Xylophasia*)
inebriata Fgn., 1977
nigrior (Sm., 1891, *Xylophasia*)
vulgaris (Grt. & Rob., 1866, *Xylophasia*)
wikeri Quinter & Laf., 2009
cristata (Grt., 1878, *Hadena*)
cariosa (Gn., 1852, *Xylophasia*)
idonea (Grt., 1882, *Hadena*)
cluna (Stkr., 1898, *Hadena*)
dionea (Sm., 1899, *Hadena*)
quinteri Mikkola & Laf., 2009
apamiformis (Gn., 1852, *Xylophasia*)
contenta (Wlk., 1857, *Hadena*)
vultuosa (Grt., 1875, *Hadena*)
a. vultuosa (Grt., 1875, *Hadena*)
b. multicolor (Dyar, 1904, *Hadena*)
plutonia (Grt., 1883, *Hadena*)
perpensa (Grt., 1881, *Hadena*)
perpenoa (Grt., 1881, *Hadena*), incorrect orig. spell.
xylodes Mikkola & Laf., 2009
alia (Gn., 1852, *Taeniocampa*)
suffusca (Morr., 1875, *Hadena*)
rorulenta (Sm., 1904, *Xylophasia*)
unanimis (Hbn., [1813], *Noctua*)
remissa (Hbn., [1809], *Noctua*)
obscura (Haw., 1809, *Noctua*), unavail., homonym
gemina (Hbn., [1813], *Noctua*)
submissa (Tr., 1825, *Noctua*)
divitis (Bryk, 1942, *Polia*)
indocilis (Wlk., 1856, *Xylophasia*)
separans (Grt., 1881, *Hadena*)
lona (Stkr., 1898, *Hadena*)
runata (Sm., 1898, *Hadena*)
ferens (Sm., 1903, *Xylophasia*)
enigra (Sm., 1904, *Xylophasia*)
ampliata (McD., 1940, *Septis*)
impulsa (Gn., 1852, *Mamestra*)
unita (Sm., 1904, *Xylophasia*)
cuculliformis (Grt., 1875, *Hadena*)
sordens (Hufn., 1766, *Phalaena*)
a. sordens (Hufn., 1766, *Phalaena*)
basilinea ([D. & S.], 1775, *Noctua*)
b. finitima Gn., 1852
cerivana (Sm., 1900, *Hadena*)
c. sableana Mikkola, 2009
digitula Mustelin & Mikkola, 2006
inordinata (Morr., 1875, *Hadena*)
a. inordinata (Morr., 1875, *Hadena*)
b. semilunata (Grt., 1881, *Hadena*)
montana (Sm., 1891, *Xylophasia*), preocc. by *Polia montana* H.-S., [1852]
c. olympia Crabo, 2009
spaldingi (Sm., 1909, *Hyppa*)
umbrifacta (Hamp., 1910, *Trachea*)
cinefacta (Grt., 1881, *Hadena*)
lignicolora (Gn., 1852, *Xylophasia*)
quaesita (Grt., 1876, *Hadena*)
atriclava (B. & McD., 1913, *Parastichtis*)
smythi Franc., 1952
helva (Grt., 1875, *Orthosia*)
antennata (Sm., 1891, *Xylophasia*)
purpurissata (B. & McD., 1913, *Parastichtis*)
siskiyou Mikkola & Laf., 2009
***ochromma** Mikkola & Laf., 2009
atrosuffusa (B. & McD., 1913, *Parastichtis*)
grotei (B. & McD., 1914, *Parastichtis*)
auranticolor (Grt., 1873, *Hadena*)
barnesii (Sm., 1899, *Hadena*)
sora (Sm., 1903, *Hadena*)
tahoeensis Mikkola & Laf., 2009.
commoda (Wlk., 1857, *Xylina*)
a. commoda (Wlk., 1857, *Xylina*)
satina (Stkr., 1898, *Hadena*)
alberta (Sm., 1903, *Hadena*)
illustra (Sm., 1908, *Xylophasia*)
b. parcata (Sm., 1903, *Hadena*)
c. striolata Mikkola, 2009
centralis (Sm., 1891, *Xylophasia*)
genialis (Grt., 1874, *Hadena*)
occidens (Grt., 1878, *Hadena*)

amputatrix (Fitch, 1856, *Hadena*)
amica (Stephens, 1829, *Hadena*), misident.
arctica (Boisduval, 1840, *Hadena*), nomen nudum
arctica (Freyer, 1845, *Hadena*), preocc. by *Hadena arctica* Zetterstedt, [1839]
pluviosa (Wlk., 1865, *Eurois*)
castanea (Grt., 1874, *Hadena*)
cymosa (Grt., 1881, *Hadena*)
formosus (Ellsworth, 1918, *Hadena*)
walshi Laf., 2009
albina (Grt., 1874, *Hadena*)
maxima (Dyar, 1904, *Polia*)
robertsoni Mikkola & Mustelin, 2006
acera (Sm., 1900, *Polia*)
burgessi (Morr., 1874, *Luceria*)
a. burgessi (Morr., 1874, *Luceria*)
b. leucoptera Mikkola, 2009
c. ona (Sm., 1909, *Luperina*)
stygia (Dyar, 1914, *Trachea*)
relicina (Morr., 1875, *Hadena*)
a. relicina (Morr., 1875, *Hadena*)
b. migrata (Sm., 1903, *Luperina*)
longula (Grt., 1879, *Hadena*)
bernardino Mikkola & Mustelin, 2000
scoparia Mikkola, Mustelin, & Laf., 2000
lateritia of authors, not (Hufn., 1766, *Phalaena*)
a. scoparia Mikkola, Mustelin, & Laf., 2000
b. gabrieli Mikkola & Mustelin, 2000
dubitans (Wlk., 1856, *Mamestra*)
insignata Wlk., 1857
insignata Wlk., 1860, preocc by *Apamea*? *insignata* Wlk., 1857
sputator (Grt., 1873, *Hadena*)
amanda (Swinhoe, 1901, *Agroperina*)
cogitata (Sm., 1891, *Xylophasia*)
geminimacula (Dyar, 1904, *Hadena*)
stagmatipennis (Dyar, 1920, *Parastichtis*)
inficita (Wlk., 1857, *Graphiphora*)
a. inficita (Wlk., 1857, *Graphiphora*)
belangeri (Morr., 1875, *Orthosia*)
popofensis (Sm., 1900, *Ommatostola*)
b. indela (Sm., 1910, *Agroperina*)
lineosa (Sm., 1910, *Agroperina*)
pendina (Sm., 1910, *Agroperina*)
c. conradi (Grt., 1879, *Orthosia*)
citima (Grt., 1883, *Orthosia*)
***hemimena** Mikkola & Laf., 2009
lutosa (Andrews, 1877, *Orthosia*)
fergusoni Mikkola & Laf., 2009
devastator (Brace, 1819, *Phalaena*)
ordinaria (Wlk., 1856, *Mamestra*)
contenta (Wlk., 1856, *Mamestra*)
speciosa (Morr., 1875, *Polia*)
zeta (Tr., 1825, *Polia*)
a. zeta (Tr., 1825, *Polia*), extralimital
clandestina (Bdv., 1829, *Polia*)
pernix (Geyer, 1832, *Noctua*)
b. ingloria (Bang-Haas, 1912, *Hadena*), extralimital
c. vicaria (Püngeler, 1902, *Hadena*), extralimital
d. assimilis (Doubleday, 1847, *Hadena*), extralimital
doubledayi (White, 1874, *Crymodes*)
jenskjeldi (Fibiger, Ronkay, & Zilli, 2005)
e. marmorata (Zetters., [1839], *Hadena*), extralimital
poli (Gn., 1852, *Crymodes*)
f. exulis (Lefebvre, 1836, *Hadena*)
gelata (Lefebvre, 1836, *Hadena*)
difflua (Geyer, 1837, *Exarnis*)
groenlandica (Dup., [1838], *Hadena*)
cervina (Germar, [1842], *Mamestra*)
gelida (Gn., 1852, *Crymodes*)
borea (Gn., 1852, *Crymodes*)
g. downesi Mikkola, 2009
h. murrayi (Gibs., 1920, *Homoglaea*)
johanseni (McD., 1933, *Homoglaea*), lapsus for *Homoglaea murrayi* Gibs.
i. pelagica Mikkola, 2009
j. nichollae (Hamp., 1908, *Protagrotis*)
alticola (Sm., 1891, *Xylophasia*)
rubrirena (Tr., 1825, *Mamestra*)
feisthamelii (Bdv., 1833, *Hadena*)
sylvicola (Evers., 1843, *Mamestra*)
hercyniae (Stgr., 1871, *Hadena*)
shibuyae (Matsumura, 1925, *Crymodes*)
abnoba (Guth, 1932, *Hadena*)
intermedia (Guth, 1932, *Hadena*)
fennica (Guth, 1932, *Hadena*)
kurilirena (Bryk, 1942, *Crymodes*)
miriquidoi (Koch, 1963, *Crymodes*)
rhaetonorica (Koch, 1965, *Crymodes*)
asciburgensis (Koch, 1965, *Crymodes*)
marginipicta Varga, 1973
pacifica Sugi, 1982
ontakensis Sugi, 1982
wasedana Sugi, 1982
contradicta (Sm., 1895, *Xylophasia*)
exornata (Möschler, 1860, *Hadena*), preocc. by *Hadena exornata* Wlk., 1858
niveivenosa (Grt., 1879, *Agrotis*)
a. niveivenosa (Grt., 1879, *Agrotis*)
viralis (Grt., 1880, *Agrotis*)
extensa (Sm., 1905, *Luperina*)
flavistriga (Sm., 1905, *Perigea*)
b. obscuroides Poole, 1989
obscura (B. & McD., 1911, *Protagrotis*), preocc. by *Noctua obscura* Haw., 1809
lintneri (Grt., 1874, *Ommatostola*)

LOSCOPIA Beck, [1992]
SINAPAMEA Rakosy, 1996
velata (Wlk., 1865, *Apamea*)
sera (Grt. & Rob., 1868, *Hydroecia*)
roblei Quinter & Laf., 2009

PROTAPAMEA Quinter, 2009
danieli Quinter, 2009
louisae Quinter, 2009

MELANAPAMEA Laf., 2009
mixta (Grt., 1881, *Hadena*)

LATEROLIGIA Zilli, Fibiger, & Ronkay, 2005
ophiogramma (Esp., [1794], *Noctua*)
biloba (Haw., 1809, *Noctua*)
maerens (Stgr., 1901, *Miana*), unavail. ab.

INDEX TO ANIMAL NAMES

Principal entries are given in bold face
Plate references are given as (1:5)

Generic names cited only in combination with specific names, whether in synonymy or text, are not given in the index. Look for such entries under the specific name. For example, *Apamea lignicolora* will be found under *lignicolora*, but not under *Apamea*. The main entry for subspecies is indicated by bold italics (e.g., *leucoptera **77***).

INDEX TO PLANT NAMES

NOTE—All *Apamea* are associated with grasses, so general references to grasses are not indexed.