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A Revision of the Family Adelidae of the Western Hemisphere (Lepidoptera: Adeloidea)

Donald R. Davis
and
Matthew J. Medeiros

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A Revision of the Family
Adelidae of the
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ABSTRACT

Davis, Donald R., and Matthew J. Medeiros. *A Revision of the Family Adelidae of the Western Hemisphere (Lepidoptera: Adeloidea)*. Smithsonian Contributions to Zoology, number 656, x+215 pages, 400 figures, 34 maps, 1 table, 2023.—The systematics, morphology, and distributions are reviewed for the New World Adelidae. Four genera (*Ceromitia*, 51 species; *Nemophora*, 1 species; *Adela*, 19 species; *Cauchas*, 16 species) are currently recognized for North, Central, and South America. Keys to all New World genera and species are provided, as are diagnoses, illustrations, and distributional data. The following species are described as new:

Adela atrata, *Adela austrina*, *Adela powelli*, *Adela stenoptera*, *Adela striata*, *Cauchas alaskae*, *Cauchas clarkei*, *Cauchas elongata*, *Cauchas excavata*, *Cauchas lobata*, *Cauchas recurvata*, *Cauchas spinulosa*, *Cauchas suffusa*, *Cauchas trifascia*, *Cauchas vittata*, *Cauchas wielgusi*, *Ceromitia aphyoda*, *Ceromitia barilochensis*, *Ceromitia beckeri*, *Ceromitia bicornuta*, *Ceromitia braziliensis*, *Ceromitia brevipectinella*, *Ceromitia capitanea*, *Ceromitia cerastia*, *Ceromitia concava*, *Ceromitia convexa*, *Ceromitia costaricaensis*, *Ceromitia elongata*, *Ceromitia exserta*, *Ceromitia fasciata*, *Ceromitia flagellata*, *Ceromitia furcata*, *Ceromitia fuscata*, *Ceromitia inaequalis*, *Ceromitia karsholti*, *Ceromitia latapicula*, *Ceromitia laticlavata*, *Ceromitia latibasis*, *Ceromitia latijuxta*, *Ceromitia lobata*, *Ceromitia nielsenii*, *Ceromitia nigrifasciata*, *Ceromitia ovata*, *Ceromitia pachyphalla*, *Ceromitia pallidofascia*, *Ceromitia paraguayensis*, *Ceromitia parvipectena*, *Ceromitia petila*, *Ceromitia sinuata*, *Ceromitia truncata*, *Ceromitia unicornuta*, and *Ceromitia unipectinella*.

The known world fauna of the monotypic family Adelidae previously consisted of approximately five genera and 294 species (Nieukerken et al. 2011), occurring in all major geographical regions except Antarctica and New Zealand. Prior to this study, four of these genera, *Adela* (14 species), *Cauchas* (5 species), *Ceromitia* (15 species), and *Nemophora* (1 species), were known to occur in North and South America, totaling slightly less than 12% of the global diversity of the family. In this study, we are reporting 52 new species, most of which are (36 species) within the large pantropical genus *Ceromitia*. Additionally, we present gene trees for *Adela*, *Cauchas*, *Ceromitia*, and *Nemophora* and discuss their phylogenetic relationships.

Cover images, from left to right: Figure 1 detail, *Adela astrella* (photo by J. Cowles); Figure 160 detail, *A. septentrionella* (Smithsonian photo); and Figure 2 detail, *Cauchas spinulosa* (photo by J. Wright).

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AMNH	American Museum of Natural History, New York City, New York, USA
ANIC	Australian National Insect Collection, CSIRO, Canberra, Australia
ANSP	Academy of Natural Sciences, Philadelphia, Pennsylvania, USA
BMNH	The Natural History Museum (formerly the British Museum [Natural History]), London, England
CASC	California Academy of Sciences, San Francisco, California, USA
CMNH	Carnegie Museum of Natural History, Pittsburgh, Pennsylvania, USA
CNC	The Canadian National Collection, Agriculture Canada, Ottawa, Canada
CU	Department of Entomology, Cornell University, Ithaca, New York, USA
DMNS	Denver Museum of Nature & Science, Denver, Colorado, USA
ECK	Collection of Edward Knudson, Houston, Texas, USA (Most of the Knudson collection is now housed at MGCL.)
GRP	Collection of Greg R. Pohl, Edmonton, Alberta, Canada

IADIZA	Instituto Argentino de Investigaciones de Zonas Aridas, Mendoza, Argentina
INBio	Instituto Nacional de Biodiversidad, Santo Domingo, Costa Rica (All collections of the former INBio have now been transferred to Museo Nacional de Costa Rica, Artrópodos [MNCR-A], San José, Costa Rica.)
LACM	Natural History Museum of Los Angeles County, Los Angeles, California, USA
MACN	Museo Argentino de Ciencias Naturales, Buenos Aires, Argentina
MCZ	Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, USA
MEM	Mississippi Entomological Museum, Mississippi State University, Starkville, Mississippi, USA
MGCL	McGuire Center for Lepidoptera and Biodiversity, Florida Museum of Natural History, Gainesville, Florida, USA
MHNG	Muséum d'histoire naturelle, Geneva, Switzerland
MNCR-A	Museo Nacional de Costa Rica, Artrópodos, San José, Costa Rica
MNHN	Museo Nacional de Historia Natural de Chile, Santiago, Chile
MSU	Department of Entomology, Michigan State University, East Lansing, Michigan, USA
NCSU	North Carolina State University, Raleigh, North Carolina, USA
NHMV	Naturhistorisches Museum, Vienna, Austria
RMNH	Naturalis Biodiversity Center (formerly Nationaal Natuurhistorisch Museum; formerly Rijksmuseum van Natuurlijke Historie), Leiden, The Netherlands
UCB	Essig Museum of Entomology, University of California, Berkeley, California, USA
UCIM	University of Connecticut Insect Museum, Storrs, Connecticut, USA
USNM	Collections of the former United States National Museum, now deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D.C., USA
VAB	Collection of Vernon A. Brou, Abita Springs, Louisiana, USA
VOB	Vitor O. Becker, Serra Bonita Reserve, Camacan, Bahia, Brazil
ZIN	Zoological Institute of Russian Academy of Sciences, St. Petersburg, Russia
ZMB	Museum für Naturkunde, Leibniz Institute for Evolution and Biodiversity Science, Berlin, Germany
ZMUC	Zoologisk Museum, Natural History Museum of Denmark, University of Copenhagen, Copenhagen, Denmark

A Revision of the Family Adelidae of the Western Hemisphere (Lepidoptera: Adeloidea)

Donald R. Davis¹ and Matthew J. Medeiros^{2*}

INTRODUCTION

Adelidae is a widely distributed family that includes at least 5 genera and 294 described species (van Nieukerken et al. 2011). Kozlov (2004) has estimated the genus *Nemophora* alone may include as many as 350 species, of which 150 species remain to be described. In the current revision, 52 new species of New World Adelidae are proposed within the following genera: *Ceromitia* (36 new species), *Adela* (5 new species), and *Cauchas* (11 new species). The genus *Nemophora* currently includes one previously described North American species. The number of described Adelidae known for the Western Hemisphere now totals 87 species. The family is known to occur on all continents except Antarctica and is absent from New Zealand (Meyrick 1912a, 1912b; Janse 1945; Heppner 1991). The Adelidae have been generally referred to as fairy moths or longhorn moths (in reference to the long antenna present in most species). Autapomorphies for the family include the elongate antenna (particularly in the males), slender lateral processes of the lateral cervical sclerites, and possibly the high number of ovarioles (10–20) per ovary (Nielsen 1980; Nielsen and Davis 1985).

Only a few records, mostly from the Eocene, have been reported for Adelidae in the fossil record (Sohn et al. 2012). Most recently, Fischer (2015) has described the pupal exuvia of an adelid case-bearing moth from the Eocene Bitterfeld amber.

Two subfamilies have been proposed (Küppers 1980; Davis 1998) within the family: Adelinae (maxillary palpus 2–3-segmented; male valvae without pectinifer [i.e., without a comb of setae]), including *Adela*, *Cauchas*, and *Nemophora*, and Nematopogoninae (maxillary palpus usually 4–5-segmented; male valvae usually with pectinifers), including *Ceromitia* and *Nematopogon*. Previous mtDNA sequence data had associated the problematic North American genus *Tridentiforma* with this family (Brown et al. 1994). The lateral cervical sclerites of *Tridentiforma*, however, differ from the typical adelid form (Davis 1998: fig.42). More recent and robust DNA analysis (Regier et al. 2015) has shown that *Tridentiforma* instead represents a distinct family, Tridentiformidae, within the Adeloidea. In contrast to most Nematopogoninae, which tend to be relatively drab in color and crepuscular or nocturnal, the adults of Adelinae are often metallic in color and predominantly diurnal (Regier et al. 2015). In addition,

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the males of many species of *Adela* and *Nemophora* swarm, usually near the species' host plant or oviposition site. The enlarged compound eyes in these males are an adaptation for swarming (McAlpine and Munroe 1968; Downes 1969). The development of specialized, spinose setae and scales near the base of the antenna of swarming males may be further adaptations associated with this courtship behavior (Nielsen 1980), and possibly for use in sound production or visual signaling (Bland 1977). (Regier et al. 2015: 24)

As treated in the current study, Adelidae have been considered a monophyletic group and a sister family to Heliozelidae (Mutanen et al. 2010; Wahlberg et al. 2013). Recent molecular analyses, however, suggest the Adelidae may be polyphyletic, with the subfamily Adelinae as a sister group to Heliozelidae (Regier et al. 2015; Milla et al. 2020). Milla et al. (2020) further suggested *Nemophora* (Adelinae) to be a sister group to Heliozelidae and *Ceromitia* and *Nematopogon* (Nematopogoninae) as a sister clade to Heliozelidae + *Nemophora*. These authors recommended further taxon sampling involving more genes to better resolve their phylogeny.

Because of the enigmatic and sometimes omnivorous feeding habits of the larva, little is known about the biology of most species in the Adelidae (Regier et al. 2015). Adults of many species, especially of *Adela* and *Cauchas*, frequently have been observed gathering in mating swarms around the flowers of various plants, probably often around the plants on which the females may oviposit (Figures 1–3; Davis 1998). However, eggs are inserted into plant tissue in which the larva may or may not feed (Heath and Pelham-Clinton 1976; Nielsen 1985). According to Chrétien (1894), during late spring and early summer, the eggs of *Nematopogon metaxella* (Hübner) are inserted into any convenient herbaceous plant. Upon hatching, the larva immediately drops to the ground, where it constructs a flattened, oval case from soil particles and eventually dead leaves (Chrétien 1894, in Regier et al. 2015).

The larva feeds on both living and dead plants and does not complete its development until the following spring. Kuroko (1961) reports a somewhat different life history for *Nemophora raddei* (Rebel) that may more accurately reflect the univoltine norm for the family. In this species the eggs are inserted into the ovaries of *Salix sieboldiana* Blume in spring. The first instar larva feeds on the ovules as well as the ovary wall. After molting, it constructs a small, oval case and descends on a silken thread to the ground where it prefers to feed on dead leaves of the host *Salix* and *Castanea crenata* Sieb. and Zucc. The mature larva (sixth instar) pupates near the end of October, with the adult emerging the following spring. The eggs of most *Adela* are inserted into the flower ovary of their host wherein the first instar larvae feed on the developing seeds. From the second instar on, the larvae become casebearers and feed on the lower or fallen

leaves of their host (Heath and Pelham-Clinton 1976). First instar larvae of some Adelidae may mine leaves (Common 1990). Over 20 families of angiosperms and one gymnosperm (Pinaceae) have been reported as hosts (Küppers 1980). (Regier et al. 2015: 24)

Weiss and West (1925) reported finding swollen, twisted petiole galls on *Parthenocissus quinquefoliella* (L.) (Vitaceae) in late May at two localities in New Jersey. Generally, the galls were irregular, somewhat flattened, with longitudinal swellings, which usually resulted in a distorted, curled growth of the petiole. The galls usually varied in length from about one to two inches, extending sometimes the entire length of the petiole. Upon dissection, the galls were found to contain 3–6 greenish white to yellowish white larvae feeding in longitudinal channels. By June 11, many larvae had matured and began leaving the galls through small openings. Before escaping the gall, the larvae constructed cases from particles of excrement. After leaving the gall, the larvae were observed crawling beneath debris on the forest floor, where they perhaps continued feeding on fallen leaves of the host in the manner typical for other *Adela*. By June 15, no galls were found to contain larvae. Pupation was reported to occur inside the case during the latter part of August. Unfortunately, Weiss and West were unable to rear adults from these larvae, thus making specific identification difficult. The larvae were sent to Carl Heinrich of the National Museum of Natural History, who determined them as a species of *Adela*, possibly *A. ridingsella*. We have examined these larvae, and while they do belong to *Adela*, it remains uncertain which of the eastern North American species of this genus they represent.

MATERIALS AND METHODS

SPECIMEN PREPARATION

Genitalic dissections were cleared by heating in hot 10% KOH for ~30 minutes and subsequently cleaned and stained with either 2% chlorazol black E or mercurochrome solutions. All genitalic illustrations were drawn from dissections temporarily stored in glycerine, which were later permanently embedded in Canada balsam or Euparal.

GENERATION OF COI BARCODE DATA, GENE TREES, AND MORPHOLOGICAL DATA

Legs from specimens as well as associated data were provided to the Barcode of Life Data System (BOLD; Ratnasingham and Hebert 2007). The approximately 650-base cytochrome c oxidase subunit I (COI) “barcode region” was sequenced using standard primers. Sequences were downloaded from the BOLD website and aligned using MEGA7 (Kumar et al. 2016). Gene trees were generated using the “GTRGAMMA” function of RAxML (Stamatakis 2014) to search for the most likely tree with 1,000 bootstrap replicates, and trees were visualized using

FigTree (Rambaut and Drummond 2012). Scale bars indicate substitutions per nucleotide position. It is important to note that the COI trees presented herein do not indicate monophyly of *Adela*, *Cauchas*, or *Nemophora* and that we have used traditional morphological characters when naming and grouping taxa in the text. Trees generated with small amounts of COI data are susceptible to errors both biological (e.g., hybridization [Shaw 2002] as well as incomplete lineage sorting) and procedural (e.g., misidentified specimens, often females in this case). Additional molecular work (particularly using nuclear genomes) will be needed to determine monophyly for these genera within the Adelidae.

Comparisons of the relative development of the adult compound eye are provided using the interocular index (=vertical diameter of eye divided by the minimum interocular distance across frons [~midway between antennal bases and tentorial pits]; Davis 1975). Genitalic terminology follows Klots (1970) and Kristensen (1984).

NOTES ON SPECIMEN DOCUMENTATION

Inexplicably, more than a few of the specimen labels examined did not include the year of collection, instead reporting only the month and day (sometimes only the month). Data in holotype, lectotype, and other type descriptions, lists, and Materials Examined sections were edited for consistency of presentation (e.g., abbreviations for months, units, locations, etc.). Text set within quotation marks in these sections (including host descriptions) was copied verbatim from the specimen label (i.e., not quoted from publications).

SYSTEMATICS

ADELIDAE

Small moths with forewing length 3.5–16 mm.

Head: (Figures 16–41). Vertex densely to sparsely covered with erect, piliform scales; frons also usually with erect, piliform scales in *Adela* and *Cauchas* but covered by smoothly appressed, broad scales in *Nemophora*. Eyes small to large, interocular index 0.5–1.7; interfacetal microsetae scattered; eyes dimorphic in most *Adela* and *Nemophora* with that of male enlarged, more approximate at vertex, and usually with facets in upper 2/3 of eye enlarged. Antenna usually longer than forewing in both sexes, up to 3× forewing length and often arising nearly contiguous in male; antenna shorter in *Cauchas*, 0.5–1.2 the length of forewing in both sexes; scape sometimes slightly swollen in male; pecten usually present, absent in *Cauchas*; flagellum filiform, usually fully scaled to apex with two annuli of appressed scales per segment, more thinly scaled ventrally; basal 0.2–0.6 of antenna roughly scaled in some *Adela*; males of some *Adela* and all *Nemophora* with variable number of mediodorsal spines (Figures 8–15) along base of flagellum (Nielsen 1980). Distance separation between bases of antennae differs between

genera and often between sexes. Pilifers present. Mandible vestigial. Haustellum usually elongate, 1.5–5.5× the length of labial palpus; though reduced, about equal to labial palpus, in some African *Ceromitia*; basal 1/4–1/3 scaled. Maxillary palpus 2–3-segmented. Labial palpus 3-segmented, variable in length, usually upturned; segments II and III usually rough and clothed either with broad scales or long piliform scales.

Thorax: Laterocervical sclerites with slender, elongate, lateral processes (Figure 42); metafurca (Figure 43) with dorsal apophyses well developed, arising perpendicular from mesal lamella free from secondary arms of metafurcasternum (Davis 1998). Forewing (Figures 46–51) slender, length/width (L/W) index 0.3–0.37; microtrichia usually present; wing membrane also densely covered with microtubercles. Radial veins with 5 branches, Rs2 and 3 separate, connate, or stalked; Rs4 usually to costa in most genera, terminating on termen below apex in *Nematopogon*; accessory cell present; base of M faint, often forked within cell; 1A+2A with short to moderately long basal fork; ♂ retinaculum a long costal fold extending under base of Sc. Hindwing similar to forewing in width, index usually 0.35; M1 and M2 either separate or stalked; 1A+2A with short basal fork; male frenulum a single stout bristle, usually accompanied by several smaller setae along costal margin; female frenulum consisting of 3–4 smaller bristles in a row along base of costa. Legs (Figures 44–45) with tibial spur pattern of 0–2–4; epiphysis present.

Abdomen: Anterior third of sternum 2 with a slender, U-shaped caudal rim; sternum 7 of female much larger than tergum 7, triangular to subrectangular, with caudal margin rounded to slightly emarginated.

Male Genitalia: Uncus reduced, often bilobed; tegumen a moderate to narrow, dorsal band. Vinculum well developed with an elongate, broad to slender, V- to Y-shaped saccus. Valvae with 0–3 pairs of pectinifers, either sessile or pedunculate; pectinifers absent in *Adela*, *Cauchas*, *Nemophora*, and some groups of *Ceromitia*. Juxta slender, sagittate. Phallus an elongate tube; cornuti [hornlike structures protruding at the end of the phallus] usually present; apex sometimes also with large, exogenous spines.

Female Genitalia: (Figure 52). Anterior and posterior apophyses subequal in length, greatly elongated, slender, forming an extensible, piercing ovipositor; apex of ovipositor laterally compressed and acute, usually minutely serrated along ventral edge. Two or more pairs of elongate, threadlike retractor apodemes (“guy-wires” *sensu* Dugdale 1974) attached to various sites along the ovipositor and associated internal organs. Spermatheca without lateral lagena. Ductus and corpus bursae membranous, without spines or signa.

Egg: Poorly known; inserted singly into plant tissue.

Larva: (Figures 54–57, 59–62, 67–73). Body slightly depressed, white to green with darkly pigmented plates and head; 7–12 mm in length. Head mostly prognathous with 4–6 pairs of stemmata; AF2 absent; adfrontal sclerite elongate, extending to deeply incised epicranial notch. Thorax with prespiracular sclerite fused to pronotum; spiracle usually free from prespiracular sclerite. Coxal plates fused, at least on T1. Legs well developed;

tarsi without enlarged, squamiform seta. Prolegs usually greatly reduced on A3–A6, absent on A10; crochets arranged in several more or less definite transverse rows that gradually decrease in size from center; prolegs in *Ceromitia* (Figure 57) more well developed, with uniordinal, circular crochets and anal proleg with uniordinal penellipse crochets (Parra and Ogden 2011).

Pupa: Vertex smoothly rounded. Antenna usually surpassing abdomen, then loosely encircling caudal end of abdomen 1–4 times (Figures 63, 74, 75). Abdomen with 1–2 rows of dorsal spines on most segments; segments 3–7 movable (Common 1990). Pupation inside larval case with the pupal exuvium partially extruded.

KEY TO THE NEW WORLD SUBFAMILIES AND GENERA OF ADELIDAE

BASED PRIMARILY ON ADULT MALE

1. Maxillary palpus 4–5-segmented; valva of male genitalia with pectinifer [Figures 222–225] (Nematopogoninae): *Ceromitia*
Maxillary palpus reduced, 2–3-segmented; valva of male without pectinifer (Adelinae) 2
2. Male antenna shorter, length $\sim 1.5\times$ length of forewing or less; without dorsal peg-like spines near base of flagellum; eyes not enlarged in male; antennal sockets widely separated [Figure 41] *Cauchas*
Male antenna usually longer than $1.5\times$ length of forewing (antenna shorter in *A. oplerella* and *A. powelli*); basal flagellomeres of male often with 2–3 dorsal, peg-like spines [Figures 8–10, 13]; eyes often dimorphic, enlarged in males with antennal sockets positioned more closely together [Figures 18–26]. 3
3. Male with valva triangular, distal half (cucullus) tapering to subacute apex [Figure 270c]; male antenna with dorsal, peg-like spines (when present) simple and reduced in size, directed toward base of antenna, and confined more to basal 3–7 flagellomeres [Figures 8–9] *Nemophora*
Male with apex of valva broader and more rounded [Figure 271c]; dorsal peg-like spines (when present) of male antenna relatively larger and uncinat, directed apically, and present on flagellomeres 7–10 [Figures 10–13]. *Adela*

Ceromitia Zeller

Ceromitia Zeller, 1852: 92 [type species: *Ceromitia wahlbergi* Zeller, 1852: 92, by monotypy].—Meyrick, 1912b: 3.—Janse, 1945: 82.—Pastrana, 1961: 192.—Nielsen, 1980: 161; 1985: 5.—Davis, 1984: 18.—Nye and Fletcher, 1991: 61.

Agisana Möschler, 1884: 308 [type species: *Agisana caffrariella* Möschler, 1884: 308, by monotypy].—Nye and Fletcher, 1991: 10.

Exorectis Meyrick, 1906: 65 [type species: *Exorectis autoscia* Meyrick, 1906: 65, by monotypy].—Nye and Fletcher, 1991: 128.

Ulometra Meyrick, 1912c: 27 [type species: *Ulometra indigna* Meyrick, 1912c: 27, by monotypy].—Meyrick, 1912b: 4.—Nye and Fletcher, 1991: 318.

Trichorrhabda Meyrick, 1912b: 3 [type species: *Nemophora fasciolata* Butler, 1883: 74, by monotypy].—Meyrick, 1912b: 4.—Pastrana, 1961: 192.—Nye and Fletcher, 1991: 314.—Davis, 1984: 18 (synonym of *Ceromitia* Zeller).

Haplotypa Janse, 1945: 85, 126 [type species: *Ceromitia praetexta* Meyrick, 1924: 79, by original designation].—Nye and Fletcher, 1991: 141.

TYPE SPECIES. *Ceromitia wahlbergi* Zeller.

ADULT. Small- to medium-size moths with forewing expanse 8–28 mm.

Head: (Figures 16, 17). Vertex rough, densely covered with piliform scales; frons rough, densely covered with piliform scales. Antenna longer than forewing in both sexes and typically longer in male than female; up to $3\times$ length of forewing in ♂, as

short as $1.5\times$ length of forewing in ♀; pecten absent; flagellum filiform, fully scaled to apex with two annuli of appressed scales per segment, more thinly scaled ventrally; sensory cilia often present and length usually $1-2\times$ width of flagellomere in both sexes; antennal sockets separated by a narrow bridge less than half the diameter of antennal socket. Haustellum usually elongate, $1.5-3\times$ the length of labial palpus, or reduced, about equal to labial palpus in some African species; basal $1/4-1/3$ scaled. Maxillary palpus usually 4–5-segmented (3-segmented in *C. tubulifolia*). Labial palpus 3-segmented, usually approximately $2\times$ the length of maxillary palpus; segments II and III with rough scaling ventrally and several bristles.

Thorax: Forewing ground color brown, ranging from dark to very light pale brown, with most species having dark or light spots scattered throughout, and occasionally with bands running from costal to anal margin; wing pattern typically varies within species; venation as illustrated (Figures 46, 47). Rs2 and Rs3 sometimes but not always stalked, even within the same species (Janse 1945). Hindwing typically uniformly pale brown; venation as illustrated.

Abdomen: Uniformly brown dorsally, ranging from dark to light brown, generally paler in color ventrally.

Male Genitalia: Vinculum-saccus elongate, $1-3.5\times$ length of valva; variable in width from broad to slender and usually tapering anteriorly. New World *Ceromitia* have valva with one or two comblike pectinifers. Juxta sagittate or anchor shaped, partially membranous.

Female Genitalia: Apex of ovipositor compressed, asymmetrical, with ventral edge slightly longer than dorsal edge and typically minutely serrate ventrally. Ductus bursae approximately the length of corpus bursae in most species. Anterior and posterior apophyses long and slender.

LARVA. Unknown for all species except *Ceromitia tubulifolia* Parra and Ogden (2011). Larval *C. tubulifolia* light yellow in color with darkly pigmented and sclerotized head. Legs 4-segmented, well developed. Prolegs on A3–A6 with uniordinal, circular crochets.

PUPA. Unknown.

DISCUSSION. Janse (1945) considered *Ceromitia* to consist of three subgenera: *Ceromitia*, *Agisana*, and *Haplotypa*. *Ceromitia* subgenus *Ceromitia* was characterized by presence of pectinifers on the male genitalia, whereas the subgenus *Agisana* included species that lacked pectinifers but had the apices of the male valva twisted at a nearly right angle with respect to the rest of the valva. However, because some of the South American *Ceromitia* have both pectinifers as well as angled apices to their valva, we do not consider twisted valvae to be diagnostic alone, and the subgenus *Agisana* was considered by Janse to consist only of individuals with twisted valvae and absence of pectinifers. The third subgenus, *Haplotypa*, is characterized by males with an unusually long saccus in the male genitalia, coupled with projections along the margin of the valva (absent in *Agisana*), but unknown to Janse, present in some New World *Ceromitia* (such as *C. schajovskoi* Pastrana) and an absence of pectinifers. The validity of these three subgenera must remain in question and should not at present be recognized as distinct genera; only *Ceromitia*, subgenus *Ceromitia*, appears to have a putative synapomorphy: presence of pectinifers.

Trichorrhabda: Meyrick was synonymized with *Ceromitia* (Davis 1984). *Trichorrhabda* was proposed to contain one species, *T. fasciolata* (Butler), with long cilia on the male antenna. However, *Ceromitia* are known to possess significant variation in length of the cilia on the male antenna, and consequently, this secondary sexual characteristic does not warrant generic distinction.

Figure 53 shows the maximum likelihood gene tree of the COI barcode region for selected species of *Ceromitia* and *Nematopogon*. The South American species of *Ceromitia* form a moderately well-supported clade (bootstrap support [BS]=0.83); the Australian *Ceromitia* species (BS=0.92) and the *Nematopogon* species (BS=0.99) both form well-supported clades. The sister-group relationship between the Australian and South American *Ceromitia* clades is also moderately well supported (BS=0.87). Somewhat surprisingly, the *Nematopogon* clade is the sister group to the Australian+South American *Ceromitia* clade (BS=0.80), with the sole African exemplar (the type species of *Ceromitia*) being sister to *Nematopogon*+Australian *Ceromitia*+South American *Ceromitia* (BS=0.81). This result would appear to indicate that *Ceromitia* is paraphyletic with respect to *Nematopogon*. As Nielsen (1985) noted, however, *Nematopogon* can be distinguished morphologically from *Ceromitia* by both the presence of feather-like hairscales on the ventral wing veins and by the male dorsal hindwing scales being narrow instead of broad. Nielsen (1985) also noted one behavioral difference: *Nematopogon* adults hold their antennae out away from the body, while Australian and South American *Ceromitia* hold their antennae closely appressed to the body. Combined with the caveats already given in the Materials and Methods section about how much one can infer from a short region of mitochondrial DNA, it thus seems likely that the COI tree is in error with respect to the placement of *Nematopogon* within *Ceromitia*. That said, it is intriguing to note that iNaturalist observations (www.inaturalist.org) of living African *Ceromitia* species show them holding their antennae out away from the body in the same way that *Nematopogon* species do rather than appressed to the body like Australian and South American *Ceromitia*. If further morphological, behavioral, and genomic research supports African *Ceromitia* being sister to *Nematopogon*+Australian *Ceromitia*+South American *Ceromitia* and a separate genus for the Australian+South American taxa is then desired, *Exorectis* Meyrick, 1906 would be the oldest available name.

KEY TO THE NEW WORLD CEROMITIA BASED ON MALE GENITALIC CHARACTERS¹

1. Male valva with one pectinifer 2
Valva with 2 pectinifers 22
2. Anterior end of saccus more than half the width of broadest part of vinculum-saccus 3
Anterior end of saccus less than half the width of broadest part of vinculum-saccus 4
3. Vinculum with prominent hornlike process arising from posterior margin [Figure 262] *C. cerastia*
Vinculum without such a process [Figure 256] *C. sciographa*
4. Vinculum-saccus no longer than approximately 2 times length of valva 5
Vinculum-saccus longer than approximately 2 times length of valva 12
5. Anterior end of saccus bluntly truncate [Figure 255] *C. beckeri*
Anterior end of saccus rounded 6
6. Phallus with pair of winglike projections from the base [Figure 265] *C. nielsenii*
Phallus without such projections 7
7. Juxta slender [Figure 254] *C. petila*
Juxta sagittate 8

8. Valva approximately as long as vinculum-saccus [Figure 260] *C. exserta*
Valva shorter than vinculum-saccus 9
9. Vinculum with large, elongate lobe arising from near posterior margin [Figure 261] *C. schajovskoi*
Vinculum without such a lobe 10
10. Uncus smoothly rounded [Figure 250] *C. tubulifolia*
Uncus bilobed [Figure 249]. 11
11. Pectinifer $\sim 1/5$ length of valva [Figure 259] *C. laninensis*
Pectinifer $\sim 1/2$ length of valva [Figure 249] *C. sinuata*
12. Juxta sagittate. 13
Juxta not sagittate 20
13. Vinculum-saccus extremely narrow over most of its length [Figure 263] *C. elongata*
Vinculum-saccus not extremely narrow 14
14. Anterior end of saccus rounded 15
Anterior end of saccus bluntly truncate 16
15. Basal (anterior) half of juxta broad; width slightly more than $2\times$ the width of caudal half [Figure 252]. *C. latijuxta*
Basal (anterior) half of juxta more slender; width $\sim 0.3\text{--}1.2\times$ width of caudal half [Figure 251] *C. barilochensis*
16. Phallus terminating with 2 cornutal spines; valva with cucullus \sim equal to length of sacculus [Figure 253].
. *C. bicornuta*
Phallus without 2 prominent cornutal spines; valva with length of cucullus greater than length of sacculus. 17
17. Anterior end of saccus narrowly truncate [Figures 266, 269] 18
Anterior end of saccus moderately broad and truncate [Figures 267, 268] 19
18. Sacculus of valva short, projected into a rounded lobe [Figure 266]. *C. lobata*
Sacculus of valva more slender, acute, and extended toward apex of valva [Figure 269]. *C. unipectinella*
19. Sacculus of valva broadly rounded [Figure 267]. *C. ovata*
Sacculus of valva more reduced, forming a short, slightly rounded lobe [Figure 268] *S. truncata*
20. Pectinifer reduced; spines much shorter than width of valva [Figure 264]. *C. brevipectinella*
Pectinifer with relatively long spines. 21
21. Juxta $\sim 1/2$ length of phallus; multiple small cornuti present [Figure 258]. *C. latipicula*
Juxta $\sim 1/3\times$ length of phallus; multiple small cornuti absent [Figure 257] *C. latibasis*
22. Anterior end of saccus more than half the width of broadest part of vinculum-saccus 23
Anterior end of saccus less than half the width of broadest part of vinculum-saccus 30
23. Phallus terminating with one cornutal spine 24
Phallus not terminating with one cornutal spine. 25
24. Uncus bilobed [Figure 241]. *C. fasciata*
Apex of uncus nearly truncate [Figure 242] *C. unicornuta*
25. Juxta sagittate. 26
Juxta not sagittate 29
26. Posterior end of juxta with acute lobe projecting caudally [Figure 240] *C. nigrifasciata*
Posterior end of juxta without such a lobe 27
27. Vinculum-saccus nearly twice length of valva [Figure 239]. *C. aphyoda*
Vinculum-saccus approximately $1.5\times$ length of valva 28
28. Posterior margin of vinculum bilobed [Figure 236]. *C. paraguayensis*
Posterior margin of vinculum not bilobed [Figure 237] *C. costaricaensis*
29. Juxta broad, similar in width to posterior half of valva [Figure 234] *C. pallidofascia*
Juxta narrow, much narrower than posterior half of valva [Figure 235] *C. viscida*
30. Vinculum-saccus no longer than approximately $2\times$ length of valva. 31
Vinculum-saccus longer than $2\times$ length of valva 38
31. Vinculum-saccus approximately $2\times$ length of valva 32
Vinculum-saccus distinctly less than $2\times$ length of valva 34
32. Uncus bilobed. 33
Uncus not bilobed [Figure 225] *C. chionocrossa*
33. Phallus with large cornutus at apex [Figure 228] *C. exalbata*
Phallus without such cornutus [Figure 226] *C. lizeri*

34. Juxta sagittate.35
 Juxta not sagittate37
35. Phallus with apical cornuti [Figure 243]. *C. braziliensis*
 Phallus without apical cornuti36
36. Posterior margin of vinculum weakly convex [Figure 232]. *C. fuscata*
 Posterior margin of vinculum very weakly bilobed [Figure 233]. *C. karsholti*
37. Posterior margin of vinculum convex [Figure 245]. *C. convexa*
 Posterior margin of vinculum concave [Figure 244]. *C. concava*
38. Anterior end of saccus cleft or bifurcate39 nudge rig
 Anterior end of saccus smoothly rounded, not cleft41
39. Anterior end of saccus slightly cleft, vinculum-saccus gradually tapering [Figure 231]. *C. phaeoceros*
 Anterior end of saccus distinctly bifurcate40
40. Apex of phallus complex, clavate; cornuti present [Figure 247]. *C. inaequalis*
 Phallus slender, with 2 anellar lobes projecting from apex [Figure 248]. *C. furcata*
41. Vinculum-saccus approximately 4× length of valva [Figure 227]. *C. eremarcha*
 Vinculum-saccus less than 3× length of valva42
42. Phallus with long flagellate projection from apex [Figure 230]. *C. flagellata*
 Phallus without such a projection.43
43. Vesica of phallus with a single large cornutus [Figure 229]. *C. pucaraensis*
 Vesica of phallus without cornutus.44
44. Apex of phallus acutely bilobed [Figure 246]. *C. pachyphalla*
 Apex of phallus not bilobed45
45. Juxta sagittate [Figure 224]. *C. fasciolata*
 Juxta not sagittate46
46. Posterior end of vinculum convex with 3 small apical lobes [Figure 222]; length of juxta ~half the length of valva
 *C. parvipectena*
 Posterior end of vinculum smoothly curved [Figure 223]; juxta ~equal in length to valva *C. capitanea*

¹*Ceromitia eccentrica*, *C. ilyodes*, and *C. laticlavia* are not included because males are not known for these three species. *Ceromitia ochrodyta* is not included because the phallus and juxta were not available for study.

The following *Ceromitia* species groups are based on morphological characters for the purpose of associating species of similar genitalic morphology together in the text. These species groups should not necessarily be taken to reflect phylogenetic relationships, as they do not always align with the COI gene trees presented herein.

CAPITANEA SPECIES GROUP

The *capitanea* group is primarily characterized by 2 pectinifers on the valva of the male genitalia and by a very slender and elongate vinculum-saccus.

Ceromitia parvipectena Davis and Medeiros, new species

FIGURES 78–79, 222, 337; MAP 1

ADULT. (Figures 78–79). Wing expanse: ♂, 14–16 mm; ♀, 12–14 mm.

Head: Vertex and frons whitish to pale brown. Antenna ~2.5× length of forewing in males, 2× length of forewing in

females; scape pale fuscous; flagellum light fuscous; sensory cilia present along basal third of flagellum in males; length of cilia ~1.5× width of flagellum. Maxillary palpus pale brown, relatively short, less than 0.5× length of labial palpus. Labial palpus pale brown with several prominent bristles, especially near apex of second segment.

Thorax: Dorsum, venter, and tegula pale to light brown. Foreleg dark brown dorsally, light brown ventrally; mid- and hindlegs light brown. Forewing mostly pale gray, irrorated with brown scales, mostly near apices of veins along termen; fringe pale gray. Hindwing uniformly pale gray.

Abdomen: Light fuscous dorsally, paler ventrally.

Male Genitalia: (Figure 222). Uncus notched. Vinculum-saccus elongate, ~2.5× length of valva; saccus broad posteriorly, tapering sharply, halfway along its length, to a very narrow, rodlike anterior end. Valva with 2 relatively small distal pectinifers, each bearing ~10–12 blunt spines. Juxta relatively short, with anterior end sharply pointed. Phallus elongate, ~2.5× length of valva.

Female Genitalia: (Figure 337). Apex of ovipositor compressed; ventral edge serrate with 2 larger teeth near anterior

edge. Vestibulum reduced. Ductus bursae $\sim 0.3\times$ length of anterior apophysis. Corpus bursae reduced, $\sim 0.2\times$ length of anterior apophysis.

HOLOTYPE. CHILE: COQUIMBO: Nague, 11 km N Los Vilos, 20 m: 1 ♂, slide USNM 130408 ♂, BOLD ID RDOPP060-10, Genbank HQ971099, 4–5 Nov 1981, D. & M. Davis (USNM).

PARATYPES. 1 male, 5 females. CHILE: MAULE: Rio Teno, ca. 40 km E Curico, 800 m: 1 ♂, 5 ♀, slide USNM 34415 ♀, 25–27 Nov 1981, D. R. Davis (USNM).

HOST. Unknown.

FLIGHT PERIOD. November.

DISTRIBUTION. (Map 1). Coquimbo and Maule regions in Chile.

ETYMOLOGY. The species name *parvipectena* is derived from the Latin *parvis* (little) and *pecten* (comb), in reference to the relatively small pectinifers.

DISCUSSION. *Ceromitia parvipectena* has male genitalia very similar to that of *C. capitanea*, but the former species has a smaller wing expanse, and rather than the posterior end of the vinculum being nearly truncate as in *C. capitanea*, the posterior end of the vinculum is convex with three small apical lobes.

***Ceromitia capitanea* Davis and Medeiros, new species**

FIGURES 4, 44, 46, 80–81, 223, 338; MAP 2

ADULT. (Figures 80–81). Wing expanse: ♂, 18–28 mm; ♀ 18–24 mm.

Head: (Figure 4). Vertex and frons light fuscous. Antenna longer in males than females, approximately $2.5\times$ length of forewing in males, $1.5\times$ length of forewing in females; scape light fuscous; flagellum brown; sensory cilia visible in males on basal third of flagellum, nearly the width of flagellomere in length. Maxillary palpus light brown, relatively short, less than $0.5\times$ length of labial palpus. Labial palpus brown.

Thorax: Dorsum, venter, and tegula pale fuscous. Fore- and midlegs dark brown dorsally and pale fuscous ventrally, hindleg light brown. Forewing of Argentinian specimens predominantly light brown; white near base with dark brown subbasal band; large brown spot present near anal margin; another smaller brown spot at apex of discal cell. Forewing of Chilean specimens generally pale fuscous irrorated with dark brown scales throughout; prominent brown spot present near anal margin; brown subbasal band present. Fringe pale brown. Hindwing uniformly light brown.

Abdomen: Fuscous dorsally, paler ventrally.

Male Genitalia: (Figure 223). Uncus weakly bilobed; apex rarely nearly rounded. Vinculum-saccus elongate, $\sim 2.25\times$ length of valva; saccus broad posteriorly, tapering sharply halfway to anterior end, anterior half narrow, attenuated. Valva with 2 distal pectinifers, each bearing ~ 8 –12 blunt spines. Juxta elongate, constricted near anterior half, with anterior end long and

attenuate. Phallus elongate, with an S-curve along its length, $\sim 2\times$ length of valva.

Female Genitalia: (Figure 338). Apex of ovipositor compressed; ventral and dorsal edges serrulate, ventral edge considerably longer than dorsal edge. Vestibulum elongate, $\sim 0.5\times$ length of anterior apophysis. Ductus bursae and corpus bursae both relatively short, both $\sim 0.25\times$ length of anterior apophysis.

HOLOTYPE. ARGENTINA: NEUQUÉN: San Martín Andes, 640 m: ♂, 10 Sep 1983, M. Gentili (USNM).

PARATYPES. 121 males, 60 females. ARGENTINA: NEUQUÉN: J. de los Andes, Laguna Verde, 1,000 m: 1 ♂, 25 Nov 1981, M. O. Gentili (ZMUC). Lago Lacar, 5 km E of Hua-Hum, 640 m: 2 ♂, 2 ♀, 14–16 Oct 1981, Nielsen & Karsholt (ZMUC). San Martín de los Andes, T. Kura, 900 m: 2 ♀, BOLD ID RDOPP150-10, Genbank HQ971150, 6 Nov 1996, M. Gentili (USNM). San Martín de los Andes: Cerro Chapelco, 1,400–1,600 m: 4 ♂, 2–19 Dec 1981, Nielsen & Karsholt (ZMUC). Quilquihue, 750 m: 1 ♂, 20 Oct 1981, M. O. Gentili (ZMUC). San Martín de los Andes, 640 m: 2 ♂, 5 Oct 1980, 1 ♀, 4 May 1982, 3 ♂, slide USNM 130431, 1 ♂, BOLD ID RDOPP140-10, 10 Sep 1983, M. Gentili (USNM). San Martín de los Andes, 640 m: 55 ♂, 22 ♀, slides USNM 130429 ♂, USNM 34314 ♀, BOLD ID RDOPP137-10, 18 Aug–14 Oct 1981, Nielsen & Karsholt (USNM, ZMUC). RIO NEGRO: San Carlos de Bariloche, Colonia Suiza, 800 m: 28 ♂, 9 ♀, slides USNM 31733 ♂, USNM 31741 ♂, USNM 130404 ♂, USNM 31734 ♀, USNM 31742 ♀, BOLD ID RDOPP124-10, 4–23 Oct 1981, Nielsen & Karsholt (USNM, ZMUC); Colonia Suiza, 810 m: 1 ♀, BOLD ID RDOPP027-10, 5 Nov–11 Dec 1978, Misión Científica Danesa (ZMUC). CHILE: CAUTIN: Chacamo, NW Nueva Imperial, 600–700 m: 1 ♀, BOLD ID RDOPP005-10, 17–23 Feb 1981, L. Peña (USNM). CURICO: E. of Curico, 750–850 m: 1 ♂, slide USNM 23644 ♂, Feb 1985, L. Peña (USNM). Las Tablas, 750–850 m: 5 ♂, Feb 1985, L. Peña (USNM). Los Niches, $35^{\circ}04'S$, $71^{\circ}09'W$: 1 ♀, BOLD ID RDOPP142-10, Genbank HQ971145, 9 Dec 1993, C. & O. Flint Jr. (USNM). MALLECO: Nr. Los Gringos Camp, Nahuelbuta National Park, 1,300 m: 1 ♀, 6–11 Jan 1982, D. R. Davis (USNM). MAULE: Paso Garcia, ca. 23 km NW Cauquenes, 300 m: 1 ♂, 29–30 Nov 1981, D. R. Davis (USNM). Trequalemu Alto, 500 m: 1 ♂, BOLD ID RDOPP004-10, 27–28 Jan 1981, L. E. Peña (USNM). ÑUBLE: Alto Tregualemu, ca. 20 km SE Chovellen, 500 m: 1 ♂, 1 ♀, 1–3 Dec 1981, D. R. Davis (USNM). Recinto, 800 m: 1 ♂, slide USNM 21226 ♂, BOLD ID RDOPP003, Genbank HQ971053, 22–23 Jan 1979, D. & M. Davis & B. Akerbergs (USNM). Shangri-la, SW side Volcan Chilian, 1,600 m: 1 ♀, 19–21 Jan 1979, D. & M. Davis & B. Akerbergs (USNM). OSORNO: Parque Nacional Puyehue, Anticura, 350 m: 2 ♂, slide USNM 130401 ♂, BOLD ID RDOPP112-10, 18 Nov–18 Dec 1981, Nielsen & Karsholt (USNM, ZMUC). Rio Rahue: 1 ♂, slide USNM 21225 ♂, 20 Oct 1969, Flint & Barria (USNM). RIO NEGRO: San Carlos de Bariloche, SANTIAGO: Nr. Pta. Yeso, ca. 70 km SE Santiago, 1,250 m: 8 ♂, 8 ♀, slides

USNM 130400 ♂ & USNM 130413 ♂, BOLD ID RDOPP045-10, Genbank HQ971084, BOLD ID RDOPP046-10, Genbank HQ971085, BOLD ID RDOPP070-10, Genbank HQ971106, 27–28 Oct 1981, D. & M. Davis (USNM). Pilay, Rio Peuco, ca. 45 km S. Santiago, 800 m: 1 ♂, 3 ♀, 23–24 Nov 1981, D. R. Davis (USNM). Rio Colorado, ca. 40 km SE Santiago, 1,100 m: 1 ♂, 7 ♀, 29–31 Oct 1981, D. & M. Davis (USNM). VALDIVIA: 20 km S Valdivia, Rincon de la Piedra, 180 m: 1 ♂, slide USNM 130403 ♂, BOLD ID RDOPP121-10, Nielsen & Karsholt (USNM).

HOST. Unknown.

FLIGHT PERIOD. August to May.

DISTRIBUTION. (Map 2). Neuquén and Rio Negro provinces in Argentina and from the Maule region to Osorno Province in central Chile.

ETYMOLOGY. The specific name is derived from the Latin *capitanea* (chief in size; large) because this is the largest New World *Ceromitia* species.

DISCUSSION. This large species has two distinct forewing patterns. The Chilean form generally tends to be more grayish in appearance, while the Argentinian form has a light brown forewing and is similar to *C. flagellata*. However, moths with both forewing patterns have similar male genitalia and body size. Although some small *C. capitanea* are no larger than individuals of several other *Ceromitia*, no other neotropical species approaches the maximum size of *C. capitanea*.

***Ceromitia fasciolata* (Butler)**

FIGURES 52, 82, 224; MAP 1

Nemophora fasciolata Butler, 1883: 74.

Trichorhabda fasciolata (Butler), Meyrick, 1912b: 3.

Ceromitia fasciolata (Butler), Davis, 1984: 18.

ADULT. (Figure 82). Wing expanse: ♂, 20 mm; ♀ unknown.

Head: Vertex whitish, slightly suffused with pale ochreous toward frons (frons badly rubbed). Antenna elongate, at least 2× length of forewing (apices of both antenna broken); flagellum uniformly whitish; scape whitish, suffused with pale ochreous; sensory cilia suberect, long, approximately 2.0–2.5× diameter of shaft. Maxillary palpus whitish, moderately long, approximately 0.7× length of labial palpus. Haustellum elongate, over 3.0× length of labial palpus. Labial palpus whitish, near base, becoming darker, more fuscous on distal half; second segment with several long, dark erect, hairlike scales.

Thorax: Dorsum and tegulae whitish, suffused with pale ochreous; lateral edges of tegulae with a spot of brownish fuscous. Venter mostly whitish. Foreleg fuscous; mid- and hindlegs much paler, whitish. Forewing [badly rubbed in unique type] whitish lightly suffused with pale ochreous along costa and over outer third of wing; a narrow, slightly curved fuscous band extending from costa two-thirds across wing near base; another,

shorter, fuscous band extending from hind margin about halfway across middle of wing; cilia creamy white. Hindwing whitish gray, cilia paler, more whitish.

Abdomen: Pale gray above, more whitish ventrally.

Male Genitalia: (Figure 224). Uncus minutely bilobed. Vinculum-saccus elongate, approximately 1.75× length of valva: Y-shaped, with proximal half narrowly constricted, rodlike. Valva with 2 pairs of pectinifers, each with 12–14 blunt spines; cucullus narrowly rounded at apex. Juxta gradually tapering from caudal, broader half to attenuate, filamentous apex. Phallus long and slender, without cornuti.

Female Genitalia: Unknown.

TYPE. Holotype, ♂ (BMNH).

TYPE LOCALITY. Valdivia, Chile.

HOST. Unknown.

FLIGHT PERIOD. Unknown.

MATERIAL EXAMINED. CHILE: Valdivia: 1 ♂ (holotype) (BMNH).

DISTRIBUTION. (Map 1). Known only from the type locality, which is located in the province of Valdivia in southern Chile.

DISCUSSION. *C. fasciolata* is known only from the male holotype. Although the wings are somewhat rubbed, the species may be recognized by the elongate, rodlike saccus of the male genitalia. Unlike *C. parvipectena*, the juxta of *C. fasciolata* is elongate, and unlike *C. capitanea*, the phallus of *C. fasciolata* is simple and straight.

Although the antennal sensory cilia of this species are among the longest known for any member of the genus, this character alone does not warrant a separate generic placement for *C. fasciolata* as proposed by Meyrick (1912b). The relative development of the antennal cilia varies interspecifically with the cilia of *C. ochrodyta* approximately equaling the length of those in *C. fasciolata*.

***Ceromitia chionocrossa* Meyrick.**

FIGURES 83, 225, 339; MAP 1

Ceromitia chionocrossa Meyrick, 1921: 405.—Davis, 1984: 18.

ADULT. (Figure 83). Wing expanse: ♂, 9–10 mm; ♀, 9–11 mm.

Head: Antenna of equal length in both sexes, approximately 2.5× length of forewing; flagellum white to pale gray, with darker gray annuli more evident over basal fourth; scape white above, fuscous beneath; sensory cilia inconspicuous, mostly appressed, 0.5–0.9× diameter of segment in length. Maxillary palpus whitish, relatively short, less than 0.5× length of labial palpus. Labial palpus whitish with a few fuscous setae near apex of second segment.

Thorax: Dorsum whitish, patagia pale fuscous. Legs mostly grayish, apices of tibial and tarsal segments faintly ringed with white; tibiae of midleg whitish. Forewing uniformly gray

except for conspicuous white cilia along termen. Hindwing uniformly light gray.

Abdomen: Pale fuscous above; grayish white ventrally.

Male Genitalia: (Figure 225). Uncus reduced, apex rounded. Vinculum-saccus elongate, V-shaped, approximately 1.5× length of valva. Valva with 2 pairs of pectinifers, each consisting of a single row of approximately 6–9 blunt spines; apex of cucullus narrowed, rounded. Juxta moderately narrow, gradually tapering anteriorly except for slight enlargement at caudal third. Phallus moderately stout, slightly curved, approximately equaling length of entire genitalia; apex with a single large curved cornutus; another single large curved cornutus just proximal to apex.

Female Genitalia: (Figure 339). Apex of ovipositor compressed with a minute dentate subapical process; ventral edge serrulate, considerably longer (~2–3×) than dorsal edge. Ductus bursae moderately long, ~1.5× length of slender vestibulum. Corpus bursae spherical, ~equal to ductus bursae in length.

TYPE. Lectotype, ♂ (present designation): “R. Trombetas, Brazil, Parish 9–19; B. M. genitalia slide ♂ No. 15207; Lectotype ♂, *Ceromitia chionocrossa* Meyr., by D. Davis; Meyrick Coll., B. M. 1938-290; Photograph on file USNM” (BMNH).

TYPE LOCALITY. Rio Trombetas, Pará, Brazil.

HOST. Unknown.

FLIGHT PERIOD. June to September.

DISTRIBUTION. (Map 1). Known from the state of Pará, Brazil, within the Amazon Basin, as well as the Essequibo Islands–West Demerara region of Guyana.

MATERIAL EXAMINED. 3 males, 3 females. **BRAZIL:** PARÁ: Specific locality unknown: 1♀ (“paralectotype” species identity questionable), Jun (BMNH). Rio Trombetas: 1♂ (lectotype), Sep (BMNH). AMAZONAS: Br. 391, km 102: 1♂, 1♀, slide USNM 130476 ♂, 30 Jul 1979, J. Arias (USNM). **GUYANA:** ESSEQUIBO ISLANDS–WEST DEMERARA: Shanklands Res., Essequibo River, 15 m, 6°40'N, 58°34'W: 1♂, 1♀, 28 Feb 2002, Davis, Pogue, & Solis (USNM).

DISCUSSION. *Ceromitia chionocrossa* is easily recognized by its wing color, particularly by the conspicuous, white fringe of cilia along the termen. The type series was originally stated by Meyrick (1921) to consist of three specimens from Brazil: one male (R. Trombetas) and two females (Pará). An examination of these three specimens has shown that the series is mixed with one female from Pará not conspecific with the others. The type locality, Rio Trombetas, is a major tributary of the Amazon River and extends through much of the state of Pará from the Venezuelan border, joining the Amazon River at a point approximately 50 km west of Obidos. Very likely, the lectotype was collected near the juncture of the Rio Trombetas and the Amazon River.

Ceromitia lizeri Pastrana

FIGURES 84–87, 226, 340; MAP 3

Ceromitia lizeri Pastrana, 1961: 199.—Davis, 1984: 18.

ADULT. (Figures 86–87). Wing expanse: ♂, 11.5–24 mm; ♀, 15–23 mm.

Head: Vertex and frons light brown or brown to mottled gray and fuscous. Antenna slightly longer in males than females, approximately 2× length of forewing in males, 1.5× length of forewing in females; scape light brown; flagellum light brown; sensory cilia present in males along basal third of flagellum, approximately equal in length to antennal segment. Maxillary palpus pale light brown, relatively short, less than 0.5× length of labial palpus. Labial palpus pale light brown with several prominent bristles, especially near apex of second segment, third segment dark brown.

Thorax: Dorsum, venter, and tegula mottled brown and fuscous. Fore- and midlegs dark brown dorsally and pale brown ventrally; hindleg light brown. Forewing pale fuscous, irrorated with light and dark brown scales; dark brown scales grouped to form spots at apex of veins on all wing margins; several faint spots throughout wing, with the darkest typically near apex of discal cell; a dark brown spot usually present along anal margin near middle of wing, with this spot sometimes tending to form a transverse medial band extending from anal margin to cubital vein; a partial dark brown subbasal band present from costal margin to medial vein. Fringe pale fuscous. Hindwing uniformly light brown.

Abdomen: Dark brown dorsally, paler ventrally.

Male Genitalia: (Figure 226). Uncus weakly bilobed. Vinculum-saccus elongate, ~2× length of valva; saccus broad distally, proximal half narrowing to an attenuate, rodlike apex. Valva with 2 pairs of distal pectinifers, each bearing ~15–18 blunt spines. Juxta elongate, with anterior end sagittate and terminating in a bluntly rounded apex. Phallus elongate, ~2× length of valva, curved near base, with a large, rounded subbasal lobe.

Female Genitalia: (Figure 340). Apex of ovipositor very slender and nearly symmetrical; a minute serrated ridge present along ventral edge. Vestibulum ~0.2× length of anterior apophysis. Ductus bursae relatively short, ~0.2× length of anterior apophysis. Corpus bursae moderately well developed, ~0.3× length of anterior apophysis.

HOLOTYPE. ARGENTINA: NEUQUÉN: Parque Lanin: 1♂, 19 Dec 1954, slide JAP 291, J. A. Pastrana, MACN-En 13596 (MACN).

ADDITIONAL MATERIAL EXAMINED. 36 males, 89 females. **ARGENTINA:** CHUBUT: El Bolsón, Lago Puelo, 250 m: 1♀, 22 Oct 1981, Nielsen & Karsholt (ZMUC). Esquel, Lago Menéndez, El Sagrario Puerto, 600 m: 7♂, 29♀, slides USNM 130421 ♂, USNM 130423 ♂, USNM 130477 ♂, USNM 34401 ♀, BOLD ID RDOPP119-10, 2–4 Jan 1982, Nielsen & Karsholt (USNM, ZMUC). NEUQUÉN: Chapelco, Techos, 1,400 m: 1♀, 8 Jan 1983, M. y P. Gentili (USNM). L. Lacar, Nonthue, 640–650 m: 1♂, 1♀, 3 May 1982 & 2 Dec 1983, M. y P. Gentili (USNM). L. Lacar, Trompul, 1,000 m: 1♂, 2♀, 6 Dec 1983, M. y P. Gentili (USNM). Lacar Quechuquina, 900 m: 1♂, 2♀, slide USNM 31788 ♂, BOLD ID RDOPP057-10, Genbank HQ971069, 14 Jan 1983, M. y P. Gentili (USNM). Lago Lacar, Pucará, 650–750 m: 4♂, 10♀, slides USNM 34394

♀, USNM 34399 ♀, USNM 130427 ♂, USNM 130446 ♂, USNM 130480 ♂, BOLD IDs RDOPP030-10, RDOPP067-10, RDOPP130-10, Genbank HQ971070, HQ971103, HQ971130, 28 Nov–27 Dec 1981, Nielsen & Karsholt (UNNM, ZMUC). Lago Queñi, 875 m: 1 ♀, 13 Jan 1984, M. y P. Gentili (USNM). Paso Cordoba, 1,300 m: 1 ♀, 21 Jan 1984, M. y P. Gentili (USNM). Paso Puyehue, 1,350 m: 2 ♂, 11 Jan 1985, M. y P. Gentili (USNM). Puyehue, A. Pantojo, 1,100 m: 2 ♂, 7 ♀, 12 Jan 1985, M. y P. Gentili (USNM). R. Alumine, L. Loan, 1,100 m: 1 ♀, 16 Jan 1984, M. y P. Gentili (USNM). San Martín de los Andes, 640 m: 2 ♂, 1 ♀, 4 May 1982, M. y P. Gentili (USNM). San Martín de los Andes, Tr. Kura, 1,000 m: 1 ♀, 27 Sep 1986, M. y P. Gentili (USNM). San Martín de los Andes, Cerro Chapelco, 1,400–1,600 m: 1 ♀, 2–19 Dec 1981, Nielsen & Karsholt (ZMUC). RIO NEGRO: Lago Nahuel Huapi, Puerto Blest, 770 m: 2 ♂, 1 ♀, slides USNM 3253 ♂, USNM 3318 ♂, BOLD ID RDOPP069-10, Genbank HQ971105, 23–30 Dec 1978, Misión Científica Danesa (USNM, ZMUC). San Carlos de Bariloche, Colonia Suiza, 800 m: 5 ♂, 13 ♀, 3 Oct 1981–7 Jan 1982, Nielsen & Karsholt (USNM, ZMUC). San Carlos de Bariloche, Colonia Suiza, 810 m: 1 ♂, 2 ♀, 10 Jan 1978 & 29 Dec 1978–1 Jan 1979, Misión Científica Danesa (ZMUC). CHILE: CHILOE: Lago Tepuhueico: 4 ♀, BOLD ID RDOPP056-10, Genbank HQ971095, 11–15 Dec 1985, L. E. Peña (USNM). Rio Ventisquero, Lago Yelcho: 1 ♂, slide USNM 130468 ♂, 5–8 Dec 1985, L. E. Peña (USNM). MALLECO: Los Raices, 1,400 m: 1 ♂, slide USNM 130430 ♂, 20–23 Dec 1994, L. E. Peña (USNM). nr. Los Gringos Camp, Nahuelbuta National Park, 1,300 m: 6 ♂, 3 ♀, slides USNM 22455 ♂, USNM 31752 ♂, USNM 31789 ♀, USNM 130478 ♂, BOLD ID RDOPP075-10, Genbank HQ971110, 6–11 Jan 1982, D. R. Davis (USNM). Rio Manzanares: 3 ♀, slide USNM ♀, 21231, 19 Oct 1969, Flint & Barria (USNM). MELIPILLA: La Viluma, SE Melipilla, 350 m: 1 ♀, 15–17 Dec 1987, L. E. Peña (USNM).

HOST. Unknown.

FLIGHT PERIOD. September to May.

DISTRIBUTION. (Map 3). From Neuquén to Chubut provinces in Argentina and from Malleco to Chiloé provinces in Chile.

DISCUSSION. This species has a variable wing pattern and coloration, with some specimens possessing much more dark coloration than others. The male genitalia most closely resemble that of *C. exalbata*, but without a large cornutus on the phallus present in the latter species.

***Ceromitia eremarcha* (Meyrick)**

FIGURES 88, 227; MAP 1

Ceromitia eremarcha Meyrick, 1931: 179.—Davis, 1984: 18.

ADULT. (Figure 88). Wing expanse: ♂, 21–23 mm; ♀, unknown.

Head. Vertex mostly whitish, lightly suffused with brownish hairs between antenna; frons white with a slight suffusion of

pale tan laterally beneath antenna. Antenna exceeding length of forewing (broken, with apices lacking); scape whitish at apex, mostly brown around base; flagellum alternately banded dull white and light brown over basal fourth, uniformly light brown distally; sensory cilia suberect, curved, length approximately equaling diameter of shaft. Maxillary palpus white, short, approximately 0.6× length of labial palpus. Labial palpus uniformly white, with an erect tuft of hairlike scales along venter of second segment.

Thorax. Dorsum dull white, with an irregular, dark fuscous band across anterior margin of mesonotum extending laterally over tegulae. Venter white. All legs white ventrally; foreleg dark fuscous dorsally; midleg paler above, brownish midleg pale tan to whitish above. Forewing mostly pale stramineous to nearly white, lightly irrorated with small spots of fuscous; a series of about six spots unevenly spaced along costa, the largest situated at the termination of R₁; another relatively large spot situated at apex of discal cell; base of wing apparently (badly rubbed) with a narrow, transverse fuscous band; cilia stramineous with a slightly darker suffusion of brown along termen at base of cilia. Hindwing uniformly pale brownish gray, with a slight bronzy iridescence.

Abdomen. Stramineous above, slightly more white beneath.

Male genitalia. (Figure 227). Uncus slightly bilobed. Vinculum-saccus extremely long, over 3.0× length of valva; saccus attenuated, rodlike. Valva with 2 pairs of nearly contiguous pectinifers; basal pectinifer shorter, with 12–13 blunt spines; apical pair with 17–20 blunt spines. Juxta elongate, broad at caudal end, with apical two-thirds very slender, attenuated. Phallus extremely long and slender, nearly equal to length of entire genitalia; apex complex, with a pair of thin, flabellate, sclerites loosely attached to dorsal surface immediately beneath apex; anterior to base of paired sclerites extend a scattered row of 5 minute cornuti; an irregularly shaped, sclerotized element loosely articulated to extreme apex of phallus; base of phallus somewhat swollen.

Female Genitalia. Unknown.

TYPE. Holotype, ♂ (NHMW).

TYPE LOCALITY. San Bernardino, Paraguay.

HOST. Unknown.

FLIGHT PERIOD. February.

DISTRIBUTION. (Map 1). Known only from the type locality of San Bernardino, which is located on the eastern shore of Lake Ypacarai, approximately 34 km east of Asuncion.

MATERIAL EXAMINED. 2 males. PARAGUAY: San Bernardino: Feb 1920, 1 ♂ (paratype) (BMNH); 1 ♂ (holotype), coll. Fiebrig (NHMV).

DISCUSSION. According to Meyrick (1931), the type series of this species consisted of three males from San Bernardino, Paraguay. Only two of these specimens are now known to exist: the holotype (Naturhistorisches Museum Wien) and a single paratype (The Natural History Museum, London). This species is most easily recognized by several unusual features of the male genitalia, particularly by the greatly attenuated saccus and the complex structure of the apex of the phallus. In both features, *C. eremarcha* bears closest resemblance to *C. elongata* but

may be easily distinguished by the different form of the pectinifer. In *C. eremarcha*, the valva possesses two separate pectinifers, whereas in *C. elongata*, all the spines of the pectinifer are united to form a single elongate comb.

Ceromitia exalbata Meyrick

FIGURES 89, 228; MAP 1

Ceromitia exalbata Meyrick, 1921: 405.—Clarke, 1970: 117.—Davis, 1984: 18.

ADULT. (Figure 89). Wing expanse: ♂, 9 mm; ♀, unknown.

Head: Vertex white; frons whitish [although badly rubbed], with a few scattered fuscous scales. Antenna 2.5–3.0× length of forewing; flagellum white, ringed with pale fuscous; scape whitish, strongly irrorated with fuscous on ventral surface; cilia moderately long, approximately equal in length to diameter of shaft. Maxillary palpus approximately 0.3× length of labial palpus. Haustellum long, ~3× length of labial palpus. Labial palpus whitish irrorated with fuscous.

Thorax: Dorsum whitish. Venter whitish. Legs grayish, heavily irrorated with fuscous; apices of tarsal segments faintly ringed with grayish white. Forewing whitish, with a few scattered patches of fuscous; one dark patch at base of costa, another at apex; discal cell with a well-defined patch at apex, another near base of cell; hind margin with a pair of small dark patches near middle; cilia unicolorous, whitish. Hindwing uniformly pale gray.

Abdomen: Grayish above; paler, more whitish ventrally.

Male Genitalia: (Figure 228). Uncus nearly acute, minutely bilobed. Vinculum elongate, V-shaped, approximately 1.5× length of valva. Valva with 2 pairs of pectinifers, each consisting of a single row of approximately 10 blunt spines; apex of cucullus subacute. Juxta slender, elongate; interior sagittate portion approximately 0.3× length of entire juxta. Phallus very slender, slightly exceeding length of entire genitalia; apex with a large, curved, stout cornutus nearly 0.3× length of phallus shaft.

Female Genitalia: Unknown.

TYPE. Holotype, ♂ (BMNH).

TYPE LOCALITY. Rio Trombetas, Brazil.

HOST. Unknown.

FLIGHT PERIOD. September.

DISTRIBUTION. (Map 1). Known only from the type locality, which is located in the state of Pará, Brazil, approximately 200–300 km northwest of Obidos.

MATERIAL EXAMINED. BRAZIL: PARÁ: Rio Trombetas: 1 ♂ (holotype).

DISCUSSION. As is unfortunately true for several species of Microlepidoptera described by Edward Meyrick, *Ceromitia exalbata* is still known only from the unique holotype. Fortunately, however, the holotype of this species is a male and

therefore demonstrates readily recognizable genitalic characters. The phallus, for example, is diagnostic in possessing the largest cornutus known for the Adelidae.

Ceromitia pucaraensis Pastrana

FIGURES 47, 90, 229, 341; MAP 4

Ceromitia pucaraensis Pastrana, 1961: 197.—Davis, 1984: 18.

ADULT. (Figure 90). Wing expanse: ♂, 8–11 mm; ♀, 11–16 mm.

Head: Vertex and frons light brown to brown. Antenna ~2× length of forewing in males, 1.5× length of forewing in females; scape brown; flagellum brown; sensory cilia inconspicuous. Maxillary palpus pale light brown, relatively short, less than 0.5× length of labial palpus. Labial palpus pale light brown with several prominent bristles, especially near apex of second segment.

Thorax: Dorsum, venter, and tegula brown to light brown in some specimens. Fore- and midlegs dark brown dorsally and pale brown ventrally; hindleg light brown. Forewing mostly solid brown, occasionally a few dark brown spots faintly visible near the ends of veins, especially along termen. Fringe brown. Hindwing uniformly brown.

Abdomen: Dark brown dorsally, paler ventrally.

Male Genitalia: (Figure 229). Uncus evenly rounded. Vinculum-saccus elongate, nearly 2.25× length of valva; caudal margin of vinculum extended as a prominent triangular lobe; margins of saccus gradually tapering toward a rounded, U-shaped anterior end. Valva with 2 pairs of pectinifers, each relatively small and consisting of 8–11 blunt spines. Juxta elongate, slender; simple in form. Phallus elongate, slender, ~2.25× length of valva; vesica with a single large cornutus; 2 anellus lobes of different lengths projecting from apex of phallus.

Female Genitalia: (Figure 341). Apex of ovipositor compressed; ventral and dorsal edges nearly smooth. Vestibulum and ductus bursae both relatively short. Corpus bursae ~0.3× length of anterior apophysis.

TYPE. ARGENTINA: NEUQUÉN: Parque Nacional Lanín, Pucará: ♂, Dec 1956, J. A. Pastrana (MACN).

TYPE LOCALITY. ARGENTINA: NEUQUÉN: Parque Nacional Lanín, Pucará.

HOST. Unknown.

FLIGHT PERIOD. October to January.

DISTRIBUTION. (Map 4). Chubut, Neuquen, and Rio Negro provinces of Argentina, and in Chile, from Malleco to Chiloé provinces.

MATERIAL EXAMINED. 130 males, 47 females. ARGENTINA: CHUBUT: El Bolsón, Lago Puelo, 250 m: 1 ♂, 6 ♀, 22–23 Oct 1981, Nielsen & Karsholt (ZMUC). Esquel, Lago Menéndez, 600 m: 13 ♂, 12 ♀, 2–4 Jan 1982, slide USNM 130417 ♂, BOLD IDs RDOPP115-10, RDOPP117-10, Genbank

HQ971139, HQ971141, slides USNM 130419 ♂, USNM 130420 ♂, Nielsen & Karsholt (USNM, ZMUC). NEUQUÉN: Lago Lacar: 5 km E of Hua-Hum, 640 m: 8 ♂, 3 ♀, 25 Nov–27 Dec 1981, slides USNM 130426 ♂, USNM 130461 ♂, BOLD ID RDOPP131-10, Nielsen & Karsholt (USNM, ZMUC). Pucará, 650 m: 5 ♂, 2 ♀, 26–27 Dec 1981, slide USNM 31791 ♂, Nielsen & Karsholt (USNM, ZMUC). Pucará, 750 m: 3 ♂, 2 ♀, 3 Dec 1978, slides USNM 16395 ♂, USNM 130445 ♂, BOLD ID RDOPP029-10, Nielsen & Karsholt (USNM, ZMUC). Trompul, 1,000 m: 2 ♂, 2 ♀, 6 Dec 1983, M. y P. Gentili (USNM). RIO NEGRO: Lago Nahuel Huapi, Puerto Blest, 770 m: 1 ♂, slide USNM 3315 ♂, BOLD ID RDOPP032-10, Genbank HQ971071, 22 Dec 1978, Misión Científica Danesa (USNM). San Carlos de Bariloche, Colonia Suiza, 800 m: 2 ♂, slides USNM 31790 ♂, USNM 130454 ♂, BOLD ID RDOPP125-10, RDOPP128-10, Genbank HQ97XXXX, HQ97XXXX, 3 Oct 1981–7 Jan 1982, Nielsen & Karsholt (USNM). CHILE: CAUTIN: Temuco, Fundo la Selva, 48 km NW Nueva Imperial, 700 m: 5 ♂, 4 ♀, slide USNM 34312 ♀, 9–11 Dec 1981, D. R. Davis (USNM). Fundo la Selva, 35 km NW Nueva Imperial, 600 m: 1 ♂, 5–8 Dec 1981, slide USNM 22461 ♂, D. R. Davis (USNM). CHILOE: Hueque Trumao, 22 km N of Quellon, 50 m: 1 ♂, 26–27 Dec 1981, BOLD ID RDOPP064-10, D. R. Davis (USNM). Rio Ventisquero, Lago Yelcho: 1 ♂, slide USNM 130433 ♂, 5–8 Dec 1985, L. E. Peña G. (USNM, ZMUC). MALLECO: Nahuelbuta National Park near Los Gringos Camp, 1,300 m: 1 ♀, 29 Jan–5 Feb 1979, BOLD ID RDOPP013-10, Genbank HQ971059, M. & D. Davis & B. Akerbergs (USNM). Nahuelbuta National Park, Near Los Gringos Camp, 1,300 m: 77 ♂, 14 ♀, 6–11 Jan 1982, slides USNM 22456 ♂, USNM 22457 ♂, USNM 22458 ♂, USNM 22459 ♂, USNM 22460 ♂, USNM 31754 ♂, USNM 31756 ♂, USNM 31760 ♂, USNM 130412 ♂, USNM 130443 ♂, USNM 130444 ♂, BOLD IDs, Genbank RDOPP029-10, RDOPP047-10 & HQ971086, RDOPP071-10, RDOPP072-10 & HQ971107, RDOPP115-10 & HQ971139, RDOPP131-10, D. R. Davis (USNM), BOLD IDs RDOPP055-10, RDOPP058-10 & RDOPP059-10, Genbank HQ971094, HQ971097, HQ971098 (USNM). Tolhuaca: 1 ♂, 9 Jan 1962, slide USNM 16090 ♂, R. Usinger (USNM). ÑUBLE: Alto Tregual-emu ca. 20 km SE Chovellen, 500 m: 1 ♀, 1–3 Dec 1981, BOLD ID RDOPP066-10, Genbank HQ971102, D. R. Davis (USNM). Las Trancas, 1300 m, 21 km E Recinto, near high waterfall: 4 ♂, 17 Jan 1979, slide USNM 16450 ♂, M. & D. Davis & B. Akerbergs (USNM). OSORNO: P. N. Puyehue, 600 m Aguas Calientes to 3 km W: 5 ♂, 12–20 Dec 1981, slides USNM 31755, USNM 130410 ♂, USNM 130440 ♂, BOLD IDs RDOPP050-10, BOLD ID RDOPP084-10, Genbank HQ971089, HQ971115, D. R. Davis (USNM).

DISCUSSION. Superficially, this species is very similar to *C. nielsenii*, but the COI data and male genitalia are very different. Unlike *C. nielsenii*, the male genitalia of *C. pucaraensis* have two pectinifers per valva, and a large cornutus is present on the phallus. This, along with the two annular lobes of different

lengths projecting from the apex of the phallus, are distinctive to *C. pucaraensis*.

Ceromitia flagellata Davis and Medeiros, new species

FIGURES 91–93, 230, 342; MAP 5

ADULT. (Figures 91–93). Wing expanse: ♂, 18–22 mm; ♀, 17–24 mm.

Head: Vertex and frons pale gray to pale brown. Antenna longer in males than females, approximately 2.5× length of forewing in males, 1.5× length of forewing in females; scape light fuscous; flagellum light fuscous; sensory cilia visible in males on basal third of flagellum, nearly the width of antennal segments in length. Maxillary palpus pale gray to light brown, relatively short, less than 0.5× length of labial palpus. Labial palpus pale gray to light brown.

Thorax: Dorsum and venter pale gray to light brown; tegula pale gray to light brown, mottled with darker brown scales. Fore- and midlegs dark brown dorsally and pale fuscous ventrally, hindleg light brown. Forewing predominantly light brown to pale gray; brown near base with brown scales blending into tegula; strong dark brown subbasal band present; dark brown spot near anal margin; another smaller brown spot sometimes present at apex of discal cell; small brown spots at apex of veins along termen present in some individuals. Fringe pale brown to pale fuscous. Hindwing uniformly light brown.

Abdomen: Light brown ventrally, paler, more whitish ventrally.

Male Genitalia: (Figure 230). Uncus weakly bilobed. Vinculum-saccus elongate, ~2× length of valva; saccus broad, margins tapering to form rounded, U-shaped anterior end. Valva with 2 pairs of distal pectinifers, bearing ~10–16 blunt spines. Juxta gradually narrowing toward base. Phallus elongate, ~2.25× length of valva, with an elongate, ligulate extension projecting from the apex, ~1.5× length of valva.

Female Genitalia: (Figure 342). Apex of ovipositor compressed; ventral and dorsal margins serrate, ventral margin considerably longer than dorsal margin. Vestibulum elongate; ~0.5× length of anterior apophysis. Ductus bursae and corpus bursae each ~0.25× length of anterior apophysis.

HOLOTYPE. ARGENTINA: NEUQUEN: San Martín de los Andes: 1 ♂, 1950, slide USNM 3255 ♂, S. Shachovskoj (USNM).

PARATYPES. 30 males, 31 females. ARGENTINA: CHUBUT: El Bolsón: Lago Puelo, 250 m: 3 ♂, 2 ♀, slides USNM 130402 ♂, USNM 130416 ♂, BOLD IDs RDOPP113-10 & RDOPP114-10, Genbank HQ971137, HQ971138, 22–23 Dec 1981, Nielsen & Karsholt (USNM, ZMUC), 1 ♂, BOLD ID RDOPP026-10, Genbank HQ971068, 17 Nov 1978, Misión Científica Danesa (USNM). Lago Puelo, El Turbio: 1 ♂, 19 Nov 1961, Gy, Topál (USNM). NEUQUEN: Junin de los Andes, Laguna

Verde, 1,000 m: 1 ♀, 25 Nov 1981, M. O. Gentili (ZMUC). Lago Lacar, Nonthue, 640 m: 2 ♂, 1 ♀, slide USNM 130459 ♂, BOLD ID RDOPP025-10, Genbank HQ971067, 2 Dec 1983, M. y P. Gentili (USNM). Lago Lacar, 5 km E Hua-Hum, 640 m: 1 ♂, 5–6 Nov 1981, Nielsen & Karsholt (ZMUC). NEUQUEN: San Martín de los Andes, Cerro Chapelco, 1,400–1,600 m: 1 ♀, 2–19 Dec 1981, Nielsen & Karsholt (ZMUC). San Martín de los Andes: 2 ♀, Nov–Dec 1950, S. Shachovskoj (USNM). RIO NEGRO: Lago Nahuel Huapi, Puerto Blest, 770 m: 1 ♂, 2 ♀, 3–8 Dec 1981, Nielsen & Karsholt (ZMUC). San Carlos de Bariloche, Colonia Suiza, 800 m: 6 ♂, 5 ♀, slide USNM 34315 ♀, 21 Oct–8 Dec 1981, Nielsen & Karsholt (USNM, ZMUC). San Carlos de Bariloche, Colonia Suiza, 810 m: 5 ♂, 8 ♀, slides USNM 16393 ♂, USNM 16396 ♀, BOLD IDs RDOPP028-10, RDOPP077-10, Genbank HQ971069, HQ971111, 5 Nov–11 Dec 1978, Misión Científica Danesa (USNM, ZMUC). TUCUMAN: Cerro San Javier, 800 m: 1 ♂, slide USNM 29842 ♂, 18 Feb 1959, J. F. G. Clarke (USNM). BRAZIL: MINAS GERAIS: Caraça Monastery, Barão de Cocais, SE of Belo Horizonte, 1,300 m: 1 ♀, BOLD ID RDOPP090-10, Genbank HQ971119, 25 Oct 1994, V. O. Becker & K. S. Sattler (VOB). CHILE: COQUIMBO: Fray Jorgé National Park, ca. 70 km W Ovalle: 3 ♀, BOLD ID RDOPP061-10, RDOPP076-10, 6–9 Nov 1981, D. & M. Davis (USNM). MALLECO: Rio Manzanares: 1 ♀, 19 Oct 1969, Flint & Barria (USNM). OSORNO: Anitcura, Puyehue: 3 ♂, 19–29 Oct 1985, Peña (USNM). Parque Nacional Puyehue, Aguas Caliente, 450 m: 2 ♀, BOLD ID RDOPP107-10, 25 Sep 1981, Nielsen & Karsholt (USNM, ZMUC). Parque Nacional Puyehue, Anticura, 350 m: 5 ♂, 18 Nov 1981, Nielsen & Karsholt (ZMUC). VALDIVIA: 20 km S Valdivia, Rincon de la Piedra, 180 m: 1 ♂, 2 ♀, 24 Sep 1981, Nielsen & Karsholt (ZMUC).

HOST. Unknown.

FLIGHT PERIOD. September to February.

DISTRIBUTION. (Map 5). *Ceromitia flagellata* has been collected in northern and central Argentina, central Chile, and Minas Gerais in southeast Brazil. Its range probably spans much of central South America.

ETYMOLOGY. The specific name is derived from the Latin *flagellata* (whip) in reference to the whiplike projection from the phallus.

DISCUSSION. The ligulate, whiplike projection from the phallus is unique in the Adelidae. The forewing pattern is distinctive compared to most species of *Ceromitia*, though in a few specimens, it is similar to some individuals of *C. capitanea*.

PHAEOCEROS SPECIES GROUP

This group is primarily characterized by two pectinifers on the valva of the male genitalia, with the anterior end of saccus more than half the width of broadest part of the vinculum-saccus.

Ceromitia phaeoceros Meyrick

FIGURES 94, 95, 231, 343; MAP 6

Ceromitia phaeoceros Meyrick, 1921: 406.—Davis, 1984: 18.

ADULT. (Figures 94, 95). Wing expanse: ♂, 13 mm; ♀, 15 mm.

Head: Vertex white, with a few scattered fuscous scales at occiput. Frons darker, more suffused with fuscous. Antenna ~equal length in both sexes, 2.5–3.0× length of forewing; flagellum mostly pale fuscous, with a scattering of white dorsally over basal fifth; sensory cilia relatively short, ~0.5–0.9× diameter of shaft, slightly longer in male than female; scape whitish dorsally, heavily suffused with fuscous ventrally. Maxillary palpus white, short, less than 0.5× length of labial palpus. Haustellum long, nearly 3.0× length of labial palpus. Labial palpus grayish white, apical segment darker.

Thorax: Dorsum and tegula grayish white. Legs mostly fuscous, irrorated with grayish white to gray; apices of tarsomeres ringed with white; hindleg pale gray. Forewing pale gray, with a rather dense, irregular scattering of brownish fuscous scales; fringe light gray, heavily irrorated with brownish fuscous. Hindwing uniformly grayish.

Abdomen: Grayish dorsally, slightly paler ventrally.

Male Genitalia: (Figure 231). Uncus simple, subacute. Vinculum-saccus elongate, nearly 2.0× length of valva; anterior end of saccus distinctly cleft. Valva with 2 pairs of pectinifers, each consisting of 13–15 blunt spines; apex of cucullus evenly rounded. Juxta relatively simple in form; lateral margin shallowly concave with narrowest width of juxta at middle; anterior margin truncate. Phallus slightly sinuate (viewed laterally); apex with a broad, stout cornutus.

Female Genitalia: (Figure 343). Apex of ovipositor compressed; ventral edge serrate, considerably longer than dorsal edge. Vestibulum ~0.3× length of anterior apophysis. Ductus bursae short. Corpus bursae large, nearly 0.5× length of anterior apophysis.

LECTOTYPE. ♂ (present designation): "Parintins, Brazil, Parish, 10–19"; BM genitalia slide No. 15211; Meyrick Coll., BM 1938-290; photograph on file USNM; Lectotype ♂, *Ceromitia phaeoceros* Meyr., by D. Davis, (BMNH).

TYPE LOCALITY. BRAZIL: AMAZONAS: Parintins.

HOST. Unknown.

FLIGHT PERIOD. October; univoltine.

DISTRIBUTION. (Map 6). Known only from the type locality, Parintins, in Amazonas, Brazil.

MATERIAL EXAMINED. 2 males. BRAZIL: AMAZONAS: Parintins: 1 ♂ (lectotype), BMNH slide 15210 ♂; 1 ♂ (paralectotype), Oct 1919, Parish (BMNH).

DISCUSSION. In *Ceromitia*, the anterior end of the saccus is cleft only in this species and in *C. sciographa*. *Ceromitia phaeoceros*, however, possesses two pectinifers on each valva, whereas *C. sciographa* has only one.

***Ceromitia fuscata* Davis and Medeiros,
new species**

FIGURES 96, 232, 344; MAP 6

ADULT. (Figure 96). Wing expanse: ♂, 13 mm; ♀, 13 mm.

Head: Vertex and frons light to dark brown. Antenna approximately 2.5× length of forewing in ♂; scape very light whitish brown to dark brown; flagellum pale whitish brown to dark brown; sensory cilia ~1× width of flagellomere in ♂. Maxillary palpus light whitish brown to dark brown, relatively short, less than 0.3× length of labial palpus. Labial palpus light to dark brown.

Thorax: Dorsum, venter, and tegula very light to dark brown. Legs light brown to dark brown. Forewing light brown with a few dark brown scales, especially near termen, sometimes forming bands, or becoming uniformly dark brown; fringe light pale brown or brown. Hindwing uniformly light pale brown or brown.

Abdomen: Brown dorsally, paler ventrally.

Male Genitalia: (Figure 232). Uncus weakly bilobed. Vinculum-saccus elongate, ~1.75× length of valva; saccus broad distally, tapering to somewhat narrower, U-shaped and rounded anterior end. Valva with 2 pairs of distal pectinifers; basal-most pair bearing ~9–17 blunt spines, more apical pair with 4–15 blunt spines. Juxta elongate, constricted near anterior third, with anterior end sagittate and terminating in a bluntly rounded apex. Phallus elongate, ~1.75× length of valva, broad and curved at base.

Female Genitalia: (Figure 344). Apex of ovipositor compressed; ventral edge minutely serrulate, longer than dorsal edge. Vestibulum ~0.2× length of anterior apophysis. Ductus bursae ~0.1× length of anterior apophysis. Corpus bursae ~0.3× length of anterior apophysis.

HOLOTYPE. BRAZIL: RIO DE JANEIRO: Petropolis, 650 m: ♂, slide DRD 4623, BOLD ID RDOPP096-10, Genbank HQ971123, 10–20 Oct 1985, V. O. Becker (VOB).

PARATYPES. 2 males, 1 female. BRAZIL: MINAS GERAIS: Nova Lima: 1 ♂, slide USNM 130469 ♂, 26 Dec 1982, V. O. Becker (USNM). Serra do Cipó, 1,400 m: 1 ♀, slide USNM 130483, BOLD ID RDOPP038-10, Genbank HQ971077, 17–19 Apr 1991, V. O. Becker (USNM). SÃO PAULO: São Paulo, 900 m: 1 ♂, slide USNM 31757 ♂ 4623 ♂, 1–7 Jan 1983, V.O. Becker (VOB).

HOST. Unknown.

FLIGHT PERIOD. October to January.

DISTRIBUTION. (Map 6). Minas Gerais and Rio de Janeiro states in southeast Brazil.

ETYMOLOGY. From the Latin *fuscus* (dark) due to the dark coloration and bands on the forewing.

DISCUSSION. Significant wing pattern variation exists in the specimens of this species; however, the male genitalia are morphologically consistent. The male genitalia bear a close

resemblance to that of *C. karsholti*, but the posterior margin of the vinculum is convex in *C. fuscata*, whereas that of *C. karsholti* is very weakly bilobed.

***Ceromitia karsholti* Davis and Medeiros,
new species**

FIGURES 97–99, 233, 345; MAP 6

ADULT. (Figures 97–99). Wing expanse: ♂, 17–23 mm; ♀, 24 mm.

Head: Vertex and frons light brown. Antenna approximately 2.5× length of forewing; scape light brown; flagellum brown with fuscous annuli along entire length; sensory cilia ~1× width of flagellomere in ♂. Maxillary palpus pale brown, relatively short, less than 0.4× length of labial palpus. Labial palpus pale brown.

Thorax: Dorsum, venter, and tegula mottled light brown to dark fuscous. Fore- and midlegs dark brown dorsally, light brown ventrally; hindleg pale brown, tibia appearing shaggy with long, piliform scales. Forewing light brown with a suffusion of dark brown scales throughout, especially near termen, 3 large brown spots present on costal margin, several smaller brown spots present near ends of veins on termen and near apex along anal margin; 2 large brown spots on distal half of anal margin; fringe light brown. Hindwing uniformly pale brown.

Abdomen: Brown dorsally, paler ventrally.

Male Genitalia: (Figure 233). Uncus weakly bilobed. Vinculum-saccus elongate, ~2× length of valva; saccus broad, tapering somewhat to a U-shaped anterior apex. Valva with 2 pairs of distal pectinifers; the distal pectinifer ~15× longer than the proximal pectinifer and bearing ~17 blunt spines; the proximal pectinifer bearing ~15 blunt spines. Juxta elongate, with anterior end sagittate and terminating in a bluntly rounded apex. Phallus elongate, ~2× length of the valva.

Female Genitalia: (Figure 345). Apex of ovipositor compressed; ventral edge minutely serrulate, considerably longer than dorsal edge. Vestibulum ~0.25× length of anterior apophysis. Ductus bursae ~0.1× length of anterior apophysis. Corpus bursae ~0.25× length of anterior apophysis.

HOLOTYPE. ARGENTINA: NEUQUEN: Pucara, 630 m: ♂, slide USNM 3254 ♂, 15 May 1973, Schajovskoi (USNM).

PARATYPES. 9 males, 2 females. ARGENTINA: CHUBUT: El Bolson, Lago Puelo, 220 m: 1 ♂, slide DRD 4595 ♂, BOLD ID RDOPP116-10, Genbank HQ971140, 26 Feb 1979, Misión Científica Danesa (ZMUC). NEUQUEN: Pucara, 630 m: 2 ♂, 25 Mar–15 May 1973, Schajovskoi (USNM). CHILE: CONCEPCION: Parque Botánico Hualpén: 1 ♂, slide USNM 32122 ♂, 8 Oct 1998, T. Ogden (USNM). VALDIVIA: 20 km S Valdivia Rincon de la Piedra, 180 m: 5 ♂, 2 ♀ (one abdomen missing), slides USNM 4589 ♂, DRD 4593 ♂, DRD 4594 ♂, USNM 130453 ♂, USNM 34392 ♀, BOLD ID RDOPP120-10, BOLD ID RDOPP122-10, BOLD

ID RDOPPI23-10, 24 Sep 1981, Nielsen & Karsholt (USNM, ZMUC).

HOST. Unknown.

FLIGHT PERIOD. September to May.

DISTRIBUTION. (Map 6). Known from Concepción and Valdivia provinces in Chile and Chubut and Neuquen provinces in Argentina.

ETYMOLOGY. The specific name is a patronym for Ole Karsholt, who collected numerous Adelidae in southern South America during the Misión Científica Danesa expeditions.

DISCUSSION. The male genitalia closely resemble that of *C. fuscata*, but *C. karsholti* has a very weakly bilobed posterior margin of the vinculum, compared to the convex posterior margin of the vinculum in *C. fuscata*.

Ceromitia pallidofascia Davis and Medeiros, new species

FIGURES 100–101, 234; MAP 7

ADULT. (Figures 100–101). Wing expanse: ♂, 17 mm; ♀, unknown.

Head: Vertex and frons light brown. Antenna approximately 3× length of forewing in ♂; scape very light whitish brown; flagellum with alternating rings of pale whitish brown to dark brown; sensory cilia ~1× width of flagellomere in ♂. Maxillary palpus light whitish brown, relatively short, less than 0.3× length of labial palpus. Labial palpus light brown.

Thorax: Dorsum, venter, and tegula light brown. Legs brown. Forewing light brown with slightly darker brown scales forming 2 faint medial bands; fringe light pale brown. Hindwing uniformly light pale brown.

Abdomen: Light brown dorsally, paler ventrally.

Male Genitalia: (Figure 234). Uncus weakly bilobed. Vinculum-saccus ~1.25× length of valva; saccus broad distally, tapering very slightly to a broad, blunt anterior end. Valva with 2 pairs of distal pectinifers, each bearing ~10 blunt spines. Juxta broad, cylindrical. Phallus elongate, ~2.25× length of valva, becoming broad and curved at base.

Female Genitalia: Unknown.

HOLOTYPE. BRAZIL: São Paulo: 1 ♂, 1912, E. D. Jones, slide 19234 ♂ (BMNH).

HOST. Unknown.

FLIGHT PERIOD. Unknown.

DISTRIBUTION. (Map 7). States of Minas Gerais and Rio de Janeiro in southeastern Brazil.

ETYMOLOGY. The specific name is derived from the Latin *pallidus* (pale) and *fascia* (band), referring to the pale medial bands across the forewing of this species.

DISCUSSION. *C. pallidofascia* is similar to several other Brazilian species such as *C. fasciata*, *C. fuscata*, and *C. viscida* but possesses much fainter wing patterns and a distinctive cylindrical juxta that is significantly broader than that of *C. viscida*.

Ceromitia viscida Meyrick

FIGURES 102–103, 235, 346; MAP 7

Ceromitia viscida Meyrick, 1921: 405.—Pastrana, 1961: 194.—Davis, 1984: 18.

ADULT. (Figures 102–103). Wing expanse: ♂, 11–13 mm; ♀, 12 mm.

Head: Vertex and frons whitish with a few scattered, fuscous, piliform scales. Antenna 2.5–3.0× length of forewing, about equal length in both sexes; flagellum entirely white; scape white dorsally, fuscous ventrally; sensory cilia short, erect, usually varying from 0.7–0.9× diameter of shaft. Eyes relatively large in both sexes. Maxillary palpus whitish, short, slightly less than half the length of labial palpus, 3-segmented; segments of equal length. Haustellum long, over 2× the length of labial palpus. Labial palpus white.

Thorax: Dorsum and tegula whitish. Legs mostly whitish, irrorated with fuscous; foreleg darker; apices of tibial and tarsal segments faintly ringed with white. Forewing grayish-white, sparsely irrorated with brownish fuscous; darker scales frequently with whitish apex and more concentrated along costa and termen; cilia with grayish and brownish fuscous scales intermixed. Hindwing uniformly grayish-fuscous.

Abdomen: Grayish dorsally, more whitish ventrally.

Male Genitalia: (Figure 235). Uncus bilobed. Vinculum-saccus elongate, ~2× length of valva; saccus broad, U-shaped, with nearly parallel margins; anterior end bluntly rounded to subtruncate. Valva with 2 pairs of distal pectinifers, each bearing ~10–14 blunt spines. Juxta elongate, slender, simple. Phallus elongate, ~1.2× length of valva.

Female Genitalia: (Figure 346). Apex of ovipositor compressed; ventral and dorsal edges serrate. Vestibulum reduced, ~0.2× length of anterior apophysis. Ductus bursae short. Corpus bursae ~0.3× length of anterior apophysis.

LECTOTYPE. ♂ (present designation): "Parintins, Brazil; Parish 10–19; ♂ genitalia slide BMNH 15213; Meyrick Coll. BM 1938-290; Lectotype ♂, *Ceromitia viscida* Meyr., by D. Davis; Photograph on file USNM" (BMNH).

TYPE LOCALITY. Parintins, Amazonas, Brazil.

HOST. Unknown.

FLIGHT PERIOD. July to October; univoltine.

DISTRIBUTION. (Map 7). Known only from the type locality of Parintins, Amazonas, Brazil.

MATERIAL EXAMINED. 2 males, 1 female. BRAZIL: AMAZONAS: Parintins: 1 ♂ (lectotype), 10–19 [Oct 1919], Parish, slide BMNH 15213 ♂, BMNH; same data except: 1 ♂ (paralectotype), slide BMNH 19224 (BMNH). Pará: 1 ♀ (paralectotype), 7–19 [Jul 1919], Parish, slide BMNH 15214 ♀ (BMNH).

DISCUSSION. *Ceromitia viscida* has male genitalia very similar to that of *C. pallidofascia*, but the juxta of *C. pallidofascia* is broader and more cylindrical, while that of *C. viscida* is very narrow and only slightly wider than the phallus.

***Ceromitia paraguayensis* Davis and Medeiros, new species**

FIGURES 104, 236; MAP 6

ADULT. (Figure 104). Wing expanse: ♂, 13–15 mm; ♀, unknown.

Head: Vertex and frons whitish to pale brown. Antenna ~3× length of forewing in males; scape pale brown; flagellum light brown; sensory cilia present along basal third of flagellum in males, cilia approximately 1.5× width of antennal segments. Maxillary palpus pale brown, relatively short, less than 0.3× length of labial palpus. Labial palpus pale brown.

Thorax: Dorsum, venter, and tegula pale brown. Fore- and midlegs dark brown dorsally, light brown ventrally; hindleg light brown. Forewing mostly light brown, irrorated with dark brown scales, mostly near apices of veins along termen and also forming a spot near cell. Fringe light brown. Hindwing uniformly light brown.

Abdomen: Light brown dorsally, paler ventrally.

Male Genitalia: (Figure 236). Uncus smoothly rounded. Vinculum-saccus somewhat elongate, ~1.5× length of valva; saccus broad, U-shaped, with nearly parallel margins; anterior end bluntly rounded to subtruncate. Posterior margin of vinculum bilobed. Valva with 2 pairs of distal pectinifers, each bearing ~14 blunt spines. Juxta very elongate, slender, constricted near anterior apex, with anterior end sagittate and terminating in a bluntly rounded apex. Phallus elongate, ~2× length of valva, curved and broad near base.

Female Genitalia: Unknown.

HOLOTYPE. PARAGUAY: NUEVA ASUNCIÓN: Teniente Enciso: ♂, 26–28 Mar 1986, Pogue & Solis (USNM).

PARATYPES. 5 males. PARAGUAY: NUEVA ASUNCIÓN: Teniente Enciso: 5 ♂, slides USNM 130434 ♂, USNM 130436 ♂, USNM 130437 ♂, BOLD ID RDOPP152-10, 26–28 Mar 1986, Pogue & Solis (USNM).

HOST. Unknown.

FLIGHT PERIOD. 26–28 March 1986.

DISTRIBUTION. (Map 6). Known only from the type locality, Nueva Asunción Province in Paraguay.

ETYMOLOGY. The specific name refers to the type locality of this species, Paraguay.

DISCUSSION. Only two other *Ceromitia* species are known from Paraguay: *C. eremarcha* and *C. unipectinella*. Of these, *C. paraguayensis* has a significantly shorter vinculum-saccus.

***Ceromitia costaricaensis* Davis and Medeiros, new species**

FIGURES 105, 237, 347; MAP 6

ADULT. (Figure 105). Wing expanse: ♂, 12 mm; ♀, 13–14 mm.

Head: Vertex and frons light brown. Antenna broken in all specimens, but at least 2× length of forewing in males; scape light brown; flagellum light brown, ringed with brown annuli; sensory cilia visible in males on basal third of flagellum, length nearly the width of antennal segments. Maxillary palpus light brown, relatively short, less than 0.5× length of labial palpus. Labial palpus brown.

Thorax: Dorsum, venter, and tegula light brown. Fore- and midlegs dark brown dorsally and light brown ventrally; hindleg light brown. Forewing brown with a suffusion of dark brown scales, sometimes forming small spots, especially along termen; fringe light brown. Hindwing uniformly light brown.

Abdomen: Brown ventrally, paler ventrally.

Male Genitalia: (Figure 237). Uncus rounded. Vinculum-saccus elongate, ~1.25× length of valva; saccus broad, U-shaped, with nearly parallel margins; anterior end very bluntly rounded to subtruncate, nearly rectangular. Valva with 2 pairs of distal pectinifers, each bearing ~10–16 blunt spines. Juxta relatively slender, nearly same width as central part of phallus, with enlarged, bilobed, and expanded anterior end; caudal end membranous and slightly expanded. Phallus elongate, with an S-curve, ~1.5× length of valva.

Female Genitalia: (Figure 347). Apex of ovipositor compressed; ventral and dorsal edges serrulate. Vestibulum large, more than 0.5× length of anterior apophysis. Ductus bursae and corpus bursae similar in length, each greater than 0.25× length of anterior apophysis.

HOLOTYPE. COSTA RICA: PUNTARENAS: Quepos, 120 m, P. N. Manuel Antonio: ♂, slide USNM 31746 ♂, Dec 1990, G. Varela & R. Zuniga (USNM).

PARATYPES. 2 males, 4 females. COSTA RICA: LAS CRUCES: Near San Vito: 1 ♀, 19–20 Mar 1965, S. S. & W. D. Duckworth (USNM). PUNTARENAS: Quepos, 120 m, P. N. Manuel Antonio: 2 ♂, 3 ♀, slides USNM 130438 ♂, USNM 31747 ♀, Dec 1990, G. Varela & R. Zuniga (USNM).

HOST. Unknown.

FLIGHT PERIOD. December to March.

DISTRIBUTION. (Map 6). Las Cruces and Puntarenas provinces in Costa Rica.

ETYMOLOGY. The species name is derived from the country of origin, Costa Rica.

DISCUSSION. This is the only *Ceromitia* species known to occur in Costa Rica, and it represents the northernmost extent of the genus in the Americas. The male genitalia are similar to *C. paraguayensis*, but the posterior margin of the vinculum of the male genitalia is not bilobed in *C. costaricaensis*.

***Ceromitia ochrodyta* Meyrick**

FIGURES 106, 238; MAP 8

Ceromitia ochrodyta Meyrick, 1921: 405.—Pastrana, 1961: 194.—Davis, 1984: 18.

ADULT. (Figure 106). Wing expanse: ♂, 9.0–10.0 mm; ♀, unknown.

Head: Vertex white, with a few scattered dark scales; frons white, heavily intermixed with fuscous. Antenna elongate, 2.5–3.0× length of forewing; flagellum white, ringed with pale fuscous; sensory cilia long, 2.5× diameter of shaft; cilia reduced in number and length on distal 1/3; scape white dorsally, intermixed with fuscous; ~0.3× length of labial palpus. Haustellum long, nearly 3.0× length of labial palpus. Labial palpus grayish.

Thorax: Dorsum white, tegula heavily suffused with grayish fuscous. Legs brownish fuscous; apices of tibial and tarsal segments faintly ringed with white. Forewing pale brownish ochreous, with a sparse scattering of dark fuscous scales, the latter most noticeable at base of costa near apex of discal cell and along distal margin of wing. Hindwing paler, more gray.

Abdomen: Grayish dorsally, paler, more whitish ventrally.

Male Genitalia: (Figure 238). Uncus rounded. Vinculum-saccus ~1.5× length of valva, U-shaped; anterior margin broad, fully rounded; caudal margin subtruncate, slightly sinuate, not sharply cleft in middle; valva relatively slender, with 2 pectinifers; basal pair slightly larger, with 11–12 blunt spines; distal pair with 9–10 spines; apex of cucullus narrowly rounded.

Female Genitalia: Unknown.

LECTOTYPE. ♂ (present designation): “Parintins, Brazil, Parish, 10–19”; BM genitalia slide no. 15210; photograph on file USNM; lectotype ♂, *Ceromitia ochrodyta* Meyr. by D. Davis (BMNH).

TYPE LOCALITY. BRAZIL: AMAZONAS: Parintins.

HOST. Unknown.

FLIGHT PERIOD. October.

DISTRIBUTION. (Map 8). Known only from the type locality, Parintins in Amazonas, Brazil.

MATERIAL EXAMINED. 2 males. BRAZIL: AMAZONAS: Parintins: 1 ♂ (lectotype), BMNH slide 15210 ♂; 1 ♂ (paralectotype), Oct 1919, Parish (BMNH).

DISCUSSION. *Ceromitia ochrodyta* was not included in the key to species because the phallus and juxta were not available for study and are possibly lost. The vinculum-saccus and valva of this species are similar to those of *C. aphyoda*, but their forewing colors are somewhat distinctive with the forewings of *aphyoda* more uniformly white.

***Ceromitia aphyoda* Davis and Medeiros, new species**

FIGURES 17, 107, 239, 348; MAP 8

ADULT. (Figure 107). Wing expanse: ♂, 13.5–15.0 mm; ♀, 14.5 mm.

Head: Vertex and frons entirely white. Antenna very elongate in male, ~3× length of forewing; total length unknown in female (broken); scape white dorsally, light brown ventrally;

basal 1/4 to 1/3 of flagellum white, gradually becoming light brown over distal 2/3; sensory sensilla suberect, minute, usually less than diameter of flagellomere in length. Maxillary palpus white, relatively short, ~0.5–0.6× length of labial palpus; basal 1/4 of haustellum with white scales. Labial palpus entirely white.

Thorax: Dorsum and tegula white. Venter and legs white, except for dorsal surfaces of fore- and midlegs, which are brownish; hindleg almost entirely white. Forewing uniformly to white to rarely pale brown dorsally, pale brown ventrally; fringe uniformly white. Hindwing darker, more grayish.

Abdomen: Stramineous to pale brown dorsally, paler ventrally.

Male Genitalia: (Figure 239). Uncus evenly rounded. Vinculum-saccus elongate, ~1.25× length of valva; saccus broad, U-shaped, with nearly parallel margins; anterior end bluntly rounded to subtruncate. Valva with 2 pairs of distal pectinifers, each bearing ~13–15 blunt spines. Juxta elongate, constricted near anterior third, with anterior end sagittate and terminating in a bluntly rounded apex. Phallus elongate, ~1.6× length of valva.

Female Genitalia: (Figure 348). Apex of ovipositor compressed, asymmetrical, with ventral edge slightly longer, with ~4 minute serrations. Ductus bursae relatively short, approximately equaling length of corpus bursae.

HOLOTYPE. BRAZIL: PARANÁ: Castro, 1892–5, 1912–534, E. D. Jones (BMNH).

PARATYPES. 9 males, 1 female. BRAZIL: PARANÁ: Castro: 5 ♂, 1890–98, Jones, ♂ slide BMNH 19236, SEM BMNH 2869 (BMNH); 1 ♂, 1 ♀, ♂ slide USNM 18366, wing slide USNM 18367, ♀ slide USNM 18157, collection Wm. Schaus (USNM). Salto Grande de Paranapanema: 2 ♂, E. D. Jones (BMNH). São PAULO: São Paulo: 1 ♂, E. D. Jones (BMNH).

HOST. Unknown.

FLIGHT PERIOD. Unknown.

DISTRIBUTION. (Map 8). Known only from the type locality, Paraná province in Brazil.

ETYMOLOGY. The specific name is derived from the Greek *aphyodes* (white) in reference to the predominantly white forewing.

DISCUSSION. *Ceromitia aphyoda* has usually whitish wings (to rarely pale brown) without spots or darker scales; only *C. lobata* and *C. parvipectena* approach this wing pattern, and each of those species has some amount of darker scales or faint brown spots on the forewing.

***Ceromitia nigrifasciata* Davis and Medeiros, new species**

FIGURES 108, 240; MAP 6

ADULT. (Figure 108). Wing expanse: ♂, 11–13 mm; ♀, unknown.

Head: Vertex and frons brown. Antenna approximately 2.5× length of forewing in male; scape brown; flagellum brown; sensory cilia inconspicuous. Maxillary palpus pale brown, relatively short, less than 0.5× length of labial palpus. Labial palpus light brown with several prominent bristles, especially near apex of second segment.

Thorax: Dorsum, venter, and tegula dark brown. Legs brown; fore- and midlegs irrorated with dark brown. Forewing light brown with a heavy suffusion of dark brown scales scattered throughout, with several prominent and broad dark brown transverse bands, including antemedial, medial, and postmedial bands; area near apex of wing mostly dark brown with only a few light brown scales; spots present at apex of veins along termen. Fringe light brown. Hindwing uniformly brown.

Abdomen: Very dark brown dorsally, paler ventrally.

Male Genitalia: (Figure 240). Uncus weakly bilobed. Vinculum-saccus elongate, ~1.75× length of valva; saccus broad, U-shaped, with nearly parallel margins; anterior end bluntly rounded to subtruncate. Valva with 2 pairs of distal pectinifers, each bearing ~12 blunt spines. Juxta elongate, posterior end with an acute lobe projecting distally. Phallus elongate, ~1.75× length of valva, curved near base.

Female Genitalia: Unknown.

HOLOTYPE. BRAZIL: SANTA CATARINA: Nova Teutonia, 27°11'S, 52°23'W, 300–500 m: ♂, slide DRD 4656 ♂, Oct 1966, F. Plaumann (VOB).

PARATYPES. 2 males. BRAZIL: SANTA CATARINA: Nova Teutonia, 27°11'S, 52°23'W, 300–500 m: 2 ♂, slide USNM 18158 ♂, Oct 1963, F. Plaumann (USNM).

HOST. Unknown.

FLIGHT PERIOD. October.

DISTRIBUTION. (Map 6). Known only from the type locality, the state of Santa Catarina in southern Brazil.

ETYMOLOGY. The specific name is derived from the Latin *nigrum* (black) and *fasciatus* (to envelop with bands) in reference to the black bands along the forewing.

DISCUSSION. The forewings are significantly darker than for most other *Ceromitia* species. The male genitalia are unusual in that the posterior end of juxta has an acute lobe projecting caudally.

***Ceromitia fasciata* Davis and Medeiros, new species**

FIGURES 109, 110, 241, 349; MAP 7

ADULT. (Figures 109, 110). Wing expanse: ♂, 10–18 mm; ♀, 10–12 mm.

Head: Vertex and frons light brown. Antenna slightly longer in males than females, approximately 2.5× length of forewing in males, 2× length of forewing in females; scape brown; flagellum brown with dark brown annuli along basal half; sensory cilia inconspicuous. Maxillary palpus light brown, relatively

short, less than 0.5× length of labial palpus. Labial palpus light brown.

Thorax: Dorsum, venter, and tegula light brown. Forelegs and midlegs brown dorsally and pale brown ventrally, hindleg light brown. Forewing light brown with dark brown spots near apices of veins along all margins of wing; broad dark brown medial and postmedial bands, occasionally forewing without dark fascia; several dark brown spots scattered near termen; fringe light brown. Hindwing uniformly grayish brown.

Abdomen: Dark brown dorsally, paler ventrally.

Male Genitalia: (Figure 241). Uncus bilobed. Vinculum-saccus elongate, ~1–1.5× length of valva; saccus broad, margins nearly parallel; anterior end broadly rounded. Valva with 2 pairs of distal pectinifers, bearing ~10–14 blunt spines. Juxta elongate and relatively broad, anterior end sagittate. Phallus elongate, ~2× length of valva, with a single cornutus projecting from apex.

Female Genitalia: (Figure 349). Apex of ovipositor reduced, compressed; ventral edge minutely serrulate, slightly longer than straight dorsal edge. Vestibulum slender, ~0.33× length of anterior apophysis. Ductus bursae similar in length to vestibulum. Corpus bursae moderate in length, oval in form, ~0.4× length of anterior apophysis.

HOLOTYPE. BRAZIL: SANTA CATARINA: Rio Vermelho: ♂, slide DRD 3026 ♂, 24 Jan 1974, O. H. Mielke (VOB).

PARATYPES. 4 males, 3 females. BRAZIL: MINAS GERAIS: Caraça Monastery, Barão de Cacoais, SE of Belo Horizonte, 1,300 m: 1 ♀, BOLD ID RDOPP079-10, Genbank HQ971112, 25 Oct 1994, V. O. Becker & K. S. Sattler (VOB). Nova Lima, 850 m: 1 ♀, BOLD ID RDOPP018-10, 1–10 Jan 1985, V. O. Becker (VOB). 1 ♀, BOLD ID RDOPP089-10, Genbank HQ971118, 24 Dec 1987, V. O. Becker (USNM). 1 ♂, slide USNM 31759 ♂, BOLD ID RDOPP080-10, 30 Dec 1988, V. O. Becker (USNM). PARANÁ: Quatro Barras, Banhado, 800 m: 1 ♂, slide DRD 3246 ♂, 28 Dec 1970, Becker & Laroca (VOB). RIO DE JANEIRO: Petropolis, 650 m: 1 ♂, slide USNM 31761 ♂, BOLD ID RDOPP083-10, Genbank HQ971114, 10–20 Oct 1985, V. O. Becker (USNM). SÃO PAULO: São Paulo: 1 ♂, 1912, E. D. Jones (BMNH).

HOST. Unknown.

FLIGHT PERIOD. October to April.

DISTRIBUTION. (Map 7). Southern Brazil, from Minas Gerais state in the southeast, to Santa Catarina state in the south, to Rio de Janeiro in the east.

ETYMOLOGY. The specific name is derived from the Latin *fasciata* (banded) in reference to the dark brown medial and postmedial bands on the forewing.

DISCUSSION. *Ceromitia fasciata* is similar to *C. braziliensis* and *C. unicornuta*, and all three species occur in Brazil. Males of *C. braziliensis* have a narrower saccus than those of *C. fasciata*, and *C. fasciata* has a bilobed uncus, whereas that of *C. unicornuta* is truncate. *C. fasciata* also has prominent dark bands extending from the costal to the anal margin in the forewing.

***Ceromitia unicornuta* Davis and Medeiros,
new species**

FIGURES 111, 242; MAP 7

ADULT. (Figure 111). Wing expanse: ♂, 18 mm; ♀, unknown.

Head: Vertex and frons whitish. Antenna of unknown length [broken near apex] but at least 1.5× length of forewing; scape light brown; flagellum brown, ringed with dark brown annuli; sensory cilia present along basal portion of flagellum, length approximately 1× width of flagellomere. Maxillary palpus light brown with third segment brown, relatively short, less than 0.5× length of labial palpus. Labial palpus light brown, third segment brown.

Thorax: Dorsum, venter, and tegula light brown. Legs light brown. Forewing light brown, irrorated with a few brown scales; 2 small brown spots present near apex of discal cell; several faint brown spots at apices of veins along termen; fringe light brown. Hindwing uniformly light brown.

Abdomen: Not examined.

Male Genitalia: (Figure 242). Uncus evenly rounded. Vinculum-saccus elongate, ~1.75× length of valva; saccus broad, U-shaped, with nearly parallel margins; anterior end bluntly rounded to subtruncate. Valva with 2 distal pectinifers, each bearing ~9 blunt spines. Juxta elongate, relatively broad, slightly constricted near middle. Phallus elongate, curved, ~1.75× length of valva, with a single prominent cornutus projecting near apex.

Female Genitalia: Unknown.

HOLOTYPE. BRAZIL: SANTA CATARINA: Nova Teutonia, 27°11'S, 52°23'W, 300–500 m: ♂, slide USNM 16140 ♂, Sep 1966, F. Plaumann (USNM).

HOST. Unknown.

FLIGHT PERIOD. September.

DISTRIBUTION. (Map 7). Known only from the type locality, Santa Catarina state in southern Brazil.

ETYMOLOGY. The species name is derived from the Latin *uni* (one) and *cornutus* (horned) in reference to the prominent single cornutal spine in the male phallus.

DISCUSSION. *Ceromitia unicornuta* has male genitalia similar to *C. braziliensis* but with a broader saccus. The genitalia are also similar to that of *C. fasciata*; however, *C. unicornuta* has a truncate uncus, whereas that of *C. fasciata* is bilobed. *C. unicornuta* also lacks the dark bands along the forewing that are present in *C. fasciata*. All three species are known from Brazil. The unique male holotype is somewhat damaged with partially descaled, rubbed wings.

BRAZILIENSIS SPECIES GROUP

The *braziliensis* species group is characterized by the presence of two pectinifers on the valva of the male genitalia and the anterior end of saccus more than half the width of broadest part of vinculum-saccus.

***Ceromitia braziliensis*, Davis and Medeiros,
new species**

FIGURES 112, 243, 350; MAP 9

ADULT. (Figure 112). Wing expanse: ♂, 14 mm; ♀, 15–16 mm.

Head: Vertex and frons pale brown. Antenna broken in 2 female specimens but ~3× as long as forewing in ♂; scape light brown; flagellum brown; sensory cilia present, less than width of flagellomeres in length; flagellomeres ringed with dark brown annuli. Maxillary palpus brown, relatively short, less than 0.5× length of labial palpus. Labial palpus light brown.

Thorax: Dorsum, venter, and tegula light pale brown. Legs light brown. Forewing light brown, with a few dark brown scales scattered throughout; dark brown scales forming small irregular spots, especially along termen; fringe light brown. Hindwing light brown with darker scales clustered near apex of wing.

Abdomen: Dark brown dorsally, paler ventrally.

Male Genitalia: (Figure 243). Uncus apically lobed. Vinculum-saccus ovate, ~1.5× length of valva; posterior margin of vinculum rounded; margins of saccus narrowing and U-shaped anteriorly. Valva with 2 pectinifers, each bearing >10–15 blunt spines; sacculus with rounded, slightly projecting lobe. Juxta elongate, sagittate at anterior end. Phallus elongate, with several apical cornuti, ~1.75× length of valva.

Female Genitalia: (Figure 350). Apex of ovipositor compressed; ventral and dorsal edges serrate. Vestibulum well developed, ~0.25× length of anterior apophysis. Ductus bursae reduced, ~0.1× length of anterior apophysis; corpus bursae ~0.3× length of anterior apophysis.

HOLOTYPE. BRAZIL: PARÁ: Capitão Poço: ♂, slide USNM 130462 ♂, 25–31 Jan 1984, V. O. Becker (VOB).

PARATYPES. 2 females. BRAZIL: MINAS GERAIS: Caraça, 1,300 m: 1 ♀, slide USNM 34406 ♀, 25 Oct 1994, V. O. Becker (USNM). RIO DE JANEIRO: Teresópolis, 1,000 m: 1 ♀, 15 Jan 1985, V. O. Becker (VOB).

HOST. Unknown.

FLIGHT PERIOD. October and January.

DISTRIBUTION. (Map 9). Known from Pará, Minas Gerais, and Rio de Janeiro states of Brazil.

ETYMOLOGY. The species name is derived from the only country in which this species has been collected, Brazil.

DISCUSSION. *Ceromitia braziliensis* has male genitalia similar to *C. unicornuta* and *C. fasciata*, and all three species are known from Brazil, but unlike the latter two species, the saccus of *braziliensis* is narrowed anteriorly.

***Ceromitia concava* Davis and Medeiros,
new species**

FIGURES 113, 244, 351; MAP 9

ADULT. (Figure 113). Wing expanse: ♂, 11 mm; ♀, 12 mm.

Head: Vertex and frons whitish. Antenna broken in male specimen; ~1.7× length of forewing in female; scape brown; flagellum brown; flagellomeres ringed with dark brown annuli, sensory cilia inconspicuous. Maxillary palpus light brown, relatively short, less than 0.5× length of labial palpus. Labial palpus light brown.

Thorax: Dorsum and venter pale brown, tegula mottled dark brown and pale brown. Legs light brown. Forewing mostly light brown, irrorated with a few dark brown scales, mostly along costal margin. Fringe light brown. Hindwing uniformly light brown.

Abdomen: Brown dorsally, paler ventrally.

Male Genitalia: (Figure 244). Uncus reduced, with short, rounded apex. Vinculum concave at apex. Vinculum-saccus relatively short, ~1.2× length of valva; saccus broad posteriorly with nearly parallel margins, then tapering to a U-shaped, bluntly rounded anterior end. Valva with 2 distal pectinifers, each bearing ~10–14 blunt spines. Juxta elongate, nearly cylindrical, with posterior end obcordate and anterior end terminating bluntly. Phallus curved near base, ~1.2× length of valva.

Female Genitalia: (Figure 351). Apex of ovipositor compressed; ventral edge minutely serrulate, somewhat longer than serrulate dorsal edge. Vestibulum elongate, ~0.4× length of anterior apophysis. Ductus bursae reduced. Corpus bursae elongate, ~0.4× length of anterior apophysis.

HOLOTYPE. BRAZIL: PARANÁ: Telêmaco Borba: 1 ♂, slide USNM 130472 ♂, 13–19 Oct 1995, V. O. Becker (VOB).

PARATYPE. 1 female. BRAZIL: PARANÁ: Telêmaco Borba: 1 ♀, slide USNM 34570 ♀, 13–19 Oct 1995, V. O. Becker (USNM).

HOST. Unknown.

FLIGHT PERIOD. Mid-October.

DISTRIBUTION. (Map 9). Known only from the type locality, Paraná province in Brazil.

ETYMOLOGY. The species name *concava* is derived from the Latin *concavus* (hollowed or arched inward), in reference to the concave caudal margin of the vinculum.

DISCUSSION. The holotype male is partially descaled; consequently, the paratype female is associated with this male primarily based on locality data. The male genitalia of *C. concava* is most similar to that of *C. convexa* but differs in possessing a concave caudal margin of the vinculum and having the pectinifers located more distally on the valva.

***Ceromitia convexa* Davis and Medeiros,
new species**

FIGURES 114, 245, 352; MAP 9

ADULT. (Figure 114). Wing expanse: ♂, 13 mm; ♀, 13 mm.

Head: Vertex and frons stramineous. Antenna broken; scape stramineous; flagellum stramineous with brown annuli along entire length; sensory cilia ~1× width of flagellomere. Maxillary palpus broken. Labial palpus light brown.

Thorax: Dorsum, venter, and tegula stramineous. Foreleg brown dorsally, stramineous ventrally. Forewing mostly light brown, with brown scales scattered throughout, mostly near cell and along margins; fringe light brown. Hindwing uniformly light brown.

Abdomen: Light brown dorsally, more whitish ventrally.

Male Genitalia: (Figure 245). Uncus gently rounded, nearly truncate. Vinculum with caudal margin convex. Vinculum-saccus relatively short, ~1× length of valva; saccus broad posteriorly with nearly parallel margins, then tapering to a V-shaped anterior end. Valva with 2 distal pectinifers, each bearing ~8–13 blunt spines. Juxta elongate, constricted near basal third, with caudal end terminating in a deeply notched apex. Phallus mostly membranous, elongate, straight, ~1.3× length of valva.

Female Genitalia: (Figure 352). Apex of ovipositor compressed; ventral edge minutely serrulate, somewhat longer than serrulate dorsal edge. Vestibulum ~0.3× length of anterior apophysis. Ductus bursae reduced. Corpus bursae moderate in length, ~0.4× length of anterior apophysis.

HOLOTYPE. BRAZIL: SANTA CATARINA: São Joaquim, 1,400 m: ♂, slide DRD 5657 ♂, BOLD ID RDOPP082-10, Genbank HQ971113, 22–24 Jan 1983, V. O. Becker (VOB).

PARATYPE. 1 female. BRAZIL: SANTA CATARINA: São Joaquim, 1,400 m: 1 ♀, slide USNM 34569 ♀, BOLD ID RDOPP081-10, 22–24 Jan 1983, V. O. Becker (USNM).

HOST. Unknown.

FLIGHT PERIOD. Late January.

DISTRIBUTION. (Map 9). Known only from the type locality, Santa Catarina province in Brazil.

ETYMOLOGY. The species name *convexa* is derived from the Latin *convexus* (arched outward; protuberant), in reference to the convex lateral margins of the male vinculum.

DISCUSSION. *Ceromitia convexa* is very similar to *C. concava*, but the male genitalia differ from the latter in possessing a straight phallus, juxta broader anteriorly, and a slightly convex posterior margin of the vinculum. The pectinifers of these species are also located more toward the middle of the valva compared to *C. concava*.

PACHYPHALLA SPECIES GROUP

This unique species is characterized by a very broad phallus with robust anellar lobes.

***Ceromitia pachyphalla* Davis and Medeiros, new species**

FIGURES 115, 246; MAP 9

ADULT. (Figure 115). Wing expanse: ♂, 17 mm; ♀, unknown.

Head: Vertex and frons reddish brown. Antenna broken in the holotype; scape brown; flagellum brown; sensory cilia approximately 1.5× width of flagellomeres and present on basal portion of flagellum. Maxillary palpus light brown, relatively short, less than 0.5× length of labial palpus. Labial palpus light brown with several prominent bristles, especially near apex of second segment; third segment dark brown.

Thorax: Dorsum, venter, and tegula brown. Midleg dark brown dorsally, light brown ventrally; fore- and hindlegs missing. Forewing mostly solid brown irrorated with a few lighter and darker brown scales scattered throughout. Fringe brown. Hindwing uniformly brown.

Abdomen: Not examined.

Male Genitalia: (Figure 246). Uncus acutely bilobed. Vinculum-saccus elongate, ~2× length of valva; saccus broad posteriorly, gradually narrowing toward smoothly rounded and U-shaped anterior end. Valva with 2 distal pectinifers, each bearing ~7–9 blunt spines. Juxta relatively short, narrowed near anterior third; anterior end sagittate and bluntly rounded. Phallus elongate, broad, ~2× length of valva; apex acutely bilobed; 2 anellar lobes projecting from near apex.

Female Genitalia: Unknown.

HOLOTYPE. ARGENTINA: CHUBUT: Esquel, Lago Menéndez, El Sagrario Puerto, 600 m: ♂, slide DRD 4596 ♂, BOLD ID RDOPP118-10, Genbank HQ971142, 2–4 Jan 1982, Nielsen & Karsholt (ZMUC).

HOST. Unknown.

FLIGHT PERIOD. Early January.

DISTRIBUTION. (Map 9). Known only from the type locality, Chubut province in Argentina.

ETYMOLOGY. The specific name is derived from the Greek *pachys* (thick) and *phallos* (penis) in reference to the stout phallus.

DISCUSSION. No other *Ceromitia* species has such a broad phallus or such robust anellar lobes projecting from the phallus.

INAEQUALIS SPECIES GROUP

This group is primarily characterized by a strongly bifurcate anterior end of the saccus.

***Ceromitia inaequalis* Davis and Medeiros, new species**

FIGURES 116, 117, 247, 353; MAP 10

ADULT. (Figures 116, 117). Wing expanse: ♂, 11–22 mm; ♀, 14–18 mm.

Head: Vertex and frons light fuscous. Antenna longer in males than females, approximately 2.5× length of forewing in males, 2× length of forewing in females; scape light fuscous to brown; flagellum light fuscous; sensory cilia visible in males on basal half of flagellum, length nearly the width of flagellum. Maxillary palpus pale fuscous, relatively short, less than 0.5× length of labial palpus. Labial palpus pale fuscous.

Thorax: Dorsum, venter, and tegula mottled pale fuscous and brown. Fore- and midlegs dark brown dorsally and pale fuscous ventrally, hindleg light brown. Forewing pale gray irrorated with brown scales throughout; prominent brown spot present near anal margin; faint brown spots present along cubital vein and at the apex of veins on termen; fringe pale brown. Hindwing uniformly light brown.

Abdomen: Pale brown dorsally, paler ventrally.

Male Genitalia: (Figure 247). Uncus shallowly notched and bilobed. Vinculum-saccus very elongate, ~3× length of valva; saccus slender, lateral margins concave; anterior end bifurcate with resultant lobes somewhat asymmetrical in size. Valva with 2 distal pectinifers, the most distal pectinifer being longer and bearing ~15 blunt spines; proximal pectinifer bearing ~10 blunt spines. Juxta furcate posteriorly, elongate, slender, tapering to an acuminate anterior end. Phallus slender, elongate, ~3× length of valva, apex complex, with small spines and cornuti arranged along clavate apex.

Female Genitalia: (Figure 353). Apex of ovipositor compressed; ventral edge serrulate, considerably longer than dorsal edge. Vestibulum reduced. Ductus bursae strongly reduced and very short, and corpus bursae ~0.25× length of anterior apophysis.

HOLOTYPE. CHILE: SANTIAGO: Rio Colorado, ca. 40 km SE Santiago, 1,100 m: ♂, slide USNM 130406 ♂, 29–31 Oct 1981, D. & M. Davis (USNM).

PARATYPES. 28 males, 25 females. ARGENTINA: NEUQUÉN: C. Cura-Rincón León, 650 m: 1 ♂, slide USNM 130474 ♂, 15 Jan 1997, M. Gentili (USNM). Chapelco, Techos, 1400 m: 1 ♀, 3 Jan 1984, M. y P. Gentili (USNM). Lago Lacar, Pucará, 650 m: 1 ♂, slide 130428 ♂, BOLD ID RDOPP135-10, 26–27 Dec 1981, Nielsen & Karsholt (ZMUC). Lago Queñi, 875 m: 1 ♂, slide USNM 130479 ♂, 13 Jan 1984, M. y P. Gentili (USNM). CHILE: ACONCAGUA: Cuesta El Melón, ca. 8 km N La Celera, 500 m: 2 ♀, BOLD ID RDOPP053-10, Genbank HQ971092, 2–3 Nov 1981, D. & M. Davis (USNM). BIOBIO: Caledonia, E Mulchen, 750 m: 1 ♂, 20–23 Jan 1988, L. E. Peña (USNM). CAUQUENES: Alto Tregualemu, 500 m: 2 ♂, 10–12 Jan 1988, L. E. Peña (USNM). CHACABUCO: 6 km W Tiltit: 1 ♀,

15 Dec 1982 (USNM). 1 ♂, slide USNM 130411 ♂, BOLD ID RDOPP048-10, Genbank HQ971087, R. L. Brown (USNM). COQUIMBO: Cta. Cavilolen, NE Los Vilos: 1 ♂, 5 Feb 1986, L. E. Peña (USNM). LINARES: El Castillo, Malcho, E Parral, 750 m: 9 ♂, 2 ♀, 8–10 Jan 1988, L. E. Peña (USNM). CURICO: 10 km NW Rauco, 34°52'S, 71°21'W, 1 ♀, 2 Dec 1982, R. L. Brown (USNM). MALLECO: Cordillera de Las Raices, Lonquimay: 1 ♂, Feb 1980, L. E. Peña (USNM). MAULE: El Pantanillo, 17 km SE Constitución, 350 m: 2 ♂, 3 ♀, slide USNM 130405 ♂, BOLD ID RDOPP062-10, 28 Nov 1981, D. R. Davis (USNM). Rio Teno, ca. 40 km E Curico, 800 m: 1 ♂, 1 ♀, slides USNM 130407 ♂, USNM 130466 ♂, 25–27 Nov 1981, D. R. Davis (USNM). MELIPILLA: La Viluma, SE Melipilla, 350 m: 1 ♂, 15–17 Dec 1987, L. E. Peña (USNM). ÑUBLE: Alto Tregualemu, ca. 20 km SE Chovellen, 500 m: 1 ♂, 26–27 Jan 1979, D. & M. Davis & B. Akerbergs (USNM). Alto Tregualemu, ca. 20 km SE Chovellen, 500 m: 2 ♀, slide USNM 34413 ♀, BOLD ID RDOPP054-10, Genbank HQ971093, 1–3 Dec 1981, D. R. Davis (USNM). Las Trancas, 21 km E Recinto, near high waterfall, 1300 m: 1 ♀, 17 Jan 1979, D. & M. Davis & B. Akerbergs (USNM). Near coastal stream, 17.5 km S Curanipe, 50 m: 1 ♀, BOLD ID RDOPP009 10, 25 Jan 1979, D. & M. Davis & B. Akerbergs (USNM). OSORNO: Pucatrihue: 1 ♀, 26–31 Jan 1980, L. E. Peña (USNM). SANTIAGO: La Leonera, Coltauco: 3 ♂, slide USNM 130463 ♂, 12–13 Feb 1986, L. E. Peña (USNM). Nr. Pta. Yeso, ca. 70 km SE Santiago, 1,250 m: 1 ♂, 2 ♀, slide USNM 34400 ♀, 27–28 Oct 1981, D. & M. Davis (USNM). Rio Colorado, 40 km E Santiago: 1 ♀, 10 Dec 1982, R. L. Brown (USNM). Rio Colorado, ca. 40 km SE Santiago, 1,100 m: 1 ♂, 6 ♀, 29–31 Oct 1981, D. & M. Davis (USNM). VALDIVIA: Las Trancas, W La Union, 500 m: 1 ♂, 5–10 Feb 1988, L. E. Peña (USNM).

HOST. Unknown.

FLIGHT PERIOD. October to February.

DISTRIBUTION. (Map 10). The west-central Argentinian province of Neuquén, west to central Chile: north from the Coquimbo region, south to Osorno province, Chile.

ETYMOLOGY. The specific name is derived from the Latin *inaequalis* (unequal) in reference to the asymmetrical, bifurcate saccus.

DISCUSSION. Two male genitalic characters are useful in separating *C. inaequalis* from other *Ceromitia* species. First, the anterior end of the saccus in *inaequalis* is not only bifurcate but with the lobes asymmetrical in size. Second, the phallus of this species is complex, with small spines and cornuti arranged along a clavate apex.

***Ceromitia furcata* Davis and Medeiros, new species**

FIGURES 118, 248; MAP 10

ADULT. (Figure 118). Wing expanse: ♂, 15 mm; ♀, unknown.

Head: The head and forewings of the unique holotype are largely denuded. Length of antenna unknown due to loss of distal segments in unique type; sensory cilia visible on basal part of flagellum, ~1.5× width of flagellomeres.

Thorax: Forewings largely denuded, pale grayish brown. Scales of thorax similar in color to forewing, pale grayish brown. Hindleg light brown.

Abdomen: Vestiture pale grayish brown.

Male Genitalia: (Figure 248). Uncus bilobed. Vinculum-saccus elongate, ~2× length of valva; saccus broad posteriorly, tapering to narrow midsection, broadening again toward anterior end; anterior end deeply furcate. Valva with 2 distal pectinifers, bearing ~10 blunt spines. Juxta slender and elongate; posterior end furcate for one-third the length of entire juxta; anterior end broad. Phallus elongate, ~2× length of valva, forked; 2 anellar lobes projecting from the apex, ~0.8× length of valva.

Female Genitalia: Unknown.

HOLOTYPE. BRAZIL: AMAZONAS: Br. 319, km 102: ♂, slide USNM 130441 ♂, 30 Jul 1979, J. Arias (USNM).

HOST. Unknown.

FLIGHT PERIOD. July.

DISTRIBUTION. (Map 10). Known only from the type locality, Amazonas state in Brazil.

ETYMOLOGY. The specific name is derived from the Latin *furcata* (forked) in reference to the forked saccus and juxta.

DISCUSSION. The anellar lobes projecting from the phallus are of uncertain homology. The male genitalia of *C. furcata* are quite distinctive; the only other species with two pectinifers on each valva and a furcate anterior end of the saccus is *C. inaequalis*, which has a much narrower vinculum and without anellar lobes projecting from the phallus.

LATIJUXTA SPECIES GROUP

This group is characterized by the presence of one pectinifer on the valva of the male genitalia and the anterior end of the saccus being less than half the width of the broadest part of the vinculum-saccus.

***Ceromitia tubulifolia* Parra & Ogden**

FIGURES 54–57, 119, 250, 354; MAP 11

Ceromitia tubulifolia Parra and Ogden, 2011: 560.

All following descriptions and illustrations of the adult and immature stages have been summarized, with minor revision, from Parra and Ogden (2011).

ADULT. (Figure 119). Wing expanse: ♂ 17 mm; ♀, 19 mm.

Head: Vertex and frons yellowish white in color. Maxillary palpus 3-segmented, 2× longer than eye diameter. Haustellum extended, scaled, 2 galea totally associated. Eyes

without setae, enlarged, nearly the size of entire head. Antenna filiform, $\sim 1.25\times$ length of forewing in males, covered with sensilla; $1.4\times$ length of forewing in females; covered with sensory cilia and 2 rows of scales per flagellomere in both sexes; pecten absent.

Thorax: Dorsum, venter, and tegula yellowish white. Forewing mostly yellowish white, irrorated with dark brown bands and scales; brown spots located at apex of some veins, especially along termen. Fringe yellowish white. Hindwing uniformly metallic white.

Abdomen: Yellowish white dorsally, paler ventrally.

Male Genitalia: (Figure 250). Uncus smoothly rounded. Vinculum-saccus elongate, $\sim 2\times$ length of valva; saccus broad posteriorly, tapering to a narrow U-shaped anterior end. Valva with a single elongate distal pectinifer, bearing ~ 25 blunt spines. Juxta constricted near the middle of its length, with anterior end sagittate and terminating in a slender, sharp, pointed apex. Phallus simple, elongate, $\sim 2.25\times$ length of valva.

Female Genitalia: (Figure 354). Apex of ovipositor compressed; ventral and dorsal edges serrate. Vestibulum and ductus bursae each $\sim 0.25\times$ length of anterior apophysis. Corpus bursae $\sim 0.3\times$ length of anterior apophysis.

HOST. Larva polyphagous, feeding from a portable case on surrounding leaf litter in a sclerophyllous forest.

LARVA. (Figures 54, 56–57). “Total length of last instar 7–10 mm. Body slightly flattened, cream to yellow in color with darkly pigmented sclerotized head and plates. Head: Mostly prognathous; 4 well-developed stemmata present. Thorax: Dorsal plates on T1. Spiracle lacks prespiracular sclerite. L setae group trisetose on T1. SV group bisetose on T1 and unisetose on T2 and T3. Legs well developed, 4-segmented; trochanter reduced to a very short segment; tarsal claw is well developed. Abdomen: Prolegs on A3–A6 with a uniordinal, circular row of crochets. SV group trisetose. A10 with dark anal plate and with 3 pair of setae; anal proleg with uniordinal, penellipse crochets” (Parra and Ogden 2011: 561–562).

LARVAL CASE. (Figure 55). Length ~ 6 mm. Case constructed from a single piece of leaf rolled into a tube, with openings at both ends. The larva feeds from one end of the tube and defecates from the other.

HOLOTYPE. CHILE: CONCEPCIÓN: Península de Hualpén. ♂, 31 Oct 1997 (UCCC-MZUC).

HOST. Unknown; larvae polyphagous, with first instars beginning to feed in leaf litter after descending to the forest floor (Parra and Ogden 2011).

FLIGHT PERIOD. Estimated to be from late October to early February; univoltine.

DISTRIBUTION. (Map 11). Currently known only from the Peninsula of Hualpén and Colcura in Concepción province in the Biobío region of Chile.

DISCUSSION. The male genitalia of *C. tubulifolia* are most similar to that of *C. sinuata*, with the latter possessing a more complex phallic apex and more constricted vinculum saccus than present in *C. tubulifolia*. Although the species reportedly

was described from 5 adults and 14 larvae, it was not possible to borrow any specimens of this species for further study.

The oviposition site is unknown. First instar larvae were reported by Parra and Ogden to live freely in leaf litter. Probably by the second instar, the larvae construct a portable case from a leaf, by rolling the leaf into a tube open at both ends, which is held together by a circular pattern of silk. Larvae continue to grow in this case, moving by their forelegs while dragging or holding the case. The larva sometimes reverses its position in the case, feeding from the opposite end. The last instar appears to have a diapause period, although it may possibly feed throughout the winter. Pupation takes place inside the leaf case.

***Ceromitia sinuata* Davis and Medeiros, new species**

FIGURES 120, 249; MAP 11

ADULT. (Figure 120). Wing expanse: ♂, 13–18 mm; ♀, unknown.

Head: Vertex and frons light brown. Antenna approximately $2\times$ length of forewing in males; scape light brown; flagellum light brown; sensory cilia visible along basal third of flagellum, length nearly equal to width of flagellum. Maxillary palpus light brown, relatively short, less than $0.5\times$ length of labial palpus. Labial palpus light brown with up to 15 prominent, dark bristles.

Thorax: Dorsum, venter, and tegula light brown. Legs light brown; foreleg dark brown dorsally; apices of tibial segments ringed with white on foreleg. Forewing mottled light brown, brown, and dark brown throughout; fringe pale brown. Hindwing uniformly pale brown.

Abdomen: Pale light brownish gray dorsally, paler ventrally.

Male genitalia: (Figure 249). Uncus elongate, terminating in a bluntly bilobed apex. Vinculum-saccus elongate, $\sim 2\times$ length of valva; saccus broad with nearly parallel margins along posterior half of its length, margins along anterior half tapering to a rounded anterior end. Posterior margin of vinculum strongly convex. Valva with a single distal pectinifer bearing ~ 35 blunt spines. Juxta elongate, with anterior end sagittate and posterior margin forked. Phallus $\sim 1.25\times$ length of valva, terminating with 2 cornutal spines.

Female Genitalia: Unknown.

HOLOTYPE. CHILE: OSORNO: Parque Nacional Puyehue, Anticura, 350 m: ♂, slide DRD 4591 ♂, BOLD ID RDOPP103-10, Genbank HQ971130, 19 Nov 1981, Nielsen & Karsholt (ZMUC).

PARATYPES. 7 males. CHILE: ARAUCA: Caramavida: 1 ♂, slide USNM 21229, 17–19 Oct 1969, Flint & Barria (USNM). OSORNO: Parque Nacional Puyehue, Anticura, 350 m: 6 ♂, slides USNM 34713, 130451 ♂, BOLD ID RDOPP110-10, Genbank HQ971135, 18–19 Nov 1981, Nielsen & Karsholt (USNM, ZMUC).

HOST. Unknown.

FLIGHT PERIOD. October and November.

DISTRIBUTION. (Map 11). Known only from the provinces of Arauco and Osorno in central Chile.

ETYMOLOGY. The specific name is derived from the Latin *sinuatus* (curved, bent) in reference to the diagnostic, strongly curved caudal margin of the vinculum in the male genitalia.

DISCUSSION. This species can be differentiated from a closely related species, *C. tubulifolia*, by the presence of a bilobed uncus and the presence of anellar lobes or projections from the phallus. *Ceromitia tubulifolia* has a non-bilobed uncus and simple phallus.

***Ceromitia barilochensis* Davis and Medeiros, new species**

FIGURES 121, 251, 355; MAP 12

ADULT. (Figure 121). Wing expanse: ♂, 18–19 mm; ♀, 17 mm.

Head: Vertex and frons light brown. Antenna approximately 2× length of forewing in ♂; between 1.3× and 2× length of forewing in ♀; scape very light whitish brown; flagellum pale whitish brown proximally becoming brown distally; sensory cilia ~0.8× width of flagellomere in ♂. Maxillary palpus light brown, relatively short, less than 0.5× length of labial palpus. Labial palpus light brown.

Thorax: Dorsum, venter, and tegula very light brown except anterior margin of tegula dark brown. Fore- and midlegs dark brown dorsally, light brown ventrally; hindleg pale brown, tibia appearing shaggy in ♂ with long, piliform scales. Forewing light brown with a stripe of dark brown scales extending laterally down the middle of wing from the base to the proximal portion of cell and with a white stripe faintly visible apical to brown stripe; a small brown spot near distal portion of cell; a suffusion of whitish and darker brown scales along costal margin of wing; fringe light pale brown. Hindwing uniformly light pale brown.

Abdomen: Brown dorsally, paler ventrally.

Male Genitalia: (Figure 251). Uncus rounded, terminating in a relatively blunt apex. Vinculum-saccus elongate, ~2× length of valva; saccus broad with rounded margins along posterior half of its length; margins along anterior half tapering to a truncate apex. Valva with a single distal pectinifer bearing ~15 blunt spines. Juxta elongate, with anterior end sagittate and terminating in a bluntly rounded apex. Phallus elongate, ~2× length of valva.

Female Genitalia: (Figure 355). Apex of ovipositor compressed; ventral edge serrulate, slightly longer than dorsal edge. Vestibulum slightly enlarged with rugose walls; junction of ductus spermathecae from anterior end of vestibulum adjacent to ductus bursae. Ductus bursae relatively short, less than length of vestibulum. Corpus bursae greatly enlarged, ~0.8× length of posterior apophysis.

HOLOTYPE. ARGENTINA: RIO NEGRO: San Carlos de Bariloche, Colonia Suiza, 810 m: ♂, slide USNM 3316 ♂, 9 Nov 1978, Misión Científica Danesa (ZMUC).

PARATYPES. 1 male, 3 females. ARGENTINA: RIO NEGRO: San Carlos de Bariloche, Colonia Suiza, 810 m: 1 ♂, 3 ♀, slides DRD 3313 ♂, DRD 4540 ♀, USNM 34440 ♀, BOLD ID RDOPP031, 9 Nov–11 Dec 1978 (USNM, ZMUC).

HOST. Unknown.

FLIGHT PERIOD. November to December.

DISTRIBUTION. (Map 12). Known only from the type locality, Rio Negro province in southern Argentina.

ETYMOLOGY. The specific name refers to the type locality, San Carlos de Bariloche.

DISCUSSION. This species has similar male genitalia to *C. latijuxta*; however, the wing pattern is distinctive, with a brown band running laterally down the middle of wing from the base to the proximal portion of the discal cell. *Ceromitia barilochensis* occurs in Argentina, whereas *C. latijuxta* is currently only known from Chile.

***Ceromitia latijuxta* Davis and Medeiros, new species**

FIGURES 122, 252, 356; MAP 12

ADULT. (Figure 122). Wing expanse: ♂, 14–18 mm; ♀, 14–18 mm.

Head: Vertex and frons light brown to stramineous. Antenna ~2× length of forewing in males and 1.5× length of forewing in females; scape and flagellum light brown; sensory cilia inconspicuous in females but nearly the width of flagellomeres in males, especially along basal half of flagellum. Maxillary palpus light brown, relatively short, less than 0.5× length of labial palpus. Labial palpus light brown with third segment dark brown.

Thorax: Dorsum, venter, and tegula light brown to stramineous. Femur and tibia brown dorsally and light brown ventrally. Forewing mostly stramineous with darker scales scattered throughout; a series of dark spots along the costa at the apices of veins and a dark spot situated at apex of discal cell; sometimes a fainter dark spot located near midpoint of wing; fringe very pale stramineous. Hindwing uniformly light brown.

Abdomen: Pale brown dorsally, paler ventrally.

Male Genitalia: (Figure 252). Uncus weakly bilobed. Vinculum-saccus elongate, ~2× length of valva; saccus broader posteriorly, slightly narrowing anteriorly to a broad, U-shaped apex. Valva with a single distal pectinifer, each bearing ~16–18 blunt spines. Juxta somewhat elongate, with anterior end sagittate and terminating in a broad, bluntly rounded apex. Phallus elongate, ~1.75× length of valva.

Female Genitalia: (Figure 356). Apex of ovipositor compressed, nearly symmetrical, with ventral edge minutely serrulate. Vestibulum slender, ~0.2× length of anterior apophysis. Ductus bursae short, 0.1× length of anterior apophysis. Corpus bursae reduced in size, slender, less than 0.2× length of anterior apophysis.

HOLOTYPE. CHILE: ARAUCO: Caramavida: ♂, slide USNM 21227 ♂, 17–19 Oct 1969, Flint & Barria (USNM).

PARATYPES. CHILE: MALLECO: 1 male, 3 females. Rio Manzanares: 1 ♂, 2 ♀, slides USNM 130465 ♂, USNM 21230 ♀, 19 Oct 1969, Flint & Barria (USNM). VALDIVIA: 20 km S Valdivia, Rincon de la Piedra, 180 m: 1 ♀, 24 Sep 1981, Nielsen & Karsholt (ZMUC).

HOST. Unknown.

FLIGHT PERIOD. September to October (univoltine).

DISTRIBUTION. (Map 12). From Arauco province to Valdivia province in Chile.

ETYMOLOGY. The specific name is derived from the Latin *latis* (broad) in reference to the broad juxta compared to other similar species.

DISCUSSION. The male genitalia are similar to that of *C. barilochensis* but with a significantly broader juxta in *C. latijuxta*.

***Ceromitia bicornuta* Davis and Medeiros, new species**

FIGURES 123, 253; MAP 11

ADULT. (Figure 123). Wing expanse: ♂, 16 mm; ♀, unknown.

Head: Vertex and frons brown. Antenna of both specimens broken but at least 2× length of forewing; scape brown; flagellum brown; sensory cilia inconspicuous. Maxillary palpus light brown, relatively short, less than 0.5× length of labial palpus. Labial palpus brown.

Thorax: Dorsum, venter, and tegula stramineous. Legs light brown to brown. Forewing mostly brown, with suffusion of white and black scales throughout, mostly in center of wing distal to cell; a brown spot situated at apex of discal cell; fringe brown. Hindwing uniformly light brown.

Abdomen: Not examined.

Male Genitalia: (Figure 253). Uncus bilobed. Vinculum-saccus elongate, ~2× length of valva; saccus broad posteriorly, tapering to a truncate anterior end. Valva with a single distal pectinifer, each bearing ~14–18 blunt spines. Juxta elongate, constricted near anterior third, with anterior third sagittate, anterior end bluntly rounded. Phallus elongate, ~2.5× length of valva, terminating with 2 cornutal spines.

Female Genitalia: Unknown.

HOLOTYPE. ARGENTINA: NEUQUÉN: Lago Lacar, Pucara, 750 m: ♂, slide USNM 3252 ♂, BOLD ID RDOPP035-10, Genbank HQ971074, 10 Nov 1978, Misión Científica Danesa (ZMUC).

PARATYPE. 1 male. ARGENTINA: NEUQUÉN: San Martín de los Andes, 640 m: 1 ♂, slide USNM 130457, BOLD ID RDOPP132-10, 17–31 Oct 1981, Nielsen & Karsholt (USNM).

HOST. Unknown.

FLIGHT PERIOD. October to November (univoltine).

DISTRIBUTION. (Map 11). Known only from the type locality, Neuquén province in Argentina.

ETYMOLOGY. The specific name is derived from the Latin *bi* (two) and *cornutus* (horn) in reference to the two cornuti that are present at the apex of the phallus.

DISCUSSION. This is the only *Ceromitia* species with two large, prominent cornuti at the apex of the phallus.

***Ceromitia petila* Davis and Medeiros, new species**

FIGURES 124, 254, 357; MAP 11

ADULT. (Figure 124). Wing expanse: ♂, 16 mm; ♀, 18 mm.

Head: Vertex and frons light brown. Antenna approximately 2× length of forewing in male, shorter in female; scape and flagellum light brown; sensory cilia nearly width of flagellomeres in male, visible along basal third of flagellum. Maxillary palpus light brown, relatively short, less than 0.5× length of labial palpus. Labial palpus light brown with third segment brown.

Thorax: Dorsum, venter, and tegula stramineous. Legs stramineous. Forewing mostly stramineous with few darker scales near termen; 2 small darker spots in discal cell, one near base, one near apex; fringe pale stramineous. Hindwing uniformly light brown.

Abdomen: Not examined.

Male Genitalia: (Figure 254). Uncus smoothly rounded. Vinculum-saccus elongate, ~2× length of valva; saccus broad, especially posteriorly; margins tapering along anterior third; anterior end rounded and U-shaped. Valva with a single distal pectinifer, each bearing ~20 blunt spines; base of valva broad. Juxta elongate, slender, with anterior end attenuate and narrow. Phallus elongate, ~2× length of valva, slightly broad near base.

Female Genitalia: (Figure 357). Apex of ovipositor compressed; ventral edge serrate, considerably longer than dorsal edge; anterior margin of dorsal edge with prominent toothlike structure. Vestibulum and ductus bursae relatively small. Corpus bursae ~0.25× length of anterior apophysis.

HOLOTYPE. CHILE: ÑUBLE: Shangri-la, SW side Volcan Chillan, 1,600 m: ♂, slide USNM 21228 ♂, BOLD ID RDOPP006-10, Genbank HQ971054, 19–21 Jan 1979, D. & M. Davis & B. Akerbergs (USNM).

PARATYPE. 1 female. CHILE: VALDIVIA: 20 km S Valdivia Rincon de la Piedra, 180 m: 1 ♀, slide DRD 4658 ♀, 24 Sep 1981, Nielsen & Karsholt (ZMUC).

HOST. Unknown.

FLIGHT PERIOD. September to January.

DISTRIBUTION. (Map 11). Known from Ñuble and Valdivia provinces in Chile.

ETYMOLOGY. The specific name is derived from the Latin *petilus* (thin, slender) in reference to the slender juxta.

DISCUSSION. The male genitalia of *C. petila* have a narrower juxta compared to most other species. The genitalia

are most similar in form to *C. nielsenii* but lack the winglike projections on the base of the phallus characteristic of that species and also have placement of the pectinifer closer to the apex of the valva.

***Ceromitia beckeri* Davis and Medeiros, new species**

FIGURES 125, 255, 358; MAP 11

ADULT. (Figure 125). Wing expanse: ♂, 11–12 mm; ♀, 12 mm.

Head: Vertex and frons light fuscous. Antenna approximately 1.5× length of forewing in males; scape light brown to brown; flagellum light brown to brown; sensory cilia inconspicuous. Maxillary palpus pale fuscous to brown, relatively short, less than 0.5× length of labial palpus. Labial palpus pale fuscous to brown.

Thorax: Dorsum, venter, and tegula light brown to brown. Fore- and midlegs dark brown dorsally and pale fuscous ventrally, hindleg light brown. Forewing pale brown to brown, irrorated with darker scales especially forming faint small brown spots or bands near the apices of veins along the costa and termen. Fringe light brown. Hindwing uniformly light brown.

Abdomen: Light fuscous dorsally, paler ventrally.

Male Genitalia: (Figure 255). Uncus rounded, with one blunt projection at apex. Vinculum-saccus elongate, ~1.5× length of valva; saccus broad posteriorly with nearly parallel margins; tapering sharply along its length to a truncate anterior end. Valva with a single distal pectinifer, each bearing ~13 blunt spines. Juxta elongate, elliptic at posterior end, tapering to a sharply pointed anterior end. Phallus elongate, ~2× length of valva.

Female Genitalia: (Figure 358). Apex of ovipositor asymmetrical, dorsal side smooth and ventral edge oblique and slightly serrated. Vestibulum, ductus bursae, and corpus bursae all relatively well developed, each nearly 0.3× length of anterior apophysis.

HOLOTYPE. BRAZIL: RIO DE JANEIRO: Cach. do Macau, 800 m: ♂, slide DRD 4592 ♂, BOLD ID RDOPP086-10, Genbank HQ971116, 15 Oct 1985, V. O. Becker (VOB).

PARATYPES. 2 males, 1 female. BRAZIL: RIO DE JANEIRO: Petropolis, 650 m: 1 ♂, BOLD ID RDOPP015-10, Genbank HQ971060, 10–20 Oct 1985, V. O. Becker (VOB). SANTA CATARINA: São Joaquim, 1,400 m: 1 ♂, slide USNM 130473 ♂, 25 Oct 1995, V. O. Becker (USNM). SÃO PAULO: Jacupiranga, 800 m: 1 ♀, slide USNM 34403 ♀, BOLD ID RDOPP088-10, 8 Feb 1993, V. O. Becker (USNM).

HOST. Unknown.

FLIGHT PERIOD. October (univoltine).

DISTRIBUTION. (Map 11). Rio de Janeiro and Santa Catarina provinces in Brazil.

ETYMOLOGY. The specific name *beckeri* is a patronym in honor of Vitor O. Becker, who collected the type series.

DISCUSSION. *Ceromitia beckeri* has male genitalia most similar to *C. nielsenii*. These two species can be easily separated by the absence of a pair of winglike projections from the base of the phallus that occur on *C. nielsenii*; *C. beckeri* is only known from Brazil.

SCIOGRAPHA SPECIES GROUP

This group is characterized by the presence of one pectinifer on the valva of the male genitalia and a very broad and slightly bilobed vinculum-saccus.

***Ceromitia sciographa* Meyrick**

FIGURES 126, 256; MAP 13

Ceromitia sciographa Meyrick, 1921: 406.—Clarke, 1970: 117.—Pastrana, 1961: 194.—Davis, 1984: 18.

ADULT. (Figure 126). Wing expanse: ♂, 17.0 mm; ♀, unknown.

Head: Vertex white, intermixed with a few fuscous scales; frons [largely denuded in holotype] apparently with a greater proportion of fuscous scales than gray or white. Antenna 2.5–3.0× length of forewing; flagellum gray, faintly banded with darker shade of gray; scape more whitish, slightly irrorated with gray; sensory cilia minute, ~0.3× diameter of shaft, somewhat appressed. Maxillary palpus grayish, ~0.6× length of labial palpus. Haustellum ~2.0× length of labial palpus. Labial palpus grayish.

Thorax: Dorsum and tegula grayish white. Legs mostly grayish; tibial and tarsal segments darker with apices faintly ringed with white. Forewing pale gray, faintly traversed by 6–8 irregular and partially interrupted, narrow bands of fuscous; fringe uniformly gray. Hindwing grayish fuscous.

Abdomen: Grayish dorsally, slightly paler ventrally.

Male Genitalia: (Figure 256). Uncus prominently bilobed. Vinculum-saccus U-shaped; anterior margin relatively blunt, slightly concave; length ~1.3× that of valva. Valva relatively broad at base; cucullus rounded, slightly enlarged; a single pectinifer present consisting of 16 blunt spines.

Female Genitalia: Unknown.

TYPE. Holotype, ♂ (BMNH).

TYPE LOCALITY. Obidos, Pará, Brazil.

HOST. Unknown.

FLIGHT PERIOD. September (univoltine).

DISTRIBUTION. (Map 13). Known only from the type locality, Obidos, Pará, Brazil, which is located at an elevation of approximately 80 m.

MATERIAL EXAMINED. 1 male. BRAZIL: Obidos, 1 ♂; holotype, September, Parish (BMNH).

DISCUSSION. Within known *Ceromitia*, the anterior end of the saccus is slightly concave in only this species and in *C. phaeoceros*. *Ceromitia phaeoceros* has two pectinifers on each valva, whereas *C. sciographa* has only one.

LATAPICULA SPECIES GROUP

This group is characterized by the presence of one pectinifer on the valva of the male genitalia and a broad base of the phallus.

***Ceromitia latibasis* Davis and Medeiros,
new species**

FIGURES 127, 257, 359; MAP 13

ADULT. (Figure 127). Wing expanse: ♂, 10–14 mm; ♀, 10–13 mm.

Head: Vertex and frons light brown. Antenna broken in female specimens, approximately 2× length of forewing in males; scape brown; flagellum brown; sensory cilia inconspicuous. Maxillary palpus pale brown, relatively short, less than 0.5× length of labial palpus. Labial palpus pale brown.

Thorax: Dorsum, venter, and tegula light brown. Foreleg dark brown dorsally and pale brown ventrally, mid- and hindlegs light brown. Forewing predominantly light brown, irrorated with dark brown scales, some of which form a basal streak or faint brown spots along cubital vein and sometimes at the apex of veins on termen; fringe light brown. Hindwing uniformly light brown.

Abdomen: Light brown dorsally, paler ventrally.

Male Genitalia: (Figure 257). Uncus weakly bilobed. Vinculum-saccus elongate, ~2.5× length of valva; saccus broader posteriorly, narrowing anteriorly to a rodlike, U-shaped anterior end. Valva with a single distal pectinifer bearing ~18 blunt spines. Juxta elongate, widened near middle, with furcate apex. Phallus elongate, ~2.5× length of valva.

Female Genitalia: (Figure 359). Apex of ovipositor compressed; ventral edge minutely serrulate, considerably longer than dorsal edge. Vestibulum elongate, ~0.5× length of anterior apophysis. Ductus bursae reduced. Corpus bursae moderate in length, ~0.3× length of anterior apophysis, with a large accessory bursa arising from middle of corpus bursae.

HOLOTYPE. BRAZIL: PARANÁ: Quatro Barras, Banhado, 800 m: ♂, slide DRD 3027 ♂, 6 Feb 1970, Becker & Laroca (VOB).

PARATYPES. 1 male, 2 females. BRAZIL: PARANÁ: Curitiba, 900 m: 1 ♀, 27 Feb 1970, T. Dairiki (VOB). SANTA CATARINA: Rio Negro, Paraná, 800 m: 1 ♂, 1 ♀, slides USNM 34402 ♀, USNM 91806 ♂, 25 Aug 1970, Becker (USNM).

HOST. Unknown.

FLIGHT PERIOD. August to February.

DISTRIBUTION. (Map 13). Paraná and Santa Catarina states in southern Brazil.

ETYMOLOGY. The specific name is derived from the Latin *latus* (broad) and *basis* (foundation) in reference to the broad base of the male valva.

DISCUSSION. This species can be distinguished from *C. latapicula* in that *C. latibasis* has a shorter juxta ~1/3 the length of the phallus and no small cornuti present. *Ceromitia*

latibasis occurs in Brazil, whereas *C. latapicula* is known from Chile and Argentina.

***Ceromitia latapicula* Davis and Medeiros,
new species**

FIGURES 128, 258, 360; MAP 13

ADULT. (Figure 128). Wing expanse: ♂, 14–17 mm; ♀, 14–17 mm.

Head: Vertex and frons light brown. Antenna longer in males than females, approximately 2× length of forewing in males, 1.5× length of forewing in females; scape brown; flagellum brown; sensory cilia inconspicuous. Maxillary palpus pale brown, relatively short, less than 0.5× length of labial palpus. Labial palpus pale brown with several prominent bristles at apex of second segment.

Thorax: Dorsum, venter, and tegula light brown. Fore- and midlegs dark brown dorsally and pale brown ventrally, hindleg light brown. Forewing predominantly light brown, irrorated with dark brown scales forming small brown spots along cubital vein and at the apex of veins on all wing margins. Fringe light brown. Hindwing uniformly light brown.

Abdomen: Light brown dorsally, paler ventrally.

Male Genitalia: (Figure 258). Uncus very weakly bilobed to flat along apex. Vinculum-saccus elongate, ~3× length of valva; saccus tapering toward nearly truncate anterior end. Valva with a pair of distal pectinifers, each bearing ~18 blunt spines; in some specimens, pectinifer of one valva notched, giving the appearance of 2 pectinifers being present on only one side. Juxta elongate, bifurcate posteriorly, constricted near anterior third, with anterior end attenuate. Phallus elongate, ~3.5× length of valva, dozens of spinulae caudal to apex and ~10 small cornuti near apex; apex complex with wall of phallus divided into at least 3 projections, with one large cornutus present; base of phallus stout.

Female Genitalia: (Figure 360). Apex of ovipositor compressed; ventral edge minutely serrulate, considerably longer than dorsal edge. Vestibulum elongate, ~0.25× length of anterior apophysis. Ductus bursae and corpus bursae each ~0.3–0.4× length of anterior apophysis.

HOLOTYPE. CHILE: CHILOE ID: Hueque Trumao, 22 km N Quellon, 50 m: ♂, slide USNM 130439 ♂, BOLD ID RDOPP138-10, 26–27 Dec 1981, D. R. Davis (USNM).

PARATYPES. 10 males, 5 females. ARGENTINA: RIO NEGRO: SAN CARLOS DE BARILOCHE, Colonia Suiza, 810 m: 3 ♂, slide USNM 3314 ♂, BOLD ID RDOPP033-10, Genbank HQ971072, 9 Dec 1978–1 Jan 1979, Misión Científica Danesa (USNM). CHILE: CHILOE ID: 1 km E Lago Tepuhueico, ca. 40 air km SW Castro, ca. 100 m: 1 ♂, 1 ♀, BOLD ID RDOPP063-10, Genbank HQ971100, 23–25 Dec 1981, D. R. Davis (USNM). MALLECO: Rio Manzanares: 1 ♀, slide USNM 21232 ♀, 19 Oct 1969, Flint & Barria (USNM). ÑUBLE: Alto Tregualemu, ca. 20 km SE Chovellen, 500 m: 2 ♀,

slide USNM 34409 ♀, BOLD ID RDOPP065-10, Genbank HQ971101, 1–3 Dec 1981, D. R. Davis (USNM). OSORNO: Anticura, Puyehue: 1 ♂, 19–29 Oct 1985, L. E. Peña (USNM). Parque Nacional Puyehue, Aguas Calientes, 450 m: 1 ♂, 25 Sep 1981, Nielsen & Karsholt (ZMUC). Parque Nacional Puyehue, Anticura, 350 m: 4 ♂, 1 ♀, slides USNM 130447 ♂, USNM 130449 ♂, BOLD IDs RDOPP104-10, RDOPP106-10, Genbank HQ971131, HQ971132, 17 Nov–18 Dec 1981, Nielsen & Karsholt (USNM, ZMUC).

HOST. Unknown.

FLIGHT PERIOD. September to January.

DISTRIBUTION. (Map 13). Rio Negro province in Argentina and from Ñuble to Chiloe provinces in Chile.

ETYMOLOGY. The specific name is derived from the Latin *latus* (broad) and *apiculus* (tip, top, diminutive of apex) in reference to the broad end of the phallus.

DISCUSSION. *Ceromitia latapicula* and *C. latibasis* have very similar male genitalia, but *C. latapicula* has a longer juxta, ~1/2 length of phallus, and small cornuti are present. *Ceromitia latapicula* is found in Chile and Argentina, whereas *C. latibasis* is currently known only from Brazil.

SCHAJOVSKOII SPECIES GROUP

This group is characterized by the presence of one pectinifer on the valva of the male genitalia, and a large lobe projecting from the sacculus of the valva.

Ceromitia laninensis Pastrana

FIGURES 129, 259; MAP 14

Ceromitia laninensis Pastrana, 1961: 194.—Davis, 1984: 18.

ADULT. (Figure 129). Wing expanse: ♂, 19–24 mm; ♀, 21 mm.

Head: Vertex and frons very pale brown. Antenna approximately 2.5× length of forewing in males; scape light brown; flagellum light brown; sensory cilia visible in males on basal half of flagellum, approximately the width of flagellum. Maxillary palpus pale brown, relatively short, less than 0.5× length of labial palpus. Labial palpus pale brown.

Thorax: Dorsum and venter light brown; tegula mottled pale brown and brown. Foreleg dark brown dorsally and pale fuscous ventrally, mid- and hindlegs light brown. Forewing pale brown irrorated with brownish and whitish scales throughout, sometimes forming irregular small spots or streaks. Fringe pale brown. Hindwing uniformly light brown.

Abdomen: Light brown dorsally, paler ventrally.

Male Genitalia: (Figure 259). Uncus bilobed. Vinculum-saccus elongate, ~1.25× length of valva; saccus tapering along entire length of margin to a V-shaped anterior end. Valva with one or 2 distal pectinifers, each bearing ~6–13 blunt spines; sacculus with a rounded apical lobe. Juxta constricted near anterior

third, with anterior end sagittate and V-shaped. Phallus elongate, ~1.25× length of valva.

Female Genitalia: Unknown.

HOLOTYPE. ARGENTINA: NEUQUÉN: Parque Nacional Lanín, Cerro Malo, 1,700 m, 19 Dec 1954: ♂ (MACN).

TYPE LOCALITY. Neuquén Province, Argentina.

HOST. Unknown.

FLIGHT PERIOD. 11–21 December (univoltine).

DISTRIBUTION. (Map 14). Known from Neuquén and Rio Negro provinces in Argentina.

MATERIAL EXAMINED. 5 males. ARGENTINA: NEUQUÉN: Parque Nacional Lanín, Cerro Malo, 1,700 m, 21 Dec 1958: 1 ♂, Schajovskoi (USNM). NEUQUÉN: Parque Nacional Lanín, Cerro Malo, 19 Dec 1954: 1 ♂, slide USNM 1878 ♂, J. A. Pastrana (USNM). RIO NEGRO: 8: Lago Nahuel Huapi: Puerto Blest, 770 m: 2 ♂, 17–18 Dec 1978, slides USNM 3319 ♂, USNM 3320 ♂, BOLD IDs RDOPP034-10, RDOPP036-10, Genbank HQ971073, HQ971075, Misión Científica Danesa (USNM, ZMUC). San Carlos de Bariloche: Colonia Suiza, 810 m: 1 ♂, 11 Dec 1978, Misión Científica Danesa (ZMUC).

DISCUSSION. Three male genitalia have been dissected (slide DRD 1878 [illustrated]; DRD 3319 & 3320 [not illustrated]). Genitalia slide 3320 is different from the other two only in possessing two pectinifers per valva, whereas the other two slides (and Pastrana's original description) indicate one pectinifer per valva. However, because the COI sequence data indicate a close relationship between the specimens with dissections (slides 3319 and 3320), and considering that all the other genitalic characters are the same, we consider the number of pectinifers to be variable in this species. The male genitalia of *C. laninensis* are similar to those of *C. exserta* except the caudal margin of the uncus is more deeply bilobed in *laninensis* and the sacculus of the valva is more broadly rounded than in *exserta*.

Although Pastrana reported five female paratypes in his original description, he did not illustrate or describe the female genitalia of *C. laninensis*. Because these females were not available for the current study, we were not able to illustrate the genitalia of this sex.

Ceromitia exserta Davis and Medeiros, new species

FIGURES 130, 260, 361; MAP 14

ADULT. (Figure 130). Wing expanse: ♂, 24 mm; ♀, 18 mm.

Head: Vertex and frons very light brown. Antenna ~2× length of forewing in male; scape brown; flagellum brown; sensory cilia present in male, length ~1× width of flagellomere. Maxillary palpus brown, relatively short, less than 0.5× length of labial palpus. Labial palpus brown.

Thorax: Dorsum and venter pale brown, tegula mottled dark and pale brown. Fore- and midlegs dark brown dorsally, light brown ventrally; hindleg light brown. Forewing mostly

light brown, irrorated with a few brown and dark brown scales, mostly on distal and caudal sections of wing. Fringe light brown. Hindwing uniformly light brown.

Abdomen: Brown dorsally, paler ventrally.

Male Genitalia: (Figure 260). Uncus bilobed. Vinculum-saccus relatively short, $\sim 1\times$ length of valva; saccus broad posteriorly; anterior half strongly tapering to V-shaped anterior end. Sacculus with a narrowly rounded and projecting apical lobe, nearly as long as pectinifer. Valva with a single distal pectinifer, bearing ~ 15 blunt spines. Juxta relatively short, constricted near anterior half, sagittate anteriorly with an attenuate and slender anterior end. Phallus elongate, $\sim 1.5\times$ length of valva.

Female Genitalia: (Figure 361). Apex of ovipositor compressed; ventral edge minutely serrulate, considerably longer than dorsal edge. Vestibulum reduced, $\sim 0.1\text{--}0.2\times$ length of anterior apophysis. Ductus bursae and corpus bursae each $\sim 0.3\text{--}0.33\times$ length of anterior apophysis.

HOLOTYPE. CHILE: Los Lagos: ♀, slide USNM 34582, 8 Dec 1994, digital image captured, L. Peña/Ugarte (USNM).

PARATYPES. 2 males. CHILE: LOS LAGOS: 2 ♂, slide USNM 130470 ♂, 8 Dec 1994, L. Peña/Ugarte (USNM).

HOST. Unknown.

FLIGHT PERIOD. December (univoltine).

DISTRIBUTION. (Map 14). Known only from the type locality, Los Lagos region in Chile.

ETYMOLOGY. The specific name is derived from the Latin *exsertus* (projecting), in reference to the apical lobe projecting from the sacculus of the male valva.

DISCUSSION. The lobe projecting from the male sacculus is significant in length but more slender compared to that in *C. laninensis*. The male genitalia are similar to *C. petila*, although the juxta of *C. exserta* is more robust.

Ceromitia schajovskoi Pastrana

FIGURES 131, 261, 362; MAP 14

Ceromitia schajovskoi Pastrana, 1961: 200.—Davis, 1984: 18.

ADULT. (Figure 131). Wing expanse: ♂, 13–22 mm; ♀, 14–22 mm.

Head: Vertex and frons mottled gray and fuscous. Antenna slightly longer in males than females, approximately $2\times$ length of forewing in males, $1.5\times$ length of forewing in females; scape light brown; flagellum light brown; sensory cilia present in males along basal third of flagellum; length of cilia \sim equal to length of flagellomere. Maxillary palpus pale light brown, relatively short, less than $0.5\times$ length of labial palpus. Labial palpus pale light brown with several prominent bristles, especially near apex of second segment, third segment dark brown.

Thorax: Dorsum, venter, and tegula mottled brown and fuscous. Fore- and midlegs dark brown dorsally and pale brown ventrally, hindleg light brown. Forewing pale fuscous, irrorated

with light and dark brown scales; dark brown scales grouped to form spots at apex of veins on all wing margins; several faint spots throughout wing, with the darkest typically near apex of discal cell; a dark brown spot usually present along anal margin near middle of wing, this spot sometimes tending to form a transverse medial band extending from anal margin to cubital vein; a partial dark brown subbasal band present from costal margin to medial vein. Fringe pale fuscous. Hindwing uniformly light brown.

Abdomen: Dark brown dorsally, paler ventrally.

Male Genitalia: (Figure 261). Uncus bilobed. Vinculum-saccus elongate, $\sim 2.25\times$ length of valva; a large, elongate lobe arising from near the posterior margin of vinculum; margins of saccus gradually narrowing toward a rounded, U-shaped anterior end. Valva with a single pectinifer, bearing ~ 18 blunt spines; sacculus with rounded, projecting lobe. Juxta elongate, constricted near anterior end, with anterior end sagittate and bluntly rounded terminally. Phallus elongate, slightly curved, $\sim 2.25\times$ length of valva.

Female Genitalia: (Figure 362). Apex of ovipositor compressed; ventral edge minutely serrulate, considerably longer than dorsal edge. Vestibulum reduced. Ductus bursae relatively long, $\sim 0.4\times$ length of anterior apophysis. Corpus bursae nearly $0.3\times$ length of anterior apophysis.

HOLOTYPE. ARGENTINA: NEUQUÉN: Parque Nacional Lanín, Pucará: ♂, Dec 1956, J. A. Pastrana (MACN).

TYPE LOCALITY. ARGENTINA: NEUQUÉN: Parque Nacional Lanín, Pucará.

HOST. Unknown.

FLIGHT PERIOD. September to March.

DISTRIBUTION. (Map 14). From Neuquén to Chubut provinces in Argentina and from Malleco to Osorno provinces in Chile and the state of Bahia in Brazil.

MATERIAL EXAMINED. 170 males, 233 females. ARGENTINA: CHUBUT: El Bolsón, Lago Puelo, 250 m: 2 ♂, 9 ♀, 22–23 Oct 1981, Nielsen & Karsholt (ZMUC). El Maiten, 700 m: 7 ♀, 16 Jan 1986, M. y P. Gentili (USNM). Esquel, Lago Menéndez, El Sagrario Puerto, 600 m: 2 ♂, 2–4 Jan 1982, Nielsen & Karsholt (ZMUC). NEUQUÉN: Lago Lacar, Caritire, 650 m: 1 ♂, 19 Sep 1984, M. y P. Gentili (USNM). Lago Lacar, Nonthue, 640 m: 2 ♀, 2 Dec 1983, M. y P. Gentili (USNM). Lago Lacar, Nonthue, 650 m: 5 ♂, 17 ♀, 7–16 Nov 1982, slide USNM 130432 ♂, BOLD ID RDOPP141-10 (USNM). Lago Lacar, Trompul, 1,000 m: 2 ♂, 6 Dec 1983, M. y P. Gentili (USNM). Lago Lacar, Yuco, 950 m: 1 ♀, 4 Oct 1983, M. y P. Gentili (USNM). Lago Lacar, 5 km E of Hua-Hum, 640 m: 5 ♂, 17 ♀, 14 Oct–27 Dec 1981, Nielsen & Karsholt (ZMUC). Lago Lacar, Pucará, 650 m: 1 ♂, 26–27 Dec 1981, Nielsen & Karsholt (ZMUC). Lago Lolog, Estancia Lolog, 940 m: 1 ♂, 3 ♀, 7–17 Oct 1981, Nielsen & Karsholt (ZMUC). Paso Cordoba, 1,300 m: 2 ♀, 21 Jan 1984, M. y P. Gentili (USNM). Paso Puyehue, 1,350 m: 1 ♂, 1 ♀, 11 Jan 1985, M. y P. Gentili (USNM). Quilahuintos (1,000 m): 1 ♂, 3 ♀, 4 Oct 1980, M. Gentili (USNM). San Martín de los Andes, Cerro Chapelco, 8 ♂, 2 ♀, 1,400–1,600 m:

12 Nov–25 Dec 1981, Nielsen & Karsholt (ZMUC). San Martín de los Andes, Piedra Trompul, 1,000 m: 2 ♂, 1 ♀, 20 Sep–15 Oct 1981, Nielsen & Karsholt (ZMUC). San Martín de los Andes (640 m): 2 ♀, 15 Sep–30 Oct 1980, M. Gentili (USNM). San Martín de los Andes, 640 m: 5 ♂, 8 ♀, 1 Oct 1982–26 Mar 1983 & 10 Sep 1983, slide USNM 130442 ♂, M. y P. Gentili (USNM). San Martín de los Andes: 1 ♂, 1 ♀, 15–20 Oct 1979, M. O. Gentili (USNM). San Martín de los Andes, 640 m: 9 ♂, 40 ♀, 18 Aug–15 Nov 1981, slide USNM 130458 ♂, BOLD IDs RDOPP133-10, BOLD ID RDOPP134-10, RDOPP136-10, Nielsen & Karsholt (USNM, ZMUC). RIO NEGRO: El Bolson: 1 ♀, 19 Sep 1961, Gy. Topál (ZMUC). El Bolson, 480 m: 1 ♀, 19 Oct 1961, Gy. Topál (ZMUC). El Bolson, 850 m: 1 ♀, 4 Oct 1961, Gy. Topál (ZMUC). El Bolson, Cerro Piltriquitron: 1 ♀, 14 Sep 1961, Gy. Topál (ZMUC). El Bolson, Rio Azul, 300 m: 2 ♂, 4 Oct 1961, Gy. Topál (ZMUC). Rio Nahuel Huapi, Puerto Blest, 770 m: 1 ♂, 1 ♀, 26 Dec 1978–1 Jan 1979, Misión Científica Danesa (ZMUC). San Carlos de Bariloche, Colonia Suiza, 800 m: 105 ♂, 74 ♀, 15 Sep 1981–7 Jan 1982, slides USNM 130425 ♂, 130455 ♂, 130456 ♂, BOLD IDs RDOPP126-10, RDOPP127-10, RDOPP129-10, HQ971143, HQ971144, Nielsen & Karsholt (USNM, ZMUC). San Carlos de Bariloche, Colonia Suiza, 810 m: 9 ♂, 25 ♀, 6–22 Nov 1978, slides USNM 3317 ♂, USNM 16394 ♂, BOLD IDs RDOPP023-10, RDOPP024-10, Genbank HQ971065, HQ971066, Misión Científica Danesa (USNM, ZMUC). San Carlos de Bariloche, Pampa del Toro, 900 m: 1 ♀, 22–23 Oct 1981, Nielsen & Karsholt (ZMUC). BRAZIL: BAHIA: Camacan Res. Serra Bonita 800 m, 15°23'S, 39°33'W: 1 ♂, 4 ♀, 24 Nov–2 Dec 2013, B. Landry & V. Becker (VOB). CHILE: MALLECO: Nahuelbuta, Los Gringos, 37°48'S, 73°01'W: 2 ♂, 15–17 Dec 1993, C. & O. Flint Jr. (USNM). OSORNO: Parque Nacional Puyehue, Aguas Calientes, 450 m: 1 ♂, 25 Sep 1981, slide USNM 130450 ♂, BOLD ID RDOPP109-10, Genbank HQ971134, Nielsen & Karsholt (USNM). VALDIVIA: 20 km S Valdivia Rincon de la Piedra, 180 m: 3 ♂, 8 ♀, 15 Nov–24 Sep 1981, slide USNM 130464 ♂, Nielsen & Karsholt (USNM, ZMUC).

DISCUSSION. This common species has, in the male genitalia, a vinculum with a large, elongate lobe arising from near the posterior margin. There is also a rounded lobe projecting from the sacculus. As mentioned under *Ceromitia ilyodes*, *C. schajovskoi* may actually be a junior synonym of *ilyodes* because the size and maculation of their females closely agree and they have similar distributions. Until more specimens, particularly males of *ilyodes*, can be collected from the type locality, or COI analysis be compared, their relationships will remain questionable.

***Ceromitia cerastia* Davis and Medeiros, new species**

FIGURES 132, 133, 262, 363; MAP 15

ADULT. (Figures 132, 133). Wing expanse: ♂, 13 mm; ♀, 13–15.5 mm.

Head: Vertex and frons light brown. Antenna ~2× length of forewing in male; ~1.3× length of forewing in female; scape light brown; flagellum brown; sensory cilia inconspicuous. Maxillary palpus light brown, relatively short, less than 0.5× length of labial palpus. Labial palpus brown.

Thorax: Dorsum and venter pale brown, tegula brown. Legs light brown. Forewing mostly brown, irrorated with a few light brown scales, mostly near anal margin and termen. Fringe light brown. Hindwing uniformly light brown.

Abdomen: Not examined.

Male Genitalia: (Figure 262). Uncus relatively broad, width equaling length, with truncate apex. Vinculum with prominent hornlike process arising from caudal margin, nearly 0.6× length of entire vinculum-saccus. Vinculum-saccus long, ~1.5× length of valva; saccus broad with nearly parallel margins along entire length, with abruptly truncated anterior end. Valva with a single distal pectinifer, bearing ~15 blunt spines; sacculus broad, approximately equal to length of valva. Juxta strongly sagittate anteriorly. Phallus curved near base, ~2× length of valva.

Female Genitalia: (Figure 363). Apex of ovipositor compressed; dorsal edge smooth, ventral edge with minute serrations. Vestibulum relatively slender, reduced, ~0.2× length of anterior apophysis. Ductus bursae and corpus bursae well developed, about 0.3× and 0.4×, respectively, the length of anterior apophysis.

HOLOTYPE. ARGENTINA: RIO NEGRO: San Carlos de Bariloche, Colonia Suiza, 810 m: ♂, slide DRD 3317 ♂, 3 Jan 1979, Misión Científica Danesa (ZMUC).

PARATYPES. 2 females. ARGENTINA: RIO NEGRO: San Carlos de Bariloche, Colonia Suiza, 810 m: 1 ♀, 3 Nov 1978 (ZMUC); 1 ♀, 11 Jan 1979, slide USNM 34642, Misión Científica Danesa (USNM).

HOST. Unknown.

FLIGHT PERIOD. November to January.

DISTRIBUTION. (Map 15). Known only from the type locality, Rio Negro province in southern Argentina.

ETYMOLOGY. The name *cerastia* is derived from the Greek *kerastes* (horned) in reference to the prominent hornlike process arising from the caudal margin of the male vinculum.

DISCUSSION. The male genitalia of this species are unique among all known *Ceromitia* in possessing an elongate, hornlike process arising from the midcaudal margin of the vinculum. The length of the process is nearly 0.6 the length of the entire vinculum-saccus. The sacculus of the valva is also unusually developed and approximately equal to the length of the entire valva.

NIELSENI SPECIES GROUP

This group is characterized by the presence of one pectinifer on the valva of the male genitalia and a very elongate vinculum-saccus.

***Ceromitia elongata* Davis and Medeiros,
new species**

FIGURES 16, 134, 263; MAP 16

ADULT. (Figure 134). Wing expanse: ♂, 23–24 mm; ♀, unknown.

Head: Vertex and frons pale brown. Antenna approximately 2.5× length of forewing in male; scape pale brown; flagellum light brown, ringed with brown annuli; sensory cilia visible in male on basal third of flagellum, nearly the width of flagellum. Maxillary palpus pale brown, relatively short, less than 0.5× length of labial palpus. Labial palpus pale brown with several prominent bristles along second segment.

Thorax: Dorsum and venter light brown to brown; tegula mottled light brown and brown. Foreleg dark brown dorsally and light brown ventrally, mid- and hindlegs light brown. Forewing very light brown, irrorated with brown scales, especially along subcostal and cubital veins; a small brown spot present near apex of discal cell; light brown spots barely visible at apices of veins along termen. Fringe light brown. Hindwing uniformly pale brown.

Abdomen: Light brown dorsally, paler ventrally.

Male Genitalia: (Figure 263). Uncus smoothly rounded. Vinculum-saccus very long, almost 3.0× length of valva; saccus attenuated anteriorly, rodlike. Valva with a single elongate pectinifer, with ~35–40 blunt spines. Juxta spherical at posterior end, with apical half sagittate. Phallus long, nearly equal to length vinculum-saccus; apex of phallus with several minute cornuti.

HOLOTYPE. COLOMBIA: NARIÑO: Volcan Galeras, 2,900 m: ♂, 13 Jan 1959, J. F. G. Clarke (USNM).

PARATYPE. 1 male. COLOMBIA: NARIÑO: Volcan Galeras, 2,900 m: 1 ♂, 13 Jan 1959, slide USNM 20103, J. F. G. Clarke (USNM).

HOST. Unknown.

FLIGHT PERIOD. 13 Jan 1959 (univoltine; only 2 specimens known, both for same date).

DISTRIBUTION. (Map 16). Known only from the type locality, Nariño Department in Colombia.

ETYMOLOGY. The specific name is derived from the Latin *elongatus* (to prolong), in reference to the elongate saccus and valva.

DISCUSSION. The male genitalia of this species are most similar to that of *C. eremarcha* in possessing the most elongate vinculum saccus in the genus. The male valvae of the two species differ in the development of the pectinifer, with that of *C. elongata* consisting of a single elongate comb, whereas that of *C. eremarcha* is divided into two combs. Currently, *C. elongata* is the only *Ceromitia* species known from Colombia.

***Ceromitia brevipectinella*, Davis and Medeiros,
new species**

FIGURES 135, 136, 264, 364; MAP 16

ADULT. (Figures 135, 136). Wing expanse: ♂, 13–17 mm; ♀, 13–17 mm.

Head: Vertex and frons brown. Antenna of equal length in both sexes, approximately 2× length of forewing; scape very light brown; flagellum light brown with dark gray annuli along entire length; sensory cilia inconspicuous. Maxillary palpus light brown, relatively short, less than 0.5× length of labial palpus. Labial palpus brown.

Thorax: Dorsum, venter, and tegula stramineous. Legs light brown, apices of tibial segments ringed with white. Forewing mostly pale stramineous, with a series of ~5 dark brown spots along the costa; another dark brown spot situated at apex of discal cell; 1–2 variably developed brown transverse bands near base of wing with nearly white scales between them; fringe pale brown. Hindwing uniformly light brown.

Abdomen: Light brown dorsally, paler ventrally.

Male Genitalia: (Figure 264). Uncus bilobed. Vinculum-saccus very elongate, ~4.5× length of valva; saccus broad, with margins gradually tapering to slightly narrowed, truncate anterior end. Valva with a single, reduced, distal pectinifer, bearing ~12–18 short, stout spines. Juxta very elongate, slender, with anterior end rounded to attenuated. Anellar lobes very slender and elongate, 0.35–0.8× length of juxta. Phallus elongate, with a single, curved cornutus projecting from apex; length ~4.5× that of valva.

Female Genitalia: (Figure 364). Apex of ovipositor compressed; ventral and dorsal edges finely serrate. Vestibulum moderately developed, ~0.3× length of anterior apophysis. Ductus bursae and corpus bursae both reduced in size, ~0.14× length of anterior apophysis.

HOLOTYPE. CHILE: OSORNO: Parque Nacional Puyehue, lower section, Lagos Berlin track, 40°44'30"S, 71°17'55"E, 485 m: ♂, 28 Dec 2016, swept from fringing vegetation, D. A. Young, digital image captured (MNHN).

PARATYPES. 23 males, 24 females. CHILE: CAUTIN: 3 km NW Tolten, 3 m: 1 ♀, BOLD ID RDOPP012-10, Genbank HQ971058, 26 Feb 1979, D. & M. Davis & B. Akerbergs (USNM). 14 km SE Pucon: 1 ♀, BOLD ID RDOPP074-10, Genbank HQ971109, 21 Dec 1982, R. L. Brown (USNM). 30 km NE Villarrica: 1 ♂, slide USNM 1513 ♂, 16–31 Dec 1964, I. Pena (USNM). Chacamo, NW Nueva Imperial, 600–700 m: 1 ♂, 17–23 Feb 1981, L. Peña (USNM). LINARES: Tranque de Bullileo: 1 ♂, slide USNM 34411 ♂, 10–12 Jan 1979, D. & M. Davis & B. Akerbergs (USNM). LLANQUIHUE: El Chingue, N Correntoso (S Vn. Calbuco), 300 m: 1 ♂, 1 ♀, BOLD ID RDOPP039-10, Genbank HQ971078, 20–25 Jan 1980, L. E. Peña (USNM). Hornohuinco, 11 km SW Lago Chapo, 300 m: 1 ♂, slide USNM 130409 ♂, BOLD ID RDOPP051-10, Genbank HQ971090, 29–31 Dec 1981, D. R. Davis (USNM). MAULE: Paso Garcia, ca. 23 km NW Cauquenes,

300 m: 3 ♂, 1 ♀, 29–30 Nov 1981, D. R. Davis (USNM). ÑUBLE: Alto Tregualemu, ca. 20 km SE Chovellen, 500 m: 1 ♂, 1 ♀, 26–27 Jan 1979, D. & M. Davis & B. Akerbergs (USNM). Near costal stream, 17.5 km S Curanipe, 50 m: 1 ♂, slide USNM 16380 ♂, BOLD ID RDOPP011-10, Genbank HQ971057, 25 Jan 1979, D. & M. Davis & B. Akerbergs (USNM). OSORNO: Cabañas Valenciana, Entre Lagos, 40°4'01"S, 72°33'57"E, 200 m: 1 ♂, 14 Dec 2016, at MV lamp, D. A. Young (ANIC). Parque Nacional Puyehue, Aguas Calientes to 2 km S, 600 m: 2 ♀, slide USNM 34404 ♀, BOLD ID RDOPP010-10, Genbank HQ971056, 10–22 Feb 1979, D. & M. Davis & B. Akerbergs (USNM). Parque Nacional Puyehue, Anticura, 350 m: 1 ♀, BOLD ID RDOPP111-10, Genbank HQ971136, 17 Dec 1981, Nielsen & Karsholt (ZMUC). Parque Nacional Puyehue, lower section, Lagos Berlin track, 40°44'30"S, 71°17'55"E, 485 m: 1 ♂, 1 Dec 2016, swept from bordering vegetation, D. A. Young (ANIC); 3 ♂, 2 ♀, 14 Dec 2016, swept from *Luma apiculata*, D. A. Young, ♂ slide USNM 34767; 2 ♀, 18–19 Dec 2016, 2 ♂, 1 ♀, 28–30 Dec 2016, swept from fringing vegetation, D. A. Young; 1 ♂, 5 ♀, 1 Jan 2017, swept from fringing vegetation, D. A. Young, USNM ♀ slides 34764, 34768 (ANIC). Termas Aguas Calientes, Puyehue, 488 m, 40°44'13"S, 71°22'48"E: 1 ♀, 24 Nov 2016, 1 ♂, 29 Nov 2016, 1 ♂, 1 Dec 2016, in temperate Valdivian rainforest near visitor center, D. A. Young (ANIC, USNM). Pucatrihue: 2 ♀, BOLD ID RDOPP040-10, RDOPP087-10, Genbank HQ971079, HQ971117, 26–31 Jan 1980, L. E. Peña (USNM). VALDIVIA: Centro-Austral: 1 ♂, slide USNM 16378 ♂, Jan–Mar 1898, V. Izquierdo (USNM).

HOST. Unknown. D. A. Young swept several females of *C. brevipectinella* in Parque Nacional Puyehue, Chile, from an isolated *Luma apiculata* (DC) Burret (Myrtaceae) tree that possessed heavy growths of lichens and other plants in its thick, dense branches. Possibly the females may have been ovipositing on this tree.

FLIGHT PERIOD. November to March.

DISTRIBUTION. (Map 16). Central Chile, from Maule region to Llanquihue province.

ETYMOLOGY. The specific name is derived from the Latin *bervis* (short) and *pectinella* (little comb) in reference to the reduced pectinifer.

DISCUSSION. *Ceromitia brevipectinella* is distinguished from all other *Ceromitia* by the combination of several characters of the male genitalia, in particular the reduced pectinifer on the valva; an elongate, gradually tapered saccus; elongate, ligulate anellar lobes; and a single curved cornutus at the apex of the phallus.

***Ceromitia nielsenii* Davis and Medeiros, new species**

FIGURES 137, 138, 265, 365; MAP 15

ADULT. (Figures 137, 138). Wing expanse: ♂, 9–18 mm; ♀, 14–18 mm.

Head: Vertex and frons whitish to brown. Antenna approximately 1.5–2.5× length of forewing in both sexes though often longer in males; scape very light brown; flagellum very light brown with dark gray annuli along basal half; sensory cilia visible in males on basal half of flagellum, with length nearly the width of flagellum. Maxillary palpus pale light brown, relatively short, less than 0.5× length of labial palpus. Labial palpus pale very light brown with several prominent dark bristles, especially at apex of second segment.

Thorax: Dorsum, venter, and tegula whitish to pale brown. Fore- and midlegs dark brown dorsally and pale brown ventrally, hindleg pale brown. Forewing pale fuscous to light pale brown, sparsely irrorated with light brown scales; sometimes forming very small spots, placed irregularly but often near apices of veins. Fringe pale fuscous to light pale brown. Hindwing uniformly pale fuscous to light pale brown.

Abdomen: Light fuscous to light gray dorsally, paler ventrally.

Male Genitalia: (Figure 265). Uncus smoothly notched. Vinculum-saccus elongate, ~2× length of valva; saccus gradually tapering along its length to a U-shaped anterior end. Valva with a single distal pectinifer bearing ~22 blunt spines. Juxta elongate, constricted near anterior third, with anterior end sagittate and terminally rounded. Phallus elongate, ~2.2× length of valva, with a lateral pair of winglike projections from the base.

Female Genitalia: (Figure 365). Apex of ovipositor compressed; ventral and dorsal edges serrate, ventral edge slightly longer than dorsal edge. Vestibulum and ductus bursae both relatively long, each ~0.25× length of anterior apophysis. Corpus bursae reduced, less than 0.1× length of anterior apophysis.

HOLOTYPE. CHILE: OSORNO: Parque Nacional Puyehue, Aguas Calientes to 3 km W, 600 m: ♂, slide USNM 22462 ♂, BOLD ID RDOPP049-10, Genbank HQ971088, 12–20 Dec 1981, D. R. Davis (USNM).

PARATYPES. 99 males, 56 females. CHILE: CAUTIN: 8 km SE Pucon: 1 ♀, 23 Dec 1982, R. L. Brown (USNM). 14 km SE Pucon: 1 ♀, 21 Dec 1982, R. L. Brown (USNM). 15 km SE Pucon: 2 ♀, 22 Dec 1982, R. L. Brown (USNM). LINARES: Puente Malcho, 600 m near Longavi River: 1 ♂, slide USNM 16379 ♂, BOLD ID RDOPP014, 13–15 Jan 1979, D. & M. Davis & B. Akerbergs (USNM). El Castillo, Malcho, E. Parral, 750 m: 1 ♂, 8–10 Jan 1988, L. E. Peña (USNM). MAULE: Carrizalillo, Forel: 30 ♂, 1 ♀, slides USNM 130435 ♂, USNM 34393 ♀, BOLD ID RDOPP144-10, 31 Jan–6 Feb 1981, L. Peña (USNM). 250 m: 19 ♂, 8 ♀, slides USNM 34269 ♂, USNM 130482 ♂, 30 Jan–6 Feb 1981, L. E. Peña (USNM). OSORNO: Anticura, Puyehue: 2 ♂, 1 ♀, 5–10 Jan 1986, L. E. Peña (USNM). Parque Nacional Puyehue, Aguas Calientes to 1 km W, 600 m: 4 ♂, 7 ♀, 2–5 Jan 1982, D. R. Davis (USNM). Parque Nacional Puyehue, Aguas Calientes to 3 km W, 600 m: 13 ♂, 5 ♀, slide USNM 34566 ♂, BOLD ID RDOPP073-10, Genbank HQ971108, 12–20 Dec 1981, D. R. Davis (USNM). Parque Nacional Puyehue, Aguas Calientes, 450 m: 21 ♂, 5 ♀, slide USNM 130414 ♂, BOLD ID RDOPP108-10, Genbank HQ971133, 25 Sep–13 Dec 1981,

Nielsen & Karsholt (USNM, ZMUC). Parque Nacional Puyehue, Anticura, 350 m: 37 ♂, 22 ♀, slide DRD 4624 ♂, 17 Nov–18 Dec 1981, Nielsen & Karsholt (ZMUC). Pucatrihue: 2 ♂, 3 ♀, slide USNM 130471 ♂, 26 Jan–12 Feb 1980, L. E. Peña (USNM). TEMUCO: Fundo Chacamo, 35 km NW Nueva Imperial, 600 m: 1 ♂, 5–8 Dec 1981, D. R. Davis (USNM).

HOST. Unknown.

FLIGHT PERIOD. September to February.

DISTRIBUTION. (Map 15). Maule region to Osorno province in Chile.

ETYMOLOGY. The specific name is a patronym in honor of Ebbe Schmidt Nielsen (deceased), who conducted extensive fieldwork on the Microlepidoptera of the Patagonian region of Argentina.

DISCUSSION. *Ceromitia nielsenii* has male genitalia very similar to *C. beckeri* but possesses a pair of winglike projections from the base of the phallus unlike *C. beckeri*. *Ceromitia beckeri* has been collected only in Brazil.

***Ceromitia lobata* Davis and Medeiros, new species**

FIGURES 139, 266, 366; MAP 16

ADULT. (Figure 139). Wing expanse: ♂, 15–22 mm; ♀, 13–14 mm.

Head: Vertex and frons pale fuscous. Antenna longer in males than females, approximately 3× length of forewing in males, 2× length of forewing in females; scape light fuscous; flagellum fuscous ringed with brown annuli along entire length; sensory cilia visible in males on basal half of flagellum, length nearly the width of flagellum. Maxillary palpus pale fuscous, relatively short, less than 0.5× length of labial palpus. Labial palpus pale fuscous with several prominent bristles especially at apex of second segment.

Thorax: Dorsum and venter pale fuscous, tegula mottled pale fuscous and brown. Fore- and midlegs dark brown dorsally and pale fuscous ventrally, especially dark at apices of tibia; hindleg light brown. Forewing pale fuscous irrorated with brown scales throughout; sometimes forming very small spots; brown scales also giving the appearance of several broken transverse bands, truncate medially and postmedially; faint brown spots present at apex of veins on termen. Fringe pale brown. Hindwing uniformly light brown.

Abdomen: Pale fuscous dorsally, paler ventrally.

Male Genitalia: (Figure 266). Uncus bilobed. Vinculum-saccus elongate, ~2.75× length of valva; posterior margin of vinculum rounded with median lobe present; margins of saccus narrowed medially, tapering to a truncated and slightly broadened anterior end. Valva with a single pectinifer bearing >20 blunt spines; sacculus with narrow projecting lobe. Juxta roughly triangular. Phallus elongate, with several medial and apical cornuti and 2 anellar lobes, ~3× length of valva.

Female Genitalia: (Figure 366). Apex of ovipositor very slender; ventral edge minutely serrate. Vestibulum ~0.2× length

of anterior apophysis. Ductus bursae relatively short, ~0.2× length of anterior apophysis. Corpus bursae well developed, ~0.4× length of anterior apophysis.

HOLOTYPE. BRAZIL: PARANÁ: Quatro Barras, Banhado, 800 m: ♂, 6 Feb 1970, Becker & Laroca (VOB).

PARATYPES. 4 males, 5 females. BRAZIL: DISTRICT FEDERAL: Planaltina, 1535'S, 4742'W, 1,000 m: 1 ♂, slide USNM 91803 ♂, 30 Mar 1976, V. O. Becker (USNM). PARANÁ: Curitiba, 920 m: 2 ♀, 10 Jan–8 Feb 1975, V. O. Becker, 2 ♀, BOLD ID RDOPP022-10, 20 Oct 1975, V. O. Becker (VOB, USNM). Quatro Barras, Banhado, 800 m: 2 ♂, slide 3024 USNM ♂, 1 ♀, slide USNM 34405 ♀, 6 Feb 1970, 1 ♂, 30 Oct 1970, Becker & Laroca (VOB, USNM).

HOST. Unknown.

FLIGHT PERIOD. October to March.

DISTRIBUTION. (Map 16). From Brazil's District Federal, south to Paraná state.

ETYMOLOGY. The specific name is derived from the Latin *lobus* (lobe) in reference to the narrow projecting lobe from the sacculus.

DISCUSSION. *Ceromitia lobata*, *C. ovata*, *C. truncata*, and *C. unipectinella* are closely related species with male genitalia that are morphologically similar in possessing an elongate vinculum-saccus and a single elongate pectinifer on the valva. The male valva of *C. lobata* is most similar to that of *C. truncata* in having the sacculus produced into a short, rounded lobe. The pectinifer of *C. lobata* is located more basally on the valva than in *C. truncata*. In addition, the juxta is relatively longer and the anterior end of the saccus is narrower in *C. lobata*.

***Ceromitia ovata* Davis and Medeiros, new species**

FIGURES 140, 267, 367; MAP 16

ADULT. (Figure 140). Wing expanse: ♂, 15 mm; ♀, 16 mm.

Head: Vertex and frons pale brown. Antenna broken in both specimens but at least 2× as long as forewing in ♂; scape light brown; flagellum light brown with flagellomeres ringed with dark brown annuli; sensory cilia visible along basal third of flagellum, length approximately equal to width of flagellomere. Maxillary palpus brown, relatively short, less than 0.5× length of labial palpus. Labial palpus light brown.

Thorax: Dorsum and venter light brown, tegula dark brown. Foreleg dark brown dorsally and light brown ventrally; mid- and hindlegs light brown with dark brown scales near joints. Forewing light brown, with a few dark brown scales scattered throughout; dark brown scales forming small irregular spots, especially along termen; fringe brown. Hindwing brown.

Abdomen: Brown dorsally, paler ventrally.

Male Genitalia: (Figure 267). Uncus bilobed. Vinculum-saccus elongate, ~2.75× length of valva; posterior margin of vinculum rounded with slight caudal notch; lateral margins of saccus

narrowed medially, terminating with an abruptly truncated and slightly broad anterior end. Valva with a single pectinifer bearing >20 blunt spines; sacculus with a broadly rounded, projecting lobe. Juxta roughly triangular. Phallus elongate, with several apical cornuti, ~2.75× length of valva.

Female Genitalia: (Figure 367). Apex of ovipositor compressed; ventral edge slightly longer than dorsal edge and serrate. Vestibulum and ductus bursae both elongate, each ~0.5× length of anterior apophysis. Corpus bursae elongate, 0.4× length of anterior apophysis, reduced in diameter; junction with relatively enlarged ductus bursae indistinct.

HOLOTYPE. BRAZIL: RIO GRANDE DO SUL: Pinheiro: ♂, slide DRD 4633, DDAV A095, BOLD ID RDOPP095-10, Genbank HQ971122, 2 Jan 1989, A. Camargo (VOB).

PARATYPE. 1 female. BRAZIL: RIO GRANDE DO SUL: Pinheiro: 1 ♀, 2 Jan 1989, A. Camargo, slide USNM 31753, DDAV-AO41, digital image captured, BOLD ID RDOPP041-10, Genbank HQ971080 (USNM).

HOST. Unknown.

FLIGHT PERIOD. Early January (univoltine).

DISTRIBUTION. (Map 16). Known only from the type locality, Rio Grande do Sul state in southern Brazil.

ETYMOLOGY. The specific name is derived from the Latin *ovata* (egg shaped), referring to the ovoid lobe arising from the sacculus of the male valva.

DISCUSSION. *Ceromitia lobata*, *C. ovata*, *C. truncata*, and *C. unipectinella* are closely related species with male genitalia that are morphologically similar in possessing an elongate vinculum-saccus and a single elongate pectinifer on the valva. *Ceromitia ovata* differs from the other species in this group in possessing valvae with a sacculus formed into a broadly rounded lobe.

***Ceromitia truncata* Davis and Medeiros, new species**

FIGURES 141, 268; MAP 16

ADULT. (Figure 141). Wing expanse: ♂, 18 mm; ♀, unknown.

Head: Vertex and frons whitish. Antenna approximately 2.5× length of forewing in males; female unknown; scape brown; flagellum brown; sensory cilia present in males along basal third of flagellum, nearly 1× width of flagellomere. Maxillary palpus whitish, relatively short, less than 0.5× length of labial palpus. Labial palpus mottled whitish and light brown with several prominent bristles along second segment.

Thorax: Dorsum and venter whitish; tegula mottled whitish and brown. Foreleg dark brown dorsally and pale brown ventrally, midleg light brown [hindlegs missing]. Forewing mostly whitish, irrorated with light brown scales; several small brown spots present along cubital vein, including 2 antemedially and one medially; small brown spot near apex of discal cell; some veins ending in small brown spots, especially along termen. Fringe light brown. Hindwing uniformly light brown.

Abdomen: Not examined.

Male Genitalia: (Figure 268). Uncus bilobed. Vinculum-saccus elongate, ~3× length of valva; posterior margin of vinculum rounded; margins of saccus nearly parallel, terminating with an abruptly truncated anterior end. Valva with a single pectinifer bearing >20 blunt spines; sacculus with rounded, projecting lobe. Juxta roughly triangular. Phallus elongate, with several medial and apical cornuti, ~3× length of valva. A pair of elongate anellar lobes usually attached near apical one-fourth of phallus.

Female Genitalia: Unknown.

HOLOTYPE. BRAZIL: MINAS GERAIS: Caraça Monastery, Barão de Cooais, SE of Belo Horizonte, 1,300 m: ♂, slide DRD 4635 ♂, BOLD ID RDOPP093-10, 1–2 Apr 1992, V. O. Becker (VOB).

HOST. Unknown.

FLIGHT PERIOD. 1–2 April 1992 (univoltine).

DISTRIBUTION. (Map 16). Known only from the type locality, Minas Gerais state in southeast Brazil.

ETYMOLOGY. The specific name is derived from the Latin *truncata* (shortened by cutting off) in reference to the abrupt, truncate end of the saccus.

DISCUSSION: The male genitalia of *C. lobata*, *C. ovata*, *C. truncata*, and *C. unipectinella* are morphologically similar in possessing an elongate vinculum-saccus and a single elongate pectinifer on the valva. The male valva of *C. truncata* is most similar to that of *C. lobata* in having the sacculus produced into a short, rounded lobe. The juxta is shorter and the anterior end of the saccus is broader in *C. truncata* than in *C. lobata*.

***Ceromitia unipectinella* Davis and Medeiros, new species**

FIGURES 142, 269, 368; MAP 16

ADULT. (Figure 142). Wing expanse: ♂, 15 mm; ♀, 15 mm.

Head: Vertex and frons brown. Antenna (broken in holotype); scape light brown; flagellum light brown, ringed with dark brown annuli; sensory cilia present in male along basal portion of flagellum, length approximately 1× width of flagellomere. Maxillary palpus light brown, relatively short, less than 0.5× length of labial palpus. Labial palpus light brown.

Thorax: Dorsum, venter, and tegula brown. Foreleg dark brown dorsally and pale brown ventrally, mid- and hindlegs light brown. Forewing nearly uniformly brown but with a few darker brown scales forming irregular and faint spots near anal margin. Fringe brown. Hindwing uniformly light brown.

Abdomen: Unavailable for study.

Male Genitalia: (Figure 269). Uncus bilobed. Vinculum-saccus elongate, ~3× length of valva; saccus broad posteriorly, with tapering, slightly convex margins; anterior end bluntly rounded to subtruncate. Valva with a single distal pectinifer bearing ~25–30 blunt spines; sacculus of valva very slender and acute. Juxta elongate, anterior end attenuate and slender. Phallus

elongate, ~3× length of valva, with 2 anellar lobes projecting from below apex; several small cornuti present near base of anellar lobes.

Female Genitalia: (Figure 368). Apex of ovipositor compressed; serrate. Vestibulum large, ~0.4× length of anterior apophysis. Ductus bursae very short, broad, immediately expanded into corpus bursae. Corpus bursae nearly 0.4× length of anterior apophysis.

HOLOTYPE. BRAZIL: SÃO PAULO: Mun. Salesópolis, Est. Biol. Boraceia, SP, 850 m: ♂, slide USNM 20776 ♂, BOLD ID RDOPP001-10, 1–3 Apr 1977, C. M. & O. S. Flint Jr. (USNM).

PARATYPES. 1 male, 1 female. BRAZIL: PARANÁ: Castro: 1 ♀, slide USNM 19226 (USNM). PARAGUAY: PARAGUARI DEPT.: Ybycui (25 km SE), in Ybycui National Park: 1 ♂, slide USNM 130460 ♂, BOLD ID RDOPP044-10, Genbank HQ971083, 12–24 Apr 1980, P. J. Spangler et al. (USNM).

HOST. Unknown.

FLIGHT PERIOD. April (univoltine).

DISTRIBUTION. (Map 16). This species is known from the municipality of Salesópolis in São Paulo in southern Brazil and the Department of Paraguari in southern Paraguay.

ETYMOLOGY. The species name is derived from the Latin *unus* (one) and *pectinella* (small comb) in reference to the single elongate pectinifer present on the valva of the male genitalia.

DISCUSSION. The male genitalia of *C. unipectinella* are very similar to those of *C. lobata*, *C. ovata*, and *C. truncata* in possessing an elongate vinculum-saccus and a single elongate pectinifer on the valva. The development of the sacculus differs in all four species, with that of *C. unipectinella* being the most slender and acute.

GROUP ASSOCIATION UNCERTAIN

Ceromitia eccentrica (Meyrick)

FIGURES 143, 369; MAP 17

Ceromitia eccentrica Meyrick, 1921: 405.—Clarke, 1970: 117.—Davis, 1984: 18.

ADULT. (Figure 143). Wing expanse: ♂, unknown; ♀, 14.5 mm.

Head: Vertex whitish with slight admixture of fuscous; frons more heavily irrorated with fuscous [but badly rubbed]. Antenna more than 2× length of forewing [apices of both antennae broken]; flagellum grayish, heavily irrorated with fuscous; scape mostly fuscous; sensory cilia inconspicuous, 0.5–0.7× diameter of flagellomere in length. Labial palpus whitish with a sparse scattering of a few fuscous, hairlike scales.

Thorax: Dorsum whitish gray. Legs grayish, heavily irrorated with fuscous; tarsal segments mostly fuscous, with apices

ringed with whitish gray. Forewing grayish, faintly irrorated with grayish white, with a few darker, fuscous scales scattered over dorsal surface; a rather indistinct, small dark spot at apex of discal cell; fringe grayish with whitish apices. Hindwing uniformly grayish.

Abdomen: Grayish above, slightly paler ventrally.

Female Genitalia: (Figure 369). Apex of ovipositor compressed; ventral edge serrulate, distinctly longer than dorsal edge. Ductus bursae relatively short, extending only slightly beyond anterior margin of eighth segment. Corpus bursae entirely membranous, without signa.

TYPE. Holotype, ♀ (BMNH).

TYPE LOCALITY. Obidos, Brazil.

HOST. Unknown.

FLIGHT PERIOD. September (univoltine).

DISTRIBUTION. (Map 17). Known only from the type locality, which is located in the state of Pará, Brazil. Obidos is situated on the north bank of the Amazon River at 1°59'S and 55°30'W.

MATERIAL EXAMINED. BRAZIL: PARÁ: Obidos, 1 ♀ (holotype) (BMNH).

DISCUSSION. This species is represented only by the female holotype, which appears to offer few diagnostic features. Consequently, the identity of this insect will remain largely uncertain until the discovery of the male. The specimen label and Meyrick's description of the species state that the unique type was collected by Parish and dated "9-19," here assumed as September 1919.

Ceromitia ilyodes (Meyrick)

FIGURE 144; MAP 17

Ceromitia ilyodes Meyrick, 1931: 414.—Pastrana, 1961: 194.—Davis, 1984: 18.

ADULT. (Figure 144). Wing expanse: ♂, unknown; ♀, 17 mm.

Head: Vertex whitish at center, becoming more brownish laterally; frons slightly darker, light brown. Antenna more than 1.25× length of forewing [total length unknown due to loss of distal segments in unique type]; flagellum uniformly gray; scape gray above, more whitish ventrally; sensory cilia sparse, erect, short, 0.6–0.9× diameter of flagellum. Maxillary palpus whitish, approximately 0.5× length of labial palpus. Haustellum long, approximately 3× length of labial palpus. Labial palpus whitish at base, distal half grayish.

Thorax: Dorsum grayish; tegulae darker, more fuscous. Foreleg fuscous; mid- and hindlegs grayish white. Forewing grayish, irrorated with whitish and fuscous scales; an indistinct, dark, transverse band extending from hind margin halfway across wing at middle; another indistinct, small spot of fuscous present near apex of discal cell. Fringe whitish with gray suffusion. Hindwing uniformly pale gray.

Abdomen: Not available for study [missing].

TYPE. Holotype, ♀ (BMNH).

TYPE LOCALITY. ARGENTINA: Lake Gutierrez, Rio Negro province.

HOST. Unknown.

FLIGHT PERIOD. November (univoltine).

DISTRIBUTION. (Map 17). Known only from the type locality, which is located at an elevation of approximately 800 m on the eastern slopes of the Andes, about 12 km south-west of San Carlos de Bariloche, Argentina.

MATERIAL EXAMINED. ARGENTINA: RIO NEGRO: Lake Gutierrez: 1 ♀ (holotype) BMNH.

DISCUSSION. This species is known only by the female holotype, which no longer possesses an abdomen. Consequently, until more conspecific material can be collected from the type locality, the identity of the species will remain in doubt. Meyrick (1931) points out the absence of vein 5 (M2) in the forewing; this abnormality, however, may not be significant and instead may be peculiar only to the holotype.

Ceromitia schajovskoi may turn out to be a junior synonym of *C. ilyodes*, as the size and maculation of their females closely agree. Furthermore, their distributions may overlap as the type localities of the two species are only about 100 km apart.

***Ceromitia laticlavata* Davis and Medeiros, new species**

FIGURES 145, 370; MAP 17

ADULT. (Figure 145). Wing expanse: ♂, unknown; ♀, 10 mm.

Head: Vertex and frons light brown. Antenna approximately 2× length of forewing; scape brown; flagellum brown; sensory cilia inconspicuous. Maxillary palpus pale whitish brown, relatively short, less than 0.5× length of labial palpus. Labial palpus light brown with a white apex and several bristles projecting laterally and ventrally from the palpus.

Thorax: Dorsum, venter, and tegula whitish. Legs mostly missing but femora very light brown. Forewing with a broad, pale yellowish white band along anal margin and a broad band of very dark brown scales along costal margin, terminating halfway along length of wing; distal half of wing with a series of very dark brown spots at apices of veins along margin and irregularly away from the margin. Fringe fuscous. Hindwing uniformly light brown.

Abdomen: Uniformly dark brown dorsally, paler ventrally.

Female Genitalia: (Figure 370). Apex of ovipositor compressed; ventral edge minutely serrulate, considerably longer than dorsal edge. Vestibulum elongate, ~0.7× length of anterior apophysis. Ductus bursae very reduced. Corpus bursae moderate in length, ~0.4× length of anterior apophysis, with a small spherical accessory bursa arising from the middle of the corpus bursae.

HOLOTYPE. BRAZIL: MINAS GERAIS: Nova Lima, 850 m: ♀, slide DRD 4590 ♀, BOLD ID ROPP021-10, Genbank HQ971064, 1–10 Jan 1985, V. O. Becker (VOB).

HOST. Unknown.

FLIGHT PERIOD. The one specimen was collected in January (univoltine).

DISTRIBUTION. (Map 17). Known only from Minas Gerais, Brazil.

ETYMOLOGY. The species name *laticlavata* is derived from the Latin *laticlavus* (having a broad stripe), in reference to the broad, pale yellowish white band that extends most of the length along the dorsal margin of the forewing.

DISCUSSION. This species has the most distinctive and striking wing pattern of all known *Ceromitia* and is not likely to be confused with any other species in the genus. The COI sequence data place it unambiguously within *Ceromitia* (near *C. costaricensis*). The male is not known.

Nemophora Hoffmannsegg

Nemophora Hoffmannsegg in Illiger, 1798: 499 [type species: *Phalaena (Tinea) degeerella* Linnaeus, 1758: 540, by subsequent designation by Hampson, 1918: 388].—Leach in Brewster, 1815: 133.—Durrant, 1915: 161.—Walsingham, 1915: 402.—Meyrick, 1928: 845.—Fletcher, 1929: 146.—Pierce and Metcalf, 1935: 109.—Diakonoff, 1951: 148.—Jacobs, 1949: 215.—Diakonoff, 1955: 142.—Powell, 1969: 217.—Küppers, 1980: 20 [synonym of *Adela* Latrille].—Nielsen, 1980: 162.—Kyrki, 1981: 125.—Davis, 1983: 4.—Davis in Stehr, 1987: 358.—Nye and Fletcher, 1991: 199.—Karsholt and Razowski, 1996: 28.—Poole, 1996: 626.—Kobayashi, 1998: 157.—Hirowatari, 2001: 193.—Kozlov, 2004: 117.—Kozlov et al. 2016: 329.

Elasmion Hübner, 1806: 2 [unavailable name, ICZN, opinion 97].—Hübner, 1822: 62 [type species: *Phalaena (Tinea) degeerella* Linnaeus, 1758: 540, by subsequent designation by Fletcher, 1929: 74 (synonym of *Nemophora Hoffmannsegg*)].—Diakonoff, 1951: 148; 1955: 143.—Küppers, 1980: 20.—Davis, 1983: 4.—Nye and Fletcher, 1991: 105.—Poole, 1996: 626.

Elasmia Hübner, 1822: 62 [missp. (multiple) of *Elasmion* Hübner].—Watson, Fletcher, and Nye, 1980: 60.—Nye and Fletcher, 1991: 105.—Poole, 1996: 626.

Eutyphia Hübner, 1816: 416 [type species: *Phalaena (Tinea) degeerella* Linnaeus, 1758: 540, by subsequent designation by Meyrick 1912b: 4].—Fletcher, 1929: 74 (synonym of *Nemophora*).—Küppers, 1980: 20.—Nye and Fletcher, 1991: 127.—Diakonoff, 1951: 148; 1955: 143.—Davis, 1983: 4.—Poole, 1996: 626.

Epityphia Hübner, 1816: 416 [type species: *Nematois latreillella* Fab.].—Fletcher, 1929: 74 [synonym of *Nemophora Hoffmannsegg*].—Diakonoff, 1951: 148; 1955: 143.—Küppers, 1980: 20.—Davis, 1983: 4.—Poole, 1996: 626.

Nemotois Hübner, 1816: 416 [type species: *Tinea schiffermillerella* (Denis and Schiffermüller), 1775: 142, by subsequent designation by Meyrick 1912b: 4, but cited as "*fasciella*, Fabricius"].—Fletcher, 1929: 146 [synonym of *Nemophora Hoffmannsegg*].—Zeller, 1853: 46.—Frey, 1856: 43.—Stainton, 1854: 51; 1873: 192.—Staudinger and Wocke, 1871: 272.—Snellen, 1882: 496.—Rebel, 1901: 243.—Meyrick, 1912a: 5; 1912b: 4; 1928: 841.—Turner, 1913: 225.—Barnes and McDunnough, 1917: 196.—Fletcher, 1929: 74.—Hering, 1932: 21.—McDunnough, 1939: 110.—Diakonoff, 1951: 148; 1955:

143.—Powell, 1969: 217.—Küppers, 1980: 20.—Davis, 1983: 4.—Nye and Fletcher, 1991: 200.—Poole, 1996: 626.

Nematais [sic] Chambers, 1876: 103.

Nematois [sic], Walsingham, 1907: 153 [invalid emendation of *Nemotois* Hübn.]. Oxford University and Cambridge Entomological Societies, 1858: 81.—Durrant, 1915: 161.—Diakonoff, 1951: 148; 1955: 143.—Powell, 1969: 217.—Davis, 1983: 4.—Nye and Fletcher, 1991: 199.

Nematophora Agassiz, 1864: 247 [unjustified emendation of *Nemophora* Hoffmannsegg, 1798, and a junior homonym of *Nematophora* Gray, 1840: 12].—Durrant, 1915: 161.—Diakonoff, 1951: 148; 1955: 143.—Küppers, 1980: 20.—Nye and Fletcher, 1991: 199.—Poole, 1996: 626.

Ucetia Walker, 1866: 1820 [type species: *Ucetia bifasciella* Walker, 1866: 1821, by monotypy].—Diakonoff, 1951: 148; 1955: 143.—Küppers, 1980: 20.—Davis, 1983: 4.—Nye and Fletcher, 1991: 199.—Poole, 1996: 626.

ADULT. Small- to medium-size moths with wing expanse: ♂, 11.6–22 mm; ♀, 10.9–18.2 mm.

Head: (Figure 18). Vertex densely to sparsely covered with erect, piliform scales; frons smooth, covered by appressed, broad scales (Figure 5). Eyes variable, dimorphic in some *Nemophora* with that of male often enlarged (especially dorsal region) with enlarged facets and more approximate to contiguous at vertex; eyes of female usually smaller, more spherical; interocular index (Davis 1975) 0.9–1.5 in male, 0.5–0.8 in female. Antenna usually longer than forewing in both sexes, 2.0–4.3× the length of forewing in male, 1.1–1.3× length of forewing in female; males with 2–9 basally to medially projecting, smooth spines arising mediodorsally from flagellomeres 2–9 or 10; number and size of spines varying between species; venter of flagellomeres with scale covering less dense on ventral surfaces and sensilla restricted mostly to venter. Antennal sockets more broadly separated in female by a distance of ~1.0× diameter of socket, less separated in male by a distance of less than 0.5× diameter of socket. Haustellum long, ~5.0–5.5× length of labial palpus. Maxillary palpus short, 3-segmented, apical segment minute. Labial palpus 3-segmented, usually upturned, with segment 2 the longest.

Thorax: Forewing (Figure 48) with all veins usually separate; M3 sometimes connate with CuA1; Rs4 ending on costa before apex; M forked within cell. Hindwing with all veins separate; M forked within cell. Male frenulum consisting of a single large bristle; female frenulum consisting of ~10–12 moderately small bristles from costal margin of wing base.

Male Genitalia: Uncus short, usually rounded, sometimes with a variably developed median ridge. Vinculum well developed with an elongate, broadly V- to Y-shaped saccus. Valvae short, triangular in lateral view; pectinifers absent. Juxta sagittate, with anterior half abruptly broader and acute.

Female Genitalia: As described for family.

DISCUSSION. Figures 66, 77, and 58 show the maximum likelihood gene tree of the COI barcode region for selected species of *Adela*, *Cauchas*, and *Nemophora* (the single tree is split across the three figures). While all sampled species of *Nemophora* are contained within a single moderately well-supported clade

(BS=0.84), *Nemophora* is paraphyletic in this tree due to several species of *Cauchas* (including the type species, *C. fibulella*) falling within this clade. In fact, *Cauchas* appears to be massively polyphyletic in the COI phylogeny, with taxa nested in several different clades throughout the tree. Morphologically, *Nemophora* differs in many ways from *Cauchas* (antennal pegs present in *Nemophora* and absent in *Cauchas*, antennal sockets approximate in *Nemophora* and widely separated in *Cauchas*, male eyes holoptic in *Nemophora* and smaller and wide apart in *Cauchas*, etc.; Nielsen 1980), so the COI tree topology is surprising. While it is tempting to simply dismiss the tree results as spurious, there are intriguing aspects of the overall topology that merit further scrutiny; these aspects will be discussed in more detail under *Adela* and *Cauchas*, as they mainly pertain to those genera.

Nemophora bellela (Walker)

FIGURES 5, 8, 9, 18, 48, 59–65, 146, 147, 270, 306, 371; MAP 18

Adela bellela Walker, 1863: 501.—Walsingham, 1880: 79; 1890: 284.

Nemotois bellela (Walker) Barnes and McDunnough, 1917: 196.—McDunnough, 1939: 110, no. 9838.

Adela bellela [sic] Walsingham, 1890: 284.—Dyar, 1903: 575.—Powell, 1969: 217 [synonym of *Nemophora bellela* Walker].

Nemotois bellela [sic] Meyrick, 1912a: 10; 1912b: 8.—Forbes, 1923: 78.—Powell, 1969: 217 [synonym of *Nemophora bellela*].

Nemotois belleta [sic] Anderson, 1915: 129.—Powell, 1969: 217 [synonym of *Nemophora bellela*].—Kozlov, 2004: 117.

Nemophora bellela (Walker) Powell, 1969: 217.—Davis, 1983: 4, no. 218.—Wojtusiak in Karsholt and Razowski, 1996: 28.—Kozlov, 2004: 117.—Powell and Opler, 2009: 40.—Pohl et al. 2015: 38.—Ahola, Davis, Itämes, Leinonen, and Mutanen, 2017: 49.

Nemophora belella [sic] Wojtusiak, 1996: 28.—Kozlov, 2004: 117.

Adela esmarkella Wocke, 1864: 211.—Küppers, 1980: 23, 267.

Nemophora esmarkella (Wocke) Karsholt and Razowski, 1996: 300 [synonym of *Nemophora bellela*].—Kozlov, 2004: 117.

Adela hedemanni Christoph, 1888: 312.—Kozlov, 2004: 117.

Nemophora hedemanni (Christoph). Kozlov, 1997: 283 [synonym of *Adela bellela* Walker].—Kozlov, 2004: 117.

Elasmion bellela (Walker). Poole, 1996: 626.

ADULT. (Figures 146, 147). Wing expanse: ♂, 14.5–20 mm; ♀, 13.7–14.8 mm.

Head: (Figures 5, 18). Vertex pale yellow to nearly white; frons dark fuscous with a pronounced coppery luster. Antenna 1.8–2.0× length of forewing (male); 1.1–1.4× length of forewing (female); scape and flagellum uniformly dark fuscous with slight coppery luster; all scales appressed with typically 2 annuli per segment; male antenna with 2–3 dorsal spines (Figures 8–9) arising mediodorsally from flagellomeres 3–5 and with rudimentary sockets usually evident on flagellomeres 1–2 and 6–7; spines relatively short (~0.2 the diameter of the flagellomere), straight, and usually one per segment except with a pair sometimes present on more basal flagellomeres; basal 2 and 3 of female

antenna with slightly thicker scale vestiture than male but scales mostly appressed and smooth. Maxillary palpus white, short, approximately 0.5 in length of labial palpus. Labial palpus mostly white dorsally, fuscous ventrally, with numerous, scattered, mostly dark bristles arising ventrally and apically from segment 2; apical segment white.

Thorax: Dorsum and tegulae dark brownish fuscous with coppery luster. Venter dark fuscous except for a pair of ventro-lateral streaks of yellowish white on prothorax. All legs yellowish white ventrally; brown to fuscous dorsally; all spurs yellowish white. Forewing with background including fringe of dark fuscous with coppery luster similar to dorsum, with numerous, broad, longitudinal streaks of orange brown mostly parallel to veins; longitudinal pattern interrupted by a broad, yellowish white fascia with dark fuscous margins across forewing at distal third; outer margin of fascia straight, inner margin sinuate. Hindwing uniformly dark brownish fuscous with a slight coppery luster.

Abdomen: (Figure 306). Uniformly dark fuscous. Sternite 7, $1.25\times$ length of tergum 7.

Male genitalia: (Figure 270). Uncus indistinct, apicocaudal margin smoothly rounded. Vinculum-saccus extremely long, $\sim 2.5\text{--}2.7\times$ length of valva; saccus broadly V-shaped, with broadly rounded anterior end. Valva short, triangular, with acute apex. Juxta elongate, $\sim 0.7\times$ length of phallus; anterior half sagittate, with acute anterior end; posterior end weakly sclerotized, broad, connected to broader anterior half by a slender rod. Phallus extremely long and slender, \sim equal to length of vinculum-saccus; apex with 2 subapical, lateral rows of 4–5 pairs of exogenous spines; base of phallus slightly curved, moderately enlarged. Legs moderately well developed.

Female Genitalia: (Figures 306, 371). Apex of ovipositor acute, both ventral and dorsal margins \sim smooth, with ventral edge longer by $1/3$. Dorsal wall of vestibulum densely lined with a large concentration of minute, rugose tubercles.

LARVA. (Figures 59–62). Color of larva whitish, with head and dorsal plates brown.

Head: Adfrontal suture terminating at epicranial suture. Adfrontal sclerite with seta AF1 present and AF2 absent; relative positions of adfrontal setae as shown in Figure 59. Six stemmata present and arranged in an uneven circle.

Thorax: Dorsal plates brown, present on segments T1–T3; prothoracic plate enlarged, including all setae of D, SD, XD, and L groups, spiracle separate; setae SV1–SV2 together on same pinaculum; meso- and metathoracic plates smaller, divided into 3 pinacula bearing D, SD, and L setae; coxal plates fused.

Abdomen: D1 and D2 arising separate on A1–A9; setae L1–L3 present on A1–A8; L3 absent on A9. Prolegs greatly reduced to several rows of multiserial crochets present on A3–A6; prolegs absent on A10. Dorsal plate of A10 with 3 pairs of setae (SD1, SD2, and D2), D1 absent; ventral plate of A10 with 5 pairs of setae (L1–L3, SV1–SV2).

LARVAL CASE. (Figures 64–65). Mature cases relatively long and narrow, varying from 16.5 to 23 mm in length (average 19.5 mm, $n=9$); walls of case composed of several

small fragments of dead leaves, the number of fragments varying from 9 to 13 (average 10.3). Frequently, the dorsal and ventral sides of the cases are constructed of a slightly different number of leaf fragments. Compared to the case of *N. degeerella* (Linnaeus), the case of *N. bellela* is considerably more elongated (9 mm in *N. degeerella*; see Itämiies 2013) and composed of a greater number of plant fragments than that of *N. degeerella* (which is made of 5 leaf fragments), but otherwise their case structure is similar.

PUPA. (Figure 63). Length 7 mm (one female examined). The general pupal morphology appears to agree with characters provided by Patočka and Turčáni (2005) for the family Adelidae (Ahola et al. 2017). According to Patočka and Turčáni, uniserial rows of spines on the third to seventh tergites and maxillae extending approximately to the level of the forelegs are characteristic of *N. degeerella* among the Adelidae. The same characters hold true for *N. bellela*. The antennae of the single female exuviae examined are long, extending to the eighth abdominal segment and then curved dorsally to wrap around the abdomen. The shape of the labrum and labial palpi also differs to some extent. In addition, there appears to be a difference in the location of SV setae on the sixth tergite, the pair of SV1 in *N. bellela* being situated closer to the stigma than those in *N. degeerella*. The cremasters are distinctly different, but the pupae compared represent opposite sexes, which explains this difference (Patočka and Turčáni 2005). In *N. bellela*, the female cremaster bears a single pair of minute spines arising from the extreme caudal-lateral margins of abdominal segment 10.

TYPE. ♀. Holotype, *Adela bellela* Walker (BMNH). Lectotype ♂, *Adela esmarkella* Wocke (ZIN). Lectotype ♂, *Adela hedemanni* Christoph (BMNH).

TYPE LOCALITY. *Nemophora bellela*: Martin Falls (St. Martin's Falls), Albany River, Hudson's Bay, Ontario, Canada. *Nemophora esmarkella*: Dovre, Norway. *Nemophora hedemanni*: Russia, Amur region.

HOST. Unknown. *Nemophora degeerella*, a closely related species, has been reported to feed on leaves of *Anemone nemorosa* (Ranunculaceae) (Schültze 1931).

FLIGHT PERIOD. Early June to late July.

DISTRIBUTION. (Map 18). *Nemophora bellela* is a boreal species that ranges widely across Canada from Quebec to British Columbia, north into the Northwest Territories, west into Yukon and Alaska. It is also widely distributed through the northern Palearctic from northern Europe (Wojtusik in Karsholt et al. 1996) east to Sakhalin in far eastern Russia.

MATERIAL EXAMINED. 69 males, 25 females. CANADA: ALBERTA: Entrance: 1 ♂, 31 May 1949. F.L.S. (GRP). Flatbush: 1 ♂, 27 Jun 1949 (GRP). Oland Road, Bragg Creek, 4600 ft. [1,402.4 m]: 1 ♂, 28 Jun 2000, D. Lowrie, DRD slide 4632 ♂, CCDB-22971-AO7, digital image captured (GPC). Nordegg: 1 ♂, CNCLEP 00137007, 24 Jun 1921, J. McDunnough; 1 ♂, 29 Jun 1921, J. McDunnough (CNC). BRITISH COLUMBIA: Atlin, 2,200 ft. [670 m]: 1 ♂, CNCLEP 00136999, 25

Jun 1955, B. A. Gibbard; 5 ♂, 23–29 Jun 1955, B. Gibbard; 4 ♂, 3–6 Jul 1955, H. Huckel (CNC); 1 ♂, 1 ♀, 24 Jun 1955, H. Huckel, slide USNM 16112, 20090 (USNM). CLINTON: 1 ♂, 11 Jun 1937, 1 ♀, 17 Jun 1938, G. Whalley (CNC). ONTARIO: Mattagami R: Smoky Falls: 1 ♀, CNCLEP 00141537, 4 Jul 1934, G. S. Whalley (CNC). Smokey Falls, Mattagami River: 1 ♀, 4 Jul (CNC). QUEBEC: Mistassini Post: 1 ♂, 19 Jul 1956, J. Lansway (UCB). Thunder River: 1 ♂, CNCLEP 00137006, gen slide 4643 DRD, DNA voucher specimen CNCLEP 00098587, BOLD CNCLA102-13, 27 Jun 1930, W. J. Brown; 1 ♂, 27 Jul (CNC). Northwest Territory: Cameron Bay: Great Bear Lake: 1 ♂, CNCLEP 00137026, 1 Jul 1937, T. N. Freeman (CNC); Reindeer Depot, McKenzie Delta: 1 ♂, CNCLEP 00137023, 11 Jul 1948, J. R. Vockeroth; Wholdaia L (CNC): 2 ♂, 2 ♀, 7–11 Jul 1948, J. Vockeroth, W. Brown (CNC); 1 ♂, CNCLEP 00141533, 2–4 Jul 1966, J. G. Chillcott (CNC). YUKON TERRITORY: Aklavik: 1 ♂, CNCLEP 00137016, 20 Jun 1953, C. D. Bird (CNC). British Mts.: 69°13'N, 140°05'W, 320 m: 1 ♂, CNCLEP 00141536, 18–20 Jun 1984, G. & M. Wood & D. Lafontaine; 1 ♂, 20 Jun 1953, C. Bird (CNC). Dawson: 1 ♂, CNCLEP 00137009, 30 Jun 1949, W. W. Judd (CNC). Dempster Hwy mi. 87: 2 ♀, CNCLEP 00098585, DNA voucher specimen BOLD CNCLA100-13, CNCLEP 00098586, DNA voucher specimen, BOLD CNCLA101-13, 1–4 Jul 1973, G. & D. M. Wood; Km 140.5, 900 m: 2 ♂, CNCLEP 00091798, 00091797, 18 Jun 1980; Km 155, 950 m: 1 ♂, CNCLEP 00098587, slide 4647 DRD, 29 Jun–3 Jul 1980, Wood & Lafontaine; La Force L: 132°20'1", 62°41', 300 ft: 1 ♂, CNCLEP 00137018, 26 Jun 1960, J. E. H. Martin; Peel Plt. Rd: North Fork Crossing, mi. 42, 3,500 ft. [1,067 m]: 1 ♂, CNCLEP 00137013, 25 Jun 1962, P. J. Skitsko, 1 ♂, 1 ♀, 30 Jun 1949, W. Judd; 1 ♂, 6 Jul 1949, P. Bruggemann (CNC); 1 ♂, 30 Jun 1949, W. Judd (UCB); 12 ♂, 11–20 Jun 1916, B. Clark, slide USNM 20088 (USNM). Rampart House: 1 ♂, 1 ♀, 9–10 Jul 1951, J. Martin (CNC). Richardson Mts.: 67°58'N, 136°29'W, 720 m: 1 ♀, CNCLEP 00098588, DNA voucher specimen, BOLD CNCLA103-13, 6–10 Jul 1987, M. Polak & M. Wood (CNC). Swim Lakes, 3,200 ft. [975 m], 133°62'13": 1 ♂, 15–23 Jun 1960, E. Rockburne (UCB). Whitehorse: 1 ♂, Jun 1916, B. P. Clark, slide USNM 20087 (USNM). Whitehorse prairie, 40 km N: 1 ♂, 19 Jun 1982, G. & M. Wood, DRD slide 4644 ♂, CNCLEP 00098584, digital image captured (CNC). La Force Lake, 3,300 ft. [1,006 m], 132°20', 62°41': 5 ♂, 1 ♀, 21–26 Jun 1960, J. Martin, USNM slide 34567 (CNC, USNM). Whitehorse, Fish Lake Beach: 2 ♂, 16 Jun 1923, J. A. Kusche (CASC). Yukon: 1 ♀, 8 Jul 1916, G. L. Harrington, slide USNM 20089 (USNM). UNITED STATES: ALASKA: Anchorage: 1 ♂, 10 Jun 1921, J. Aldrich (USNM). 7 mi. [11.3 km] SW Cantwell, near Broad Pass, 2,300 ft. [700 m]: 1 ♀, 26 Jun 1979, Opler ♀ Powell (UCB). 17 mi. [27.4 km] SW Cantwell: 1 ♂, 1 ♀, 26 Jun 1979, Opler ♀ Powell (UCB). 97 mi. [11.3 km] SW Ester: 1 ♀, 26 Jun 1979, Opler ♀ Powell (UCB). Ester Dome (near Fairbanks), 64°53'N, 148°03'W: 1 ♂, 11 June 1981, leg. K. W. Philip. 9 mi. [14.5 km] NW Fairbanks, 600 ft. [183 m]: 1 ♀, 25 Jun 1971, K. Philip (USNM); Sheep Creek Road @ Goldstream, ~11 miles NW of Fairbanks,

64°55'N, 147°57'W, 1 ♂, 25 June 1971; 1 ♀, 3 July 1968; leg. K. W. Philip (USNM). 9 mi. [14.5 km] E. Kenai: 1 ♀, 24 Jun 1957, W. Bryant (MSU). King Salmon, Naknek River: 2 ♂, 10 Jul 1952, J. Hartley (CNC). Mt. Fairplay, 3,600 ft. [1,100 m], Taylor Hwy mile 32: 2 ♂, 19 Jul 1962, P. Skitsko (CNC). Naknek, on tundra: 1 ♂, 8 Jul 1952, W. Mason (CNC). Nenana: 1 ♀, 16 Jun 1953, slide USNM 34802, R. Sailer (USNM). North Fork Crossing, Peel Plt. Road mile 42, 3,200 ft. [475 m]: 1 ♀, 25 Jun 1962 (CNC). Steese Hwy, 6.3 mi. [10 km] NE Fox: 3 ♀, 26 Jun 1979, Opler ♀ Powell (UCB). Unalakleet: 1 ♀, 23 Jun 1961, B. Heming (CNC).

DISCUSSION. *Nemophora bellela* is the only circumpolar species of *Nemophora* and the only member of the genus to occur in the Americas (Kozlov 2004). Forbes (1923) reported this species from Colorado, but the present deposition of that specimen is unknown. A search for this species in the Lepidoptera collections of Cornell University by Jason Dombroskie revealed no specimens of *bellela*. Paul Opler, Chris Grinter, and David Bettman (personal communications) likewise reported no specimens in the Colorado State University or the Denver Museum Collections. However, on 2 July 2023, a specimen from Saguache County, Colorado (38.178058, -105.799247), was observed and posted to iNaturalist (<https://www.inaturalist.org/observations/170916686>).

The foregoing descriptions and illustrations of the immature stages of *N. bellela* are summarized from Ahola et al. (2017). Unfortunately, the present deposition of the single larva examined in that study is unknown and, consequently, could not be reexamined. Also, only one female pupal exuviae of *N. bellela* (Figure 63) is known, but it was examined for this study. Because of its poor condition, a full description of the pupal characters could not be provided.

Adela Latrielle

Adela Latrielle, 1797: 147 [type species: *Phalaena reaumurilla* Linnaeus, 1758: 540, by subsequent monotypy (but included as “*reaumurilla* Fabricius,” an incorrect authorship)]; 1802: 417; 1803: 106; 1804: 187; 1805: 253; 1809: 224; 1810: 364.—Sodoffsky, 1837: 95, 97, 130.—Herrich-Schäffer, 1843–1856, 1856: 20–31.—Duponchel, 1844: 355.—Gistel, 1848: viii.—Zeller, 1853: 1.—Clemens, 1864: 425.—von Heinemann, 1870: 73.—Walsingham, 1880: 77.—Snellen, 1882: 489.—Meyrick, 1893: 486.—Dyar, 1903: 575.—Spuler, 1898: 468.—Meyrick, 1912a: 8; 1912b: 10.—Walsingham, 1915: 402.—Fracker, 1915: 62.—Forbes, 1923: 77.—Meyrick, 1928: 843.—McDunnough, 1939: 110.—Jacobs, 1949: 217.—Küppers, 1980: 16, 20.—Nielsen, 1980: 162.—Davis *in* Stehr, 1987: 358.—Davis, 1983: 4; 1984: 18.—Nye and Fletcher, 1991: 7.—Poole, 1996: 626.—Karsholt and Razowski, 1996: 28.—Hirowatari, 1997: 272.

Adelo Gistel, 1848: 486 [incorrect subsequent spelling of *Adela* Latrielle, 1797].—Nye and Fletcher, 1991: 6.

Capillaria Haworth, 1828: 519 [junior homonym of *Capillaria* Zeder, 1800], type species: *Phalaena viridella* Scopoli, 1763: 250, by subsequent designation by Meyrick, 1912b: 8.—Walsingham, 1915: 402.—Küppers, 1980: 20.—Nye and Fletcher, 1991: 54.—Hirowatari, 1997: 272.

Metallitis Sodoffsky, 1837: 95 [unnecessary objective replacement name for *Adela* Latreille 1797].—Walsingham, 1915: 402.—Nye and Fletcher, 1991: 188.

Aedilis Gistel, 1848: viii [junior homonym of *Aedilis* Audinet-Serville, 1835: 32; also an unnecessary objective replacement name for *Adela* Latreille 1797].—Walsingham, 1915: 402.—Nye and Fletcher, 1991: 7.

Dicte Chambers, 1873: 73 [type species: *Dicte corruscifasciella* Chambers, 1873: 73, by monotypy].—Walsingham, 1880: 78, 1915: 402.—Küppers, 1980: 20.—Nye and Fletcher, 1991: 94.—Hirowatari, 1997: 272.

ADULT. Small- to medium-size moths with wing expanse ~7.0–16.0 mm in male; 7.0–15.0 mm in female.

Head: (Figures 19–40). Vertex and frons densely to sparsely covered with erect, piliform scales. Eyes dimorphic in most *Adela* with those of male enlarged and more approximate at vertex; interocular index (Davis 1975) 0.6–1.9 in male, 0.6–0.7 in female. Antenna usually longer than forewing in both sexes, 1.0–3.4× the length of forewing in male, 0.8–3.3× length of forewing in female; male flagellomeres usually numbering more than 150; female antenna usually with ~half as many segments; males of some species with 1–3 anteriorly projecting, usually hook-shaped peg spines arising dorsally from flagellomeres 8 and 9, 9 and 10, or 8, 9, and 10 (Figures 10–15); ventral surface of spines irregular, with triangular projections; antennal sockets of male separated by a narrow bridge usually less than half the diameter of antennal socket; antennal sockets of female usually more widely separated a distance of ~1.5–2.0× the diameter of antennal socket; antennal peg spines absent in female. Maxillary palpus short, 2–3-segmented. Labial palpus 3-segmented, variable in length, usually upturned, with segment 2 the longest.

Thorax: Forewing (Figure 49) with Rs2 and Rs3 either separate or stalked, other veins free; Rs4 ending on costa before apex; hindwing male frenulum a single long spine; female frenulum consisting of ~3–4 relatively large black spines at base of costa and a series of ~7–10 smaller, paler spines more distad; M1 and 2 stalked or separate.

Abdomen: (Figures 307–321). Sternum 7 enlarged, ~1.2–1.5× length of tergum 7.

Male Genitalia: Uncus reduced, often superficially bilobed. Vinculum well developed with an elongate, broadly V- to U-shaped saccus. Valva short, triangular in lateral view and rounded distally; pectinifers absent. Juxta sagittate, with anterior half abruptly broader.

Female Genitalia: As described for family.

DISCUSSION. The adults of this genus are most similar to *Cauchas* but differ in possessing usually longer male antennae (typically longer than 1.5× length of forewing), with the basal flagellomeres of the male possessing two to three dorsal, peg-like spines

(absent in *Cauchas*) and with the eyes often enlarged in the males and with the antennal sockets positioned more closely together.

Figures 66, 77, and 58 show the maximum likelihood gene tree of the COI barcode region for selected species of *Adela*, *Cauchas*, and *Nemophora* (the single tree is split across the three figures). *Adela* falls out as two separate clades that are not sister to each other: (1) a well-supported clade (BS=0.90) containing all Western Hemisphere *Adela* species that lack male antennal hook-pegs plus all Western Hemisphere *Cauchas* species, with the *Adela* and *Cauchas* species not forming separate subclades within this clade but instead being heavily intermingled with each other; and (2) a moderately supported clade (BS=0.73) containing all *Adela* species (both Nearctic and Palearctic) that possess male antennal hook-pegs. Both of these clades also contain a few Palearctic *Cauchas* species. The “hook-peg” *Adela* clade is sister to the *Nemophora* clade, though with poor support (*Nemophora* males also possess antennal peg spines, though they are not hook-shaped), and the “no peg” *Adela*+Nearctic *Cauchas* clade is sister to the combined *Nemophora*+“hook-peg” *Adela* clade, though again with poor support. Setting aside for the moment the polyphyly of the Palearctic *Cauchas*, what is perhaps most interesting about these results is that *Adela* splits cleanly into two clades based on whether or not they possess male antennal hook-pegs, irrespective of whether they are Palearctic or Nearctic species. While we must bear in mind the caveats given in the Materials and Methods section about how much one can safely infer from a single, tiny region of mitochondrial DNA, the possibility that these two clades might be indicating true signal is intriguing. That said, there are morphological characters that do not match the pattern of these two COI clades: antennal sockets are approximate in *Adela* and widely separated in *Cauchas*, male eyes are holoptic in *Adela* and smaller and wide apart in *Cauchas*, and so on (Nielsen 1980). If further study, particularly of nuclear genomes, shows the same “hook-peg” versus “no peg” pattern as the COI clades, then it would be reasonable to consider true *Adela* as comprising only those species that possess male antennal hook-pegs. In that case, the clade comprising “no peg” *Adela*+Nearctic *Cauchas* would be in need of a new genus name; *Chalceopla* Braun, 1921 is available for that purpose. Further discussion of *Cauchas* can be found under that genus.

The monotypic genus *Trichofrons* Amsel, 1937 [type species: *Adela pantherella* Guenée in Lucas, 1849: 409, pl. 4 (fig. 11), by original designation] was proposed for a North African species that differs in wing venation from typical *Adela*; whether those differences are significant enough to warrant separate generic status is a question that is beyond the scope of this revision, and we do not attempt to answer it here.

KEY TO THE NEW WORLD SPECIES OF *ADELA*

1. Basal 1/4–1/3 of antenna appearing thicker than remainder of flagellum and bearing rough, semi-erect scales 2
Antenna smoothly scaled throughout its length 8
2. Forewing unicolorous, without fasciae 3
Forewing with variable, usually fasciate patterns over distal third 4
3. Forewing coppery brown [Figure 174] *powelli*
Forewing black with iridescent purplish brown [Figure 157] *atrata*
4. Subapical region of forewing with variable pattern of 2–4 pale yellowish-brown striations extending mostly lengthwise to wing margin [Figures 188–189]; male antenna with 3–4 dorsal peg spines. *striata*
Subapical region of forewing with variable pattern of slender, fuscous, and silvery brown to bluish fasciae traversing wing; antenna with 2–3 dorsal peg spines. 5
5. Forewing mostly dark fuscous with 2–3 variably faint, pale bluish fasciae traversing distal third of forewing; eyes not sexually dimorphic with male eyes relatively reduced [Figure 23]. 6
Forewing predominantly light to dark reddish brown with 2–3 variably developed, black and silvery gray fasciae traversing distal third of forewing; eyes sexually dimorphic with male eyes enlarged [Figure 39] 7
6. Fasciae across distal third of forewing indistinct and separated by darker, more fuscous scales [Figure 153]; male valva with ventral margin of sacculus irregular [Figure 273c]; basal third of male antenna rough scaled. *caerulelella*
Fascia across distal third of forewing more distinct and separated by more brownish scales [Figures 154–156]; male valva with ventral margin of sacculus more smooth and rounded [Figure 274c]; basal third of male antenna smoothly scaled *aethiops*
7. Basal most fascia at distal third of forewing straight, not curved [Figure 191]; distribution Bolivia *boliviella*
Basal most fascia at distal third of forewing slightly curved toward apex [Figures 178–187]; distribution Central America *astrella*
8. Forewing very slender, width less than 0.28 its length [Figure 158]; male antenna without hook spines *stenoptera*
Forewing broader, width more than 0.3 its length. 9
9. Distal half of forewing with 1 or more fasciae completely traversing wing 10
Distal half of forewing without fascia traversing wing 17
10. Distal third of forewing with 3 pale bluish fasciae traversing wing [Figure 155]; basal third of female antenna rough scaled *aethiops*
Distal third of forewing with no pale bluish fasciae and fewer than 3 whitish fascia traversing wing; basal third of female antenna smoothly scaled. 11
11. A usually Y-shaped, whitish fascia traversing forewing at mid-length; distal anal region of forewing with a cluster of ~5–6 relatively large, black spots [Figure 175]. 12
Forewing without Y-shaped median fascia; black spots absent from distal anal region. 13
12. Basal half of forewing coppery brown with a golden sheen often present in female [Figure 175]; distribution northeastern North America [Map 25] *ridingsella*
Basal half of forewing usually darker [Figures 176, 177]; distribution southern Arizona through Central America [Map 25] *austrina*
13. Forewing with a single white fascia completely traversing wing near distal third 14
Forewing with 2 white fasciae completely traversing wing 15
14. Forewing also with a subapical fascia partially traversing forewing [Figure 162]; wing expanse 12–13 mm. *purpurea*
Forewing with only a single complete fascia near distal third of wing [Figure 149]; wing expanse less than 12 mm. *singulella*
15. Forewing with a third subapical fascia extending ~3/4 across wing [Figure 163] 16
Forewing with 2 fasciae at basal third and distal third of wing and no subapical fascia [Figures 160, 161] *septentrionella*
16. Male with vestiture of vertex of head predominantly or entirely orange [Figure 166]. *eldorada*
Vestiture of vertex of male head predominantly or entirely black [Figure 163]. *trigrapha*
17. Length of antenna is \times length of forewing: ♂ 1.0–1.2 \times ; ♀ 0.8 \times [Figures 172, 173] *oplerella*
Length of antenna is \times length of forewing: ♂ 2.0 \times or more; ♀ 1.2 \times or more 18
18. Eyes not strongly dimorphic between sexes, with diameter of male eye similar to that of female and not greater than distance between eyes [Figures 19–22] 19

- Eyes strongly dimorphic between sexes, with diameter of male eye greatly enlarged to more than 2× the distance between eyes [Figures 25, 26, 31–34] 20
19. Forewing usually with a single, narrow white fascia traversing wing slightly beyond mid-length [Figure 149]; forewing sometimes immaculate; length of antenna longer: ♂ 3.0–3.3×, ♀ 2.5–3.5× length of forewing *singulella*
Forewing usually immaculate, sometimes with a tiny white spot at the distal end of the discal cell; length of antenna shorter: ♂ 2.5–3.0×; ♀ 2.5–2.6× length of forewing [Figure 148] *punctiferella*
20. Forewing typically with 2 slender, white fasciae near middle of wing [Figures 160, 161] but sometimes without fasciae and entirely fuscous; eyes of male proportionately less enlarged, with interocular distance at vertex ~0.8× vertical diameter of eye [Figure 25] *septentrionella*
Forewing without white fasciae near mid-length of wing; usually with 1–6 pale yellowish to whitish spots of variable size along wing margin; eyes of male more enlarged, with interocular distance at vertex ~0.5× or less the vertical diameter of eye [Figures 31, 33] 21
21. Forewing usually more densely spotted with 1–6 pale yellowish to white spots [Figures 168, 169] but sometimes immaculate; fringe fuscous; vinculum-saccus of male with subtruncate anterior end [Figure 281a]. *flammeusella*
Forewing less densely spotted with 2–3 white to pale yellow spots [Figures 170, 171] but sometimes immaculate; fringe white; vinculum-saccus of male with narrower anterior end [Figure 282a]. *thorpella*

Adela punctiferella Walsingham

FIGURES 19–20, 148, 271, 307, 372; MAP 19

Adela punctiferella Walsingham, 1890: 284.—Dyar, 1903: 575, no. 6556.—Meyrick, 1912a: 11; 1912b: 9.—McDunnough, 1939: 110, no. 9846.—Powell, 1969: 231.—Davis 1983: 4, no. 219.—Poole, 1996: 626.—Powell and Opler, 2009: 40.

ADULT. (Figure 148). Wing expanse: ♂, 8.6–10.5 mm; ♀, 9.5–10.4 mm.

Head: (Figures 19, 20). Vertex and frons white with fuscous hairs almost equally intermixed; fuscous hairs tending to be greater in length. Male antenna long, ~2.5–3.0× length of forewing; 112–137-segmented; flagellum grayish along basal half, becoming gradually whiter toward apex; apical third completely white; scape mostly white with some scattered gray scales; cilia minute, visible only under higher magnification (~100×), less than 0.2× the width of flagellomere; bases of antenna separated a distance ~equal to diameter of socket. Female antenna ~2.5–2.6× the length of forewing, with about 108–119 segments; antennal sockets widely separated ~equal to their diameter; scape smooth and fuscous above, with a tuft of black and white hairs ventrally; flagellum mostly fuscous dorsally, whitish or partially banded with white ventrally. Eyes sexually dimorphic; obovoid in male and enlarged, interocular index approximately 0.6; eyes well separated at vertex, the interocular distance about 1.6× the vertical diameter of eye. Female with eyes suboval and slightly reduced in size; interocular index approximately 0.5; eyes widely separated at vertex as in male (Figures 19–20). Maxillary palpus grayish, 3-segmented, less than 1/6 the length of labial palpus; apical segment minute. Labial palpus whitish with a mixture of long, fuscous, erect, piliform scales arising from second segment; apical segment gray, smooth.

Thorax: Dorsum grayish bronze with a greenish hue; venter predominantly white. Legs gray to grayish bronze dorsally, whitish ventrally; tarsomeres not ringed with white. Forewing

uniformly grayish bronze with a slight greenish hue, except for a small white spot sometimes present at apex of discal cell; a slender white line usually not traversing wing seldom present; fringe same color as wing. Hindwing uniformly bronzy gray with a purplish hue. M1 and M2 separate.

Abdomen: (Figure 307). Bronzy gray dorsally, with a scattering of white ventrally, often concentrated near sternum 7; many specimens all silvery white ventrally. Seventh sternite of female ~2.8–2.9× length of sixth; eighth sternite uniformly and lightly pigmented.

Male Genitalia: (Figure 271). Uncus triangular, apex slightly rounded. Vinculum-saccus elongate, approximately 2× the length of valva; anterior end slightly broader than in *A. singulella* and sometimes slightly notched. Valva with slender cucullus ~0.4× the length of entire valva with rounded apex; sacculus broad at base then narrowing apically; sacculus ~0.6× length of valva. Juxta elongate, slender; anterior end broadly sagittate nearly half the length of entire juxta; posterior half gradually broadening caudally. Phallus elongate, slender; base moderately flared, bilobed; apex abruptly narrowing.

Female Genitalia: (Figure 372). Apex of ovipositor acute, symmetrical, similar to *A. singulella*. Vestibulum elongate, length ~1.8× the vertical diameter; surface slightly rugose.

TYPE. Holotype, ♀ (BMNH).

TYPE LOCALITY. Los Angeles Co., California.

HOST. Unknown. Adult moths have been observed on or hovering over *Erigeron* sp. (Asteraceae), *Cryptantha barbigera* (A. Gray) Greene, *Phacelia distans* Benth. (Boraginaceae); *Lupinus* sp., *Trifolium* sp. (Fabaceae); *Gilia tricolor* Benth. and *G. scopulorum* M. E. Jones (Polemoniaceae).

FLIGHT PERIOD. Beginning of March to April at lower elevations to mid-May in the interior mountains (Powell 1969).

DISTRIBUTION. (Map 19). Generally more southern than *A. singulella*, occurring in semiarid parts of California and southern Nevada, east side of the coast ranges from Colusa County southward, southern end of the Sierra Nevada, the desert ranges

east of the Sierra Nevada into Nye County, Nevada, both cis- and transmontane sides of the Transverse and Northern Peninsular Ranges south to Pima County, Arizona (Powell 1969, in part).

MATERIAL EXAMINED. 358 males, 160 females. **UNITED STATES:** **ARIZONA:** Pima Co.: Kitt Peak, entrance road, 32°0'43", 111°34'30", 3,340 ft. [1,018.3 m]: 18 ♂, 13 ♀, 17 Mar 2012, Wagner & M. Brummermann, on *Cryptantha barbiger*, USNM slide 34694 ♂, BOLD ID LNAUS674-12; 31°59'36", 111°34'42.5": 3 ♂ 5 ♀, 24 Mar 2012, DLW lot 2012C444, on *Cryptantha barbiger*. Pima Co.: Catalina Hwy, mile marker 2: 1 ♀, 29 Mar 2012, Wagner, on *Phacelia distans*; Catalina Hwy, 32°20'20", 110°41'33", 4,440 ft. [1,353.7 m]: 1 ♀, 29 Mar 2012, Wagner, on *Erigeron*, BOLD ID LNAUS675-12. Tucson, Sabino Canyon, 32°31'01", -110°82'22" [19°19'19.7", 110°48'43"], 2,800 ft. [853.7 m]: 21 Mar 2012, 1 ♂, 1 ♀, Wagner & Brock, USNM slide 34449 ♂ (DLW, USNM). Yavapai Co.: 2 mi. [3.2 km] E Cleator: 7 ♂, 16 ♀, 23 Apr 1978, R. Wielgus, USNM slides 20835 ♂, 34262 ♂, 34451 ♂, 20836 ♀ (USNM). **CALIFORNIA:** Colusa Co.: Lodoga, 4 mi. [6.4 km] NW: 6 ♂, 3 ♀, 12 Apr 1962, J. Powell, UCB. Fresno Co.: Mercy Hot Spring: 5 ♂, 1 ♀, 2 Mar 1965, J. Powell, antenna slide USNM 16076, slide USNM 16058 ♀ (UCB, USNM). Inyo Co.: Aguerberry Camp, 3 mi. [4.8 km] SW, 5,320 ft. [1,632 m], Panamint Mts.: 1 ♀, 11 May 1957, Langston (UCB). Mazourka Canyon, Independence, 8 mi. [13 km] NE: 42 ♂, 37 ♀, 11 May 1969, Powell and Chemsak, BOLD ID LNAUS673-12 (UCB, USNM). Westguard Pass, 6 mi. [9.6 km] W: 1 ♀, 16 May 1969 (UCB). Kern Co.: Canebraker Creek, 3 mi. [4.8 km] W. Walker Pass: 8 ♂, 1 ♀, 30 Apr 1964, J. Powell, USNM slide 16078 ♀ antenna (UCB, USNM). Dove Well: 4 ♀, 1 May 1964, J. Powell (UCB). Havilah: 3 ♂, 1 ♀, 28 Apr 1964, J. Powell (UCB). Havilah, 3 mi. [4.8 km] NE: 1 ♂, 1 ♀, 15 May 1963, J. Powell (UCB). Walker Pass cmpg, 35.663905°, -118.036926°, 1,540 m, 1 ♂, CNCLEP00146675, DRD genitalia slide 34728 (USNM), 1 ♂, CNCLEP00146676, 2 ♀, CNCLEP00146678, CNCLEP00146680, 11 May 2016, J.-F. Landry & V. Albu, afternoon sweeping flowers (CNC). Lake Co.: Lakeport, 1 mi. [1.6 km] SW: 1 ♂, 24 Apr 1963, R. Thorpe (UCB). Los Angeles Co.: 1 ♀ (holotype), Mar, Riley (BMNH); 1 ♂, 15 Apr 1937, E. Linsley (UCB); 1 ♂, Mar (USNM). Los Angeles: 3 ♂, Coquillett (USNM). Mint Canyon: 3 ♂, 1 ♀, 6 Apr 1950, C. Henne (USNM). Near Pasadena, 1,080 ft. [330 m]: 1 ♂, 4 ♀, 2 Apr 1909, F. Grinnell Jr. (LACM). Madera Co.: 8 air km S. O'Neals, 400 m: 1 ♂, 10 Apr 2010, Albu & Powell, ♂, BOLD ID LNAUT1793-14 (UCB). Monterey Co.: 4 air mi. [6.4 km] E. Arroyo Seco Guard Station, 650 ft. [198 m]: 1 ♂, 9 May 1975, P. Rude, 1 ♂, 10 May 1975, J. Powell (UCB). Horsebridge, 1.5 air mi. [2.4 km] SW. Arroyo Seco Guard Station, 1,300 ft. [396 m]: 1 ♂, 3/7 May 1975, J. Powell (UCB). Riverside Co.: R. R. Canyon, 4 mi. [6.4 km] E. Elsinore: 60 ♂, 5 ♀, 12–17 Apr 1965, J. Powell (UCB). Pinyon (Piñon) Flat, 16 road mi. [25.7 km] SW. Palm Desert: 7 ♂, 13 Apr 1963, J. Powell; 3 ♂, 1 ♀, 20 Apr 1962, MacNeill, Rentz, and Brown, UCB slide 1804 ♀ (UCB); 62 ♂, 14 ♀, MacNeill, Rentz, ♀ Brown (CASC). Sage: 1 ♂, 1 ♀, 15 Apr 1965, J. Powell (UCB). 5 mi. [8 km] S. Sage: 37 ♂, 3 ♀, 15–16

Apr 1965, J. Powell; 2 ♂, 4 ♀, 15 Apr 1965, C. Torsch; 12 ♂, 2 ♀, 17 Apr 1965, Slobodchikoff (UCB). San Benito Co.: 4 mi. [6.4 km] S. Mercey Hot Springs: 31 ♂, 6 ♀, 2 Mar 1965, J. Powell (UCB). San Bernardino Co.: Camp Baldy, San Bernardino Mts.: 5 ♂, USNM slide 1299 ♂ (USNM). Fontana, 4 mi. [6.4 km] N: 1 ♀, 14 Apr 1965, Powell (UCB). Mint Canyon, Canyon NW. Summit: 1 ♂, 30 Apr 1945 (UCB). San Bernardino: 3 ♂, Sep, 2 ♂, USNM slide 20082 ♀ (USNM). Santa Clara Co.: Coyote, 1 mi. [1.6 km] N: 2 ♀, 21 Mar 1965, *Gilia tricolor*, P. Opler (UCB); 8 ♂, 12 ♀, 4 Apr 1965, P. Opler (UCB). Hale Hill, N of Morgan Hill, 20 Mar 1990, BOLD ID LNAUT1792-14 (UCB). New Almaden, 3 mi. [4.8 km] W: 1 ♂, 25 Mar 1965, P. Opler, sweeping mostly *Gilia tricolor*, *Lupinus*, ♀ *Trifolium* (UCB). 2 mi. [3.2 km] W. San Martín: 3 ♂, 5 Mar 1986, 1 ♂, Murphy, Powell; 1 ♀, 9 Apr 1986, Murphy, Opler, Powell (UCB). Tulare Hill: 1 ♂, 23 Mar 1990, A. Lanner, BOLD ID LNAUT1791-14 (UCB). Tulare Hill, 2 mi. [3.2 km] NW Coyote: 1 ♂, 9 ♀, 14 Mar 1986; 4 ♂, Murphy, Powell; 1 ♀, 9 Apr 1986, Murphy, Opler, Powell (UCB). Santa Cruz Co.: Uras Canyon: 1 ♂, 22 Apr 1950, J. W. Tilden (CASC). Solano Co.: Stebbins-Cold Canyon Reserve: 23 Mar 1990, J. Powell, BOLD ID LNAUT1794-14 (UCB). Ventura Co.: Lockwood Valley Rd, 34.749359°, -119.046612°, 1,528 m, 4 ♂, CNCLEP00146339, CNCLEP00146339, CNCLEP00146340, CNCLEP00146341, CNCLEP00146342, 10 May 2016, J.-F. Landry & V. Albu, afternoon sweeping flowers (CNC). **NEVADA:** Nye Co.: Mercury: 1 ♂, 11 Jun 1965 (UCB).

DISCUSSION. Walsingham named this species for the presence of a small white spot sometimes present at the apex of the discal cell. But as Powell (1969) noted, only about 30% of the known specimens of *A. punctiferella* examined possess this spot. Unmarked specimens of *A. singulella* and *punctiferella* are very similar in appearance. Adults of *A. punctiferella* tend to be slightly smaller in size and their antennae often slightly shorter. The male genitalia of the two species differ slightly, with the sacculus of *A. punctiferella* noticeably longer than in *singulella* and the apex of the cucullus more slender. *Adela punctiferella* also has a more southern distribution, occurring as far south as southern Arizona. The COI gene tree (Figure 66) indicates that *A. punctiferella* and *A. singulella* form a clade within the New World *Adela*.

Adela singulella Walsingham

FIGURES 21, 22, 149, 272, 308, 373; MAP 19

Adela singulella Walsingham, 1880: 80; 1890: 285.—Dyar, 1903: 576, 6561.—Meyrick, 1912a: 11; 1912b: 9.—McDunnough, 1939: 110, no. 9845.—Powell, 1961: 63; 1969: 229.—Davis, 1983: 4, no. 220.—Poole, 1996: 626.—Powell and Opler, 2009: 40.

ADULT. (Figure 149). Wing expanse: ♂, 8.8–10 mm; ♀, 10–11.3 mm.

Head. (Figures 21, 22). Whitish, almost equally intermixed with fuscous. Antenna of approximately equal length in male and female, ~3.0–3.3× length of forewing in male and

2.5–3.5× in female, with ~128–148 segments; dorsal sex spines absent; scales predominantly whitish, basal third including scape strongly banded with fuscous; antennal sockets relatively widely separated ~1.0× the interocular distance in both sexes. Eyes approximately similar in size in male and female, circular, interocular index ~0.6–0.67; facets of uniform size. Haustellum with basal half white, sometimes irrorated with grayish fuscous. Maxillary palpus grayish, usually with equal white scaling; typically 3-segmented, rarely 2. Labial palpus mostly white in female, with mixture of long fuscous and whitish hairs from venter of segment II; segment III fuscous dorsally; male with segment I white, II and III fuscous, irrorated with white ventrally; hairs from segment II mostly fuscous.

Thorax: Dorsum fuscous with coppery luster. Venter white. Legs fuscous dorsally, white ventrally; tibial spurs mostly white. Forewing typically dark fuscous with a coppery to purplish luster, often with a narrow, straight, white fascia slightly beyond middle of wing and often with edge of costa white from fascia to apex; the white fascia absent in populations from the California central coast range and along the west slope of the Sierra Nevada (Powell 1969). Hindwing approximately same ground color as forewing, usually with a slight purplish luster. M1 and M2 separate.

Abdomen: (Figure 308). Dark bronzy fuscous dorsally, white ventrally. Seventh sternite of female 2.8–2.9× length of sixth; eighth sternite uniformly and lightly pigmented.

Male Genitalia: (Figure 272). Uncus triangular, apex narrowly rounded. Vinculum-saccus elongate, approximately 2× the length of valva; anterior end slightly narrower than in *A. punctiferella* and evenly rounded. Valva with slender cucullus ~0.5× the length of entire valva with rounded apex that is curved slightly ventrad; sacculus broad at base and then narrowing abruptly near middle of valva; sacculus ~0.5× length of valva. Juxta elongate, slender; anterior end broadly sagittate and ~one-third the length of entire juxta; posterior half gradually broadening caudally. Phallus elongate, slender; base moderately flared, bilobed; apex abruptly narrowing.

Female Genitalia: (Figure 373). Apex of ovipositor acute, symmetrical, similar to *A. punctiferella*. Vestibulum elongate, length ~2× the vertical diameter; surface slightly rugose.

TYPE. Lectotype, ♂ (present designation): “Type; Head of dry creek, Mendocino Co, California, 24. V. 1871, Wlsm; Walsingham Collection 1910–427; *Adela singulella* Wlsm., P.Z.S. 1880, 80. Pl. XI. 4, Type ♂; ♂ genitalia on slide 15294, D. R. Davis; Lectotype, *Adela singulella* Wlsm., by D. R. Davis” (BMNH).

TYPE LOCALITY. UNITED STATES: CALIFORNIA: Mendocino Co.: Head of dry creek.

HOST. Adults were observed ovipositing in Polemoniaceae: *Gilia achilleifolia* Benth. and *Gilia capitata* Sims. Adults were also observed visiting flowers to collect nectar (subsequently called “nectaring”) or hovering over the flowers of *Cryptantha* spp. and *Plagiobathmus nothofulvus* A. Gray (Boraginaceae) (data from specimen labels) and in close association with *Gilia scopulorum* M. E. Jones and *G. tricolor* Benth. (Polemoniaceae) (Powell 1969).

FLIGHT PERIOD. Mid-May to mid-June north of San Francisco Bay, the central Sierra Nevada and the San Gabriel Mountains. April in south coast range and southern Sierra Nevada (Powell 1969).

DISTRIBUTION. (Map 19). At present, this species is known only from California, where it occurs in southern Mendocino, Napa, and northern Marin Counties (typical form); west slope of the Sierra Nevada (600–6,000 ft) [183–1829 m] from El Dorado to Kern County, in the coast ranges of Santa Clara County southward to San Luis Obispo County (unbanded form), thence into the San Gabriel Mountains (taken verbatim from Powell 1969); also found at lower elevations through the coastal ranges from El Dorado and Lake Counties in the north as far south as San Diego County (Powell 1969).

MATERIAL EXAMINED. 255 males, 152 females. **UNITED STATES:** CALIFORNIA: Specific locality unknown: 2 ♂, “type” Fernald Coll. (USNM). El Dorado Co.: 4 mi. [6.4 km] W Georgetown: 8 ♂, 4 ♀, 7 Jun 1967, Powell, USNM slide 16081 antenna (UCB, USNM). Kern Co.: 6 mi. [9.6 km] W Alta Sierra: 8 ♂, 2 ♀, 18 Apr 1962, D. Janzen (UCB). 3 mi. [4.8 km] W Wofford Hts: 19 ♂, 3 ♀, 2 May 1964, J. Powell, USNM slide 16083 ♀ (UCB, USNM). Lake Co.: Hobergs: 1 ♀, 31 May 1969, Opler (UCB). Kelsey Creek, 4 mi. [6.4 km] NW Cobb: 2 ♂, 3 ♀, 28 May 1978, P. Rude (UCB). Los Angeles Co.: Mint Canyon S: 1 ♂, 30 Apr 1945 (UCB); 1 ♂, 1 ♀, 6 Apr 1950, C. Henne, USNM slide 16080 antenna, legs (USNM). Santa Monica Mts., 1,800 ft. [550 m]: 1 ♂, 17 Apr 1955, C. Henne, hovering over *Cryptantha* flowers (UCB). Tanbark Flat: 1 ♂, 18 Jun 1950, W. McDonald (LACM); 1 ♀, 18 Jun 1956, G. Stage (UCB); 1 ♂, 18 Jun 1956, A. Menke (UCB). Marin Co.: 5 mi. [8 km] E. Nicasio: 21 ♂, 5 ♀, 25 May 1969, Opler, *Gilia capitata*, USNM slide 16084 ♀ (UCB, USNM). Mariposa Co.: El Portal, 3.5 mi. [5.6 km] E: 2 ♀, G. Stage, *Gilia capitata* (UCB). Mendocino Co.: Head of dry creek: 1 ♂ (lectotype), 24 May 1871, Walsingham, ♂ slide 15294 (BMNH); 1 ♂, 2 ♀ (paralectotypes), 24 May 1871, USNM slide 20079 ♀, Walsingham (BMNH, USNM). 5 mi. [8 km] SW Ukiah: 1 ♀, 22 May 1960; 1 ♂, 24 ♀, 11 Jun 1961 (CASC); 8 ♂, 1 ♀, 22 May 1960, S. Cook, slide 1695 (UCB). Monterey Co.: 4 mi. [6.4 km] E Arroyo Seco Guard Station, 650 ft. [198 m]: 1 ♀, 9 Apr 1979, P. Rude (UCB). Paloma Creek, 3 air mi. [4.8 km] NE Arroyo Seco Guard Station, 900 ft. [275 m]: 1 ♂, 3 ♀, 5 May 1975, Powell ♀ Chemsak, on *Gilia capitata* (UCB). Napa Co.: Conn Dam, 7 mi. [11.3 km] NE: 4 ♂, 1 ♀, 18 May 1966, J. Powell, USNM slide 16082 ♀ (UCB, USNM); 5 ♂, 19 ♀, 5 Jun 1964, Chemsak, *Gilia capitata* var. *capitata*, USNM slide 16044 ♀ (UCB, USNM); 12 ♂, 11 ♀, 5 Jun 1964, J. Powell (UCB). Rutherford, 11 mi. [17.7 km] E: 1 ♂, 30 May 1968, S. Welles (UCB). San Bernardino Co.: Camp Baldy, San Bernardino Mts.: 4 ♂, 1 ♀, USNM slide 20064 ♂ (USNM). San Bernardino: 1 ♂, 1 ♀, Sept, USNM slides 16040 wings, 20082 ♀ (USNM). San Benito Co.: Pinnacles: 3 ♂, 15 Apr 1960, K. Ait (UCB). San Luis Obispo Co.: La Panza Camp, 12 mi. [19.3 km] NE Pozo: 2 ♂, 6 ♀, 25 Apr 1968, Chemsak ♀ Powell (UCB); 5 ♂, 1 ♀, 25 Apr 1968, D. Viers (UCB); 3 ♂, 2 ♀, 29 Apr 1960, R. Langston (UCB); 7 ♂, 4 ♀, 29 Apr 1960, G. Toschi, *Gilia achilleifolia* (UCB). Paso Robles, 3 mi. [4.8 km] W:

1 ♂, 1 ♀, 28 Apr 1968, Powell (UCB). Santa Clara Co.: New Almaden, 0.5 mi. [0.8 km] N: 6 ♂, 2 ♀, 23 Apr 1965, P. Opler, on *Gilia achilleifolia*, USNM slide 16079 ♂ (UCB, USNM). Herbert Creek, 3 mi. [4.8 km] W New Almaden: 2 ♂, 20 Apr 1966, J. Slater (UCB); 2 ♂, 28 Apr 1969, J. Powell (UCB). San Diego Co.: Morris Ranch, CNF [Cleveland National Forest], Laguna Mts.: 4 ♂, 31 May 2005, D. K. Faulkner (USNM). Sierra Co.: Shenanigan Flat, 1 mi. [1.6 km] W Indian Valley: 2 ♂, 2 ♀, 17 Jun 1967, G. Gorelick (UCB). Shenanigan Flat, 2 mi. [3.2 km] W Indian Valley: 7 ♂, 3 ♀, 17 Jun 1967, P. Opler, *Gilia capitata* (UCB). Yuba River, 9 mi. [14.5 km] W Goodyears Bar: 18 ♂, 2 ♀, 29 May 1965, C. MacNeill (CASC). Sonoma Co.: 2 mi. [3.2 km] E Healdsburg: 23 ♂, 10 ♀, 18 May 1966, J. Powell, USNM slide 34649 antenna ♂ (UCB, USNM); 3 ♂, 18 May 1966, Slater (UCB); 5 ♀, 18 May 1966, J. Wolf (UCB). Tulare Co.: Ash Mt. Headquarters, 1,700 ft. [518 m]: 4 ♂, 2 ♀, 30 Apr 1979, M. Buegler (UCB); 1 ♀, 3 May 1979, J. Chemsak (UCB); 9 ♂, 4 ♀, 27 Apr 1979; 5 ♂, 1 ♀, 28 Apr 1979; 3 ♂, 1 ♀, 4 May 1979, J. Powell, on *Gilia capitata* (UCB); Ash Mt. Headquarters, 2,000 ft. [610 m]: 3 ♂, 2 ♀, 30 Apr 1979; J. Powell, in copula on *Gilia capitata* 1400 (UCB). 9 mi. [14.5 km] NW California Hot Spring: 6 mi. [9.6 km] N Kaweah: 1 ♂, 14 May 1963, Powell, *Gilia capitata* (UCB). Coffee Camp, 5 mi. [8 km] E Springfield: 2 ♀, 1 May 1979, J. Powell (UCB). 4 mi. [6.4 km] N Kaweah: 3 ♀, 13 May 1963, S. Earnshaw (UCB). 6 mi. [9.6 km] N Kaweah: 1 ♂, 1 ♀, 28 Apr 1979, J. Powell, on *Gilia capitata* (UCB). Lemoncove, 4 mi. [6.4 km] NE: 2 ♂, 4 ♀, 13 May 1963, Powell (UCB). 1 mi. [1.6 km] NE Posey: 1 ♂, 14 May 1963, S. Earnshaw (UCB); 1 ♂, 14 May 1963, C. Toschi (UCB). Trinity Co.: 5 air mi. [8 km] SE Hayfork: 4 ♂, 25 May 1973, J. Powell (UCB). 6 air mi. [9.6 km] SE Hayfork: 4 ♂, 1 ♀, 23 May 1973, Chemsak ♀ Szerlip (UCB). Tuolumne Co.: Mather, 1 mi. [1.6 km] S: 20 ♂, 6 ♀, G. Stage, on *Gilia capitata* (UCB). 1 mi. [1.6 km] NE Tuolumne: 1 ♂, 1 May 1961, J. Powell (UCB). North Fork Tuolumne River, 3 mi. [4.8 km] NE Tuolumne: 3 ♂, 13 May 1961, R. Brown (CASC). Yuba Co.: Sierra Foothill Field Station, 5 mi. N Smartville, 1,300–1,500 ft. [396–457 m]: 1 ♂, 4 May 1980, M. E. Buegler (USNM).

DISCUSSION. The typical form of this species is characterized by the single, slender white fascia slightly beyond the middle of the wing. The white fascia is absent in populations from the California central coast range and along the west slope of the Sierra Nevada (Powell 1969). The costal margins of the forewing are often white from the fascia to the apex. In addition to these often variable characteristics, the male genitalia of *A. singulella* differ from the immaculate form of *A. punctiferella* by the relatively shorter sacculus and more curved cucullus.

Adela caeruleella Walker

FIGURES 12–15, 23, 24, 150–153, 273, 309, 374; MAP 20

Adela caeruleella Walker, 1863: 502.—Meyrick, 1893: 486; 1912a: 12; 1912b: 10.—Forbes, 1923: 78.—Davis, 1983: 4, no. 227.—Heppner, 2003: 233.—Knudson and Bordelon, 1999: 1.

Adela bella Chambers, 1873: 73; 1877: 207; 1878a: 110; 1878b: 127; 1879: 125.—Walsingham, 1880: 78, 79; 1890: 285.—Dyar, 1903: 575, no. 6553.—Kearfott in Smith, 1903: 124, no. 7091.—Engel, 1908: 135.—Forbes, 1923: 78.—Philpott, 1927: 727–728, fig. 32.—McDunnough, 1939: 110, no. 9847.—Kimball, 1965: 303.—Powell, 1969: 218.—Heppner, 1974: 67; 2003: 233.—Davis, 1983: 4, no. 227 [new synonym of *Adela caeruleella*].—Poole, 1996: 626.—Heppner, 2003: 233.

Adela chalybeis Zeller, 1873: 226.—Chambers, 1878b: 127.—Walsingham, 1880: 79; 1890: 285 [synonym of *Adela bella*].—Riley in Smith, 1891: 96, no. 5140 [synonym of *Adela bella*].—Dyar, 1903: 575, no. 6553 [synonym of *Adela bella*].—Meyrick, 1912a: 12 [synonym of *Adela bella*]; 1912b: 10 [synonym of *Adela bella*].—Forbes, 1923: 78 [synonym of *Adela bella*].—McDunnough, 1939: 110, no. 9847 [synonym of *Adela bella*].—Powell, 1969: 218 [synonym of *Adela bella*].—Davis, 1983: 4, no. 227.—Heppner, 2003: 233 [synonym of *Adela caeruleella*]. *Adela iochora* Zeller, 1877: 220.—Davis, 1983: 4, no. 227.—Heppner, 2003: 233 [synonym of *Adela caeruleella*].

Adela iochroa [sic] Walsingham, 1880: 79; 1890: 285.—Riley in Smith, 1891: 86, no. 5140 [synonym of *Adela bella*].—Dyar, 1903: 575, no. 6553 [synonym of *Adela bella*].—Meyrick, 1912a: 12 [synonym of *Adela bella*]; 1912b: 10 [synonym of *Adela bella*].—McDunnough, 1939: 110, no. 9847 [synonym of *Adela bella*].—Powell, 1969: 218 [synonym of *Adela bella*].

Adela oichroa [sic] Forbes, 1923: 78 [synonym of *Adela bella*].

Adela aeruginosella Walsingham, 1890: 285.—Riley in Smith, 1891: 96, no. 5539.—Dyar, 1903: 575, no. 6552.—Kearfott in Smith, 1903: 124, no. 7090.—Meyrick, 1912a: 12; 1912b: 10.—McDunnough, 1939: 110, no. 9848.—Powell, 1969: 218.—Davis, 1983: 4, no. 227 [synonym of *Adela caeruleella*].

ADULT. (Figures 150–153). Wing expanse: ♂, 6.0–6.7 mm; ♀, 6.5–7.0 mm.

Head: (Figures 23–24). Vertex pale reddish brown, frons smooth, iridescent bronze. Antenna of male greatly elongated, 3.0–3.3× length of forewing, 165–169-segmented; basal 10–12 segments smoothly scaled, dark fuscous, gradually becoming white along outer 0.8 of shaft; dorsal sex spines variable, 2–3 present on segments 11–13. Female with antenna shorter, 1.5× length of forewing, 85–88-segmented; basal half uniformly dark fuscous densely covered by rough, semi-erect scales, becoming abruptly smooth and uniformly white along distal half; antennal bases of both sexes closely approximate, separated by less than 0.5× diameter of scape. Eyes unspecialized, spherical, similar in size in both sexes; interocular index 0.7–0.8; widely separated at vertex approximately 2.0× diameter of eye. Maxillary palpus pale brown, 2-segmented. Galeae with basal fourth sparsely covered with pale brown to whitish scales. Labial palpus relatively short, second segment whitish to light brown, with long fuscous setae ventrally, approximately equal in length to third, third segment mostly fuscous, with scattering of white scales at base.

Thorax: Dorsum dark fuscous, slightly lustrous. Venter mostly whitish. Legs dark fuscous with apices of all tarsal

segments distinctly ringed with white; foretibiae with a median ring of white near base of epiphyses. Forewing dark fuscous with a slight purple luster becoming more brownish in older museum specimens; apical third of wing with an irregular series of 3 narrow, partially interrupted fasciae; fasciae iridescent (thus varying in color according to incidence of light), ranging in color from dull brownish purple to blue; fasciae frequently indistinct; a series of usually 4 marginal spots bordering termen the same color as fasciae, female occasionally with bluish fasciae separated by 3 irregular, pale brownish fasciae; fringe dark fuscous. Hindwing slightly paler than forewing, uniformly fuscous, not iridescent; M1 and M2 stalked half their length.

Abdomen: (Figure 309). Dark fuscous above and below, with a slight purple luster; abdomen of male with a few scattered white scales laterally near base. Seventh sternite of female approximately 2.5× length of sixth; eighth sternite lightly and uniformly sclerotized.

Male Genitalia: (Figure 273). Uncus minutely bilobed. Vinculum-saccus elongate, nearly 2.0× length of valvae; saccus U-shaped, anterior margin moderately rounded. Valvae roughly triangular, ventral margin irregular. Juxta with anterior half somewhat sagittate; posterior half slender. Phallus elongate, very slender, without cornuti; base slightly flared.

Female Genitalia: (Figure 374). Apex of ovipositor acute, asymmetrical; cutting edge ventral, serrulate. Bursa copulatrix relatively reduced, not exceeding posterior apophyses in length. Vestibulum reduced, irregular in form.

TYPES. Lectotype, ♂ (*Adela caeruleella*, present designation): "Type; 626; *Adela caeruleella* [sic] Wkr., spn. b loc?, Type like W. A. Damel Distrib.; 30. *Adela caeruleella* [sic]; lectotype ♂, *Adela caeruleella* Wlk., by D. Davis" (BMNH). Lectotype ♀ (*Adela bella*, present designation): "Type 1402; Kentucky, Chambers; 12; *Adela bella* Cham., Ky. May; Lectotype ♀, *Adela bella* Cham., by D. Davis (MCZ)." Holotype, ♂ (*Adela chalybeis*) (MCZ). Holotype ♂ (*Adela iochora*); "im Museum Staudinger," present deposition unknown. Lectotype ♂ (*Adela aeruginosella*, present designation): "Type; Louisiana, Morrison, 1884; Walsingham Collection, 1910–427; *Adela aeruginosella* Wlsm., Type ♂; Type; Lectotype ♂, *Adela aeruginosella* Wlsm., by D. R. Davis" (BMNH).

TYPE LOCALITIES. Unknown (*Adela caeruleella*), probably eastern United States, although erroneously stated by Walker originally as Australia. Kentucky (*Adela bella*). Texas (*Adela chalybeis*). Texas, near Dallas (*Adela iochora*). Louisiana (*Adela aeruginosella*).

HOST. Unknown. Chambers (1873) observed adults feeding on the flowers of *Celastrus scandens* L. (Celastraceae). Adults were also collected on flowers of *Cornus* sp. (Cornaceae) in late March and congregating on the leaves of *Carpinus caroliniana* Walter (Betulaceae) in mid-March to mid-April in Torreya State Park, Florida (Heppner 1974), and were observed nectaring on flowers of a yellow umbellifer in late May in Adams County, Ohio.

FLIGHT PERIOD. Mid-March to mid-August.

DISTRIBUTION. (Map 20). *Adela caeruleella* ranges widely through much of eastern North America from southeastern Canada (Quebec) to Florida, west to Missouri and Texas, and south into northeastern Mexico. The species seems to prefer well-shaded habitats within deciduous forests.

MATERIAL EXAMINED. 130 males, 68 females. CANADA: QUEBEC: Kazubazua: 1 ♀, 18 Aug 1931, G. Whalley (CNC). MEXICO: Tamaulipas: near Gomez Farias: 1 ♂, 5–8 Mar (LACM). UNITED STATES: ALABAMA: Dale Co.: Ozark, Camp Rucker: 1 ♂, 2 Apr 1943, J. Franclemont (CU). De Kalb Co.: 2 mi. [? km] SE Mentone: 2 ♂, 11 May 1995, J. Heppner (FSCA). Mobile Co.: Chickasaw [near Mobile]: 2 ♂, 20 Apr 1930 (USNM). DELAWARE: New Castle Co.: 1 ♂, 2 Jun 1936, F. Jones (USNM); Newark: 1 ♀, 7 Jun 1970, D. Brady (USNM). DISTRICT OF COLUMBIA: Washington: 1 ♀ (LACM); 1 ♂, Jun, F. Pratt (USNM). FLORIDA: Alachua Co.: University of Florida Horticultural Unit, 10 mi. NW Gainesville: 1 ♀, 19–26 Mar 1978, H. Greenbaum (USNM). Duval Co.: Ft. George Island: 1 ♂, 15 Apr 1979 (FSCA); St. John's Bluff: 2 ♂, 15 Apr 1979, H. J. Baggett (USNM). Jacksonville: 2 ♂ (AMNH). Jefferson Co.: Aucilla Wilderness Management Area, 14 mi. S Wacissa: 3 ♂, 16 Mar 1964, J. Heppner (FSCA, USNM). Liberty Co.: Torreya State Park: 3 ♂, 16 Mar 1974, J. Heppner (FSCA, USNM); 4 ♂, 1 ♀, 23 Mar 1985, S. W. Gross, *Cornus* sp. blossoms (FSCA, USNM); 1 ♂, 28 Apr 1952, G. Whalley (USNM); 5 ♂, 28 Apr 1952, G. Whalley (CNC); 6 ♀, 22 Apr (UCB). GEORGIA: Gilmer Co.: Conasauga Ck.: 1 ♂, 15 May 1998, J. Heppner (FSCA). Rabun Co.: Chattahoochee National Forest, Tate Campground [near border of North Carolina]: 1 ♂, 16–17 May 1970, O. Flint (USNM). Clayton, 2,000 ft. [609.6 m]: 1 ♂, 18–26 May 1911, J. Bradley (CU). KANSAS: Douglas Co.: Breidenthal Reserve; 15 mi. [24 km] SE Lawrence: 4 ♂, 22–27 May (USNM). KENTUCKY: Specific locality unknown: 1 ♀ (lectotype, *Adela bella*), May, Chambers (MCZ). Bullitt Co.: Mt. Washington: 1 ♂, 23 May 1966, C. Covell (USNM). Menifee Co.: 1 ♂, 10 May 1987, J. Heppner (FSCA). LOUISIANA: Specific locality unknown: 1 ♂ (lectotype, *Adela aeruginosella*), 10 ♂, 1 ♀, 1884, Morrison (paralectotypes, *Adela aeruginosella*) (BMNH); 1 ♂, 1884, Morrison (paralectotypes, *Adela aeruginosella*) (USNM); 5 ♂, slide USNM 1297?? (USNM). Natchitoches Parish: Kisatchie National Forest. West of Gorum: 1 ♀, 12 Apr 1996, V. A. Brou (VAB); St. Tammany Parish: 4.2 mi. NE Abita Springs, sec. 24, T6, SR 12E, 1 ♂, 5 Apr 2001, V. A. Brou (VAB); Covington: 14 ♂, 7 ♀, Apr 16, 1988, 6 ♂, Apr 21, 1988, V. A. Brou (VAB, USNM). West Feliciana Parish: Tunica Wildlife Management Area: 1 ♂, 2 ♀, Apr 13, 2010, V. A. Brou (VAB). MARYLAND: Garrett Co.: 3 km S Sang Run: 2 ♂, 23–25 Jun 1989 (USNM). Montgomery Co.: Plummer's Island: 1 ♀, 26 May 1912, H. Barber (USNM). Prince George's Co.: Riverdale: 1 ♀, 6 Jun 1920 (USNM). Talbot Co.: Wittman: 4 ♂, 23 May (USNM). MASSACHUSETTS: Dukes Co.: Martha's Vineyard: 1 ♀, 28 Jun 1941, F. Jones (USNM). MISSISSIPPI: Hancock Co.: Catahoula Creek: 1 ♂, 4 Apr, B. Mather (MEM). Hinds Co.:

Clinton: 1 ♀, 23 Apr 1966, B. Mather (MEM). Oktibbeha Co.: Agr. Col. [Mississippi State University, State College]: 2 ♂, 3–5 Apr 1921 (USNM); 2 ♂, 3–5 Apr 1921, H. Dozier, F. Benjamin (USNM). Warren Co.: Vicksburg: 1 ♂, 15 Apr ? (MEM). MISSOURI: Specific locality unknown: 1 ♂ (LACM). NEW JERSEY: Burlington Co.: New Lisbon: 2 ♂, 1 ♀, 30 May 1938, A. Busck (USNM). Cape May Co.: Angelesea: 1 ♂, 26–30 May 1905, A. Lister (AMNH); 2 ♂, 1 ♀, 27–30 May 1905, W. Kearfott (CNC); 1 ♀, 30 May 1905, W. Kearfott (CU); 3 ♂, 1 ♀, 30 May 1905 (LACM); 1 ♀, 30 May 1905 (MCZ); 10 ♂, 11 ♀, 27–30 May 1905, Haimbach, Kearfott, USNM slides 20055 ♂, 20058 ♀ (USNM). NEW YORK: Cattaraugus Co.: Gowanda: 2 ♂, 27 Jun 1909, W. Wild (CU). NORTH CAROLINA: Buncombe Co.: Black Mts.: 15 ♂, 6 ♀, 3 May–12 Jun, W. Beutenmueller (AMNH); 1 ♂, W. Beutenmueller (CU); 2 ♂, 1 ♀, 1–7 Jun 1912, W. Beutenmueller (USNM). Macon Co.: Highlands: 1 ♀, 23 May 1957, W. Brown (CNC). Haywood Co.: 1.5 rd. mi. down from Purchase Knob, 3,500 ft. [1,067 m]: 1 ♂, 9–10 Jun 2002, UV trap, J. Adams (USNM). Moore Co.: Near Eastland: 1 ♂, 15 May (USNM). Transylvania Co.: Blantyre: 1 ♂, early May 1908, F. Sherman (USNM). Lake Toxaway: 3 ♂ (AMNH). OHIO: Adams Co.: Buzzardroost Rock, N38°46'W, 83°26'30", 250 m; 4 ♀, 30 May 1993, nectaring on yellow umbellifer (in shade), O. Pellmyr and E. Augenstein (USNM). Hamilton Co.: Cincinnati: 1 ♂, 20 May 1906, 1 ♀, 6 Jun 1905, A. Braun (BMNH); 2 ♂, 16–29 May, A. Braun (LACM); 1 ♀, 16 May 1903, A. Braun (MCZ); 17 ♂, 9 ♀, 4 May 1903, 11 Jun 1907 (USNM). PENNSYLVANIA: Allegheny Co.: Oak Station: 1 ♂, 13 Jun 1909, F. Marloff (CU). Beaver Co.: New Brighton: 1 ♂, 15 Jun 1902, 1 ♂, 17 Jun 1906, 19 ♂, 7 ♀, 28 Jun–7 Jul 1907, Merrick (USNM). Delaware Co.: Castle Rock: 1 ♂, 26 May 1908 (USNM). SOUTH CAROLINA: Greenville Co.: Greenville: 1 ♀, 18 May (ZMCU). TENNESSEE: Carter Co.: Roan Mountain State Park: 1 ♂, 8 Jun 1999, J. Hepner (FSCA). Henderson Co.: Natchez Trace State Park: 1 ♂, 1 ♀, 12 May 1968, J. Donahue (USNM). Morgan Co.: Burrville: 1 ♂, 19 May 1937, J. Vockeroth (CNC). TEXAS: Specific locality unknown: 2 ♂, 1906 (BMNH); 1 ♂, 1 ♀ (MCZ); 1 ♀, 3 May, Boll (USNM). Dallas Co.: Dallas: 1 ♂ (holotype, *Adela chalybeis*), Boll (MCZ); 2 ♂ (MCZ); 1 ♀, 1 Apr 1907, F. Pratt, 1 ♂, 5 Apr 1908, F. Bishop (USNM). VIRGINIA: Locality unknown: 1 ♀, 4 Jun 1884 (USNM). Chesterfield Co.: Pocahontas State Park: 1 ♀, 11–12 May 2002, Virginia Bio-Blitz (USNM). Fairfax Co.: Dead Run: 1 ♂, 23 May 1915, R. Shannon (USNM). Falls Church: 3 ♂, 3–5 Jun 1914, Heinrich (USNM). Great Falls: 1 ♂, 1 ♀, 8 May 1921, W. Forbes (CU); 2 ♂, May (LACM); 1 ♂, 1 ♀, 22 May–10 Jun 1906 (MCZ); 1 ♂, 6 Jun 1917, Heinrich (USNM). Lancaster Co.: Belle Isle State Park, Watch House Trail, 37°46.3'N, 76°36'W: 1 ♂, 19 May 2010, O. Flint (USNM). Nelson Co.: Wintergreen Resort, Blue Ridge Mts., 3,400 ft. [1,037 m]: 1 ♀, 18 Jun 1978, S. Miller (USNM). WEST VIRGINIA: Kanawha Co.: South Charleston: 2 ♂, 27 May 1980, P. Adler, coll. on false Solomons Seal flowers (USNM).

DISCUSSION. *Adela caeruleella* bears closest resemblance to its Central American sister species, *A. aethiops*. In

addition to their disjunct distributions, *A. caeruleella* may be distinguished from the latter by the slightly narrower apical forewing fascia and darker color between the fascia in *caeruleella* compared to *A. aethiops*. The sagittate juxta and more irregular ventral margins of the valvae of *A. caeruleella* can also be useful in species diagnoses.

Walker (1863) described *A. caeruleella* from a series of three specimens. Author DRD has determined two of the three specimens are conspecific with *A. bella*, but the third, distinctly smaller specimen appears to be a species of *Cauchas*. A positive identification of the latter was not possible because of its poor condition. The origin of the third specimen was supposedly Australia (probably an error), whereas the origins of the previous two are unknown. One of the two *Adela* specimens bears a circular type label. Because it is the best preserved of the three specimens, we have selected it as the lectotype. The remaining conspecific specimen, a male in very poor condition, has been designated a paralectotype.

Because Walker erroneously accredited *A. caeruleella* to the Australian fauna, it was not suspected of occurring in North America until Meyrick (1912a) listed the species along with *A. bella* in his catalogue of the family Adelidae. Forbes (1923) later suggested that *A. bella* (and not *A. purpurea* as stated by Powell 1969) may be a synonym of *A. caeruleella*. An examination of the type series proved Forbes correct in his supposition, and the name *A. bella* has joined the American lists as another junior synonym of this relatively common, eastern insect.

Only one specimen, a well-preserved female, is known to remain of the original type series of *A. bella*. This has been selected as lectotype and is deposited in the collections of the Museum of Comparative Zoology is Cambridge, Massachusetts.

Adela chalybeis was described from a single male specimen collected by Boll in Texas. Three male specimens in the Museum of Comparative Zoology bear the identical label: "Dallas, Tex. Boll." One of these also bears a "Zeller" label as well as a green identification label (typical of many of Zeller's specimens) with the inscription "*Adela chalybeis* Z." Davis has labeled this well-preserved specimen as the holotype of *A. chalybeis* and has confirmed its synonymy with *A. caeruleella*.

Similarly, *Adela iochora* was also described by Zeller from a single male collected by Boll near Dallas, Texas. Zeller stated that the specimen was deposited in the Museum of Staudinger; however, its present deposition is unknown. It is important to note that every author using this name subsequent to Zeller (1877) has misspelled *iochora*. Walsingham (1880) incorrectly wrote the name "iochroa," and later authors followed his rendition evidently without checking the original spelling. Zeller does not appear to have made an inadvertent error in his spelling of *iochora*; consequently, any later emendation of the name would be invalid. Very likely the name was originally derived from the Greek *ion* (violet) and *korax* (raven).

Thirteen specimens, twelve males and one female, are believed to comprise the type series of *Adela aeruginosella*. An additional male in the collection of the National Museum of Natural

History also bears the typical label “Louisiana, Morrison,” but it possesses no other indication that the specimen was actually examined by Walsingham at the time of his description. One male, which bore a type label, has been designated a lectotype, and the remaining eleven males and one female, all deposited in the British Museum (Natural History), have been labeled paralectotypes.

Walsingham (1890) distinguished *A. aeruginosella* from *A. bella* principally on the basis of three variable color features of the forewing. One of these, the reputed absence of the fasciae across the apical third of the forewing, actually varies within the type series. A few paralectotypes were observed to possess faint fasciae by varying the angle of light reflecting from the forewing. Furthermore, over most of the entire range of *A. caeruleella*, the fasciae frequently appear more distinct in the female. Consequently, considering the total range of variation observed in this species, and the absence of any diagnostic morphological features, we have synonymized *A. aeruginosella* under *A. caeruleella*.

***Adela aethiops* Rogenhofer**

FIGURES, 154–156, 274, 310, 375; MAP 20

Adela aethiops Rogenhofer, 1875: plate 139, fig. 1.—Meyrick, “1892” [1893]: 486; 1912a: 10; 1912b: 9.—Walsingham, 1915: 402.—Davis, 1984: 18.

ADULT. (Figures 154–156). Wing expanse: ♂, 13–17 mm; ♀, 13.1–13.6 mm.

Head: Dark fuscous to black. Male antenna elongate, ~3.0× length of forewing, with about 210–212 segments; antenna nearly contiguous at base; scape and pedicel black with purplish luster; entire flagellum (including base) smoothly scaled, dark fuscous, ringed with white, gradually becoming entirely white over distal three-fourths; specialized peg spines present on segments 10 and 11. Female antenna shorter, ~1.3× length of forewing, with ~81–83 segments; antenna nearly contiguous at base as in male; scape and basal 1/2–3/5 of flagellum densely covered with rough, semi-erect, black with purplish luster scales; apical 1/2–2/5 of flagellum more slender, smoothly covered with flattened white scales. Eyes of male unspecialized, moderate in size, interocular index 0.75–0.8; outline broadly elliptical, margins entire, facets of uniform dimensions throughout; eyes of female similar. Galeae with basal fifth covered with dark fuscous scales. Maxillary palpus, 2-segmented, dark fuscous. Labial palpus dark fuscous dorsally, whitish ventrally, with a sparse scattering of long, erect, dark bristlelike scales from venter of second segment; second segment of moderate length, approximately 1.3× length of third.

Thorax: Dorsum black with purplish green iridescence. Venter predominantly light tan. Legs dark fuscous to black except for whitish to light tan venter of tibiae and white rings at apices of tibial and tarsal segments. Forewing almost entirely black with slight purplish luster; apical half with 3 narrow, transverse

bands of iridescent blue usually visible and a marginal series of 5 to 8 iridescent blue spots; transverse bands of uniform size and equally separated from one another. Hindwing uniformly black.

Abdomen: (Figure 310). Shiny black dorsally, slightly more brownish (i.e., fuscous) ventrally.

Male Genitalia: (Figure 274). Uncus reduced, largely ventrad to tegumen. Vinculum-saccus V-shaped, elongate, nearly 2.0× the length of valvae. Valvae broad to base of cucullus, then deeply excised on ventral margin with cucullus well set off and broadly rounded. Juxta elongate, very slender with anterior half sublanceolate and not sagittate. Phallus slender, base moderately flared; cornuti absent.

Female Genitalia: (Figure 375). Apex of ovipositor acute, asymmetrical; cutting edge ventral, serrulate. Bursa copulatrix relatively reduced, slender, not exceeding posterior apophyses in length. Vestibulum reduced, irregular in form.

LECTOTYPE. ♂ (present designation): “Type, H.T.; 200; Angas; Felder Coll., Rothschild, 1913–86, 400165; Novara CXXXIX, 1.1. *Adela aethiops*, Angus ♂, n.; Type; Lectotype ♂, *Adela aethiops* F., by D. R. Davis” (BMNH).

TYPE LOCALITY. Unknown (probably Central America although erroneously stated by Rogenhofer (1875: pl. 139, fig. 1 [caption]) as “Australia (Angas)”).

HOST. Unknown.

FLIGHT PERIOD. Adults have been collected mostly in late May to late July in Tamaulipas, Mexico; also collected in March (Guatemala).

DISTRIBUTION. (Map 20). Presently known only from the tropical region of Central America, from Nuevo León in Mexico south to the Alta Vera Paz in Guatemala.

MATERIAL EXAMINED. 47 males, 3 females. Specific locality unknown: ♂ (lectotype) (BMNH). **GUATEMALA:** ALTA VERA PAZ: Cubihuitz, 1,050 ft. [320 m]: 1 ♂, Mar 1880, Chapin (BMNH). **MEXICO:** NUEVO LEÓN: Chipinque Mesa, 4,300 ft. [1,311 m]: 1 ♂, 20 Sep 1975, J. Powell, J. Chemsak, BOLD 01202090 (UCB). TAMAULIPAS: Gomez Farias, 1,000 m: 7 ♂, 29–31 Jul 1988, V. Becker 69835, V. Becker, M. A. Solis, BOLD ID LANUU4541-15, slide USNM 31793 ♂; 1,200 m: 29 ♂, 2 ♀, 24–28 May 1997, slide USNM 34663 ♀, V. O. Becker 109231 (USNM, VOB). Specific locality unknown: 2 ♂, 1 ♀, Staudinger, slides DRD 4604 ♂, 4611 ♀. **VERACRUZ:** Coatepec: 1 ♂, Brooks (BMNH). 1.6 mi. [2.6 km] N of Coscomatepec: 1 ♂, 22–24 Jul 1966, Flint & Ortiz (USNM). 10 km W of Coscomatepec, 1,800 m: 1 ♂, 12 Jul (UCB). 3 mi. [4.8 km] N Huatusco: 1 ♂, 17 Jul 1980, Schaffner, Weaver, Friedlander (USNM); 5 mi. [8 km] S of Huatusco: 1 ♂, 23 Jul 1966, Flint & Ortiz (USNM). N of Huatusco: 1 ♂, 22–24 Jul 1966, Flint & Ortiz (USNM).

DISCUSSION. *Adela aethiops* is closely related to *Adela caeruleella* but differs in the slightly broader forewing fascia, slightly paler color of the scales between the fascia, and by the different arrangement of the fasciae on the outer half of the forewing (Figures 153, 155). Along with many other morphological features shared by these two species, *A. aethiops* similarly possesses reduced, unspecialized eyes in the male and female. The

TABLE 1. Variation of head morphology among New World *Adela* and *Nemophora*. A dash (—) indicates measurement not taken.

Taxon	♂ Eye	♀ Antenna basal scales	♂ Antenna basal scales	Spines ♂ antenna	♂ Antenna × forewing	♀ Antenna × forewing
<i>Adela</i>						
<i>aethiops</i>	reduced	rough	smooth	2	3×	1.3×
<i>astrella</i>	enlarged	rough	rough	2	2.7–3.1×	1.3–1.8×
<i>atrata</i>	reduced	—	smooth	2	2.5×	—
<i>austrina</i>	enlarged	smooth	smooth	2	2.2–2.5×	1.3×
<i>boliviella</i>	enlarged	—	rough	2	>2.9×	—
<i>caeruleella</i>	reduced	rough	smooth	2–3	3.0–3.3×	1.5×
<i>eldorada</i>	enlarged	smooth	smooth	0	3.0×	1.5×
<i>flammeusella</i>	enlarged	smooth	smooth	0	2.5–3.0×	1.5×
<i>oplerella</i>	reduced	smooth	smooth	0	1.0–1.2×	0.8×
<i>powelli</i>	enlarged	—	rough	2	1.3×	—
<i>punctiferella</i>	reduced	smooth	smooth	0	2.5–3.0×	2.5–2.6×
<i>purpurea</i>	enlarged	smooth	smooth	1–3	2.6–3.2×	1.5×
<i>ridingsella</i>	enlarged	smooth	smooth	2	2.5–3.0×	1.2–1.5×
<i>septentrionella</i>	enlarged	smooth	smooth	0	2.5×	1.5×
<i>singulella</i>	reduced	smooth	smooth	0	3.0–3.3×	2.5–3.5×
<i>stenoptera</i>	reduced	—	smooth	0	>2.3×	—
<i>striata</i>	enlarged	rough	rough	3–4	2.7–3.1×	1.3×
<i>thorpella</i>	enlarged	smooth	smooth	0	2.5×	1.3×
<i>trigrapha</i>	enlarged	smooth	smooth	0	3.0–3.2×	1.2–1.25×
<i>Nemophora</i>						
<i>bellela</i>	enlarged	smooth	smooth	2–3	1.8–2.0×	1.1–1.4×

approximate basal half of the female flagellum is similarly covered by black, rough scaling in both species. The female antennae of *A. aethiops* are unusual in being basally rough scaled, thus differing from the basally smooth scaled antennae present in the females of most *Adela* species (Table 1).

The number of specimens comprising the type series was not stated by Rogenhofer; thus, it has been necessary to select a lectotype. A single specimen in fair condition and now deposited in the Natural History Museum (BMNH) in London is the only known representative remaining of any possible type series for this species; this individual has been designated as lectotype. Rogenhofer (1875) credited the species as originating from Australia, but Walsingham (1915) later corrected this error on the basis of material subsequently collected from Central America. To date, the species has been found in no other countries except Mexico and Guatemala.

The authorship of *Adela aethiops* has been variously attributed to either Felder or Felder and Rogenhofer in previous references. It is now clear, however, from a publication review by Higgins (1963) of the *Novara Reise* that Rogenhofer is the correct and sole author of this species. According to Higgins (1963: 156), all names and figures published in Heft 5 of the *Novara Reise* should be attributed to Rogenhofer alone. This heft includes the final plates of the entire series (numbers 121–140) and

was believed by Higgins (1963: 159) to have been published on or after July 1875.

The largest series of this species was collected by Vitor Becker at an elevation of about 1,200 m near Gomez Farias, Tamaulipas, Mexico. Becker observed a scattered stream of mostly males, not associated with any particular plant at the time, but crossing an open forest clearing at a height of approximately four to five meters above the ground.

***Adela atrata* Davis and Medeiros,
new species**

FIGURES 157, 275; MAP 20

ADULT. (Figure 157). Wing expanse: ♂, 14 mm; ♀, unknown.

Head: Vertex with long, scattered, black piliform scales. Frons with smoothly appressed, broad, shiny black scales. A cluster of long, black hairs arising immediately below scape near upper margin of frons. Antenna of male elongate, approximately 2.5× length of forewing, smoothly scaled, with ~150 segments; antennae nearly contiguous at base; basal fourth of flagellum black with coppery luster, with white scales ventrally over distal

2/3 and becoming entirely white over apical flagellomeres; 2 specialized sex spines present, on flagellomeres 9–10. Eyes relatively reduced; interocular distance ~0.6. Labial palpus lustrous black, with a basal tuft of ~12–14 long black hairs.

Thorax: Dorsum and venter uniformly black with bronzy iridescence. Legs black with bronzy iridescence; apices of all tarsomeres with a narrow row of a few white scales on dorsal and lateral surfaces. Forewing and fringes uniformly black with dark purplish to coppery luster. Hindwing and fringes uniformly black.

Abdomen: Uniformly black.

Male genitalia: (Figure 275). Uncus reduced, rounded, and ventrad to tegumen. Vinculum-saccus U-shaped, elongate, ~1.8× length of valva. Valva broad at base with ventral margin slightly curved and narrowing before moderately enlarged, rounded cucullus. Juxta very slender, ~half the length of phallus and with a narrow, acute posterior end. Phallus slender, base moderately flared, apical area with numerous, minute cornuti.

HOLOTYPE. GUATEMALA: SOLOLÁ: Corazon del Bosque, Novillero, 2,435 m: 1 ♂, 13–15 May, 2017, J. B. Hepner and E. Fuller, slide 4652, digital image captured (MGCL).

PARATYPE. MEXICO: CHIAPAS: Sibakte'el, Tenejapa, alt. 5,500': 1 ♂, 6–8 Aug 1966, D. E. Breedlove & J. Emmel (CASC).

TYPE LOCALITY. Corazon del Bosque, Novillero, Sololá, Guatemala.

HOST. Unknown.

FLIGHT PERIOD. Specimens have been collected in May and August.

DISTRIBUTION. (Map 20). Known only from the type locality in southern Guatemala and Chiapas, Mexico.

ETYMOLOGY. The species name is derived from the Latin *atratus* (dressed in black) in reference to the uniformly black color of this species.

DISCUSSION. *Adela atrata* appears most similar to *A. aethiops* in possessing generally dark forewings but without the slender distal fascia present on the forewings of *A. aethiops*. The male genitalia of these two species in particular are similar in possessing a very slender, reduced juxta. The male valvae of *A. atrata* differ in possessing a shorter, less rounded ventral margin compared to that of *A. aethiops*.

***Adela stenoptera* Davis and Medeiros, new species**

FIGURES 158, 159, 276; MAP 20

ADULT. (Figure 158). Wing expanse: ♂, 14 mm; ♀, unknown.

Head: Vertex predominantly covered with pale brownish-orange, piliform scales, intermixed with dark fuscous piliform scales; frons (mostly denuded) with a few, moderately broad, whitish scales. Antenna of male (tip broken) >2.3× length of forewing; basal third of flagellum dark fuscous, gradually becoming more bronzy toward apex; dorsal sex spines absent;

antennal bases nearly contiguous, separated a distance slightly less than half the diameter of scape. Eye unspecialized, spherical. Maxillary palpus short (not dissected), with long brownish fuscous piliform setae. Galea with a few brownish fuscous scales basally. Labial palpus short, with long, piliform, brownish fuscous setae from second segment.

Thorax: Dorsum dark purplish fuscous. Venter mostly silvery white laterally. Legs dark fuscous with apices of tibial and tarsal segments narrowly ringed with white. Forewing slender; W/L index 0.11; dorsum and fringe fuscous with slight bronzy luster; a small patch of pale brownish-orange scales at apex of discal cell, a broader fascia of similar scales beyond discal cell extending halfway across wing, and another more narrow fascia of similar scales beyond, near apex of forewing. Hindwing uniformly fuscous, not iridescent.

Abdomen: Dark fuscous.

Male Genitalia: (Figure 276). Uncus minutely broadly bilobed. Vinculum-saccus elongate, ~2.0× length of valva; saccus narrowly U-shaped, anterior end narrow. Valva roughly triangular, ventral margin with a large, midventral bulge. Juxta slender, with anterior half strongly sagittate; posterior half much more slender and caudally forked. Phallus elongate, very slender, with base slightly flared; cornuti grouped in 2 rows of minute, densely packed spines at apex of phallus.

HOLOTYPE. ♂, COSTA RICA: HEREDIA: 10 km SE La Virgen, 450–550 m, 10°20'N, 84°05'W, 20 Feb 2003 (INBio).

HOST. Unknown.

FLIGHT PERIOD. February (univoltine).

DISTRIBUTION. (Map 20). Known only from the type locality in northeastern Costa Rica.

ETYMOLOGY. The species name is derived from the Greek *stenos* (narrow) and *pteron* (wing) in reference to the characteristic slender wings of this species.

MATERIAL EXAMINED. 1 male (holotype). 20 Feb 2003, INBio-OET-ALAS transect; 05/L/00/015; slide DRD 4426 (INBio).

DISCUSSION. The forewings of *Adela stenoptera* are the most slender of any member of this genus. The forewing pattern of *stenoptera* most resembles that of *A. aethiops* in possessing subapical, pale brownish-orange fascia, but the fascia in *stenoptera* are fewer and less developed. The male genitalia of the two species are generally similar in form except that the ventral margin of the valva is more pronounced and the juxta is sagittate in *A. stenoptera*.

***Adela septentrionella* Walsingham**

FIGURES 25, 26, 67–76, 160, 161, 277, 311, 376; MAP 21

Adela septentrionella Walsingham, 1880: 79; 1890: 285.—Dyar, 1903: 576, no. 6559.—Meyrick, 1912a: 10; 1912b: 9.—McDunnough, 1939: 110, no. 9042.—Powell, 1967: 84; 1969: 229.—Powell, 1971: 47(1): 74.—Burdick and Hasegawa, 1978: 77.—Davis, 1983: 4, no. 221.—Davis in Stehr, 1987: 359, fig. 26.36f.—Poole, 1996: 626. Powell and Opler, 2009: 40.—Pohl et al., 2015: 38.

ADULT. (Figures 160–161). Wing expanse: ♂, 9.5–12.0 mm; ♀, 10.0–12.0 mm.

Head: (Figures 25–26). Entirely dark fuscous to black in male, pale brownish white with varying amount of dark fuscous hairs in female, sometimes predominantly pale brownish white. Antenna more slender and $\sim 2.5\times$ length of forewing in male, ~ 160 – 165 -segmented; relatively stouter and $1.5\times$ length of forewing in female, and ~ 82 – 85 -segmented; scape and pedicel fuscous; bases of male antennae separated a distance of less than $0.5\times$ the diameter of antennal socket; antenna of female more widely separated a distance of 1.5 – $1.7\times$ diameter of antennal socket; flagellomeres of male fuscous to black, banded with silvery white ventrally over basal $1/4$; mostly fuscous dorsally indistinctly banded with grayish white over basal half becoming entirely fuscous over distal half; dorsal sex spines absent; flagellomeres of female more distinctly banded dorsally and ventrally with fuscous and silvery white over basal $2/3$ becoming entirely silvery white over distal $1/3$. Eyes sexually dimorphic, reduced, circular with facets of uniform size in female; enlarged, slightly obovoid in male, with facets in dorsal $2/3$ of eye enlarged; eyes approximate at vertex in male, interocular distance about $0.8\times$ vertical diameter of eye. Basal third of haustellum sparsely covered fuscous scales in male, more grayish in female. Labial palpus densely covered with long fuscous hairs in male, sometimes with slight suffusion of white over apical segment; heavily irrorated with white in female, apical segment almost entirely white.

Thorax: Dorsum fuscous to black, sometimes with a slight coppery luster. Legs fuscous to black with apices of tibial and tarsal segments white; spurs predominantly white. Forewing fuscous to black, occasionally with a slight coppery luster, rarely immaculate except in more northern parts of range, usually variously marked with white; typically 2 narrow, distally curved, white fasciae traversing wing at basal third and apical third; a subterminal series of 1–9 white dots sometimes present but frequently absent. Hindwing uniformly fuscous, slightly iridescent. M1 and M2 separate.

Abdomen: (Figure 311). Fuscous to black dorsally, more grayish ventrally; sternal segments of female frequently margined with white, especially posteriorly. Seventh sternite of female approximately 2.6 – $2.7\times$ the length of sixth. Eighth sternite uniformly and lightly pigmented.

Male Genitalia: (Figure 277). Uncus reduced, largely ventrad to tegumen. Vinculum-saccus elongate, approximately $2\times$ length of valva; gradually narrowing anteriorly to narrow, rounded anterior end. Valva with relatively broad base; sacculus abruptly narrowing to slender cucullus approximately half the width of base of valva; cucullus with mostly parallel dorsal-ventral margins, terminating in a nearly truncate apex. Juxta elongate, slender; anterior end narrowly sagittate; posterior half with parallel margins. Phallus elongate, slender, slightly sinuate near apex; base moderately flared.

Female Genitalia: (Figure 376). Apex of ovipositor subacute, nearly symmetrical, with ventral edge slightly longer and more oblique than dorsal and bearing 8–9 minute serrations

around apex and continuing mostly ventrad. Vestibulum elongate, over $3.0\times$ as long as deep; surface slightly rugose.

LARVA. (Figures 67–73). Maximum length examined 8 mm.

Head: Maximum width ~ 0.5 mm. Chaetotaxy as illustrated (Figures 68–69); seta AF1 present, AF2 absent; labrum with 6 pairs of dorsal setae and 3 pairs of short, stout epipharyngeal setae along anterior-ventral margin. Six stemmata present, approximately of equal size and arranged in an irregular circle (Figure 69). Antenna with sensilla as shown (Figure 69). Mandible with 3 cusps (Figure 73).

Thorax: Pronotum extending ventrally to include all 3 lateral setae; spiracle separate. Meso- and metathorax with all 3 lateral setae arising on same pinaculum separate from moderately developed notal plates. Legs moderately well developed. All thoracic coxal plates fused.

Abdomen: D1 and D2 arising separate on segments A1–A9; pinacula poorly developed to absent on all segments; L1–L3 present on A1–A9. Prolegs greatly reduced to multiserial crochets present on A3–A6 (Figure 67), absent on A10. A slightly bulbous, mid-dorsal plate present on A8 extending slightly over A7 and bearing D1. Large dorsal plate present on A10 and bearing 3 pairs of setae.

LARVAL CASE. (Figure 76). A flattened, elongate, dark, brownish black tube ~ 5.5 – 6 mm long, 1.5 – 2 mm wide, sometimes slightly constricted near anterior end. Exterior of case covered with fine particles of frass and plant debris.

MALE PUPA. (Figures 74–75). Length ~ 5 mm. Antennae extending straight for nearly entire length of body and then coiled 2–3 times around caudal end of abdomen. Hindlegs extending to caudal end of abdomen; wing sheaths extending to caudal margin of A6. Dorsal spines arranged in a single row from A4–A8. Caudal end of abdomen terminating in a broadly furcate cremaster.

TYPE. Lectotype ♂ (present designation): 8–11 June 1871; Walsingham Collection, 1910–427; syntype, BMNH.

TYPE LOCALITY. UNITED STATES: CALIFORNIA: Head of Noyo R., Mendocino Co.

HOST. *Holodiscus* (Rosaceae). Powell (1967, 1971) reported females ovipositing in the unopened buds of *Holodiscus discolor* (Pursh) Maxim (Rosaceae) in May in the San Francisco Bay Area. Once an oviposition site had been selected, Powell (1967) noted that oviposition required about 30 to 40 seconds. Larvae have been collected from *Holodiscus* near Fairfax, Marin County, California. Adults have also been observed visiting the flowers of Asteraceae: *Achillea millefolium*, Rosaceae: *Holodiscus*, and Ranunculaceae: *Ranunculus*.

FLIGHT PERIOD. Mid-April (rare), May and June, to mid-July at high elevations (Powell 1969); univoltine.

DISTRIBUTION. (Map 21). Widespread in the Pacific Coast states from the Transverse Range in Southern California north to southern British Columbia, Canada. Powell (1969) reports the species to be more boreal than other West Coast *Adela*, ranging from near the coast to near timberline above 6,000 feet

in the Trinity Alps and the mid-Sierra Nevada and 8,000 feet in the southern Sierra Nevada. Powell (2009) also reports one record from Santa Cruz Island, California.

MATERIAL EXAMINED. 598 males, 227 females.

CANADA: **BRITISH COLUMBIA:** Comox: 1 ♂, 21 Jun 1938, J. McDunnough (CNC). Duncan, Vancouver Island: 2 ♂, 1 ♀, Hanham (USNM); 1 ♂, Jun 1925, A. Hanham (USNM); 1 ♂, 8 Jun 1923, W. Anderson (USNM); 1 ♂, 9 Jun 1955, G. Shewell (CNC); 3 ♂, 2 ♀, Hanham (USNM). Fitzgerald: 2 ♀, 12 Jun 1921, W. Carter (USNM). Langford: 10 ♂, 18 ♀, 26 May–2 Jun 1960, 1 ♂, D. Evans, in flight (CNC). Miracle Beach, near Oyster River: 1 ♂, 11 Jun 1955, J. McGillis (CNC). Qualicum: 9 ♂, 7 ♀, 15 May 1955, G. Shewell (CNC); 1 ♀, 15 Jun 1955, J. McGillis (CNC). Qualicum Bay: 1 ♀, 15 Jun 1955, J. McGillis (CNC). Quamichan Lake, Vancouver Island: 2 ♀, 3 Jun 1924, E. Blackwell (USNM). Royal Oak: 1 ♂, 12 Jun, W. Downes (CNC). Saanich District: 3 ♂, 3 Jun 1919, W. Downes (CNC). Seton Lake, Lillooet: 3 ♂, 2 ♀, 27 May–3 Jun 1926 (CNC). Shawnigan: 1 ♂, 11 Jun 1921, W. Downes (CNC). Shawnigan Lake, Vancouver Island: 2 ♂, 18 Jun 1927, J. Clarke (USNM). Sooke: 3 ♂, 3 ♀, 10 Jun 1925 (USNM). Vancouver: 1 ♂, 15 May 1915 (CNC); 1 ♂, 14 Jun 1926, Livingston (MCZ). Victoria: 1 ♂, 20 May 1925, W. Downes (CNC); 11 ♂, 26 May 1922, W. Carter (USNM); 1 ♂, 1 ♀, 26 May 1962, W. Carter (UCB); 1 ♀, 30 May 1923, E. Blackmore (USNM); 1 ♂, 3–10 Jun 1919, E. Blackmore (CNC); 1 ♂, 6 Jun 1930, W. Proce (UCB); 1 ♂, 8 Jun 1923 (USNM); 1 ♂, 11 Jun 1919, W. Downes (CNC); 1 ♂, 1 ♀, 14 Jun 1903, A. Hanham (USNM). Victoria, Mt. Douglas: 3 ♀, 16 Jun 1933, J. McDunnough (CNC). Wellington: 6 ♂, 4 ♀, Jun, G. Taylor, slide USNM 20076 ♂ (USNM).

UNITED STATES: **CALIFORNIA:** (Specific locality unknown) 1 ♂ (paralectotype) (USNM). Alameda Co.: 2 ♂, 3 May 1908, G. Pilate (BMNH); 2 ♂, 3 May 1905, G. Pilate (UCB); 72 ♂, 1 ♀, 3–10, G. Pilate, slide 20075 ♀ (USNM). Berkeley: 5 ♂, 1 ♀ [no data], 7 ♂, 2 ♀, 14 May 1915, Van Duzee (CU); 1 ♂ (UCB). Canyon: 6 ♂, 5 ♀, 1 Jun 1969, F. Ennik (UCB). Oakland: 1 ♂, 15 May 1960, Lundgren (UCB). Oakland, Diamond Canyon: 8 ♂, 4 May 1957, B. Adelson (UCB). Redwood Canyon, Oakland Hills: 8 ♂, 2 ♀, 30 May 1961, Lundgren (UCB). Strawberry Canyon: 3 ♂, 1 ♀, 13 May 1949, Langston; 1 ♂, 22 May 1964, Doyen, 1 ♂, 22 May 1964, R. Thorpe (UCB); South Rim, Strawberry Canyon: 1 ♂, 1 ♀, 14 May 1961, Lundgren (UCB). Hayward: 8 ♂, 2 ♀, 24 Apr 1965, J. Slater (UCB). Patterson Reserve, Del Valle Lake: 1 ♂, 3 May 1973, J. Powell (UCB). Contra Costa Co.: Briones Reservoir: 1 ♂, 1 ♀, 4 May 1985, J. Powell (UCB). Mitchell Canyon, near Clayton: 1 ♂, 27 May 1961, J. Powell (UCB). Mt. Diablo: 3 ♂, 18 May 1947, Anderson (UCB). Russell Farm, 4 mi. [6.4 km] NE Orinda: 4 ♂, 3–10 May 1972, 2 ♂, 25 May 1975, J. Powell (UCB); 5 ♀, 29 May 1968, Opler (UCB). Tilden Park, Berkeley Hills: 2 ♂, 2 ♀, 4 May 1966, Powell (UCB); 9 ♂, 2 ♀, 10 May 1979, 8 ♂, 7 ♀, 20 May 1979, Wagner (UCB). Del Norte Co.: Little Grayback Pass NE: 4 ♂, 1958, Powell (UCB). Patrick Creek: 1 ♂, 9 Jun 1963, Thurman (UCB). El Dorado Co.: Fallen Leaf Lake, 1 mi. [1.6 km] S Lake Tahoe: 4 ♂, 22 Jun 1915, A. Fisher (USNM).

Glen Alpine: 1 ♂, 1 ♀, Aug 1909, F. Williams (CASC). Humboldt Co.: 2 mi. [3.2 km] W. Briceland: 1 ♂, 21 May 1976, Dietz and Hafernik (UCB). Shelter Cove: 5 ♂, 1 ♀, 21 May 1976, Dietz and Wharton (UCB). Los Angeles Co.: San Gabriel Canyon: 10 ♂, 28 Apr 1935 (LACM); 2 ♂, 28 Apr 1935 (USNM). San Gabriel Mts.: 10 ♂, 9 Jun 1917, USNM slide 20072 ♂ (USNM). Madera Co.: San Joaquin Exp. Range, 21 mi. NE Madera: 4 larvae, with cases (LACM, USNM). Marin Co.: Alpine Lake: 3 ♂, 25 Apr 1958, Powell (UCB); 1 ♂, 30 May 1959, D. Burdick (UCB). 1 mi. [1.6 km] N Alpine Lake: 1 ♀, 13 May 1966, Powell (UCB). 2 mi. [3.2 km] W Fairfax: 1 ♂, case, pupa, 5 larvae, 13 Mar 1970, em. 31 Mar 1970, larval slides USNM 34682, 34692, S. Szerlip, J. Powell No. 7063, ex *Holodiscus* (UCB, USNM); 39 ♂, 4 ♀, 17 Apr 1961, 2 ♂, 2 ♀, 21 Apr 1969, Powell (UCB). 2 mi. [3.2 km] SW Fairfax, near Meadow Club: 3 ♂, 4 ♀, 17 Apr 1961, C. D. MacNeill and P. Arnaud (CASC). Five Road, near W Blythedale, Mill Valley: 3 ♀, 14 May 1967, T. W. Davies (BMNH). 2 mi. [3.2 km] SE Inverness, Inverness Ridge, 800–1,040 ft. [244–317 m]: 1 ♀, 12 May 1974, Whitman (UCB). 33 mi. [53 km] NE Nicasio: 4 ♂, 28 Apr 1960, Taylor (UCB). 4 mi. [6.4 km] E Nicasio: 13 ♂, 13 Apr 1968, P. Opler, *Holodiscus* (UCB). Ross: 1 ♂, 28 Apr 1918, J. Bradley (CU). Taylor State Park: 1 ♂, 8 May 1949, Gilaspy (UCB). Tocaloma: 5 ♂, 23–28 May 1909, F. Williams (CASC). Mendocino Co.: 2 mi. [3.2 km] W Branscomb: 23 ♂, 7 ♀, 25/27 May 1976, Chemsak, Szerlip, and Wharton (UCB). 3 mi. [4.8 km] W Branscomb: 1 ♂, 25 May 1976, Szerlip, *Ranunculus* (UCB). 5 mi. [8 km] N Branscomb, N California Coast Range Preserve: 1 ♀, 24 May 1976, Wharton (UCB). Head of Noyo River: 1 ♂ (paralectotype), 8–11 Jun 1871, Walsingham (BMNH). NCCRP [University of California Northern California Coast Range (Angelo) Preserve]: 3 ♂, 2 ♀, 20/24 May 1985, J. Brown (UCB). 1 mi. [1.6 km] N Piercy: 1 ♂, 8 ♀, 20/23 May 1976, R. Dietz ♀ Chemsak (UCB). Yorkville, 6 mi. [9.6 km] SE: 1 ♀, 18 May 1966, J. Wolf (UCB). Monterey Co.: Carmel: 1 ♀, Apr, A. Vachell (USNM). Big Creek Reserve: 6 ♂, 1 ♀, 25/26 Mar 1980; 7 ♂, 11/13 Apr 1985; 1 ♂, 5 Jun 1982, Powell, redwood-stream association (UCB). Hastings Reserve, near Jamesburg: 1 ♀, 23 May 1938 (UCB). Horse Bridge, 1.5 air mi. [2.4 km] SW Arroyo Seco Guard Station, 1,300 ft. [396 m]: 7 ♂, 3 ♀, 3/7 May 1975, J. Powell, Rude (UCB). Portington Canyon, 9 mi. SE Big Sur: 1 ♂, 6 ♀, 7/14 May 1966 (CASC). San Benito Co.: Limekiln Canyon, SW Paccines: 1 ♂, 24 Apr 1968, Opler (UCB). San Francisco Co.: 5 ♂, 2 ♀, Apr, through C. V. Riley, slides USNM 20073 ♂, 20074 ♂, 20077 ♀ (USNM). San Luis Obispo: Atascadero, 9 mi. [14.5 km] SW: 1 ♀, 26 Apr 1968, D. Viers (UCB). 14 mi. [22.5 km] SW Paso Robles: 2 ♂, 1 ♀, 27 Apr 1968, Opler (UCB). Queen Bee, 1 mi. [1.6 km] SE Camp: 1 ♂, 2 May 1969, Rude (UCB). San Mateo Co.: Corte de Madera Creek, vicinity of Portola: 9 ♂, 9 ♀, 7 May 1960, P. Arnaud (CASC). San Bruno Mts.: 1 ♂, 4 ♀, 16 Apr 1982, J. DeBenedictis (UCB); 1 ♂, 28 Apr 1951, D. Rentz (UCB); 3 ♂, 3 ♀, 6 May 1966, J. Powell (UCB); SW of Brisbane: 5 ♂, 4 Apr 1983, Langston (UCB). San Francisco: 19 ♂, 2 ♀, 6 Apr 1968, H. Reinhard (CASC). San Mateo: 1 ♀, A. Agassiz (MCZ). Santa Barbara Co.: Buellton, 1 mi. [1.6 km] S: 1 ♂, 1 ♀, 11 May 1965, R. Langston

(UCB). Santa Clara Co.: Alum Rock Park: 3 ♂, 27 Apr 1951, J. Tilden (CASC); 1 ♂, 27 Apr 1981, J. Tilden (UCB); 1 ♀, 17 May 1958, Hunter (UCB). 3 mi. [4.8 km] W New Almadon: 1 ♀, 29 May 1965, Opler (UCB). Herbert Creek, 3 mi. [4.8 km] W New Almadon: 2 ♂, 28 Apr 1969, Opler (UCB). Palo Alto: 1 ♂, 1 ♀, Apr 1904, Grinnell (LACM); 1 ♂, 1 ♀, Apr 1904 (USNM). Palo Alto, Stanford Univ.: 1 ♂, 19 Apr 1911, 1 ♂, 6 May 1911 (USNM). 1 mi. [1.6 km] W Quimby, Mt. Hamilton: 3 ♂, 1 ♀, 15 May 1965, J. Brown (UCB). Santa Cruz Co.: Boulder Creek: 3 ♂, 6 ♀, 2 May 1970, J. Tilden (CASC). Santa Cruz: 8 ♂, 1 ♀, Apr 1921, E. Jones (BMNH). Santa Cruz, Canada Cervado: 1 ♀, 26 Apr 1966, J. Powell (UCB). Santa Cruz Mts.: 1 ♂, 5 ♀, through C. V. Riley, slide USNM 20082 ♀ (USNM). Siskiyou Co.: Caribou Mt. 6,300–7,000 ft. [1,920–2,134 m], Trinity Alps: 6 ♂, 7 ♀, 9 Jul 1969, Powell (UCB). Sonoma Co.: Bodega: 7 ♂, 3 May 1936, E.C.J. (CNC); 3 ♂, 3 May 1936, E.C.J. (LACM). The Geysers: 1 ♂, 3 Jun 1938, E. Johnson (CNC). Two Rock: 3 ♂, 19 Apr 1936, E.C.J. (CNC); 1 ♂, 3 May 1936, E. C. J. (USNM). Sobre Vista: 2 ♂, 31 Apr 1910, J. Kusche (UCB). Sutter Co.: Marysville Buttes: 37 ♂, 3 ♀, 2 May 1928, H. Keifer (CASC). Trinity Co.: 6 mi. [9.6 km] SE Hayfork: 5 ♀, 23 May 1973, S. Szerlip (UCB). Tulare Co.: Mineral King: 31 ♂, 5 ♀, 8 Jul 1915, slide 20078 ♂ (USNM). IDAHO: Clearwater Co.: 3.2 km W Ahsahka, rd. mi. 38.8 on rt. 12, R1E T37N S32SW, 250 m: 1 ♂, 26 May 1990, O. Pellmyr & J. Thompson, flying over mixed forested rocky slope (USNM). Latah Co.: Moscow Mts.: 1 ♂, 1 ♀, 18/20 Apr 1963, W. Ferguson (UCB); 1 ♂, 1 ♀, 7 Jun 1925, J. Clarke, USNM slide 20615 ♀ (USNM). Idaho Co.: Selway [variant spelling: Sellway/Celway] Falls, [46.052°N052°N, 115.306°W306°W], 20 mi. [32 km] SE Lowell, 46°37'N, 115°18'15"W: 1 ♂, 2 ♀, 5 Jul 1964, M. Furniss, on western Yarrow flowers (USNM); 6 mi. [9.6 km] N Selway Falls: 2 ♂, 1 ♀, 3 Jul 1964, R. Furniss, on Yarrow (UCB). Shoshone Co.: Wallace [47.474°N, 115.927°W]: 3 ♂, 2 ♀, 1–7 Jun, Sweadner (UCB). OREGON: Benton Co.: Corvallis: 1 ♀, Apr (CU). North Fork Alsea River, 4.5 mi. [7.2 km] NNE Alsea, near State Fish Hatchery: 1 ♂, 26 May 1966, Mays ♀ Cornell (USNM). Clatsop Co.: Olney: 1 ♂, 15 Jun 1925, Van Dyke (CU). Jackson Co.: Rogue River: 1 ♂ (lectotype), 5 ♂, 5 ♀ (paralectotypes), 4–6 May 1872, Walsingham (BMNH); 1 ♂, 1 ♀ (paralectotypes), 7 May 1872, Walsingham (USNM). 2 mi. [3.2 km] N Bull Gap, Rogue River National Forest: 1 ♂, 3 ♀, 3 Jul 1970, Dietz ♀ Rude (UCB). 3 mi. [4.8 km] N Trail: 1 ♀, 19 Jun 1975, Powell (UCB). Josephine Co.: Grayback Camp, near Oregon Caves: 1 ♂, 3 ♀, 22 Jun 1965 (CASC). O'Brien: 1 ♂, 30 May 1952, V. Roth (UCB). Oregon Caves National Monument: 1 ♂, 4 ♀, 20 Jun 1962, C. Toschi (UCB). Umatilla Co.: Blue Mts., Tollgate Road: 2 ♂, 8 Jun 1931, J. Clarke (USNM). Co. [unknown]: Roaring River Fish Hatchery: 1 ♂, 15 May 1940, R. Post (UCB). WASHINGTON: Garfield Co.: 2.6 km SE Lower Granite Dam, along Wawawai Grade, T13N R43E S4NE: 1 ♂, 8 ♀, 17–21 May 1990, O. Pellmyr, on herb-rich steppe, nectaring on *Achillea millefolium* (USNM). King Co.: Seattle: 1 ♀, 24 May 1994 (CU); 1 ♂, 2 ♀, 7–17 Jun 1901 (USNM); 7 ♂, 9 Jul 1943, on Bracken (USNM). Kittitas Co.: Easton: 1 ♂, through C. V. Riley (USNM). Mason Co.: Stimson Creek: 1 ♂, 24 May 1947,

E. Johnson (CNC). San Yuan Co.: Orcas Island: 2 ♂, 27 May 1923, J. Clarke (USNM). Whatcom Co.: Bellingham: 1 ♂, 30 Apr 1923, J. Clarke (CU); 4 ♂, 30 Apr–30 May 1923, J. Clarke (USNM). Yakima Co.: Kusshi Canyon: 1 ♂, 28 May 1949, E. Johnson (CNC). Status Creek: 2 ♂, 1 ♀, 29 May 1949, E. Johnson (CNC).

DISCUSSION. *Adela septentrionella* can usually be recognized by the dark forewings traversed by two white fasciae across the basal third and distal third of the wing (Figures 160, 161). As Powell (1969) has observed, the white markings on the forewings of many specimens from the more northern parts of its range (Oregon, Washington, and British Colombia) are often reduced, with some specimens being essentially immaculate with black forewings.

The immature stages of this species that are illustrated in this report constitute one of the few examples of a New World species of *Adela* for which the immature stages have been examined. A larva possibly representing *Adela ridingsella* has been reported (Weiss and West 1925), but the identification of that larva is questionable. The specimens of *A. septentrionella* reported here were collected in Madera and Marin Counties, California, by Powell and others, well within the range of *A. septentrionella*. Some of the larvae were collected by Powell from *Holodiscus*, on which he (Powell 1967, 1971) had also observed adult females ovipositing. Full-grown larvae were also collected in their cases from leaf litter beneath *Holodiscus* near Fairfax, Marin County, California, on 13 March (Powell 1971).

Adela purpurea Walker

FIGURES 6, 27, 28, 162, 278, 312, 377; MAP 21

Adela purpurea Walker, 1863: 501.—Walsingham, 1880: 77, 78, 79, 1890: 285.—Meyrick, 1912a: 10; 1912b: 9.—Barnes and McDunnough, 1917: 196, no. 8454.—McDunnough, 1939: 110, no. 9844.—Powell, 1969: 219.—Davis, 1983: 4, no. 229.—Poole, 1996: 626.—Pohl et al. 2015: 38.

Adela purpura [sic] Walker, Riley in Smith, 1891: 97, no. 5144 [incorrect spelling].—Dyar, 1903: 575, no. 6557.—Kearfott in Smith, 1903: 124, no. 7095.—Forbes 1923: 78.—Davis, 1983: 4, no. 229 [synonym of *A. purpurea*].

Adela biviella Zeller, 1873: 226.—Chambers, 1877: 206; 1878: 127; 1879: 125.—Walsingham, 1880: 78, 79 [synonym of *A. purpurea*]; 1890: 285 [synonym of *A. purpurea*].—Riley in Smith, 1891: 97, no. 5144 [synonym of *A. purpurea*].—Dyar, 1903: 575, no. 6557 [synonym of *A. purpurea*].—Meyrick, 1912a: 10 [synonym of *A. purpurea*]; 1912b: 9 [synonym of *A. purpurea*].—Forbes, 1923: 78 [synonym of *A. purpurea* [sic]].—McDunnough, 1939: 110 [synonym of *A. purpurea*].—Powell, 1969: 219 [synonym of *A. purpurea*].—Davis, 1983: 4, no. 229 [synonym of *A. purpurea*].—Poole, 1996: 626 [synonym of *A. purpurea*].

ADULT. (Figure 162). Wing expanse: ♂, 12–15 mm; ♀, 13–15 mm.

Head: (Figures 6, 27–28). Fuscous to black in male except for short, appressed, whitish scales over frons; whitish

ochreous in female. Antenna approximately $2.6\text{--}3.2\times$ length of forewing in male, $\sim 185\text{--}190$ -segmented, with usually 2, but varying from 1–3, sex spines arising from segments 11, 12, and rarely 13; antenna $1.5\times$ length of forewing in female, 86–93-segmented; scape and pedicel in both sexes fuscous above, silvery white beneath and laterally, with a few whitish hairs arising between antennal bases; flagellum mostly fuscous above, ringed with silvery white, predominately silvery white ventrally; bases of antenna nearly contiguous in male, separated only $0.4\times$ diameter of antennal socket; antenna widely separated in female for a distance about $1.25\times$ diameter of socket. Eyes sexually dimorphic; enlarged, elliptical in male with interocular index approximately 1.0. Eyes circular and reduced in female; interocular index about 0.7. Galeae with basal fourth sparsely covered with whitish scales. Maxillary palpus blackish; usually 2-segmented, if 3, then third greatly reduced. Labial palpus densely hairy, fuscous in male; whitish in female and admixture of fuscous hairs throughout and with inner sides of third segment occasionally fuscous; second segment of male elongate, approximately equaling vertical diameter of eye and over $6.0\times$ length of terminal segment.

Thorax: Dorsum and venter fuscous with purplish bronze iridescence. Legs fuscous with apices of tibial and tarsal segments ringed with white; spurs and tibial area around base of epiphyses and spurs irrorated with white. Forewing fuscous with a pronounced purplish bronzy luster, faintly irrorated with white; a prominent, whitish transverse band extending straight across wing slightly beyond middle; a second, smaller band midway between postmedial band and apex, extending somewhat obliquely from costa to tornus; subapical band frequently reduced and not reaching tornus, rarely absent; both bands with inner margins bordered by dark fuscous; fringe uniformly fuscous. Hindwing thinly scaled, opaque, uniformly pale grayish; M1 and M2 stalked about $0.3\times$ their length.

Abdomen: (Figure 312). Fuscous above and beneath, occasionally with more gray beneath in some females. Female with seventh sternite approximately $3.3\times$ length of sixth; eighth sternite mostly lightly sclerotized, anterior margin slightly more pigmented.

Male Genitalia: (Figure 278). Uncus situated ventrad to tegumen. Vinculum-saccus broad, elongate, approximately $2.0\times$ length of valvae; anterior end broadly rounded. Valva with sacculus extended into a prominent lobe from ventral margin of valva; apex of cucullus subtruncate with ventral angle produced into a broad, short, acute lobe. Juxta with anterior $0.3\text{--}0.5\times$ spatulate, anterior margin broadly rounded; posterior $0.5\text{--}0.7\times$ abruptly constricted, very slender. Phallus elongate, slightly sinuate; base moderately flared laterally; apex simple, acute, with numerous, minute, scalelike spines densely concentrated over apical end of vesica.

Female Genitalia: (Figure 377). Apex of ovipositor rounded, symmetrical, with a row of minute, widely spaced serrulations dorsally and somewhat removed anteriorly from apex. Bursa copulatrix relatively reduced, not exceeding apical ends of

anterior apophyses. Sinus vaginalis reduced, irregular in outline, darkly pigmented.

TYPES. Holotype, ♂ (*Adela purpurea*) (BMNH). Holotype, ♂ (*Adela biviella*) (BMNH).

TYPE LOCALITIES. St. Martin's Falls, Albany River, Hudson Bay, Ontario (*Adela purpurea*). "Wahrscheinlich, Massachusetts" (*Adela biviella*).

HOST. Unknown. Adults have been reported on *Salix* species (Salicaceae); "found on willow bloom in April" (Forbes 1923: 78).

FLIGHT PERIOD. Late March to early July; univoltine.

DISTRIBUTION. (Map 21). *Adela purpurea* is the most boreal of our Nearctic *Adela*, ranging widely across the Canadian and Transitional Faunal Zones of North America from Labrador to eastern Alaska. Northward it extends almost to the Arctic Circle. In the eastern half of its broad range, *A. purpurea* occurs as far south as New Jersey. In the West, it may range through the southern Rocky Mountains as far as Colorado, although, at present, there exists only one record without a specific locality other than Colorado to indicate this.

MATERIAL EXAMINED. 267 males, 33 females. CANADA ALBERTA: Banff, Loop, 4,500 ft. [1,372 m]: 2 ♂, 6 Jun 1927, O. Bryant (USNM). Calgary: 5 ♂, 7–16 May 1914, F. Wolley (CNC); Calgary, near Elbow River: 1 ♂, 17 May 1964 (GRP). Edmonton: 4 ♂, 1 May 1925, 6–12 May 1924, 4 ♂, O. Bryant (USNM). Lethbridge: 1 ♀, 21 May 1938, G. Whalley (CNC). Lloydminster, Blackfoot Hills: 2 ♂, 9 May 1949, P. Braggemann (CNC); Lloydminster, Sunnysdale: 11 ♂, 3 May 1942, P. Braggemann (CNC). Nordegg: 6 ♂, 8–9 Jun 1921, J. McDunnough (CNC). Lac La Biche, 20–30 km E Touchwood Lake Road: 1 ♀, 19 May 1994, G. R. Pohl et al. (GRP). BRITISH COLUMBIA: Summit Lake, Alaska Highway, mile 392: 2 ♂, 23–27 Jun 1959, R. Leach (CNC); 4,500 ft. [1,372 m]: 1 ♀, 2–4 Jul 1959, R. Leach (CNC). Toad River, Alaska Highway, mile 440, 4,500 ft. [1,372 m]: 1 ♂, 19 Jun 1959, E. MacDougall (CNC). LABRADOR: Goose Bay: 3 ♂, 10 Jun 1948, W. Judd (CNC). MANITOBA: Aweme: 1 ♂ 21 Apr 1911, S. Criddle, 1 ♂, 23 Apr 1925, 2 ♀, 25 May 1921, N. Criddle (CNC). Churchill: 1 ♂, 22 Jun 1937, W. Brown, 1 ♂, 27 Jun 1947, T. Freeman (CNC). Gillam: 3 ♂, 2 ♀, 11 Jun 1950, J. McAlpine (CNC). McCreary: 3 ♂, 12 May 1933, A. Harper (USNM). Winnipeg: 6 ♂, 3 ♀, 5–7 Jun 1898, A. Hanharn (USNM). NORTHWEST TERRITORY: Hay River: 2 ♂, 1–4 Jun 1951, P. Ehrlich (CNC). NOVA SCOTIA: 1 ♂, 16 May 1906, MacNabs (USNM). Halifax Watershed Area, Halifax Co.: 3 ♂, 12 May 1960, D. Ferguson (USNM). ONTARIO: Almonte: 15 ♂, 22 Apr 1968, P. Braggemann (CNC). Bel's Corners: 1 ♂, 1 ♀, 25 Apr 1941, 1 ♀, 1 May 1951, T. Freeman (CNC). Borden River, Highway 101, 50 mi. [80.5 km] E of Timmons: 1 ♂, 22 May 1968, P. Braggemann (CNC). Constance Bay: 15 ♂, "26–30 Apr 1933–35", G. Whalley, 3 ♂, 26 Apr 1935, McDunnough (CNC); 1 ♂, 26 Apr 1935, G. Whalley (USNM). Hymers: 2 ♂ (USNM). Mer Bleue: 1 ♂, 13 May 1932, W. Brown (CNC). Merivale: 1 ♀, 21 Jun 1983, G. Whalley (CNC). Ottawa: 33 ♂, "26–29 Apr 1906–38", C. Young (CNC); 1 ♂, 27 Apr 1901,

A. Winn, 3 ♂, 2 ♀, 28 Apr 1906, C. Young (USNM). St. Martin's Falls, Albany River, Hudson Bay: 1 ♂ (holotype, *Adela purpurea*) (BMNH). QUEBEC: Lac Mondor [46°37'N, 72°46'W], Ste. Flore: 43 ♂, 9 ♀ 4–21 May 1951, E. Munroe (CNC); 2 ♀, 11–13 May 1951, E. Munroe (USNM). Montreal: 1 ♂, 28 Apr 1901, A. Winn, on willow blooms (CNC); 1 ♂, 1 ♀, 27–28 Apr 1901, W. Dietz (MCZ); 2 ♂, 27–28 Apr 1901, A. Winn, on willow blooms (USNM). O. Chelsea: 1 ♂, 25 Apr 1935, W. Brown (CNC). SASKATCHEWAN: Assiniboine Res.: 5 ♂, 12 May 1925, J. DeGryse (CNC). YUKON: Rampart House: 14 ♂, 2 Jun 1951, J. Martin (CNC); 1 ♂, 2 Jun 1951, J. Martin (USNM). UNITED STATES: ALASKA: North Star Borough: Fairbanks: 1 ♂, 28 May 1967, K. Philip (USNM). Sheep Creek Road and Goldstream, 11 mi. [17.6 km] NW Fairbanks, 64°55'N, 147°57'W: 1 ♂, 9 May 1970, 1 ♂, 19 May 1968, K. Philip (USNM). COLORADO: 1 ♀, W. Dietz (MCZ). MAINE: Hancock Co.: Bar Harbor: 2 ♂, 12 Apr 1937, A. E. Brower; 2 ♂, 1 ♀, 1–2 May, 1937, A. E. Brower (USNM). Mount Desert: 2 ♂, 1 May 1934, A. E. Brower (USNM). Knox Co.: Camden: 2 ♂, 29 Apr 1944, A. E. Brower (USNM). Oxford Co.: Norway, 40 mi. [64.4 km] NNW Portland: 2 ♂, S. Smith (MCZ). Penobscot Co.: Enfield, 34 mi. [55 km] NNE Bangor: 1 ♀, 1 May 1933, L. P. Gray (USNM); 2 ♂, 9 May (CU); 6 ♂, 5 May 1935, V. dos Passos, L. Gray (AMNH); 1 ♂, 5 May 1935, V. dos Passos (USNM). Orono: 1 ♂, 24 Feb 1880, Fernald (BMNH); 1 ♂, Fernald (MCZ); 1 ♂, 1 ♀, 4 May 1881 (USNM). MASSACHUSETTS: Berkshire Co.: Newton: 1 ♂, 25 Apr 1909 (MCZ). Wellesley: 4 ♂, 1 ♀, 18–20 Apr 1899 (MCZ). Essex Co.: North Saugus, 1.8 mi. [2.9 km] SW Lynnfield: 1 ♂, 1906, E. Titus (USNM). Middlesex Co. Natick: 7 ♂, 19 Apr 1891, A. P. Morse (MCZ). Sherborn, 4.5 mi. [7.2 km] NW Medfield: 1 ♂, 1 ♀, 19 Apr 1891, A. P. Morse (MCZ). Norfolk Co.: Wollaston [Quincy]: 4 ♂, May 1895, F. N. Sprague (MCZ); 2 ♂, May 1895, F. N. Sprague (USNM). Worcester Co.: Princeton: 2 ♂, 19 Apr 1902 (MCZ). MICHIGAN: Clare Co.: 1 ♂, 1 ♀, 29 Apr 1939, R. Dreisbach (MSU). Macomb Co.: 2 ♂, 29 Apr 1944, J. Neuman (MSU); 1 ♂, 29 Apr 1944, J. Neuman (USNM). Midland Co.: 1 ♂, 31 Mar 1945; 1 ♂, 24 Apr 1943; 1 ♂, 29 Apr 1939; 2 May 1937, R. Dreisbach (MSU). Washtenaw Co.: Ann Arbor: 1 ♂, 20 Apr (CU). NEW HAMPSHIRE: Rockingham Co.: Hampton: 3 ♂, 1 ♀, 15 Apr 1910, 5 ♂, 26 Apr 1908, S. Shaw (USNM). NEW JERSEY: Bergen Co.: Ramsey: 1 ♂, 31 Mar 1918, 2 ♂, 21 Apr 1917, on *Salix*, 4 ♂, 25 Apr 1911 (AMNH); 1 ♂, 25 Apr 1911 (USNM). Essex Co.: Hemlock Falls [near Milburn]: 1 ♂, 17 Apr 1904, Watson (AMNH). Union Co.: Summit: 1 ♂, May, W. B. (USNM). NEW YORK: Albany Co.: Albany: 1 ♂, 29 Apr 1934, A. Frederick (AMNH). Fulton Co.: 2 ♂, 27 Apr 1901 (CU). Cranberry Creek, 2.5 mi. [4 km] "NWN" [possibly NNW?] Hampton: 1 ♂, 26 Apr 1908 (CU). Rockland Co.: Ramapo, 7 mi. [11.3 km] W Spring Valley: 1 ♂, 24 Apr, on willow catkins (USNM). Tompkins Co.: McLean Bogs Reserve, 3 ♂, 6–7 May 1961, R. Hodges (USNM).

DISCUSSION. *Adela purpurea* is one of the most easily recognized of our North American *Adela*. The dark, purplish forewing, traversed by a prominent whitish fascia slightly beyond the middle of the wing, and a smaller, usually incomplete, subapical

fascia distinguish this species from all other members of the genus. *Adela purpurea* also occurs further north than any other North American *Adela* and is the only species whose range extends across the continent. Although the host of this species has not been confirmed, the frequent association of the adults with *Salix* flowers strongly suggests this genus as a possible oviposition site and larval food plant.

Adela trigrapha Zeller

FIGURES 29–30, 42–43, 49, 163–165, 279, 313, 378; MAP 22

Adela trigrapha Zeller, 1875: 342.—Chambers, 1878b: 128.—Walsingham, 1880: 78, 79.—Riley in Smith, 1891: 97, no. 5150.—Dyar, 1903: 576, no. 6563.—Kearfott in Smith, 1903: 124, no. 7101.—Meyrick, 1912a: 10; 1912b: 9.—Barnes and McDunnough, 1917: 196, no. 8451.—McDunnough, 1939: 110, no. 9841.—Powell, 1967: 83; 1969: 220.—Davis, 1983: 4, no. 225.—Poole, 1996: 626.—Powell and Opler, 2009: 40.—Pohl et al., 2015: 38.

Adela (*Nematais*? [sic]) *trifasciella* Chambers, 1876: 103.—Powell, 1969: 220 [synonym of *Adela trigrapha*].—Davis, 1983: 4, no. 225.

Adela (*Nemotois*) *trifasciella* Chambers, Walsingham, 1880: 79 [synonym of *Adela trigrapha*].

Adela trifasciella Chambers, 1878: 128.—Riley in Smith, 1891: 97, no. 5149.—Dyar, 1903: 576, no. 6562.—Kearfott in Smith, 1903: 124, no. 7100.—Meyrick, 1912a: 10; 1912b: 9.—Barnes and McDunnough, 1917: 196, no. 8450.—McDunnough, 1939: 110, no. 9840.—Davis, 1983: 4, no. 225 [synonym of *Adela trigrapha*].

Adela fasciella Chambers, 1876: 103; 1878: 128 [synonym of *Adela trigrapha*].—Walsingham, 1880: 78, 79 [synonym of *Adela trigrapha*].—Riley in Smith, 1891: 97, no. 5150 [synonym of *Adela trigrapha*].—Dyar, 1903: 576, no. 6563 [synonym of *Adela trigrapha*].—Meyrick, 1912a: 10 [synonym of *Adela trigrapha*]; 1912b: 9 [synonym of *Adela trigrapha*].—Barnes and McDunnough, 1917: 196, no. 8451 [synonym of *Adela trigrapha*].—Powell, 1969: 220 [synonym of *Adela trigrapha*].—Davis, 1983: 4, no. 225 [synonym of *Adela trigrapha*].

Adela flammeusella (not *flammeusella* Chambers) Linsley and Usinger, 1936: 50.—Powell, 1969: 220 [synonym of *Adela trigrapha*].

Adela flammsusella [sic] (not Chambers) Linsley and Usinger, 1936: 53.—Powell, 1969: 220 [synonym of *Adela trigrapha*].

ADULT. (Figures 163–165). Wing expanse: ♂, 11–15 mm; ♀, 10–13.5 mm.

Head: (Figures 29–30). In male, frons entirely covered with rough, black hairs; vertex entirely black or predominantly so with a slight mixture of orange hairs near center of crown posterior to eyes; frons and vertex entirely orange in female except for a few black hairs arising below antenna along inner rim of eye. Antenna of male elongate, ~3.0–3.2× length of forewing, with ~153–170 segments; dorsal sex spines absent; antennal sockets narrowly separated by about 0.3× their diameter; scape black above, spotted with white ventrally; flagellum with basal 0.2–0.25 black, heavily ringed with white, becoming entirely white over outer 0.75. Antenna of female shorter, about 1.20–1.25× length

of forewing, ~70–75-segmented; antennal sockets widely separated by about 1.5× their diameter; scape black with occasional specks of white ventrally; basal 0.75 of flagellum either entirely fuscous or with slight irroration or annulation of white; outer 0.25 entirely white. Eyes sexually dimorphic; obovoid in male, greatly enlarged, interocular index approximately 1.0; eyes narrowly separated at vertex, the interocular distance about 0.3 that across frons. Eyes suboval and reduced in female; interocular index approximately 0.7; eyes widely separated at vertex, the distance slightly greater than interocular distance across frons. Maxillary palpus black, normally 3-segmented. Galeae with basal fourth covered with black scales and elongate hairs. Labial palpus black with a dense brush of long setae from venter of second segment; second segment approximately equal to third in length.

Thorax: Dorsum and tegulae shiny black; collar entirely black or sparsely intermixed with orange. Venter and most of legs fuscous to black; undersides of tarsi heavily irrorated with white; apex of tarsal segments usually ringed with white; apex of tarsal segments usually ringed with white. Forewing of male black with 3 narrow, whitish to pale yellowish white, transverse bans or fasciae; inner fascia at basal fourth of costa, oblique, not parallel to outer 2 fasciae, closer to wing base at hind margin; median fascia from middle of costa, obliquely slanted, more distant from base at hind margin; outer fascia from apical fourth of costa, approximately parallel to median band, directed toward tornus but terminating just before termen, interrupted or abbreviated in 40 of the males examined; fringe black. Forewing of female black with a dark green luster; banding similar to male except often narrower and usually pale yellowish white; outer band interrupted or abbreviated in 4 of the females examined. Hindwing slightly paler than forewing, dark fuscous with a slight purplish iridescence; a single, small white to yellowish white spot usually present at hind margin near 1A, rarely absent; a second, smaller spot sometimes present near termination of 2A, usually absent in female; fringe dark fuscous. M1 and M2 separate.

Abdomen: (Figure 313). Usually entirely shiny black in both sexes; occasionally with slight irroration of grayish white on seventh segment of female. Seventh sternite of female approximately 2.8–2.9× length of sixth. Eighth sternite lightly and uniformly sclerotized.

Male Genitalia: (Figure 279). Uncus minutely bilobed. Vinculum-saccus elongate, approximately 2.5× length of valvae; nearly V-shaped but with anterior end of saccus broadly rounded. Valvae roughly triangular; ventral margin irregular, sharply indented near cucullus; outer margin of cucullus rounded, slightly produced ventrally. Juxta slender, with anterior half sagittate, anterior end acute. Phallus elongate, slightly sinuate, base moderately flared to about twice the diameter of main shaft; cornuti absent.

Female Genitalia: (Figure 378). Apex of ovipositor acute, compressed, cutting edges nearly symmetrical with ventral edge slightly longer; minutely serrulate. Vestibulum elongate, length approximately 2.4× that of depth, dorsal half rugose; without distinct sclerite but darkened anteroventrally.

TYPES. Lectotype, ♂ (present designation, *Adela trigrapha*): “*Adela trigrapha* Z., Californ.?, Zeller Coll., Walsingham Collection, 1910–427; Type; Micro No. 1; Lectotype ♂, *Adela trigrapha* Z. by D. R. Davis” (BMNH). Syntypes [?], ♂ (*Adela trifasciella*); deposition unknown, presumed lost. Neotype, ♂ (*Adela trifasciella*, designated by Powell 1969) (BMNH). Syntypes [?], ♀ (*Adela fasciella*); deposition unknown, presumed lost. Neotype, ♀ (*Adela fasciella*, designated by Powell 1969) (BMNH).

TYPE LOCALITIES. Probably from California (*Adela trigrapha*). “Received from Mr. James Behrens, of San Francisco, California” (syntypes [?], *Adela trifasciella*). Two miles west of Fairfax, Marin County, California (neotype, *Adela trifasciella*). “Mr. Behrens, San Francisco” (syntypes [?], *Adela fasciella*). Two miles west of Fairfax, Marin County, California (neotype, *Adela fasciella*).

HOST. Powell (1969) has reported adults ovipositing in the buds of Polemoniaceae: *Leptosiphon* (as *Linanthus androsaceus* (Benth.) Greene and *L. bicolor* (Nutt.) Greene), near Alpine Lake, Marin County, California.

FLIGHT PERIOD. Late March to early June; univoltine.

DISTRIBUTION. (Map 22). This species ranges widely through much of the western coastal areas of North America, normally at elevations below 4,000 ft. [1,219.5 m], from southern British Columbia, southward through cismontane California to San Diego County.

MATERIAL EXAMINED. 487 males, 93 females. **CANADA:** **BRITISH COLUMBIA:** Duncans: Vancouver Island: 3 ♂, 8–15 May 1915, A. Hanham, USNM slide USNM 1313 ♂ (USNM). Goldstream: 1 ♂ (CNC); 6 ♂, 3–17 May 1903, A. Hanham, 3 ♂ (USNM). Langford: 1 ♂, 23 Apr 1951, D. Evans (CNC). Mt. Tzouhalem: 1 ♂, 24 May 1921, E. Blackmore (BMNH); 2 ♂, 24 May 1921, E. Blackmore (USNM). Victoria: 1 ♀, 16 May 1929, W. Downes (CNC). **UNITED STATES:** **CALIFORNIA:** Specific locality unknown: 1 ♂ (lectotype, *Adela trigrapha*), 1 ♀ (paralectotype, *Adela trigrapha*), 2 ♂ (BMNH). Alameda Co.: Lake del Valle, Paterson Reserve, 300–350 m, Oak, bunchgrass gully, T4S R2E S24 NW: 2 ♂, 1 ♀, 1 May 1988, Ole Pellmyr (USNM). Mines Road, near Livermore: 13 ♂, 2 ♀, 27 Apr 1947, T. W. Davies (LACM); 3 ♂, 27 Apr 1947, T. Davies (USNM). Contra Costa Co.: Mitchell Canyon: 5 ♂, 21 Apr 1956, R. Fisher (CU). Mt. Diablo: 1 ♀, 19 Apr 1931, Keifer (USNM). Russelmann Park: 2 ♀, 5 May 1957, 3 ♂, 1 ♀, 9–19 Apr 1958, J. Powell (USNM). El Dorado Co.: Clarksville: 2 ♂, 12 Apr 1932, Keifer (USNM). Shingle Spring: 2 ♂, 24 Apr 1935, Keifer (USNM). Fresno Co.: Wet Cliffs along Rt. 180: 2 ♂, 1 ♀, 8 Jun 1963, C. Alexander (USNM). Humboldt Co.: Bair's Ranch, Redwood Creek: 1 ♂, 10 Jun 1903, H. Barber (USNM). Kern Co.: Democrat Springs: 6 ♂, 1 ♀, 20 Apr 1958, C. Hogue (LACM). Near Democrat Hot Springs, Kern River Canyon, 2,600 ft. [192.7 m]: 2 ♂, 24 Apr 1958 (USNM). Miracle Springs: 2 ♂, 1 ♀, 29 Apr 1964, J. Powell (USNM). 1 mi. [1.6 km] E of Woody: 1 ♀, 25 Apr 1964, C. Toschi (USNM). Lake Co.: 1 mi. [1.6 km] SW of Lakeport: 3 ♂, 3 ♀, 24 Apr 1963, R. Thorpe

(USNM). Marin Co.: Ross: 1 ♂, 28 Apr 1918, J. Bradley (CU). San Geronimo: 1 ♂, 9 Apr, O. Sacken (BMNH). San Rafael: 1 ♂, 31 Mar, O. Sacken (BMNH). 2 mi. [3.2 km] W of Fairfax: 1 ♂ (neotype, *Adela trifasciella*), 17 Apr 1961, J. Powell; 1 ♀ (neotype, *Adela fasciella*), 17 Apr 1961, J. Powell (USNM). Mendocino Co.: Head of Dry Creek: 2 ♂, 4 ♀, 24 May 1871, Walsingham (BMNH); 1 ♂, 1 ♀, 24 May 1871, Walsingham (USNM). Mendocino: 7 ♂ (USNM). Mouth of Albion River: 1 ♂, 30–31 May 1871, Walsingham (BMNH). Ukiah: 3 ♂, 28 Apr 1931, D. Meadows (USNM). Napa Co.: Berryessa Val.: 2 ♂, 19 Apr 1935, Keifer (USNM). Riverside Co.: R. R. Canyon, 4 mi. [6.4 km] E of Elsinore: 3 ♂, 13 Apr 1965, C. Toschi (USNM). San Benito Co.: Pinnacles National Monument: 3 ♂, 25 Apr 1960, JM & SN Burns (USNM). San Diego Co.: Warner's Ranch [near Warner Springs]: 6 ♂, 20 Apr (USNM). San Luis Obispo Co.: San Luis Obispo: 2 ♂, Mar, A. H. Vachell (MCZ); 12 ♂, 6 ♀, Mar, A. H. Vachell, USNM slide 1913 ♂, ♀ (USNM). San Mateo Co.: San Francisco: 9 ♂, [18]98, W. Dietz (MCZ); 14 ♂, 3 ♀, 26 Mar (BMNH); 1 ♂, Mar (USNM). San Mateo: 8 ♂ (MCZ). Santa Barbara Co.: Santa Cruz Island: 189 ♂, 16 ♀, 24–27 Mar 1941, L. M. Martin (LACM); 7 ♂, 2 ♀, 24–26 Mar 1941, L. Martin (USNM). Prisoners Harbor, Santa Cruz Island: 2 ♂, 2 ♀, 29 Apr–1 May 1966, J. Powell (USNM). Stanford Univ. Jasper Ridge Biological Preserve, 420 ft. [128 m]: 1 ♂, 8 Apr 1995, Paul Arnaud Jr., USNM slide 34651 ♂ (USNM). Santa Clara Co.: Mt. Hamilton, 1,170 m, T75 R3B 89NE, open oak forest, free flying: 1 ♂, 30 Apr 1990, O. Pellmyr & J. N. Thompson (USNM). Santa Clara: 13 ♂, 4 ♀ (USNM). Silver Creek area: 1 ♂, 15 Apr 1952, J. Tilden (USNM). Sonoma Co.: 12 ♂, 7 ♀, 10–25 May, A. Vachell, USNM slide 2846, wing SEM (USNM); 1 ♂, 1 ♀, 10–25 May, A. Vachell (CU); 2 ♂, 10–25 May, A. Vachell (CNC). Guerneville: 9 Apr, ECJ (CNC). Kenwood [16 km ESE Sta. Rosa]: 2 ♂, 2 ♀, 2–11 Apr 1940, E. Johnston (CNC). Petaluma: 2 ♂, 3 ♀, 13–20 Apr 1940, 2 ♀, 2–6 May 1939, E. Johnston (CNC); 1 ♀, 13 Apr 1940, E. Johnston (USNM). The Geysers: 2 ♂, 5 ♀, 1 May 1935, 6 ♂, 1 ♀, 10 May 1938, 1 ♂, 4 Apr 1940, E. Johnston (CNC). Two Rock: 11 ♂, 19–26 Apr 1936, E. Johnston (CNC); 2 ♀, 19 Apr 1936, E. Johnston (LACM). Stanislaus Co.: Del Puerto Canyon, 23 mi. [36.8 km] W Patterson: 2 ♂, 2 ♀, 30 Apr 1963, J. Powell (USNM). Tulare Co.: Sequoia National Park, S Fork drive on Kawah River at 9.5 mi., T18S R29E S14SE, shady oak slope on Cruciferae sp. 850 m: 1 ♀, O. Pellmyr & J. N. Thompson (USNM). Tuolumne Co.: 6 km NE Tuolumne, on Cottonwood Creek Road, 730 m, R16E 72N S34SE, 750 m, oak pine forest flying in low vegetation: 2 ♂, 4 May 1990, O. Pellmyr & J. N. Thompson (USNM). OREGON: Benton Co.: Corvallis: 1 ♂, 27 Apr 1932, J. Schuh (CU). Jackson Co.: Gold Hill: 1 ♂, C. Biederman (CNC); 7 ♂, C. Biederman, slide USNM 20084 ♂ (USNM). Medford: 6 ♂, 15–27 May 1932 (LACM). Mt. Ashland Road, 4,300 ft. [1,311 m]: 30 ♂, 2 ♀, 27 May 1970, J. Clarke, slides USNM 16121 ♀, 16500 ♂, 18352 ♂, 31736 ♀ (USNM). To Rogue River: 1 ♂, 4–6 May 1872, Walsingham (BMNH). Josephine Co.: 2 mi. [3.2 km] E Merlin: 40 ♂, 9 ♀, May 1970, J. Clarke, slides 16045 ♀, 16066 ♂ (USNM). Selma, Deer Creek:

1 ♂, 18 May 1962 (LACM). 5.3 mi. W Selma on Illinois River Road, 470–500 m, T38S R9W S2SE, oak serpentine, on *L. affinis* [genus not stated]: 1 ♂, O. Pellmyr & J. N. Thompson (USNM).

DISCUSSION. This species and the following, *Adela eldorada*, are easily recognized by their forewing pattern that possesses three whitish to yellowish white, equally spaced fasciae. Distinguishing the two species from each other, however, is difficult, and in many instances questionable without sufficient ecological information or possibly molecular sequence data, which is inadequate at present. As discussed by Powell (1969), *A. trigrapha* typically differs from *A. eldorada* morphologically in being slightly smaller, with a darker head in the male and more narrow, whiter fasciae. In the populations of *A. trigrapha* he examined, Powell observed the median fascia to vary in width from 0.1 to 0.2 times the distance between the median and inner fasciae in the cell compared to a range of 0.18 to 0.28 (rarely to 0.5) for the same ratio in *A. eldorada*. More significantly, perhaps, *A. trigrapha* prefers to inhabit open meadows or grassy hillside areas where it may be frequently observed visiting flowers. Powell (1967, 1969) has noted females of *A. trigrapha* ovipositing at the base of unopened buds of *Leptosiphon* (as *Linantus androsaceus* and *L. bicolor*).

A rather large series of *A. trigrapha* was collected by J. F. Gates Clarke near Merlin, Oregon. These specimens were observed flying low over the ground in open meadow situations interspersed between wooded stands of predominantly *Quercus garryana* Douglas. The heads of the males from this population are completely black. The widths of the fasciae of their forewing fall mainly within the *A. trigrapha* range as given by Powell, with similar variation also characteristic of the California *A. eldorada* populations. The width of the outer band ranged from 0.14 to 0.24 times the distance between the middle and the outer bands in the males of the Merlin specimens. The outer bands of the few females from this population ranged from 0.16 to 0.20 times the interfascial distance. The outer fasciae of these Oregon specimens were noticeably more complete than in most California populations of *A. trigrapha*, with only seven males with the outer bands interrupted in the male ($n=64$) and no reductions noted in the females ($n=8$).

Zeller (1875: 342–343) described *A. trigrapha* from three “typical” specimens in his collection, representing both sexes, all questionably from California. He further mentioned a “var. b,” consisting of a single male in his collection from California and an “ordinary” or typical male also from California deposited in the Roesslerschen collection. His “var. b” differed from the typical form by having outer fascia of the forewing interrupted.

The collections of the Natural History Museum (London) currently contain six specimens of *A. trigrapha* from the Zeller collection. Only two of these have been considered syntypes by author DRD for the reasons given below. Both specimens, one male and one female, bear a green Zeller label with the following data: “*Adela trigrapha* Z., Californ.?” Thus, the origin of both specimens was questionably from California, agreeing with

Zeller's statement for part of his original series. The remaining four Zeller specimens all bear definite California labels and possible dates indicating they were probably collected after 1875. For example, three males possess locality labels of "S. Calif., 81," suggesting they were collected in 1881. Although one of these also bears a circular type label, none should be considered syntypal. The male syntype referred to previously, which also bears a small label, "Micro No. 1," has been selected as the lectotype. The depositions of the other three specimens originally mentioned by Zeller remain unknown.

Adela trifasciella was probably described from a single male specimen, although Chambers (1876) does not state the exact number. The specimen(s) was originally received from Mr. James Behrens of San Francisco, California. The present deposition of Chambers' type(s) is not known and is presumably lost. Consequently, Powell (1969) has designated a neotype closely agreeing with Chambers' description and has deposited this type in the National Museum of Natural History.

In the same paper and immediately following the description of *A. trifasciella*, Chambers also proposed *A. fasciella*. This name, too, was probably based on a single specimen (a female) received from Mr. Behrens of San Francisco. However, as originally suspected by Chambers, *A. fasciella* merely represents the somewhat dimorphic female of *A. trifasciella*, both names being junior synonyms of *A. trigrapha*. The type(s) of *A. fasciella* is also presumed lost. Therefore, a neotype has been selected by Powell (1969) and deposited in the National Museum of Natural History.

***Adela eldorada* Powell**

FIGURES 166, 167, 280, 314, 379; MAP 22

Adela eldorada Powell, 1969: 221.—Davis, 1983: 4, no 226.—Poole, 1996: 626.

Adela trigrapha Usinger and Storer (nec Zeller, 1875), 1963: 91.—Powell and Opler, 2009: 40.

ADULT. (Figures 166, 167). Wing expanse: ♂, 12.5–14.5 mm; ♀, 11.5–13.5 mm.

Head: In male, frons entirely clothed with rough black hairs; vertex posterior to antenna intermixed with pale yellowish-brown hairs and over crown posterior to eyes; in female, frons and crown entirely pale yellowish brown to orange except for a few black hairs arising near inner rim of eye below antenna. Antenna of male elongate, approximately 3.0× length of forewing, 165–175 segments; antennal sockets narrowly separated by about one-third their diameter; scape black dorsally, spotted with whitish to pale brown beneath; flagellum with basal sixth usually fuscous dorsally, becoming more annulated with silvery white dorsally and ventrally with apical three-fourths or more entirely white; specialized sex spines absent. Antenna of female shorter, about 1.5× length of forewing, with 70–76 segments; antennal sockets widely separated by about 1.5× their diameter; scape as

in male; basal 0.3–0.75 of flagellum uniformly fuscous, becoming entirely white near outer fourth. Eyes sexually dimorphic; ob-ovoid in male, greatly enlarged, interocular index approximately 1.0; eyes narrowly separated at vertex, the distance being about 0.33 that across middle of frons. Eyes reduced and suboval in female; interocular index about 0.7; eyes widely separated at vertex, the distance slightly greater than that across middle of frons. Maxillary palpus black, typically 3-segmented. Galeae with basal fourth clothed with blackish scales and elongate hairs. Labial palpus black with a dense brush of elongate setae along ventral half of second segment; second segment approximately equal to third in length.

Thorax: Dorsum and tegulae shiny black; collar primarily orange intermixed with black. Venter and most of legs fuscous with slight bronzy iridescence; tarsal segments heavily irrorated ventrally and usually ringed with white at apices. Forewing of male black with 3, pale yellowish white, transverse bands; inner band at basal fourth of costa, strongly oblique, not parallel to outer 2 bands, slanted instead toward base of wing and hind margin; median band from middle of costa, slanted away from base of wing to hind margin; outer band from apical fourth of costa, more or less parallel to median band, directed toward tornus but terminating just before termen, usually interrupted at middle; fringe black. Forewing of female black with a dark green iridescence; banding similar to male except usually narrower; outer band less frequently interrupted than in male. Hindwing paler than forewing in both sexes, with a slight purplish iridescence; usually 2 yellowish-white spots present in male along hind margin near 1A and 2A; basal spot frequently absent, especially in female; hindwing occasionally immaculate; M1 and M2 separate.

Abdomen: (Figure 314). Entirely shiny black in female, with irroration of grayish white along eighth sternite in male. Seventh sternite of female approximately 2.8× length of sixth.

Male Genitalia: (Figure 280). Similar to *Adela trigrapha* Zeller.

Female Genitalia: (Figure 379). Similar to *Adela trigrapha* Zeller. Apex of ovipositor acute, compressed; cutting edges nearly symmetrical, minutely serrulate to nearly smooth and largely ventral. Vestibulum elongate, dorsal margin rugose.

TYPE. Holotype, ♂; 3 May 1964, J. Powell (UCB).

TYPE LOCALITY. UNITED STATES: CALIFORNIA: One mile [1.6 km] east of Woody, Kern County.

HOST. Unknown.

FLIGHT PERIOD. Late March to mid-June; univoltine.

DISTRIBUTION. (Map 22). Powell (1961) records this species only from the western slopes of the Sierra Nevada of California, where it ranges in elevations from 1,500 to 6,000 ft. [460 to 1,830 m] from Butte County south to Kern County.

MATERIAL EXAMINED. 5 males, 3 females. UNITED STATES: CALIFORNIA: Kern Co.: 1 mi. [1.6 km] east of Woody: 1 ♂, 1 ♀ (paratypes), 3 May 1964, P. Rude, slides USNM 16056 ♀, 16067 ♂ (USNM). Placer Co.: East end Bear Valley near Emigrant Gap: 2 ♂, 1 ♀, slides USNM 19342 ♂, 34756 ♂ (paratypes),

1 Jun 1964, P. Arnaud (USNM). Tuolumne Co.: Near North Fork Tuolumne River, 3 mi. [4.8 km] NE Tuolumne: 2 ♂ (paratypes), 1 May 1961, C. MacNeill (USNM). Twain Harte, 4,000 ft. [1,220 m]: 1 ♀ (paratype), 20 Jun 1963, M. Lundgren (USNM).

DISCUSSION. *Adela eldorada* is difficult, if not impossible at times, to distinguish from *A. trigrapha* on the basis of morphological evidence. Powell (1969) has listed several features usually present in *A. eldorada* that aid in separating it from most populations of *A. trigrapha*. Perhaps the most reliable and most useful character is the partially pale yellowish-brown to orange vertex in the males of *A. eldorada*. Individuals of this species also tend to be larger, with broader, yellowish-white forewing bands. Powell also noted the labial palpus, particularly the second segment, to be relatively longer in this species, but he cautioned that this character, too, is not always reliable. Noticeable variation in palpal length appears to exist between and within populations of what are considered to be *A. trigrapha*, with some individuals having proportionately longer palpi than *A. eldorada*. The variation in labial palpal length appears to be similar to the other key characters separating these two species in that marked variation within a species tends to obscure overall interspecific differences. Powell, however, has noted that in a few locations where populations of both species come together, specific morphological differences are amplified. Thus, as suggested by him, a character displacement phenomenon may be operating.

A crucial biological as well as taxonomical feature of *A. eldorada* is that it apparently inhabits an ecological habitat distinct from *A. trigrapha*. Powell has observed *A. eldorada* largely restricted to partially shaded forest areas and more or less open chaparral, and it has not been reported visiting flowers. By contrast, *A. trigrapha* seems to prefer open meadows or grassy hill-sides and frequently visits flowers, particularly Asteraceae. The principal reason Powell offers for proposing *A. eldorada* as a distinct species was his observation of the rigid adherence to these particular habitats by nearly sympatric populations of these two moths near Woody, Kern County, California.

Because of the taxonomic importance of ecological information in this species complex in relation to the great similarity of morphological features, it is very difficult at present to recognize or separate *A. eldorada* and *A. trigrapha* unless adequate habitat data are available. In this treatment, we have relied most heavily on crown color in the male as a diagnostic character because of the relative uniformity of this character within the populations examined. In contrast, such characters as labial palpal length and the color and width of the forewing bands seem to be more variable within populations. Given the fact that *A. eldorada* and *A. trigrapha* do not form separate groups in the COI tree (Figure 66), more comprehensive DNA sequence data should be obtained in the future to further test our species hypotheses. It is also possible that hybridization between species, misidentification of some specimens, or homoplasy in the COI barcode data is responsible for the pattern of the tree seen in Figure 66.

For the present, it seems best to recognize *A. eldorada* as a moderately high elevation species, restricted primarily to the

western slopes of the Sierra Nevada Mountains of California. Further field work on populations in more diverse areas, paying particular attention to possible host preferences, may help to elucidate the relationships of *A. eldorada* and *A. trigrapha*, as well as providing fresh material for further DNA sequence analysis.

Adela flammeusella Chambers

FIGURES 31–32, 168–169, 281, 315, 380; MAP 23

Adela flammeusella Chambers, 1876: 104.—Walsingham, 1880: 78.—Dyar, 1903: 575, no. 6555.—Kearfott in Smith, 1903: 124, no. 7093.—Meyrick, 1912a: 10 [synonym of *flammeella*]; 1912b: 9.—Barnes and McDunnough, 1917: 196, no. 8453.—McDunnough, 1939: 110, no. 9843.—Powell, 1969: 224.—Davis, 1983: 4, no. 224.—Poole, 1996: 626.—Powell and Opler, 2009: 40.

Adela flamensella [sic] Chambers, 1878: 127.—Walsingham, 1880: 79; 1890: 284.—Riley in Smith, 1891: 97, no. 5142.—Dyar 1903: 575, no. 6555 [synonym of *Adela flammeusella*].—Powell, 1969: 224 [synonym of *Adela flammeusella*].

Adela flammensella [sic] Kearfott in Smith, 1903: 124, no. 7093 [synonym of *Adela flammeusella*].—Powell, 1969: 224 [synonym of *Adela flammeusella*].

Adela flammeella Meyrick, 1912: 10 [invalid emendation]; 1912b: 9.—Powell, 1969: 224 [synonym of *Adela flammeusella*].

Adela lactimaculella Walsingham, 1880: 80; 1890: 284 [synonym of *Adela flamensella* [sic]].—Riley in Smith, 1891: 97, no. 5142 [synonym of *Adela flamensella* [sic]].—Dyar, 1903: 575, no. 6555 [synonym of *Adela flammeusella*].—Barnes and McDunnough, 1917: 196, no. 8453 [synonym of *Adela flammeusella*].—McDunnough, 1939: 110, no. 9843 [synonym of *Adela flammeusella*].—Powell, 1969: 224 [synonym of *Adela flammeusella*].—Davis, 1983: 4, no. 224 [synonym of *Adela flammeusella*].

ADULT. (Figures 168–169). Wing expanse: ♂, 9.5–13 mm; ♀, 11–13 mm.

Head: (Figures 31–32). In male, frons covered with rough, whitish hairs slightly mixed with a few black hairs beneath antenna; gena whitish; vertex predominantly black, usually with suffusion of whitish to pale ochreous hairs posteriorly behind eyes and around occiput. Female with frons and vertex rough, entirely ochreous to orange except for a few black hairs beneath antenna; gena whitish. Antenna of male greatly elongated, approximately 2.5–3.0× length of forewing, 160–170-segmented; antennal sockets narrowly separated by about 0.65× their diameter; scape smooth, mostly dark fuscous above, whitish below with a tuft of black and white hairs arising ventrally; flagellum with basal third predominantly fuscous dorsally and ringed with white below, becoming entirely white over apical two-thirds; specialized sex spines absent. Antenna of female shorter, approximately 1.5× length of forewing with 70–74 segments; antennal sockets widely separated by about 1.5× their diameter;

scape dark fuscous dorsally, with a mixture of black and white hairs ventrally; flagellum entirely dark fuscous over basal half, gradually becoming white over apical half. Eyes sexually dimorphic; obovoid in male, greatly enlarged, interocular index about 0.9; eyes approximate at vertex, interocular distance about 0.5× vertical diameter of eye. Eyes suboval and reduced in female, interocular index approximately 0.6; eyes widely separated at vertex, the distance approximately equal to interocular distance across frons. Maxillary palpus whitish, 3-segmented. Base of galea covered with whitish scales and hair; hairs longer in male. Labial palpus with basal 2 segments white, apical segment with basal 2 segments white; apical segment dark fuscous, variably irrorated with white; venter of second segment with a dense brush of black hairs intermixed with white; brush of hairs darker and more dense in male; second and third segments approximately equal in length.

Thorax: Dorsum dark fuscous with a slight coppery luster; collar whitish to ochreous. Venter paler, whitish to dark gray. Legs fuscous above, mostly whitish ventrally; epiphysis greatly reduced, minute, less than one-eighth the length of foretibia. Forewing fuscous with a bronzy green to purplish iridescence, usually marked with 2–6 whitish to pale yellowish spots; males usually more heavily spotted although immaculate forms occur in both sexes; typically 2 relatively large, equally spaced costal spots present as well as a third midway along hind margin; in addition, some populations (particularly northern) exhibit a fourth spot just above tornus and 2 smaller spots near basal fourth of wing; basal spots usually arranged with a smaller one above near costa and a larger one directly below; both spots rarely united to form an incomplete fascia; fringe fuscous; R4 and R5 rarely stalked; terminal fringe fuscous. Hindwing uniformly fuscous with a slight bronzy to purplish luster; M1 and M2 separate.

Abdomen: (Figure 315). Dark fuscous above, slightly more grayish beneath with a few scattered white scales on caudal segments in some specimens. Female with seventh sternite elongate, about 3.0× length of sixth; eighth segment uniformly and lightly pigmented.

Male Genitalia: (Figure 281). Uncus reduced, ventrad to tegumen. Vinculum-saccus elongate, approximately 2.5× length of valvae; anterior end of saccus broad, subtruncate. Valvae triangular in outline; ventral margin slightly irregular although not sharply indented or excavate. Juxta elongate, anterior end sagittate, posterior half slender. Phallus elongate, sinuate; base moderately flared; apex attenuate; cornuti absent.

Female Genitalia: (Figure 380). Apex of ovipositor acute, smooth, symmetrical. Vestibulum elongate, over 3.0× as long as deep; dorsal half of vestibulum rugose.

TYPES. Holotype, ♀ (*Adela flammeusella*): deposition unknown, presumed lost; neotype, ♀, designated by Powell (1969); 6 mi. SE Yorkville, Mendocino Co. California (USNM). Lectotype, ♂ (*Adela lactimaculella*, present designation): “Head of Noyo R. Mendocino Co., California, 8–11.VI.1871, Wlsm.; Walsingham Collection, 1910–427; *Adela lactimaculella*, Wlsm. P.Z.S.

1890, 80-1.P1-IX-5, TYPE ♂; Lectotype ♂, *Adela lactimaculella* Wlsm., by D. Davis” (BMNH).

TYPE LOCALITIES. Unknown (holotype, *Adela flammeusella*); Chambers (1876) stated that the holotype was received from Mr. Behrens [San Francisco]. Six miles SE of Yorkville, Mendocino Co., California (neotype, *Adela flammeusella*). Head of Noyo River, Mendocino Co., California (lectotype, *Adela lactimaculella*); as pointed out by Powell (1969) and Essig (1941), Walsingham’s itinerary during this period (8–11 Jun 1871) suggests the type series was collected in the vicinity of Little Lake, near Willets.

HOST. Unknown. Oviposition sites may involve various species of *Orthocarpus* (Orobanchaceae), Powell (1969).

FLIGHT PERIOD. Early March to late June; univoltine.

DISTRIBUTION. (Map 23). This species occurs rather widely in latitude through the extreme western United States at elevations mostly below 2,000 ft. [610 m] from southern Washington southward to San Diego County, California.

MATERIAL EXAMINED. 343 males, 77 females.

UNITED STATES: CALIFORNIA: Alameda Co.: Mine’s Road, near Livermore: 3 ♂, 27 Apr 1947, T. W. Davies (LACM). Palo Alto: 2 ♂, 7–8 Mar 1906, C. R. Coolidge (MCZ). Redwood Regional Park, Oakland: 12 ♂, 1 ♀, 15–17 Apr 1952, D. Hardwick (CNC); 1 ♂, 1 ♀, 15–17 Apr 1952, D. Hardwick (USNM). El Dorado Co.: Clarksville: 3 ♀, 12 Apr 1932, 1 ♀, 27 Apr 1932, H. Keifer (USNM). Cool: 2 ♂, 2 ♀, 24 Apr 1961, J. Powell (USNM). Lake Co.: 1 mi. [1.6 km] SW Lakeport: 1 ♀, 24 Apr 1963, R. Thorp (USNM). 2 mi. [3.2 km] SE Upper Lake: 1 ♂, 11 May 1961, J. Powell (USNM). Los Angeles Co.: La Sierra Canyon, Santa Monica Mts., 1,000 ft. [305 m]: 2 ♂, 1 ♀, 4 May 1957 (USNM). Stunt Cyn., Calabasas: 13 ♂, 1 ♀, 26 Apr (USNM). Marin Co.: Mill Valley: 2 ♂, 11 Apr 1926, W. Wild (CU). Ross: 6 ♂, 4 ♀, 28 Apr 1918, J. Bradley (CU). San Rafael: 2 ♂, 12 Apr (BM). 1 mi. [1.6 km] N Alpine Lake: 2 ♂, 1 ♀, 3 Jun 1964, J. Powell (USNM). Mendocino Co.: Head of Noyo River [near Willets]: 1 ♂ (lectotype, *Adela lactimaculella*); 5 ♂, 3 ♀ (paralectotypes, *Adela lactimaculella*), 8–11 Jun 1871, Walsingham (BMNH); 1 ♂, 1 ♀ (paralectotypes, *Adela lactimaculella*), 8–11 Jun 1871, Walsingham (USNM). 5 mi. [8.0 km] SW Ukiah: 2 ♀, 11 May 1961, R. Langston (USNM). 6 mi. [9.6 km] SE Yorkville: 1 ♀ (neotype, *Adela flammeusella*), 18 May 1966, J. Powell (USNM). Placer Co.: 5 mi. [8.0 km] N Auburn: 5 ♂, 24 Apr 1961, J. Powell (USNM). Colfax: 2 ♂, 1 ♀, Apr, A. H. Vachell (MCZ); 23 ♂, 2 ♀, Apr, 2 ♂, Jul, A. Vachell, slide USNM 20061 ♀ (USNM). Plumas Co.: Specific locality unknown: 1 ♂ (CNC); 5 ♂, 3 ♀, slides USNM 20061 ♀, 20069 ♂ (USNM). Sacramento Co.: Clay Sta. Road: 1 ♂, 1 ♀, 27 Apr 1963, L. Thurman (USNM). San Diego Co.: San Diego: 3 ♂, 1 ♀, 4 Apr 1907, W. Wright, slide USNM 16070 ♂ wing (USNM). San Luis Obispo Co.: San Luis Obispo: 1 ♂, W. Dietz (MCZ). San Mateo Co.: San Francisco: 1 ♂ Mar (USNM). Santa Barbara Co.: Santa Cruz Island: 1 ♂, 5 ♀, Apr 1921, E. Jones (BMNH); 5 ♂, 2 ♀, 25–27 Mar 1941, L. Martin (LACM). Santa Clara Co.: San Antonio Valley at Del Puerto

Canyon Road: 2 ♂, 3 ♀, 30 Apr 1963, J. Powell (USNM). Santa Clara: 2 ♂ (USNM). Silver Creek Hills: 3 ♂, 3 ♀, 20 Apr 1962, J. Chemsak (USNM). Sonoma Co.: Kenwood: 1 ♂, 10 Apr 1936, 1 ♂, 23 Apr 1935, E. C. Johnston (LACM). Petaluma: 2 ♂, 1 ♀, 20 Apr 1940, 4 ♂, 1 ♀, 6 May 1939, E. Johnston (CNC); 1 ♂, 6 May 1939, E. Johnston (USNM). The Geysers: 15 ♂, 11 ♀, 28 Apr 1940, 10 May 1938, E. Johnston (CNC); 1 ♂, 1 May 1935, E. C. Johnston (LACM); 1 ♂, 1 ♀, 1 May 1935, E. Johnston (USNM). OREGON: Josephine Co.: 2 mi. [3.2 km] E Marlin: 48 ♂, 12 ♀, 27 May 1970, J. F. G. Clarke, slide USNM 16038 ♂ (USNM). WASHINGTON: Asotin Co.: 1.5 mi. [2.4 km] S Anatone: 155 ♂, 2 ♀ 22 Jun 1970, J. F. G. Clarke, slide USNM 16069 ♂ (USNM). Klickitat Co.: Lyle: 1 ♂, 1 ♀, 9 Jun 1931, T. Clarke (CU); 4 ♂, 1 ♀, 9 Jun 1931, T. Clarke (USNM).

DISCUSSION. This species closely resembles *Adela thorpella* superficially, but it usually can be distinguished by the fuscous fringe along the termen and by the darker, more bronzy or coppery luster of the forewing. The most diagnostic feature of *A. flammeusella* is the greatly reduced epiphysis, a character not shared by any other known *Adela*. The epiphyses are so reduced in *A. flammeusella* that a casual microscopic examination in situ of the foretibiae usually reveals none present, and it is only after cleaning that the epiphyses can be easily seen.

Considerable geographical variation in the maculation of this species is evident. Pattern variation within populations does occur, of course, although comparative differences between populations are often more striking. There appears to exist, with certain exceptions, a general trend for the relative degree of maculation to increase northward and perhaps with altitude. Within any population, the females normally possess fewer markings than the males. In the most northern populations examined (near Anatone, Washington), all the males were heavily marked with five or six spots. Only two females were present in this sample, and these possessed four or five spots on the forewing. Specimens from Lyle, Washington, and Merlin, Oregon, not only were less heavily marked than the Anatone population but also possessed fewer markings than some populations from Southern California. However, specimens from Southern California (San Diego, Santa Cruz Island) usually consist of immaculate females and a high percentage of immaculate males.

Chambers (1876) described *Adela flammeusella* from a single immaculate female in imperfect condition received from a Mr. Behrens in San Francisco. Both antennae and some of the mouthparts (palpus) were reportedly missing from the specimen. The holotype now appears lost, and Powell (1969) has selected a nearly immaculate neotype to replace it.

Adela lactimaculella represents the maculated form of this species and was based on a series of seven males and four females from Mendocino County, California. All specimens were collected near the head of the Noyo River, perhaps in the vicinity of Little Lake, near the town of Willets. Author DRD selected a male in good condition as the lectotype and has confirmed the identification of the entire syntypic series as a synonym of *A. flammeusella*.

Adela thorpella Powell

FIGURES 33–34, 170–171, 282, 316, 381; MAP 24

Adela thorpella Powell, 1969: 226.—Davis, 1983: 4, no. 223.—Poole, 1996: 626.—Powell and Opler, 2009: 40.

ADULT. (Figures 170–171). Wing expanse: ♂, 12–13.5 mm; ♀, 12–13 mm.

Head: (Figures 33–34). In male, frons and gena rough, covered with long, white hairs and tuft of black hairs and a tuft of black hair beneath antenna; vertex and occiput white, with a few scattered black hairs and a slight mixture of pale ochreous between eyes in some specimens; frons, gena, and entire crown white in female with only a few scattered black hairs. Antenna of male greatly elongated, approximately 2.5× length of forewing, with ~115–120 segments; antennal sockets narrowly separated about 0.5× their diameter; scape smooth and black above, with a dense black tuft below, slightly irrorated with white; basal half of flagellum usually dark fuscous, variably ringed with white; distal half usually entirely white; specialized sex spines absent. Female with antenna shorter, approximately 1.3× length of forewing, with ~65–70 segments; antennal sockets widely separated about 1.25× their diameter; scape smooth and fuscous above, with a tuft of black and white hairs ventrally; flagellum mostly fuscous dorsally, whitish or partially banded with white ventrally. Eyes sexually dimorphic; obovoid in male and greatly enlarged, interocular index approximately 0.8–0.9; eyes closely approximate at vertex, the interocular distance about 0.3× vertical diameter of eye. Female with eyes suboval and reduced in size; interocular index ~0.6; eyes widely separated at vertex the distance approximately equal to interocular distance across frons. Maxillary palpus whitish, typically 3-segmented. Base of galea covered with whitish scales and hairs; hairs considerably longer in male. Labial palpus mostly white above in male with a dense brush of predominantly long, black hairs ventrally; palpus similar in female except ventral brush more white and shorter; second and third segments approximately equal in length.

Thorax: Dorsum dark fuscous with long grayish to whitish hairs from lateral margins and collar. Venter whitish to gray in male; mostly white in female. Legs fuscous dorsally, mostly white or irrorated with white ventrally; legs densely covered with long fuscous to white hairs in male; legs only moderately hairy in female; epiphyses well developed, approximately one-third the length of foretibiae. Forewing fuscous with a slight golden to brassy iridescence, often immaculate although sometimes variably marked in male with 1–3 small, whitish to pale yellowish spots as follows: one indistinct spot rarely present midway along costa; an obliquely apposable pair of spots sometimes present near outer fourth of costa and outer fourth of hind margin; sometimes outer costal spot the only mark on wing; costal margin usually edged with white; terminal fringe white. Hindwing fuscous, usually slightly darker than forewing and less iridescent, sometimes with a faint purplish luster; M1 and M2 separate.

Abdomen: (Figure 316). Fuscous above, light fuscous below, often irrorated with white laterally and on caudal sternites; caudal segment of male and external parts of genitalia covered with white scales. Seventh sternite of female $3.25\times$ length of sixth; eighth sternite uniformly and lightly pigmented.

Male Genitalia: (Figure 282). Uncus reduced, largely ventrad to tegumen. Vinculum-saccus elongate, approximately $2.5\times$ length of valvae; anterior end more narrow than in *A. flammeusella*, rounded. Valvae narrowly triangular in general outline; ventral margin nearly straight; cucullus evenly rounded. Juxta elongate, slender; anterior end narrowly sagittate; posterior half slightly flared caudally. Phallus elongate, slender, slightly sinuate; base moderately flared; apex attenuate as in *A. flammeusella*, with a slender, caudal extension from one side.

Female Genitalia: (Figure 381). Apex of ovipositor subacute, more rounded than in *A. flammeusella*, smooth, nearly symmetrical, with ventral edge slightly longer and more oblique than dorsal. Vestibulum elongate, over $3.0\times$ as long as deep; surface mostly rugose.

TYPE. Holotype, ♂, 9 Apr 1958, J. Powell (UCB).

TYPE LOCALITY. Russelmann Park, north slope of Mt. Diablo, 1,100 ft. [335.4 m], Contra Costa County, California.

HOST. Unknown; adult moths have been observed visiting a rather wide range of plants; for example, "Asteraceae: *Layia* species; Boraginaceae: *Plagiobothrys* species; Papaveraceae: *Meconella* species; *Meconella linearis* (Benth.) Jepson; *Platystemon* species; *Platystemon californicus* Benth." (Powell 1969: 227).

FLIGHT PERIOD. Late March to mid-May; univoltine.

DISTRIBUTION. (Map 24). At present, this species is known only from California, where it occurs primarily at lower elevations through the coastal ranges from El Dorado and Lake Counties in the north as far south as San Diego County.

MATERIAL EXAMINED. 12 males, 8 females. UNITED STATES: CALIFORNIA: Specific locality unknown: 1 ♂ (BMNH); 2 ♀ (USNM). Colusa Co.: 4 mi. [6.4 km] NW Lodoga: 1 ♂, 2 ♀, 12 Apr 1962, J. Powell (USNM). El Dorado Co.: Tallac, Lake Tahoe: 1 ♂, B. Clark (USNM). Riverside Co.: 4 mi. [6.4 km] E Elsinore: 1 ♂, 17 Apr 1965, J. Powell (USNM). Gavilan [Peak]: 1 ♀, 22 Apr 1941, G. J. Perry (USNM). San Luis Obispo Co.: 4 mi. [6.4 km] S Creston: 4 ♂, 13 Apr 1967, Powell ♀ Chemsak (USNM). 3 mi. [4.8 km] N Nacimiento Dam: 2 ♂, 2 ♀, 14 Apr 1967, J. Powell (USNM). Santa Clara Co.: 1 mi. [1.6 km] N New Almaden: 2 ♂, 29 Mar 1965, P. Opler, slides DRD 2710 ♂, USNM 16071 legs, 18167♂ (USNM). 3.5 mi. [5.6 km] NE New Almaden: 1 ♀, 3 Apr 1965, P. Opler, slide USNM 16046 ♀ (USNM).

DISCUSSION. Morphologically, *Adela thorpella* bears closest resemblance to *A. flammeusella* but may be distinguished from the latter by the white fringe and more golden or brassy luster of the forewing, the well-developed foreleg epiphyses, and the eyes of the male being more approximate at the vertex. In scale color, *A. thorpella* resembles *A. oplerella* most closely but differs sharply from that species in possessing enlarged eyes in the male, longer antennae in both sexes, narrower male valvae, and

a generally larger, overall size. Powell (1969) reported the Southern California specimens of *A. thorpella* were slightly smaller and darker, with a greater degree of white spotting.

The species was evidently recognized as undescribed over a half century ago by Walsingham, who identified at least two specimens as belonging to a new genus and species and designated one as the type. Walsingham's name was never published and thus has no nomenclatural validity.

Adela oplerella Powell

FIGURES 35, 36, 172, 173, 283, 317, 382; MAP 24

Adela oplerella Powell, 1969: 228.—Davis, 1983: 4, no. 222.—Poole, 1996: 626.

ADULT. (Figures 172, 173). Wing expanse: ♂, 10–12 mm; ♀, 11.5–12 mm. Powell and Opler, 2009: 40.

Head: (Figures 35, 36). In male, frons and gena covered with long white hairs heavily intermixed with black, especially near rim of eye beneath antenna; vertex mostly clothed with black hairs; occiput primarily whitish to pale ochreous. Head mainly whitish to pale ochreous in female, with black hairs intermixed, especially between antennae. Antenna of male relatively short, approximately $1.0\text{--}1.2\times$ length of forewing, 45–60-segmented; antennal sockets widely separated over $1.5\times$ their diameter; scape mostly smooth and dark fuscous above, whitish ventrally with a long tuft of primarily black hairs; flagellum fuscous above, usually banded with white ventrally, becoming entirely fuscous over outer fourth; dorsal sex spines absent. Antenna shorter in female, about $0.8\times$ length of forewing, approximately 40–45-segmented; antennal sockets widely separated $1.0\text{--}1.2\times$ their diameter; scape similar to male except more whitish below with ventral hair tuft reduced; flagellum similar to male except more whitish ventrally. Eyes not sexually dimorphic; reduced and unspecialized in male, suboval as in female; interocular index approximately 0.6 in male and 0.7 in female; eyes widely separated at vertex in both sexes, interocular distance about equal to that across frons. Maxillary palpus white, 3-segmented. Base of galea white with a few scattered, fuscous hairs in male. Labial palpus shorter in female, whitish above except for dorsum of segment, which frequently is fuscous; venter with a dense brush of primarily black hairs; second and third segments approximately equal in length.

Thorax: Dorsum dark fuscous with long whitish to pale ochreous hairs from lateral margins and collar. Venter grayish. Legs fuscous above, usually whitish ventrally; epiphyses well developed, over one-third the length of foretibiae. Forewing fuscous with a slight golden olivaceous to brassy iridescence, often immaculate or with 2 faint whitish to pale yellowish spots, one at outer third of costa, the other at lower, apical corner of discal cell; costal margin sometimes edged with white; fringe whitish to tornus. Hindwing fuscous, slightly more dark than forewing, less iridescent, occasionally with a faint purplish luster; M1 and M2 separate.

Abdomen: (Figure 317). Fuscous above, slightly paler, more grayish beneath with whitish irroration posteriorly. Female with seventh sternite elongate, approximately 3.4× length of sixth; eighth sternite with a broad, darkly pigmented band laterally, but not continuous ventrally.

Male Genitalia: (Figure 283). Genital capsule similar to that of *A. thorpella* in being elongate and narrowly triangular. Valva more irregular in outline than that of *thorpella* with sacculus more defined and constricted before cucullus. Anterior half of juxta more sagittate (deeply divided) than in *thorpella*.

Female Genitalia: (Figure 382). Apex of ovipositor subacute, more rounded than in *A. flammeusella* and similar to *A. thorpella*, smooth, asymmetrical, ventral edge longer and more oblique than dorsal and with a distinct ventral, barb-like projection. Vestibulum elongate, length approximately 3.0× that of depth, dorsal area slightly rugose.

TYPE. Holotype, ♂, 30 Apr 1967, Opler & Turner (UCB).

TYPE LOCALITY. Five miles southeast of Nicasio, Marin County, California.

HOST. Unknown. Adult moths have frequently been collected and observed on *Platystemon californicus* Benth., Papaveraceae, by Paul Opler and others.

FLIGHT PERIOD. Late March to late April, univoltine.

DISTRIBUTION. (Map 24). At present reported only from central coastal California within the general San Francisco Bay area from Marin County south to Santa Clara County.

MATERIAL EXAMINED. 6 males, 4 females. UNITED STATES: CALIFORNIA: Marin Co.: 5 mi. [8 km] SE Nicasio: 4 ♂, 2 ♀ 30 Apr 1967, Opler & Turner, slides USNM 2708 ♂, 18168 ♂ (USNM). Santa Clara Co.: 0.5 mi. [0.8 km] N New Almaden: 1 ♂, 1 ♀, 4 Apr 1965, P. Opler, slide USNM 16074 ♀ (USNM). 1 mi. [1.6 km] N New Almaden: 1 ♂, 1 ♀, 29 Mar 1965, P. Opler (USNM).

DISCUSSION. Although superficially resembling *Adela thorpella* in wing color, *A. oplerella* differs strikingly from the former in possessing shorter antennae and reduced eyes in the male, as well as being generally smaller in size. The smaller, unspecialized eyes in the males of *A. oplerella* may further suggest a possible courtship behavioral difference. According to Powell (1969), both species occur together on *Platystemon californicus* in central coastal California.

The shortened, reduced antennae (40–60 segments) are unique among Nearctic *Adela* [usually with more than 150 segments]. Despite these specializations, the generic association of *A. oplerella* within *Adela* rather than *Cauchas* is affirmed by the relatively larger compound eyes and more closely positioned antennal sockets in *A. oplerella* as typical for other *Adela*.

Adela ridingsella Clemens

FIGURES 10, 37, 38, 175, 285, 318, 383; MAP 25

Adela ridingsella Clemens, 1864: 426; 1872: 250.—Packard, 1869: 348.—Chambers, 1878b: 127.—Walsingham, 1880: 79; 1890: 285.—

Dyar, 1903: 575, no. 6558.—Busck, 1903: 217.—Meyrick, 1912a: 10; 1912b: 9.—Walsingham, 1915: 404 [in part].—Forbes, 1923: 77.—McDunnough, 1939: 110, no. 9839.—Heppner, 1974: 34.—Powell, 1969: 218.—Davis, 1983: 4, no. 228.—Poole, 1996: 626.

Adela ?ridingsella Clemens.—Weiss and West, 1925: 116.—Powell, 1969: 218.

Dicte corruscifasciella Chambers, 1873: 74.—Walsingham, 1880: 79 [synonym of *Adela ridingsella*]; 1890: 285.—Powell, 1969: 218.—Davis, 1983: 4, no. 228.

Adela (Dicte) corruscifasciella (Chambers), 1878b: 127.

Adela corruscifasciella (Chambers). Walsingham, 1880: 79 [synonym of *Adela ridingsella*]; ♀ 1890: 285.—Dyar, 1903: 575, no. 6558.—Meyrick, 1912a: 10; 1912b: 9.—Walsingham, 1915: 404.—McDunnough, 1939: 110, no. 9839.—Powell, 1969: 218.—Davis, 1983: 4, no. 228.

Adela corruscifasciella [sic] Walsingham, 1880: 79.—Powell, 1969: 218 (misspelling).—Davis, 1983: 4, no. 228.

Adela schlaegeri Zeller, 1873: 226.—Dyar, 1903: 575, no. 6558.—Meyrick, 1912a: 10; 1912b: 9.—Walsingham, 1915: 404.—McDunnough, 1939: 110, no. 9839.—Powell, 1969: 218.—Davis, 1983: 4, no. 228.

ADULT. (Figure 175). Wing expanse: ♂, 14.0–16.0 mm; ♀, 10.8–14.0 mm.

Head: (Figures 37, 38). Frons and vertex densely hairy, rough, fuscous intermixed with grayish white in male, whitish to pale ochreous in female. Antenna of male smoothly scaled, greatly elongated, ~2.5–3.0× length of forewing, 145–149-segmented; antennal sockets narrowly separated by about 1/3 their width; scape fuscous, heavily irrorated with silvery white; flagellum usually silvery white ventrally, fuscous, ringed with silvery white dorsally; dorsal sex spines present at base of segments 8 and 9; antenna of female shorter, ~1.2–1.5× length of forewing and 72–75-segmented; antennal sockets more widely separated than in male by a distance ~equal to their width; scape ochreous; flagellum similar to male in color and vestiture. Eyes sexually dimorphic, obovoid in male, greatly enlarged, vertical diameter ~0.8× interocular distance; eyes closer at vertex; female with interocular distance ~0.6× eye diameter; eye oval and reduced, vertical diameter ~0.65× interocular distance; eyes widely separated at vertex, distance ~equal distance across frons. Maxillary palpus light fuscous in male, pale ochreous in female, 3-segmented. Base of haustellum covered with whitish to ochreous scales. Labial palpus densely covered with a mixture of pale grayish to fuscous hairs in male, pale ochreous in female; second segment moderately elongate, ~2.5× length of apical segment in male, 1.4× in female.

Thorax: Dorsum uniformly fuscous in male, fuscous in female with tegulae ochreous. Venter pale fuscous to silvery gray in male, more whitish in female. Legs fuscous dorsally, tibia usually with a streak of silvery white ventrally; tibial spurs, most of hind femora and apices of tibiae and tarsal segments silvery white; epiphysis well developed, more than 1/3 length of foretibia. Forewing with basal 1/3 to 1/2 pale coppery brown in male, usually golden ochreous in female; apical 2/3 to 1/2 with a complex pattern of silvery white, black, and brownish markings as follows: a transverse, silvery white fascia near middle;

another much shorter band across apex, closely adjacent to a slightly longer subapical band; an oblique silvery white fascia extending from costa about halfway across wing to where it closely approaches the prominent median fascia; area between basal and apical fascia light brown, with a series of small black spots radiating out from discal cell and arranged in approximately parallel rows between radial and cubital veins; a series of 5–7 large black spots near tornus; apical half of forewing same color as basal half; fringe uniformly pale brownish ochreous. Hindwing uniformly gray; M1 and M2 stalked ~1/3 their length.

Abdomen: (Figure 318). Brownish to medium fuscous dorsally, slightly lustrous; usually paler ventrally, more grayish, and usually with 5 broad whitish bands traversing across sterna 3–7. Seventh sternite of female ~3× length of sixth; eighth sternite uniformly lightly pigmented.

Male Genitalia: (Figure 285). Uncus reduced, located ventrad to tegumen. Vinculum-saccus broad, elongate, ~2.0× length of valva; anterior end of saccus rounded. Valva subtriangular in outline; gradually narrowing to cucullus; ventral margin irregular; cucullus expanded slightly ventrally. Juxta elongate; anterior end sagittate and margin rounded; posterior half slender. Phallus elongate, slender, slightly sinuate; base abruptly expanded; a short, rounded, mid-dorsal ridge present near base.

Female Genitalia: (Figure 383). Apex of ovipositor compressed, acute, slightly asymmetrical, with ventral minutely serrate edge longer, more oblique than dorsal. Vestibulum reduced, with dorsal margin raised and bulbous immediately caudad to junction with spermatheca.

TYPE. Lectotype, ♂ (*Adela ridingsella*, present designation) (ANSP). Holotype, Sex ? (*Dicte corrufasciella*) (?MCZ). Holotype, ♂ (*Adela schlaegeri*) (BMNH).

TYPE LOCALITIES. Virginia (*Adela ridingsella*). Kentucky (*Dicte corrufasciella*). Ohio (*Adela schlaegeri*).

HOST. Unknown; possibly Vitaceae: “*Parthenocissus quinquefolia* (L.) Planch.” (Weiss and West, 1925); on cultivated bunch of grapes (Corrette, pers. comm.).

FLIGHT PERIOD. Usually late May to late July in North America north of Mexico.

DISTRIBUTION. (Map 25). As now recognized, this species is restricted to mostly eastern North America from north-eastern Canada over much of the eastern deciduous forests and along the Appalachian Mountains south to Tennessee and North Carolina. This species also occurs in Mississippi (Richard Brown, Mississippi State University, personal communication), from Warren Co. and Winston Co.; this material was not examined by the authors.

MATERIAL EXAMINED. 51 males, 37 females. CANADA: NOVA SCOTIA: Digby: 1 ♂, 13 Jun (CNC). South Milford: 1 ♀, 24 Jun, J. McDunnough (CNC). ONTARIO: Caradoc: 1 ♂, 20 Jun 1918, H. Hudson (CNC). Go Home Bay: 1 ♂, 27 Jun 1932, G. Whalley (CNC). Kearney: 1 ♀, 23 Jun 1926, F. Ide (CNC); 1 ♂, 1 ♀, 3–5 Jul 1909, W. Wild (CU). Leamington: 1 ♂, 11 Jun, L. Milne (CNC). Merivale: 1 ♂, 11 May 1933, G. Whalley (CNC). Orillia [Orilla]: 1 ♂, 7 Jun,

1 ♂, 29 Jun 1926, C. Curran (CNC). Ottawa: 2 ♀, 29 Jun–1 Aug 1905, C. Young (CNC). Severn: 1 ♂, 1 ♀, 16 Jun 1925, C. Curran (CNC). South March: 1 ♀, 5 Jun 1942, T. Freeman (CNC). Sparrow Lake: 1 ♂, 12 Jun 1916, A. Braun (ANSP). Toronto: 1 ♂, 1 ♀, 17 May–27 Jun 1897, W. Dietz (MCZ). Wau-bamic, Parry Sound: 1 ♂, 3–5 Jun, 14 Jun 1915, H. S. Parrish (CU). QUEBEC: Covey Hill: 1 ♂, 24 Jun 1924, G. Whalley (UCB). Knowlton: 2 ♀, 28 Jun 1929, J. McDunnough (CNC); 1 ♀, 10 Jul 1921, L. Milne (CNC); 1 ♀, 8 Jul 1929, L. Milne (USNM). Loc Mondor, Ste Flore: 1 ♂, 22 Jun 1951, E. Munroe (UCB). Meach Lake: 1 ♂, 1 ♀, 7 Jun 1903, C. Young, 1 ♂, 22 Jun 1906, C. Young (CNC). UNITED STATES: KANSAS: Specific locality unknown: 1 ♂, W. Dietz (MCZ). MAINE: Aroostook Co.: Ashland: 2 ♂, 9 July (USNM); Hardwood Mt., Ashland: 1 ♂, 14 Jul, A. E. Brower (USNM). Franklin Co.: Oguossoc (Rangeley): 1 ♂, 12 Jul (USNM). Kennebec Co.: Augusta: 2 ♂, 28 Jun 1953, 1 ♀, 12 Jul 1940, A. E. Brower (USNM). Penobscot Co.: Lincoln: 1 ♀, 13 Jul (FSCA); 2 ♂, 10 Jul; 1 ♀, 11 Jul, 1 ♀, 17 Jul (USNM). Piscataquis Co.: Mt. Katahdin, 4,600–5,267 ft. [1,402–1,616 m]: 1 ♂, 27 Jul 1956, A. E. Brower; Depot Camp, Mt. Katahdin, 1,100 ft. [30.5 m]: 1 ♀, 7 Jul 1957, A. E. Brower (USNM). MARYLAND: Montgomery Co.: Plummer’s Island: 1 ♂, Jun 1906, A. Busck (USNM). Prince Georges Co.: Beltsville: 1 ♀, 21 Jun 1910, W. McAtee (USNM). MASSACHUSETTS: Specific locality unknown: 1 ♀ (USNM). Berkshire County: Mt. Washington: 1 ♂, 29 Jun–1 Jul 1916 (USNM). Middlesex Co.: Framington: 1 ♂, 17 Jun 1904, slide USNM 20069 ♂ (USNM). NEW HAMPSHIRE: Grafton Co.: Bretton Woods, White Mts., 1,600 ft. [488 m]: 1 ♂, 8–15 Jul (USNM). Del Water Gap: 2 ♀ (AMNH). Franconia: 1 ♀ (AMNH). Rockingham Co.: Center Harbor: 1 ♀, slide USNM 20067 ♀ (AMNH). Hampton: 1 ♂, 4 Jun 1925, 1 ♂, 10 Jun 1906; 2 ♂, 21 Jun 1914, 1 ♂, 23 Jun 1934; 1 ♂, 3 Jul 1909, S. A. Shaw (USNM). NEW JERSEY: Essex Co.: Specific locality unknown: 1 ♂, 1956, R. May Jr. (AMNH). NEW YORK: Cattaraugus Co.: Rock City: 1 ♂, 2 ♀, 4–6 Jul 1915 (CU). Erie Co.: East Aurora: 1 ♂, 1912, W. Wild; 2 ♂, 3 Jul 1932, W. Wild (CU). Fulton Co.: Gloversville: 1 ♀, Alexander (CU). Greene Co.: Specific locality unknown, 2,500 ft. [762 m]: 1 ♀, 5 Jul 1899, L. Howard (USNM). Tompkins Co.: Ithaca: 2 ♀, 29 Jun 1885, J. Steadman (CU); 1 ♂, 31 Jun 1930 (USNM). Ithaca, Six Mile Creek: 1 ♂, 22 Jun 1937, P. Babi (CU). Slaterville Springs: 1 ♀, 6 Jul 1960, R. Hodges (USNM). Oneida Co.: Trenton Falls: 2 ♂, 6 Jun 1921, Leonard ♀ Forbes (CU). Union Co.: Marshville: 1 ♂, 13 May 1978, K. Corrette, on cultivated bunch grapes (NCSU). NORTH CAROLINA: Buncombe Co.: Black Mtn.: 2 ♀, 1 Jun–11 Jul 1907, W. Beutenmuller (USNM); 4 km SW Black Mtn.: 1 ♀, 21–27 Jun 1986, W. Steiner (USNM). Jackson Co.: Balsam: 1 ♂, 1 ♀ (USNM). OHIO: Specific locality unknown: 1 ♂ (holotype, *Adela schlaegeri*) (BMNH). PENNSYLVANIA: Beaver Co.: New Brighton: 1 ♂, 10 Jun 1906, H. Merrick (USNM). Washington Co.: Specific locality unknown: 1 ♀, Ehrmann (MCZ). TENNESSEE: Cocke Co.: Cosby Campground, Great Smoky Mts. National Park: 2 ♂, 1 ♀, 7 May 1973, at light, J. Heppner (FSCA, USNM). VIRGINIA: Fairfax Co.: Franconia, Dogue Creek: 1 ♀, 30 May 1981, Opler & Powell (UCB). Giles Co.: Head Sugar Run,

route 663, SW Pearisburg, 37°15.3'N, 80°51.3'W: 1 ♂, 8 June 2010, O. Flint (USNM). WEST VIRGINIA: Pocahontas Co.: Highland Scenic Highway: 1 ♂, 7 Jun 2010, J. Glaser, BOLD ID LNAUT1784-14, USNM ENT 00976344 (USNM).

DISCUSSION. *Adela ridingsella* possesses one of the most distinctive wing patterns among all of the New World Adelidae. It also differs from the eastern North American *Adela* in possessing three segmented maxillary palpi but shares with all eastern *Adela* the stalked condition of M1 and M2 in the hindwing. Previous authors considered as conspecific the predominantly eastern North American populations of *A. ridingsella* and the more geographically isolated Central American species proposed in the present study as *Adela austrina*. Other than the males usually being noticeably darker, the Central American specimens do not differ significantly in wing pattern from the eastern North American *A. ridingsella*, although the vinculum-saccus is noticeably larger and a basal mid-dorsal ridge on the phallus is absent in *A. austrina*.

As reviewed in the introduction of the current study, little is known about the biology of the New World Adelidae. The only published information questionably attributed to *A. ridingsella* mentions an adelid gall on Virginia creeper (*Parthenocissus quinquefolia* (L.) Planch.). Weiss and West (1925) reported finding swollen, twisted petiole galls on this plant in late May at two localities in New Jersey. In general, the galls were irregular, somewhat flattened, longitudinal swellings, which usually resulted in a distorted, curled growth of the petiole. Unfortunately, Weiss and West were unable to rear adults from these larvae, thus making specific identification uncertain. The larvae were sent to Carl Heinrich of the National Museum of Natural History who determined them as a species of *Adela*, possibly *A. ridingsella*. These specimens are still present in the collections of the Museum and were examined in this study. While they do represent larvae of *Adela*, it remains uncertain which of the eastern species of this genus they represent.

***Adela austrina* Davis and Medeiros, new species**

FIGURES 176, 177, 286, 319; MAP 25

Walsingham, 1915: 404 [in part, see Discussion below].

ADULT. (Figures 176, 177). Wing expanse: ♂, 13.0–15.5 mm; ♀, 12.2–12.6 mm.

Head: Frons and vertex densely hairy, rough, color varying from dark fuscous intermixed with fewer white hairs to mostly pale ochreous intermixed with fewer black and white hairs in male; whitish to pale ochreous in female, intermixed with a few black hairs. Antenna of male greatly elongated, ~2.2–2.5× length of forewing, 140–143-segmented; antennal sockets narrowly separated by about 1/3 their width; scape fuscous, often with a few small clusters of silvery white scales; flagellum

mostly black with silvery white scales forming a partial to mostly complete apical annulus on each flagellomere; dorsal sex spines present at base of segments 8 and 9; antenna of female shorter, ~1.3× length of forewing and ~74-segmented; antennal sockets more widely separated than in male by a distance ~equal to their width; scape pale ochreous; flagellum similar to male in color and vestiture. Eyes sexually dimorphic, obovoid in male, greatly enlarged, vertical diameter ~0.8× interocular distance; eyes closer at vertex, interocular distance ~0.6× eye diameter; eye oval and reduced in female, vertical diameter ~0.65× interocular distance; eyes widely separated at vertex, distance ~equal distance across frons. Maxillary palpus dark fuscous in male, pale ochreous in female, 3-segmented. Base of haustellum covered with fuscous to ochreous scales. Labial palpus densely covered with a mixture of pale whitish to fuscous hairs in male, pale ochreous in female; second segment moderately elongate, ~2.5× length of apical segment in male, 1.4× in female.

Thorax: Dorsum uniformly dark to medium fuscous in male, sometimes bordered with ochreous scales and with ochreous tegulae in paler males; dorsum and tegulae uniformly ochreous in female. Venter fuscous in male, ochreous in female. Legs fuscous dorsally, tibia sometimes with a streak of silvery white ventrally; tibial spurs, most of hind femora and apices of tibiae and tarsal segments silvery white; epiphysis well developed, more than 1/3 length of foretibia. Forewing with basal 1/3 to 1/2 fuscous to coppery brown in male, usually golden ochreous in female; apical 2/3 to 1/2 with a complex pattern of silvery white, black, and brownish markings similar to that of *A. ridingsella*, as follows: a transverse, silvery white fascia near middle; another much shorter band across apex, closely adjacent to a slightly longer subapical band; an oblique whitish fascia extending from costa about halfway across wing to where it approaches the prominent median fascia. Area between basal and apical fasciae dark to light brown, with a series of small black spots radiating out from discal cell and arranged in parallel rows between radial and cubital veins; a series of 5–7 variable black spots near tornus; fringe uniformly fuscous to dark brown in males, paler brownish ochreous in females. Hindwing uniformly dark to medium grayish fuscous.

Abdomen: (Figure 319). Dark fuscous dorsally, slightly paler, more grayish ventrally, but with whitish ventral bands either absent or greatly reduced compared to *A. ridingsella*. Seventh sternite of female ~3× length of sixth; eighth sternite uniformly lightly pigmented.

Male Genitalia: (Figure 286). Uncus reduced, located ventrad to tegumen. Vinculum-saccus elongate, ~2.0× length of valva, slightly narrower than in *A. ridingsella*; anterior end of saccus rounded. Valva similar in general outline to *A. ridingsella*; gradually narrowing to cucullus; ventral margin smoother than that of *A. ridingsella*; cucullus moderately expanded, with distal lobe more pronounced and acute than in *A. ridingsella*. Juxta elongate; anterior end sagittate; anterior margin rounded; posterior half more slender than in *A. ridingsella*. Phallus elongate, slender,

slightly sinuate; base abruptly expanded; basal mid-dorsal ridge not present.

Female Genitalia: As described and illustrated for *Adela ridingsella*.

HOLOTYPE. MEXICO: VERACRUZ: 6 air km SW Banderilla, 1,710 m: ♂, 17 Aug 1987, Brown and Powell, black-light. Digital image captured. Genitalia slide 4648 (UCB).

PARATYPES. 8 males, 9 females. COSTA RICA: GUANACASTE PROVINCE: Estación Maritza, lado oeste [west side] del Volcán Orosi, 600 m: 1 ♂, Jul 1998, L-N-326900, 373000, genitalia slide USNM 34608; 1 ♂, 14 Jul 1988, M. Scoble, digital image captured, genitalia slide USNM 34609 (USNM); Estación Maritza, SW side Volcán Cacao, 1,100 m: 1 ♀, 7 Mar 1988, Janzen & Hallwachs, BOLD ID LNAUT1787-14, USNM ENT 00976347 (USNM). LIMON PROVINCE: Sector Cerro Concori, Finca De E. Rojas, 150 m: 1 ♀, Dec 1991, L-N-286000, 567500, genitalia slide USNM 34662 (USNM). SAN JOSE: EL SAVAJE, Río Tabarsia, 8 km (road) E Palmichai, 1,650 m, 9.847 N, 84.164 W, 19–20 Jan 1992, Holzenthal, Kjer, Quesada, BOLD ID LNAUT1799-14, USNM ENT 00976359 (USNM). GUA-TEMALA: ALTA VERA PAZ: Chiacam: 1 ♀, Jan–Mar 1880, Chapman (BMNH). PETEN: Poptún: 1 ♀, 15–16 Sep 1973, V. O. Becker (USNM). MEXICO: NUEVO LEÓN: Chipinque Mesa, 4,300 ft. [1,310 m]: 1 ♀, 19 Sep 1975, Powell ♀ Chemsak, at light (UCB). TAMAULIPAS: Gomez Farias, 1,000 m: 1 ♂, 29–31 Jul 1988, V. O. Becker & M. A. Solis, Col Becker 69834 (USNM). VERACRUZ: 6 air km SW Banderilla, 1,710 m: 1 ♂, 17 Aug 1987, Brown & Powell, BOLD ID LNAUT1785-14, USNM ENT 00976345. VERACRUZ: Cordoba: 1 ♂, Dec, F. Knab, genitalia slide USNM 16088 (USNM); 6 rd. km N Banderilla, 1,710 m: 1 ♂, 20 Aug 1987, J. Brown and J. Powell, BOLD ID LNAUS698-12, USNM ENT 008002731; 1 ♀, same locality and date, slide USNM 34748 (UCB, USNM); San Andreas, 6 km NW Jalapa: 1 ♀, 20 Aug 1987, J. Brown and J. Powell, digital image captured, BOLD USNM ENT 00718726, DDAV A186 (UCB); 1 ♂, 20 Aug 1987, J. Brown and J. Powell, BOLD USNM ENT 00718725, genitalia slide USNM 39740 (USNM). TAMAULIPAS: Gomez Farias, 1,000 m: 1 ♂, V. O. Becker 69834 (USNM). NICA-RAGUA: MATAGALPA: ± 12 km N. Matagalpa, Selva Negra Ecological, GPS: N 13.00036°, W 085.90923°, 1,300 m elev., 1 ♀, 13–17 Jun 2017, B. Landry & F. L. Landry, lepi-led lamp + mercury vapor lamp (MHNG). UNITED STATES: ARIZONA: Cochise Co.: Garden Canyon, 31°27'19", –110°22'24", 6,200 ft. [1,890.2 m]: 1 ♀, 8 Sep 2012, Julian H. Cowles, nectaring at *Stevia serrata*, BOLD Processing ID LNAUV2471-17 (USNM).

HOST. Unknown. Adults have been observed nectaring on Asteraceae: *Stevia serrata* Cav. in Garden Canyon, Cochise County, Arizona, by Julian H. Cowles.

FLIGHT PERIOD. Adults have been collected in July and December in Costa Rica, January to March and September in Guatemala, June in Nicaragua, and August to December in Mexico. They are probably univoltine at a particular locality.

DISTRIBUTION. (Map 25). This species has been found to occur from southern Arizona and the state of Nuevo León in northern Mexico south to Limón province in southern Costa Rica.

ETYMOLOGY. The species name is derived from the Latin *austrinus* (southern) in reference to the more southern distribution of this species compared to its more eastern North American sister species, *Adela ridingsella*.

DISCUSSION. As discussed under the foregoing species, *A. ridingsella*, previous authors considered the two species conspecific despite their disjunct distributions. Morphologically, the wing patterns and genitalia of the two species are very similar. It is uncertain as to how significant the minor differences in the male genitalia (e.g., slightly longer vinculum-saccus in *A. austrina*) would be if more males of *A. austrina* were available for examination. However, in addition to their geographical separation, the scale color of the forewing bases of the males of *A. austrina* are typically much darker than in *ridingsella*, with some variation noted in a few paler males from Costa Rica.

Adela astrella Walsingham

FIGURES 1, 39–40, 178–187, 287, 320, 384; MAP 26

Adela astrella Walsingham 1915: 403.—Meyrick, 1912a: 10; 1912b: 9.—Davis, 1984: 18.

Adela lithopola Walsingham, 1915: 403 [new synonym].—Meyrick, 1912b: 9.—Davis, 1984: 18.

ADULT. (Figures 1, 178–187). Wing expanse: ♂, 10.5–14 mm; ♀, 11–13.5 mm.

Head: (Figures 39–40). Vertex of male sparsely covered with a mixture of black and whitish brown, piliform scales, becoming more whitish brown between antenna bases and with long black, piliform scales beneath scape and immediately above frons. Vertex of female almost entirely covered with sparse, pale whitish-brown, piliform scales, continuing down between antennal bases, and with long black, piliform scales beneath scape and immediately above frons. Frons of both sexes completely covered with appressed, shiny, silvery broad scales. Antenna of male elongate, approximately 2.7–3.1× length of forewing, with ~130–135 segments; antenna nearly contiguous at base; scape and pedicel black with purplish luster, with basal 8–9 flagellomeres shiny black, more thickly scaled, becoming biannulate with rings of white scales on flagellomere ~9 to apex; white scaling more prominent ventrally; 2 specialized peg spines present on flagellomeres 9 and 10. Eyes dimorphic, greatly enlarged in male. Female with antenna relatively stouter and ~1.3–1.8× length of forewing, ~70–75-segmented; bases of antennae more widely separated a distance of ~1.5× diameter of antennal socket; scape and basal 1/5–1/4 of antenna uniformly dark fuscous with dense, rough scaling; distal 3/5 mostly biannulate, dark fuscous,

banded with silvery white apically, becoming more fuscous near apex. Eyes ~round, smaller than male in diameter. Basal 1/4 to 1/3 third of haustellum fuscous covered with appressed, silvery scales in both sexes. Labial palpus black, densely covered with long black hairs in both sexes.

Thorax: Dorsum and venter dark fuscous to black with coppery iridescence. Legs shiny dark fuscous to black except for white ventral scaling of foreleg and faint white apices of tibial and tarsal segments of mid and hindlegs. Forewing mostly dark fuscous with strong coppery luster; apical third of forewing with highly variable pattern of black and silvery spots and bands; a narrow, distinct, black band traversing wing slightly beyond middle of forewing; inner margin of band usually edged with a less distinct band of light brownish scales and outer margin edged with silvery scales; a similar, more variable and sometimes interrupted double band extending nearly parallel and slightly distad to basal band; a third, much shorter and usually incomplete subapical band extending from costal margin usually halfway to hind margin. Scale pattern in and around apex of forewing highly variable, consisting of mostly 3–8 silvery spots bordered with black scales (Figures 178–187); apical fringe brownish. M1 and M2 usually separate, sometimes connate. Hindwing uniformly dark fuscous.

Abdomen: (Figure 320). Uniformly shiny dark fuscous to black.

Male Genitalia: (Figure 287). Uncus reduced, with minutely bilobed apex, positioned largely ventrad to tegumen. Vinculum-saccus narrowly U-shaped, elongate, ~2.3× length of valva. Valva with ventral margin smoothly curved, without any indentation. Juxta elongate, very slender with anterior fifth sagittate. Phallus slender, base abruptly flared; cornuti absent.

Female Genitalia: (Figure 384). Apex of ovipositor compressed, acute, slightly asymmetrical, with minutely serrated ventral edge longer, more oblique than dorsal edge. Vestibulum reduced, with bilobed dorsal margin immediately caudad to junction with spermatheca. Ductus bursae gradually enlarging to corpus bursae.

TYPES. Holotype, ♂ (*Adela astrella* Wlsm.) (BMNH). Holotype, ♀ (*Adela lithopola* Wlsm.) (BMNH).

TYPE LOCALITIES. MEXICO: GUERRERO: Amula, 6,000 ft. [1,829 m] (*Adela astrella* Wlsm.). VERACRUZ: Jalapa, 4,500 ft. [1,372 m] (*Adela lithopola* Wlsm.).

HOST. Unknown.

FLIGHT PERIOD. Possibly bivoltine, where it is known to fly from June to September in the United States and northern Mexico. Further south in Guatemala, adults have been collected as early as March.

DISTRIBUTION. (Map 26). *Adela astrella* has been collected frequently through most of Mexico and ranges from the southern border of the United States (Cochise County, Arizona, and Brewster County, Texas) south to Alta Vera Paz, Guatemala.

MATERIAL EXAMINED. EL SALVADOR: SANTA ANA: 82 males and 35 females. Montecristo, C. Miramundo,

Metapan, 2,300 m, Cloud Forest: 1 ♂, 12 Dec 1971, G306, S. and L. Steinhauser (FSCA). GUATEMALA: ALTA VERA PAZ: Cublitz, 1,050 ft. [320 m]: 1 ♂, Mar 1880, Chapin (BMNH). EL PETÉN: Ixpanpajul National Park (Res.) (Mirador), 320 m: 1 ♀, 16–21 Jun 2013, J. B. Heppner and E. Fuller, DNA 2014, photo 11541 (FSCA); Santa Ana, 80 m: 1 ♂, 28 May–2 Jun, 2017, J. B. Heppner and E. Fuller, photo 13743 (FSCA). SOLOLA: Suchitepequez: Finca Tarrales: Volcan Atitlan: 1 ♀, 6 Jun 2013, J. B. Heppner and E. Fuller, DNA 2014, photo 11539 (USNM). MEXICO: CHIAPAS: Santo Domingo, 15 mi. [24 km] SE Simojovel: 10 ♂, 13 Jul 1958, photo, slides USNM 16039 ♂, 34643 ♂, 1 ♀, 10 Jul 1958, slide 16062 ♀, J. A. Chemsak (UCB, USNM). COAHUILA DE ZARAGOZA: 1 mi. [0.6 km] S El Tunal, 2,300 m: 1 ♂, 10 Aug 1977, DDAV A167, BOLD 00718707, E. I. Schlinger (UCB). COLIMA: Colima: 1 ♂, USNM 20062 ♂, Conradt, photo (USNM). DISTRITO FEDERAL: Mexico City: 2 ♂, 1 ♀, Sep 1919, 5518, USNM 16035 ♂, R. Muller (USNM). DURANGO: Las Rusias, 12 mi. [19.2 km] E la Ciudad Durango, 9,200 FT. [2,084.9 m]: 1 ♂, 14–18 Aug 1972, F. Powell, digital image captured (USNM). GUERRERO: Amula, 6,000 ft. [1,829 m]: 1 ♂ (holotype, *Adela astrella* Wlsm.), Jul 1918 (BMNH). 10 km E Tixtla, 1,770 m: 1 ♂, 18/22 Sep 1982, J. A. Powell, J. A. Chemsak, DDAV-A162, BOLD 00718702 (UCB). HIDALGO: 4 ♂, slide USNM 16036 ♂, Van Ostrand (UCB, USNM). 14 mi. [22.4 km] S Jacala, 6,800 ft. [2,073 m]: 3 ♂, 3 ♀, 28 Sep 1975, digital image captured, DDAV A157, BOLD 00718697; DDAV A164, BOLD 00718704, BOLD ID LNAUS690-12, USNM slides 34666 ♂, 34745 ♂, 34751 ♂, 34753 ♂, BOLD ID LINAUS690-12, J. Powell, J. Chemsak (UCB, USNM). Real del Monte: 1 ♂. JALISCO: Ajijic: 1 ♂, 16–18 Jul 1966, slide USNM 20051 ♂, Flint and Ortiz (USNM). MICHOACAN: 9 mi. [14.4 km] W Morella, 6,800 ft. [2,073 m]: 2 ♂, 2 ♀, 9 Oct 1975, DDAV A154, BOLD 00718694; BOLD ID LNAUS695-12, USNM slide 34750, BOLD ID LNAUS695-12, J. Powell, J. Chemsak, color illustration, photo on file; 10 mi. [16 km] E Morella, 6,800 ft. [2,073 m]: 1 ♂, 9 Oct 1975, J. Powell, J. Chemsak, BOLD ID LNAUU4553-15 (UCB, USNM). 12 mi. [19.2 km] W Ciudad Hidalgo, 7,000 ft. [2,134 m]: 1 ♂, BOLD ID LNAUS689-12, J. Powell, J. Chemsak (UCB). 7 mi. [11.2 km] E Michoacan: Zacapu: 1 ♂, USNM slide 18282 ♂ (USNM). NUEVO LEÓN: Chipinque: Mesa, 4,300 ft. [1,311 m]: 1 ♂, 2 ♀, DDAV A163, BOLD 00718703, 20 Sep 1975, BOLD ID LINAUS688-12 (UCB). 3 mi. [4.8 km] E Galeana Jct, 6,000 ft. [1,829 m]: 2 ♂, 15 Sep 1976, DDAV A155, BOLD 00718695; DDAV A165, BOLD 00718705 (UCB). 18 mi. [28.8 km] W Linares, 2,700 ft. [823 m]: 2 ♀, 24–26 Sep 1975, J. Powell, J. Chemsak, BOLD ID LNAUU4551-15, LNAUS687-12 (UCB). 2 mi. [3.2 km] W Iturbide, 5,200 ft. [1,585.4 m]: 2 ♂, 21–22 Sep 1975, digital image captured (UCB, USNM). 4 mi. [6.4 km] W Iturbide, 5,500 ft. [1,676.8 m]: 2 ♀, 24 Sep 1975, 34666, J. Powell, J. Chemsak, photo on file (UCB, USNM); 4 mi. [6.4 km] W Iturbide, 5,500 ft. [1,676.8 m]: 1 ♂, 25 Sep 1975, at light, USNM slide 34430 ♂, J. Powell, J. Chemsak, T. Friedlander (UCB). 9 [14.4 km] mi. W Morelia, 6,800 ft. [2,073 m]:

2 ♀, 9 Oct 1975, J. Powell, J. Chemsak, BOLD 00718694, BOLD ID AUS695-12(UCB). 40 mi. [64 km] S San Roberto, 6,000 ft. [1,829 m]; 1 ♂, 22 Sep 1976, J. A. Powell, J. A. Chemsak, BOLD ID LNAUS692-12 (UCB). 5 mi. [8 km] W Dr. Arroyo, 6,200 ft. [1,890 m]; 2 ♂, 2 ♀, 22 Sep 1976, BOLD ID LNAUS694-12, DRD slide 4341 ♂, J. A. Powell, J. A. Chemsak (UCB, USNM). OAXACA: El Tejocote, 31 mi. [49.6 km] N Oaxaca, 7,300 ft. [2,225.6 m]; 2 ♂, 1 ♀, 7 Oct 1975, USNM slide 34431 ♂, DDAV A156, USNM slide 34744 ♂, J. Powell, J. Chemsak, T. Friedlander, BOLD 00718696 (UCB, USNM). 125 km S Tuxtepec: 1 ♂, 21 Aug 1984, D. M. Wood, specimen ID CNC 00137031, slide 4690 (CNC). PUEBLA: 4.4 mi. [7.04 km] SW Acatepec: 1 ♂, 9 Jul 1981, Bogar, Schaffner, Friedlander (USNM). 7.5 km NE Azumbilla, 2,200 m: 2 ♂, 2 ♀, 22 Aug 1987, USNM slide 34746 ♂, BOLD ID LNAUS679-12; BOLD ID LNAUS680-12, J. Brown and J. Powell (UCB, USNM). SINALOA: 8 mi. [12.8 km] W El Palmito, 6,000 ft. [1,829 m]; 2 ♂, 12 Oct 1975, DDAV A158, BOLD 00718698, USNM slide 34432 ♂, J. Powell; 5 mi. [8 km] W El Palmito, 6,000 ft. [1,829 m]; 2 ♂, 1 ♀, 13 Oct 1975, DDAV A166, BOLD 00718706; DDAV A178, BOLD ID LNAUS693-12, J. Powell, J. Chemsak, T. Friedlander, color illustration (UCB, USNM). VERACRUZ: Jalapa, 4,500 ft. [1,372 m]; 1 ♀ (holotype, *Adela lithopa* Wlsm.) (BMNH). Lake Catemaco: 1 ♂, 17 Jun 1969, B. V. Peterson (CNC). San Andres, 6 km NW Jalapa: 2 ♀, 20 Aug 1987, bl, J. W. Brown, J. A. Powell (UCB). UNITED STATES: ARIZONA: Cochise Co.: Huachuca Mts.: 5 ♂, 9 Jun 1949, Lindsay and Kaiser, 49-15428, USNM slide 20052 ♂ (JFGC 9640 ♂) (USNM); 1 ♀, 9 Sep 2010, Jillian Cowles; 8,000 ft. [2,439 m]; 5 ♂, 2 ♀, 4 Sep 2011, Jillian Cowles, BOLD ID LNAUU4548-15, USNM slides 34427 ♂, 34428 ♀, digital image captured, pine zone, on flowers *Stevia serrata*; Garden Canyon, 6,200 ft. [1,890 m], 31°27'19"–110°22'24": 1 ♂, 8 Sep 2012, Jillian Cowles, BOLD ID LNAUU4549-15, nectaring on *Stevia serrata*; 6,200 ft. [1,890 m]; 8 ♂, 6 ♀, 8 Sep 2012, USNM slide 34535 ♂, 34752 ♂, Jillian Cowles (USNM). TEXAS: Brewster Co.: Chisos Mts. Big Bend National Park, Old Mine Trail: 2 ♂, 10 Aug 1975, on yellow composite, T. Friedlander (USNM).

DISCUSSION. *Adela astrella* has been the most commonly collected species of the genus in Central America. The distal forewing pattern of the species is highly variable, consisting of a series of variably developed fasciae and spots on a predominantly reddish-brown background (Figures 182–187). Because the forewing pattern of another Mexican species, *Adela lithopola*, appears to be one expression of this variation, we here synonymize *A. lithopola* under *A. astrella*. *Adela lithopola* is represented only by the unique female holotype, now in poor condition with most of the antennae and right forewing missing.

Adela astrella appears most closely related to another predominantly Mexican species, *Adela striata*. The two species are easily distinguished by the color and patterns of their forewings, with the wings of *A. astrella* lacking the longitudinal, distal striations characterizing *A. striata*.

Adela striata Davis and Medeiros, new species

FIGURES 188, 189, 288, 321, 385; MAP 26

ADULT. (Figures 188, 189). Wing expanse: ♂, 11.5–14.4 mm; ♀, 11.0–14.2 mm.

Head: Mostly black with small frontal tuft of pale brownish hairs between and below antennal bases in male; dorsal area predominately with pale brownish hairs in female. Frons with smooth, appressed, highly lustrous, golden silvery scales in both sexes. Antenna of male elongate, approximately 2.7–3.1× length of forewing, with ~130–135 segments; antenna nearly contiguous at base; scape and pedicel black with purplish luster, with basal 8–9 flagellomeres shiny black, becoming biannulate with rings of white scales beyond antennal spines on flagellomere 10 to apex; 3–4 specialized sex spines present on flagellomeres 9 and 10. Eyes dimorphic, greatly enlarged in male. Female with antenna relatively stouter and ~1.3× length of forewing, ~70–75-segmented; bases of antennae more widely separated a distance of ~1.5× diameter of antennal socket; scape and basal 2/5 of antenna uniformly dark fuscous with dense, rough scaling; distal 3/5 mostly biannulate, dark fuscous banded with silvery white, becoming more fuscous near apex. Eyes ~round, smaller than male in diameter. Basal 1/4 to 1/3 of haustellum covered with appressed silvery scales in both sexes. Labial palpus black, densely covered with long black hairs in both sexes.

Thorax: Dorsum and venter dark fuscous to black with coppery iridescence. Legs shiny dark fuscous to black except for white ventral scaling of foreleg and white ventral scaling on tibiae and white rings at apices of tibial and tarsal segments of mid- and hindlegs. Forewing mostly dark fuscous with strong coppery luster; a narrow, distinct, black band traversing wing slightly beyond middle of forewing; inner margin of band often edged with a less distinct band of light brownish scales; a similar, much shorter double band extending from subapical costal margin across 1/3 of wing; scale pattern around apex of forewing highly variable, consisting of mostly 5–6 short, longitudinal, pale brownish bands, bordered with black scales, forming a striated pattern mostly along the radial and medial wing veins from the discal region of the forewing to the apical margin (Figures 188–189); apical fringe brownish. Hindwing uniformly dark fuscous.

Abdomen: (Figure 321). Uniformly shiny dark fuscous to black above, with slightly more silvery to golden luster ventrally.

Male Genitalia: (Figure 288). Uncus reduced, with usually truncate apex, positioned largely ventrad to tegumen. Vinculum-saccus narrowly U-shaped, elongate, ~2.3× length of valva. Valva broad at base, with ventral margin smooth and slightly rounded to base of cucullus, then constricted ventrally, with cucullus set off and more broadly rounded. Juxta elongate, very slender with anterior third sagittate. Phallus slender, base moderately flared; cornuti absent.

Female Genitalia: (Figure 385). Apex of ovipositor compressed, acute, slightly asymmetrical, with minutely serrate ventral edge longer, more oblique than dorsal edge. Vestibulum reduced, with bilobed dorsal margin immediately caudad to junction with spermatheca. Ductus bursae gradually enlarging to corpus bursae.

HOLOTYPE. ♂. MEXICO: DURANGO: Las Rusias, 9,200 ft. [2,084.9 m], 12 mi. [19.2 km] E La Ciudad. 14–18 Aug 1972, J. Powell (UCB).

PARATYPES. 61 males, 7 females. MEXICO: DURANGO: 3–4 mi. [4.8–6.4 km] S El Salto, 8,000 ft. [2,439 m]: 4 ♂, 1 ♀, 11 Aug 1986, ♂ slide USNM 4531, DDAV-A153, DDAV-A168 (UCB, USNM); 9 mi. [14.4 km] W El Salto, 8,700 ft. [2,652.4 m]: 1 ♂, 1 ♀, 12 Aug 1986, Brown & Powell, ♀ slide USNM 34699, DNA voucher CCDB 19582-CO7, BOLD LNAUS696-12 (USNM); 8 mi. [12.8 km] W La Ciudad, 8,700 ft. [2,652.4 m]: 7 ♂, 17 Aug 1972, MacNeill & Powell, ♂ slide USNM 18277, wing slide USNM 18285, DNA voucher CCDB 29003-G10, BOLD LNAUU4547-15 (UCB, USNM); Las Rusias, 9,200 ft. [2,084.9 m], 12 mi. [19.2 km] E La Ciudad: 1 ♀, 14–18 Aug 1972, J. Powell, ♀ slide USNM 3017 (USNM). GUERRERO: 19 km E Tixtla, 1,770 m: 1 ♂, 18–22 Sep 1982, J. A. Powell and J. A. Chemsak, DNA voucher CCDB 29003-HO3, BOLD LNAUU4552-15 (UCB). HIDALGO: 3 mi. [4.8 km] E. Zimapán, 6,200 ft. [1,890 m]: 1 ♀, 28 Sep 1975, J. Powell, BOLD ID LNAUS683-12 (UCB). ATLACOMULCO: 8,550 ft. [2,606.7 m]: 1 ♂, 30 Aug 1963, Scullen & Bolinger, slide USNM 16089 (USNM). MICHOACÁN: 7 mi. [11.2 km] SE Zacapu: 11 ♂, 9 Sep 1972, ex Umbelliferae, E. A. Kane, B. Villegas, ♂ slide USNM 18279, wing slide USNM 18286, slide USNM 18283, ♀ slide USNM 18278, DNA voucher CCDB 29003-HO1, BOLD LNAUU4550-15 (UCB, USNM). SINALOA: 49 mi. E Jct. Hwy 15 & 40 on Hwy 40, 6,000': 1 ♀, 27 Aug 1964, D. C. & K. A. Rentz and J. A. Grant (CASC); 1 ♂, 1 mi. [0.63 km] W. El Palmito, Hwy. #40, 402, 1,930 m: 13 Sep 1972, E. Schlinger, BOLD ID 00718719 (UCB); 8 mi. [12.8 km] W. El Palmito, 6,400 ft. [1,951.2 m]: 13 ♂, 1 ♀, 8–12 Aug 1972, bl. & white lights, J. Powell, D. Viers & C. D. MacNeill, ♀ slide 34736, BOLD NGSFT2453-16, NGSFT2454-16 (USNM); 5 mi. [8 km] W El Palmito, 6,400 ft. [1,951.2 m]: 5 ♂, 13 Aug 1972, D. Viers, J. Powell, & C. D. MacNeill, slide USNM 34687, BOLD NGSFT2455-16 (UCB, USNM). 11 mi. [17.6 km] E Revolcadero, 7,800 ft. [2,378 m]: 7 ♂, 1 ♀, 10–11 Aug 1972, J. Powell, 9 ♂, 16 Aug 1972, DNA voucher CCDB 29003-GO9, BOLD LNAUS4546-15 (UCB, USNM). ZACATECAS: 13 mi. [20.8 km] SW Concepción del Oro: 1 ♂, 9 Jul 1983, Kovarik, Harrison, Schaffner (USNM).

HOST. Unknown.

FLIGHT PERIOD. Early August to early September; univoltine.

DISTRIBUTION. (Map 26). This species has been collected from the states of Durango, Sinaloa, and Zacatecas in northwestern Mexico and Michoacán, Mexico, Hidalgo, and Guerrero in south-central Mexico.

ETYMOLOGY. The species name is derived from the Latin *stria* (line, furrow), in reference to the slender, pale

brownish striations of scales extending from the discal cell to the apical margin of the forewing in this species.

DISCUSSION. *Adela striata* appears most closely related to another predominantly Mexican species, *Adela astrella*. The two species are easily distinguished by the color and patterns of their forewings, with the wings of *striata* usually being darker with a more reddish to coppery luster compared to the more brownish forewing ground color of *astrella*. More significantly, the subapical forewing pattern of *astrella* lacks the longitudinal, pale brownish striations characteristic of *A. striata*. The male genitalia of *striata* differs from that of *astrella* in possessing valvae with more incised ventral margins (Figure 288c).

Adela boliviella Kozlov

FIGURES 190, 191, 289; MAP 27

Adela boliviella Kozlov, 2013: 42 (4): 1.

ADULT. (Figures 190, 191). Wing expanse: ♂, 14.8 mm; ♀, unknown.

Head: Vertex with mixture of dark fuscous and pale yellow, piliform scales; frons smooth, iridescent bronze. Antenna of male greatly elongated, >2.9× (with broken tip) length of forewing; scape dark coppery brown; basal 10–12 flagellomeres densely covered dorsolaterally with slightly raised, broad, dark bronzy fuscous scales; beyond these scales, flagellum more slender and generally dark brown basally and lighter brown apically; dorsal peg spines present on segments ~9–10 near apex of densely scaled region of flagellum. Eye enlarged; interocular index ~1.5. Haustellum brown, base thickened by bronze scales. Labial palpus 0.3× vertical eye diameter in length, fuscous, with sparse brown piliform scales.

Thorax: Dorsum brownish fuscous, slightly lustrous. Venter paler, brown (but badly rubbed in holotype). Legs poorly preserved in holotype, generally brown with faint, whitish annuli at apices of tarsomeres. Forewing light bronzy brown with subapical area between darker fascia pale yellowish orange; a single, fuscous fascia traversing distal third of wing and 2, shorter, sinuate fascia traversing near apex of wing; each fascia slender, dark fuscous with a broader, yellowish orange inner border and a more slender, grayish white outer border; a much shorter fascia barely distinct at wing apex and with a pair of smaller subapical spots on costa and termen. Hindwing coppery brown; fringe brown.

Abdomen: Dark brown.

Male genitalia: (Figure 289). Uncus minutely trilobed. Vinculum-saccus elongate, nearly 2.4× length of valva; saccus V-shaped; anterior margin narrowly rounded; posterior margin slightly sinuate. Valva roughly triangular; apex broadly rounded; ventral margin slightly sinuate, with a few, small dentate protuberances. Juxta ~0.4× length of phallus, anteriorly roughly sagittate in outline with broader, minutely bilobed anterior margin. Phallus very slender, ~equal to length of vinculum-saccus; apex of phallus with a slender acute spinelike projection; base broadly triangular.

Female Genitalia: Unknown.

TYPE. Holotype, ♂ (ZMB).

TYPE LOCALITY. BOLIVIA: Mizque [Torochito].

HOST. Unknown.

FLIGHT PERIOD. Unknown.

DISTRIBUTION. (Map 27). Known only from the type locality in central Bolivia.

MATERIAL EXAMINED: 1 male (holotype). BOLIVIA: Mizque [Torochito], slide 4610 (ZMB).

DISCUSSION. The recently described *Adela boliviella* is the only member of the predominantly Holarctic genus *Adela* currently known from South America. All other New World *Adela* are known to occur no further south than Costa Rica (*A. austrina* and *A. stenoptera* are the only two species currently known from Costa Rica). Because most species of *Adela* are diurnal and seldom collected at light, greater efforts to collect this genus during the day will be needed in order to assess their diversity and distribution in the neotropics. Adults of *Adela boliviella* are most similar to *A. astrella* in wing pattern.

Adela powelli Davis and Medeiros, new species

FIGURES 174, 284; MAP 27

ADULT. (Figure 174). Wing expanse: ♂, 12 mm; ♀, unknown.

Head: Vertex mostly covered with scattered, black, piliform scales with a patch of pale brownish, piliform scales from the middle of the vertex extending forward between antennal bases down to frons. Frons smooth, silvery in color. A small cluster of black hair tufts arising immediately below scape near upper margin of frons. Antenna of male elongate, approximately 1.3× length of forewing, with ~111 segments; antennae nearly contiguous at base; scape and basal 10–12 flagellomeres black with coppery luster, becoming biannulate with rings of white scales beyond antennal spines on flagellomere 12 to apex; 2 specialized sex spines present on flagellomeres 10 and 11. Eyes greatly enlarged in male. Labial palpus lustrous black, with a basal tuft of 5–7 long black hairs.

Thorax: Dorsum and venter dark brown with strong silver to coppery iridescence. Legs shiny dark fuscous to black, with apices of all tarsomeres narrowly ringed with white. Forewing and fringes uniformly dark reddish brown with coppery luster. Hindwing and fringes uniformly dark fuscous.

Abdomen: Uniformly shiny dark fuscous to black above, with slightly more silvery to coppery luster ventrally.

Male Genitalia: (Figure 284). Uncus greatly reduced, with mostly curved apex, positioned ventrad to tegumen. Vinculum-saccus narrowly U-shaped, elongate, ~2.6× length of valva. Valva broad at base, with a small lobe arising from ventral margin of sacculus, then with ventral margin straight and strongly tapering to truncate and abruptly broadened cucullus. Juxta elongate, slender with anterior third broadly sagittate. Phallus slender, base moderately flared; apical fourth with a concentration of numerous (over ~30), minute cornuti.

TYPE. Holotype, ♂ (UCB).

TYPE LOCALITY. MEXICO: GUERRERO, 32 km W Iguala, 1,350 m.

HOST. Unknown.

FLIGHT PERIOD. September; probably univoltine.

DISTRIBUTION. (Map 27). Known only from the type locality in northern Guerrero, Mexico.

ETYMOLOGY. The species name is proposed in honor of Dr. Jerry A. Powell, University of California, Berkeley, California, who has collected and studied the family Adelidae extensively.

MATERIAL EXAMINED. MEXICO: GUERRERO, 32 km W Iguala, 1,350 m: 1 ♂ (holotype), 11 Sep 1982, J. A. Powell, J. A. Chemsak, slide 4649, digital image captured, BOLD ID LNAUS 691-12 (UCB).

DISCUSSION. *Adela powelli* is unique among all known Central American *Adela* in possessing uniformly reddish-brown forewings that lack conspicuous fasciae or distal spots. The male genitalia are diagnostic in possessing valvae with a broad, truncate apex that bends abruptly ventrad when viewed laterally (Figure 284c).

Cauchas Zeller

Cauchas Zeller, 1839: 186 [as a subgenus of *Adela*] [type species: *Tinea fibulella* ([Denis and Schiffermüller], 1775: 143), subsequent designation by Fletcher, 1929: 42].—Küppers, 1980: 20 [synonym of *Adela* Latreille].—Nielsen and Johansson, 1980: 145.—Nielsen, 1980: 162.—Davis *in* Stehr, 1987: 358.—Nye and Fletcher, 1991: 58.—Kozlov, 1993: 113.—Poole, 1996: 626.

Cyanauges Braun, 1919: 24, Preoccupied, *nec* Gorham and Lewis, 1874: 54 [type species: *Incurvaria cyanella* Busck, original designation].—Braun, 1921: 20 [synonym of *Chalceopla*].—Forbes, 1923: 76 [synonym of *Chalceopla*].—Powell, 1969: 231.—Nielsen, 1980: 162.—Davis, 1983: 4.—Nye and Fletcher, 1991: 85.—Poole, 1996: 626.

Chalceopla Braun, 1921: 20 [type species: *Incurvaria cyanella* Busck, original designation (for *Cyanauges*)]. Forbes, 1923: 76.—Powell, 1969: 231.—Nielsen, 1980: 162 [synonym of *Cauchas*].—Davis, 1983: 4.—Nye and Fletcher, 1991: 61.—Poole, 1996: 626.

ADULT. Small moths with wing expanse ~♂, 7.0–12.0 mm; ♀, 7.5–11.5 mm.

Head: (Figure 41). Vertex and frons densely to sparsely covered with erect, piliform scales. Eyes not dimorphic, instead spherical in both sexes; interocular index 0.4–0.6. Antenna equally long in both sexes, varying from ~0.5× to 1.5× the length of forewing, with ~30–60 segments; male flagellomeres without dorsal spines; antennal sockets widely separated, closer to eye margin than to each other, with the intersocket distance ranging from 1.5–2.6 the diameter of socket. Maxillary palpus short, 2–3-segmented. Labial palpus 3-segmented, relatively short compared to other genera.

Thorax: Venation (Figures 50–51) similar to *Adela* with all veins usually separate; forewing with Rs3 and Rs4 sometimes connate. Hindwing with all veins separate; base of 1A+2A usually with basal loop. Female frenulum usually with ~2–5 relatively

long black bristles from base of costa and a series of 8–14 smaller, paler spines more distad. Foreleg with epiphysis present.

Abdomen: (Figures 322–336). Sternum 7 enlarged, ~1.5–1.7 the length of tergum 7.

Male Genitalia: Similar to *Adela* in having the uncus reduced, often superficially bilobed. Vinculum well developed with an elongate, broadly U-shaped saccus. Valvae short, variable in lateral view, often with cucullus more slender and extended than in *Adela* and with saccular lobe more produced; pectinifers absent. Juxta sagittate or nearly so, with anterior half broader. Phallus usually with numerous minute spinules scattered around caudal apex.

Female Genitalia: As described for family; vestibulum variably sclerotized.

DISCUSSION. The adults of this genus are most similar to those of *Adela*, but the male antennae are shorter (length ~1.5× length of forewing or less) and lack the dorsal peg-like spines near the base of the flagellum. The eyes of the male are also not as enlarged in *Cauchas* and the antennal sockets are more widely separated.

On the basis of the male genital morphology, *Cauchas clarkei* and *C. elongata* appear to be the most derived species among the North American *Cauchas*. *Cauchas elongata* in particular is unusual in possessing a very slender, non-sagittate juxta with a pair of unique, elongate anellar lobes.

Figures 66, 77, and 58 show the maximum likelihood gene tree of the COI barcode region for selected species of *Adela*, *Cauchas*, and *Nemophora* (the single tree is split across the three figures). All Nearctic *Cauchas* fall out in a single, well-supported clade (BS=0.90) that also includes all Western Hemisphere “no peg” *Adela* species (see Discussion section under *Adela*); the *Adela* and *Cauchas* species do not form separate subclades within this clade but instead are heavily intermingled with each other. Palearctic *Cauchas*, on the other hand, are grossly polyphyletic, with species widely scattered across the COI tree. As was discussed under *Adela*, the clade uniting Nearctic *Cauchas* species with “no peg” *Adela* species, to the exclusion of “hook-peg” *Adela* species, is a striking result that warrants further study. If further research supports the “hook-peg” versus “no peg” split, the genus name *Chalceopla* Braun, 1921 would be available for the species comprising the “no peg” *Adela* + Nearctic *Cauchas* clade.

It is unclear what to make of the Palearctic *Cauchas* results. Further research is obviously needed; nuclear genomes will be crucial in determining if Palearctic *Cauchas* is monophyletic and, if not monophyletic, in determining how the various Palearctic species are related to *Adela* (both “hook-peg” and “no peg”), Nearctic *Cauchas*, and *Nemophora*.

KEY TO THE NEW WORLD SPECIES OF *CAUCHAS*

1. Forewing variably marked with white to pale yellowish spots or fasciae 2
Forewing uniformly gray to dark fuscous, without pale markings 10
2. Forewing with one or more white, transverse fasciae 3
Forewing usually with 1–2 small whitish to pale yellowish spots 6
3. Forewing with a single complete or incomplete fascia at distal third of wing [Figures 194, 207–209] 4
Forewing with a single, usually complete basal fascia and 2 additional, incomplete fasciae extending only partway across distal third of wing [Figures 211, 212, 217, 218] 5
4. Forewing with a single, slender, complete subapical fascia [Figure 194] *vittata*
Forewing with broader, more variable, incomplete subapical fascia [Figures 207–209] *sedella*
5. Male valva with reduced, acute, basal lobe [Figure 300] *trifascia*
Male valva with prominent, rounded, basal lobe [Figure 303] *wielgusi*
6. Sacculus of male valva produced to form a prominent, slender lobe 7
Sacculus of male valva not produced to form a slender lobe 8
7. Saccular lobe of male valva more slender, length ~2× width [Figure 301]; forewing either immaculate or with small white spot on distal third of hind margin [Figures 213–215] *lobata*
Saccular lobe of male valva stouter, length ~equal to maximum width [Figure 302]; forewing with a small white spot just beyond middle of hind margin [Figure 216] *excavata*
8. Forewing with a relatively broad, pale yellowish spot at distal third of hind margin [Figures 199–204]; male with large triangular, acute process arising from apex of phallus [Figure 296b] *cockerelli*
Forewing sometimes with much smaller pale spot on hind margin and/or at apex of discal cell [Figures 195, 196]; apex of phallus without large process 9
9. Base of male valva very broad, vertical width ~5× width of cucullus; cucullus slender and without large spines [Figure 297c] *simpliciella*
Base of valva not broadly expanded; cucullus nearly as broad as sacculus and bearing prominent spines [Figure 293c] *spinulosa*
10. Male with base of valva greatly expanded, greatest width more than 3× that of cucullus and abruptly narrowing to cucullus 13
Base of valva more slender, gradually narrowing to cucullus 11

11. Base of valva slender, less than 1.8× width of cucullus and gradually tapering to subacute apex [Figure 305d] *elongata*
Base of valva moderately broad, ~2.5× width of cucullus, and tapering more abruptly to cucullus [Figures 290, 291] 12
12. Male sacculus reduced, length of ventral margin ~0.2× length of valva; anterior end of male saccus more rounded [Figure 291c] *alaskae*
Male sacculus more elongate, length of ventral margin ~0.33× length of valva; anterior end of saccus truncate [Figure 290c] *dietziella*
13. Valva of male genitalia terminating in a slender, strongly curved cucullus [Figure 304c]. *clarkei*
Cucullus more stout and not curved 14
14. Male sacculus enlarged, extending ~0.6× length of valva; inner costal margin of cucullus recurved [Figure 294] *recurvata*
Sacculus extending less than half the length of valva; costal margin of cucullus not recurved. 15
15. Male valva with small, apical, ventral lobe [Figure 299d]; juxta sagittate *cyanella*
Apex of male valva simple, without ventral lobe; juxta not sagittate, with anterior end more rounded, laterally flared and recurved 16
16. Base of male valva very broad [Figure 297c], vertical width ~5× width of cucullus. *simpliciella*
Base of male valva less broad [Figure 295c], vertical width ~0.5× width of cucullus. *suffusa*

***Cauchas dietziella* (Kearfott), new combination**

FIGURES 192, 290, 322, 386; MAP 28

Incurvaria dietziella Kearfott, 1908: 187, Pl. 3, fig. 4.

Tineola dietziella (Kearfott), Barnes and McDunnough, 1917: 193, no. 8299.

Cyanauges dietziella (Kearfott), Braun, 1919: 24.

Chalceopla dietziella (Kearfott), Forbes, 1923: 76.—McDunnough, 1939: 109, no. 9812.—Davis, 1983: 4, no. 212.

ADULT. (Figure 192). Wing expanse: ♂, 8.5–9.5 mm; ♀, 8.5–10.5 mm.

Head: Pale ochreous. Antenna with scape and dorsum of flagellum entirely covered by fuscous scales. Maxillary palpus pale ochreous. Basal third of haustellum brownish fuscous. Labial palpus stramineous; second segment with a tuft of 6–8 fuscous and stramineous hairs intermixed near apex.

Thorax: Dorsum fuscous with bronzy iridescence. Venter and legs brownish fuscous with bronzy iridescence. Forewing entirely dark fuscous with a mixture of golden bronze and purplish luster. Hindwing nearly as dark as forewing, fuscous with slight bronzy luster.

Abdomen: (Figure 322). Fuscous, slightly more grayish and lustrous ventrally. Female with seventh sternite 2.8–2.9× length of sixth; eighth sternite lightly and uniformly pigmented, without dark sclerotization laterally.

Male Genitalia: (Figures 290). Uncus reduced, situated ventrally beneath tegumen. Vinculum-saccus relatively short, only slightly exceeding (1.1–1.2×) length of valva; anterior end of saccus broad, bluntly rounded. Base of valva only moderately expanded, gradually narrowing to cucullus; ventral margin of cucullus slightly expanded. Juxta with anterior half sagittate, anterior end bluntly rounded; posterior half broad, with lateral margins subparallel. Phallus with base moderately expanded, ovoid; cornuti absent; caudal apex of phallus with numerous spinules laterally.

Female Genitalia: (Figures 322, 386). Apex of ovipositor compressed, nearly symmetrical with dorsal edge slightly shorter than ventral edge, both edges minutely serrulate. Vestibulum reduced in size, walls not thickly convoluted, rather uniformly pigmented; vaginal plate dorsal in position, relatively distinct.

TYPE. Lectotype, ♂ (present designation) bearing following 5 labels: (1) “Essex Co., N.J., VI-8-07, W. D. Kearfott”; (2) “TYPE, Collection of W. D. Kearfott”; (3) “♂ genitalia on slide 20538, D. R. Davis”; (4) “Type No. 12058 USNM”; (5) “Lectotype ♂, *Incurvaria dietziella* Kft., by D. Davis” (USNM).

TYPE LOCALITY. Essex County Park, New Jersey.

HOST. Unknown. Specimens possibly from the type series were observed by Kearfott (1908: 138): “flying about or resting on the leaves of dogwood, *Cornus candidissimus*” [*Cornus racemosa* Lam.], Cornaceae.

FLIGHT PERIOD. Late May to middle June; univoltine.

DISTRIBUTION. (Map 28). This species ranges widely through northeastern North America, from New Jersey, USA, north to the province of Ontario, Canada.

MATERIAL EXAMINED. 6 males, 29 females. **CANADA:** ONTARIO: Black Lake, N Burgess Twp.: 3 ♂, 30 May–1 Jun (CNC); 1 ♂, 1 ♀, 1 Jun (USNM). Bobcaygeon: 2 ♂, 6 Jun 1932, J. McDunnough, slide 2508 ♂ (CNC). QUEBEC: Aylmer: 1 ♂, 25 May (CNC). Mt. Albert 3,400 ft. [1,036.3 m]: 2 ♂, 1 ♀, 19–22 Jul 1940, A. E. Brower (USNM). **UNITED STATES:** CONNECTICUT: Windham Co.: Putnam: 1 ♀, 27 May 1933, A. Klots (AMNH). MAINE: Bar Harbor: 1 ♀, 26 May 1938, A. E. Brower (USNM). NEW JERSEY: Essex Co.: Essex County [Park]: 2 ♂ (paralectotypes), 8 Jun (LACM); 4 ♀ (paralectotypes), 30 May 1907, W. D. Kearfott (MCZ); 1 ♀, 8 Jun (ANSP); 1 ♂ (lectotype), 8 Jun 1907, W. D. Kearfott, USNM slide 20538 ♂; 6 ♂, 8 ♀ (paralectotypes) 30 May–8 Jun 1907, W. D. Kearfott; 16 ♀, 30 May–8 Jun 1907, W. D. Kearfott (USNM).

DISCUSSION. The dark fuscous coloration with a distinct glint of purplish iridescence on the forewings superficially distinguishes *Cauchas dietziella* from one of its nearest relatives, *C. cyanella*. *Cauchas dietziella* also seems to lack the purplish luster in the hindwings that is usually evident in *C. cyanella*. The two may be further separated on the basis of genital differences, particularly with regard to the different form of the male valvae.

Kearfott described *C. dietziella* from a series of 50 specimens collected in Essex County Park, New Jersey, although his labels merely give the locality as Essex Co., N.J. Most of the original series is now present in the collection of the National Museum of Natural History, although many are not indicated as types and an unspread series of 13 specimens (presumably collected by Kearfott in 1907) bear no labels at all. From the 15 specimens bearing a red "Type" label, author DRD has selected a male lectotype—one of two specimens in the series that also bear a USNM type No. 12058 label. A few females in the Type-designated series are actually in slightly better condition, but because of the superior diagnostic characters present in the male genitalia, a male lectotype was chosen.

On at least two separate occasions, adults of *C. dietziella* have been observed swarming around or resting on dogwood (*Cornus*), thereby strongly suggesting that this genus is the food plant for these moths. Kearfott (1908: 187) reported that the entire type series was collected on two small clumps of *Cornus racemosa* (= *C. candidissima*). The adults were observed flying in the bright sunshine, both morning and afternoon. He made a concerted effort to collect and observe these insects over several weeks but was unable to confirm anything definite regarding their life history. More recently, in the spring of 1972, Downes collected adults of this species on dogwood near Black Lake in Ontario, Canada. No immatures were collected or observed by him, however.

***Cauchas alaskae* Davis and Medeiros, new species**

FIGURES 193; 291, 323, 387; MAP 28

ADULT. (Figure 193). Wing expanse: ♂, 8.5–10 mm; ♀, 10.5 mm.

Head: Vestiture mostly consisting of long, scattered pale brownish hairs over vertex and lower region of head, with black hairs over frons. Antenna entirely covered dorsally with smooth, fuscous scales; scape entirely dark fuscous. Labial palpus mostly dark fuscous except for white scales dorsally on second segment and with 6–8 dark hairs arising mostly laterally and apically from second segment. Scales over base of haustellum fuscous.

Thorax: Dorsum and venter uniformly dark fuscous to brownish fuscous with a slight bronzy luster. Legs including spurs dark fuscous dorsally, with white scales ventrally, especially on hindwings. Forewing uniformly dark brownish fuscous similar to dorsum of thorax. Hindwing and fringe similar to forewing, uniformly brownish fuscous with a slight bronzy luster.

Abdomen: (Figure 323). Similar in color dorsally and ventrally to dorsum of thorax, uniformly dark fuscous.

Male Genitalia: (Figure 291). Uncus consisting of a small, somewhat truncate terminal lobe with a minute, median rounded apex. Vinculum-saccus elongate, approximately 2× the length of valva; generally broad in width and tapering slightly to a broadly rounded anterior end. Valva broad at base, narrowing smoothly to form slender, digitate cucullus; sacculus well developed, nearly 3× the width of cucullus. Juxta of medium length, ~equal to valva in length; anterior end of juxta broadly sagittate, with a pair of short lateral extensions; furcations at posterior end of juxta greatly reduced. Phallus slightly curved, without cornuti; apex of phallus encircled by 5–7 scattered rows of minute, external spines.

Female Genitalia: (Figures 323, 387). Apex of ovipositor compressed, acute, symmetrical with ventral edge slightly longer and with more serrulations. Ductus spermathecae elongate, equal to length of ductus bursae in length. Vestibulum well developed with thickened walls.

HOLOTYPE. ♂. UNITED STATES: ALASKA: Denali Borough, 4 mi. [6.4 km] N Cantwell: 2,000–2,200 ft. [609.8–670.7 m], digital image captured, DDAV-A173, DRD genitalia slide 4626, 26 Jun 1979 (UCB).

PARATYPES. 7 males, 1 female. UNITED STATES: ALASKA: Fairbanks North Star Borough: 7 mi. [11.2 km] SW Ester: 2 ♂, 30 Jun 1979 (UCB); Murphy's Dome, 20 mi. [32 km] NW Fairbanks, 2,600–2,800 ft. [792.7–853.7 m]: 3 ♂, genitalia slide DRD 4542, USNM 34715, 1 Jul 1979 (UCB, USNM); Denali Borough: 12 mi. [19.2 km] S. Anderson: 1 ♂, 28 Jun 1979, 1 ♀, genitalia slide USNM 34723, P. Opler, J. Powell (UCB, USNM). 4 mi. N Cantwell: 2,000–2,200 ft.: 1 ♂, digital image captured, DDAV-A173, DRD genitalia slide DRD 4626, 26 Jun 1979 (UCB).

HOST. Unknown.

FLIGHT PERIOD. Late June to early July; univoltine.

DISTRIBUTION. (Map 28). Currently known from south-central Alaska in Denali and Fairbanks North Star Boroughs.

ETYMOLOGY. The name *alaskae* is the genitive singular of the general type locality, Alaska.

DISCUSSION. *Cauchas alaskae* appears most similar to *C. suffusa* in general morphology, but the former has forewings of a more uniform dark fuscous color and possesses male genitalia with several distinguishing features. The vinculum saccus of *C. alaskae* is noticeably longer and with a slenderer anterior (basal) end. The sacculus of the male valva is also less developed and the juxta is longer with the basal edges less upturned in *C. alaskae* compared to *C. suffusa*.

***Cauchas vittata* Davis and Medeiros, new species**

FIGURES 3, 50, 194, 292, 324, 388; MAP 28

ADULT. (Figures 3, 194). Wing expanse: ♂, 7–8 mm; ♀, 7–9 mm.

Head: White, with a scattering of black hairs, especially at vertex. Antenna of male approximately 1.2–1.5 the length of

forewing, 50–60-segmented; scape mostly fuscous above, silvery white beneath, flagellum fuscous annulated with white over basal fifth, becoming entirely fuscous over distal four-fifths with slight irroration of white; apical 7–10 segments usually white. Antenna of female 1.1–1.2× length of forewing, 46–53-segmented; scape almost entirely white, slightly irrorated with fuscous; flagellum white, almost equally annulated with fuscous, often becoming entirely white over apical fifth. Antenna widely separated in both sexes for a distance approximately 1.5× diameter of antennal socket. Eyes not sexually dimorphic, rounded, interocular index approximately 0.65–0.7. Base of haustellum covered with whitish scales. Maxillary palpus white, 3-segmented. Labial palpus white with apical segment frequently suffused with brownish fuscous; second segment with a relatively dense brush of long, erect white and black hairs ventrally.

Thorax: Dorsum brownish fuscous with a bronzy luster. Venter and undersides of legs white; dorsal surfaces of legs bronzy brown. Forewing brownish fuscous with a prominent bronzy iridescence; a single, relatively narrow, slightly oblique transverse fascia across outer third of wing; fringe brownish fuscous. Hindwing slightly darker than forewing, less iridescent but with a faint purplish luster; female frenulum consisting of 3–4 relatively large bristles; M1 and M2 separate.

Abdomen: (Figure 324). Brownish fuscous above, mostly whitish beneath. Female with seventh sternite elongate, approximately 4.2× the length of sixth; eighth sternite very lightly pigmented.

Male Genitalia: (Figure 292). Uncus minutely bilobed, situated ventrad to tegumen. Vinculum-saccus elongate, approximately 2.0× length of valvae; anterior end narrowed, rounded. Valvae elongate triangular, with ventral margin nearly straight and gradually narrowed to tip; cucullus rounded with ventral margin slightly expanded. Juxta with anterior end sagittate, subacute. Phallus elongate, slender, nearly straight with base slightly expanded; cornuti absent, but with numerous minute spines scattered over one side of apical 0.1–0.2 of phallus.

Female Genitalia: (Figures 324, 388). Apex of ovipositor compressed, acute, relatively smooth, slightly asymmetrical with ventral edge longer, more oblique than dorsal. Bursa copulatrix moderately long, usually not extending beyond apices of anterior apophyses when extended. Vestibulum elongate, length approximately 3.0× depth; darkly pigmented, dorsal surface moderately rugose.

HOLOTYPE. ♂, Railroad Canyon, 4 mi. [6.4 km] E Elsinore, Riverside County, California, 14 Apr 1965, J. Powell (UCB).

PARATYPES. 16 males, 19 females. **UNITED STATES:** **ARIZONA:** Graham Co.: Marijilda Canyon: Graham Mts.: 2 ♂, 6 ♀, 1 Apr 1961, P. Wygodzinsky, slides 2998, 3012 (UCB); 2 ♀, 1 Apr 1961, P. Wygodzinsky, USNM slide 20093 ♀ (USNM). Pima Co.: Catalina State Park, 32°25'20"–110°54'46", 14 Mar 2012, Wagner & Nagle, associated with *P. distans*, 11 ♂, 12 ♀ (UCIM, USNM). 1.8 mi. west of Dove Mountain Road and north of Tangerine Road, 11°54'46": 7 ♂, 4 ♀, ♂ slides USNM

34571, 34536, 24–25 Mar, R. Wielgus, diurnal flight around Scorpion weed (*Phacelia distans*) (USNM); Kitt Peak, entrance road, 3,340 ft., 32°0'43"–111°34'30": 12 ♂, Wagner & Brummermann, associated with *Phacelia distans*, ♂ slide 34450, Bold ID LNAUS 670. Kitt Peak, entrance road, 3,800 ft., 31°59'26"–111°34'42.5": 1 ♂, 5 ♀, 24 Mar 2012, Wagner, on *Cryptantha barbiger*a (UCIM, USNM). Santa Catalina Hwy, 4,000 ft., 32°19'27.4": 2 ♂, 2 ♀, 29 Mar 2012, Wagner, on *Phacelia distans*, wing slide 34647. Santa Catalina Hwy, mile marker 2: 1 ♂, 1 ♀, 29 Mar 2012, Wagner, on *Phacelia distans* (UCIM). Tucson, Sabine Canyon: 2,800 ft., 32°19'19.7"–110°48'43": 1 ♂, 1 ♀, 21 Mar 2012, Wagner & Brock (UC). Tucson, Tangerine Road: 32°25'46"–111°6'52": 4 ♂, 3 ♀, 12 Mar 2012, Wagner & Nagle, ♂ slide 37664, Bold ID LNAUS 671-12 (UCIM, USNM). **CALIFORNIA:** Los Angeles Co.: near Pasadena: 1,080 ft.: 2 ♀, 2 Apr 1909, F. Grinnell Jr. (LACM). Riverside Co.: Piñon Flat: 1 ♂, 20 Apr 1962, C. MacNeill, D. Rentz ♀ R. Brown (CASC). Railroad Canyon, 4 mi. [6.4 km] E Elsinore: 2 ♂, 1 ♀, 11–14 Apr 1965, J. Powell, USNM slide 20095 ♀ (UCB); 2 ♂, 1 ♀, 12–14 Apr 1965, J. Powell, USNM slides 16034 ♀, 20094, 20092 ♂ (USNM). 5 mi. [8.0 km] S Sage: 2 ♂, 3 ♀, 16 Apr 1965, J. Powell, D. Viers (UCB).

HOST. Unknown, but adults frequently associated with *Phacelia distans* Benth., Boraginaceae. Adults have been collected by R. Wielgus in late March flying around *Phacelia distans* Benth. in Arizona. David Wagner has also collected numerous adults on *Phacelia distans* at several localities in Pima County, Arizona, in March and on *Cryptantha barbiger*a (A. Gray) Greene. Adults (Figure 3) also have been observed on Boraginaceae: *Phacelia* (probably *P. cicutaria* E. Greene), by Paul G. Johnson (pers. comm. to author MJM, Oct 2022) in Ventura County, California.

FLIGHT PERIOD. Late March to April.

DISTRIBUTION. (Map 28). Presently known from 4 localities in Southern California (southwestern Riverside Co.; Los Angeles Co.; Ventura Co.; southwestern Kern Co. at 6,685 ft. [2,038 m] in elevation, Paul G. Johnson, pers. comm.) and southeastern Arizona (Graham and Pima Counties). Additional specimens that likely represent this species have been collected in eastern San Benito Co., California, by Paul G. Johnson (pers. comm.).

ETYMOLOGY. The specific name is derived from the Latin *vitta* (ribbon, band), in reference to the conspicuous banding on the forewing in this species.

DISCUSSION. The generic placement for *Cauchas vittata* is currently based on certain morphological features more prevalent in the genus *Cauchas* than in the closely allied genus *Adela* (Nielsen 1980). These include the similar eye development between the sexes (not sexually dimorphic in *Cauchas*), the broad separation of the antennal bases in both sexes (more narrowly separated in *Adela*), the absence of sex spines at the base of the antenna (also absent in some *Adela*), and the relative short antennae (with only the antennae of *A. oplerella* similarly reduced). Although *Cauchas vittata* bears closest superficial resemblance to *Adela singulella*, a variably banded species from California,

these two species may be readily separated on the basis of their different antennal lengths (much shorter in *C. vittata*), total relative lengths of the male genitalia (longer in *A. singulella*), and the seventh abdominal segment of the female (proportionately longer in the females of *C. vittata*). The ventral margin of the valva is nearly straight in *C. vittata* compared to the more irregular form in *A. singulella*.

***Cauchas spinulosa* Davis and Medeiros, new species**

FIGURES 2, 195, 196, 293, 325, 389; MAP 29

ADULT. (Figures 2, 195, 196). Wing expanse: ♂, 7–8.5 mm; ♀, 7.5–9.0 mm.

Head: Whitish to pale ochreous, intermixed with black hairs at vertex; frons sparsely covered with whitish hairs except for a tuft of black hair along inner margin of eye. Antenna fuscous, with a slight admixture of whitish scales ventrally along basal half; venter of scape silvery white. Maxillary palpus silvery white; basal half of haustellum covered with whitish scales. Second segment of labial palpus whitish with a cluster of predominantly black hairs intermixed with white arising ventrally and distally; apical segment covered with fuscous scales dorsally and whitish ventrally.

Thorax: Dorsum fuscous with a slight bronzy luster. Venter predominantly silvery white. Legs mostly white, with dorsal surfaces typically fuscous. Forewing fuscous with a bronzy iridescence; typically 2 pale yellowish spots present and situated thusly: a relatively large spot at apex of discal cell and a smaller spot along hind margin immediately basad of tornus; the subternal spot is often absent and less frequently both spots are lacking. Hindwing uniformly fuscous, slightly paler than forewing.

Abdomen: (Figure 325). Fuscous above, mostly whitish below. Seventh sternite of female 3.0–3.1× length of sixth. Eighth sternite without dark band ventrally, mostly lightly pigmented except for dark pigmentation laterally.

Male Genitalia: (Figure 293). Uncus reduced, truncate. Vinculum-saccus moderately long, approximately 1.5× as long as valva; cephalic end narrowed, nearly V-shaped. Valva rather slender; sacculus reduced; cucullus relatively broad, with numerous, elongate, spiniform setae scattered over inner surface. Juxta with anterior end sagittate, subacute; lateral margins of posterior half nearly parallel. Phallus with 2 longitudinal rows of dense, stout cornuti, increasing in size apically; base of phallus moderately flared.

Female Genitalia: (Figures 325, 389). Apex of ovipositor compressed, acute, asymmetrical with ventral edge distinctly longer than dorsal edge and with a shallow subapical indentation. Vestibulum enlarged; vaginal plate darkly sclerotized and relatively distinct, dorsal in position.

HOLOTYPE. 5 mi. [8 km] S Sage, Riverside County, California, ♂, 16 Apr 1965, J. Powell (UCB).

PARATYPES. 60 males, 20 females. **UNITED STATES: CALIFORNIA:** Los Angeles Co.: Claremont, Robert Bernard Biological Field Station, 34°109'N, –117°710'W: 4 ♂, 3 ♀, 13–17 Apr

2016, 4 ♂, 21 Apr 2018, J. Wright, USNM slide 34714 ♂, adults nectaring on *Camissoniopsis bistorta* (USNM). Los Angeles: 2 ♂, Apr, Bucholz, USNM slide 17554 ♂ (USNM). Riverside Co.: 5 mi. [8 km] south of Sage: 10 ♂, 5 ♀, 16 Apr 1965, J. Powell, DRD slide 2486 ♀ (UCB); same data: 2 ♂, 3 ♀, USNM slides 20588 ♂, 20592 ♂, 20593 ♀ (USNM); same data: 1 ♀, C. Slobodchikoff (UCB); same data: 5 ♂, 1 ♀, C. Toschi (UCB); same data: 7 ♂, 2 ♀, D. Veirs (UCB); same data: 1 ♂ (USNM). Elsinore: 1 ♀, 28 Mar 1899 (MCZ). R. R. Canyon, 4 mi. [6.4 km] E Elsinore: 8 ♂, 14 Apr 1965, J. Powell (UCB); same data: 1 ♂, 1 ♀, USNM slide 16032 ♀ (USNM); same data: 1 ♂, P. Turner (UCB); same data: 1 ♂, D. Veirs (UCB); same locality: 4 ♂, 11 Apr 1965, *Coreopsis californica*, R. Langston (UCB); same data: 1 ♀ (USNM). San Diego Co.: Cardiff: 2 ♂, 1 ♀ (in copula), 22 Mar 1967, J. Powell (UCB). 1 mi. [1.6 km] E Cardiff: 2 ♂, 1 ♀ (in copula), 2 Apr 1974, at flowers *Camissonia bistorta* [now placed in the genus *Camissoniopsis*], J. Powell (UCB); same data: 1 ♂, USNM slide 17443 ♂ (USNM); same locality: 1 ♂, 31 Mar 1974 (UCB). 3 mi. [4.8 km] E Encinitas, 50 ft. [15.2 m]: 1 ♂, 27–28 Apr 1967, from flowers *Yucca schidigera*, D. Davis, USNM slide 17444 ♂ (USNM). San Diego: 1 ♂, 5 Apr 1915, M. Van Duzee (USNM). San Luis Obispo Co.: Carrizo Natl. Monument, 35.044°N, 119.661°W: 1 ♂, 1 Apr 2005, P. Jump, USNM slide 33903 ♂ (USNM). Ventura Co.: Lockwood Cr. Rd, 34.74°N, 119.03°W: 5,025 ft. [1,532 m]: 1 ♂, 1 ♀, 4 May 2013, P. G. Johnson, #287, USNM slide 34834 ♂ (UCB, USNM). Lockwood Valley Road: 2 ♂, 2 May 2015, V. Albu, USNM slides 34691 ♂, 34800 ♂ (USNM).

HOST. Unknown. Although no rearings have been conducted, adults have been collected from flowers of the following plants: Agavaceae, “*Yucca schidigera* Roezl” (D. Davis); Asteraceae, “*Coreopsis californica* (Nutt.) H. Sharsm”; Onagraceae, “*Camissoniopsis* (= *Camissonia*) *bistorta* (Nutt. ex. Torrey and A. Gray) Wagner and Hoch” (J. Powell, J. Wright).

FLIGHT PERIOD. Late March to late April; univoltine.

DISTRIBUTION. (Map 29). This species is known only from the coastal hills of Southern California from Riverside and Los Angeles Counties south to San Diego. Additional specimens that likely represent this species have been collected at Pinnacles National Park, San Benito Co., California, by Paul G. Johnson (pers. comm.).

ETYMOLOGY. The species name is derived from the Latin *spinulosa* (having small spines), in reference to the large, spiniform setae of the male valvae, a diagnostic characteristic of this species.

DISCUSSION. The adults of this species are either immaculate (and uniformly fuscous) or maculate (with one or two small, pale yellowish spots). A majority of those specimens examined were of the latter phenotype, although the subternal spot is usually lacking and the discal spot is sometimes reduced and barely discernible without magnification.

The broad taxonomic range of plants represented by the captured adults probably represent only resting sites or, at most, the relative nonspecificity of adult nectaring behavior; however, some of these records, particularly those from

Camissoniopsis (Onagraceae), may represent an actual larval host.

***Cauchas recurvata* Davis and Medeiros, new species**

FIGURES 197, 294, 326, 390; MAP 29

Adela simpliciella Walsingham [misidentification, in part, nec Walsingham, 1880], 1890: 284.

ADULT. (Figure 197). Wing expanse: ♂, 8.5–9.0 mm; ♀, 8.5–10 mm.

Head: Pale ochreous. Antenna entirely covered with dark fuscous scales dorsally. Base of tongue covered with dark fuscous scales. Labial palpus pale ochreous, with a cluster of 4–8 dark hairs concentrated near apex of second segment.

Thorax: Dorsum fuscous with a bronzy iridescence. Venter and legs fuscous to bronzy brown; tarsal segments usually light brown. Forewing uniformly dark fuscous with a slight bronzy to purplish luster. Hindwing fuscous, nearly as dark as forewing, with a slight bronzy to purplish luster.

Abdomen: (Figure 326). Dark fuscous above, brownish fuscous beneath. Female with seventh sternite 3.1–3.2× length of sixth; eighth sternite mostly lightly pigmented except for a narrow area of dark pigmentation laterally.

Male Genitalia: (Figure 294). Uncus reduced, minutely bilobed. Vinculum-saccus elongate, approximately 2× length of valva; apex of saccus broadly rounded. Valva broad for most its length, abruptly constricted at outer third; cucullus rounded, costal margin strongly recurved ventrally. Juxta with anterior half broadly sagittate, apex rounded; posterior half relatively narrow, with lateral margins subparallel. Phallus with base expanded, ovoid; apex simple; cornuti absent.

Female Genitalia: (Figures 326, 390). Apex of ovipositor compressed, dorsal and ventral edges relatively short, symmetrical, bluntly rounded, minutely serrulate. Structure of vestibulum as shown in figures; vaginal plate well developed; primarily dorsal in position.

HOLOTYPE. Leamington, Ontario, Canada, ♂, 3 Jun 1937, coll. G. S. Walley, ♂ genitalia on slide DRD 2907 (CNC).

PARATYPES. 5 males, 13 females. CANADA: ONTARIO: Leamington; 1 ♂, 3 Jun 1937, G. S. Walley (CNC). Pelee Island: 2 ♂, 10 ♀, 4 Jun 1937, G. S. Walley (CNC); 2 ♂, 2 ♀, 4 Jun 1937, G. S. Walley (USNM). Pelee: 1 ♀, COI=BIOUG02962-D10; BOLD ID CNPPB2139-12.

HOST. Unknown.

DISTRIBUTION. (Map 29). Known only from the extreme southwestern section of Ontario, Canada.

ETYMOLOGY. The species name is derived from the Latin *recurvatus* (recurved), in reference to the strongly recurved costal margin of the male cucullus.

DISCUSSION. The strongly recurved costal margin of the cucullus in the male is probably the most diagnostic feature of

this species and easily separates it from all other members of the genus. The relatively blunt apex of the ovipositor is sometimes useful for recognizing the females of this species, but this character alone is not reliable in separating *C. recurvata* from another eastern and perhaps partially sympatric species, *C. dietziella*.

Walsingham (1890: 294) confused this species with *C. simpliciella* and stated that it occurred in Texas. A male and female specimen now in the collections of the British Museum probably represent the material to which Walsingham referred. The locality labels on both specimens bear the information “Texas, Boll, Ragonot No. 566.” Because *C. recurvata* is not believed to occur in the southwestern United States, the two specimens have not been selected as paratypes, and their reported place of origin has not been considered in the distribution of the species.

If the two specimens in question were collected by Jacob Boll, then it is most likely that they were captured somewhere in New England, perhaps in eastern Massachusetts, where Boll collected intermittently during the early 1870s (Geiser 1948). His specimens of *Cauchas recurvata* may have been incorrectly labeled as originating in Texas because the great majority of the insects Boll collected in this country were from the north-central part of that state.

***Cauchas suffusa* Davis and Medeiros, new species**

FIGURES 198, 295; MAP 30

ADULT. (Figure 198). Wing expanse: ♂, 9.5–10 mm; ♀, unknown.

Head: Whitish, heavily intermixed with fuscous hairs; a black tuft of hairs concentrated immediately below antennal sockets along inner margin of eye. Antenna, including scape, entirely fuscous. Maxillary palpus and basal fourth of tongue covered with fuscous scales. Labial palpus almost entirely white, with a suffusion of fuscous at apex of a distal segment; second segment with elongate hairs at apex mostly white.

Thorax: Dorsum fuscous. Venter predominantly white with a slight suffusion of fuscous. Legs pale fuscous above, whitish beneath. Forewing mostly fuscous with a pale bronzy iridescence; apical third of wing and base of cubitus strongly suffused with dull whitish scales. Hindwing uniformly fuscous, noniridescent, paler in color than forewing.

Male Genitalia: (Figure 295). Uncus prominent, slightly bilobed. Vinculum-saccus elongate, nearly 2× the length of valva; cephalic end broadly rounded, U-shaped. Valva broad at base with sacculus well developed, abruptly constricted at middle to form slender, digitate cucullus. Juxta relatively short, usually not exceeding valva in length; anterior end broadly rounded, with lateral margins strongly curved caudally and tapering; posterior end strongly furcate. Phallus without cornuti but with an irregular, darkly sclerotized, partially internal process near apex; external wall of phallus continuous with internal process; posterior end of phallus slightly curved, only moderately expanded.

HOLOTYPE. Bob Scott Campground, 7,300–7,500 ft. [2,225–2,290 m], Toiyabe National Forest, Lander County, Nevada, ♂, 1 Jun 1974, J. F. G. Clarke (USNM).

PARATYPE. UNITED STATES: NEVADA: Same locality as holotype; 1 ♂, 31 May 1974, J. F. G. Clarke, ♂ genitalia slide USNM 17437 (USNM).

HOST. Unknown.

FLIGHT PERIOD. Late May to early June; univoltine.

DISTRIBUTION. (Map 30). Currently this species is known only from the Toiyabe National Forest (approximately 8 miles [12.8 km] southeast of Austin) of central Nevada.

ETYMOLOGY. The species name is derived from the Latin *suffusus*, past participle of *suffundere* (to diffuse beneath), in reference to the more suffused white markings on the forewing of this species.

DISCUSSION. This species shows greatest affinities to *Cauchas alaskae*, but the male genitalia of the two differ in having the vinculum saccus relatively broader, the sacculus of the valvae more elongate, and the juxta shorter with more upcurved basal edges in *C. suffusa*. *Cauchas suffusa* also resembles *C. cockerelli* Busck in some respects, but the two may be easily differentiated by characteristics of the forewing maculation and male genitalia. Whereas the forewings of *C. cockerelli* are clearly marked by a distinct spot extending from the discal cell to the hind margin, no such definition is evident in *C. suffusa*. The whitish markings of the latter are instead more suffused and widespread. In addition, the scales bordering the base of the cubital vein are typically white in *suffusa* and immaculate (i.e., fuscous) in *C. cockerelli*. With regards to the male genitalia, the valvae of the two species are very similar; however, *C. suffusa* lacks the asymmetrical flange-like process at the apex of the phallus, which is present in *C. cockerelli*. The juxta of *C. suffusa* also differs greatly from that of *C. cockerelli* in the prominently upturned lateral edges present in *suffusa*.

The male genitalia of *C. sedella* also resemble to some extent those of *C. suffusa* but differ in having the cucullus curved ventrally as compared to the simple, uncurved condition in *C. suffusa*. The relatively broad, shortened form of the juxta is characteristic for *C. suffusa*.

The only two known specimens of this species were collected after dark at a blacklight. The general habitat in which they were found was rather similar to that frequented by several other *Cauchas* in consisting of a mixed forest–high prairie type of vegetation, characterized by such plant genera as *Pinus*, *Juniperus*, *Artemisia*, and *Balsamorhiza*.

***Cauchas cockerelli* (Busck)**

FIGURES 199–204, 296, 327, 391; MAP 30

Incurvaria cockerelli Busck, 1915: 93.—Barnes and McDunnough, 1917: 196, no. 8438.

Chalceoplus cockerelli (Busck), Braun, 1921: 21; 1925: 224.—McDunnough, 1939: 109, no. 9815.—Davis, 1983: 4, no. 215.

Cauchas cockerelli (Busck), Pohl et al. 2015: 38.

ADULT. (Figure 199–204). Wing expanse: ♂, 9–10 mm; ♀, 10–11 mm.

Head: Reddish to pale ochreous with suffusion of black hairs near center of vertex between antennal bases. Antenna completely covered dorsally with slightly iridescent, fuscous scales, becoming whitish on outer 10–15 segments. Maxillary palpus pale ochreous. Haustellum with basal half covered with fuscous scales. Labial palpus with basal 2 segments pale ochreous to whitish; second segment with a tuft of 6–10 dark hairs concentrated along venter and at apex; apical segment heavily suffused with fuscous.

Thorax: Dorsum dark fuscous, with a coppery to greenish bronze luster. Venter grayish fuscous with suffusion of silvery white. Pro- and mesothoracic legs fuscous; metathoracic legs light fuscous above, grayish white with silvery iridescence ventrally. Forewing dark fuscous, with a greenish bronze luster; a single, relatively large, oval, pale yellowish spot situated at outer third of wing, extending from hind margin halfway to costa and never more than 2/3 width of wing; fringe dark fuscous. Hindwing fuscous, with a slightly purplish luster, nearly as dark as forewing; basal 2/3 of costal margin whitish; cilia fuscous, slightly paler at tips of scales.

Abdomen: (Figure 327). Fuscous above, pale fuscous ventrally with suffusion of grayish to silvery white posteriorly. Seventh sternite of female 3.0× length of sixth sternite; eighth segment very lightly pigmented, without dark sclerotization laterally.

Male Genitalia: (Figure 296). Uncus reduced, truncate to subtruncate. Vinculum-saccus broad, elongate, approximately 2.0× length of valva; anterior end of saccus broadly rounded. Valva with sacculus broadly expanded, distinctly set off and abruptly narrowing to slender, digitate, distal half; cucullus relatively straight, apex not curved ventrally. Juxta with anterior half sagittate, anterior tip bluntly rounded; caudal half with lateral margins approximately parallel. Phallus with base broadly flared to 2.5–3.0× width of shaft; apex asymmetrical, with a triangular, acute process arising from one side; cornuti absent.

Female Genitalia: (Figures 327, 391). Apex of ovipositor compressed, acute, asymmetrical, with dorsal edge nearly straight and ventral edge oblique, minutely serrulate; ventral edge continuous with shaft, not indented. Vestibulum somewhat reduced in size, uniformly and lightly pigmented; vaginal plate indistinct.

TYPE. Lectotype, ♀ (present designation), bearing following 4 labels: (1) “Between Ward and Peaceful Valley, Colo., July 5, 1914 (Cockerell)”; (2) “Type, No. 19288 USNM”; (3) “*Incurvaria cockerelli* Busck, Type”; and (4) “Lectotype, *Incurvaria cockerelli* Busck, by D. Davis, 1975” (USNM).

TYPE LOCALITY. Between Ward and Peaceful Valley, Boulder Co., Colorado.

HOST. Unknown.

FLIGHT PERIOD. Early June to late July; univoltine.

DISTRIBUTION. (Map 30). This species ranges widely through several mountain systems of northwestern North America, from the Yukon Territory of Canada south through the

Rocky Mountains of Colorado and from the Cascade Range of Washington east to the Black Hills of South Dakota.

MATERIAL EXAMINED. 19 males, 15 females. **CANADA:** ALBERTA: Waterton Lakes: 1 ♀, 15 Jul (CNC). YUKON: Dawson: 1 ♂, 10 Jun 1916, B. Clark (USNM). Whitehorse, Grey Mtn. summit, 1,300 m, subalpine shrubs, 60.6596°N, 134.8839°W: 1 ♂, 14 Jul 2006, JF Landry ♀ G. Pohl, CNC LEP 00026563, DNA extracted (CNC). BRITISH COLOMBIA: Clinton: 1 ♀, 18 Jun (CNC). Likely: 1 ♂, 6 Jul (CNC), 1 ♂, 9 Jul (USNM). Vernon: 1 ♂, 14 Jul (CNC). **UNITED STATES:** COLORADO: Boulder Co.: Between Ward and Peaceful Valley: 1 ♀ (lectotype), 5 Jul 1914, Cockerell (USNM). Clear Creek Co.: Watrous Gulch Trail, 10,300 ft. [3,140.2 m]: 1 ♂, 1 ♀, 3 Jul 2016, V. Legit and M. Albu, USNM slide 24739 (USNM). Grand Co.: Rocky Mtn. National Park, Lower Hidden Valley Picnic Area: 1 ♀, 30 Jul 1995, P. Opler (CSU). Rocky Mtn. National Park, Shadow Lake Dam, Ranger Meadow: 1 ♂, 29 Jul 1995, Opler & Simms (CSU). St. Louis Creek, nr. Fraser, 8,600 ft. [2,621.2 m]: 1 ♂, 7 Jul 1946. San Juan Co., Silverton: 1 ♂, 16–23 July (LACM); 5 ♂, 4 ♀, 16–23 July, USNM slides 20519 ♂, 20517 ♂, 20520 ♀ (USNM). Boulder Co.: Longs Peak [Rocky Mountain National Park]: 1 ♀ (paralectotype), 25 Jun, Cockerell (USNM). Park Co.: Platte Canyon: 1 ♂, Jul, Oslar (USNM). MONTANA: Beaverhead Co.: 12 mi. [19.2 km] S Wise River: 2 ♂, 2 ♀, 7 Jul (UCB). Glacier Co.: Glacier National Park: 1 ♂, 16 Jul 1920, A. Braun, slide 1174 ♂ (ANSP). Granite Co.: 14 mi. [22.4 km] S Clinton, 4,000 ft. [1,219.5 m]: 1 ♀, 27 Jun ?? (UCB). SOUTH DAKOTA: Lawrence Co.: Stovehole Park: T2N, R1E, S23: 1 ♀, 4–6 Jul 1965, R. Hodges (USNM). WASHINGTON: Ferry Co.: Columbia Mt., 6,500 ft. [1,982 m]: 1 ♂, 1 ♀, 23 Jul 1962, J. Clarke, USNM slide 20521 ♂ (USNM).

DISCUSSION. *Cauchas cockerelli* may be easily confused with one of its nearest relatives, *C. sedella*. The ranges of these two western species may partially overlap in Colorado, and their maculation is somewhat similar. The forewings of *C. cockerelli*, however, possess a single, rather large, pale yellowish spot at the distal third of the wing, extending from the hind margin rarely across the wing, in contrast to the either complete or interrupted and usually narrower transverse band at this position in *C. sedella*. The male genitalia of *C. cockerelli* may be distinguished from that of *C. sedella* in that the valva of the former does not possess a curved cucullus. In *C. sedella*, the cucullus is curved ventrally. Probably one of the most unique features of *C. cockerelli* is the broad, flap-like process from the apex of the phallus.

Cauchas suffusa represents another species with close affinities to *C. cockerelli*. In addition to lacking any apical modification of the phallus, *C. suffusa* may be separated from *C. cockerelli* by the absence of any well-defined spot in the forewing of the former.

Similar to the situation outlined for *Cauchas cyanella*, Busck did not clearly designate a holotype for *C. cockerelli* in his original description. The “type” was simply stated as “Cat. No. 19288, USNM.” Two female specimens, both in the collections of the National Museum of Natural History, now bear this number, and it is possible that these two constitute the entire

type series. The localities of both (Long Peak, Colorado, and between Ward and Peaceful Valley, Colorado) agree essentially with the habitat data given by Busck. Because one specimen is labeled “type” and the other “cotype,” it is probable that Busck intended his “type” specimen to be the holotype. In order to remove any future doubt as to its true status, we have designated Busck’s “type” from “between Ward and Peaceful Valley, Colorado,” as the lectotype and the remaining “cotype” specimen as the paralectotype.

Cauchas simpliciella (Walsingham)

FIGURES 205, 206, 297, 328, 392; MAP 31

Adela simpliciella Walsingham, 1880: 81; 1890: 284.—Meyrick, 1912a: 12.—Barnes and McDunnough, 1917: 196, no. 8439.—Davis, 1983: 4, no. 216.—Powell and Opler, 2009: 41.

Chalceopla simpliciella (Walsingham).—Powell: 1969: 231.—Davis, 1983: 4, no. 216.

Incurvaria itoniella Busck, 1915: 92.—McDunnough, 1939: 109, no. 9799.

Chalceopla itoniella Busck.—Braun, 1921: 21.—Davis, 1983: 4, no. 216 [synonym of *Chalceopla simpliciella*].

Chalceopla ovata Braun, 1921: 21.—Davis, 1983: 4, no. 216 [synonym of *Chalceopla simpliciella*].

Chalceopla discalis Braun, 1925: 223 [new synonym].—McDunnough, 1939: 109, no. 9814.—Davis, 1983: 4, no. 217.

Cauchas simpliciella (Walsingham), Pohl et al. 2015: 38.

ADULT. (Figures 205, 206). Wing expanse: ♂, 8.0–11.0 mm; ♀, 9.0–11.5 mm.

Head: Stramineous to pale orange to reddish brown, sparsely irrorated with a few black piliform scales over the frons and frequently with a dark concentration of scales between antennal bases. Antenna entirely covered with dark fuscous scales dorsally except for silvery white occasionally present on distal 12 or fewer segments. Maxillary palpus white. Basal 1/3 to 1/4 of haustellum covered with silvery white scales dorsally. Labial palpus mostly white with a scattering of 6–10 dark bristly hairs near apex of second segment; apical segment variable, either completely fuscous, white with apical half fuscous, or completely white.

Thorax: Dorsum fuscous with a bronzy luster. Venter metallic fuscous to silvery gray. Legs mostly fuscous, frequently silvery gray to whitish ventrally. Forewing variable, usually entirely fuscous with either a bronzy brown or purplish luster, occasionally spotted with pale yellow as follows: a relatively large oval spot near apex of discal cell. A small irregular spot on hind margin near termination of 2A + 3A, which may coalesce with discal spot, and an elongate patch of variable size in the costal fold near wing base. Hindwing fuscous, nearly as dark as forewing, usually with a slight purplish iridescence; fringe often with outer third grayish.

Abdomen: (Figure 328). Fuscous dorsally, pale fuscous to silvery gray ventrally in male and often whitish in female. Female sternum seven 3.0–3.1× length of sixth; eighth sternite with dark sclerotization laterally.

Male Genitalia: (Figure 297). Uncus short, usually rounded. Vinculum-saccus of moderate length, $\sim 1.1\text{--}1.2\times$ length of valva; saccus broadly rounded. Base of valva greatly expanded; sacculus with a shallow, concave pocket present along medioventral margin; valva gradually narrowing to slender, subtruncate cucullus. Juxta relatively short and broad; anterior half sagittate; anterior apex broadly rounded; anellus produced dorsally into 2 short, compressed, rounded lobes. Phallus slightly curved; base moderately flared; vesica with a dense cluster of usually 30–40 elongate cornuti, the majority of which are $\sim 1/4\text{--}3/4$ the width of the phallus in length.

Female Genitalia: (Figures 328, 392). Apex of ovipositor compressed, asymmetrical, with dorsal edge straight and ventral edge oblique, minutely serrulate; ventral edge indented at junction with shaft. Vestibulum relatively enlarged caudally with walls slightly grooved.

TYPES. Lectotype, ♂ (*Adela simpliciella*, present designation), bearing the following five labels: (1) “Type”; (2) “Rogue R, Josephine Co., Oregon, 7. V. 1872, Wlsm., *Adela simpliciella* Wlsm., P.Z. S. 1880, 81, Pl. XI. 7, Type ♂;” (3) “Walsingham Collection 1910–427”; (4) “No. 698, found 7, Wlsm 11”; and (5) “♂ genitalia on slide 2495, D. R. Davis” (BMNH). Lectotype, ♂ (*Incurvaria itoniella*, present designation) bearing following labels: “19024”; “Kaslo Br. Columbia, June 6 03, Cockle Coll.”; and *Incurvaria itoniella* Busck, type.” Holotype, ♀ (*Chalceopla discalis*) (ANSP). Holotype, ♀ (*Chalceopla ovata*) (ANSP).

TYPE LOCALITIES. Rogue River, Josephine Co., Oregon (*Chalceopla simpliciella*). Kaslo, British Columbia (*Chalceopla itoniella*). North slope of Logan Canyon, Cache Co., elevation approximately 5,500 ft. [1,677 m], near Logan, Utah (*Chalceopla discalis*). On the cliffs on Goat Mountain above Going-to-the-Sun Chalets, Glacier National Park, Montana (*Chalceopla ovata*).

HOST. Adults often associated with various genera of Brassicaceae, especially on *Erysimum*, and more rarely with *Arabis* or *Thelypodium*, where females oviposit into young seed pods (Powell and Opler 2009). In the material examined below, Pellmyr also records a female nectaring/ovipositing in capsules of *Sisymbrium altissimum* L. near Coulee City, Washington. Adults have also been collected numerous times on *Erysimum capitatum* (Douglas ex Hook.) Greene and on *Descurainia richardsonii* O. E. Schultz, *Lepidium* sp., *Thysanocarpus* sp., as well as on Boraginaceae: *Phacelia egea* (Greene ex Brand) Greene ex J. T. Howell, and Saxifragaceae: *Lithophragma parviflorum* Hook (Nutt.).

FLIGHT PERIOD. Mid-March (in southern latitudes and lower elevations) to late July (in northern latitudes and higher elevations), univoltine.

DISTRIBUTION. (Map 31). *Cauchas simpliciella* occurs widely over western North America from the provinces of Alberta and British Columbia in Canada, south as far as San Luis Obispo County, California, and east to Colorado and Idaho.

MATERIAL EXAMINED. 314 males, 246 females. CANADA: ALBERTA: Banff, Cascade Mt. Amphitheater, 7,000 ft. [2,134 m]: 1 ♀, 2 Jul 1925, D. Riley (USNM). Laggan, Mt.

St. Piran, 6,800–8,000 ft. [2,073–2,410 m]: 1 ♂, 10 Jul 1925, O. Bryant (USNM). Waterton Lakes: 1 ♀, 9 Jul 1925, J. McDunnough (CNC), 1 ♀, 9 Jul 1925, J. McDunnough (USNM). Waterton Lakes Park: 1 ♀, 18 Jun 1922, C. Young (CNC). Waterton Lakes National Park, Rowe Lakes Trail, 49.056°N, 114.067°W, 1,600–2,000 m: 1 ♂, 1 ♀, 8 Jul 2005, G. Pohl, USNM slide 33587♂ (GRP, USNM). BRITISH COLUMBIA: Hedley, Nickel Plate, 5,000 ft. [1,525 m]: 1 ♀, 13 Jul (CNC). Fitzgerald: 1 ♀, 12 Jun 1921, V. Carter ((USNM). Kamloops, Mt. Lolo: 1 ♂, 31 May 1938, G. Whalley (CNC). Kaslo: 1 ♂ (lectotype, *Chalceopla itoniella*), 1 ♂, 2 ♀ (paralectotypes, *Chalceopla itoniella*), USNM slides 20570 ♂, 20567 ♀, 6 Jun 1903, Cockle (USNM). Keremeos, Shingle Ck. Road: 1 ♂, 9 Jun 1935, A. Gartrell (CNC). Lillooet, Seton Lake: 1 ♀, 29 May 1926, J. McDunnough (CNC). Mt. Kobau, subsummit, 1,781 m: 1 ♂, 17 Jun 2014, afternoon sweeping. J. Landry & D. Holden, CNCLEP00121197, digital image captured, slide USNM 34732 (USNM). Osoyoos: 1 ♂, 2 ♀, 27–28 May 1938, G. Whalley (CNC), 1 ♂, 28 May 1938, G. Whalley (USNM). Telegraph Cr. Stikine R: 1 ♂, 16 Jun (USNM). Westbank: 1 ♂, 2 ♀, 19 May 1955, W. Wilson (CNC). UNITED STATES: CALIFORNIA: Alameda Co.: specific locality unknown: 1 ♂, 26 Apr 1908, G. Pilate (ANSP). Contra Costa Co.: Antioch: 7 ♂, 4 ♀, 7 Apr 1968, G. Gorelick, 4 ♂, 8 Apr 1967, G. Gorelick, 4 ♂, 2 ♀, 14 Apr 1977, J. Powell, on *Erysimum capitatum*, 1 ♀, 16 Apr 1967, G. Gorelick, 5 ♀, 19 Apr 1957, P. Opler, on *Erysimum* (UCB); 1 ♂, 19 Apr 1957, P. Opler (USNM); 1 mi. [1.6 km] E Antioch: 2 ♂, 3 ♀, 25 Apr 1965, W. Turner (UCB); 4 ♂, 1 ♀, 14 Apr 1977, J. Powell, on *Erysimum capitatum* (UCB). Antioch Dunes: 2 ♂, 1 ♀, 8 Apr 1967, P. A. Opler, *Erysimum*. Antioch: Antioch National Wildlife Refuge (LC): 1 ♂, 1 ♀, 21 Apr 1982, J. Powell, *Erysimum capitatum* (UCB). Del Norte Co.: Little Grayback Pass: 1 ♂, 9 Jul 1958, J. Powell, USNM slide 20553 ♂ (USNM); 1 ♂, 3 ♀, 24 Jul 1969, J. Powell (UCB). Fresno Co.: Auberry: San Joaquin River Gorge: 6 ♂, 4 ♀, 21 Mar 2009, V. Albu. (UCB). Jacalitos Canyon: 9 ♂, 3 ♀, 21 Mar 1977, J. Powell, on *Erysimum capitatum* (UCB). San Joaquin River, W of Herndon: 1 ♂, 1 ♀, 3 Apr 1970, J. Powell, on *Erysimum capitatum* (UCB). Glenn Co.: Plaskett Meadows, 6,300 ft. [1,920 m]: 2 ♂, 1 ♀, 14 Apr 1972, J. Powell (UCB). Humboldt Co.: Six Rivers National Forest, Board Camp Mtn., 4,700 ft. [~440 m], on FR4N38 1 mi. [1.6 km] west of FR1: 8 ♂, 14 Jul 2005, R. Wielgus, diurnal, observed from late afternoon to sunset flying above Euphorbs and attracted to Yarrow, slide USNM 33276 (USNM). Inyo Co.: Argus Mtn Range: Homewood Canyon: 1 ♀, 12 Mar 2005, V. & M. Albu (UCB). Kern Co.: Havilah, 3,000 ft. [915 m]: 1 ♂, 28 Apr 1964, J. Powell (UCB). Along Kern River: 2,000 ft. [610 m]: 1 ♂, 17 Apr 1977, 1 ♂, 24 Mar 1979, 2 ♂, 29 Mar 1990, 1 ♀, 29 Mar 1994, 1 ♂, 11 Apr 1995, 1 ♀, 4 Apr 1996, 2,200 ft. [671 m]: 1 ♂, 182.2, 1 ♂, 31 Mar 1985, 1 ♂, 28 Mar 1987, Ron H. Leuschner (UCB). Tehachapi Mtn. Park, 8 km S Tehachapi, 5,000 ft. [1,525 m]: 5 ♂, 1 ♀, 16 Jun 1980, DeBenedictis ♀ S. Meredith; Tehachapi Mtn. Park: 1 ♂, 1 ♀, 16 Jun 1981, Powell, on *Erysimum capitatum*; Tehachapi Mtn. Park: 1 ♂, 3 ♀, 23 Jun 1982, DeBenedictis ♀ Powell; Tehachapi Mtn., 5,500–6,000 ft. [1,675–1,830 m]: 1 ♂, 1 ♀, 17 Jun 1981,

- DeBenedictis ♀ Powell (UCB). 3 mi. [4.8 km] W Wofford Hts: 1 ♂, 3 ♀, 29 Apr (UCB). Lake Co.: 4 mi. [6.4 km] W Finley: 28 ♂, 6 ♀, 3 Apr 1962, J. Powell (UCB); 2 ♂, 1 ♀, 3 Apr 1962, J. Powell (USNM). Lassen Co.: Laufman Sta. 3 mi. [4.8 km] SE Milford, 5,100 ft. [1,555 m]: 1 ♀, 17 May 1982 J. Powell (UCB). Los Angeles Co.: Los Angeles: 1 ♀, Apr (USNM). Pasadena: Eaton Canyon Wash: 1 ♀, 25 Mar 1965, R. H. Crandall (UCB). Madera Co.: Lewis Creek Trail, Sierra N. F., Oakhurst: 1 ♀, 4 May 2018, V. Albu; O'Neal's: 1,500 ft: 4 ♂, 1 ♀, 24 Mar 2009, 1 ♂, slide 34424 ♂, V. & M. Albu (USNM), 1 ♂, 4 ♀, 10 Apr 2010, V. Albu, 1 ♂, 1 ♀, 5 Apr 2011, V. & M. Albu, 2 ♀, 8 Apr 2012, 1 ♀, 20 Apr 2018, slide 34799 ♂, V. Albu; Rt. 235, Wishon Powerhouse, 2 ♀, 17 Apr 2010, V. & M. Albu (UCB, USNM). Marin Co.: 5 mi. [8 km] SE Nicasio: 5 ♂, 8 ♀, 13 Apr 1968, P. Opler, *Thysanocarpus* (UCB); 1 ♂, 13 Apr 1968, P. Opler, USNM slide 20557 ♂ (USNM). Mariposa Co.: El Portal: 2,100 ft. [640 m]: 1 ♂, 16 Apr 1976, R. Leuschner (UCB). Mendocino Co.: Head of Noyo River: 1 ♀, 8–11 Jun 1871, Walsingham (BMNH). Placer Co.: Colfax: 14 ♂, 5 ♀, Apr, A. Vachell, USNM slide 20540 ♂ (USNM). San Benito Co.: Big Panoche Creek, San Benito–Fresno Co. line: 1 ♂, 17 ♀, 21 Apr 1967, J. Powell, *Erysimum capitatum* (UCB); 1 ♂, 1 ♀, 21 Apr 1967, J. Powell, USNM slide 20552 ♂, *Erysimum capitatum* (USNM). Limekiln Canyon, SW of Paicines: 1 ♂, 1 ♀, 24 Apr 1968, J. Powell (UCB). Limekiln Road, 5 mi. [8 km] SW of Paicines: 16 ♂, 7 ♀, 24 Mar 1966, J. Powell, J. Powell No. 66 C 24 (UCB); 3 ♂, 1 ♀, 24 Mar 1966, J. Powell, USNM ♂ slides 20551, 20554, 20539 (USNM). Monterey Co.: 4 mi. [6.4 km] E Arroyo Seco Guard Station, 650 ft. [198 m]: 2 ♂, 6 ♀, 9 Apr 1975, P. Rude, J. Chemsak (UCB). 1 mi. S Jamesburg: 2,900 ft. [884 m]: 1 ♂, 2 ♀, Chemsak, Powell; 1 ♂, 5 May 1975, Chemsak, Powell & Szerlip (UCB). Paloma Creek, 3 air mi. [4.8 km] NE Arroyo Seco Guard Station, 900 ft. [274 m]: 6 Guard Station, 650 ft. [198 m]: 6 ♂, 15 ♀, Powell ♀ Chemsak; 5 air mi. [8 km] NE Arroyo Seco Guard Station, 800 ft. [245 m]: 1 ♀, 4 May 1975, Rogers ♀ Powell (UCB). 1 mi. [1.6 km] S Jamesburg, 2,900 ft. [884 m]: 3 ♂, 2 ♀, 5 May 1975, Powell, Chemsak, Szerlip (UCB). 2.4 km SE Jamesburg, T18S R4E S19NE, 960 m: 3 ♂, 2 ♀, 2–5 May 1988, O. Pellmyr, *Quercus chrysolepis* forest, USNM slide 34468 (USNM). Plumas Co.: Squirrel Creek, 8 mi. [12.8 km], E Quincy, 3,900 ft. [1,189 m]: 1 ♂, 15 May 1982 (UCB). Thompson Creek: 4 mi. [6.4 km] SE Quincy: 3,500 ft. [1,067 m]: 2 ♂, 3 ♀, on # 1428, 15–20 May, 2 ♂, assoc. # 1428, 1 ♂, 15 May 1982, Feather River at Seneca: 3,700 ft. [1,128 m]: 7 ♂, 29 May 1982, J. A. Powell (UCB). San Benito Co.: 5 mi. [8 km] SW Paicines Lime Kiln Rd: 4 ♂, 3 ♀, 24 Mar 1966, J. Powell, A. Slater & J. Wolf (UCB). San Benito: Big Panoche Ck: 1 ♂, slide USNM 34717 (USNM), 7 ♀, 21 Apr 1967, J. Powell, *Erysimum capitatum* (UCB, USNM). San Luis Obispo Co.: Croker Spring Road, Carrizo NM Tremblor Range, 1 ♂, 34425, 1 ♂, on wild mustard flowers, 2 ♀, 18 Apr 2009, V. & M. Albu (USNM). Carrizo Plain National Monument: 1 ♀, 19 Apr 2009, V. & M. Albu (USNM). Paso Robles: 1 ♂, 1 ♀, 2 Apr 1977, J. Powell (UCB). Santa Barbara Co., Colson Canyon Rd: 3.2 km N Tepusquet Peak: grassy oak slope: 460 m, 2 ♂, 22 Mar 1989, O. Pellmyr & J. N. Thompson, around *Lepidium ?dictyotum* (UCB). Figueroa Mt. Rd: Los Olivos: 1,200 ft., [366 m]: 1 ♀, 16 Apr 2011, V. & M. Albu (UCB). Shasta Co.: Platina: at intersect. Rte 36 & Redding Rd, 680 m, shrubby oak forest, 1 ♀, 29 Apr 1989, O. Pellmyr, on *Lepidium*, R9WT29NS16SW (USNM). Siskiyou Co.: Hockaday Spr. 5 km SW Etna, 4,600 ft. [1,400 m]: 2 ♂, 1 ♀, 24 Jun 1980, J. Powell (UCB). Shasta Retreat: 1 ♂, 2 ♀, 1–7 Jun, USNM slide 20541 ♂ (USNM). Solano Co.: Cold Canyon Reserve (UCNRS): 2 ♂, 1 ♀, 21 Mar 1992, J. Powell (UCB). Sonoma Co.: The Geysers: 1 ♀, May 1939, E. Johnston (USNM). Stanislaus Co.: Del Puerto Canyon, 20 mi. [33 km] W. Patterson: 1 ♂, 19 Mar 1969, J. Powell (UCB); 1 ♂, 19 Mar 1969, J. Powell, USNM slide 20556 ♂ (USNM). Del Puerto Canyon at N Fork Del Puerto Creek, 900–1,200 ft. [275–365 m]: 1 ♂, 9 Apr 1977, J. Powell (UCB). Stanislaus Co.: Del Puerto Canyon Mine area: 1 ♂, 1 ♀, 1 May 1975, David Bauer (UCB). Trinity Co.: Hayfork Ranger Station, 2,300 ft. [700 m]: 9 ♂, 1 ♀, 22–23 May 1973, J. Powell, on *Phacelia egenae* (UCB). 5 air mi. [8 km] SE Hayfork: 5 ♂, 4 ♀, 25 May 1973, J. Powell, on *Erysimum capitatum* (UCB). 6 air mi. [9.6 km] NE Hayfork: 6 ♂, 3 ♀, 20 May 1975, J. Powell (UCB). 8 air mi. [13 km] W Hayfork, Buttercreek Meadows, 3,750 ft. [1,145 m]: 11 ♂, 3 ♀, 20–21 May 1973 (UCB). 1 mi. [1.6 km] SW Hayfork Summit, 3,300 ft. [1,005 m]: 2 ♂, 2 ♀, 20 May 1973, J. Chemsak (UCB). Tulare Co.: 2 mi. [3.2 km] E Johnsondale: 1 ♂, 27 Apr 1964, R. Langston (UCB). Tuolumne Co.: North Fork, Tuolumne River. 3 mi. [4.8 km] NE Tuolumne: 4 ♂, 1 May 1961, 1 ♀, 8 May 1961, 27 ♂, 18 ♀, 13 May 1961, Brown ♀ MacNeil (CASC). COLORADO: Eagle Co.: Vail Pass, 10,600 ft. [3,232 m]: 4 ♀, 4 Jul 1982, R. Leuschner (UCB). Larimer Co.: Red Feather Lakes: 1 ♂, 29 May 1975, P. Opler, DRD slide 4639 (UCB). IDAHO: Latah Co.: 6 mi. [9.6 km] NE Moscow: 3 ♂, 29 Jun 1975, Turner & J. Powell, USNM slide 34725 ♂ (UCB, USNM). Nez Perce Co.: Lewiston: 1 ♂, J. Clarke, USNM slide 20571 ♂ (USNM). Shoshone Co.: Pine Creek, 2,600 ft. [790 m]: 2 ♂, 15–21 Jun (CM). MONTANA: Beaverhead Co.: Lemhi Pass, 7,340 ft. [2,235 m]: 1 ♂, 2 ♀, 30 Jul (USNM). Flathead Co.: Glacier National Park, on the cliffs on Goat Mountain above Going-to-the-Sun Chalets: 1 ♀ (holotype, *Chalceopla ovata*), 18 Jul 1920, A. Braun, ♀ slide DRD 1182; 1 ♂, 1 ♀, 23 Jul 1920, A. Braun (ANSP). Glacier National Park, The Garden Wall, 7,000 ft. [2,135 m]: 4 ♂, 4 ♀, 30 Jul 1973, E. Jäckh (USNM). OREGON: Specific locality unknown: 1 ♂, slide USNM ♂ 1318 (USNM). Baker Co.: Baker, Pine Creek: 1 ♂, 19 Jun (USNM). Benton Co.: Mary's Peak: 2 ♂, 27 Jun 1979, J. Doyen (UCB). Jackson Co.: 11.5 mi. [18.5 km] E Ashland: 1 ♂, 1 ♀, 3 May 1970, J. Clarke (USNM). Rogue River National Forest, 2 mi. [3.2 km] N. Bull Gap: 3 ♂, 3 ♀, 3 Jul 1970, Dietz & Rude (UCB). Josephine Co.: Rogue River: 1 ♂ (lectotype, *Chalceopla simplicella*), 7 May 1872, Walsingham, ♂ slide DRD 2495; 1 ♂, 1 ♀ (paralectotypes, *Chalceopla simplicella*), 4–7 May 1872, Walsingham (BMNH); 1 ♂ (paralectotype, *Chalceopla simplicella*), 7 May 1872, Walsingham, 2 Jun, Walsingham, DRD slide ♂ 1374 (BMNH). Klamath Co.: Crater Lake: 1 ♂, 16–23 Jul, USNM slide 20568 ♂ (USNM). UTAH: Cache Co.: North slope in Logan Canyon,

~5,500 ft. [1,677 m], near Logan, 1 ♀ (holotype, *Chalceopla discalis*), 26 Jun 1924, A. Braun, slide DRD 1183 ♀ (ANSP). WASHINGTON: Asotin Co.: Weissenfels Ridge Rd, 16 km NNE Anatone roadside among pasture: 1 ♂, DRD 34426, 10 May 1987, on *Descurainia ?richardsonii*, 750 m, T9N R46E S14MW; Montgomery Ridge: 900 m: 4 ♀, 3 May 1987, Olle Pellmyr, steppe vegetation, on *Descurainia richardsonii*, 8TN R46E S24SE (UCB, USNM). Benton Co.: Hanford Works, 640 ft. [195 km]: 2 ♀, 16 Apr 1952, J. Davis (CU). Ferry Co.: Columbia Mt. 6,500 ft. [1,980 m]: 2 ♂, 1 ♀, 23 Jul 1962, J. Clarke (USNM). Grant Co.: Ephrata: Devil's Canyon: 1 ♂, slide USNM 34721 (USNM), 19 Apr 1987, O. Pellmyr & W. F. Wehling, *Artemisia* steppe, on or nr. *Lithophragma tenellum*, T21N R26E S8NW. 4.6 km S Coulee City Rd 34 & Pinto Ridge Rd: 1 ♀, 23 Apr 1987, O. Pellmyr, J. N. Thompson, & W. F. Wehling, disturbed steppe, outcrop, T24N R28E S14NE. 1 ♀, slide USNM 34722 (USNM), 1 ♀, 7 May 1987, Olle Pellmyr, nectaring/ovipositing in capsules of *Sisymbrium altissimum*, T21N R26E S8NW (USNM); 4 mi. S Coulee City, Pinto Ridge Rd × Rd 34 NE, T24N R28E S14NW, 2 ♂, 9 May 1989, slide USNM 34470 (USNM). Kittitas Co.: Easton: 1 ♂ (USNM). Whitman Co.: Almota: 1 ♂, 3 ♀, 26 Apr 1931, J. Clarke (USNM). Cow Creek Canyon: 1 ♀, 18 Apr (CNC). Almota: 1 ♂, 1 ♀, 6 May 1972, W. J. Turner; Snake River: 1.3 km above Granite Point: 250 m: 2 ♂, 4 ♀, 5 Apr 1987, 10.1 km above Granite Point: 250 m: 1 ♀, 13 Apr 1987, steppe community, on *Lithophragma parviflorum*; 600 m above Granite Point: 220 m: 1 ♂, 30 Mar 1990, herb-rich grassy steppe, T13N R44E S24NW, Olle Pellmyr (UCB, USNM). Palouse Falls: 1 ♀, 3 May 1931, J. Clarke (CU). Pullman: 1 ♂, 11 May 1932, J. Clarke (CU); 1 ♂, 3 ♀, 8 May–9 Jul 1930, J. Clarke, F. Hinman (USNM); 1 ♂, 9 Jul 1932, digital image captured, slide USNM 34734, J. Clarke (USNM). Yakima Co.: Satus Creek: 1 ♀, 28 May (CNC). WYOMING: Albany Co.: Centennial: 7,200 ft. [2,195 m]: 1 ♂, 2 ♀, 15–16 July 1982, Ron Leuschner (UCB). Teton Co.: Jackson Hole, Grand Teton National Park: 1 ♂, 1 ♀, 3 Jul 1959, A. Braun (ANSP); 1 ♂, 3 Jul 1959, A. Braun, USNM slide 20558 ♂ (USNM).

DISCUSSION. Although sometimes variable in forewing pattern and superficially resembling a few other western species of *Cauchas*, this species is easily identified by characters of the male genitalia. Unless accompanied by associated males or COI data, female *C. simpliciella* are often impossible to identify with confidence on the basis of morphology. Most variation observed involves wing pattern, which is the most extreme within the genus. This may in part reflect the relatively broad distribution of the species. Of the large series of 556 specimens examined, nearly all were immaculate, with the forewing color ranging from a pale bronzy brown to a dark, purplish fuscous. Only nine specimens, including the holotypes of *C. discalis* and *C. ovata*, were variously spotted. Most of these specimens exhibited a forewing pattern similar to that described for *C. ovata* (Braun, 1921) and *C. discalis* (Braun, 1925), both synonymized herein. One male from Pullman, Washington, possessed a forewing pattern in which the discal and marginal spots were broadly confluent. The other four specimens examined from Pullman were immaculate.

The spotted form has been observed only from the more northern part of the species' range or from higher elevations. Only three slightly maculate individuals were observed within the large series from California.

The male genitalia, with its broadly expanded sacculus and numerous, large, subapical cornuti, provides the easiest means for recognizing the species. The greatest variation observed within the genitalia involves the relative length of the cornuti, with the majority ranging in length from 0.25× to 0.75× the maximum width of the phallus.

Walsingham (1880) originally proposed *Cauchas simpliciella* in *Adela*. He believed it to be allied to the European *Cauchas rufimitrella* (Scopoli) and *Adela violella* (Treitschke), both with antenna considerably longer than the forewing in the male. A holotype was not designated by Walsingham, nor were the number of syntypes mentioned. He did state that “♂ and ♀” were collected in southern Oregon during May 1872. Three males and one female collected along the Rogue River in southern Oregon between May 4 and 7 and deposited in the BMNH have been recognized as syntypes. One specimen bears a “type” label and the other three “paratype” labels. The male labeled as type has been designated a lectotype and the remaining specimens as paralectotypes. Two additional males from the type locality and apparently collected by Walsingham (1880) are deposited in the USNM. Although probably included by Walsingham in his original type series, these specimens bear the date “VI. 1872” and thus are excluded as syntypes.

Chalceopla itoniella was proposed by Busck (1915) without any reference to a type designation or type series other than a USNM catalogue number 19250, a locality (Kaslo, British Columbia), and collector (J. W. Cockle). Although one male is labeled “type” and the remaining specimens as “cotypes,” none bore a type number 19250. Instead, the series are labeled consecutively from 19021 to 19024. To avoid possible future confusion, we have selected the male “type” as the lectotype and the remaining specimens as paralectotypes. Because the male genitalia of *C. itoniella* agree with that of *C. simpliciella*, this name has been synonymized under the latter. Whereas the type series of *simpliciella* represents the darker extreme for the species, the type series of *itoniella* represents the paler, more bronzy gray color variation.

Similarly, Braun's names, *C. discalis* and *C. ovata*, for the maculated form of this species are also synonymized. Although these names were based on single females, they closely agree in wing pattern with *simpliciella* males from Colorado.

***Cauchas sedella* (Busck), new combination**

FIGURES 207–209, 298, 329, 393; MAP 31

Incurvaria sedella Busck, 1915: 93.—Barnes and McDunnough, 1917: 196, no. 8439.

Lampronia sedella (Busck).—McDunnough, 1939: 109, no. 9799.

Chalceopla sedella (Busck).—Davis, 1983: 4, no. 214.

ADULT. (Figures 207–209). Wing expanse: ♂, 8–11 mm; ♀, 8.5 mm.

Head: Stramineous with a slight admixture of black hairs near antennal bases and inner margin of eyes; a dark concentration of hairs usually forming a fuscous band across vertex between antennal bases. Antenna with dorsum sometimes entirely covered by fuscous scales; apical 6–12 segments frequently white. Maxillary palpus and base of haustellum white. Labial palpus mostly white with apical segment partially or entirely fuscous; second segment with 6–8 dark hairs arising near apex.

Thorax: Dorsum fuscous with a bronzy luster. Venter fuscous with a silvery gray iridescence. Legs fuscous above, whitish ventrally. Forewing fuscous with a pronounced golden bronzy iridescence; a single, narrow, slightly oblique, pale yellow band at distal third; band is frequently interrupted near middle. Hindwing uniformly fuscous, slightly darker than forewing, with a slight purplish luster.

Abdomen: (Figure 329). Fuscous above and below, with a slight bronzy iridescence; occasionally with a faint, silvery gray luster underneath. Female with seventh sternite approximately 3.0–3.1× length of sixth; eighth sternite lightly pigmented, with dark sclerotizations laterally.

Male Genitalia: (Figure 298). Uncus reduced, subtruncate. Vinculum-saccus relatively long, nearly 2× length of valva; saccus broadly rounded. Valva broad at base, abruptly constricted to form long, slender cucullus; apex of cucullus curved ventrally. Juxta with anterior end subsagittate, apex broadly rounded; lateral processes reduced; posterior half with lateral margins subparallel. Phallus curved, with base not expanded; apex asymmetrical, flared to one side as in *C. cockerelli*, acute; with 1–2 small, apical cornuti.

Female Genitalia: (Figures 329, 393). Apex of ovipositor compressed; dorsal and ventral cutting edges approximately equal in length, symmetrical, and not serrated. Vestibulum reduced in size, walls relatively smooth, dorsal plate distinct, located dorsally in pouch, and more or less quadrate in outline.

TYPE. Lectotype, ♀ (present designation), bearing following 5 labels: (1) “Boulder Cañon [Canyon], Colo., June 21 (Cockerell)”; (2) “on *Sedum stenopetalum*”; (3) “*Incurvaria sedella* Busck, cotype”; (4) “Photo, D. R. Davis”; and (5) “Lectotype ♀, *Incurvaria sedella* Bsk., USNM 19289, by D. Davis 1975” (USNM).

TYPE LOCALITY. Boulder Canyon, Colorado.

HOST. Unknown. Adults collected “on *Sedum stenopetalum* Pursh.” Crassulaceae (from specimen label).

FLIGHT PERIOD. Late June to late July; univoltine.

DISTRIBUTION. (Map 31). Known only from the Rocky Mountains of Colorado and northern New Mexico.

MATERIAL EXAMINED. 20 males, 6 females. UNITED STATES: COLORADO: Boulder Co.: Boulder Canyon: 1 ♀ (lectotype), 21 Jun, Cockerell, 2 ♀ (paralectotypes) 21 Jun, Cockerell (USNM). Fremont Co.: Florissant: 1 ♂, 21 Jul (LACM). Jefferson Co.: Chimney Gulch, Golden: 6 ♂, 1 Jul 1904, Osler, USNM ♂ slides 20559, 20560 (USNM). Larimer Co.: Moraine Park, Rocky Mtn.

National Park: 1 ♂, 17 Jun 1991, P. Opler, by net (CSU). Twin Oaks, 8,200 ft. [2,499 m], Rocky Mtn. National Park: 1 ♀, 17 Jun 1990, P. Opler (CSU). San Miguel Co.: Trout Lake, 9,800 ft. [2,988 m]: 6 ♂, 3 ♀, 17 Jul 1937, A. Klots (AMNH); 1 ♂, 17 Jul 1937, A. Klots (CU); 1 ♂, 17 Jul 1937, A. Klots, slides USNM 20561, 20562 ♂ (USNM); 2 ♂, 17 Jul 1937, A. Klots, digital image captured, slides USNM 20566, 20569 ♂ (USNM). San Juan Co.: Silverton: 1 ♂, 16–23 Jul, USNM ♂ slide 20563 (USNM). NEW MEXICO: San Miguel Co.: Las Vegas: 1 ♂, 4 Aug (LACM). Sangre de Cristo Mts.; near Cowles: 1 ♂, 24 Jul 1939, A. Braun, slide 1178 ♂ (ANSP).

DISCUSSION. *Cauchas sedella* may be distinguished from its nearest relative, *C. cockerelli*, by features of the male genitalia. The valvae of *C. sedella* terminate in a ventrally curved cucullus, whereas those of *C. cockerelli* are straight. Also the phallus is more curved in *C. sedella* and lacks the broadly expanded base of the phallus observed in *C. cockerelli* but shares with its relative the asymmetrical expansion at the apex of the phallus. In all the material of *Cauchas* examined, *C. cockerelli* appears unique in possessing a single, rather large, yellowish spot on the forewing along the outer third of the hind margin. In contrast, *C. sedella* exhibits a transverse yellow band, which frequently is interrupted, at this position. Certain maculate specimens of *C. simpliciella*, such as those from Trout Lake, Colorado, may superficially resemble specimens of *C. sedella* with the interrupted band; however, the costal spot of *C. simpliciella* is definitely round and is not contiguous with the costal margin as in the case with *C. sedella*. More significantly, the apex of the male valva is more downcurved and the base of the valva less broad in *C. sedella*, and the phallus possesses fewer cornuti than in the phallus of *C. simpliciella*.

Because a holotype was never designated in the original description of *C. sedella*, we have selected a lectotype for this species. Three female syntypes and a wing slide of one male syntype, all deposited in the National Museum of Natural History, are known for *C. sedella*; however, none of these previously bore the USNM catalogue number 19289 mentioned by Busck (1915). All syntypes are from the type locality (“Boulder Cañon” [Canyon], Colorado) and were collected on *Sedum stenopetalum* (Crassulaceae) by T. D. A. Cockerell. One was labeled by Busck as the type and the others as cotypes. Busck apparently intended the one he labeled “type” to represent the holotype; however, because of its superior physical condition, I have selected one of his “cotypes” as the lectotype. The wing slide of the male paralectotype contains all four wings; unfortunately, the whereabouts of the remainder of the specimen is not known.

It is not known if the plant association provided by Cockerell actually represents the host; however, the fact that three specimens were collected on this plant probably indicates that it is an important nectar source. According to Rydberg (1906), *Sedum stenopetalum* occurs widely over the montane sections of western North America at elevations between 4,000 [1,220 m] and 12,000 [3,660 m] feet.

A series of nine specimens of *C. sedella*, collected by A. B. Klots at Trout Lake, Colorado, from an elevation of 10,000 feet

[3,050 m], represent one of the highest altitudes that adelids have been collected within North America. Three specimens of *C. simpliciella* were also collected with this species from that locality.

***Cauchas cyanella* (Busck), new combination**

FIGURES 41, 45, 51, 210, 299, 330, 394; MAP 32

Incurvaria cyanella Busck, 1915: 92.—Barnes and McDunnough, 1917: 196, no. 8437.

Cyanauges cyanella (Busck), Braun, 1919: 24.

Chalceopla cyanella (Busck), Forbes, 1923: 76.—Braun, 1924: 238.—Philpott, 1927: 726, 729.—Braun, 1933: 230, 234.—McDunnough, 1939: 109, no. 9811.—Davis, 1983: 4, no. 213.

ADULT. (Figure 210). Wing expanse ♂, 9.5–10 mm; ♀, 9.5–11.5 mm.

Head: (Figure 41). Reddish ochreous. Antenna with scape and dorsum of flagellum fully covered with fuscous scales. Maxillary palpus reddish ochreous. Basal third of haustellum clothed with pale ochreous scales dorsally. Labial palpus entirely pale ochreous to stramineous; second segment with a tuft of usually 6–8 divergent, stramineous hairs near apex.

Thorax: Dorsum light fuscous with prominent bronzy iridescence. Venter and legs grayish fuscous with bronzy iridescence. Forewing similar in color to dorsum, immaculate, fuscous with golden-bronze luster. Hindwing nearly as dark as forewing, fuscous with mostly purplish iridescence; costal margin with bronzy iridescence.

Abdomen: (Figure 330). Fuscous above, more grayish ventrally, slightly iridescent. Female with seventh sternite 3.1× length of sixth; eighth sternite of uniform color, lightly pigmented.

Male Genitalia: (Figure 299). Uncus reduced, subtruncate. Vinculum-saccus moderately long, broad, approximately 1.5× length of valva; anterior end of saccus broadly rounded. Valva with base as broad as long, gradually narrowing apically, a narrow ridge extending along ventral margin from base of sacculus to cucullus; apex of cucullus with small ventral lobe. Juxta with anterior half sagittate, anterior end narrowly rounded, subacute; posterior half with lateral margins subparallel, apex slightly bifid. Phallus with base moderately flared; vesica with approximately 30 minute, short, conical cornuti.

Female Genitalia: (Figures 330, 394). Apex of ovipositor compressed, acute, asymmetrical, with dorsal edge nearly straight and ventral edge oblique, minutely serrulate; ventral edge slightly indented at junction with shaft. Vestibulum of moderate size, uniformly pigmented; vaginal plate indistinct.

TYPE. Lectotype, ♀ (present designation) bearing following 4 labels: (1) “Oak Station, Alleg. Co. Pa., V-26-12, Fred Marloff”; (2) “Type No. 19287 USNM”; (3) “*Incurvaria cyanella* Busck, Type”; and (4) “Lectotype ♀, *Incurvaria cyanella* Bsk., by D. Davis 1975” (USNM).

TYPE LOCALITY. Oak Station, Pennsylvania.

HOST. The only reputed host association for *C. cyanella* is from a single adult female collected by E. P. Darlington at New Lisbon, New Jersey (see Material Examined below), that bears a label “emerged upper side *Q. marilandica*.” Because this implies that the moth actually emerged from inside the leaf, this record is questionable. Most likely the moth was simply resting on the leaf and was mistakenly assumed to have emerged from the leaf.

FLIGHT PERIOD. Early May to late June; univoltine.

DISTRIBUTION. (Map 32). Known only from the eastern United States, from New Jersey west to Ohio.

MATERIAL EXAMINED. 20 males, 33 females. **UNITED STATES:** **NEW JERSEY:** Burlington Co.: New Lisbon: 1 ♀, 27 May 1947, E. P. Darlington, emerged upper side *Q[uercus] marilandica* (ANSP). Essex Co.: Specific locality unknown: 1 ♂, 3 ♀, 8 Jun 1907 (BMNH); 1 ♂, 11 May 1921, W. D. Kearfott (USNM); Essex Co.: Essex County Park: 1 ♂, June 1922, W. D. Kearfott (USNM). **OHIO:** Cincinnati: 1 ♂, 7 May 1903, A. Braun (ANSP); 1 ♀, 7 May 1903, A. Braun (USNM). **PENNSYLVANIA:** Allegheny Co.: Oak Station: 2 ♂, 10 ♀, 20 May–2 Jun 1912, 2 ♀, 28 Jun 1911, F. Marloff (CM); 1 ♀ (lectotype), 21 May 1912, F. Marloff, 1 ♀ (paralectotype), 28 Jun 1911, F. Marloff, 2 ♂, 3 ♀, 20 May–28 Jun 1912, F. Marloff, USNM slides 20527 ♀, 20526 ♀, 20528 ♂ (USNM). Pittsburgh: 2 ♂, 15–18 May (ANSP); 1 ♂, 15 May, H. Engel (BMNH); 6 ♂, 8 ♀, 6–17 May, H. Engel (CM); 3 ♂, 3 ♀, 8–19 May, USNM slide 20524 ♂ (USNM).

DISCUSSION. *Cauchas cyanella* is sometimes confused with another, closely related species from the eastern United States, *C. dietziella*. The two may be easily distinguished on the basis of differences in the male genitalia, particularly in the form of the valvae. The general coloration of *C. cyanella* is also characteristic in being more brownish and generally paler than *C. dietziella*, which possesses a distinct metallic, golden-bronze iridescence.

Busck (1915: 92) did not state the number or sex of the specimens comprising the original type series but merely mentioned the type as “Cat. No. 19287, USNM.” It is evident from examining Busck’s original series that he probably did intend one particular specimen to be the actual holotype, but because of the omission of a definite designation in his description and of the manner in which he labeled his series, a formal lectotype selection is necessary. Only four female specimens, all in the collection of the National Museum of Natural History, are known to possess type labels. Although all labels bear the USNM number 19287, one specimen (which Busck probably intended as the holotype) possesses a label that reads “Type,” with the others stating “cotype.” The “type” and one “cotype” were collected at Oak Station, Pennsylvania, by Fred Marloff, thus agreeing with the only locality originally mentioned by Busck. A third “cotype” was collected in Cincinnati, Ohio, and the fourth from Beltsville, Maryland. The latter is not conspecific with the rest but represents instead a specimen of *Paraclemensia acerifoliella* (Fitch).

The specimen originally designated as “type” by Busck has been selected as the lectotype and the one “cotype” from Oak Station as the paralectotype. Because the remaining “cotype” from Cincinnati, Ohio, was not mentioned in Busck’s description of the species, it has no type status and has not been designated as a paralectotype.

***Cauchas trifascia* Davis and Medeiros, new species**

FIGURES 211, 212, 300, 331, 395; MAP 32

ADULT. (Figures 211, 212). Wing expanse: ♂, 8–10 mm; ♀, 8.5–10 mm.

Head: White, intermixed with a few dark hairs at vertex and a small dark concentration at inner margins of antennal sockets. Antenna entirely covered dorsally with fuscous scales. Maxillary palpus and base of haustellum white. Labial palpus white except for apical segment, which is partially tipped with fuscous; second segment with 2–4 dark hairs arising near apex.

Thorax: Dorsum bronzy brown. Venter white. Legs brown above, white beneath. Forewing bronzy brown, usually marked by 3, often incomplete, whitish fascia as follows: a narrow band at basal third of wing usually traversing wing, a rather broad band from distal third of hind margin extending usually more than halfway across wing, and a curved band at the distal fourth of costa extending diagonally almost to tornus. Hindwing mostly fuscous with a faint purplish iridescence; anal area with a slight suffusion of whitish scales, sometimes forming a faint white spot at margin of cell 2A; fringe uniformly grayish fuscous.

Abdomen: (Figure 331). Bronzy brown above with posterior margin of each segment bordered with white; mostly white beneath. Female with seventh sternite 3.1–3.2× length of sixth; eighth sternite without dark sclerotization, essentially unpigmented.

Male Genitalia: (Figure 300). Uncus indistinct, bluntly rounded. Vinculum-saccus long, over 2× length of valva; anterior end of saccus broadly rounded. Valva broad at base, tapering to a slender slightly curved cucullus; sacculus sharply indented halfway along ventral margin. Juxta with anterior half broadly sagittate, anterior margin abruptly tapering, acute; posterior half with lateral margins subparallel. Phallus with base broadly expanded; cornuti absent; apical third with dense covering of minute spinulae; apex simple.

Female Genitalia: (Figures 331, 395). Apex of ovipositor compressed, acute, somewhat asymmetrical with ventral edge more oblique; both dorsal and ventral edges minutely serrulate. Structure of vestibulum as shown in Figure 331; vaginal plate somewhat reduced, ventral in position.

HOLOTYPE. ♂, Apache Canyon, 1.5 mi. [2.4 km] E Hwy 33, 34.572°N, 119.389°W, elev. 3,465 ft. [1,056.4 m], Los Padres National Forest, Ventura Co., California (USNM).

PARATYPES. 41 males, 12 females. **UNITED STATES:** CALIFORNIA: Inyo Co.: Homewood Canyon, Argus Mts. Range: 1 ♂, 1 ♀, 12 Mar 2005, V. Albu, USNM slide 34724

♂ (UCB, USNM). Riverside Co.: Palm Desert, 1,100 ft. [289 m]: 1 ♀, 28 Mar 1982, R. H. Leuschner (UCB). San Bernardino Co.: Kramer Hills, San Bernardino County, California, 2 ♂, 1 ♀, 19 Apr 1958, J. Powell, genitalia slide DRD 2905, DRD 1368, ♀, USNM slide 20577 ♂, USNM slide 20576 ♀ (UCB, USNM); Hwy 178, 7 mi. [11.2 km] SE Trona: 1 ♂, 12 Mar 2004, V. & M. Albu (UCB). Johannesburg, 1 mi. [1.6 km] NE: 1 ♀, 15 Apr 1962, C. A. Toschi, USNM slide 16064 ♀ (USNM). Granite Mts., 3 mi. [4.8 km] ESE Apple Valley: 3 ♀, 13 Apr 1964, R. Langston (UCB). San Diego Co.: Anza Borrego Desert State Park, Plum Canyon, 695 m, 33.107501°, –116.428863°, 28 ♂, 5 ♀, day collected, 19 Mar 2017, C. Grinter & D. Bettman, specimens noted as “flying among branches of *Larrea tridentata* (DC.) Coville, above an understory of *Phacelia distans* Benth. Plants IDed by Aaron Schusteff,” ♂ genitalia preparation #CCG_00097, CASENT 8373950 (CASC). Ventura Co. Apache Canyon, same data as holotype: 9 ♂, 26 Mar 2016, P. M. Jump (USNM).

HOST. Unknown.

FLIGHT PERIOD. Mid-March to mid-April; univoltine.

DISTRIBUTION. (Map 32). Presently known from Ventura, Inyo, San Bernardino, and Riverside Counties, California.

ETYMOLOGY. The species name is derived from the Latin *tres* (three) and *fascia* (band, stripe), in reference to the three white fascia present on the forewing of this species.

DISCUSSION. This species may be easily distinguished from all other members of *Cauchas* on the basis of both maculation and male genitalia characters. The only species that approaches it closely in maculation is *C. wielgusi*, which is currently known primarily from Arizona, with a single record from the San Gabriel Mountains of Los Angeles County, California. As discussed under *wielgusi*, both species possess a white, basal transverse fascia and two, more distal, incomplete white fasciae. The apical fascia from the costal margin is longer and more oblique in *C. trifascia* than in *C. wielgusi*. The valvae of the male genitalia are unique in having the ventral margin of the sacculus produced into a conspicuous, acute lobe, compared especially to the much larger, more rounded saccular lobes present in *C. wielgusi*, *C. excavata*, and *C. lobata*.

***Cauchas lobata* Davis and Medeiros, new species**

FIGURES 213–215, 301, 332, 396; MAP 32

ADULT. (Figures 213–215). Wing expanse: ♂, 8–11 mm; ♀, 8–11.5 mm.

Head: Ochreous with scattered black hairs especially dense at vertex. Antenna entirely covered dorsally with dark fuscous scales. Maxillary palpus and base of haustellum light fuscous to grayish. Labial palpus with second segment predominantly whitish but heavily irrorated with fuscous at apex and exterior sides, with numerous, erect, scattered, black hairs ventrally; apical segment entirely fuscous.

Thorax: Dorsum dark fuscous with a coppery luster. Venter light fuscous to lustrous gray. Legs almost entirely fuscous, with a slight amount of grayish white ventrally. Forewing dark fuscous with a slight bronzy green to coppery red iridescence; maculation variable, either immaculate or with a small whitish spot on hind margin near tornus; a similar spot sometimes present near outer third of costal margin. Hindwing as dark as forewing but with a slight purplish luster.

Abdomen: (Figure 332). Dark fuscous above; light fuscous, more grayish ventrally. Seventh sternite of female approximately 3× length of sixth; eighth sternite with a broad, darkly pigmented band gradually widening ventrally to become about one-half as wide as entire segment.

Male Genitalia: (Figure 301). Uncus with apex truncate. Vinculum-saccus broad, elongate; approximately 2× length of valva; anterior end of saccus broadly rounded. Valva moderately broad at base; sacculus extended posteriorly into a prominent, digitate lobe; ventral margin of valva deeply excavated dorsal to lobe with apical two-thirds of valva narrowing gradually to slender rounded cucullus. Juxta with anterior end sagittate, anterior margin narrowly rounded; posterior half with lateral margins subparallel. Phallus with base slightly broadened, rounded; apex asymmetrical, cornuti absent; a pair of short, slender anellar lobes present around apex of phallus; length of lobes ~equal to diameter of phallus.

Female Genitalia: (Figures 332, 396). Apex of ovipositor compressed, acute, asymmetrical with dorsal edge nearly straight and ventral edge longer, oblique, minutely serrulate; a minute, shallow, subapical indentation present ventrally. Vestibulum of moderate size, not elongate; vaginal plate sclerotized but not well defined.

HOLOTYPE. Leggett, Mendocino Co., California, ♂, 19 May 1966, coll. in copula, J. Powell (UCB).

PARATYPES. 66 males, 76 females. **CANADA:** BRITISH COLOMBIA: Wellington: 1 ♂, 12 May 1956, coll. R. Guppy (CPK). **UNITED STATES:** CALIFORNIA: Specific locality unknown: 1 ♀ (USNM). Alameda Co.: Berkeley Hills, 1,400 ft. [426.8 m], NE Oakland: 1 ♂, 1 ♀, 16 May 1963, J. Powell (BMNH); 2 ♂, 1 ♀, 10 May 1962, J. Powell, JAP 1499 ♂ (UCB); 1 ♂, 1 ♀, 12 May 1966, J. Powell (UCB); 2 ♀, 15 May 1964, J. Powell (UCB); 11 ♂, 13 ♀, 16 May 1963 (UCB); 1 ♂, 27 May 1966, J. Powell, ♂ genitalia slide USNM 34718 (USNM); 1 ♀, 3 Jun 1966, J. Powell (UCB); 1 ♂, 3 ♀, 14 May 1963, J. A. Chemsak (UCB); 1 ♀, 12 May 1966, J. Powell (USNM); 1 ♂, 4 ♀, 16 May 1963, ♀ genitalia on slides DRD 1160, 2514, USNM 16029 (USNM). Livermore, 5 mi. [8 km] E: 1 ♂, 15 May 1955, M. Washbauer, ♂ genitalia slide DRD 2507 (UCB). Humboldt Co.: Larabee Valley: 1 ♂, 2 Jun 1935, B. P. Bliven (CASC); 1 ♂, 16 Jun 1935, B. P. Bliven, ♂ genitalia preparation #CCG_00101 (CASC). Los Angeles Co.: San Gabriel Mts.: Horse Flats, 6,000 ft. [1,829 m] 1 ♀, 21 Jun 1958, C. Henne (USNM); San Gabriel Mts.: San Gabriel Canyon: 1 ♀, 28 Jun 1935, C. Henne (USNM). Mendocino Co.: Leggett: 4 ♂, 3 ♀, 14 May 1966, J. Powell, ♀ in copula with holotype (UCB); 1 ♂, 19 May 1966, J. Powell (CASC;

with an additional label stating "Paratype *Chalceopla lobata* D. Davis 1974"); 1 ♂, 1 ♀, 19 May 1966, J. Powell (USNM). Plumas Co.: Feather River at Seneca, 3,700 ft. [1,128 m]; 3 ♂, 19 May 1982, J. Chemsak (UCB). Squirrel Creek, 8 mi. E Quincy, 3,500 ft. [1,067 m]: 1 ♂, 15 May 1982, D. L. Wagner USNM ♂ slide 34718 (USNM). Thompson Creek, 4 mi. SE Quincy, 3,500 ft. [1,067 m]: 2 ♂, 2 ♀, 15 May 1982, D. L. Wagner, USNM slide 34688 (UCB, USNM). San Luis Obispo Co.: Nacimiento Dam: 3 ♀, 11 May 1965, J. Powell (UCB); 1 ♂, 11 May 1965, J. Powell, USNM slide 20581 ♂ (USNM). Siskiyou Co.: Mt. Shasta City: 1 ♂, 25 Jun 1958, J. Powell, USNM slide 20579 ♀ (USNM). Sonoma Co.: 2 mi. [3.2 km] E Healdsburg: 3 ♂, 6 ♀, 18 May 1966, J. Powell, ♂ genitalia slide DRD 2504 (UCB); 2 ♀, 18 May 1966, J. Powell (CASC; with an additional label stating "Paratype *Chalceopla lobata* D. Davis 1974"); 4 ♂, 2 ♀, 18 May 1966, J. Slater (UCB); 1 ♀, 18 May 1966, J. Slater, USNM slide 16027 ♀ (USNM); 2 ♂, 18 May 1966, J. Powell, USNM slide 20582 ♂ (USNM). Spring Mtn.: 5 ♂, 6 ♀, 13–26 May 1939, CNC; 2 ♂, 7 May 1939, 1 ♂, 2 ♀, 26 May 1939, 5 ♀, 29 May 1939, USNM slides 20768 ♂, 34693 ♂ (USNM). Stanislaus Co.: Del Puerto Canyon, 19 mi. [30.4 km] W Patterson: 3 ♂, 8 ♀, 23 May 1967, J. Powell (UCB); 1 ♀, 23 May 1967, J. Powell, USNM slide 16028 ♀ (USNM). Tuolumne Co.: North Fork Tuolumne River, 3 mi. [4.8 km] NE Tuolumne: 10 ♂, 5 ♀, 1 May 1961, J. Powell (UCB); 2 ♂, 1 May 1961, J. Powell, ♂ slide USNM 20465, 20580 (USNM).

HOST. Unknown; adults have been collected in flowers of *Achillea* (Asteraceae).

FLIGHT PERIOD. Early May to early June; univoltine.

DISTRIBUTION. (Map 32). This relatively common, widespread species occurs from British Columbia south along the Sierra Nevada Mountains and coastal ranges of California as far south as San Luis Obispo County.

ETYMOLOGY. The species name is derived from the Latin *lobatus* (lobed, having a rounded protuberance), in reference to the prominent saccular lobe present on the male valva.

DISCUSSION. *Cauchas lobata* is most easily recognized by the deeply lobed valvae of the male, a character that has suggested the specific name. The lobe, a digitate development of the sacculus, is more pronounced in this species than in either *C. trifascia* or *C. excavata* and more similar to that developed in *C. wielgusi*, a more southern species with trifasciate forewings. The females of *C. lobata* are less diagnostic but do normally possess a broad, darkly pigmented band across the eighth sternite similar to but broader than that found in *C. excavata* females and a rather indistinct, moderately darkened vaginal plate, two features that help to separate the females of this species from most other members of *Cauchas*.

The somewhat variable maculation demonstrated in this species appears to be random in occurrence and not associated by sex or geographical distribution. Approximately one-third of the 119 specimens examined were spotted to some degree, and this usually consisted of a solitary small whitish spot near the tornus of the forewing. A few specimens also possessed a smaller costal spot.

***Cauchas excavata* Davis and Medeiros,
new species**

FIGURES 216, 302, 333, 397; MAP 33

ADULT. (Figure 216). Wing expanse: ♂, 8–9.5 mm; ♀, 8.5–10 mm.

Head: Whitish, almost equally intermixed with black hairs. Antenna entirely covered dorsally with fuscous scales; underside of scape white. Maxillary palpus and base of haustellum white. Labial palpus white with apical half or more of third segment fuscous; second segment with a scattered brush of fuscous hairs ventrally.

Thorax: Dorsum fuscous with a bronzy brown luster. Venter silvery white. Legs fuscous above, silvery white underneath. Forewing uniformly fuscous with a bronzy-brown iridescence except for a slender, whitish spot slightly distal from middle of hind margin; spot frequently extended as a narrow, oblique band traversing up to one-third the width of wing. Hindwing as dark as forewing but with a slight purplish luster.

Abdomen: (Figure 333). Fuscous above; heavily suffused with white throughout in male ventrally; female with anterior 5 sternites white, sixth and seventh fuscous; seventh sternite of female approximately 3× length of sixth; eighth sternite with a relatively broad, irregular, darkly pigmented band, expanding ventrally.

Male Genitalia: (Figure 302). Uncus indistinct, slightly bilobed, usually folded ventrally under tegumen. Vinculum-saccus broad, elongate, approximately 2.5× length of valva; anterior end of saccus broadly rounded. Valva with base moderately broad, with sacculus produced ventrally into a rather short, rounded lobe; ventral margin distad of lobe deeply excavated, with valva terminating in a slender, rounded cucullus. Juxta with anterior half sagittate, anterior margin broadly rounded; posterior half with lateral margin slightly curved outward. Phallus with base moderately expanded; apex asymmetrical, with a short, rounded flap-like process from one side; cornuti absent.

Female Genitalia: (Figures 333, 397). Apex of ovipositor compressed, acute, slightly asymmetrical with ventral edge longer than dorsal, ventral edge minutely serrulate, nearly smooth; posterior apophyses abruptly expanding laterally immediately anterior of apex, with lateral margins correspondingly irregular, scalloped. Vagina moderately enlarged; vaginal plate rather distinct, darkly pigmented, dorsal in position.

HOLOTYPE. Mineral King, Tulare County, California, ♂, 24–30 Jun (USNM).

PARATYPES. 29 males, 17 females. **UNITED STATES:** CALIFORNIA: Monterey Co.: Marina Dunes at Ft. Ord: 1 ♀, 18 May 1977, J. Powell, *Erysimum ammophilum* (UCB). Tulare Co.: Mineral King: 14 ♂, 12 ♀, 1–7 Jul, USNM slides ♀ 16030, 16031 (USNM); same data: 1 ♂ (CNC), 2 ♂, 1 ♀ (UCB); 1 ♂, 8–15 Jul, USNM slide DRD 20595 ♂ (USNM); 1 ♂, 16–23 Jul (USNM); 2 ♂, 24–31 Jul (USNM); 1 ♂, 2 ♀, 1–17 Aug, USNM slide 20594 ♂ (USNM). South Fork Camp, 13 mi.

[20.8 km] SE Three Rivers, 32–3,600 ft. [976–1,098 m]: 7 ♂, 1 ♀, 3 May 1979, J. Powell, USNM slide 34716 (UCB, USNM).

HOST. Unknown.

FLIGHT PERIOD. Late June to early August; univoltine.

DISTRIBUTION. (Map 33). At present known only from Monterey and Tulare Counties, in the Sierra Nevada Mountains of east-central California at elevations of approximately 3,200 to 3,600 ft. [976–1,098 m].

ETYMOLOGY. The species name is derived from the Latin *excavatus* (excavated, hollowed out), in reference to the pronounced excavated region of the valva between the enlarged sacculus lobe and cucullus.

DISCUSSION. The deeply excavated ventral margin of the male valvae is one of the principal diagnostic features of this species and is the one that has suggested the specific name. Three other closely related members of this genus (*C. wielgusi*, *C. lobata*, and *C. trifascia*) demonstrate a similar lobate development of the sacculus. Some of these can be distinguished on the basis of other characters (e.g., forewing color pattern). The sacculus lobe of *C. excavata* is intermediate in size between the well-developed condition present in *C. lobata* and the very reduced form in *C. trifascia*. The sacculus lobe of *C. excavata* is less pronounced and the base of the valva broader than in *C. wielgusi*. The vestibulum in the females of *C. excavata* is most similar to that of *C. lobata* in possessing a dorsal vaginal plate (ventral in *C. trifascia*); however, the vestibulum of *C. excavata* is much larger than that of either *C. lobata* or *C. trifascia*.

Cauchas excavata is evidently a species adapted to relatively high elevations and probably ranges much further north along the Sierra Nevada Mountains. An imperfect specimen collected at Mineral King, California, and now deposited in the National Museum of Natural History may also represent this species; however, this has not been selected as a paratype because of its poor condition. The maculation of this individual varies slightly from the norm in that an additional, small, white costal spot is present on the outer third of the wing.

***Cauchas wielgusi* Davis and Medeiros,
new species**

FIGURES 7, 217–218, 303, 334, 398; MAP 33

ADULT. (Figures 217–218). Wing expanse: ♂, 8.2–9.1 mm; ♀, 7.1–9.0 mm.

Head: (Figure 7). Almost equally intermixed with white and black hairs over vertex, with slightly more white hairs over frons. Antenna entirely covered dorsally with fuscous scales; scape fuscous, with a few scattered white scales ventrally. Apices of maxillary palpus and base of haustellum white. Labial palpus mostly white except for mostly fuscous apical segment; second segment with 6–8 dark hairs arising mostly laterally and apically.

Thorax: Dorsum uniformly dark grayish fuscous with a slight bronzy luster; a pair of elongate, white scale tufts arising bilaterally from caudal margin of metanotum. Venter paler, more

gray. Legs including spurs dark grayish fuscous dorsally, white ventrally. Forewing dark grayish fuscous similar to dorsum of thorax, but with more bronzy luster; usually marked by 3, often incomplete, whitish fasciae as follows: a narrow fascia near basal third of wing completely traversing wing, a slightly broader fascia from distal third of hind margin extending ~halfway or slightly more so across wing, and a short, slightly curved fascia at distal fourth of costa extending slightly diagonally less than halfway to tornus. Hindwing and fringe uniformly grayish fuscous with a slight bronzy luster, seldom with any suffusion of white scales in anal area.

Abdomen: (Figure 334). Similar in color to dorsum dorsally, uniformly dark grayish fuscous; mostly white ventrally in male and with only a few white scales caudally in female. Seventh sternite of female approximately 3.3× length of sixth; eighth sternite with a relatively narrow, slightly pigmented band ventrally.

Male Genitalia: (Figure 303). Uncus indistinct, bluntly rounded. Vinculum-saccus long, U-shaped, ~2× length of valva; anterior end of saccus broadly rounded. Valva moderately narrow at base, expanding to form a prominent, digitate lobe at apex of sacculus, then abruptly narrowing to relatively slender, rounded cucullus. Juxta with anterior third reduced except for bilateral, caudally directed lobes at anterior end; posterior 2/3 with lateral margins subparallel. Phallus with base slightly expanded; cornuti absent; apical third with dense covering of minute spinulae; apex simple.

Female Genitalia: (Figures 334, 398). Apex of ovipositor compressed, acute; somewhat asymmetrical with ventral edge more oblique; both dorsal and ventral edges minutely serrulate. Structure of vestibulum as shown in Figure 334; dorsal walls of vestibulum slightly sclerotized.

HOLOTYPE. ♂. Kitt Peak entrance road, 3,800 ft., 31°59'26", -111°34'42.5", Pima Co., Arizona, 24 Mar 2012, D. Wagner, *Arabis perennans* [now *Boechera perennans*] (USNM).

PARATYPES. 60 males, 18 females. **UNITED STATES:** **ARIZONA:** Pima Co.: same data as holotype: 3 ♂, 5 ♀ (DLW). Molino Flats, 4,550 ft. [1,387 m], 32°20'19", -110°41'12", 2 ♂, 2 ♀, 29 Mar 2012, D. Wagner, J. Brock, M. Robinson, D. Mullins, on *Arabis perennans* [now *Boechera perennans*] (DLW). Yavapai Co.: 2 mi. east [km] Cleator: 26 ♂, 5 ♀, 11 Mar 1979, ♂ digital image captured, slide USNM 34261; 21 ♂, 3 ♀, 24 Mar 1979; 4 ♂, 2 ♀, 25 Mar 1979, slides USNM 21223 ♂, 21224 ♀, 34805 ♀ (USNM). 1.5 mi. east of Cleator, Yavapai Co., Arizona, 1 ♂, 18 March 1980, coll. R. Wielgus (CNC, UCB, USNM). **CALIFORNIA:** Los Angeles Co.: San Gabriel Mts.: 2,250 ft., Millard Canyon: 1 ♂, 10 Apr 1909, F. Grinnell Jr., slide USNM 16068 (USNM). Kern Co.: Walker Pass cmgd., 35.663905°, -118.036926°, 1,540 m, 7 ♂, 2 ♀, 11 May 2016, sweeping flowers, leg. J.-F. Landry & V. Albu, CNCLEP 00146686, digital image captured, slide USNM 34731 (USNM). San Bernardino Co.: Mitchell Caverns, 4,300 ft., Providence Mts., 1 ♂, 7 Apr 1966, R. M. Brown (CASC); Bonanza King Mine, 2 mi. N Providence Mts., 1 ♂, 7 Apr 1966, R. M. Brown, ♂ genitalia preparation #CCG_00100 (CASC). **COLORADO:** Gunnison Co.: Copper Creek, 2,950–3,450 m, 8 mi. NW

of Crested Butte, No. 118, 1 ♀, 16 Jul 1984, S. M. Louda, host: *Cardamine cordifolia*, USDA lot 85-14756 (USNM).

HOST. Unknown. Adults have been collected from flowers of Brassicaceae: *Arabis perennans* (S. Watson) W. A. Weber (now *Boechera perennans*), by D. Wagner. It is uncertain whether the Colorado host record from *Cardamine cordifolia* A. Gray (Brassicaceae) represents an actual larval rearing or adult nectaring record.

FLIGHT PERIOD. Middle to late March in Arizona; early April in the Providence and San Gabriel Mountains, California; mid-July in Colorado; univoltine.

DISTRIBUTION. (Map 33). Most specimens collected thus far have been from central (Yavapai County) and southern (Pima County) Arizona. Isolated records are reported from the Providence and San Gabriel Mountains of California, as well as from much higher elevation in western Colorado.

ETYMOLOGY. The specific name *wielgusi* is named in honor of Mr. Ronald S. Wielgus (deceased June 2018), who collected most of the specimens (Wagner and Rubinoff 2018).

DISCUSSION. With very similar forewing patterns, *Cauchas wielgusi* is most likely to be confused with *C. trifascia*, a species currently known from Inyo, Riverside, San Bernardino, and Ventura Counties, California. Both moths possess three, partially incomplete white fasciae across the forewing, with those of *wielgusi* usually being slightly narrower. Their patterns differ in the relative size and position of the outer, incomplete fasciae. The median fascia from the dorsal margin is slightly more distal in *wielgusi*, and the apical fascia from the costal margin is shorter than that of *trifascia*. The valvae of the male genitalia provide the surest means of distinction, with the valvae of *wielgusi* possessing a prominent saccular lobe that is poorly developed in *trifascia*. The valvae of *C. excavata* and *lobata* are also similar to that of *C. wielgusi* in possessing pronounced saccular lobes, but those of *C. wielgusi* arise more apically from the valva and the forewings of the other species are immaculate or nearly so.

Cauchas clarkei Davis and Medeiros, new species

FIGURES 219, 304, 335, 399; MAP 33

ADULT. (Figure 219). Wing expanse: ♂, 8.5–11 mm; ♀, 9.5–11 mm.

Head: Whitish to pale ochreous with a band-like concentration of black hairs between antennal bases and a variable scattering of black hairs posteriorly on vertex and anteriorly along inner margin of eyes. Antenna entirely covered dorsally with fuscous to black scales. Maxillary palpus and base of haustellum usually black, occasionally whitish to light fuscous. Labial palpus whitish with apical segment blackish; rarely white; second segment with scattered black or rarely white scales ventrally.

Thorax: Dorsum dark fuscous with a slight purplish to bronzy iridescence. Venter light fuscous to grayish with slight silvery luster. Legs usually fuscous above, whitish beneath.

Forewing uniformly fuscous with a bronzy iridescence, rarely with whitish fringe. Hindwing similar in color to forewing but with a more purplish luster.

Abdomen: (Figure 335). Dark fuscous above, slightly paler, more grayish beneath with terminal segments of female often whitish. Seventh sternite of female $\sim 2.7\times$ length of sixth; eighth sternite not darkly pigmented, unicolorous.

Male Genitalia: (Figure 304). Uncus relatively well developed; apex subtruncate, slightly emarginate. Vinculum-saccus moderately long, approximately equaling valva in length; anterior end of saccus broadly rounded. Valva very broad, breadth nearly $0.7\times$ that of length; ventral margin broadly rounded almost to apex; apex of cucullus extended as a slender, digitate lobe curved ventrally. Juxta with anterior end sagittate, subacute; posterior half with lateral margins curved moderately outward, not parallel. Phallus slightly curved; base moderately expanded; approximately 15–20 short cornuti present, each about $0.3\text{--}0.2\times$ width of phallus at middle.

Female Genitalia: (Figures 335, 399). Apex of ovipositor compressed, acute, nearly symmetrical; ventral edge slightly dorsal and with a shallow subapical indentation. Vestibulum relatively reduced; vaginal plate indistinct; dorsal region immediately caudad to spermathecal papilla with dark, thickened, spinose walls.

HOLOTYPE. 28 mi. [44.8 km] SE Joseph, Wallowa Co., Oregon, 5,400 ft. [1,646.3 m], ♂, 20 Jun 1970, coll. J. F. G. Clarke, USNM 72087 (USNM).

PARATYPES. 59 males, 36 females. **CANADA:** BRITISH COLUMBIA: Mt. Kobau (base) nr. Osoyoos: 8 ♂, CNCLEP 00141586, 00141587, 00141590, 00141591, 00141593, USNM slide 34726 ♂, 00141594, 00141595, 00141597, 4 ♀, 00141588, 00141589, 00141592, 00141596, 25 May 1996, in flight ca. 18h00 (CNC, USNM). Oliver: 1 ♂, 16 May 1938, J. K. Jacob (USNM). Vaseux Lake: 2 ♂, 14–21 May 1936, A. N. Gartrell, ♂ genitalic slides DRD 2509, 2525 (CNC?). Summerland Agric. Research Station: 2 ♂, CNCLEP 00141580, 00141585, 7 ♀, 00141577, 00141578, 00141579, 00141581, 00141582, 00141583, 00141584, 28 May 1996, in flight ca. 17h00, J.-F. Landry (CNC). **UNITED STATES:** CALIFORNIA: Modoc Co.: Buck Creek Ranger Station, 5,150 ft. [1,570 m]: 10 ♂, 7 ♀, 5–7 Jun 1970, Powell (UCB) and 1 ♂, 1 ♀, 5–7 Jun 1970, P. A. Rude (CASC; an additional label on the specimens reads “*Chalceopla clarkei* D. Davis 1974”); 1 ♂, 1 ♀, 5–7 Jun 1970, J. Powell (USNM). OREGON: Josephine Co.: 2 mi. [3.2 km] E Merlin: 1 ♂, 1 May 1970, J. F. G. Clarke (USNM). Wallowa Co.: 28 mi. [44.8 km] SE Joseph, 5,400 ft. [1,646 m]: 17 ♂, 9 ♀, 19–21 Jun 1970, J. F. G. Clarke, USNM slide 20585 ♂, USNM slides ♀ 16001, 16003, 16007, 16009, 16012, 16013, 16019, 16021, 16023 (USNM); 1 ♂, 20 Jun 1970, J. F. G. Clarke (AMNH); 1 ♂, 20 Jun 1971, J. F. G. Clarke (BMNH); 1 ♂, 21 Jun 1971, J. F. G. Clarke (CNC); 1 ♂, 21 Jun 1971, J. F. G. Clarke (UCB). SOUTH DAKOTA: Lawrence Co.: Hardy Work Camp, T3N, R1E, S30: 1 ♂, 18 Jun 1965, R. N. Hodges (USNM). WASHINGTON: Asotin Co.: Asotin, Montgomery Ridge, 900 m, T8N R46E S24SE: 1 ♂, 2 ♀, 3 May 1987, O. Pellmyr, Steppe vegetation, on *Descurainia*

richardsonii, USNM slide 34466 (USNM). Columbia Co.: Blue Mts., 5,700 ft. [1,738 m], Godman Springs [SE of Dayton]: 6 ♂, 3 ♀, 24 Jun 1970, J. F. G. Clarke, USNM slide 20586 ♂, USNM slides ♀ 16006, 20587 (USNM). Garfield Co.: 2.6 km SE Lower Granite Dam, along Wawawai Grade, 425 m, R43E T13N S4SE: 2 ♀, 6 May 1989, O. Pellmyr, herb-rich roadside (USNM). Whitman Co.: 3 km N of head of Rock Lake, along Hole-in-the-Ground Road, 550 m, T20N R41E S13NW: 1 ♂, 29 May 1989, O. Pellmyr, USNM slide 34467; 1.7 km SE of head of Rock Lake, outcrop along Stephen Road, 650 m, T20N R41E S26NW: 2 ♂, 29 May 1989, O. Pellmyr, nectaring on *Heuchera cylindrica*; 600 m above Granite Pt. on Snake River, 220 m, T13N R44E S24NW: 1 ♂, 31 Mar 1990, O. Pellmyr, herb-rich grassy steppe (USNM).

HOST. Unknown. Adults have been collected from flowers of Brassicaceae: *Descurainia richardsonii* O. E. Schultz and Saxifragaceae: *Heuchera cylindrica* Douglas.

FLIGHT PERIOD. Early May to late June; univoltine.

DISTRIBUTION. (Map 33). Rather widely distributed through the Cascade Range of the northwestern United States from Northern California north to southern British Columbia and west to the Black Hills of South Dakota.

ETYMOLOGY. The name *clarkei* is a patronym in honor of Dr. John Fredrick Gates Clarke (1905–1990), formerly of the Smithsonian’s USNM, in recognition of the extensive field investigations he conducted for much of his life on the Microlepidoptera of the Pacific Northwest. Clarke was a mentor and former colleague of author Donald Davis.

DISCUSSION. Several features of the male and, to a lesser extent, female genitalia easily distinguish *Cauchas clarkei* from the most superficially similar species, *C. elongata* and *C. simpliciella*. The unique valvae, with their peculiar apical, appendicular extension of the cucullus, easily separate the males of *C. clarkei* from all other members of the genus. The females of this species, however, are less easily recognized but can be identified by the thickened, spinose region of the vagina caudad to the spermathecal papilla. In addition, the shorter seventh sternite and absence of a darkly sclerotized lateral band on the eighth segment of *C. clarkei* adequately separate the females of this species from the otherwise superficially identical *C. elongata*.

As discussed under *C. elongata*, Clarke observed *C. clarkei* and the former species flying together in a high, moist steppe zone of the Columbia Basin province in northeastern Oregon. The dominant flora of this locality is probably best characterized as a *Festuca-Symphoricarpos* association as discussed by Franklin and Dyrness (1969). Clarke also collected *C. clarkei* unaccompanied by *C. elongata* in the Blue Mountains of southeastern Washington, a locality approximately 80 air miles [128 km] northwest of the mixed Oregon population. Clarke reported (personal communication to DRD [see Etymology]) that the habitat was similar to the latter site in that *Lupinus* and *Astragalus* were among the dominant forms of vegetation, with *Pinus ponderosa* Douglas present but scattered.

No host association for the larvae of this insect has been established yet, although Paul Opler has collected adults from the flowers of *Arabis puberula* Nutt. and *Isatis tinctoria* L. at the Buck Creek Ranger Station in Northern California. Olle Pellmyr has also observed the moths nectaring on *Heuchera cylindrica* near the head of Rock Lake, Whitman County, Washington.

***Cauchas elongata* Davis and Medeiros,
new species**

FIGURES 220, 221, 305, 336, 400; MAP 34

ADULT. (Figures 220, 221). Wing expanse: ♂, 10–11 mm; ♀, 10–12 mm.

Head: Pale ochreous with a band-like concentration of black hairs between antennal bases and occasional scattered black hairs at vertex and along inner margin of eyes. Antenna entirely covered with black scales dorsally. Maxillary palpus and base of haustellum whitish. Labial palpus whitish with apical segment entirely dark fuscous or mostly so; inner surfaces sometimes whitish; second segment with scattered black hairs ventrally.

Thorax: Dorsum dark fuscous with slight purplish to bronzy iridescence. Venter grayish with slight silvery luster. Legs fuscous above, whitish underneath. Forewing typically uniformly dark fuscous with a bronzy iridescence, occasionally with a narrow, whitish streak bordering costal margin and, to a lesser degree, hind margin of wing. Hindwing as dark as forewing, fuscous with a slight purplish luster.

Abdomen: (Figure 336). Dark fuscous above; slightly paler, more grayish beneath with terminal sternites of female frequently whitish. Seventh sternite of female 3.4–3.5× length of sixth; eighth sternite with a lateral, narrow, crescent-shaped, darkly pigmented band curving ventrally toward caudal margin.

Male Genitalia: (Figure 305). Uncus reduced, ventrad to tegumen. Vinculum-saccus elongate, approximately 1.5× length of valva; anterior end of saccus broad, subtruncate, with a shallow median depression. Valva relatively narrow, elongate, gradually tapering from base to apex; costal margin of valva gradually curved ventrally; ventral margin approximately straight. Juxta not sagittate; anterior end gradually flared, subtruncate. Anellus developed dorsad to phallus into an elongate, closely parallel pair of slender sclerites. Phallus with a lateral pair of flap-like processes near apical third; apical third with a compressed dorsal ridge extending from lateral projections to apex; cornuti absent.

Female Genitalia: (Figures 336, 400). Apex of ovipositor compressed, acute, slightly asymmetrical; ventral edge slightly longer than dorsal and with a shallow subapical notch. Vestibulum greatly enlarged, vaginal plate well developed, darkly sclerotized and covering most of dorsal half of vagina.

HOLOTYPE. 28 mi. [45 km] SE Joseph, Oregon, 5,400 ft. [1,646 m], ♂, 20 Jun 1970, coll. J. F. Gates Clarke, USNM 72086 (USNM).

PARATYPES. 40 males, 29 females. CANADA: BRITISH COLOMBIA: Osoyoos, Krueger Mt.: 1 ♂, 11 May 1936,

A. N. Gartrell, ♂ slide USNM 19343 (USNM); 2 ♀, 11 May 1936, A. N. Gartrell (CNC). Pinantan Lake: 1 ♀, 18 May 1937, J. R. Jacob (CNC). Penticton, Brent's Lake: 1 ♀, 30 May 1935, ♀ genitalia slide 2909 (CNC). Summerland: 1 ♂, 6 May 1936, A. N. Gartrell (CNC); 1 ♂, 2 Sep 1936, bred from maple, A. N. Gartrell (USNM). UNITED STATES: CALIFORNIA: Tuolumne Co.: Chipmunk Flat [between Kennedy Meadow and Sonora Pass, elevation ca. 8,800 ft. [2,683 m]]: 2 ♂, 2 ♀, 25 Jun–1 Jul 1962, J. Powell (UCB); 1 ♂, 1 Jul 1962, J. Powell (USNM). COLORADO: Larimer Co.: Red Feather Lakes: 1 ♂, 5 Jun 1988, P. Opler, slide DRD 4637 (UCB). IDAHO: Kootenai Co.: Cottonwood Creek, 6 mi. [9.6 km] NE Harrison: 1 ♂, 4 ♀, 18 May 1976, 29 May 1975, D. F. Viers, USNM slide 34720 ♂ (UCB, USNM). Latah Co.: 2.1 km NE Laird Park, R2W T42N S31NE: 1 ♂, 19 May 1990, O. Pellmyr, herb-rich meadow in mixed forest, nectaring on *Lomatium*, USNM slide 34464 (USNM). Nez Perce Co.: 600–2,400 m ENE Spalding, south shore of the Clearwater River, rocky shore, T36N R4W S23N+24NW: 1 ♀, 14 May 1989, O. Pellmyr (USNM). Shoshone Co.: Pine Creek, 2,600 ft. [793 m]: 3 ♂, 1 ♀, 15–31 May, Sweadner (CM); 1 ♂, 1 ♀, 22–31 May, Sweadner, ♂ slides DRD 1089, ♀ slide DRD 1191 (USNM). MONTANA: Cascade Co.: Little Belt Mts., 200 m N Belt Creek Ranger Station, T14N R8E S6NW: 1 ♂, 8 Jun 1989, O. Pellmyr (USNM). OREGON: Baker Co. 2 mi. [3.2 km] NW Sumpter: 1 ♀, 18 Jun 1970, J. F. G. Clarke, USNM slide 16004 ♀ (USNM). Wallowa Co.: 28 mi. [44.8 km] SE Joseph, 5,400 ft. [1,646 m]: 24 ♂, 15 ♀, 19–21 Jun 1970, J. F. G. Clarke, USNM ♂ slide 34161, USNM ♀ slides DRD 16000, 16002, 16005, 16008, 16010, 16011, 16014–16018, 16020, 16022, 16024, 16025 (USNM); 1 ♂, 21 Jun 1970, J. F. G. Clarke (AMNH); 1 ♂, 20 Jun 1970, J. F. G. Clarke (BMNH).

HOST. Aceraceae: “bred from maple” [*Acer* species], from specimen label (though these data are highly questionable; see Discussion section below). Adults have been observed by O. Pellmyr nectaring on Apiaceae: *Lomatium*.

FLIGHT PERIOD. Early May to early July; univoltine.

DISTRIBUTION. (Map 34). This species ranges rather widely from British Columbia south through the Cascade and Sierra Nevada Mountains to west-central California.

ETYMOLOGY. The species name is derived from the Latin *elongatus* (prolonged), in reference to the long, slender male valva of this species.

DISCUSSION. Although superficially very similar to *Cauchas clarkei*, *C. simpliciella*, and a few other immaculate members of this genus, *C. elongata* is easily distinguished by several unique features of the male and female genitalia. The subtruncate, slightly emarginate saccus, unique juxta and phallus, and long, slender valvae of the male clearly separate the species from all other *Cauchas*. The elongate form of the valvae, which can be observed easily in situ, has suggested the specific name. The most diagnostic characteristic of the female is the darkly pigmented, crescent-shaped band situated laterally on the eighth segment. The vaginal plate is also unique in being greatly enlarged, quadrate, and well defined. All of these unusual genitalic specializations indicate *C. elongata* to be the most derived member of the genus.

Little is known of the biology of this species other than a possible, single host record on maple from Summerland, British Columbia. The emergence [?] date on the label of the bred specimen is partly illegible but appears to be "2.IX.1936," thus suggesting a reared specimen, considering the normal spring flight period of this species. The species is boreal in distribution and has been collected at high altitudes in the southern part of its range. Olle Pellmyr observed adults nectaring on *Lomatium* in an herb-rich meadow in Laird Park, Idaho. Clarke

has encountered the species equally intermixed with *C. clarkei* near Joseph, Oregon. Clarke (pers. comm.) observed the moths in large numbers flying low over the ground in a *Festuca-Symphoricarpos* association. In addition to the dominant type of vegetation, the collecting site is characterized by such herbaceous genera as *Astragalus*, *Balsamorhiza*, *Lupinus*, and scattered individuals of *Pinus ponderosa* but lacking any species of *Acer*. Consequently, the sole rearing record of *C. elongata* from maple is highly questionable.

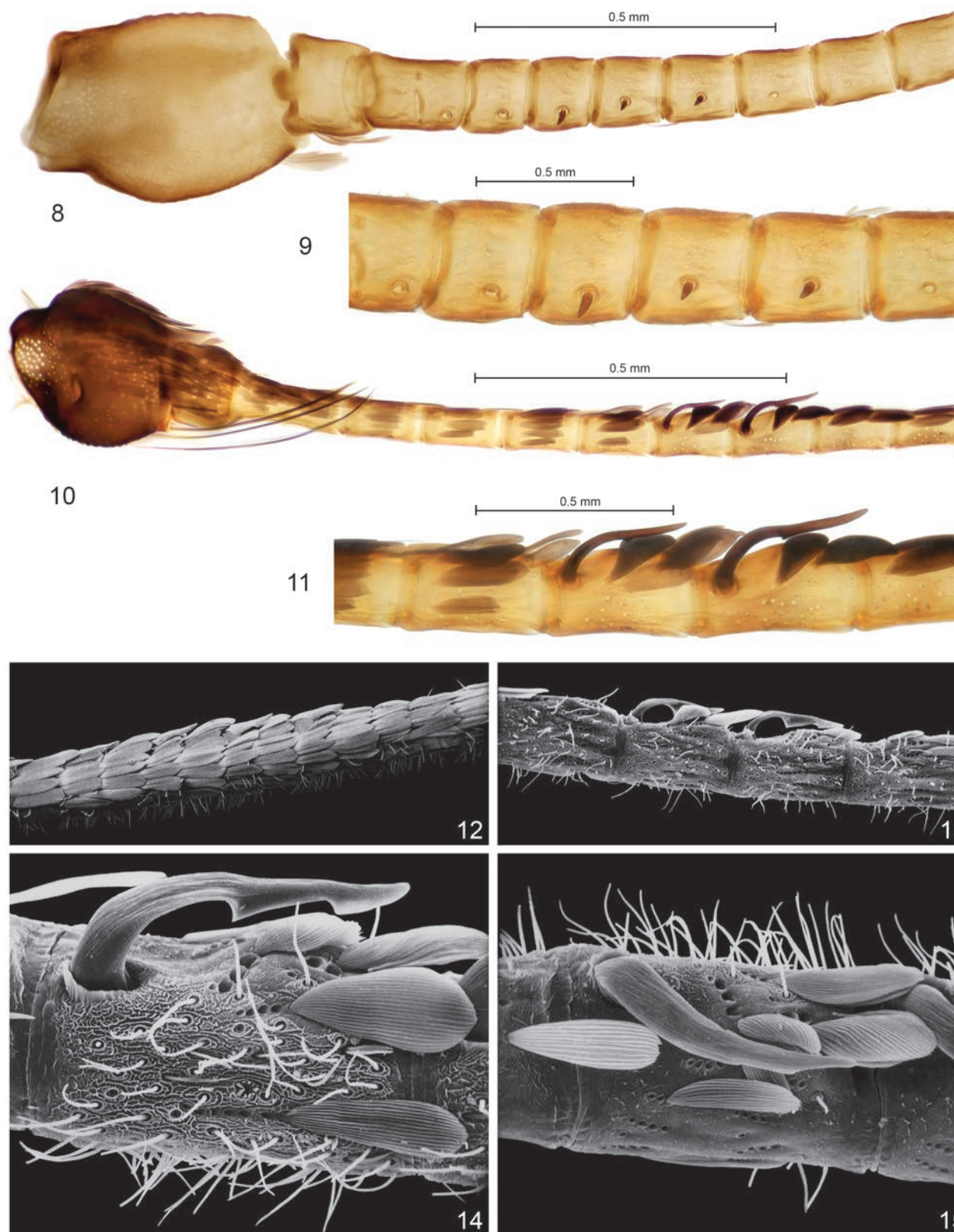
Figures



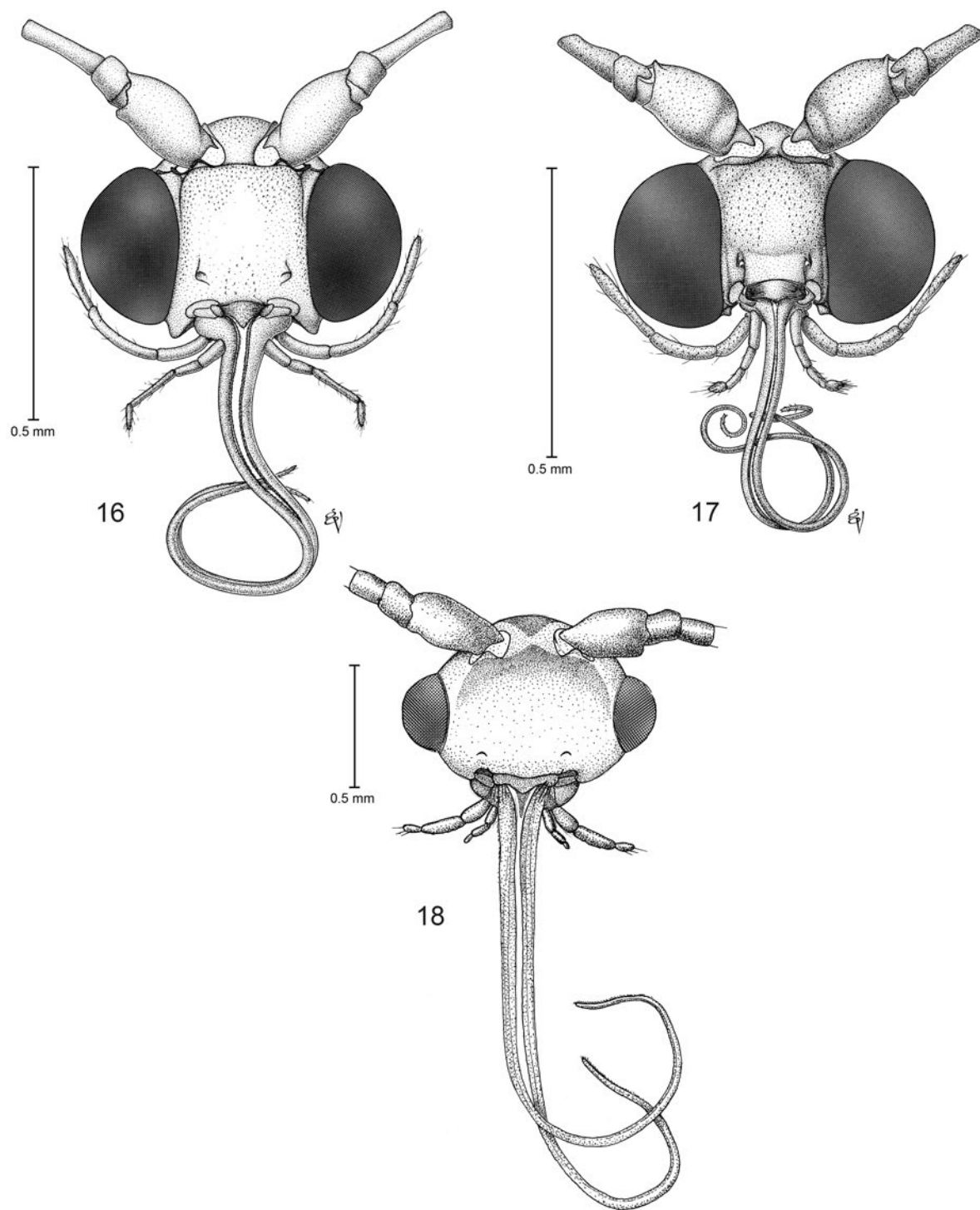
FIGURES 1–3. Adults nectaring at flowers. 1, *Adela astrella*, on *Stevia serrata* Cav., Garden Canyon, ~7,000 ft, Arizona (photo by Julian H. Cowles in early September). 2, *Cauchas spinulosa*, on Onagraceae: *Camissoniopsis bistorta* (Torrey and Gray) Wagner and Hoch (photo by Jonathan Wright in mid-April). 3, *Cauchas vittata*, on Boraginaceae: *Phacelia* (probably *P. distans* Benth.), Ventura County, California (photo by Paul G. Johnson).



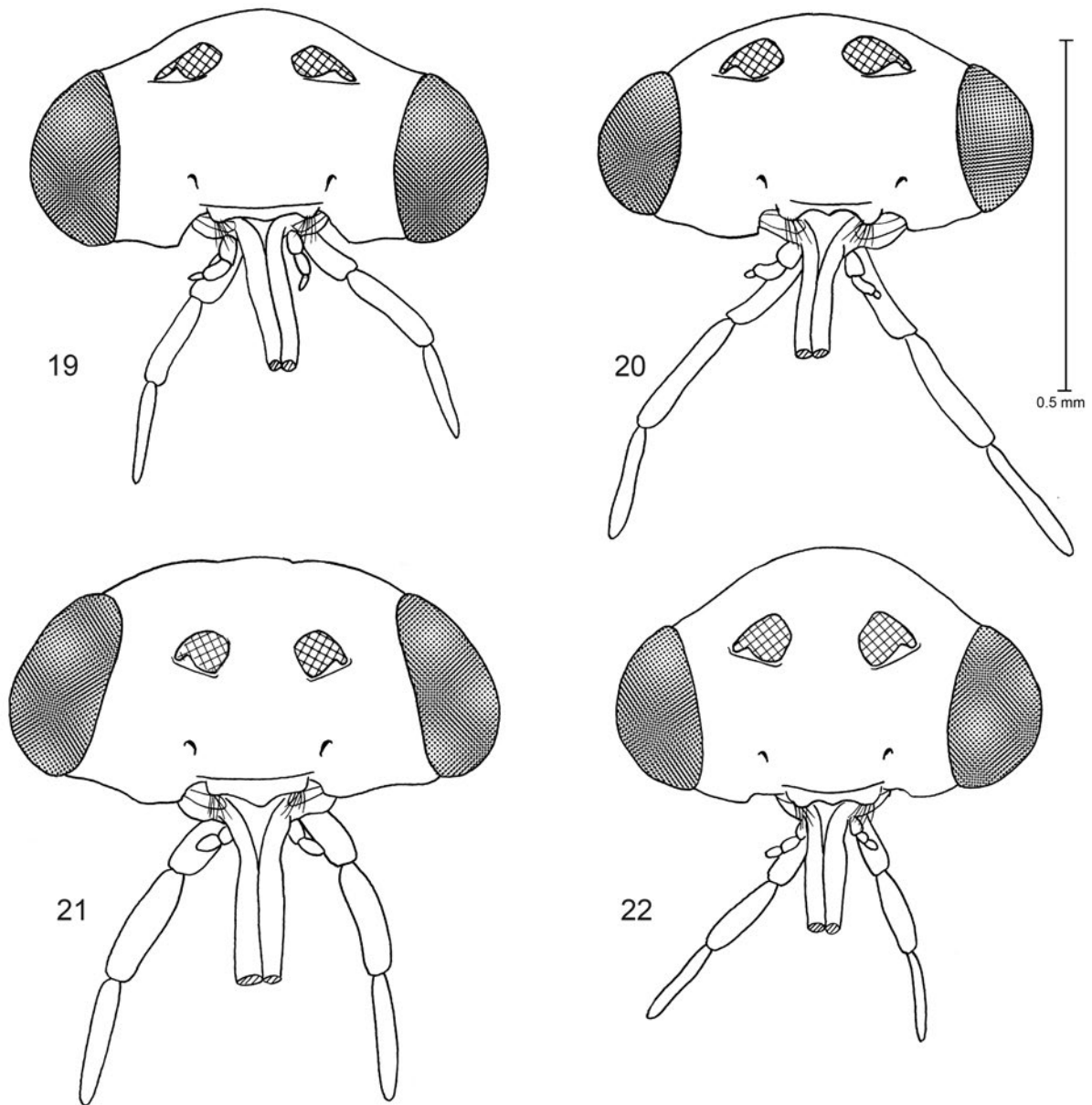
FIGURES 4–7. Frontal–ventral views of adult heads. 4, *Ceromitia capitanea*. 5, *Nemophora bellela*. 6, *Adela purpurea*. 7, *Cauchas wielgusi*.



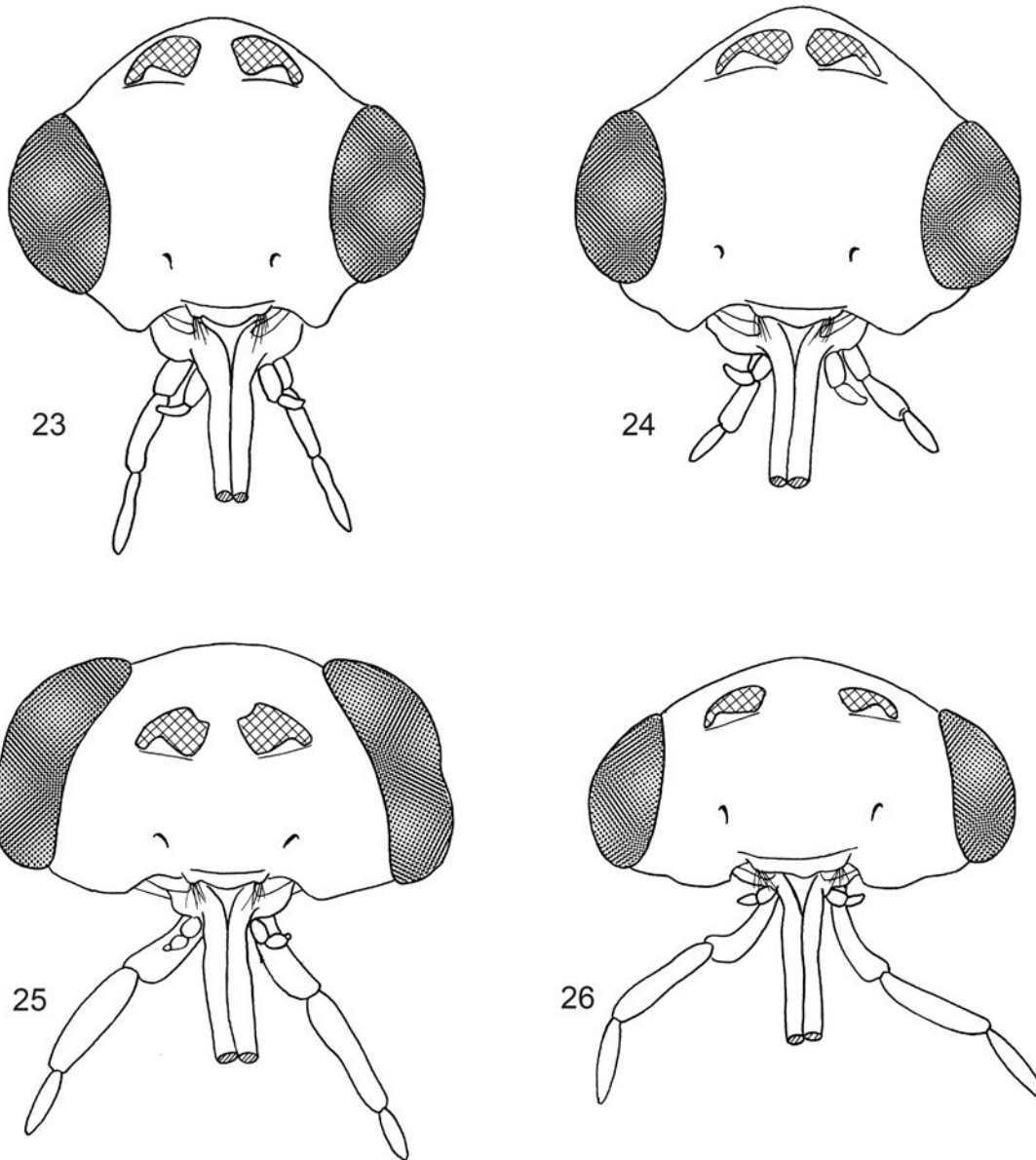
FIGURES 8–15. Adult male antennal morphology (scale=0.5 mm). 8, *Nemophora bellela*, scape, pedicel, and basal flagellomeres. 9, Enlargement of antennal spines in Figure 8. 10, *Adela ridingsella*, scape, pedicel, and basal flagellomeres. 11, Enlargement of antennal spines in Figure 10. 12–15, *Adela caeruleella*, basal flagellomeres: 12, Basal flagellomeres 10–20, fully scaled. 13, Flagellomeres with scales removed to show spines. 14, Enlarged lateral view of antennal spine. 15, Dorsal view of spine in Figure 14.



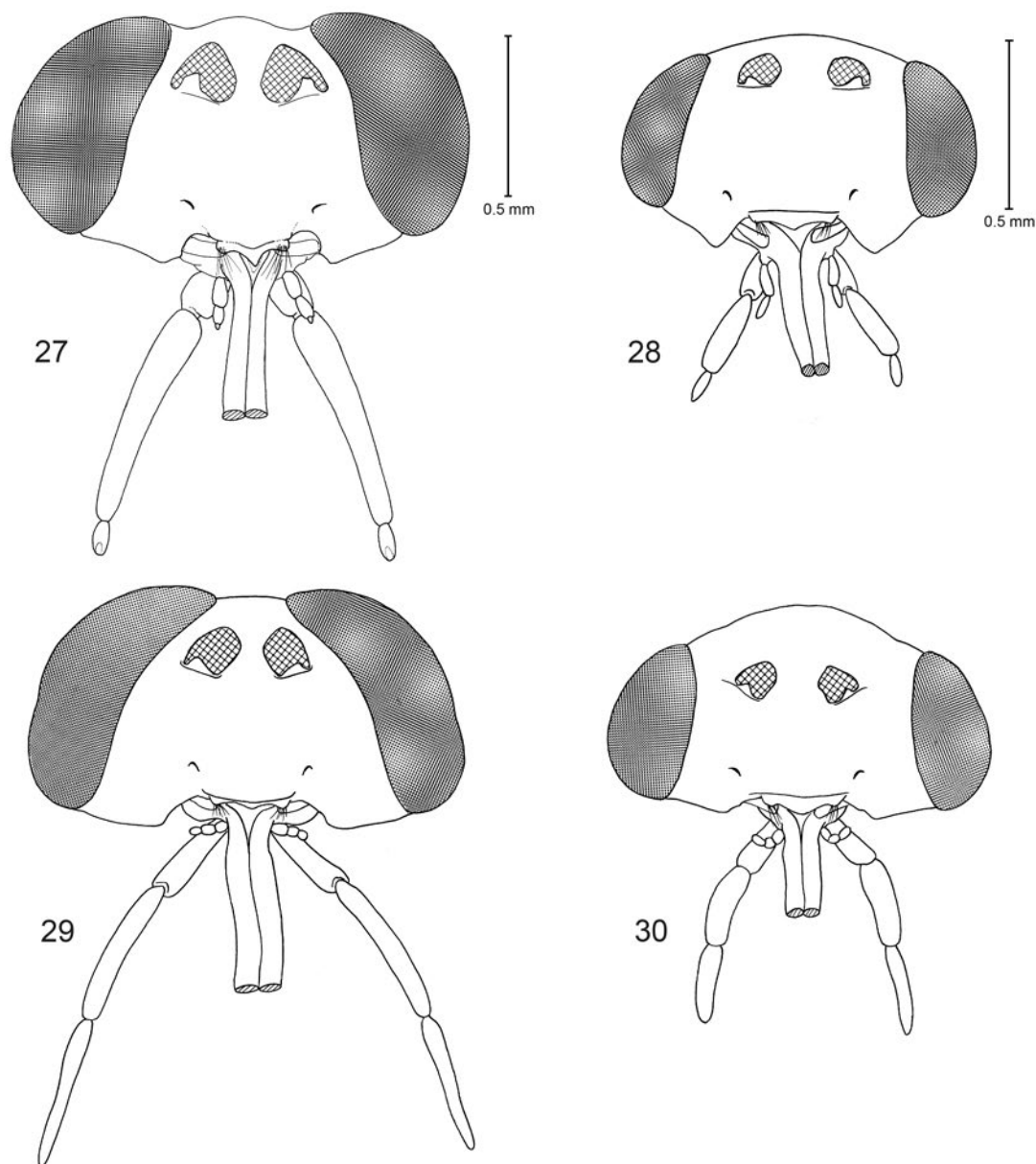
FIGURES 16–18. Adult head morphology, anterior view (scale=0.5 mm). 16, *Ceromitia elongata*. 17, *Ceromitia aphyoda*. 18, *Nemophora bellela*.



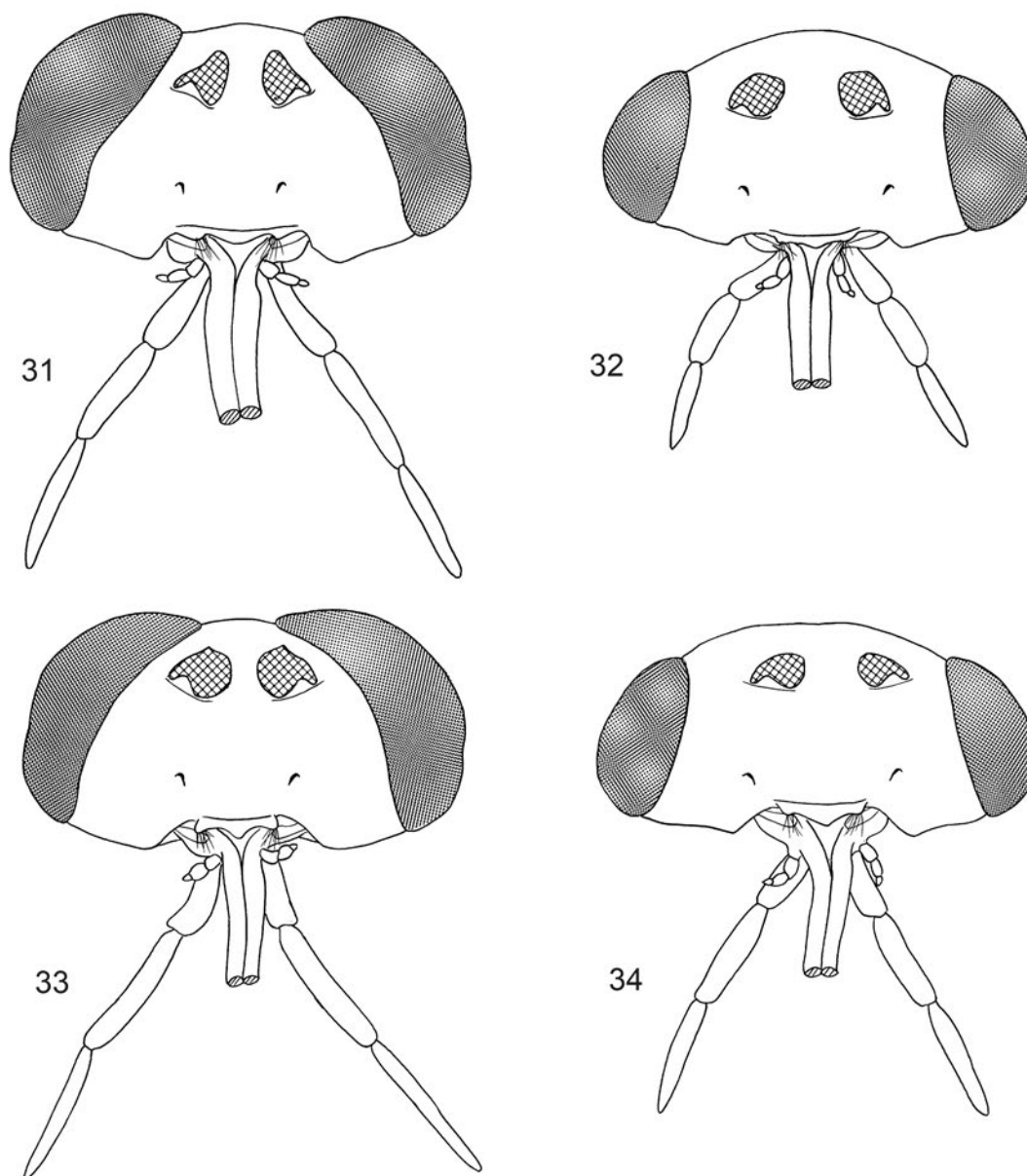
FIGURES 19–22. Adult head morphology, anterior view (scale=0.5 mm). 19–20, *Adela punctiferella*. 19, Male. 20, Female. 21–22, *Adela singulella*. 21, Male. 22, Female.



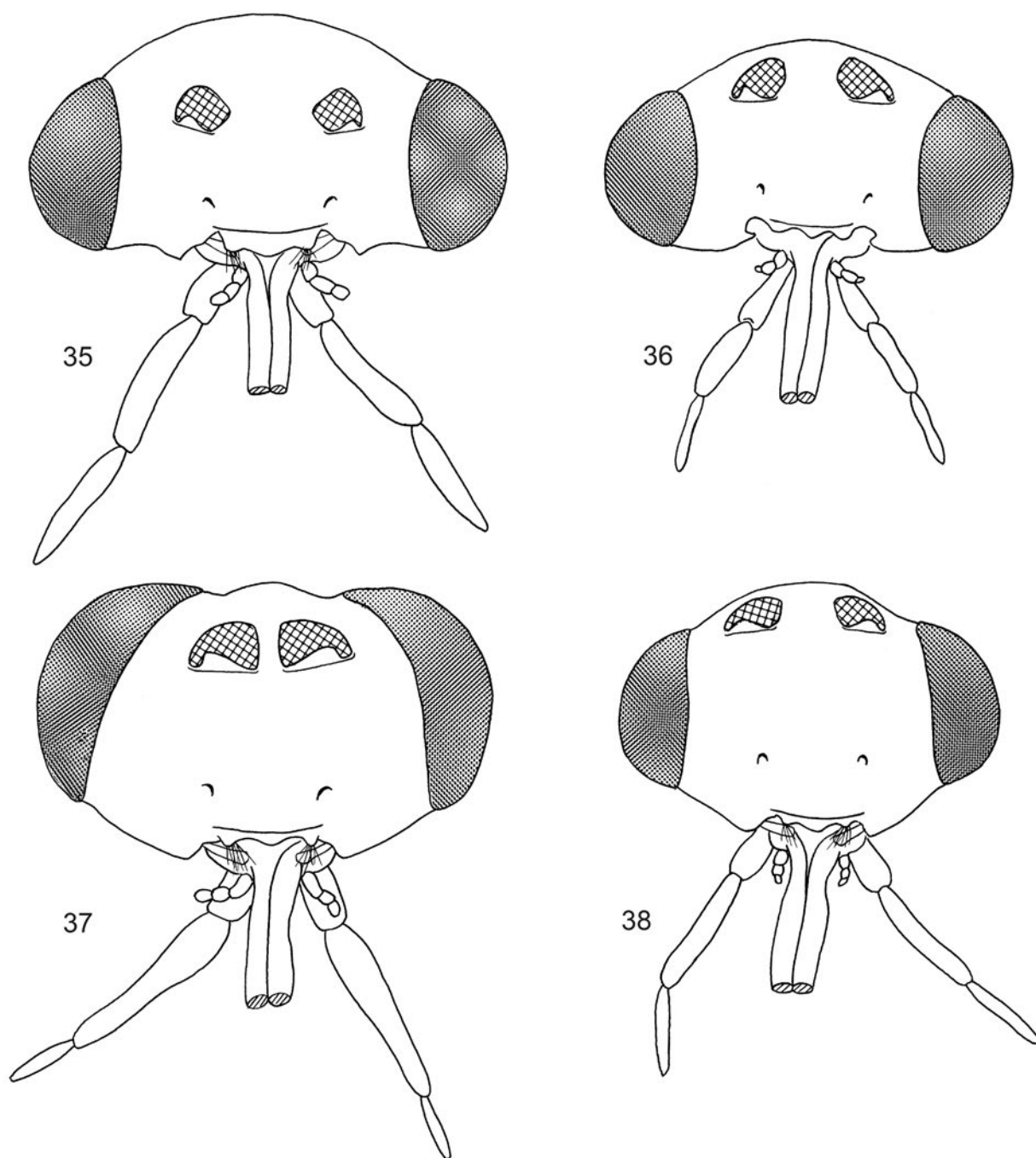
FIGURES 23–26. Adult head morphology, anterior view. 23–24, *Adela caeruleella*. 23, Male. 24, Female. 25–26, *Adela septentrionella*. 25, Male. 26, Female.



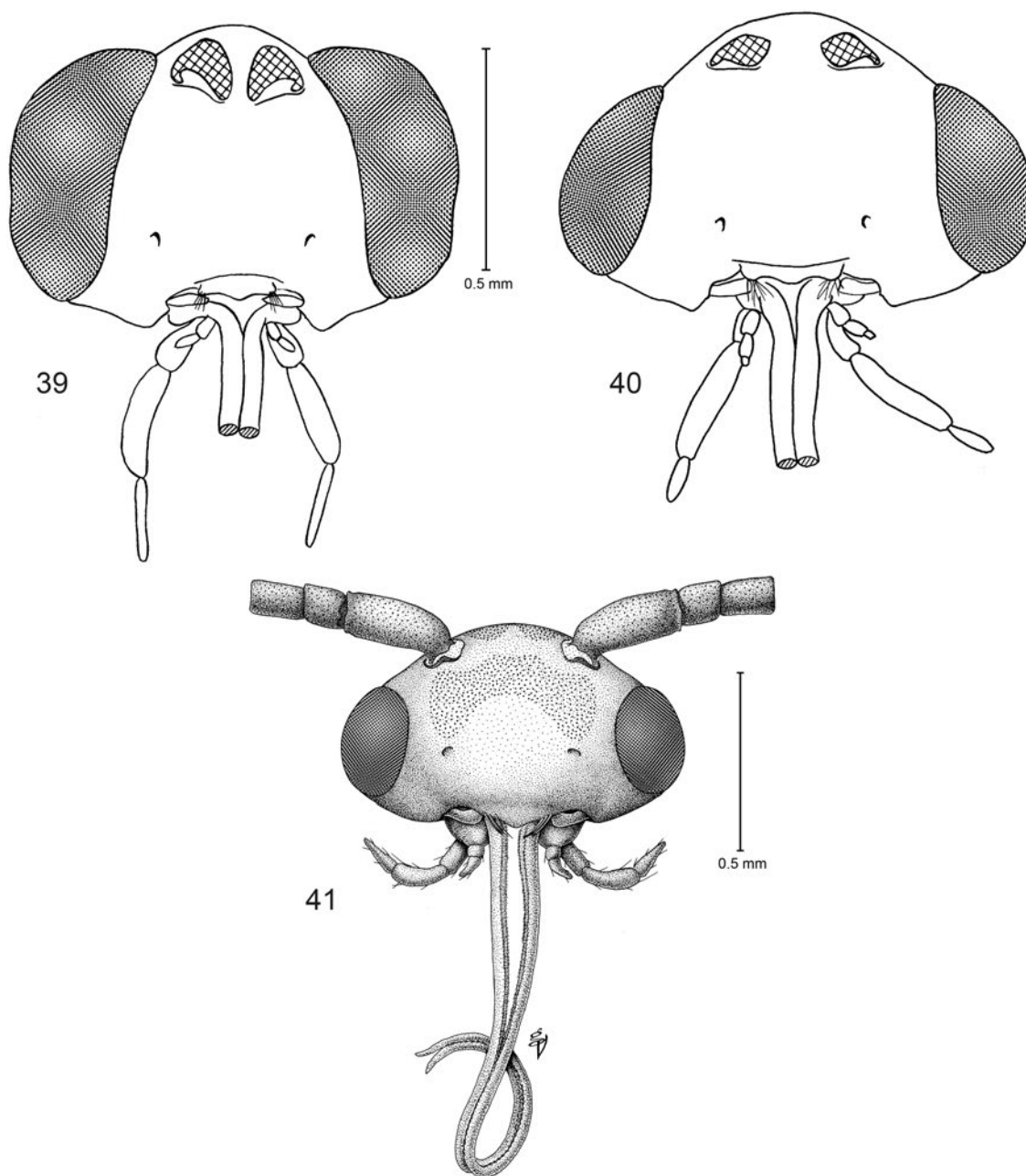
FIGURES 27–30. Adult head morphology, anterior view (scale=0.5 mm). 27–28, *Adela purpurea*. 27, Male. 28, Female. 29–30, *Adela trigrapha*. 29, Male. 30, Female.



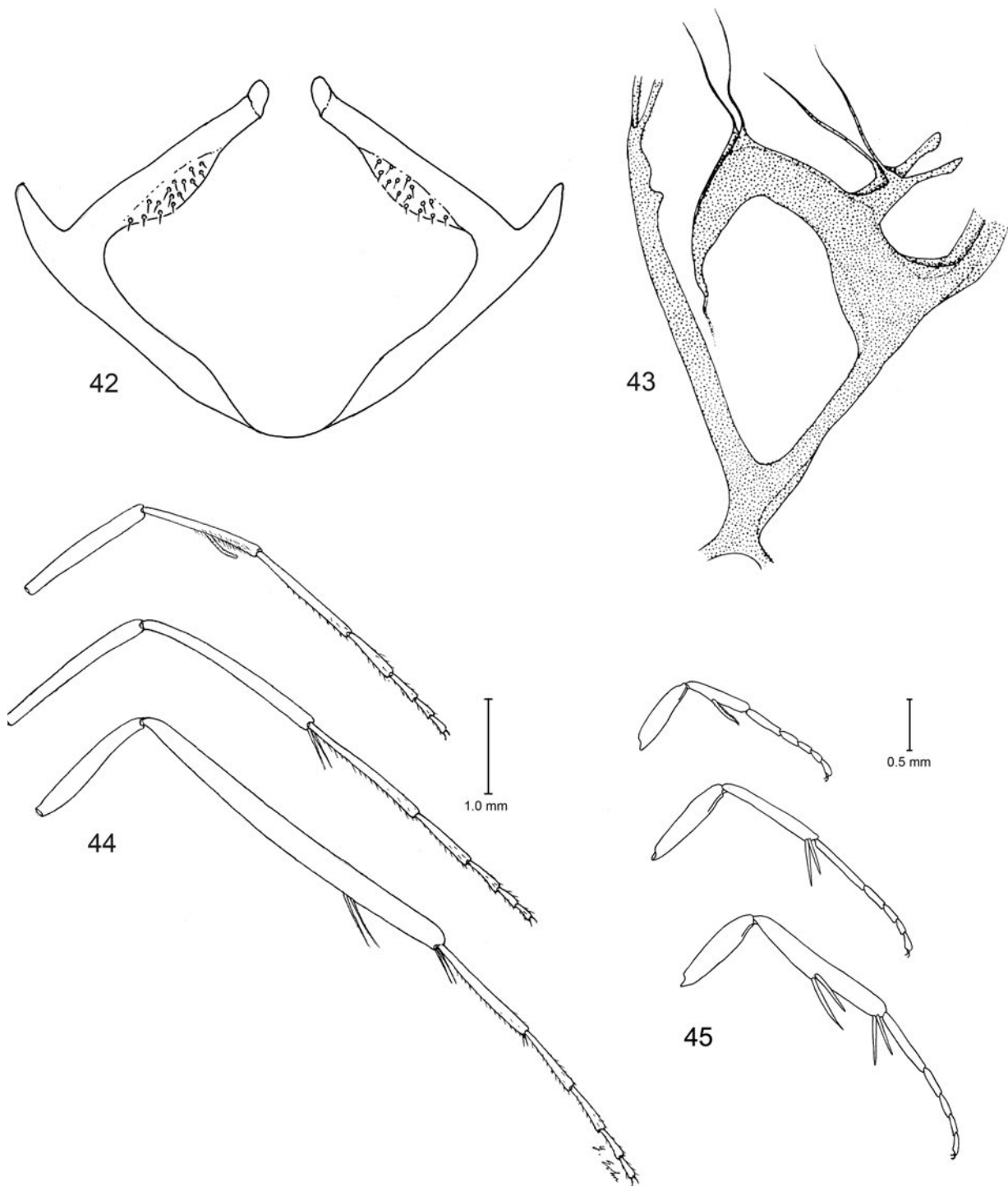
FIGURES 31–34. Adult head morphology, anterior view. 31–32, *Adela flammeusella*. 31, Male. 32, Female. 33–34, *Adela thorpella*. 33, Male. 34, Female.



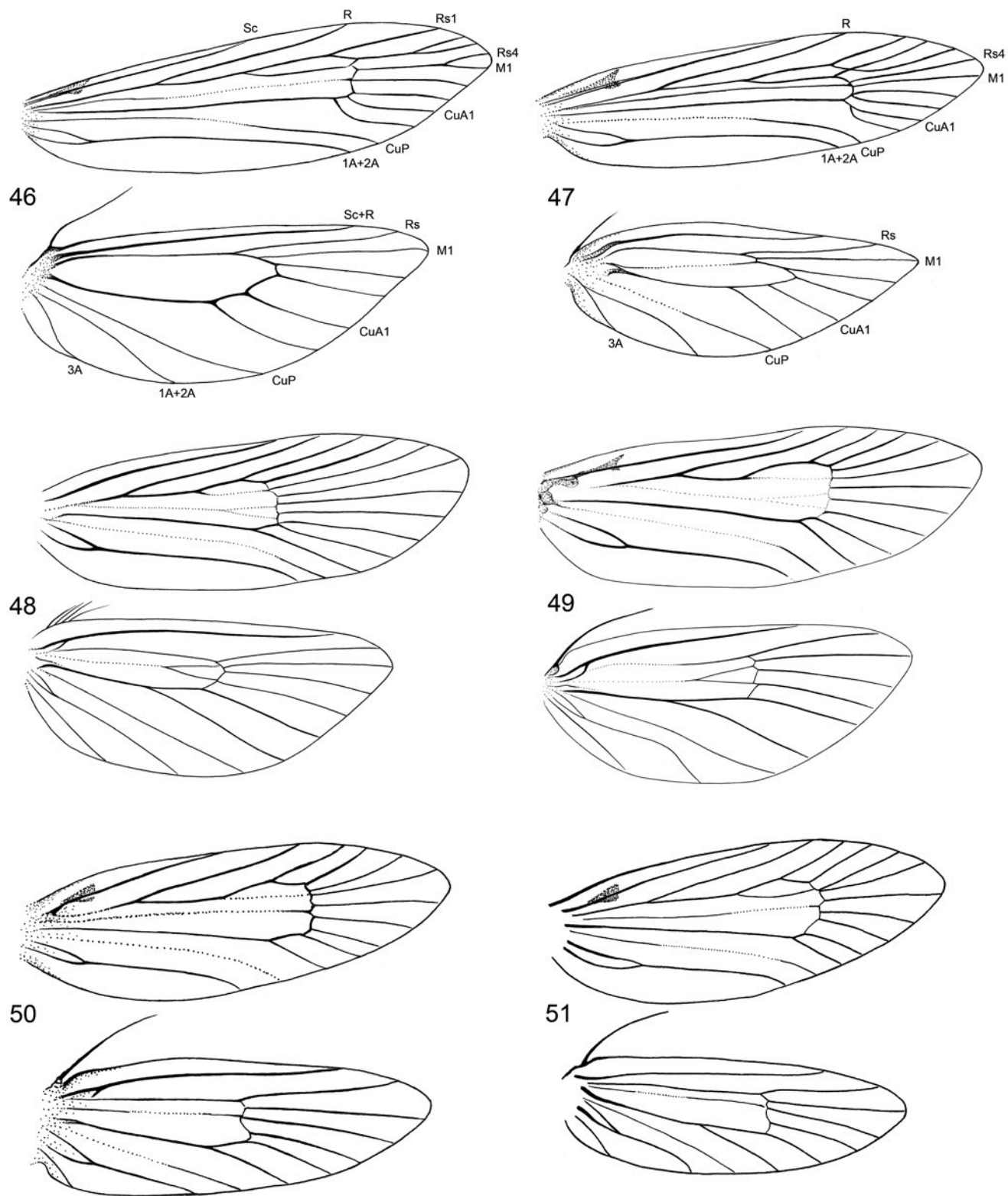
FIGURES 35–38. Adult head morphology, anterior view. 35–36, *Adela oplerella*. 35, Male. 36, Female. 37–38, *Adela ridingella*. 37, Male. 38, Female.



FIGURES 39–41. Adult head morphology, anterior view (scale=0.5 mm). 39–40, *Adela astrella*. 39, Male. 40, Female. 41, *Cauchas cyanella*, male.



FIGURES 42–45. Thoracic morphology. 42, Lateral cervical sclerite, *Adela trigrapha*. 43, Metathoracic furcasternum, lateral view, *Adela trigrapha*. 44–45, Leg morphology. 44, *Ceromitia capitanea* (1 mm). 45, *Cauchas cyanella* (0.5 mm). Scale lengths as indicated.



FIGURES 46–51. Wing venation. 46, *Ceromitia capitanea*. 47, *Ceromitia pucaraensis*. 48, *Nemophora bellela*. 49, *Adela trigrapha*. 50, *Cauchas vittata*. 51, *Cauchas cyanella*.

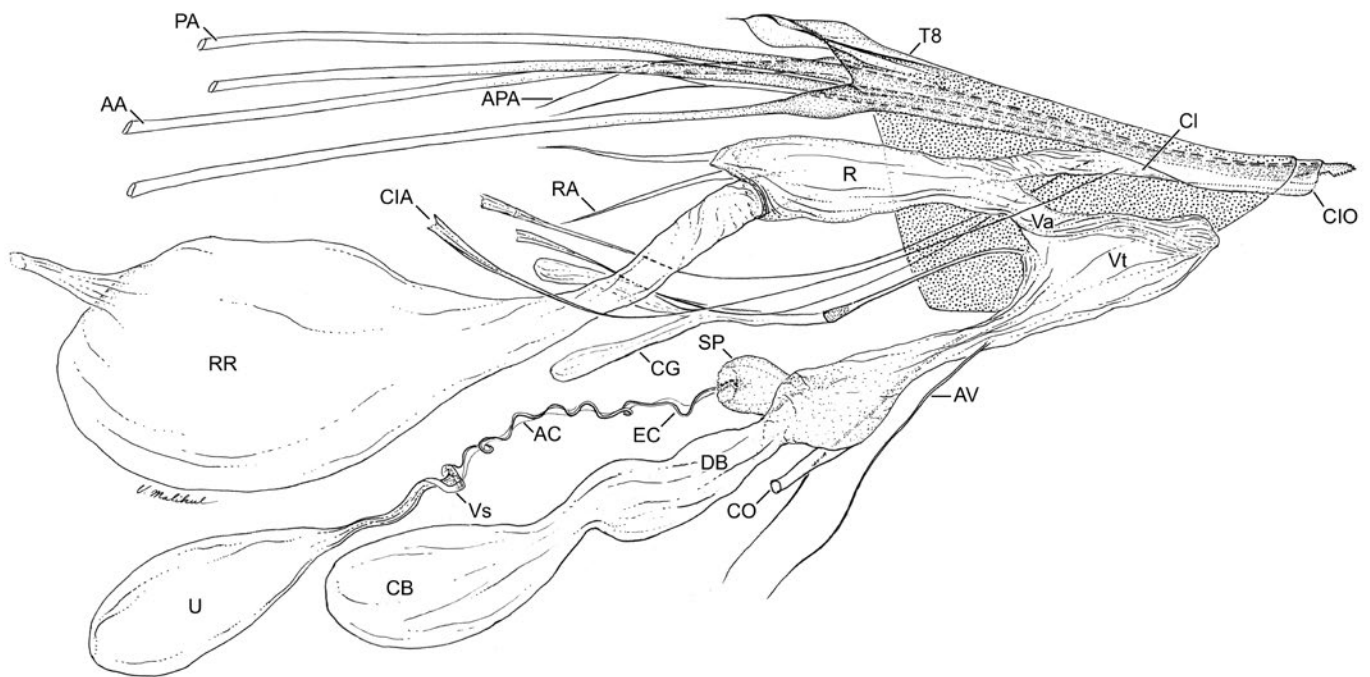


FIGURE 52. Female genital morphology (from Davis 1998), *Ceromitia fasciolata*. AA=anterior apophyses; AC=afferent (transport) canal; APA=apodeme of posterior apophysis; AV=apodeme of vestibulum; CB=corpus bursae; CG=colleterial gland; Cl=cloaca; CIA=cloacal apodeme; CIO=cloacal opening; CO=common oviduct; DB=ductus bursae; EC=efferent (fertilization) canal; PA=posterior apophysis; R=rectum; RA=rectal apodeme; RR=rectal reservoir; SP=spermathecal papilla; U=utriculus of spermathecal; Va=vagina; Vs=vesicle; Vt=vestibulum; T8=eighth abdominal tergite.

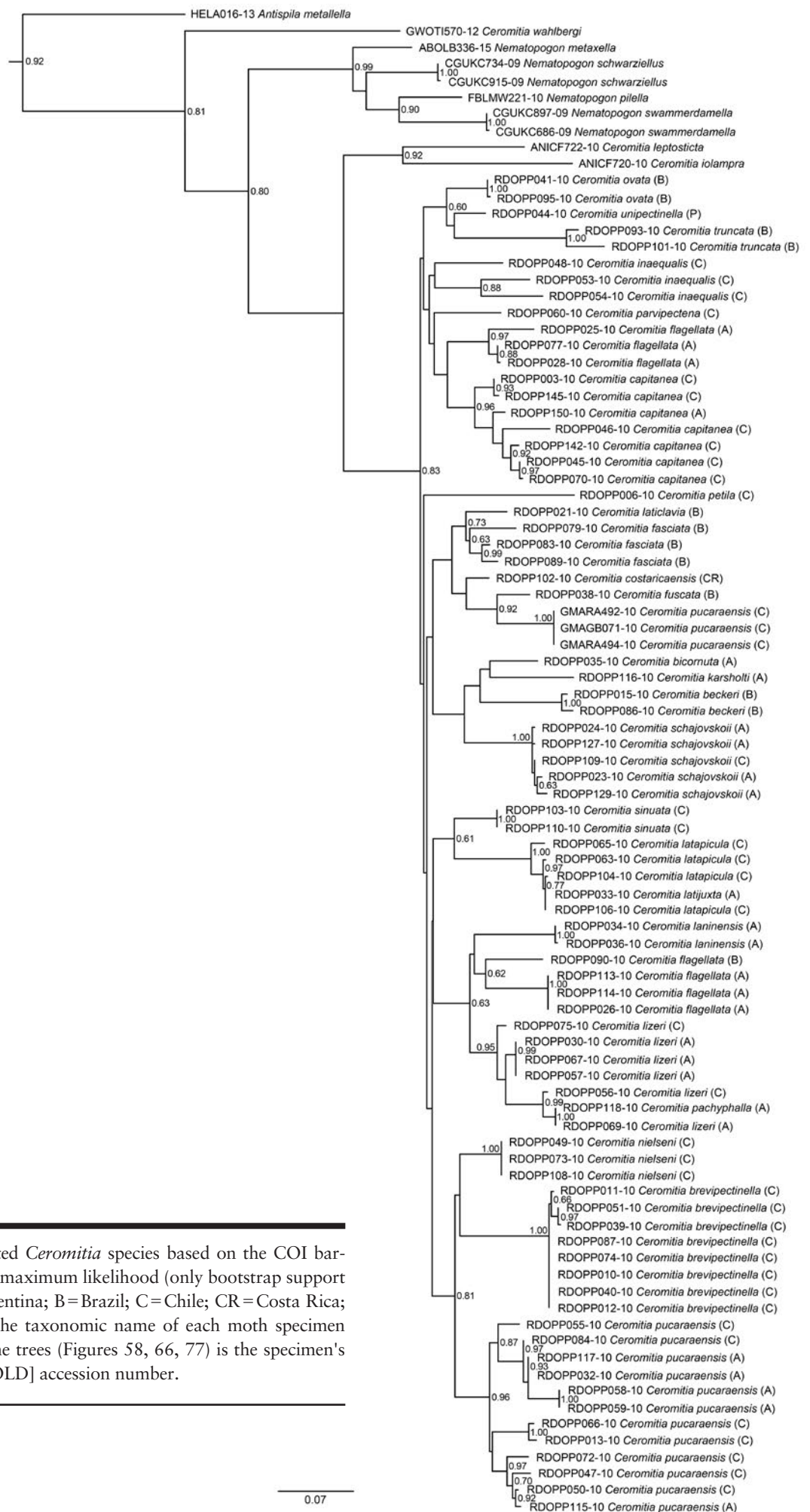
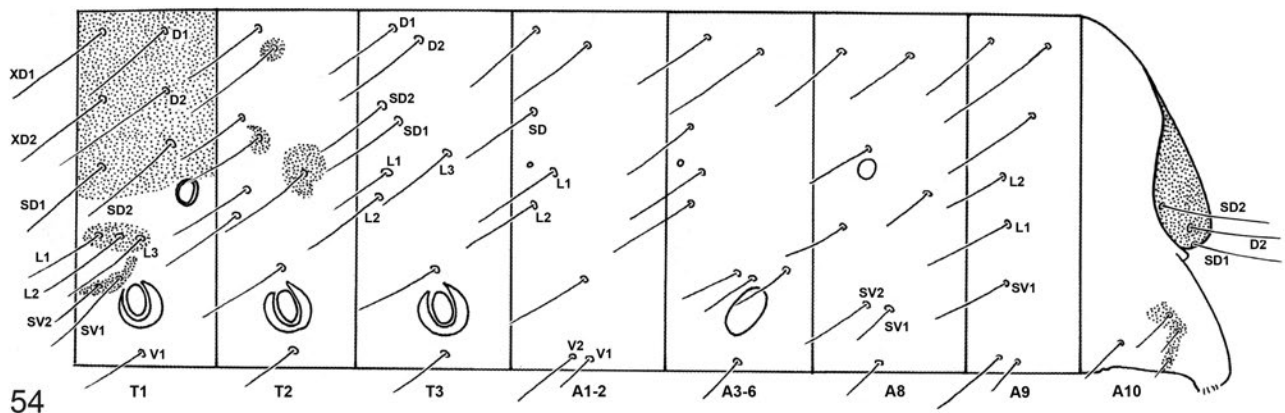
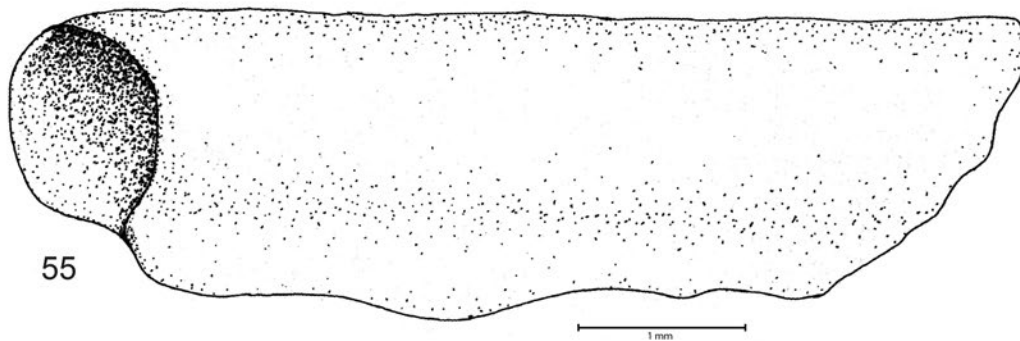


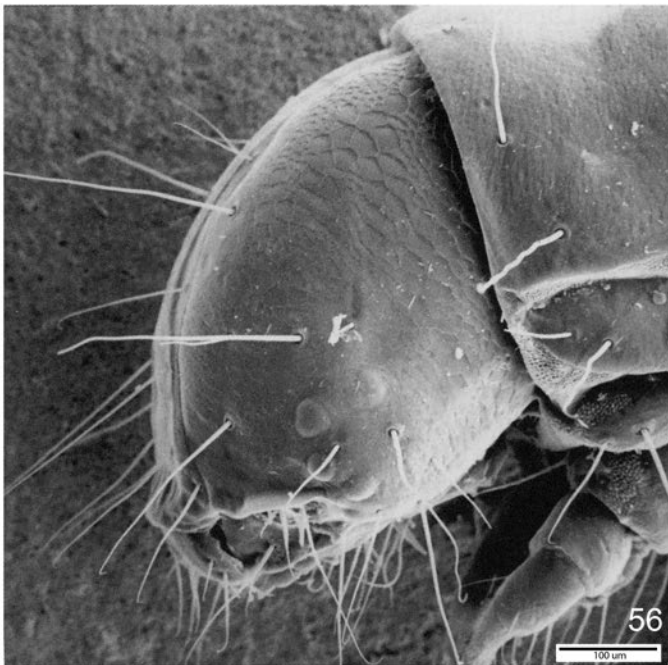
FIGURE 53. Gene tree for selected *Ceromitia* species based on the COI barcode region and generated using maximum likelihood (only bootstrap support values >0.6 are shown). A=Argentina; B=Brazil; C=Chile; CR=Costa Rica; P=Paraguay. The code before the taxonomic name of each moth specimen listed in this and subsequent gene trees (Figures 58, 66, 77) is the specimen's Barcode of Life Data System [BOLD] accession number.



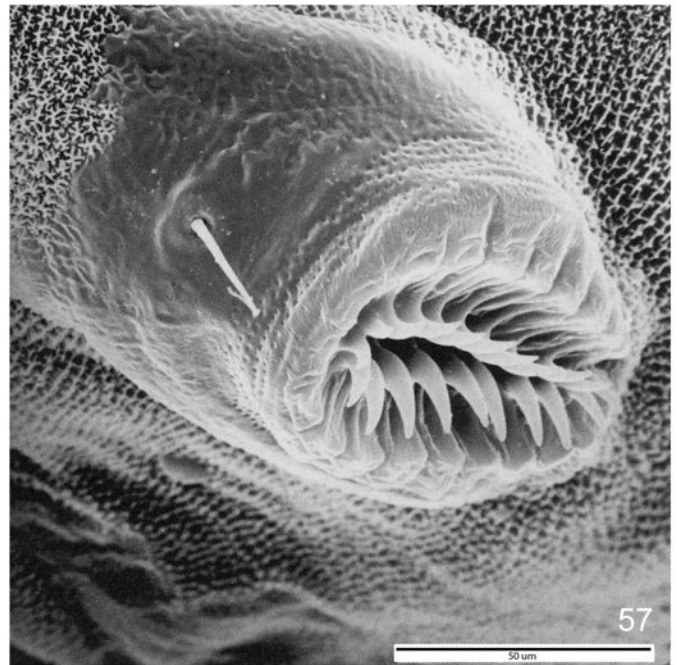
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FIGURES 54–57. Immature stages of *Ceromitia tubulifolia* (from Parra and Ogden 2011). 54, Larval chaetotaxy; thoracic segments 1–3, abdominal segments 1–2, 3–6, 8–10. 55, Larval case, scale=1 mm. 56, Larval head, lateral view, scale=100 μ m. 57, Proleg and crochets, scale=50 μ m.

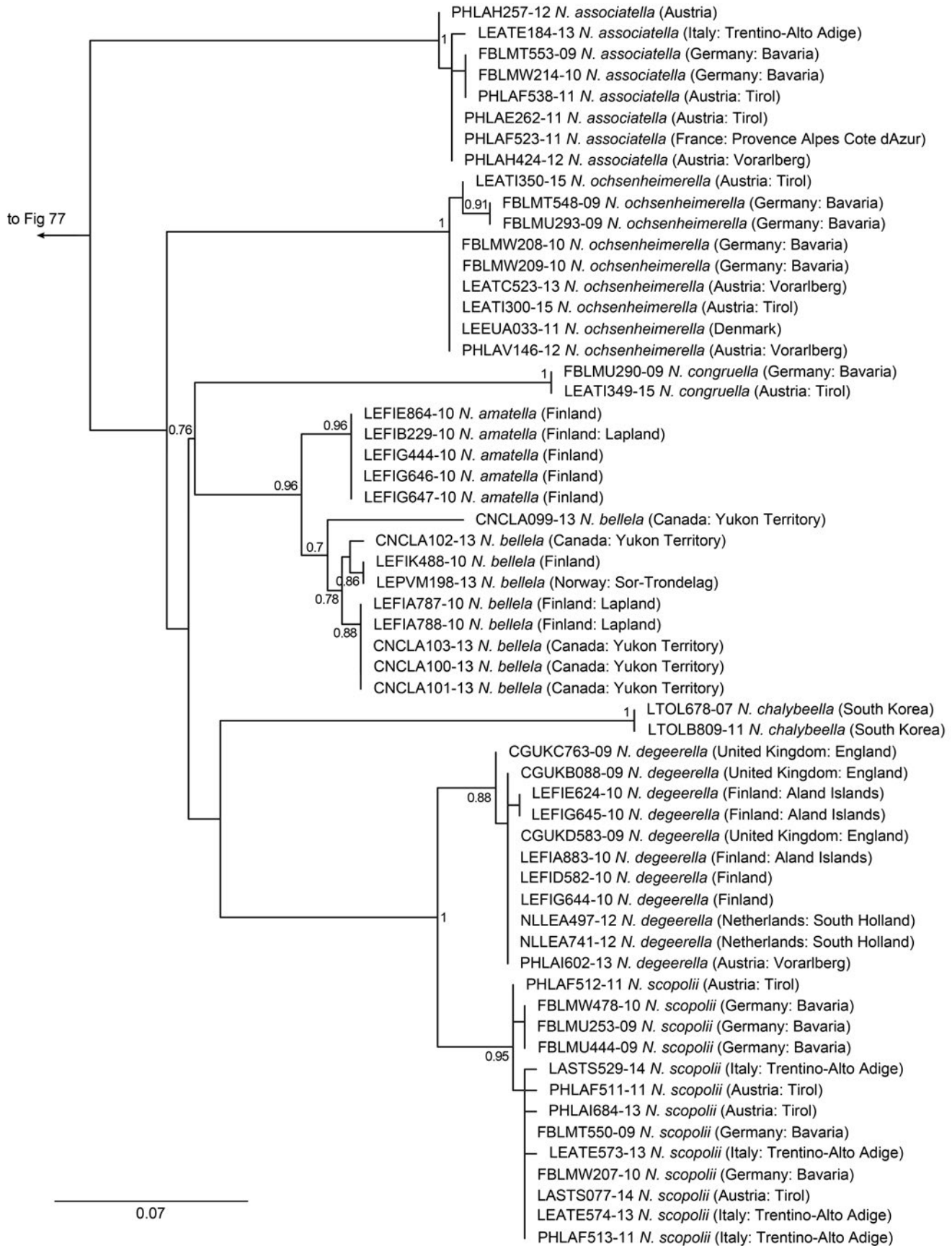
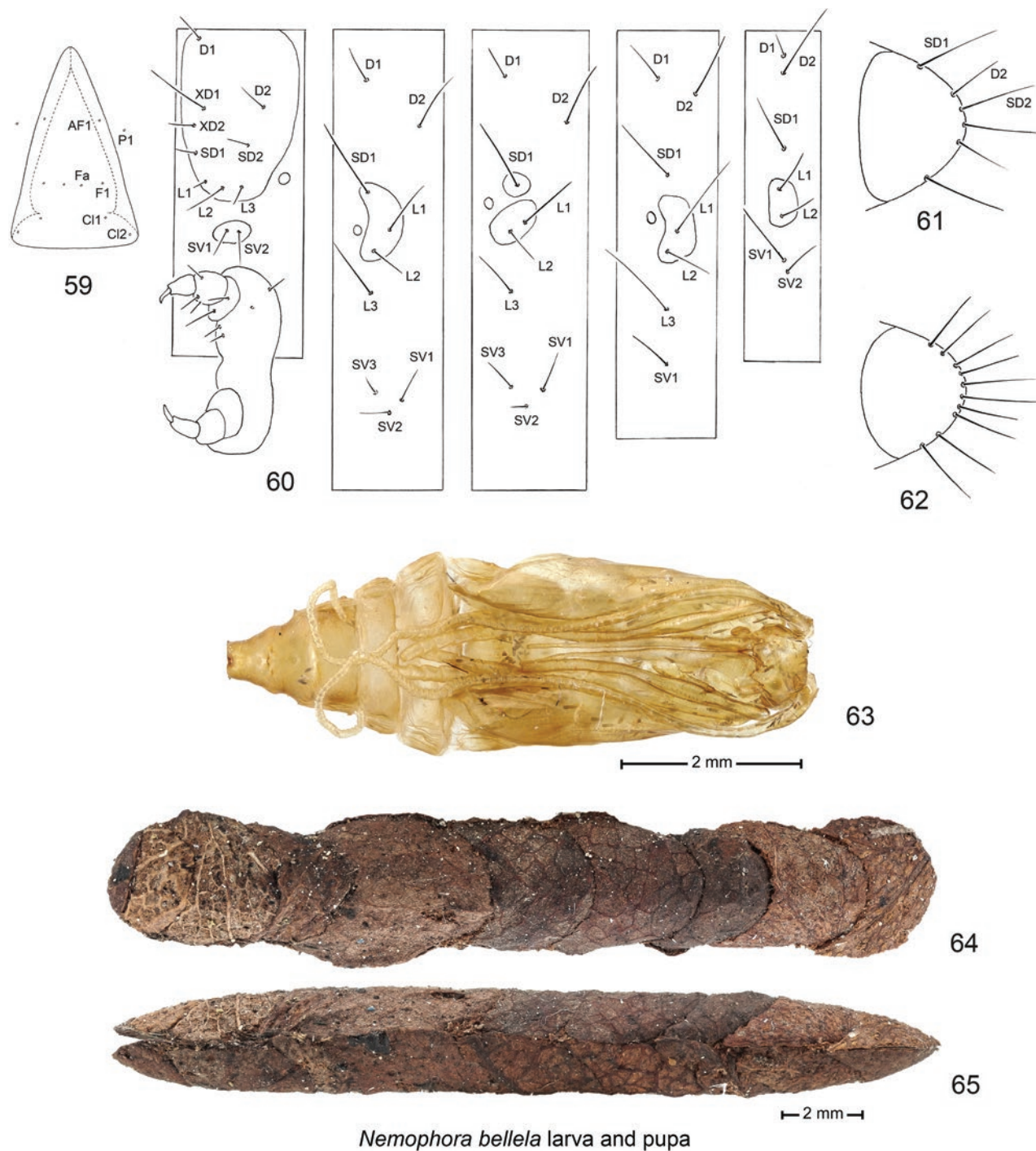


FIGURE 58. Gene tree for selected *Nemophora* species based on the COI barcode region and generated using maximum likelihood (only bootstrap support values >0.7 are shown). This is part of a larger tree combining *Adela*, *Cauchas*, and *Nemophora* and connects to the tree in Figure 77.



Nemophora bellela larva and pupa

FIGURES 59–65. Immature stages of *Nemophora bellela* (from Ahola et al. 2017). 59–62, Chaetotaxy of last instar larva: 59, Frontoclypeal area of head. 60, Body segments T1 (prothorax) and abdominal segments A1, A2, A8, and A9. 61, Dorsal plate of A10. 62, Ventral plate of A10. 63, Pupal exuvium. 64–65, Pupal cases. 64, Ventral view. 65, Lateral view (scale lengths as indicated).

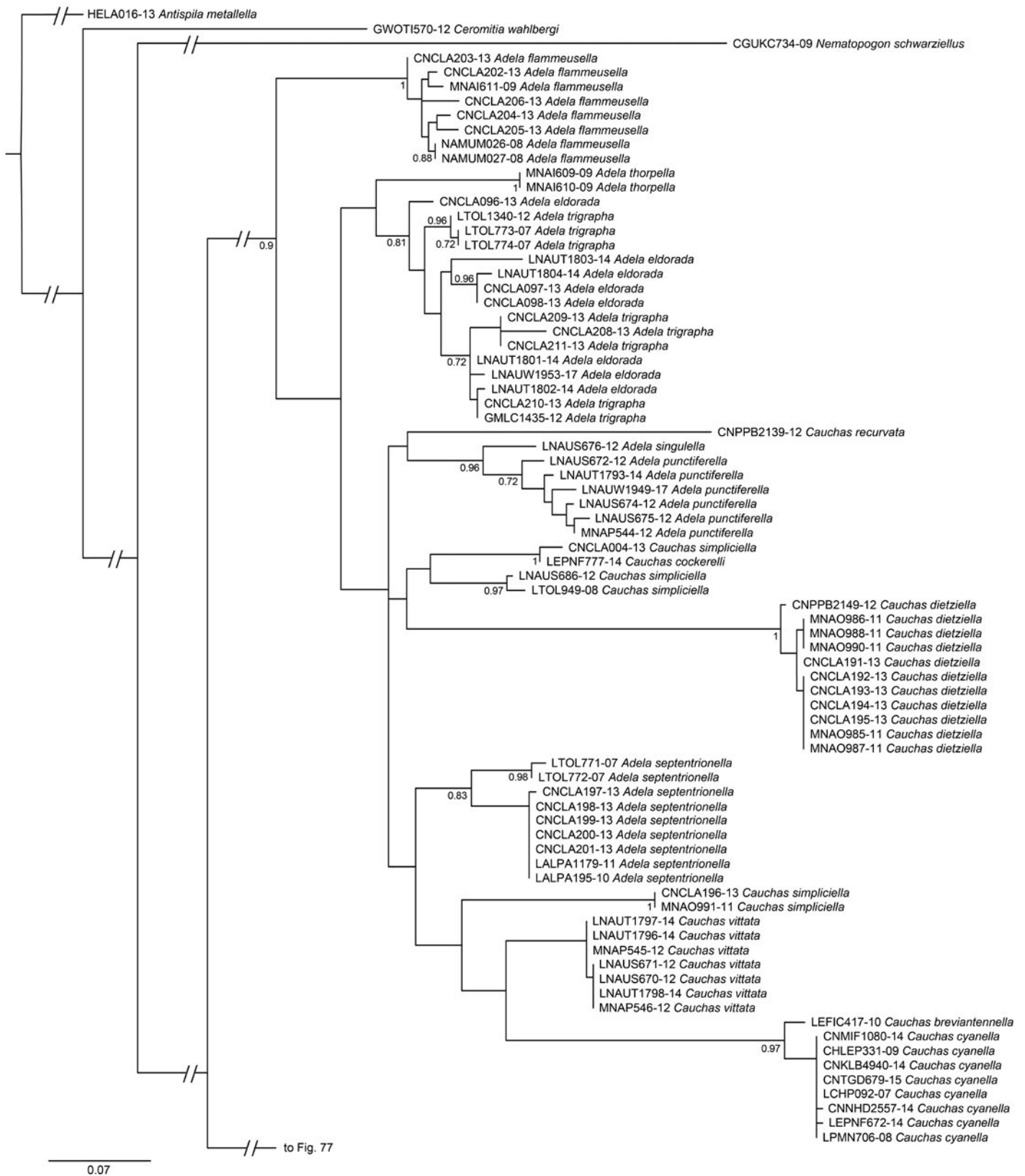
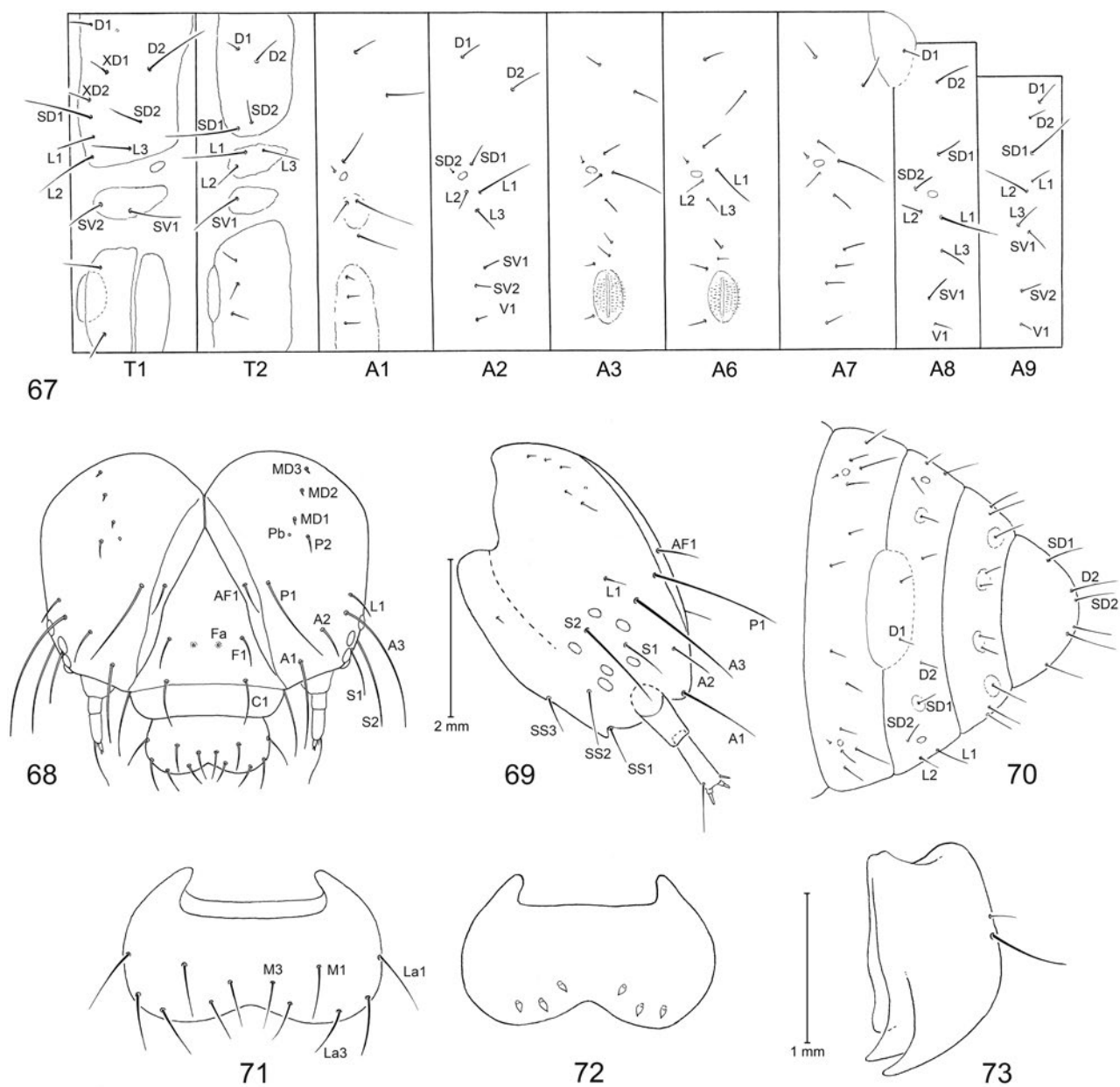
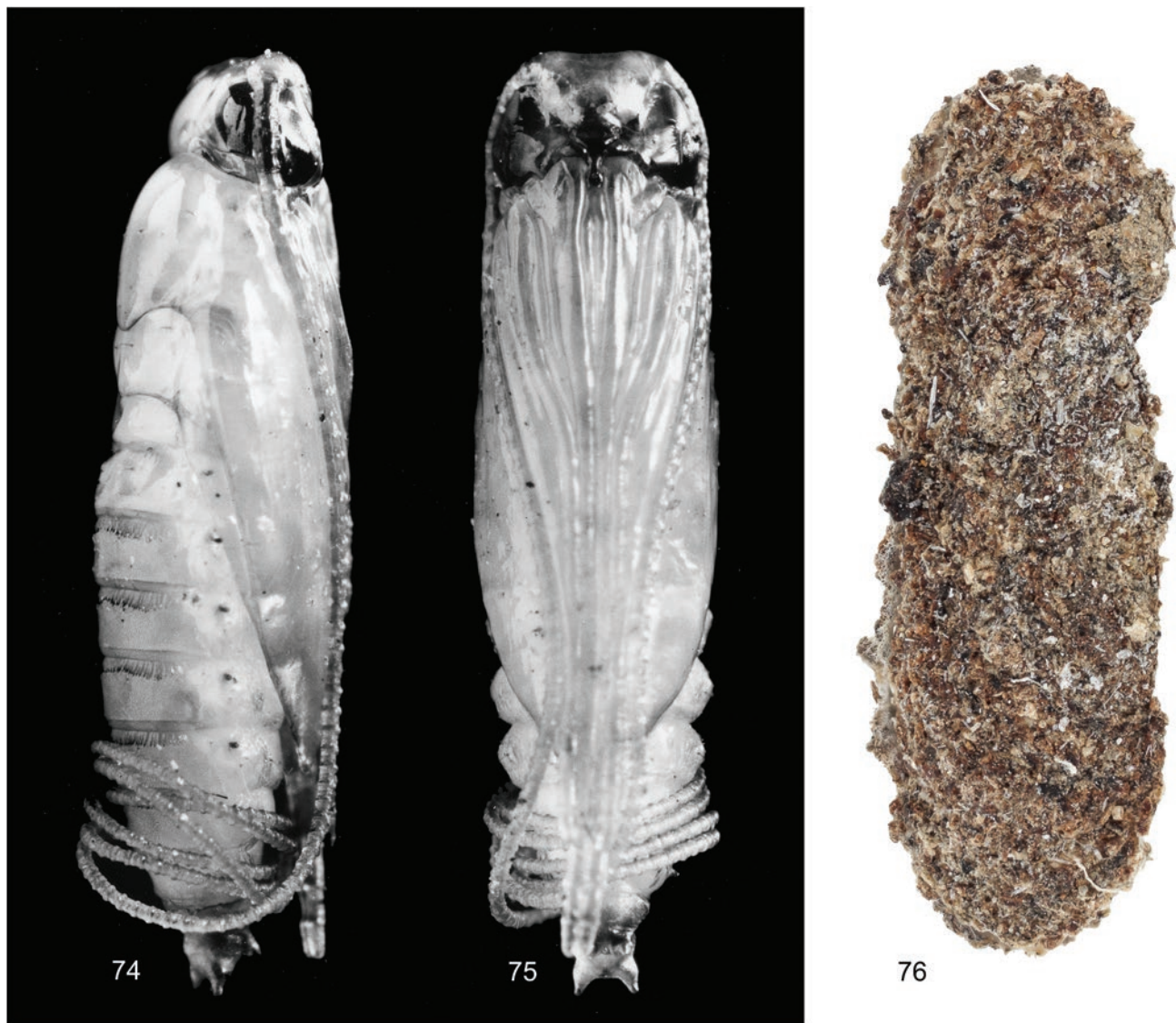


FIGURE 66. Gene tree for selected outgroups, *Adela*, and *Cauchas* species based on the COI barcode region and generated using maximum likelihood (only bootstrap support values >0.7 are shown). This is part of a larger tree combining *Adela*, *Cauchas*, and *Nemophora* and connects to the tree in Figure 77.

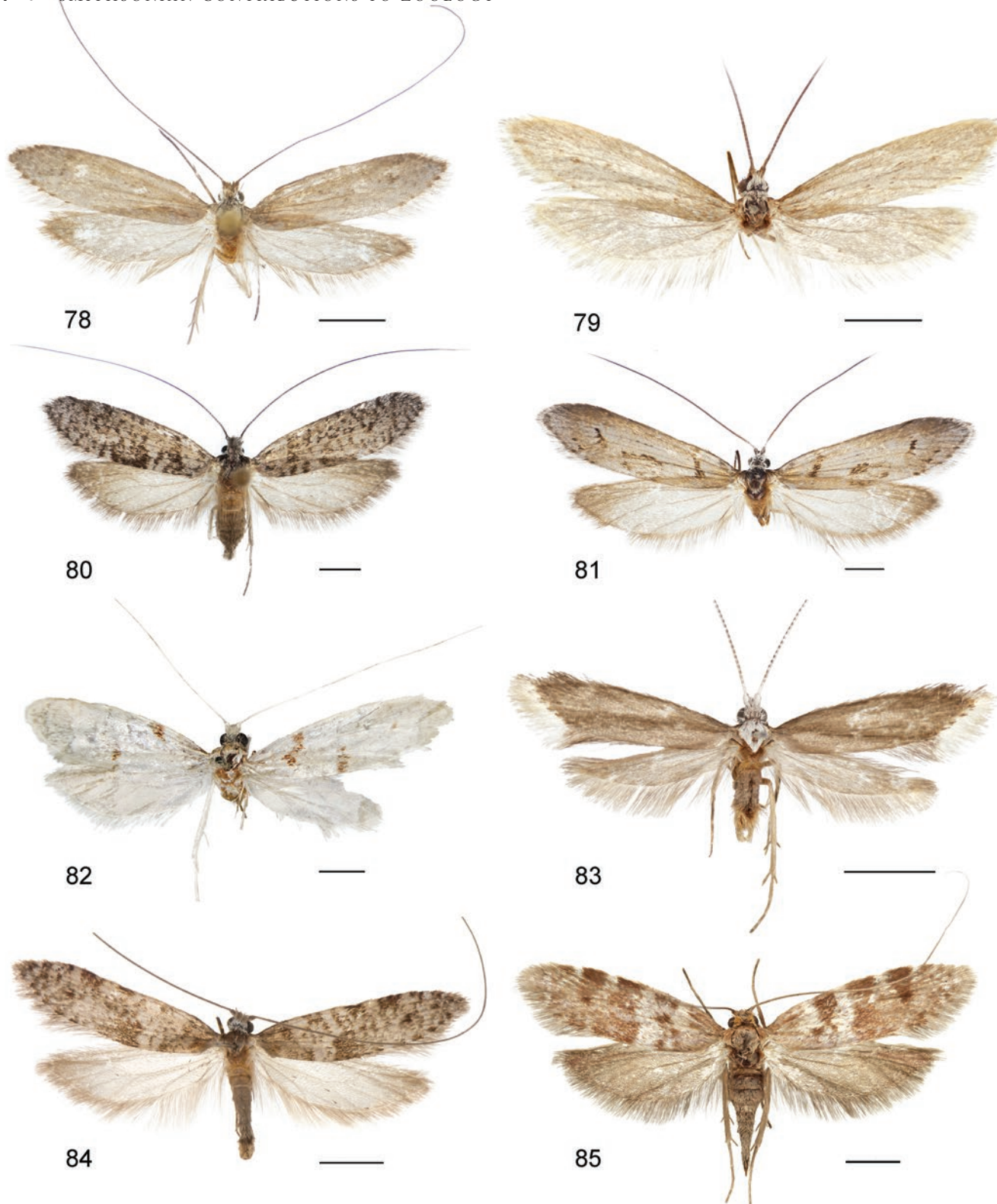


FIGURES 67–73. Chaetotaxy of late larval instar of *Adela septentrionella*. 67, Lateral view of prothorax (T1), mesothorax (T2), and abdominal segments A1–A3, A6–A9. 68, Dorsal view of head. 69, Lateral view of head. 70, Dorsal view of abdominal segments 7–10. 71, Labrum, dorsal view. 72, Labrum, ventral view. 73, Mandible, ventral view (scale lengths as shown).

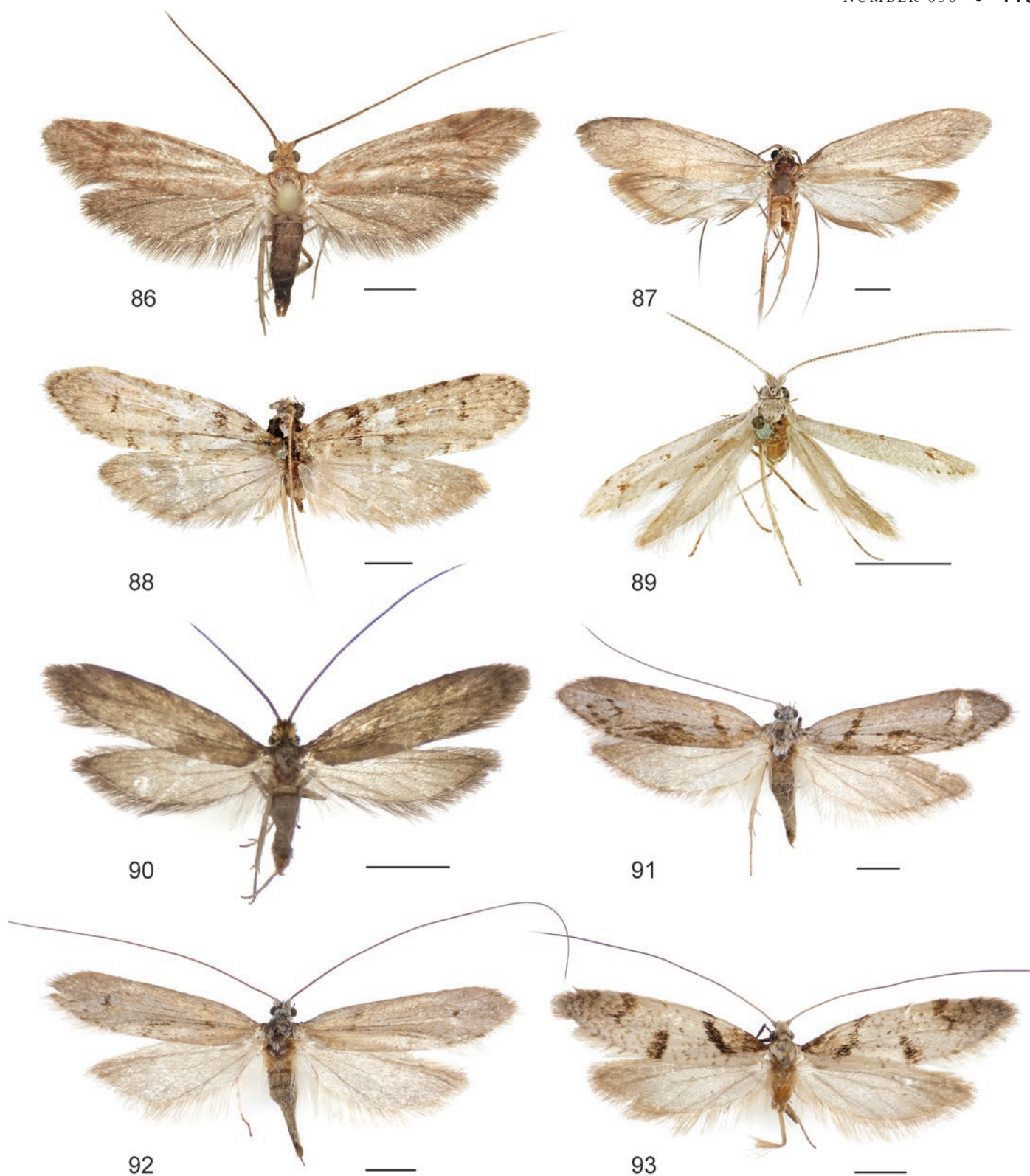


FIGURES 74–76. Pupal stages of *Adela septentrionella*. 74, Lateral view of pupa (length 5 mm). 75, Ventral view of pupa. 76, Dorsal view of pupal case (length 6 mm).

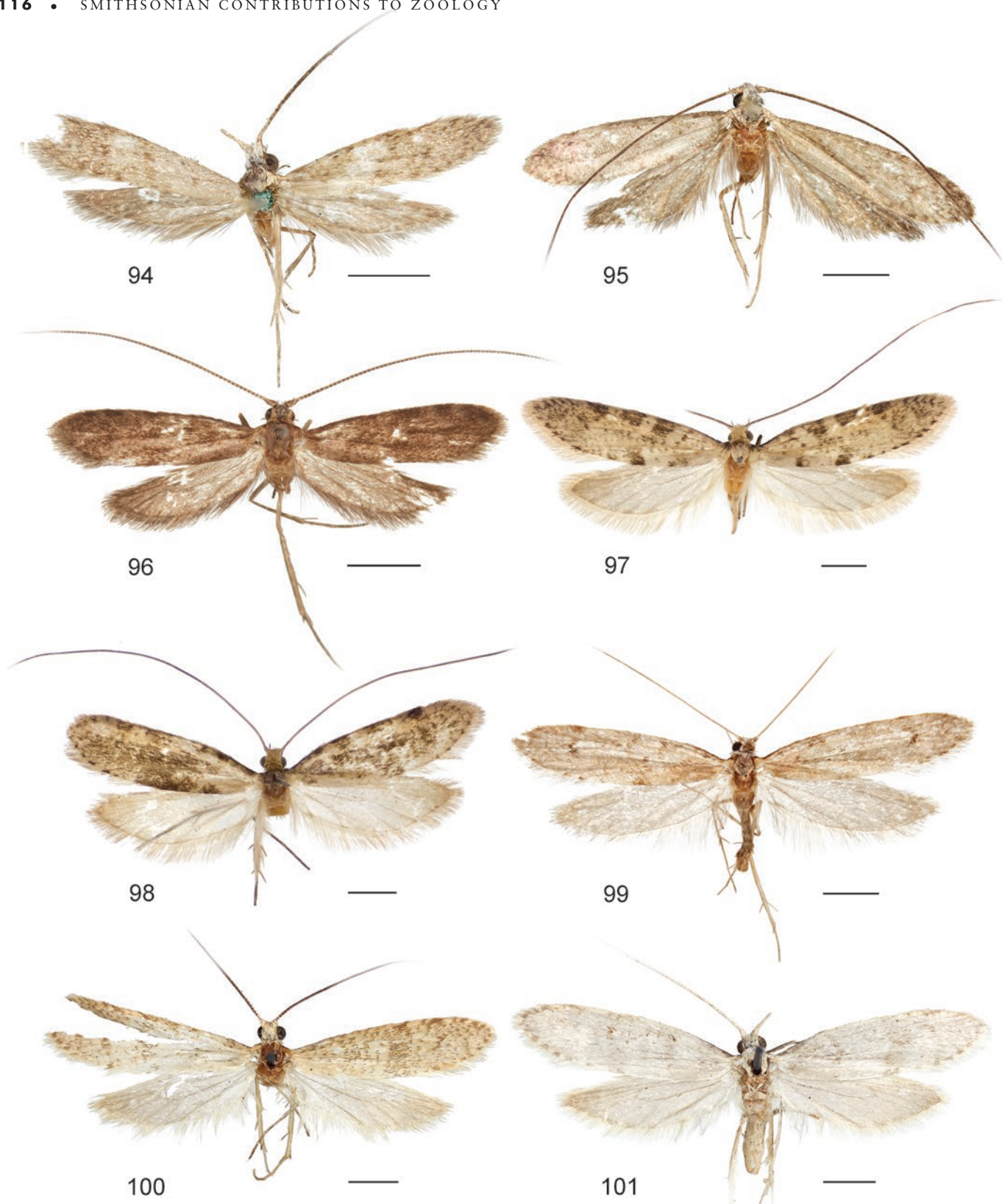
FIGURE 77. (Opposite) Gene tree for selected *Adela*, *Cauchas*, and *Nemophora* species based on the COI barcode region and generated using maximum likelihood (only bootstrap support values >0.7 are shown). This is part of a larger tree combining *Adela*, *Cauchas*, and *Nemophora* and connects to the tree in Figures 58 and 66.



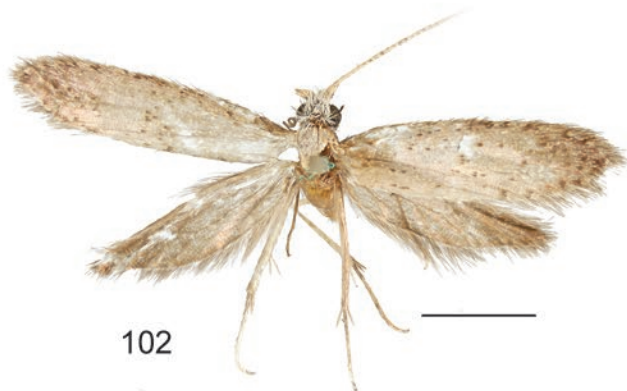
FIGURES 78–85. Adults of *Ceromitia* (scale lengths=2 mm, forewing lengths in parentheses). 78, *C. parvipectena* Davis & Medeiros, paratype ♀, CHILE: Maule (7.2 mm). 79, *C. parvipectena* Davis & Medeiros, holotype ♂, CHILE: Coquimbo (6.2 mm). 80, *C. capitanea* Davis & Medeiros, paratype ♀, CHILE: Santiago (10.5 mm). 81, *C. capitanea* Davis & Medeiros, paratype ♂, ARGENTINA: Neuquén (13 mm). 82, *C. fasciolata* Butler, holotype ♂, CHILE: Valdivia (9 mm). 83, *C. chionocrossa* Meyrick, ♂, GUYANA: Mazaruni-Potaro (5.0 mm). 84, *C. lizeri* Pastrana, ♂, ARGENTINA: Neuquén (8.2 mm). 85, *C. lizeri* Pastrana, ♀, ARGENTINA: Rio Negro (9.0 mm).



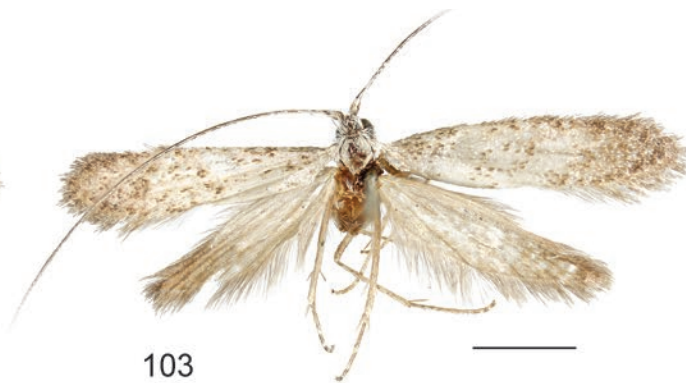
FIGURES 86–93. Adults of *Ceromitia* (scale lengths=2 mm, forewing lengths in parentheses). 86, *C. lizeri* Pastrana, ♂, CHILE: Malleco (9.2 mm). 87, *C. lizeri* Pastrana, holotype ♂, ARGENTINA: Neuquén (12.0 mm). 88, *C. eremarcha* Meyrick, paratype ♂, PARAGUAY: Bernardino (9.9 mm). 89, *C. exalbata* Meyrick, holotype ♂, BRAZIL: Pará (4.2 mm). 90, *C. pucaraensis* Pastrana, ♂, CHILE: Temuco (6.7 mm). 91, *C. flagellata* Davis & Medeiros, paratype ♀, ARGENTINA: Rio Negro (12.0 mm). 92, *C. flagellata* Davis & Medeiros, paratype ♀, ARGENTINA: Rio Negro (10.5 mm). 93, *C. flagellata* Davis & Medeiros, paratype ♂, ARGENTINA: Chubut (10.5 mm).



FIGURES 94–101. Adults of *Ceromitia* (scale lengths=2 mm, forewing lengths in parentheses). 94, *C. phaeoceros* Meyrick, lectotype ♂, BRAZIL: Parintins (5.7 mm). 95, *C. phaeoceros* Meyrick, paralectotype ♀, BRAZIL: Parintins (7.5 mm). 96, *C. fuscata* Davis & Medeiros, holotype ♂, BRAZIL: Rio de Janeiro (5.8 mm). 97, *C. karsholti* Davis & Medeiros, paratype ♂, CHILE: Valdivia (10.2 mm). 98, *C. karsholti* Davis & Medeiros, paratype ♂, CHILE: Valdivia (10.3 mm). 99, *C. karsholti* Davis & Medeiros, paratype ♂, CHILE: Valdivia (7.0 mm). 100, *C. pallidofascia* Davis & Medeiros, holotype ♂, BRAZIL: São Paulo (8.5 mm). 101, *C. pallidofascia* Davis & Medeiros, paratype ♂, BRAZIL: São Paulo (8.5 mm).



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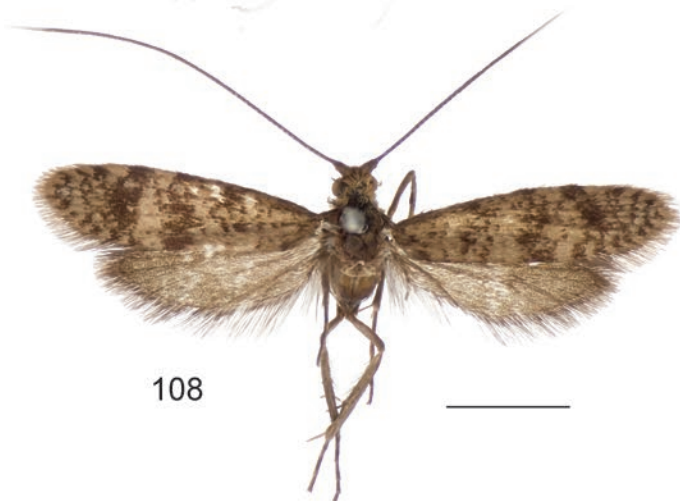
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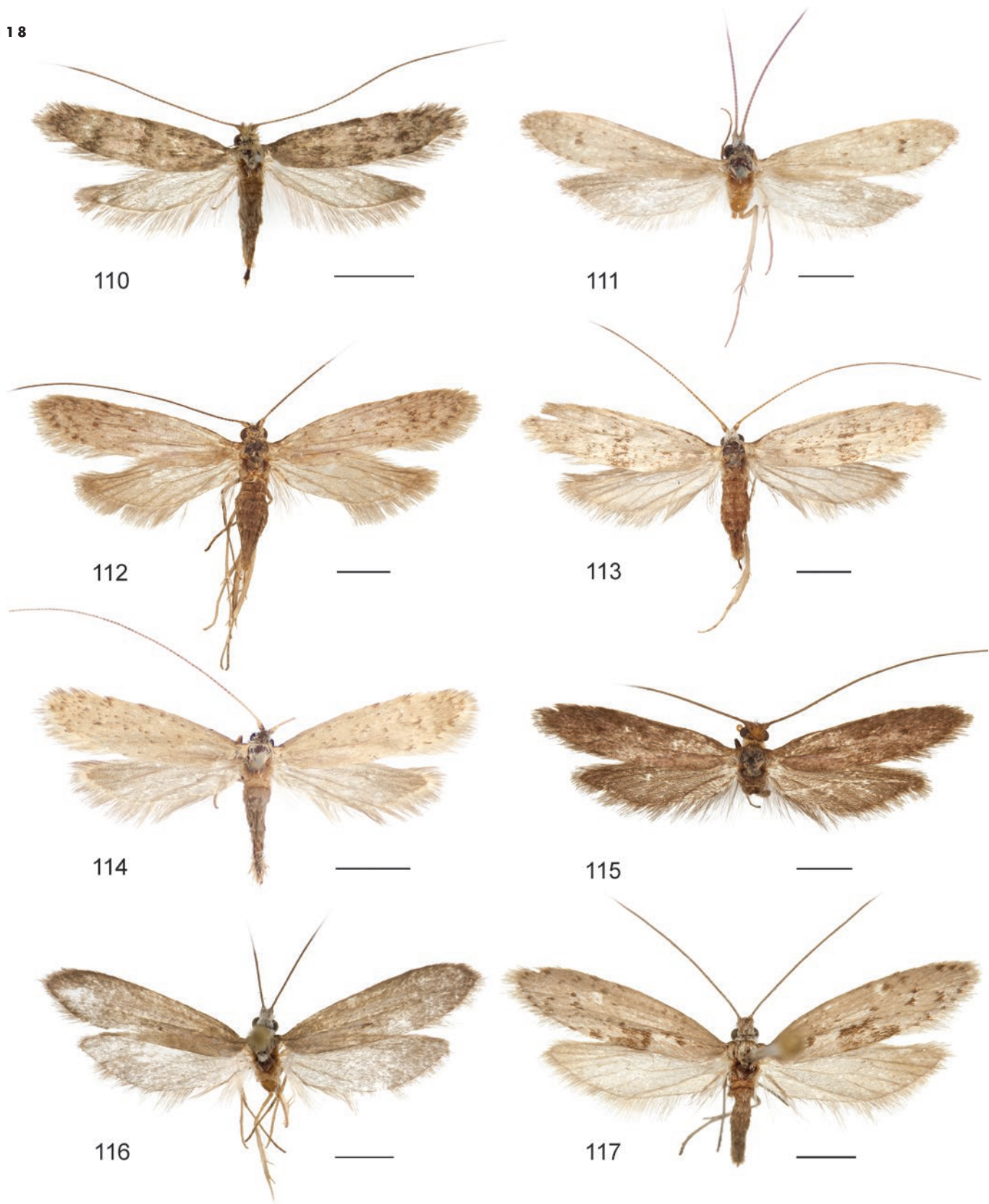


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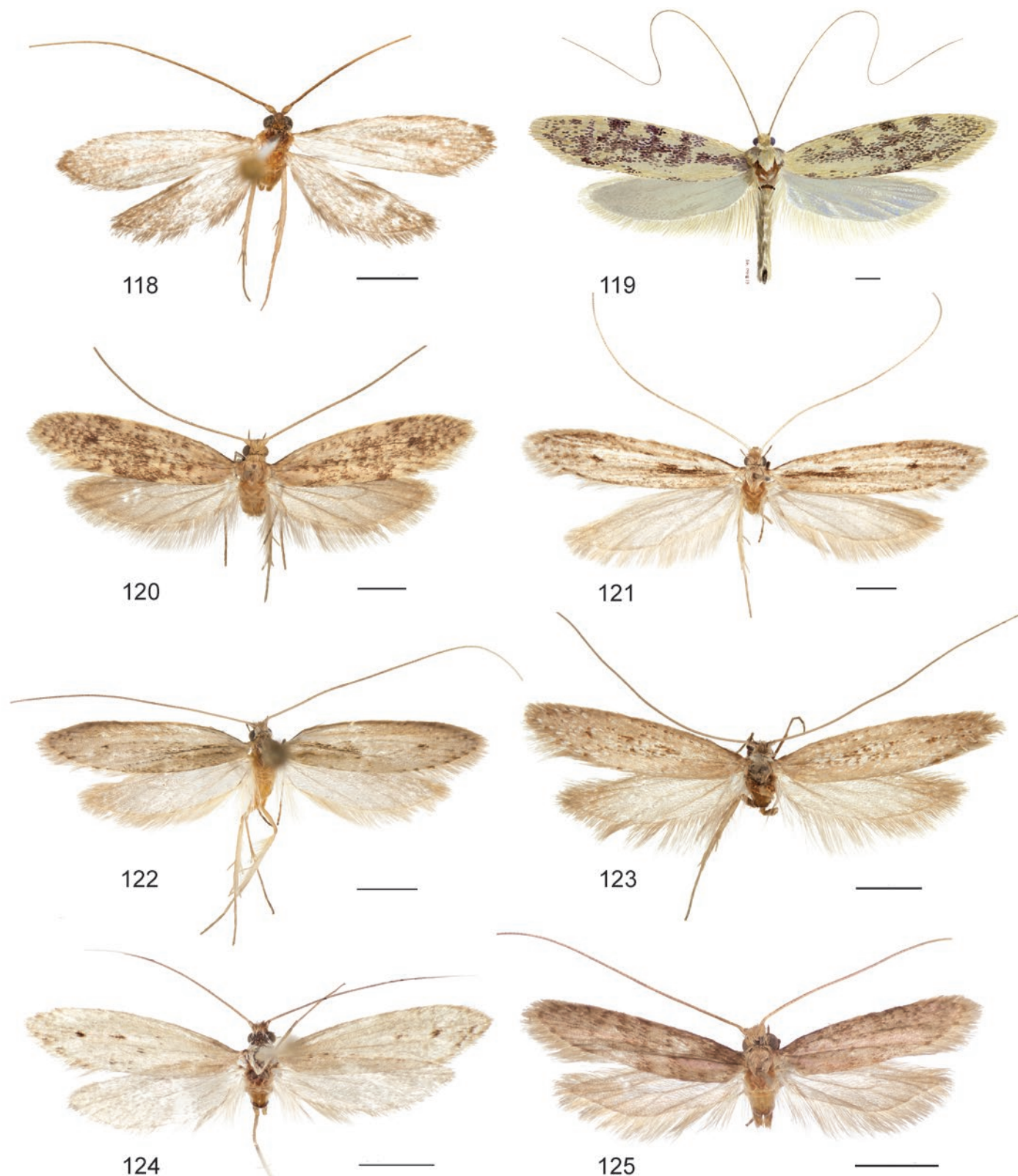


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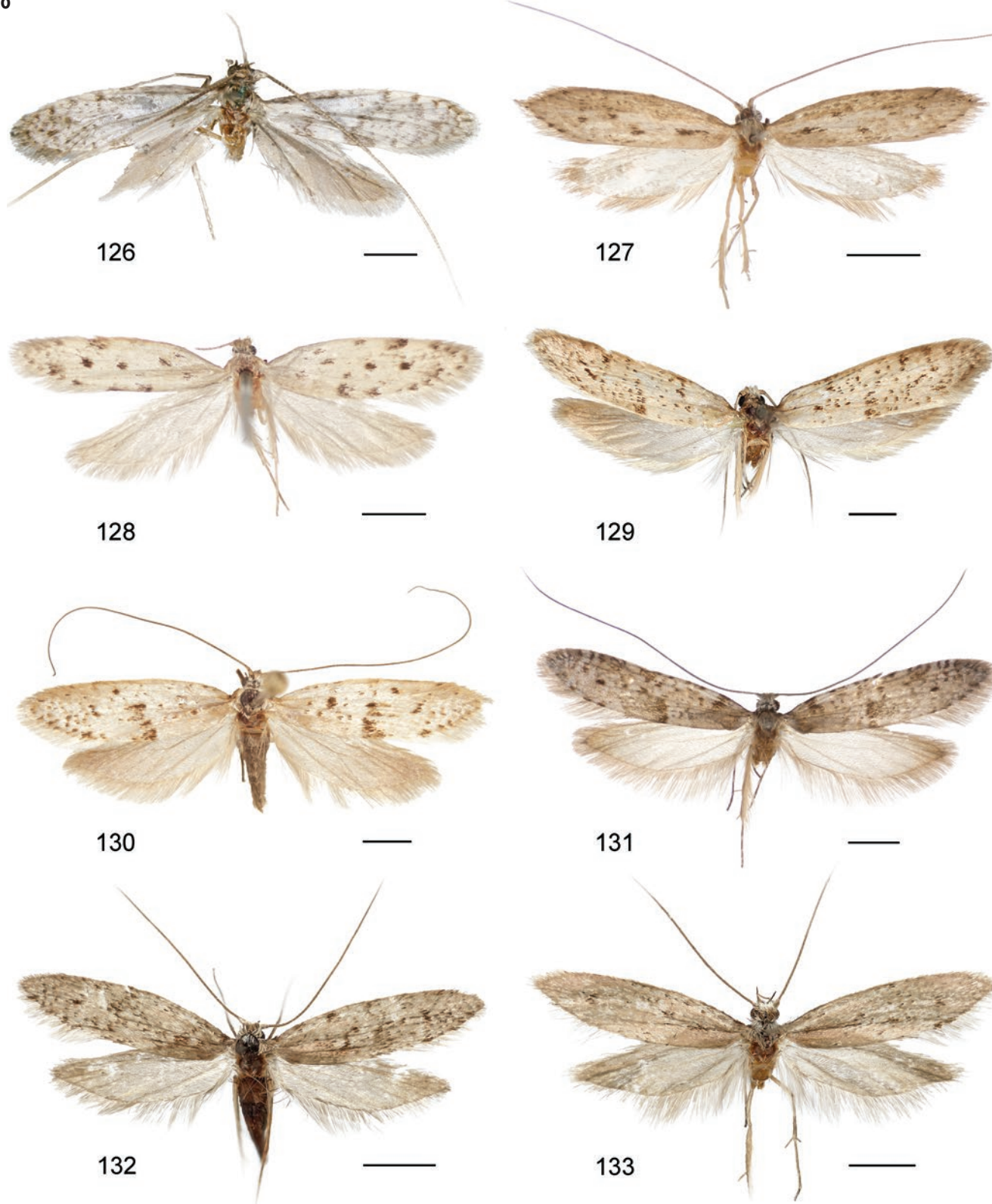
FIGURES 102–109. Adults of *Ceromitia* (scale lengths=2 mm, forewing lengths in parentheses). 102, *C. viscida* Meyrick, lectotype ♂, BRAZIL: Parintins (5.0 mm). 103, *C. viscida* Meyrick, paralectotype ♀, BRAZIL: Pará (6.2 mm). 104, *C. paraguayensis* Davis & Medeiros, holotype ♂, PARAGUAY: Nueva Asunción (7.0 mm). 105, *C. costaricensis* Davis & Medeiros, paratype ♀, COSTA RICA: Puntarenas (7.0 mm). 106, *C. ochrodyta* Meyrick, paralectotype ♂, BRAZIL: Parintins (4.4 mm). 107, *C. aphyoda* Davis & Medeiros, holotype ♂, BRAZIL: Paraná (7.6 mm). 108, *C. nigrifasciata* Davis & Medeiros, holotype ♂, BRAZIL: Santa Catarina (6.0 mm). 109, *C. fasciata* Davis & Medeiros, paratype ♂, BRAZIL: Minas Gerais (5.3 mm).



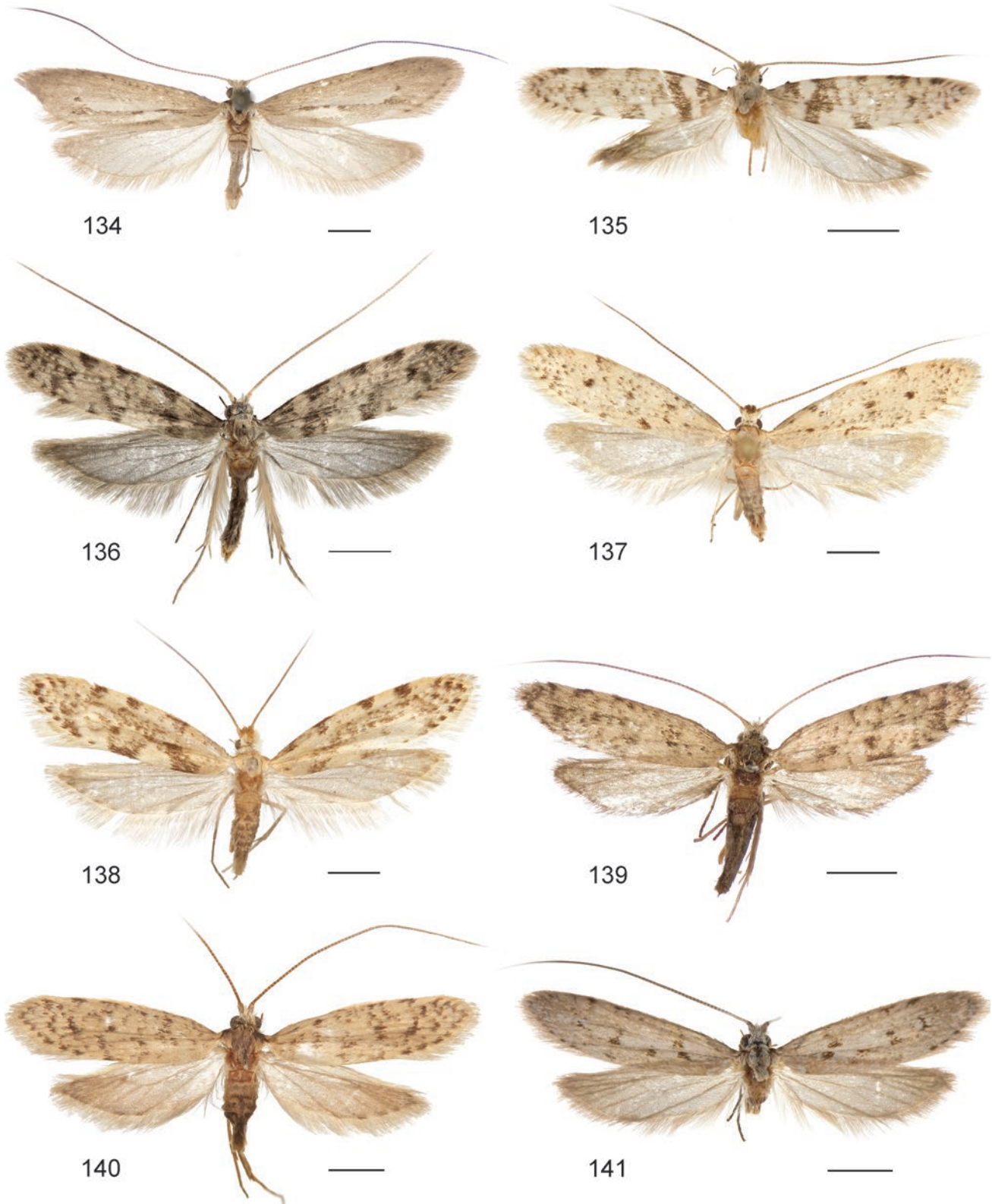
FIGURES 110–117. Adults of *Ceromitia* (scale lengths=2 mm, forewing lengths in parentheses). 110, *C. fasciata* Davis & Medeiros, paratype ♀, BRAZIL: Minas Gerais (6.0 mm). 111, *C. unicornuta* Davis & Medeiros, paratype ♂, BRAZIL: Santa Catarina (8.6 mm). 112, *C. braziliensis* Davis & Medeiros, paratype ♀, BRAZIL: Rio de Janeiro (7.8 mm). 113, *C. concava* Davis & Medeiros, paratype ♀, BRAZIL: Paraná (7.5 mm). 114, *C. convexa* Davis & Medeiros, ♀, BRAZIL: Santa Catarina (5.8 mm). 115, *C. pachyphalla* Davis & Medeiros, holotype ♂, ARGENTINA: Chubut (8.0 mm). 116, *C. inaequalis* Davis & Medeiros, paratype ♂, CHILE: Maule (9.1 mm). 117, *C. inaequalis* Davis & Medeiros, paratype ♀, CHILE: Aconcagua (8.0 mm).



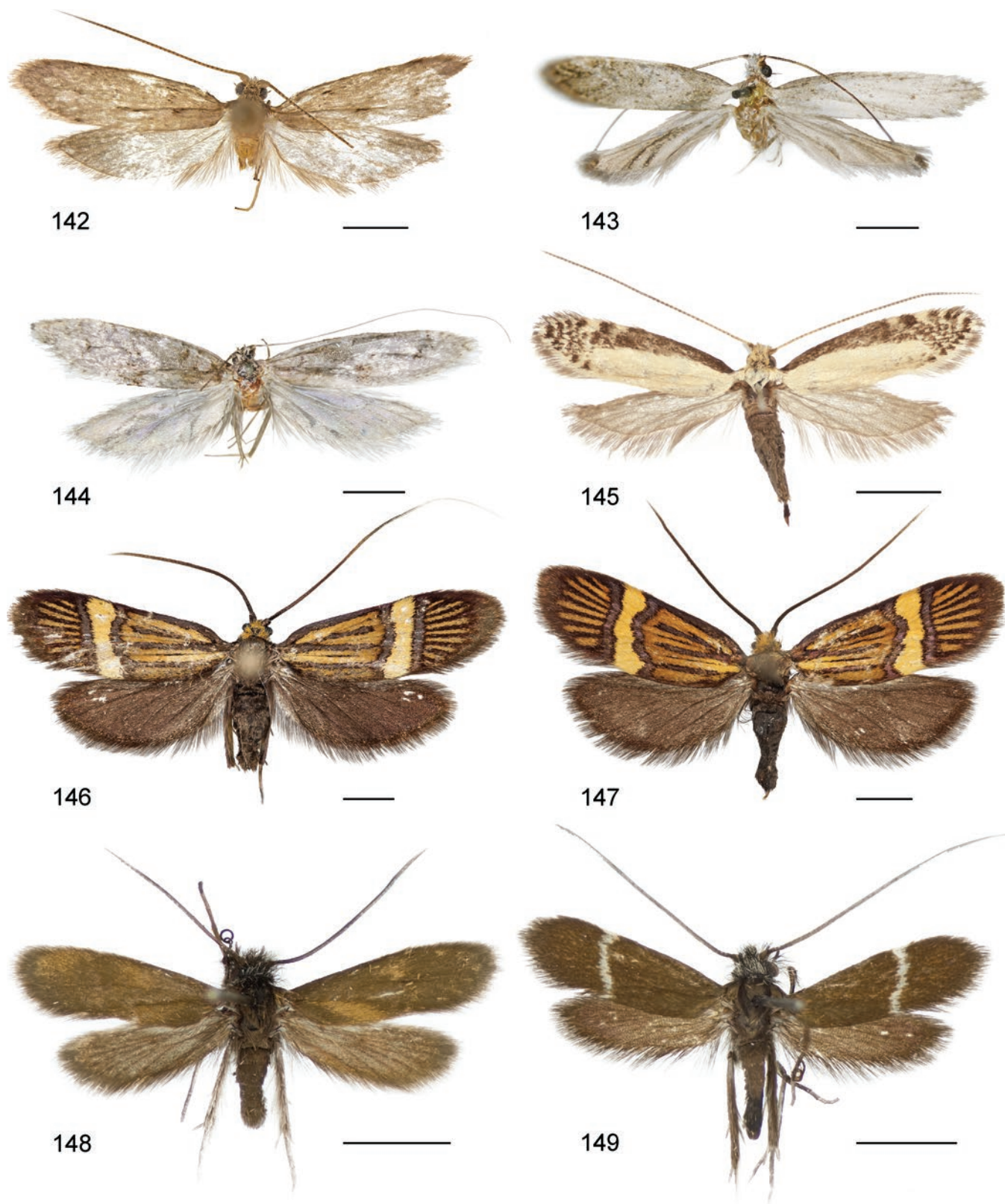
FIGURES 118–125. Adults of *Ceromitia* (scale lengths = 2 mm, forewing lengths in parentheses). 118, *C. furcata* Davis & Medeiros, holotype ♂, BRAZIL: Amazonas (7.0 mm). 119, *C. tubulifolia* Parra & Ogden, holotype ♂, CHILE: Concepción, (~15.5 mm) (from Parra and Ogden 2011). 120, *C. sinuata* Davis & Medeiros, holotype ♂, CHILE: Osorno (8.3 mm). 121, *C. barilochensis* Davis & Medeiros, paratype ♂, ARGENTINA: Rio Negro (9.0 mm). 122, *C. latijuxta* Davis & Medeiros, holotype ♂, CHILE: Arauco (8.3 mm). 123, *C. bicornuta* Davis & Medeiros, holotype ♂, ARGENTINA: Neuquén (7.0 mm). 124, *C. petila* Davis & Medeiros, holotype ♂, CHILE: Maule (7.5 mm). 125, *C. beckeri* Davis & Medeiros, holotype ♂, BRAZIL: Rio de Janeiro (5.2 mm).



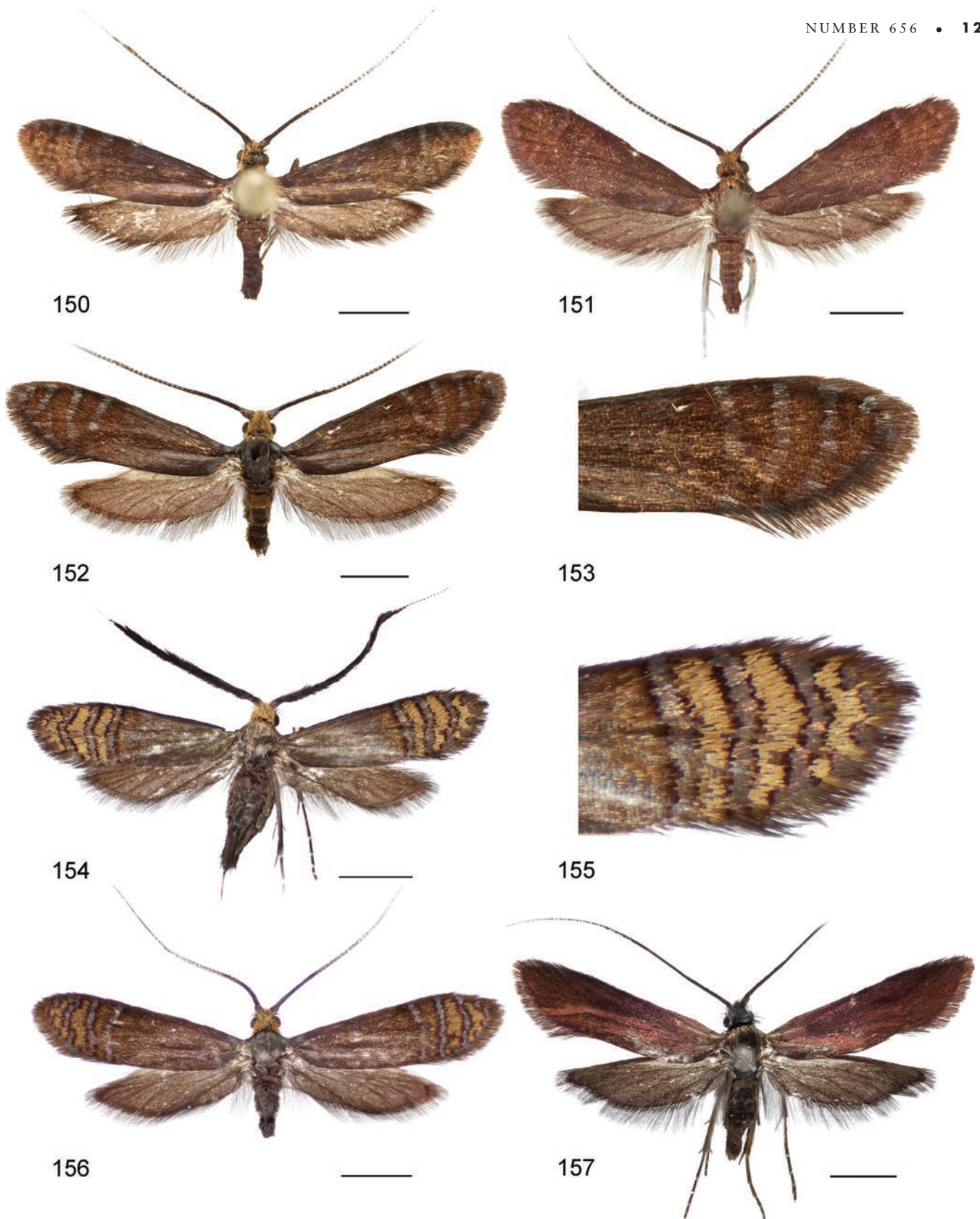
FIGURES 126–133. Adults of *Ceromitia* (scale lengths = 2 mm, forewing lengths in parentheses). 126, *C. sciographa* Meyrick, holotype ♂, BRAZIL: Pará (7.6 mm). 127, *C. latibasis* Davis & Medeiros, paratype ♂, BRAZIL: Paraná (6.9 mm). 128, *C. latipicula* Davis & Medeiros, paratype ♀, CHILE: Malleco (7.0 mm). 129, *C. laninensis* Pastrana, holotype ♂, ARGENTINA: Neuquén (10.0 mm). 130, *C. exserta* Davis & Medeiros, holotype ♂, CHILE: Valdivia (9.0 mm). 131, *C. schajovskoi* Pastrana, ♂, ARGENTINA: Rio Negro (10.1 mm). 132, *C. cerastia* Davis & Medeiros, paratype ♀, ARGENTINA: Rio Negro (6.0 mm). 133, *C. cerastia* Davis & Medeiros, holotype ♂, ARGENTINA: Rio Negro (7.8 mm).



FIGURES 134–141. Adults of *Ceromitia* (scale lengths = 2 mm, forewing lengths in parentheses). 134, *C. elongata* Davis & Medeiros, holotype ♂, COLOMBIA: Nariño (11.2 mm). 135, *C. brevipectinella* Davis & Medeiros, paratype ♀, CHILE: Osorno (7.1 mm). 136, *C. brevipectinella* Davis & Medeiros, holotype ♂, CHILE: Osorno (7.5 mm). 137, *C. nielsenii* Davis & Medeiros, paratype ♂, CHILE: Osorno (9.0 mm). 138, *C. nielsenii* Davis & Medeiros, paratype ♀, CHILE: Osorno (8.0 mm). 139, *C. lobata* Davis & Medeiros, paratype ♀, BRAZIL: Paraña (7.0 mm). 140, *C. ovata* Davis & Medeiros, paratype ♀, BRAZIL: Rio Grande do Sul (8.0 mm). 141, *C. truncata* Davis & Medeiros, holotype ♂, BRAZIL: Minas Gerais (8.2 mm).



FIGURES 142–149. Adults of *Ceromitia*, *Nemophora*, and *Adela* (scale lengths=2 mm, forewing lengths in parentheses). 142, *C. unipunctinella* Davis & Medeiros, holotype ♂, BRAZIL: São Paulo (7.8 mm). 143, *C. eccentrica* Meyrick, holotype ♀ (6.9 mm). 144, *C. illyodes* Meyrick, holotype ♀, ARGENTINA: Rio Negro Province (7.5 mm). 145, *C. laticlavata* Davis & Medeiros, holotype ♀, BRAZIL: Minas Gerais (5.0 mm). 146, *N. bellela* (Walker), ♂, CANADA: Alberta (10 mm). 147, *N. bellela* (Walker), ♂, CANADA: Yukon (9 mm). 148, *A. punctiferella* Walsingham, ♂, USA: California (4.8 mm). 149, *A. singulella* Walsingham, ♂, USA: California (4.7 mm).



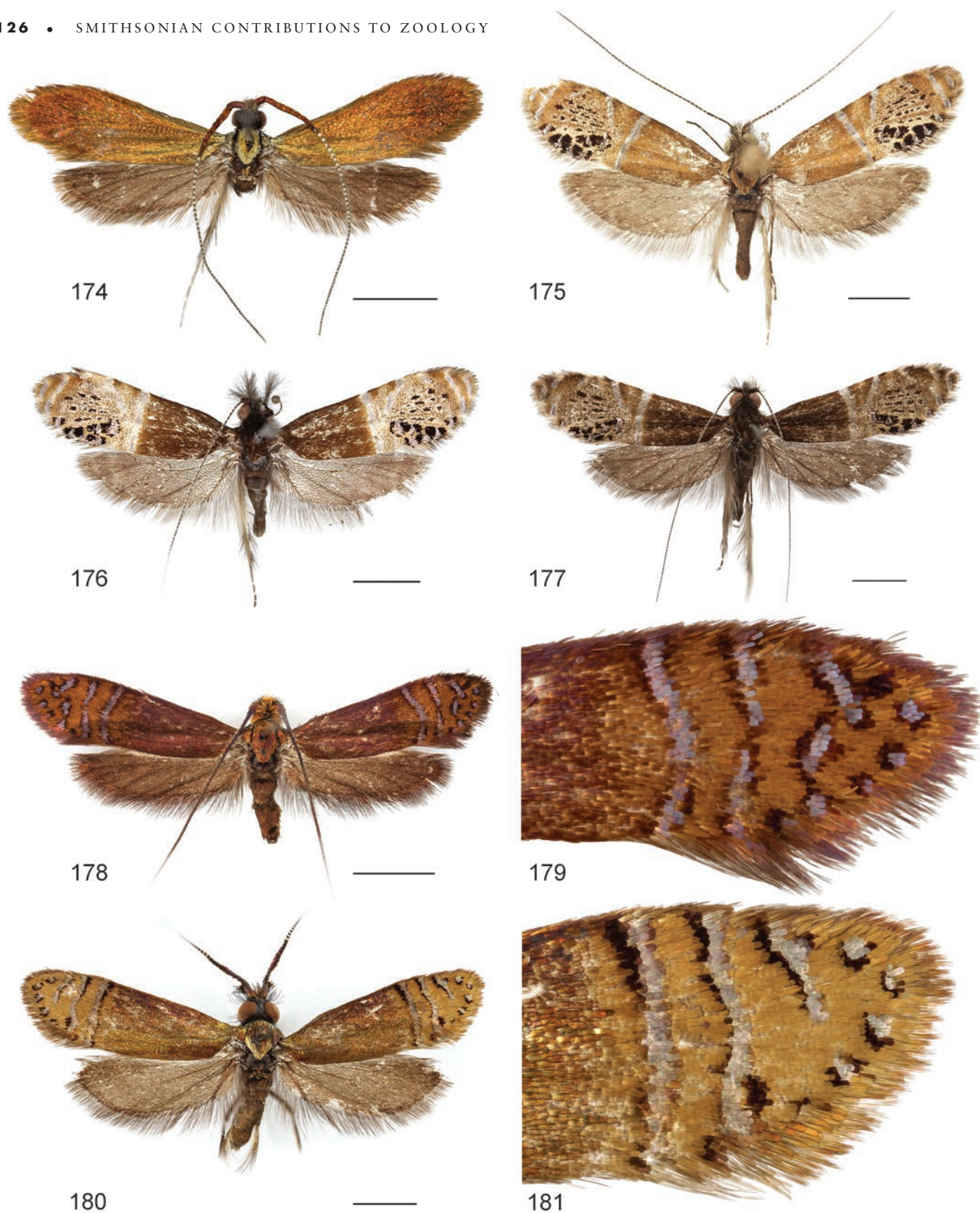
FIGURES 150–157. Adults of *Adela* (scale lengths=2 mm, forewing lengths in parentheses). 150, *A. caeruleella* Walker, ♂, USA: Florida (6.3 mm). 151, *A. caeruleella* Walker, ♂, USA: Alabama (6 mm). 152, *A. caeruleella* Walker, ♂, USA: New Jersey (6.5 mm). 153, *A. caeruleella* Walker, forewing apex of 152. 154, *A. aethiops* Rogenhofer, ♀, MEXICO: Tamaulipas (6.6 mm). 155, *A. aethiops* Rogenhofer, forewing apex of 154. 156, *A. aethiops* Rogenhofer, ♂, MEXICO: Tamaulipas (6.7 mm). 157, *A. atrata* Davis & Medeiros, holotype ♂, GUATEMALA: Sololá (7 mm).



FIGURES 158–165. Adults of *Adela* (scale lengths = 2 mm, forewing lengths in parentheses). 158, *A. stenoptera* Davis & Medeiros, holotype ♂, COSTA RICA: Heredia (7.1 mm). 159, *A. stenoptera* Davis & Medeiros, forewing apex of 158. 160, *A. septentrionella* Walsingham, ♂, USA: California (5.2 mm). 161, *A. septentrionella* Walsingham, ♀, USA: Washington. 162, *A. purpurea* Walker, ♂, CANADA: Nova Scotia (7.7 mm). 163, *A. trigrapha* Zeller, ♂, USA: Oregon (6.5 mm). 164, *A. trigrapha* Zeller, ♀, USA: Oregon (5.8 mm). 165, *A. trigrapha* Zeller, ♂ (left) and ♀ (right) in copula, USA: Oregon.



FIGURES 166–173. Adults of *Adela* (scale lengths=2 mm, forewing lengths in parentheses). 166, *A. eldorada* Powell, ♂, USA: California (6 mm). 167, *A. eldorada* Powell, ♀, USA: California (5.4 mm). 168, *A. flammeusella* Chambers, neotype ♀, USA: California (5.7 mm). 169, *A. flammeusella* Chambers, ♂, USA: Washington (5.1 mm). 170, *A. thorpella* Powell, ♂, USA: California (5.4 mm). 171, *A. thorpella* Powell, ♂, USA: California (6 mm). 172, *A. oplerella* Powell, paratype ♂, USA: California (5 mm). 173, *A. oplerella* Powell, paratype ♂, USA: California (5.4 mm).



FIGURES 174–181. Adults of *Adela* (scale lengths=2 mm, forewing lengths in parentheses). 174, *A. powelli* Davis & Medeiros, holotype ♂, MEXICO: Guerrero (5.5 mm). 175, *A. ridingsella* Clemens, ♂, USA: North Carolina (7 mm). 176, *A. austrina* Davis & Medeiros, paratype ♂, MEXICO: Veracruz (6.5 mm). 177, *A. austrina* Davis & Medeiros, paratype ♂, MEXICO: Veracruz (7 mm). 178, *A. astrella* Walsingham, ♂, MEXICO: Nuevo Leon (5 mm). 179, Forewing apex of 178. 180, *A. astrella* Walsingham, ♂, MEXICO: Hidalgo (6 mm). 181, Forewing apex of 180.



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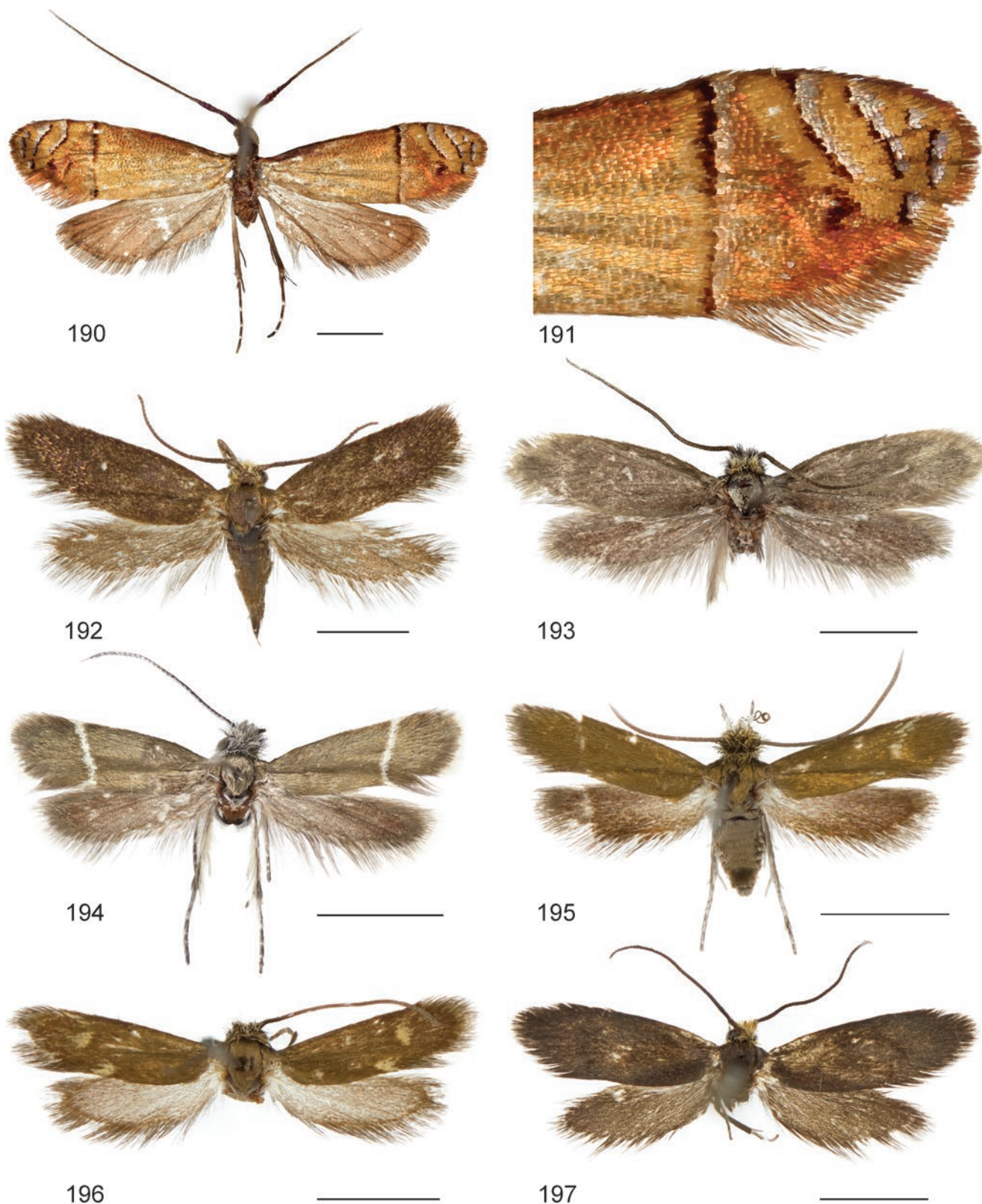


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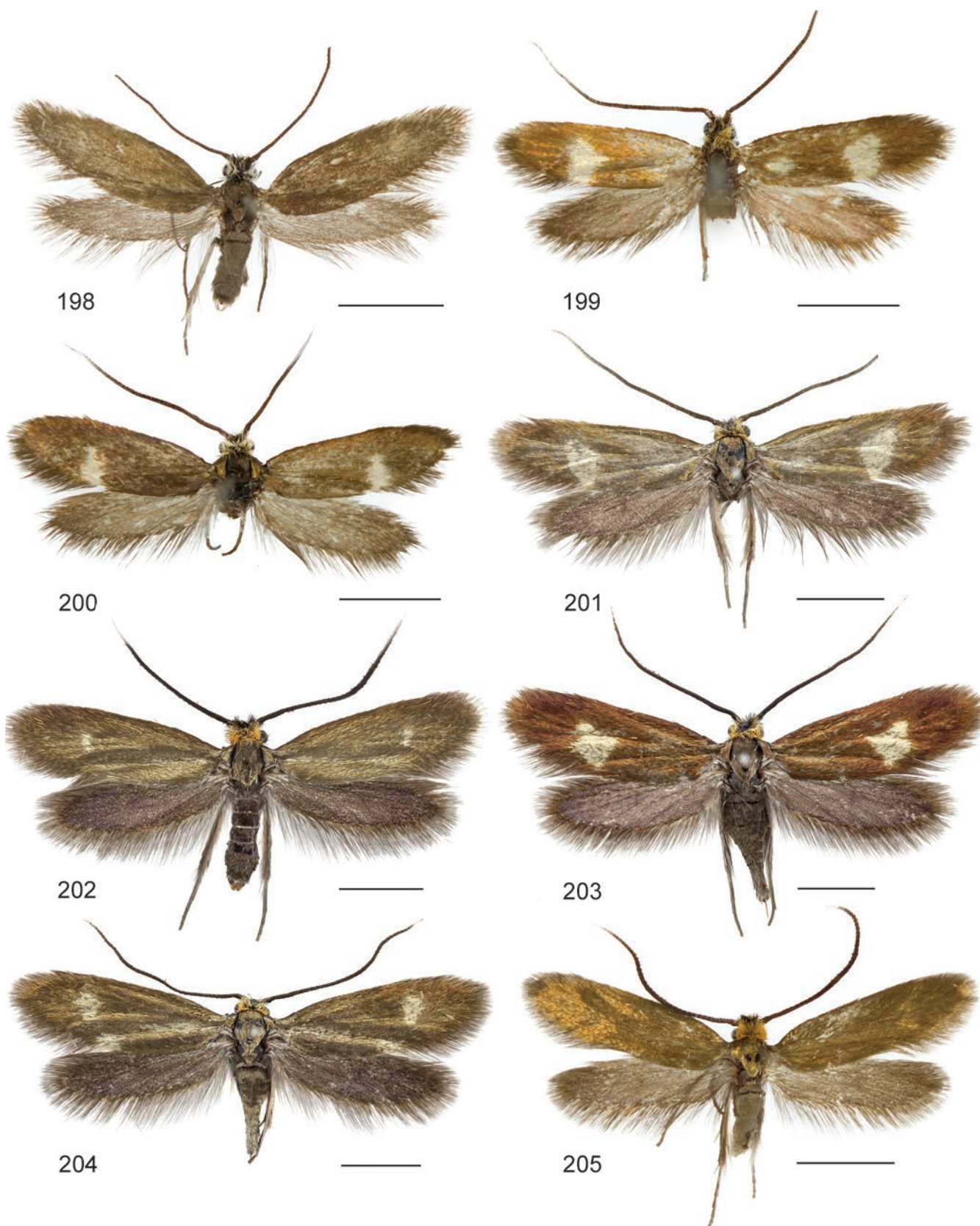


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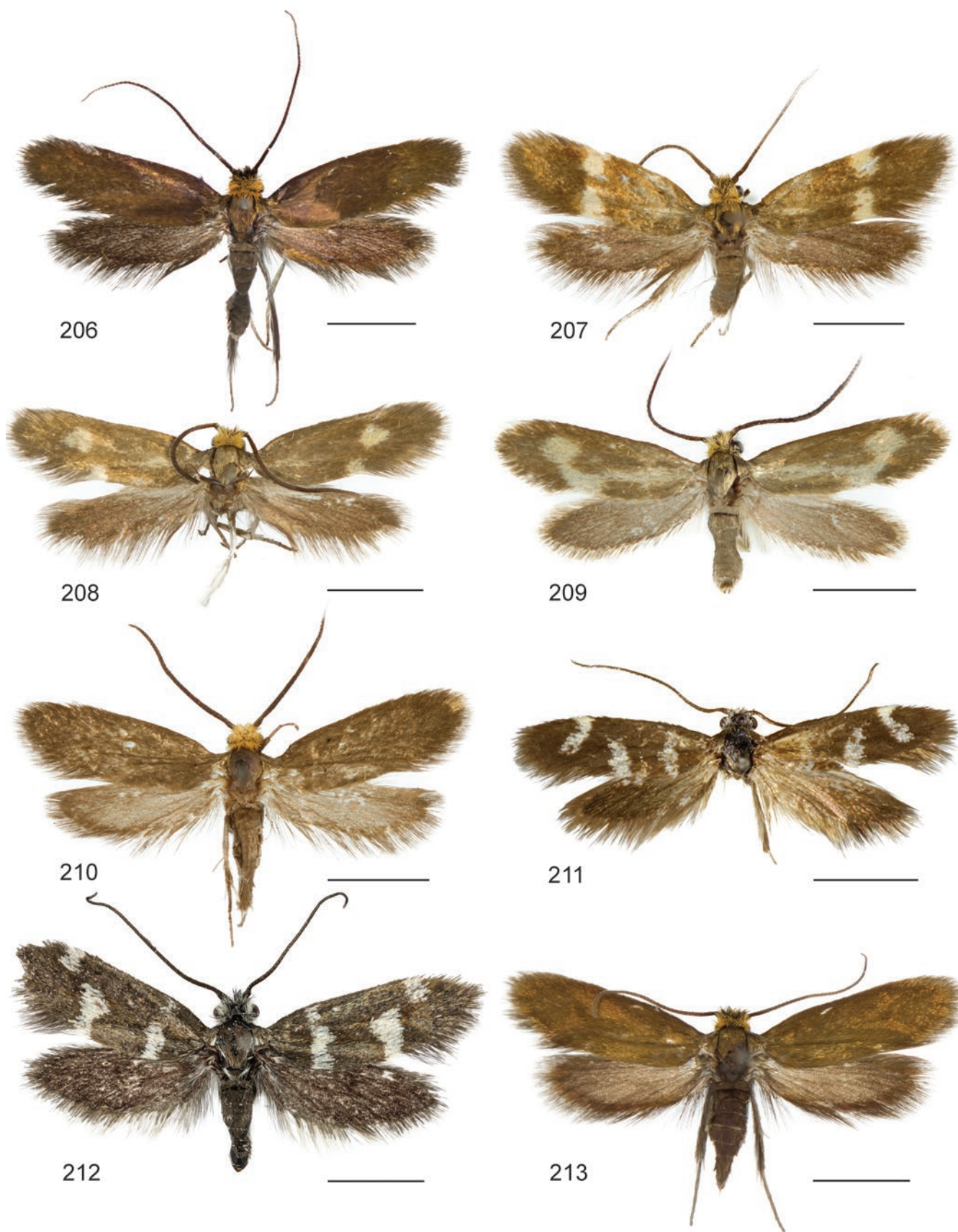
FIGURES 182–189. Adults of *Adela* (scale lengths=2 mm, forewing lengths in parentheses). 182, *A. astrella* Walsingham, ♂, MEXICO: Hidalgo (6.5 mm). 183, Forewing apex of 182. 184, *A. astrella* Walsingham, ♂, MEXICO: Hidalgo (6.1 mm). 185, Forewing apex of 184. 186, *A. astrella* Walsingham, ♂, COSTA RICA (6.8 mm). 187, Forewing apex of 186. 188, *A. striata* Davis & Medeiros, holotype ♂, MEXICO: Durango (6 mm). 189, Forewing apex of 188.



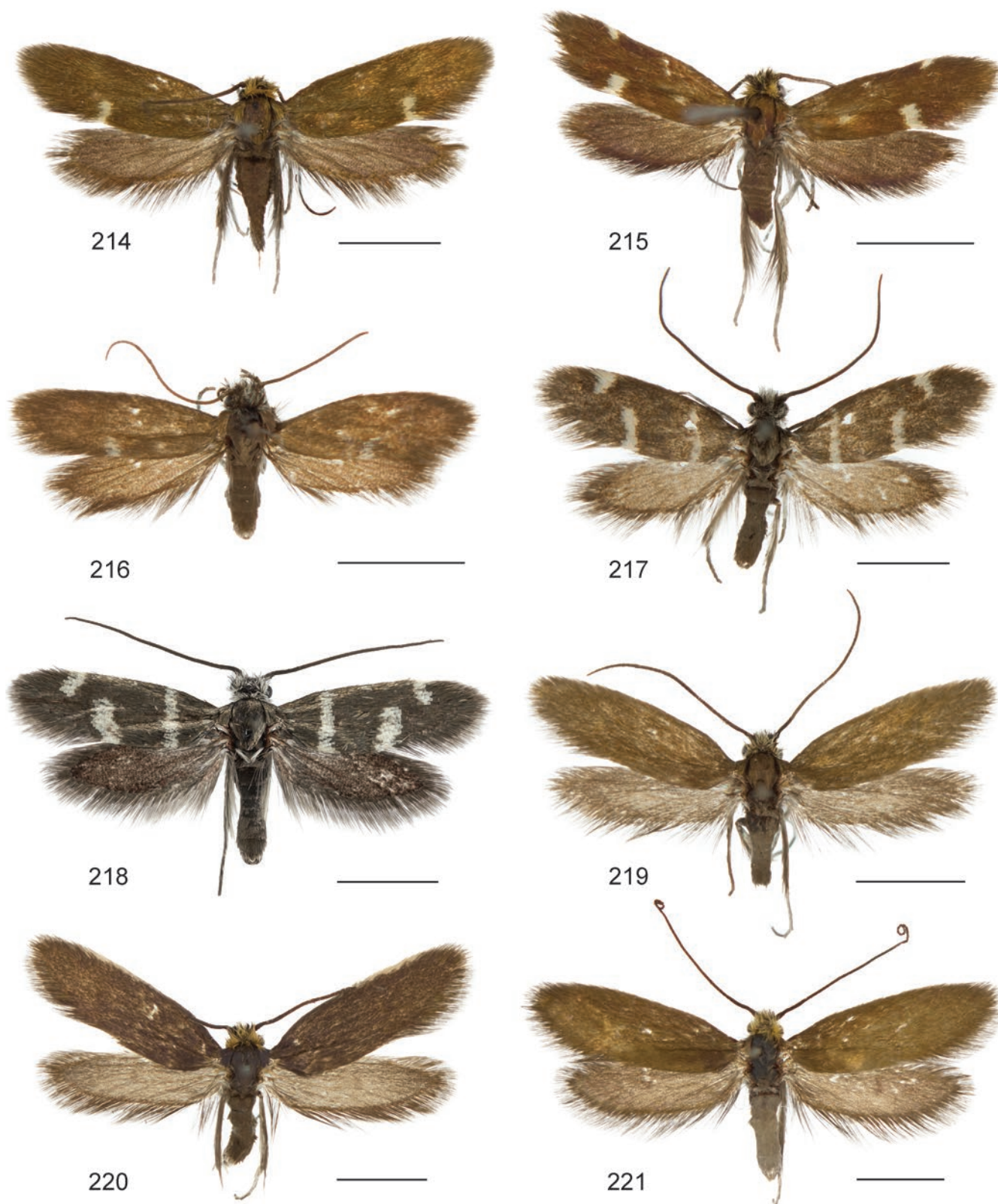
FIGURES 190–197. Adults of *Adela* and *Cauchas* (scale lengths=2 mm, forewing lengths in parentheses). 190, *A. boliviella* Kozlov, holotype ♂, BOLIVIA: Mizque (6.8 mm). 191, Forewing apex of 190. 192, *C. dietziella* Kearfott, paralectotype ♀, USA: New Jersey (4.5 mm). 193, *C. alaskae* Davis & Medeiros, holotype ♂, USA: Alaska (4 mm). 194, *C. vittata* Davis & Medeiros, holotype ♂, USA: California (3.7 mm). 195, *C. spinulosa* Davis & Medeiros, paratype ♂, USA: California (3.5 mm). 196, *C. spinulosa* Davis & Medeiros, paratype ♀, USA: California (3.8 mm). 197, *C. recurvata* Davis & Medeiros, paratype ♀, CANADA: Ontario (4.5 mm).



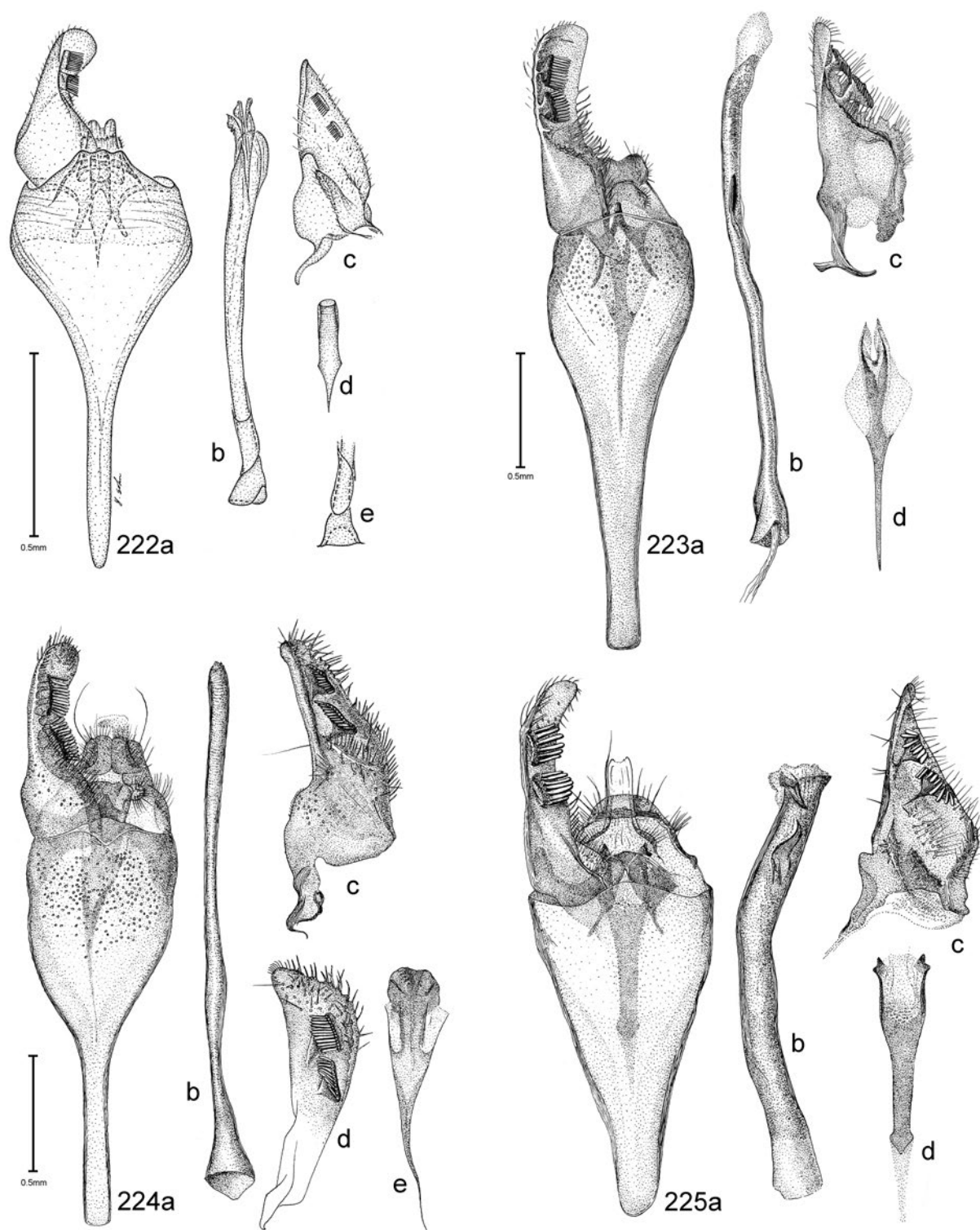
FIGURES 198–205. Adults of *Cauchas* (scale lengths=2 mm, forewing lengths in parentheses). 198, *C. suffusa* Davis & Medeiros, holotype ♂, USA: Nevada (4.6 mm). 199, *C. cockerelli* (Busck), ♂, CANADA: British Columbia (5 mm). 200, *C. cockerelli* (Busck), ♂, USA: Washington (4.5 mm). 201, *C. cockerelli* (Busck), ♂, CANADA: Yukon (5 mm). 202, *C. cockerelli* (Busck), ♂, CANADA: British Columbia (5.1 mm). 203, *C. cockerelli* (Busck), ♀, CANADA: British Columbia (6 mm). 204, *C. cockerelli* (Busck), ♀, CANADA: British Columbia (5.6 mm). 205, *C. simpliciella* (Walsingham), ♂, USA: Montana (5.1 mm).



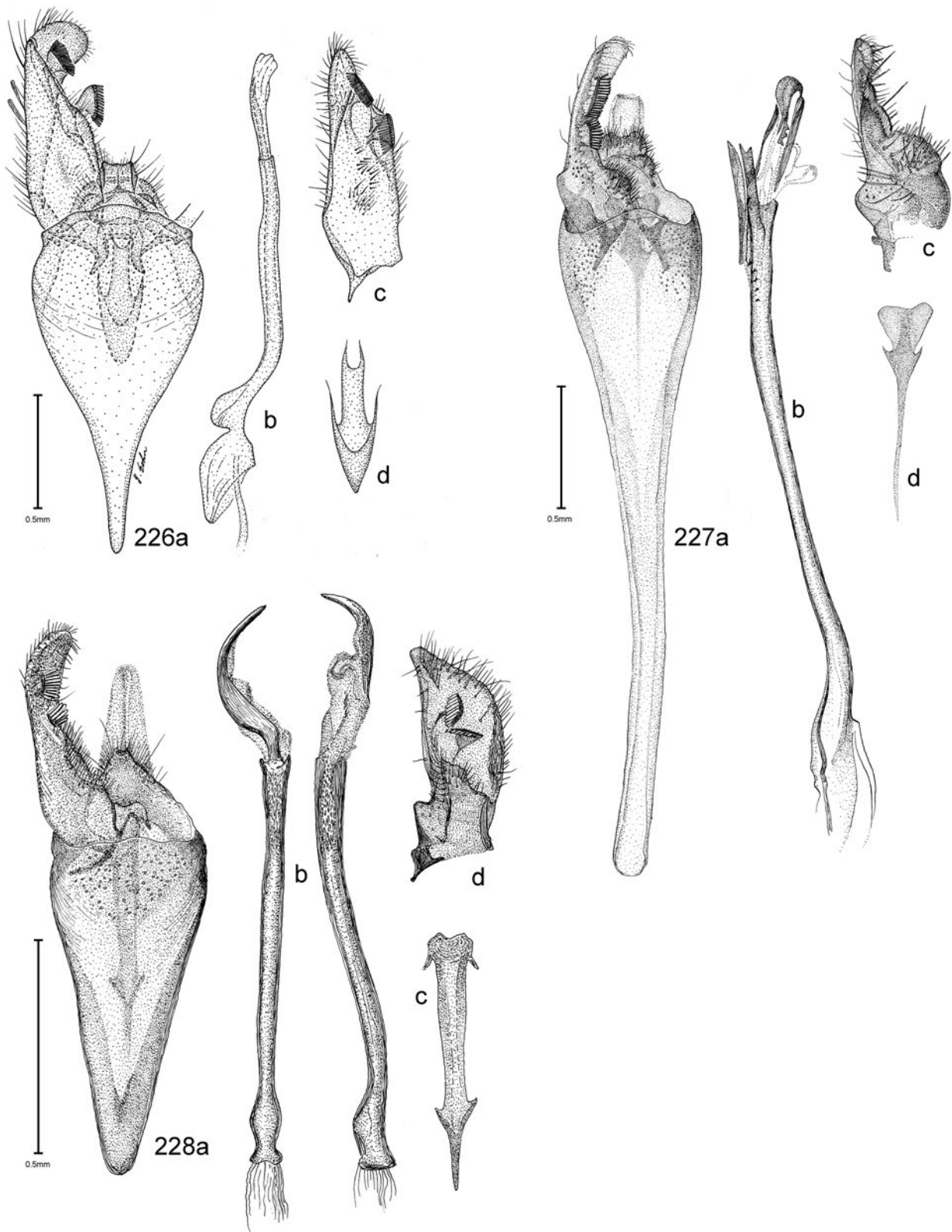
FIGURES 206–213. Adults of *Cauchas* (scale lengths=2 mm, forewing lengths in parentheses). 206, *C. simpliciella* (Walsingham), ♂, USA: California (5.3 mm). 207, *C. sedella* (Busck), ♂, USA: Colorado (5.1 mm). 208, *C. sedella* (Busck), ♂, USA: Colorado (4.9 mm). 209, *C. sedella* (Busck), ♂, USA: Washington (4.5 mm). 210, *C. cyanella* (Busck), ♀, USA: Pennsylvania (4.8 mm). 211, *C. trifascia* Davis & Medeiros, paratype ♂, USA: California (3.9 mm). 212, *C. trifascia* Davis & Medeiros, holotype ♂, USA: California (5 mm). 213, *C. lobata* Davis & Medeiros, paratype ♀, USA: California (5.1 mm).



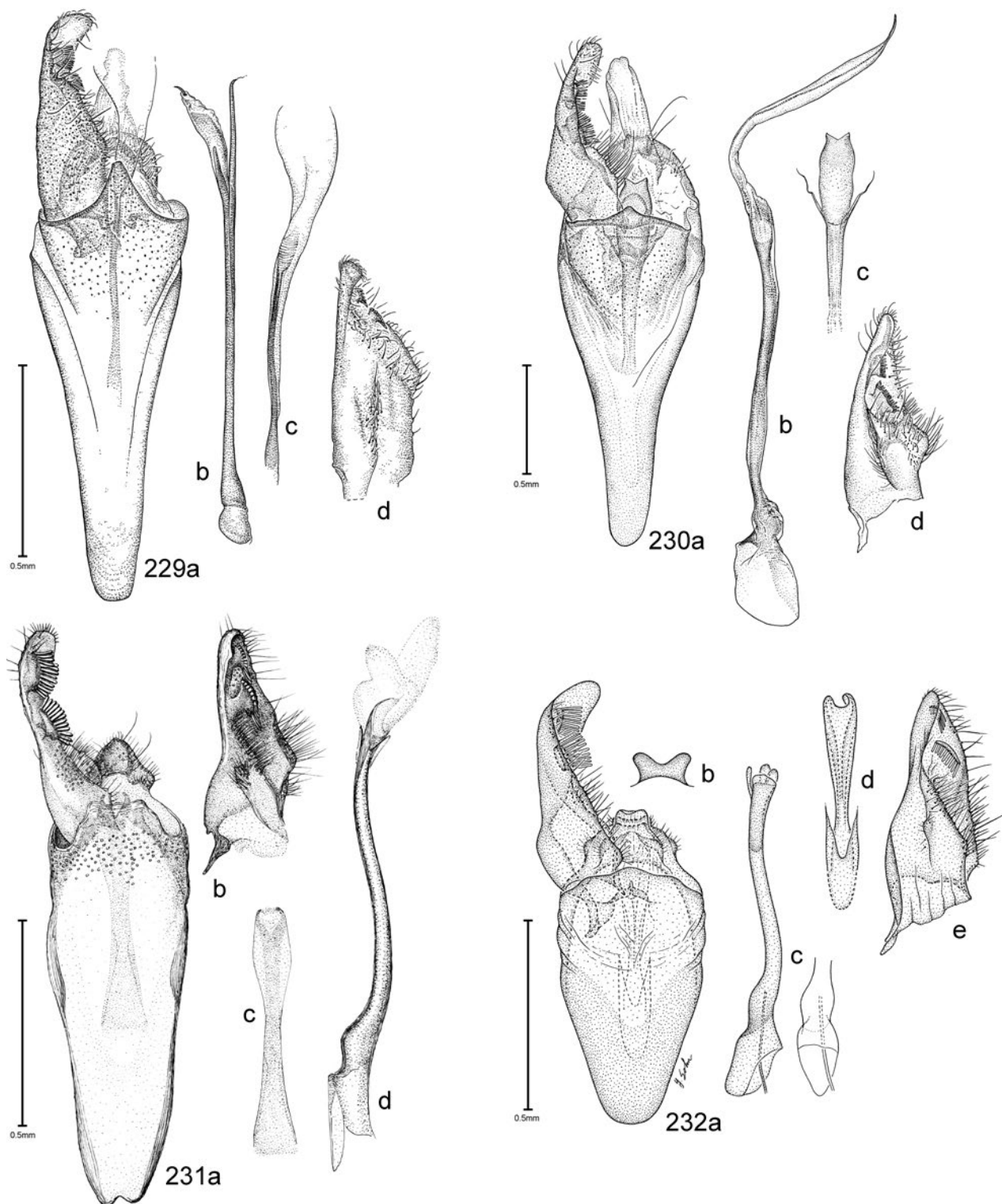
FIGURES 214–221. Adults of *Cauchas* (scale lengths=2 mm, forewing lengths in parentheses). 214, *C. lobata* Davis & Medeiros, paratype ♀, USA: California (5.1 mm). 215, *C. lobata* Davis & Medeiros, paratype ♂, USA: California (4.4 mm). 216, *C. excavata* Davis & Medeiros, holotype ♂, USA: California (3.8 mm). 217, *C. wielgusi* Davis & Medeiros, paratype ♂, USA: Arizona (4.1 mm). 218, *C. wielgusi* Davis & Medeiros, paratype ♂, USA: California (4 mm). 219, *C. clarkei* Davis & Medeiros, paratype ♂, USA: Oregon (4.6 mm). 220, *C. elongata* Davis & Medeiros, paratype ♂, USA: Oregon (5.3 mm). 221, *C. elongata* Davis & Medeiros, holotype ♂, USA: Oregon (5.5 mm).



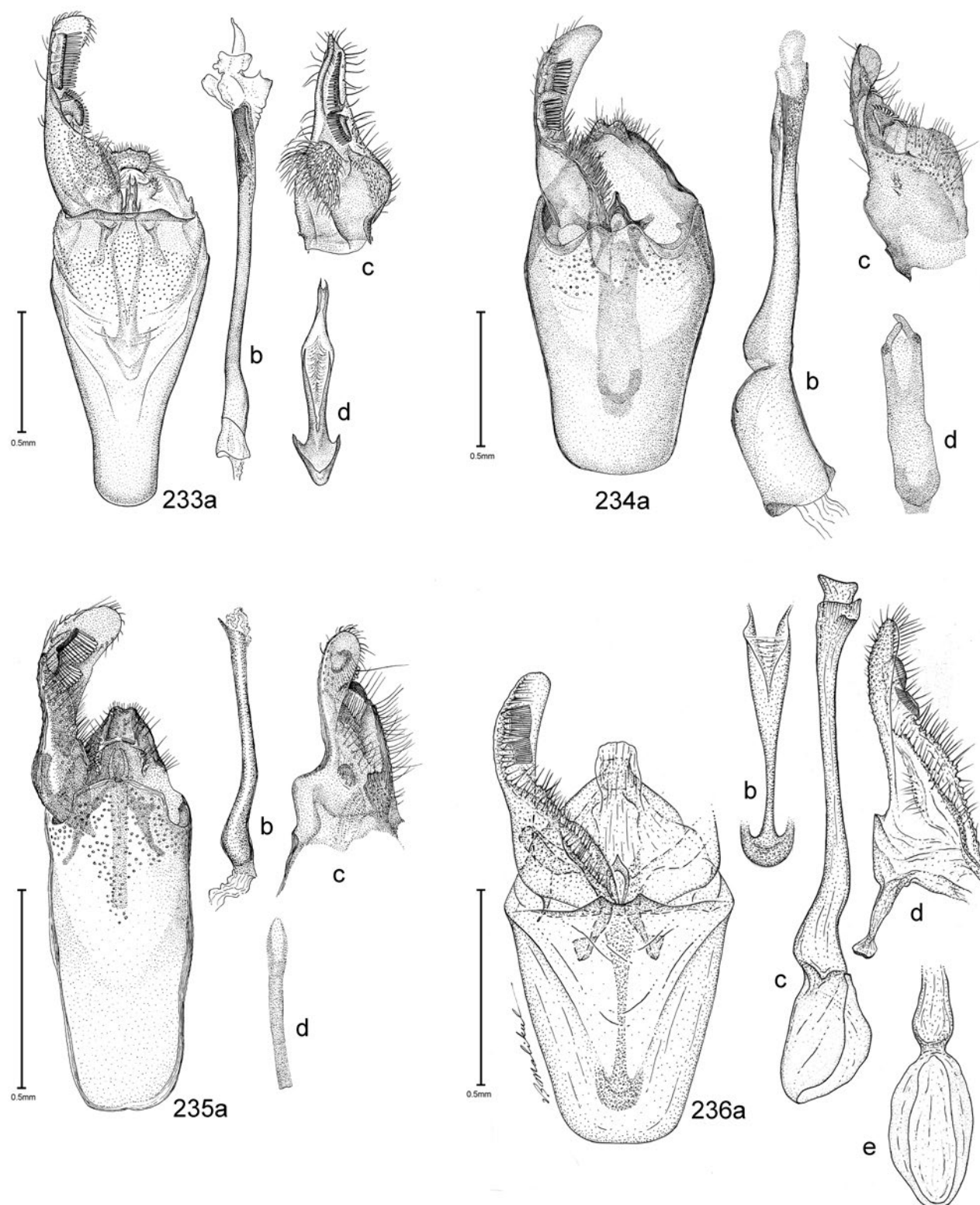
FIGURES 222–225. Male genitalia of *Ceromitia* (scale lengths=0.5 mm). 222, *C. parvipectena*: (a) ventral view; (b) phallus, lateral view; (c) valva, lateral–mesal view; (d) juxta; (e) base of phallus, ventral view. 223, *C. capitanea*: (a) ventral view; (b) phallus, lateral view; (c) valva, lateral–mesal view; (d) juxta. 224, *C. fasciolata*: (a) ventral view; (b) phallus, ventral view; (c) valva, lateral view; (d) valva lateral/ventral view; (e) juxta. 225, *C. chionocrossa*: (a) ventral view; (b) phallus, lateral view; (c) valva, lateral view; (d) juxta.



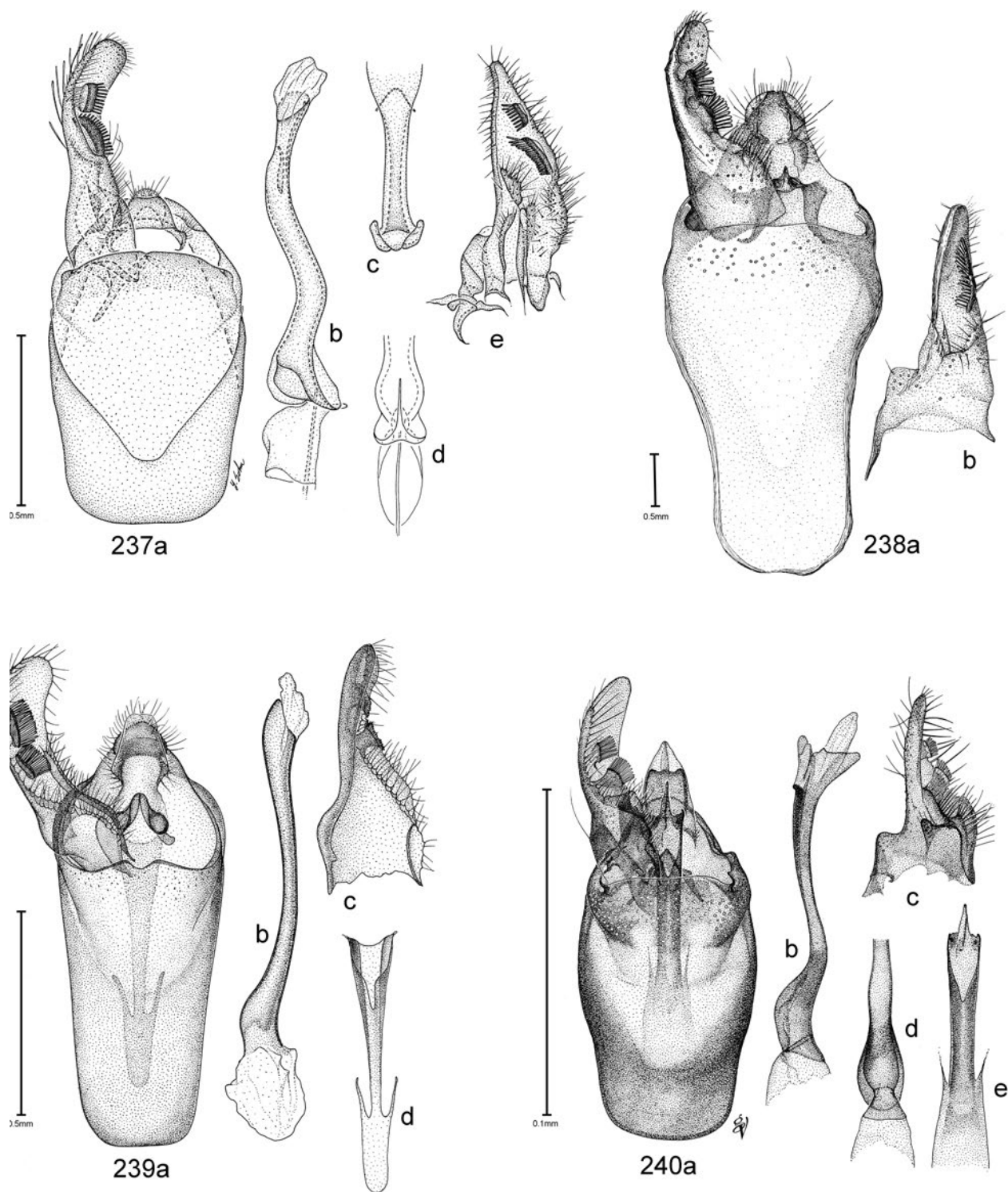
FIGURES 226–228. Male genitalia of *Ceromitia* (scale lengths=0.5 mm). 226, *C. lizeri*: (a) ventral view; phallus, lateral view; (b) phallus, lateral view; (c) valva, lateral-mesal view; (d) juxta. 227, *C. eremarcha*: (a) ventral view; (b) phallus, lateral view; (c) valva, lateral-mesal view; (d) juxta. 228, *C. exalbata*: (a) ventral view; (b) phallus, ventral and lateral views; (c) juxta; (d) valva, lateral-mesal view.



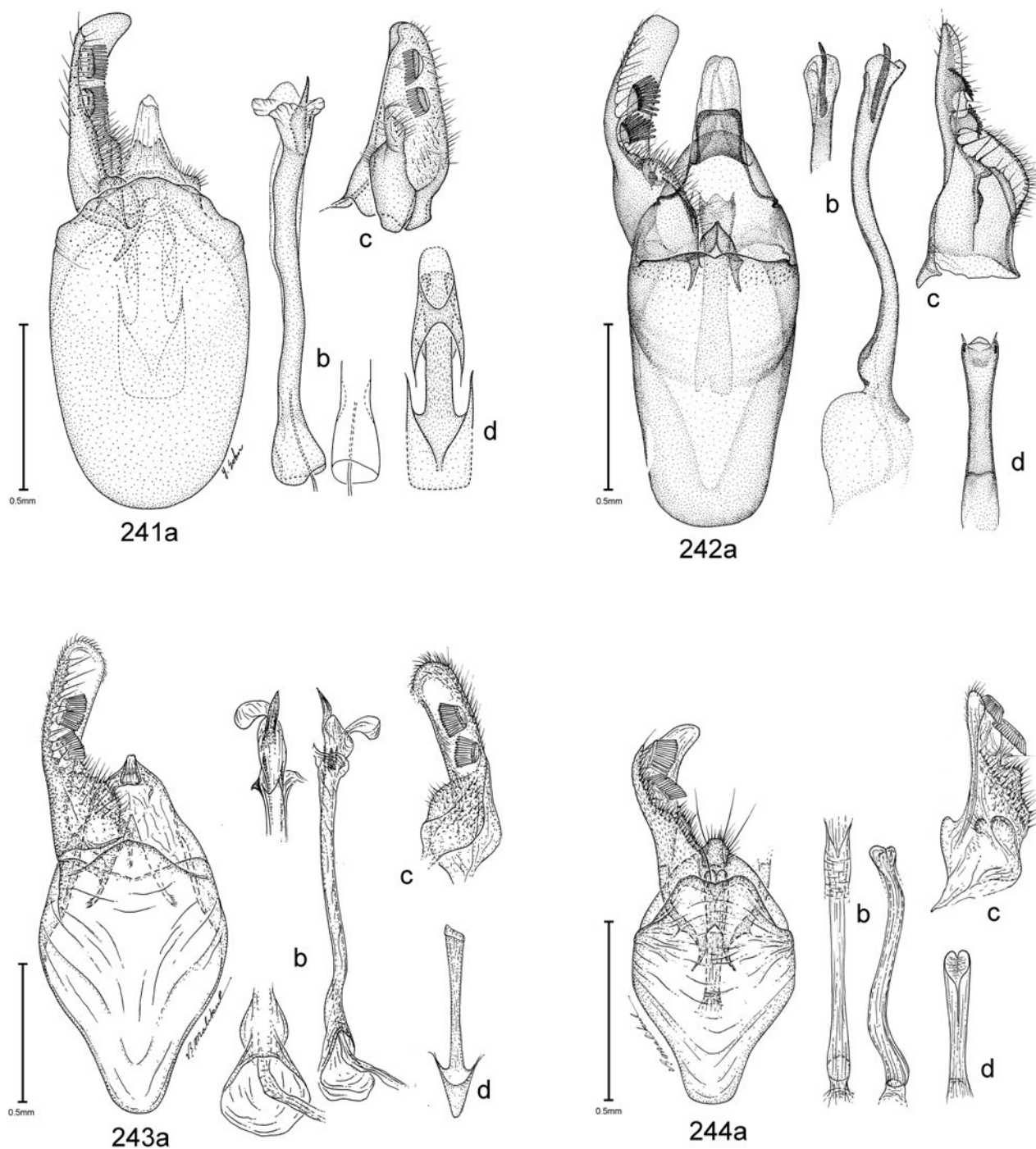
FIGURES 229–232. Male genitalia of *Ceromitia* (scale lengths=0.5 mm). 229, *C. pucaraensis*: (a) ventral view; (b) phallus, ventral view; (c) juxta; (d) valva, lateral-mesal view. 230, *C. flagellata*: (a) phallus, lateral view; (b) juxta; (c) juxta; (d) valva, lateral-mesal view. 231, *C. phaeoceros*: (a) ventral view; (b) valva, lateral-mesal view; (c) juxta; (d) phallus, lateral view. 232, *C. fuscata*: (a) ventral view; (b) uncus, ventral view; (c) phallus, lateral view with ventral view of base; (d) juxta; (e) valva, lateral-mesal view.



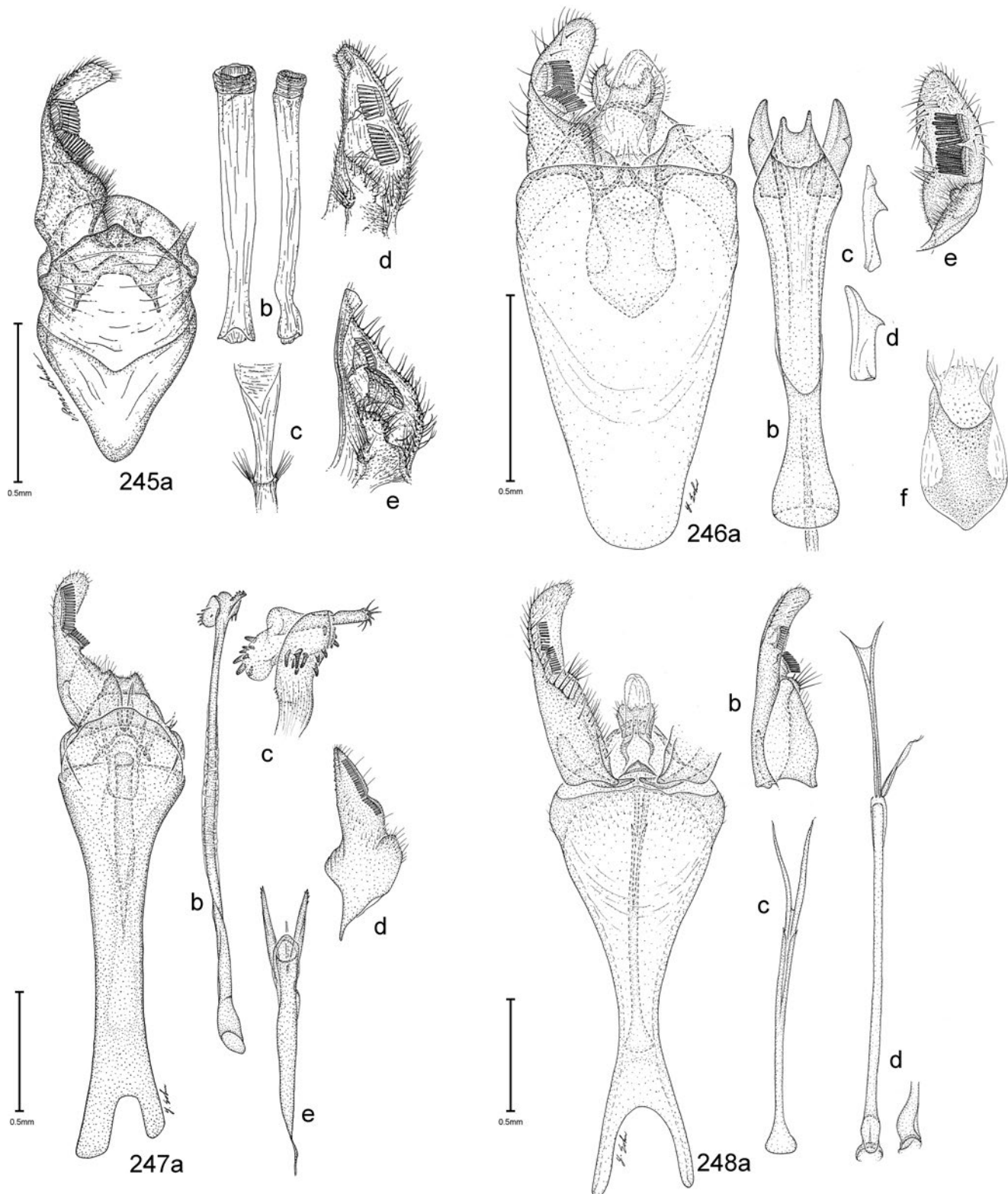
FIGURES 233–236. Male genitalia of *Ceromitia* (scale lengths=0.5 mm). 233, *C. karsholti*: (a) ventral view; (b) phallus, lateral view; (c) valva, lateral–mesal view; (d) juxta. 234, *C. pallidofascia*: (a) ventral view; (b) phallus, lateral view; (c) valva, lateral–mesal view; (d) juxta. 235, *C. viscida*: (a) ventral view; (b) phallus, lateral view; (c) valva, lateral–mesal view; (d) juxta. 236, *C. paraguayensis*: (a) ventral view; (b) juxta; (c) phallus, lateral view; (d) valva, lateral–mesal view; (e) phallus base, ventral view.



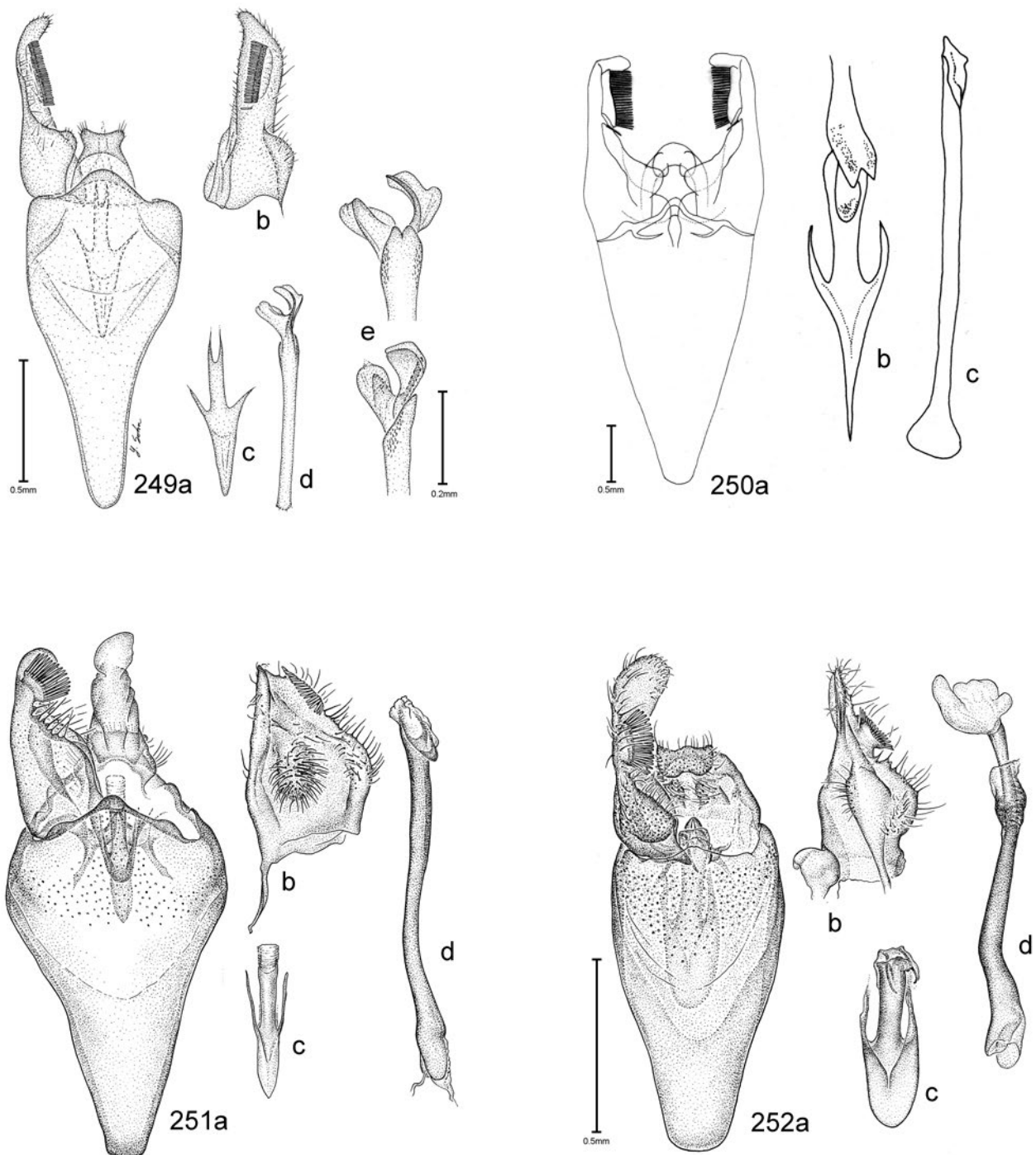
FIGURES 237–240. Male genitalia of *Ceromitia* (scale lengths=0.5 mm). 237, *C. costaricensis*: (a) ventral view; (b) phallus, lateral view; (c) juxta; (d) phallus base, ventral view; (e) valva, lateral–mesal view. 238, *C. ochrodyta*: (a) ventral view; (b) valva, lateral view. 239, *C. aphyoda*: (a) ventral view; (b) phallus, lateral view; (c) valva, lateral–mesal view; (d) juxta. 240, *C. nigrifasciata*: (a) ventral view; (b) phallus, lateral view; (c) valva, lateral–mesal view; (d) phallus base, ventral view; (e) juxta.



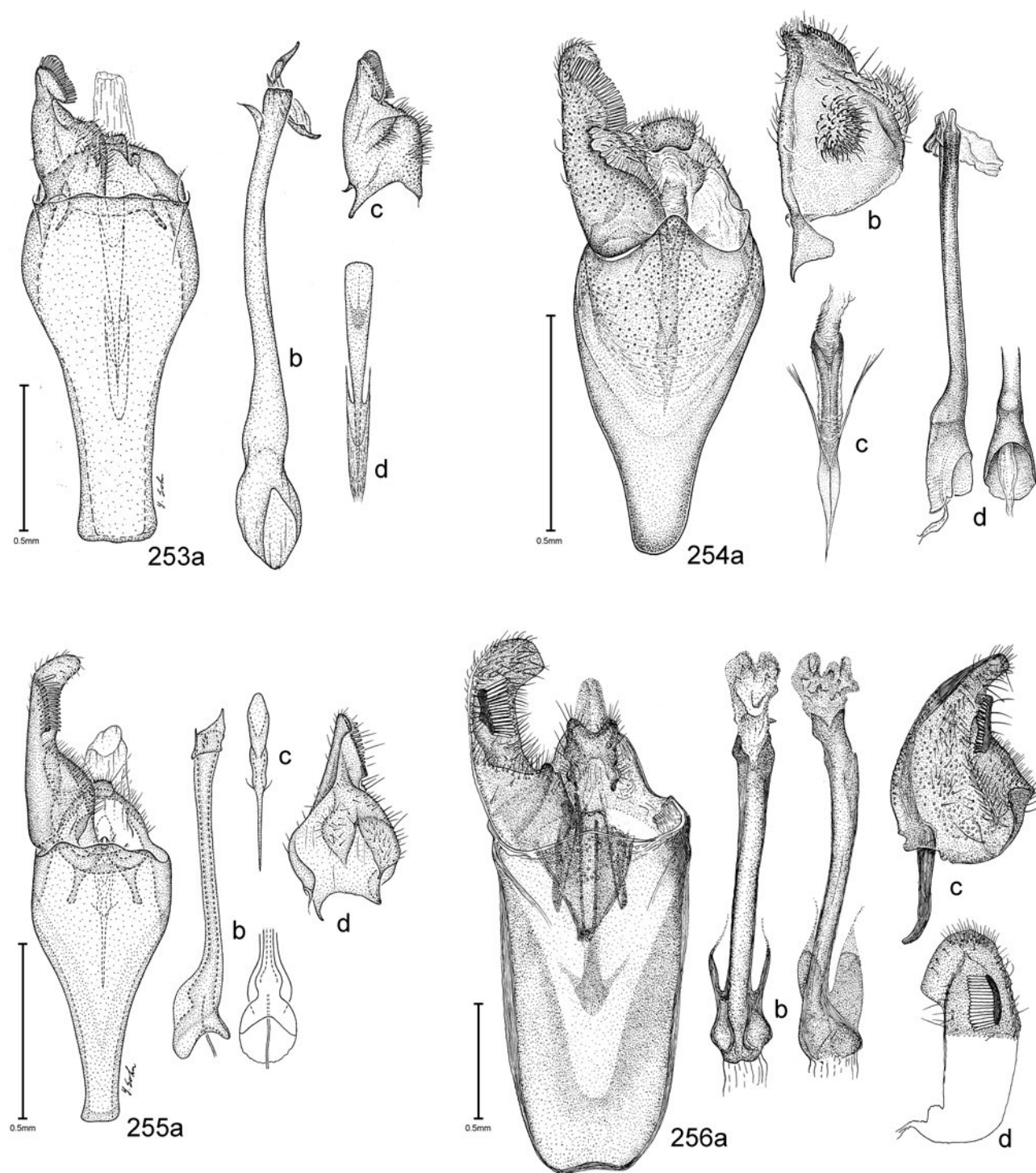
FIGURES 241–244. Male genitalia of *Ceromitia* (scale lengths=0.5 mm). 241, *C. fasciata*: (a) ventral view; (b) phallus, lateral view and ventral view of base; (c) valva, lateral-mesal view; (d) juxta. 242, *C. unicornuta*: (a) ventral view; (b) phallus, lateral view and ventral view of apex; (c) valva, lateral-mesal view; (d) juxta. 243, *C. braziliensis*: (a) ventral view; (b) phallus, lateral view, and ventral views of base and apex; (c) valva, lateral-mesal view; (d) juxta. 244, *C. concava*: (a) ventral view; (b) phallus, with ventral and lateral apical views, respectively; (c) valva, lateral-mesal view; (d) juxta.



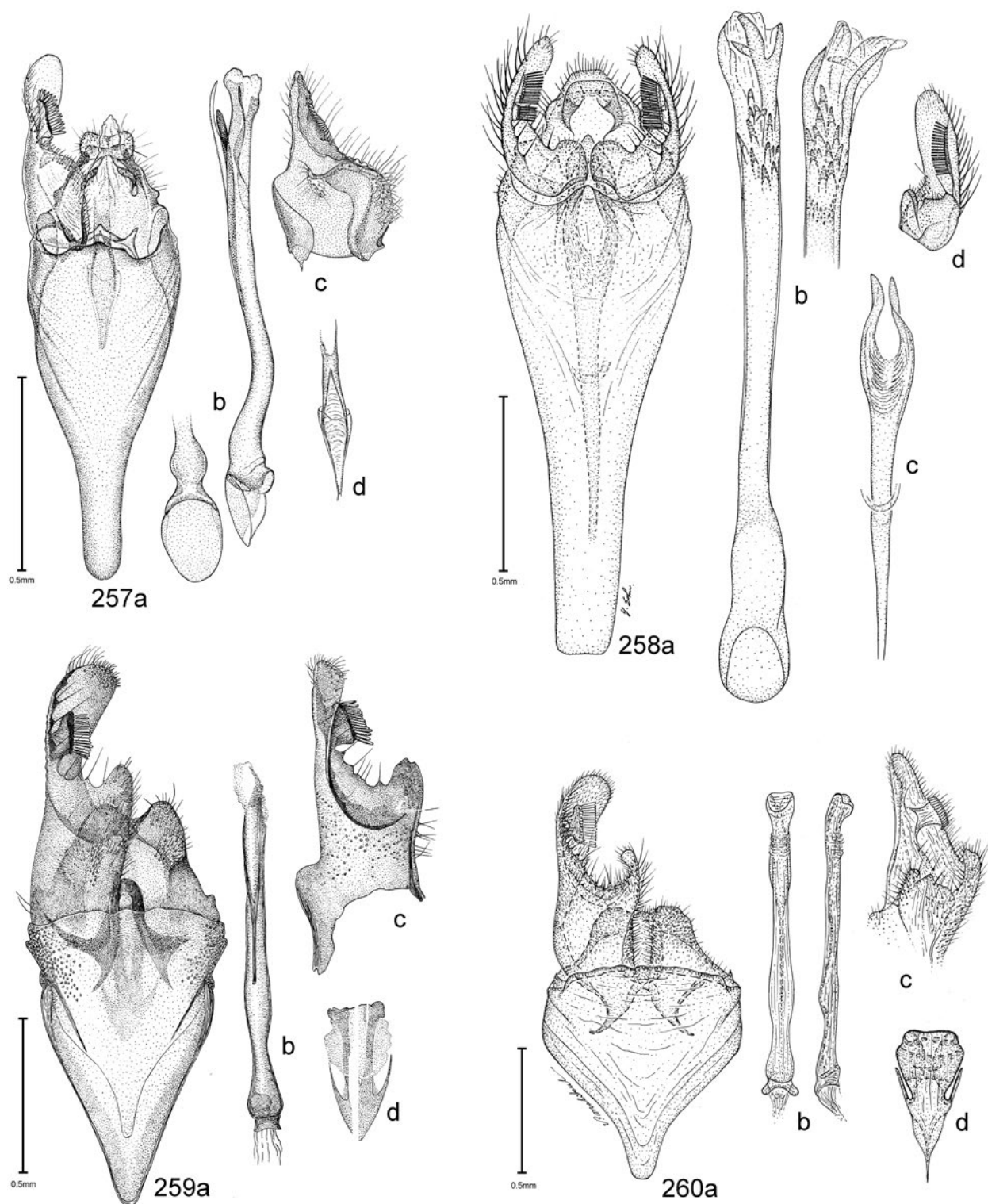
FIGURES 245–248. Male genitalia of *Ceromitia* (scale lengths=0.5 mm). 245, *C. convexa*: (a) ventral view; (b) phallus, ventral and lateral views; (c) juxta; (d) valva, lateral-mesal view; (e) valva, dorsal-lateral view. 246, *C. pachyphalla*: (a) ventral view; (b) phallus, ventral view; (c) apex of dorsal anellar lobes; (d) apex of ventral anellar lobes; (e) valva, lateral-mesal view; (f) juxta. 247, *C. inaequalis*, (a) ventral view; (b) phallus, lateral view; (c) apex of phallus lateral view; (d) valva, lateral-mesal view; (e) juxta. 248, *C. furcata*: (a) ventral view; (b) valva, lateral-mesal view; (c) juxta; (d) phallus, ventral view and lateral view of phallus base.



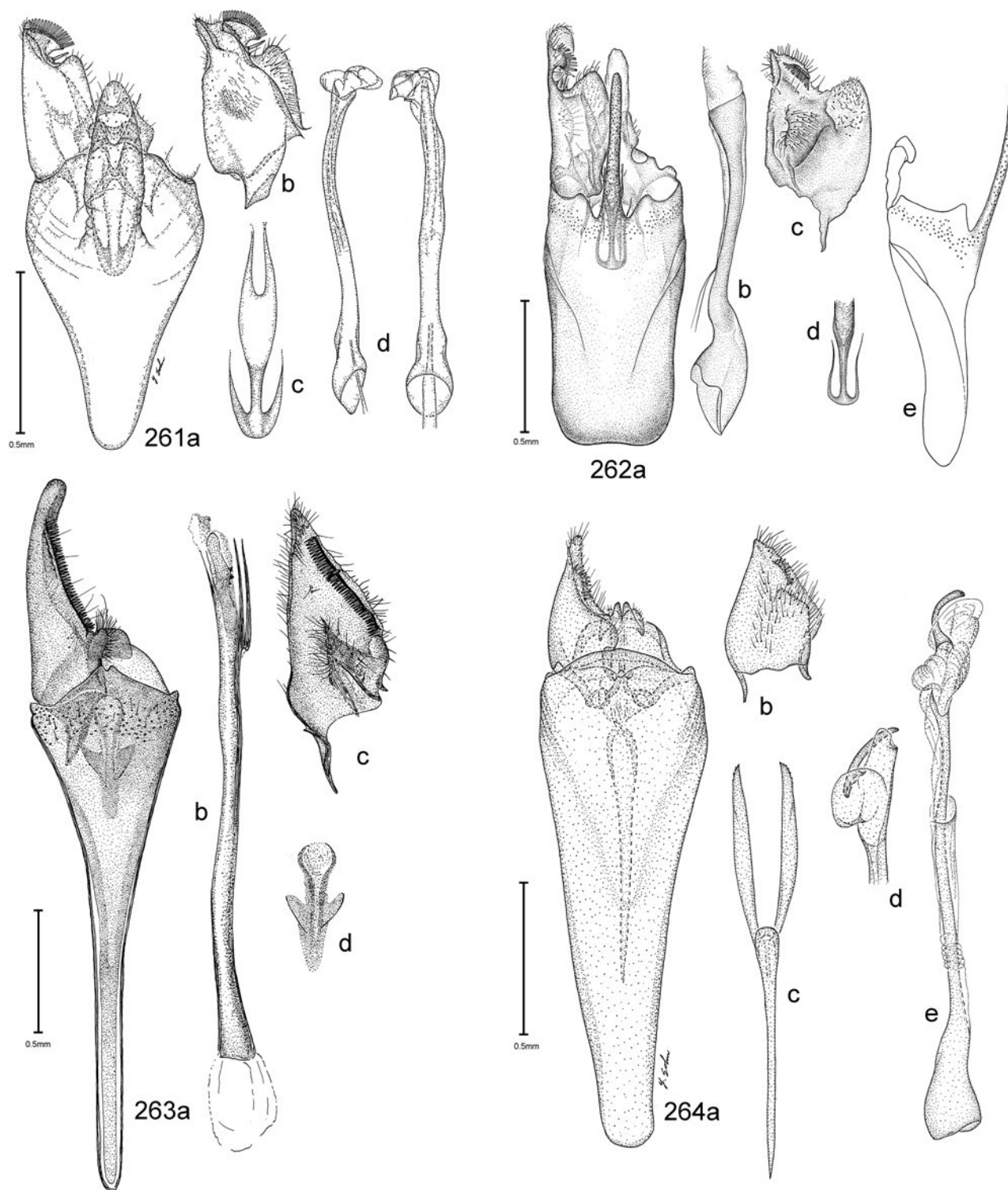
FIGURES 249–252. Male genitalia of *Ceromitia* (scale lengths=0.5 mm). 249, *C. sinuata*: (a) ventral view; (b) valva, lateral–mesal view; (c) juxta; (d) phallus, lateral view. 250, *C. tubulifolia*: (a) ventral view; (b) juxta; (c) phallus, ventral view (from Parra and Ogden 2011). 251, *A. barilochensis*: (a) ventral view; (b) valva, lateral–mesal view; (c) juxta; (d) phallus, lateral view. 252, *A. latijuxta*: (a) ventral view; (b) valva, lateral–mesal view; (c) juxta; (d) phallus, lateral view.



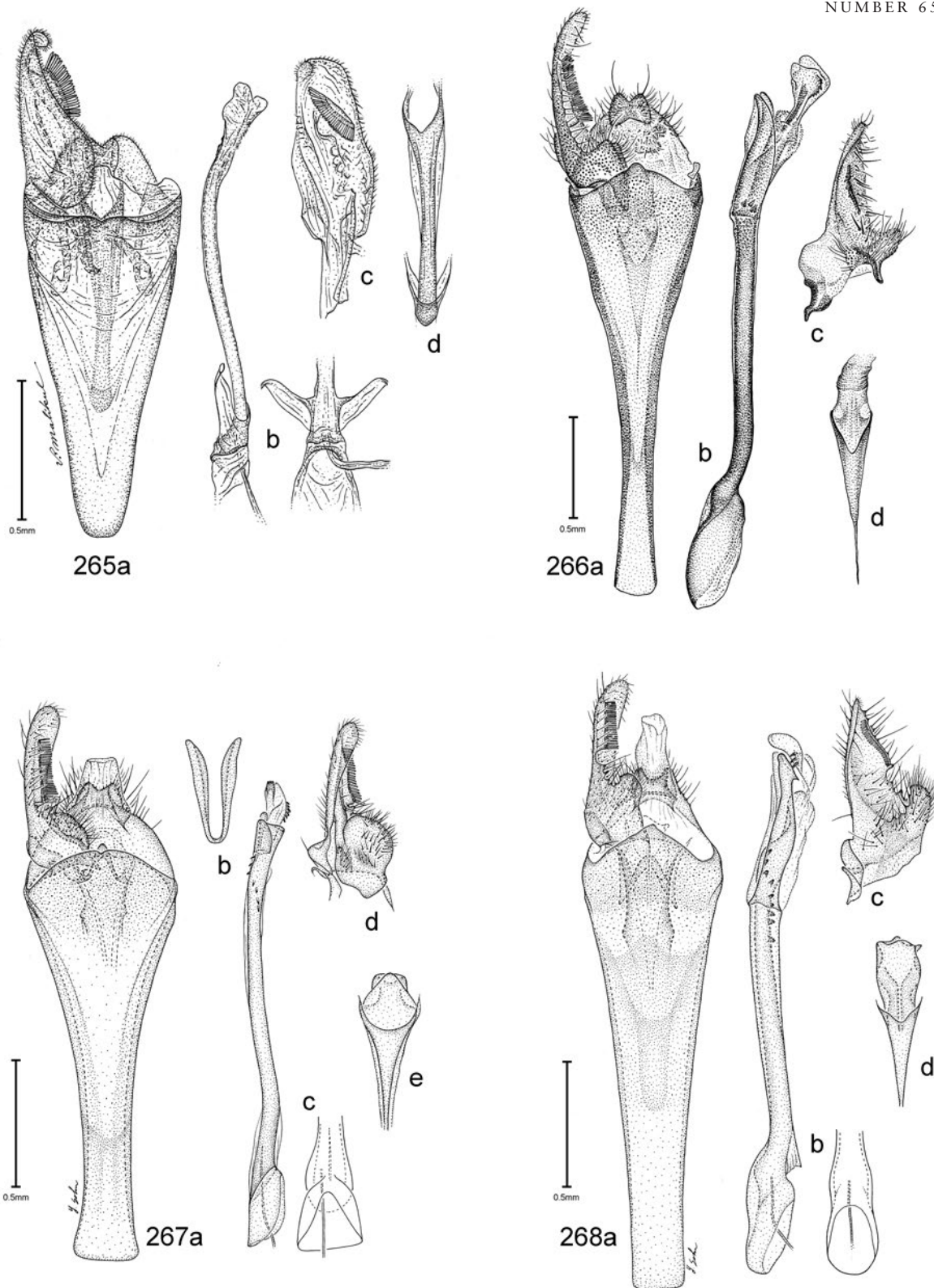
FIGURES 253–256. Male genitalia of *Ceromitia* (scale lengths=0.5 mm). 253, *C. bicornuta*: (a) ventral view; (b) phallus, lateral view; (c) valva, lateral-mesal view; (d) juxta. 254, *C. petila*: (a) ventral view; (b) valva, lateral-mesal view; (c) juxta; (d) phallus, lateral view and ventral view of base. 255, *C. beckeri*: (a) ventral view; (b) phallus, lateral view and ventral view of base; (c) juxta; (d) valva, lateral-mesal view. 256, *C. sciographa*: (a) ventral view; (b) phallus, ventral and lateral-mesal views; (c) valva, dorsal-lateral view; (d) valva lateral view of apex.



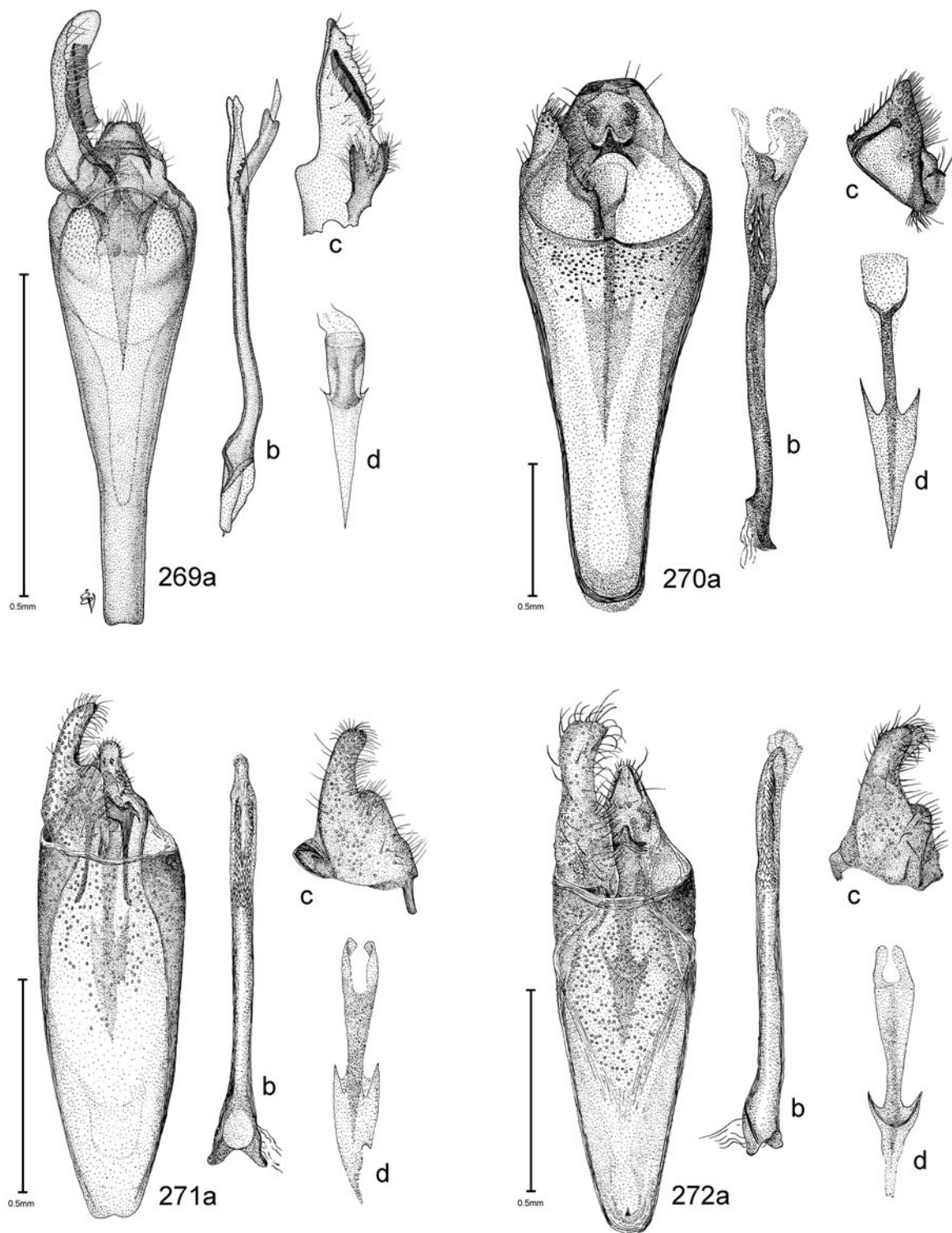
FIGURES 257–260. Male genitalia of *Ceromitia* (scale lengths = 0.5 mm). 257, *C. latibasis*: (a) ventral view; (b) phallus, lateral view and ventral view of base; (c) valva, lateral-mesal view; (d) juxta. 258, *C. latapicula*: (a) ventral view; (b) phallus, ventral view and lateral view of apex; (c) juxta; (d) valva, lateral-mesal view. 259, *C. laninensis*: (a) ventral view; (b) phallus, ventral view; (c) valva, lateral-mesal view; (d) juxta. 260, *C. exserta*: (a) ventral view; (b) phallus, ventral and lateral views; (c) valva, lateral-mesal view; (d) juxta.



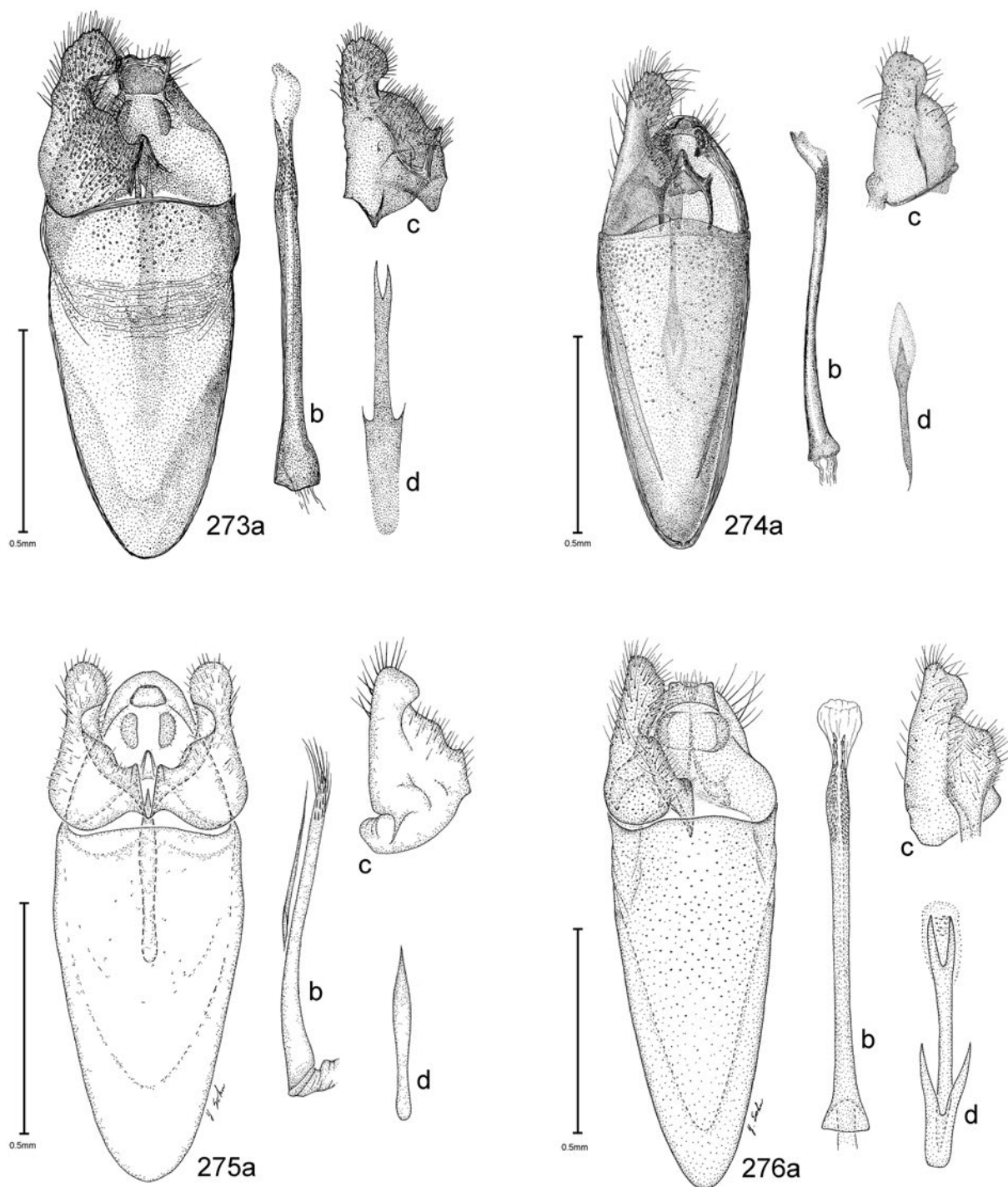
FIGURES 261–264. Male genitalia of *Ceromitia* (scale lengths=0.5 mm). 261, *C. schajovskoi*: (a) ventral view; (b) valva, lateral-mesal view; (c) juxta; (d) phallus, lateral and ventral views. 262, *C. cerastia*: (a) ventral view; (b) phallus, lateral view; (c) valva, lateral-mesal view; (d) juxta; (e) lateral view of genital capsule. 263, *C. elongata*: (a) ventral view; (b) phallus, lateral view; (c) valva, lateral-mesal view; (d) juxta. 264, *C. brevipectinella*: (a) ventral view; (b) valva, lateral-mesal view; (c) juxta; (d) lateral view of phallus apex; (e) phallus, lateral view.



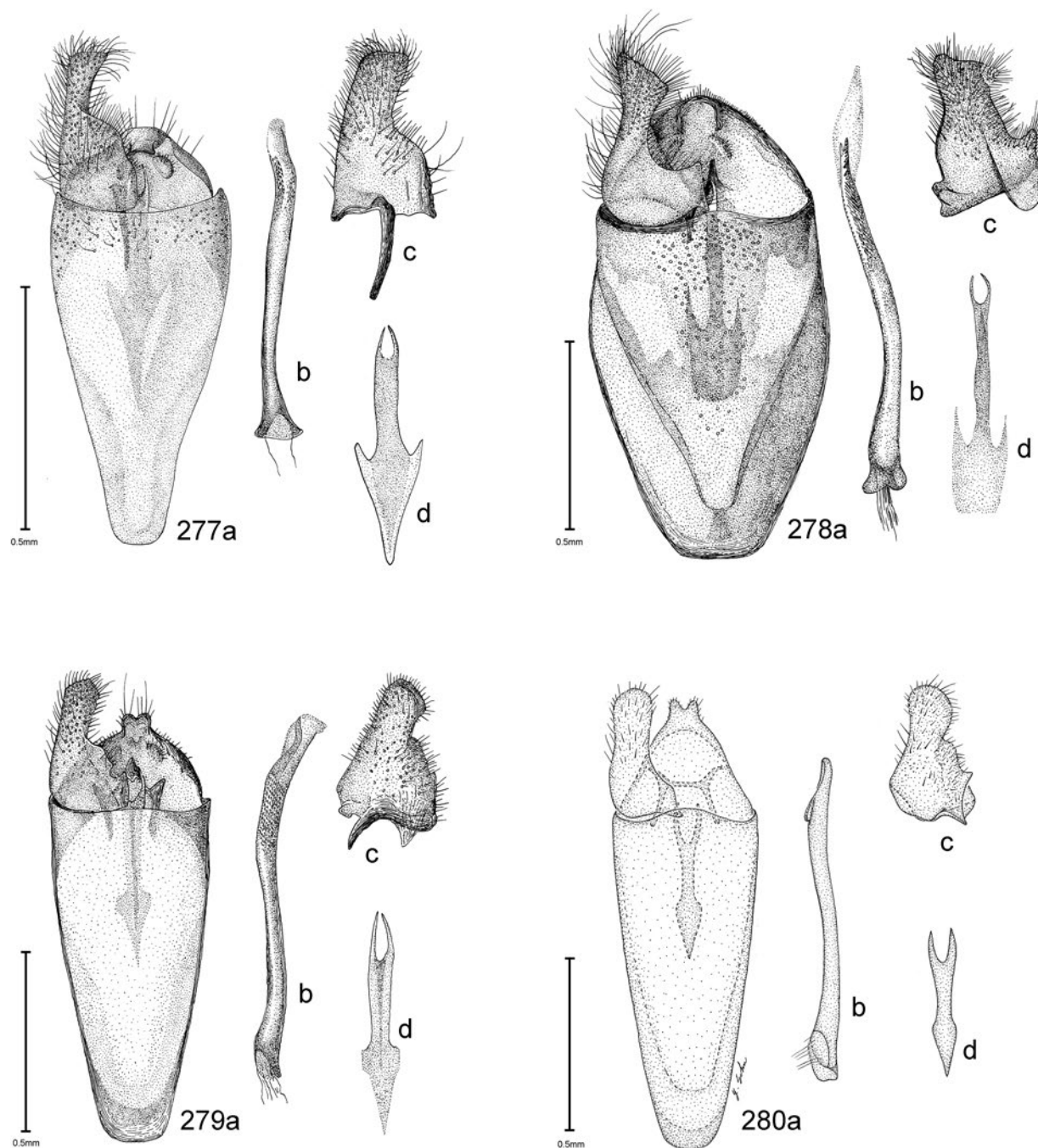
FIGURES 265–268. Male genitalia of *Ceromitia* (scale lengths=0.5 mm). 265, *C. nielseni*: (a) ventral view; (b) phallus, lateral view and ventral view of phallus base; (c) valva, lateral-mesal view; (d) juxta. 266, *C. lobata*: (a) ventral view; (b) phallus, lateral view; (c) valva, lateral-mesal view; (d) juxta. 267, *C. ovata*: (a) ventral view; (b) anellar lobes of phallus, ventral view; (c) phallus, lateral view and ventral view of phallus base; (d) valva, lateral-mesal view; (e) juxta. 268, *C. truncata*: (a) ventral view; (b) phallus, lateral view with ventral view of phallus base; (c) valva, lateral-mesal view; (d) juxta.



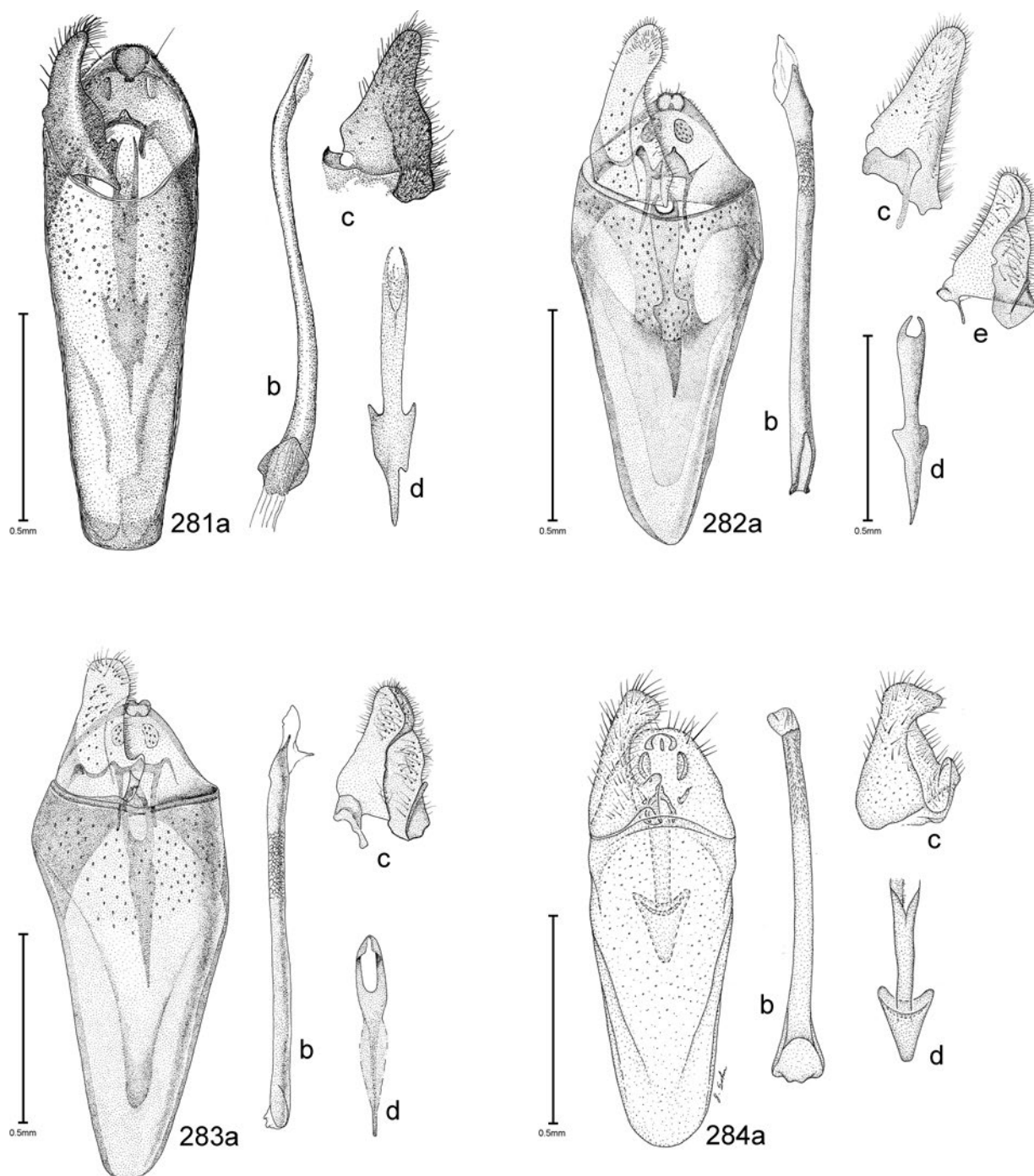
FIGURES 269–272. Male genitalia of *Ceromitia*, *Nemophora*, and *Adela* (scale lengths = 0.5 mm). 269, *C. unipectinella*: (a) ventral view; (b) phallus, lateral view; (c) valva, lateral–mesal view; (d) juxta. 270, *N. bellela*: (a) ventral view; (b) phallus, lateral view; (c) valva, lateral–mesal view; (d) juxta. 271, *A. punctiferella*: (a) ventral view; (b) phallus, ventral view; (c) valva, lateral–mesal view; (d) juxta. 272, *A. singulella*: (a) ventral view; (b) phallus, lateral view; (c) valva, lateral–mesal view; (d) juxta.



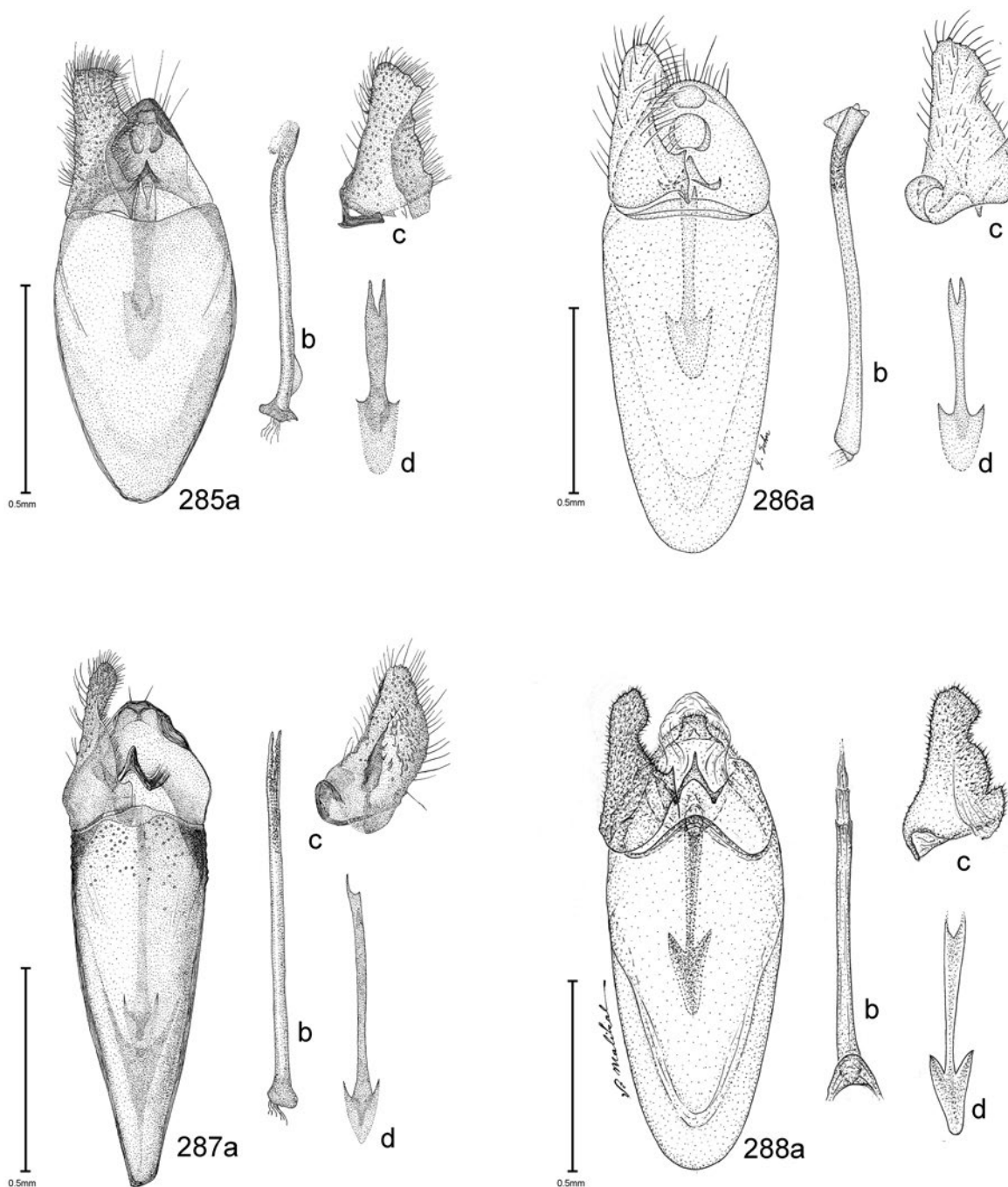
FIGURES 273–276. Male genitalia of *Adela* (scale lengths=0.5 mm). 273, *A. caeruleella*: (a) ventral view; (b) phallus, ventral view; (c) valva, lateral-mesal view; (d) juxta. 274, *A. aethiops*: (a) ventral view; (b) phallus, lateral view; (c) valva, lateral-mesal view; (d) juxta. 275, *A. atrata*: (a) ventral view; (b) phallus and juxta, lateral view; (c) valva, lateral-mesal view; (d) juxta. 276, *A. stenoptera*: (a) ventral view; (b) phallus, ventral view; (c) valva, lateral-mesal view; (d) juxta.



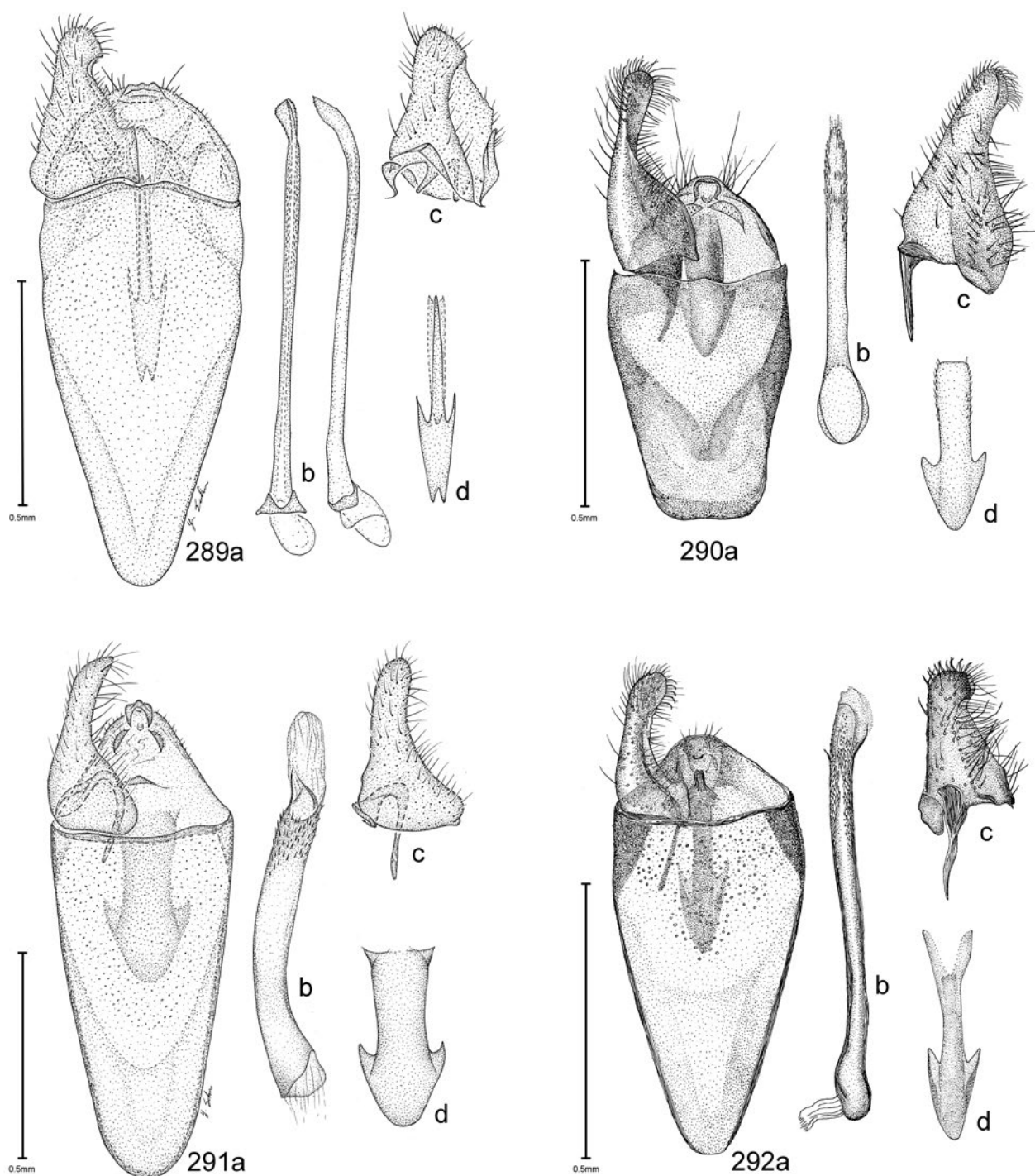
FIGURES 277–280. Male genitalia of *Adela* (scale lengths=0.5 mm). 277, *A. septentrionella*: (a) ventral view; (b) phallus ventral view; (c) valva, lateral–mesal view; (d) juxta. 278, *A. purpurea*: (a) ventral view; (b) phallus, lateral view; (c) valva, lateral–mesal view; (d) juxta. 279, *A. trigrapha*: (a) ventral view; (b) phallus, lateral view; (c) valva, lateral–mesal view; (d) juxta. 280, *A. eldorada*: (a) ventral view; (b) phallus, lateral view; (c) valva, lateral–mesal view; (d) juxta.



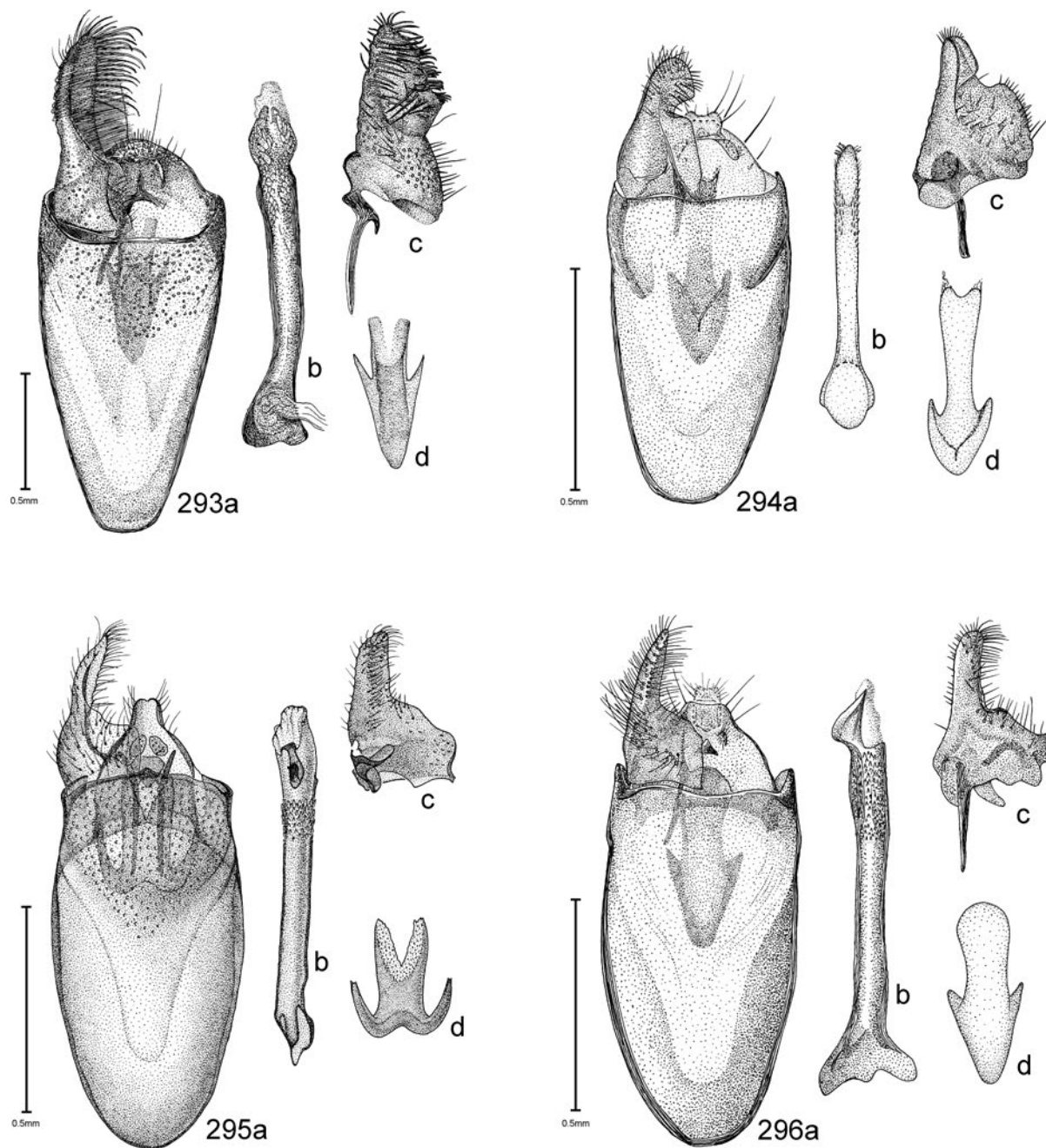
FIGURES 281–284. Male genitalia of *Adela* (scale lengths=0.5 mm). 281, *A. flammeusella*: (a) ventral view; (b) phallus, lateral view; (c) valva, lateral view; (d) juxta. 282, *A. thorpella*: (a) ventral view; (b) phallus, lateral view; (c) left valva, lateral view; (d) juxta; (e) right valva, lateral-ventral view. 283, *A. oplerella*: (a) ventral view; (b) phallus, lateral view; (c) valva, lateral view; (d) juxta. 284, *A. powelli*: (a) ventral view; (b) phallus, ventral view; (c) valva, lateral view; (d) juxta.



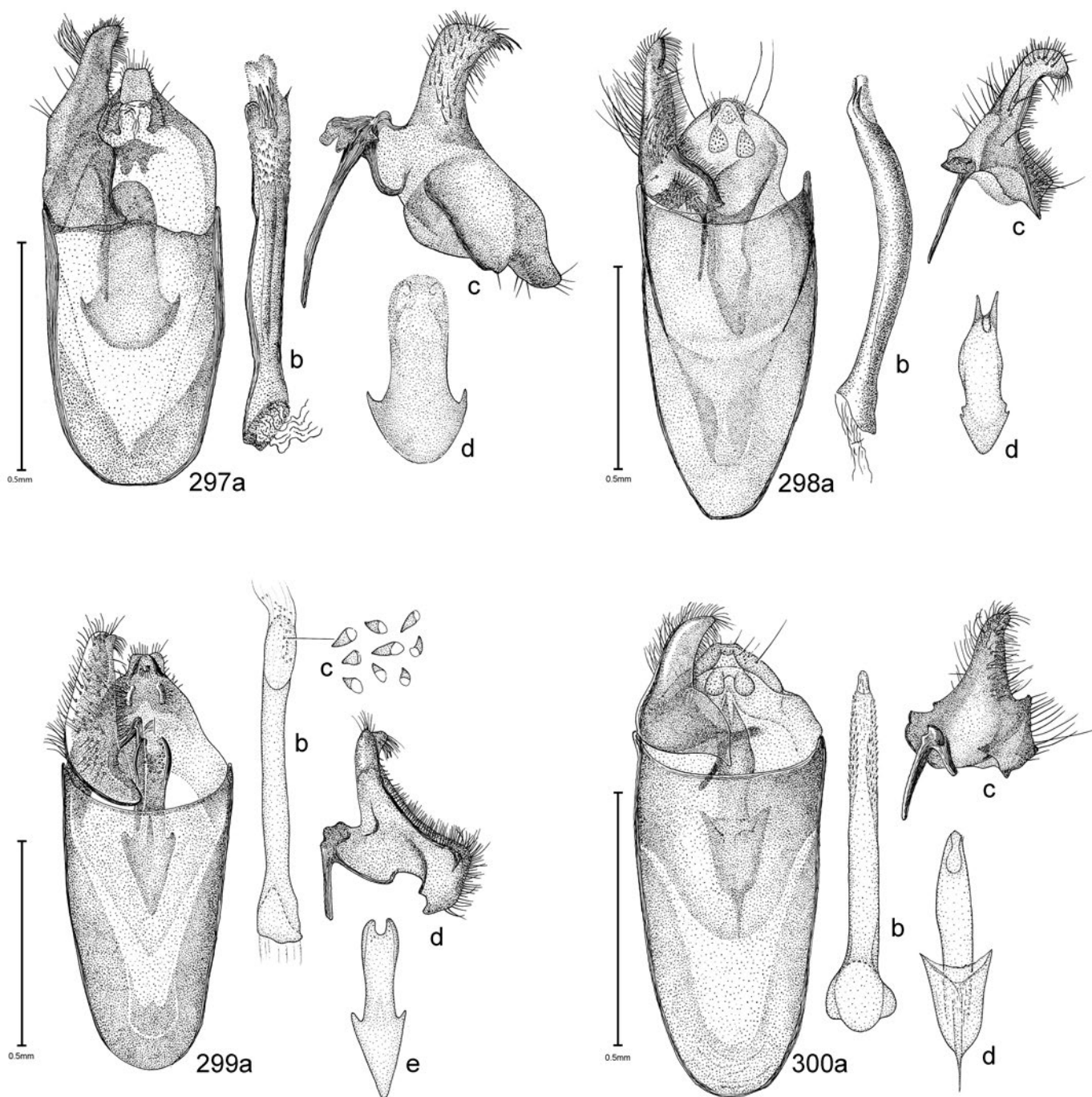
FIGURES 285–288. Male genitalia of *Adela* (scale lengths=0.5 mm). 285, *A. ridingsella*: (a) ventral view; (b) phallus, lateral view; (c) valva, lateral view; (d) juxta. 286, *A. austrina*: (a) ventral view; (b) phallus, lateral view; (c) valva, lateral view; (d) juxta. 287, *A. astrella*: (a) ventral view; (b) phallus, ventral view; (c) valva, lateral view; (d) juxta. 288, *A. striata*: (a) ventral view; (b) phallus, ventral view; (c) valva, lateral view; (d) juxta.



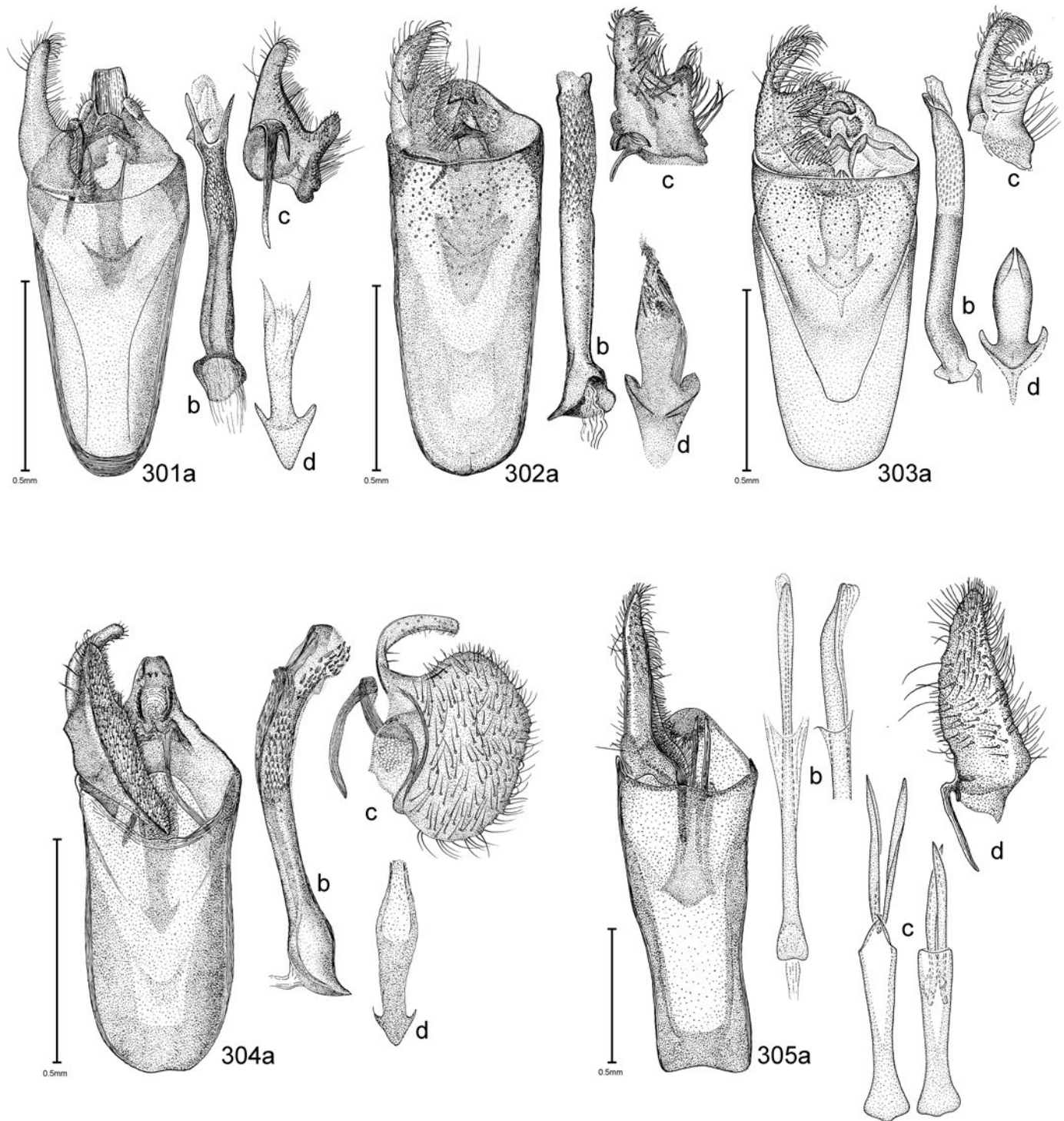
FIGURES 289–292. Male genitalia of *Adela* and *Cauchas* (scale lengths=0.5 mm). 289, *A. boliviella*: (a) ventral view; (b) phallus, ventral and lateral views; (c) valva, lateral view; (d) juxta. 290, *C. dietziella*: (a) ventral view; (b) phallus, ventral view; (c) valva, lateral view; (d) juxta. 291, *C. alaskae*: (a) ventral view; (b) phallus, lateral view; (c) valva, lateral view; (d) juxta. 292, *C. vittata*: (a) ventral view; (b) phallus, lateral view; (c) valva, lateral view; (d) juxta.



FIGURES 293–296. Male genitalia of *Cauchas* (scale lengths=0.5 mm). 293, *C. spinulosa*: (a) ventral view; (b) phallus, ventral view; (c) valva, lateral view; (d) juxta. 294, *C. recurvata*: (a) ventral view; (b) phallus, ventral view; (c) valva, lateral view; (d) juxta. 295, *C. suffusa*: (a) ventral view; (b) phallus, lateral view; (c) valva, lateral view; (d) juxta. 296, *C. cockerelli*: (a) ventral view; (b) phallus, ventral view; (c) valva, lateral view; (d) juxta.



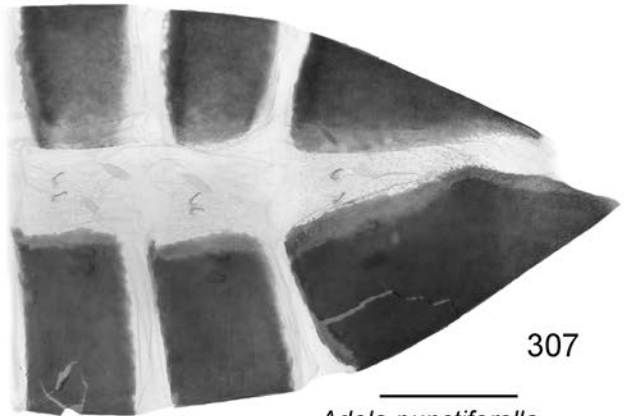
FIGURES 297–300. Male genitalia of *Cauchas* (scale lengths = 0.5 mm). 297, *C. simpliciella*: (a) ventral view; (b) phallus, ventral view; (c) valva, lateral view; (d) juxta. 298, *C. sedella*: (a) ventral view; (b) phallus, lateral view; (c) valva, lateral view; (d) juxta. 299, *C. cyanella*: (a) ventral view; (b) phallus, ventral view; (c) with spicules enlarged; (d) valva, lateral view; (e) juxta. 300, *C. trifascia*: (a) ventral view; (b) phallus, ventral view; (c) valva, lateral view; (d) juxta.



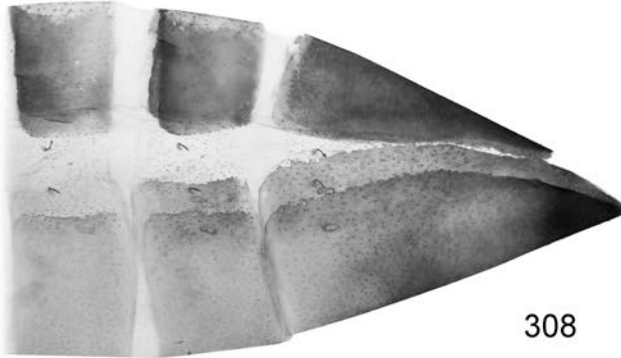
FIGURES 301–305. Male genitalia of *Cauchas* (scale lengths=0.5 mm). 301, *C. lobata*: (a) ventral view; (b) phallus, ventral view; (c) valva, lateral view; (d) juxta. 302, *C. excavata*: (a) ventral view; (b) phallus, ventral view; (c) valva, lateral view; (d) juxta. 303, *C. wielgusi*: (a) ventral view; (b) phallus, lateral view; (c) valva, lateral view; (d) juxta. 304, *C. clarkei*: (a) ventral view; (b) phallus, lateral view; (c) valva, lateral view; (d) juxta. 305, *C. elongata*: (a) ventral view; (b) phallus, ventral view with lateral view of apex; (c) juxta, ventral (left) and lateral views; (d) valva, lateral view.



Nemophora bellela



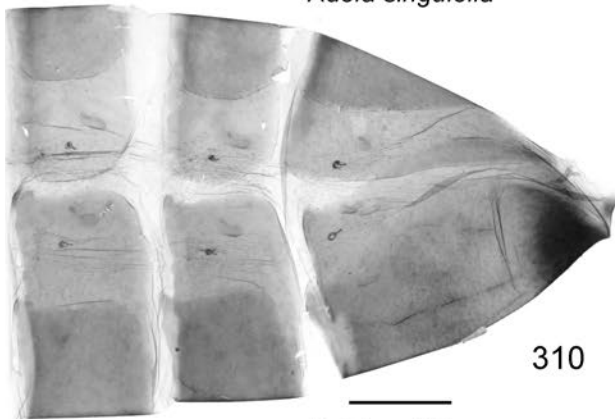
Adela punctiferella



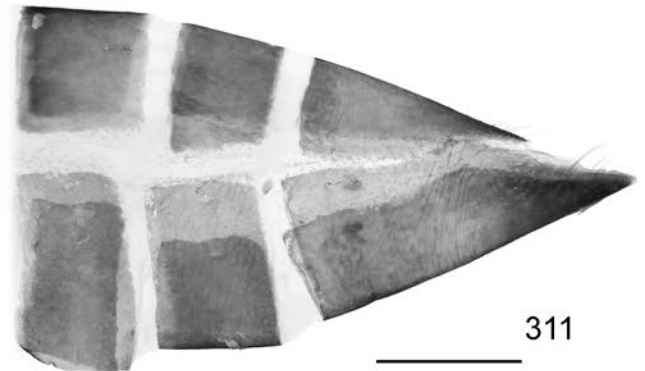
Adela singulella



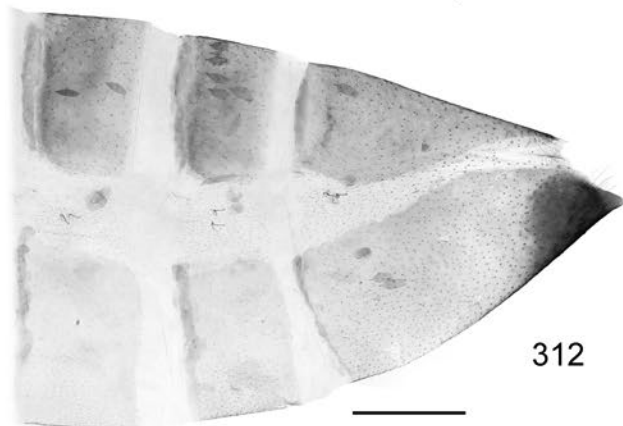
Adela caeruleella



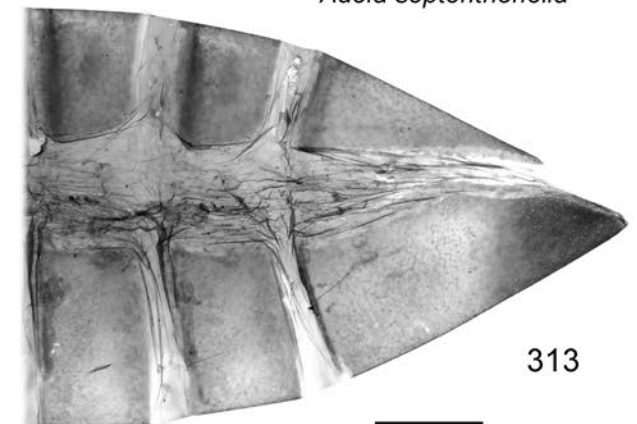
Adela aethiops



Adela septentrionella

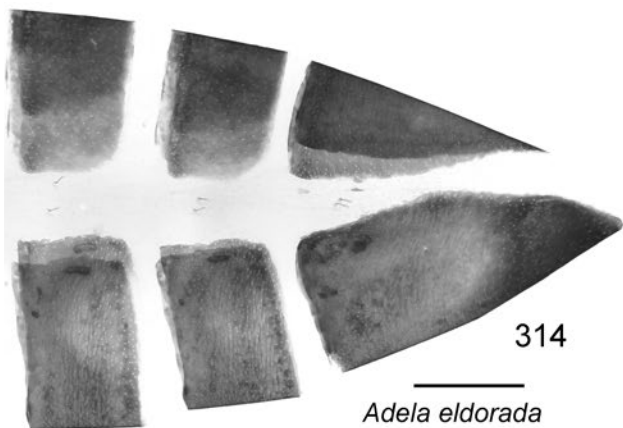


Adela purpurea



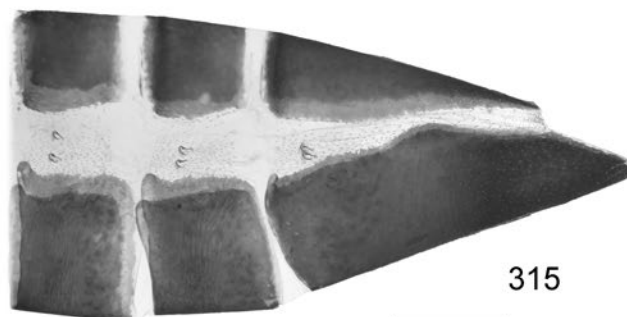
Adela trigrapha

FIGURES 306–313. Female abdomens (lateral view) of *Nemophora* and *Adela* (scale lengths=0.5 mm). 306, *N. bellela*. 307, *A. punctiferella*. 308, *A. singulella*. 309, *A. caeruleella*. 310, *A. aethiops*. 311, *A. septentrionella*. 312, *A. purpurea*. 313, *A. trigrapha*.



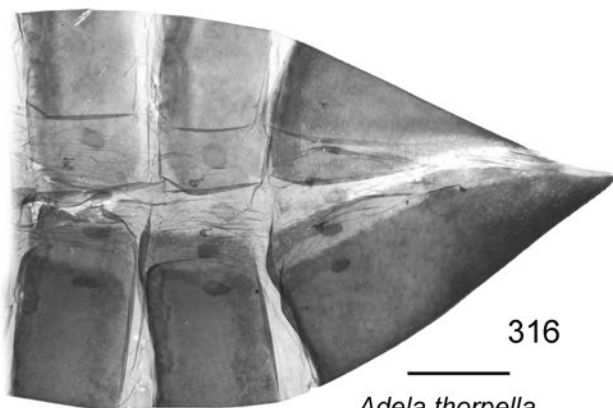
314

Adela eldorada



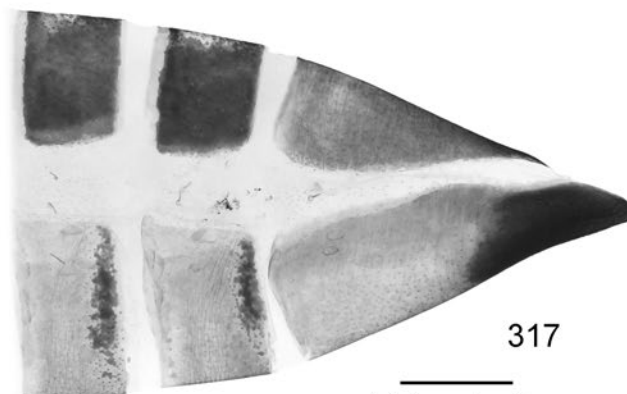
315

Adela flammeusella



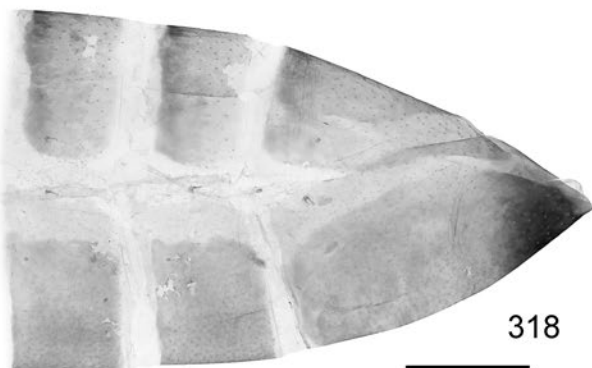
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Adela thorpella



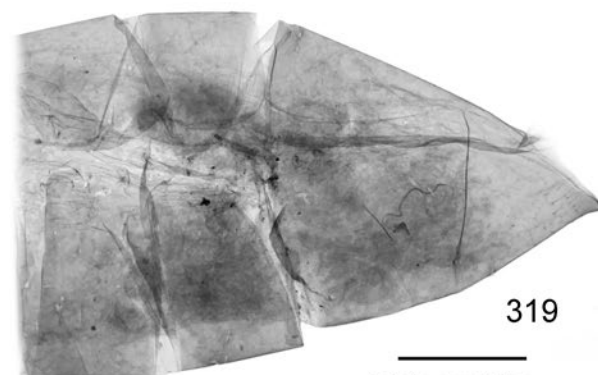
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Adela oplerella



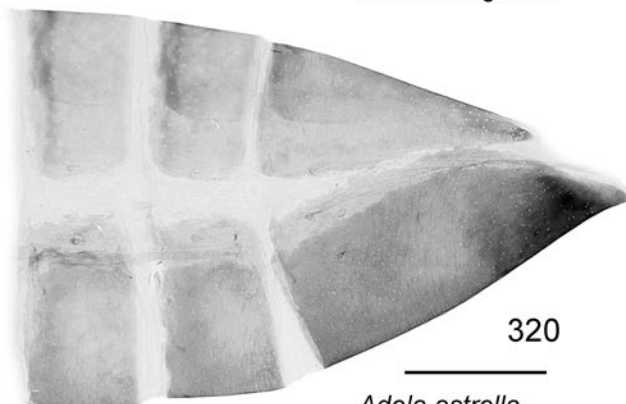
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Adela ridingsella



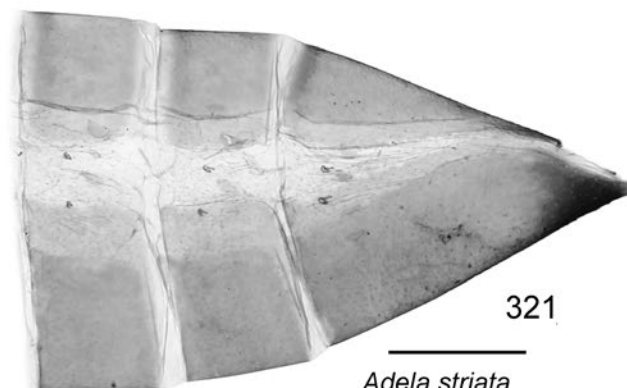
319

Adela austrina



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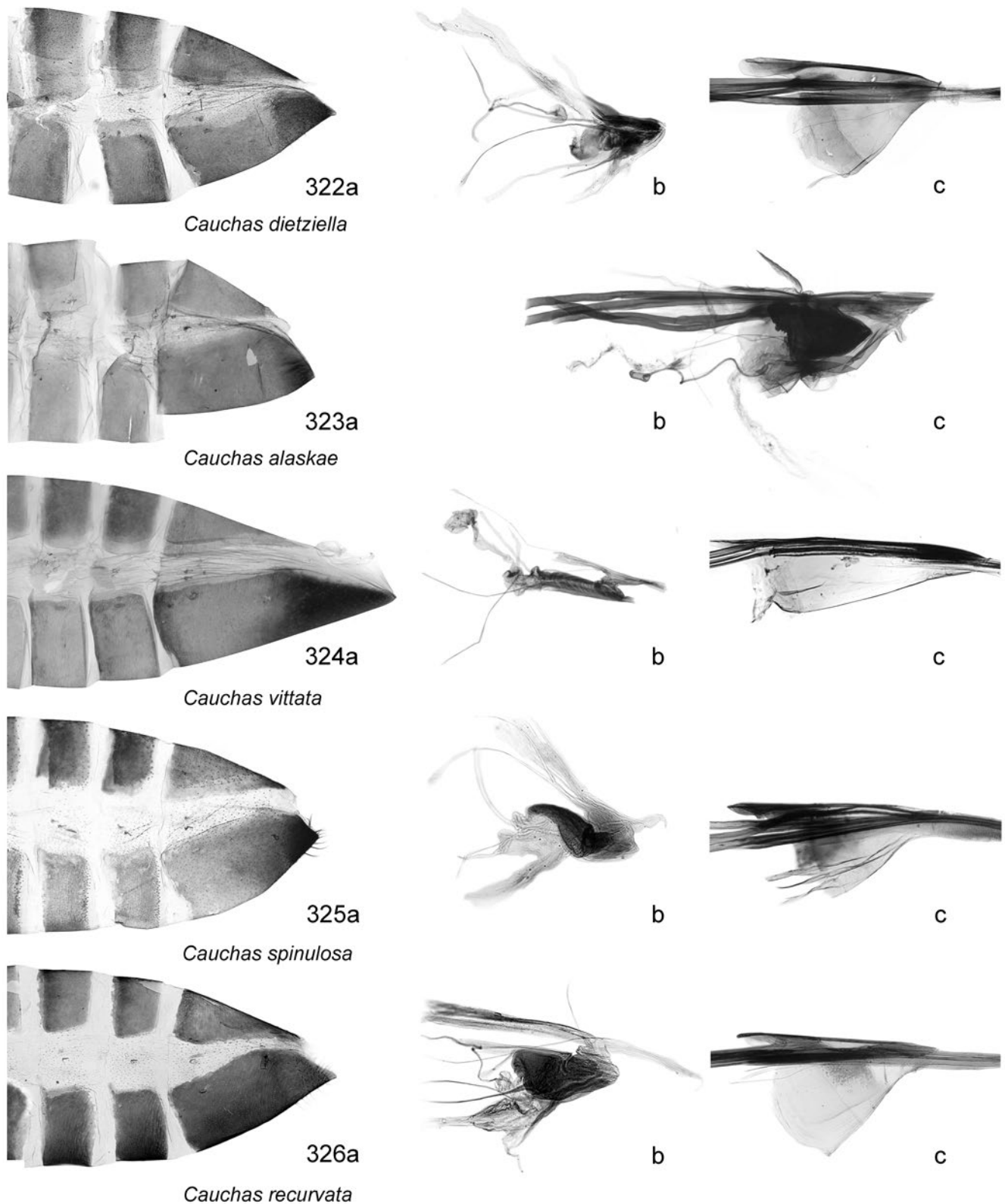
Adela astrella



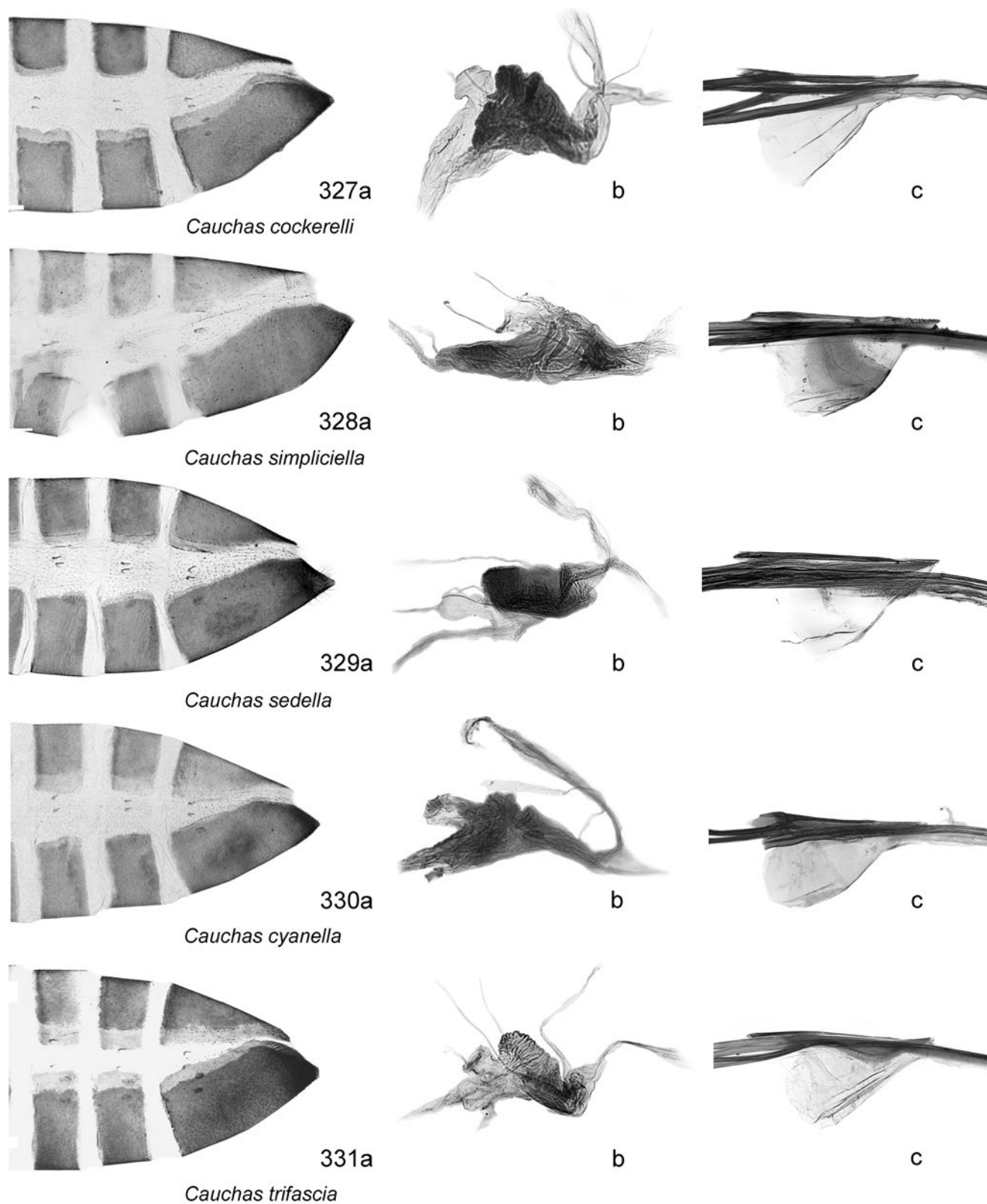
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Adela striata

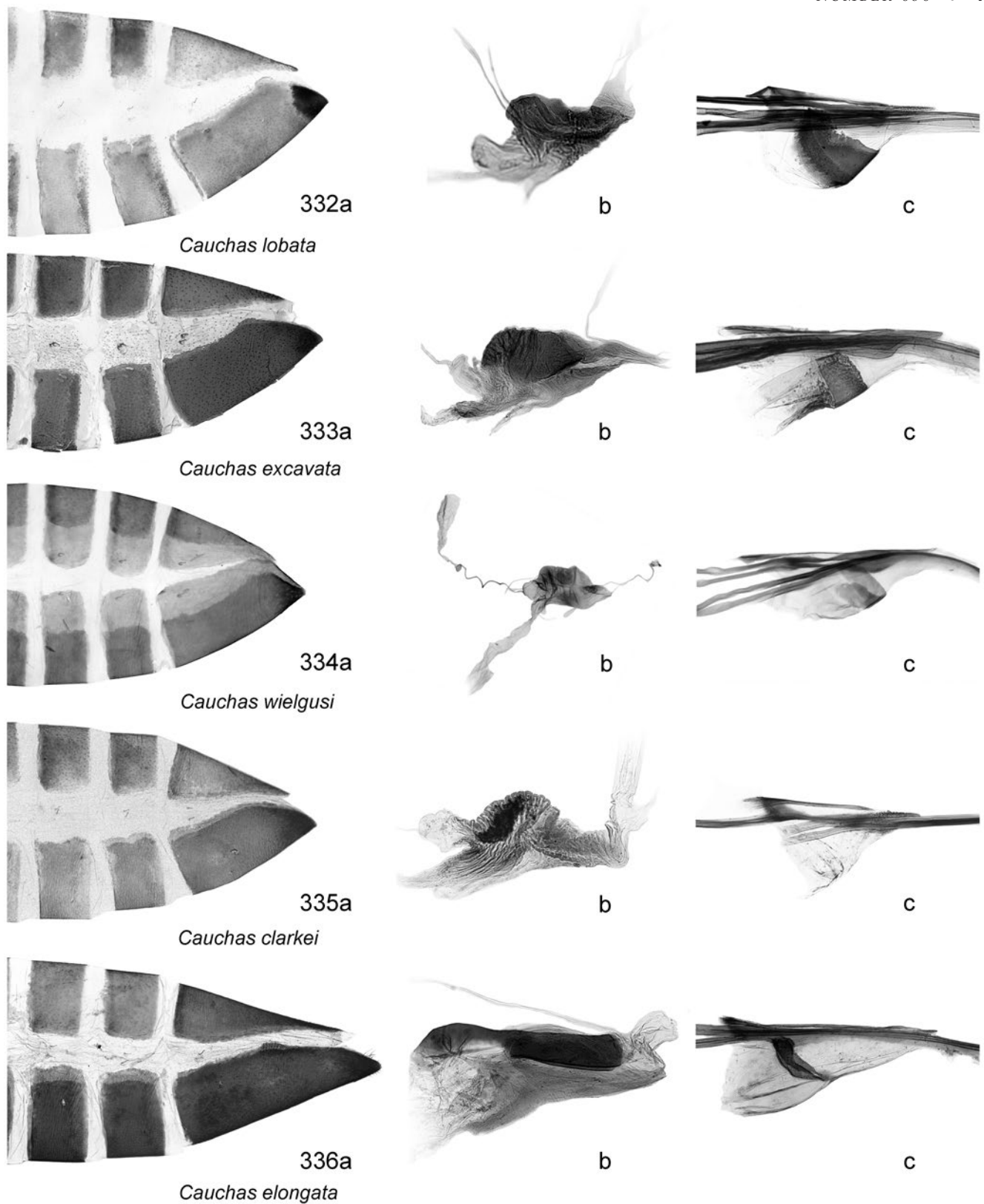
FIGURES 314–321. Female abdomens (lateral view) of *Adela* (scale lengths=0.5 mm). 314, *A. eldorada*. 315, *A. flammeusella*. 316, *A. thorpella*. 317, *A. oplerella*. 318, *A. ridingsella*. 319, *A. austrina*. 320, *A. astrella*. 321, *A. striata*.



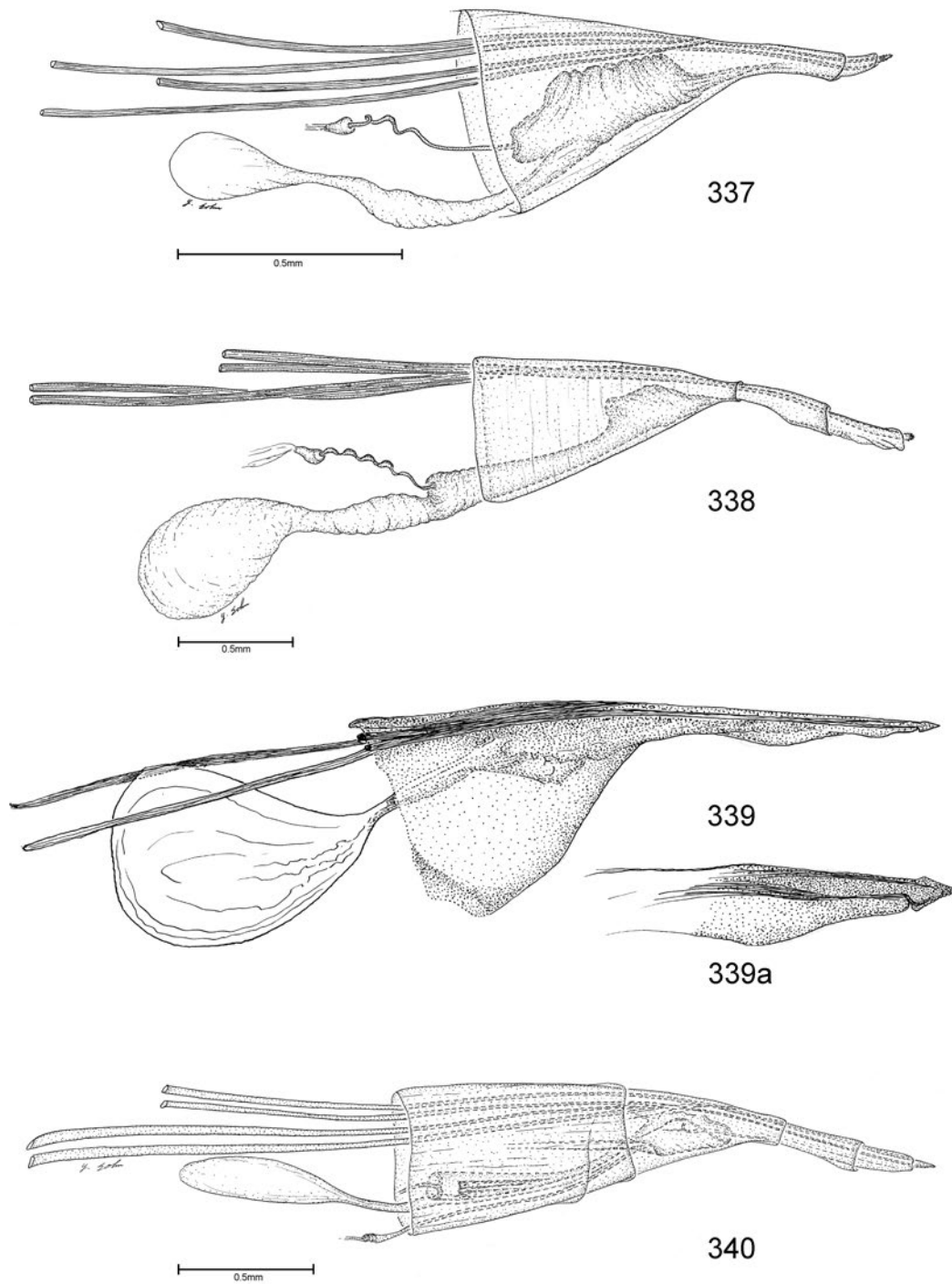
FIGURES 322–326. Lateral view of female abdomens and genitalia of *Cauchas*. 322, *C. dietziella*: (a) abdomen; (b) vagina and vestibulum; (c) eighth segment; 323, *C. alaskae*: (a) abdomen; (b) vagina and vestibulum; (c) eighth segment. 324, *C. vittata*: (a) abdomen; (b) vagina and vestibulum; (c) eighth segment. 325, *C. spinulosa*: (a) abdomen; (b) vagina and vestibulum; (c) eighth segment. 326, *C. recurvata*: (a) abdomen; (b) vagina and vestibulum; (c) eighth segment.



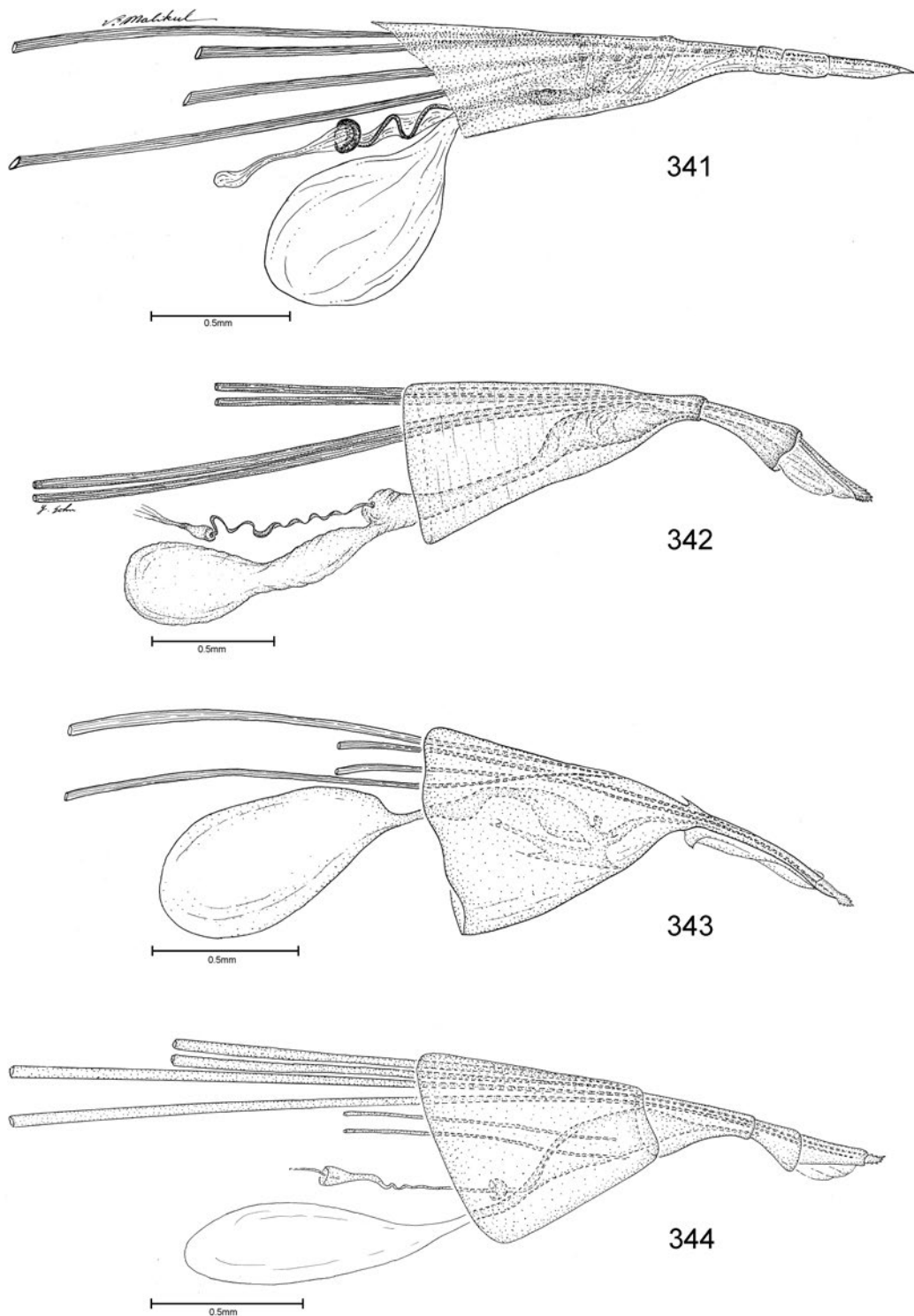
FIGURES 327–331. Lateral view of female abdomens and genitalia of *Cauchas*. 327, *C. cockerelli*: (a) abdomen; (b) vagina and vestibulum; (c) eighth segment. 328, *C. simpliciella*: (a) abdomen; (b) vagina and vestibulum; (c) eighth segment. 329, *C. sedella*: (a) abdomen; (b) vagina and vestibulum; (c) eighth segment. 330, *C. cyanella*: (a) abdomen; (b) vagina and vestibulum; (c) eighth segment. 331, *C. trifascia*: (a) abdomen; (b) vagina and vestibulum; (c) eighth segment.



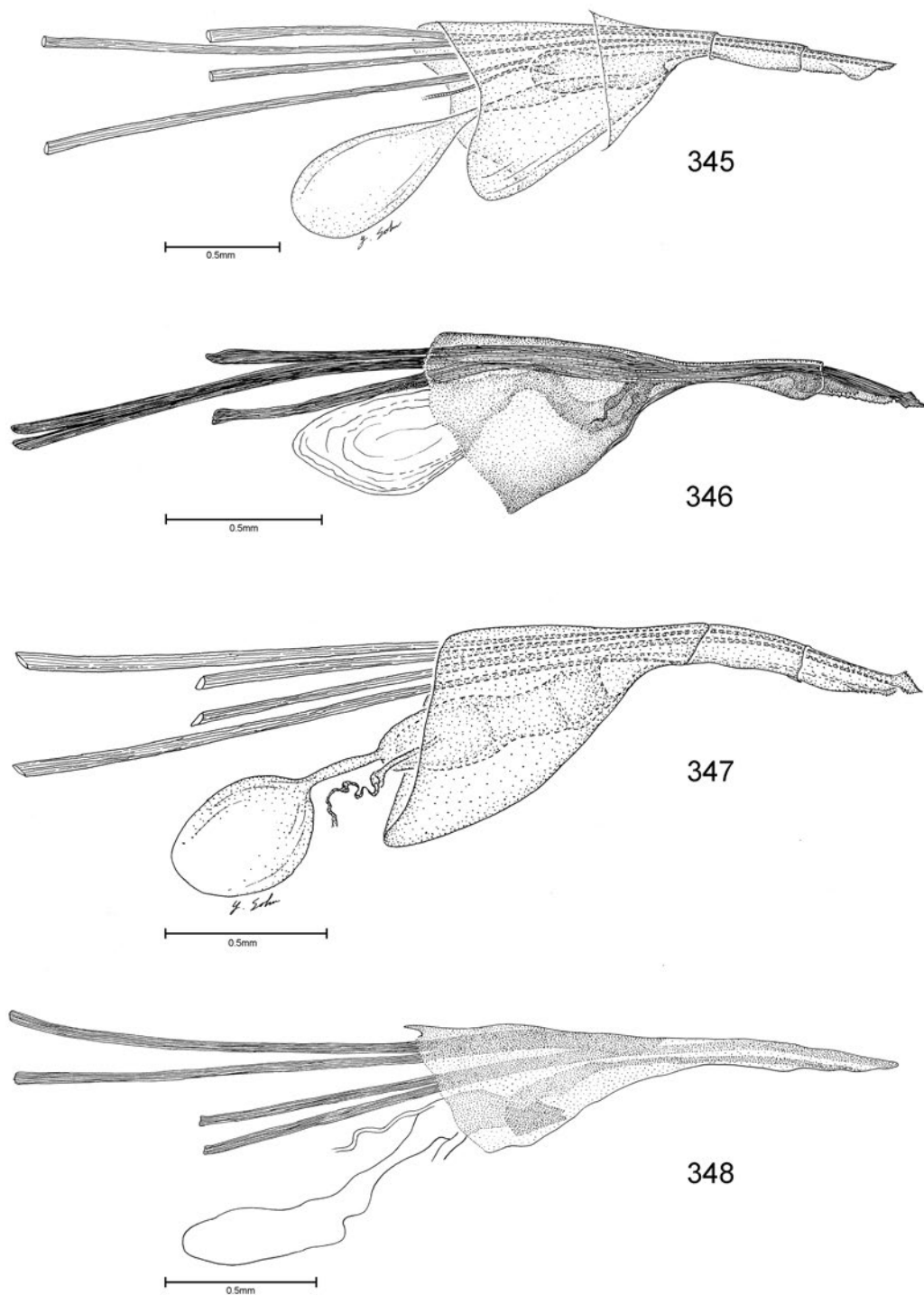
FIGURES 332–336. Lateral view of female abdomens and genitalia of *Cauchas*. 332, *C. lobata*: (a) abdomen; (b) vagina and vestibulum; (c) eighth segment. 333, *C. excavata*: (a) abdomen; (b) vagina and vestibulum; (c) eighth segment. 334, *C. wielgusi*: (a) abdomen; (b) vagina and vestibulum; (c) eighth segment. 335, *C. clarkei*: (a) abdomen; (b) vagina and vestibulum; (c) eighth segment. 336, *C. elongata*: (a) abdomen; (b) vagina and vestibulum; (c) eighth segment.



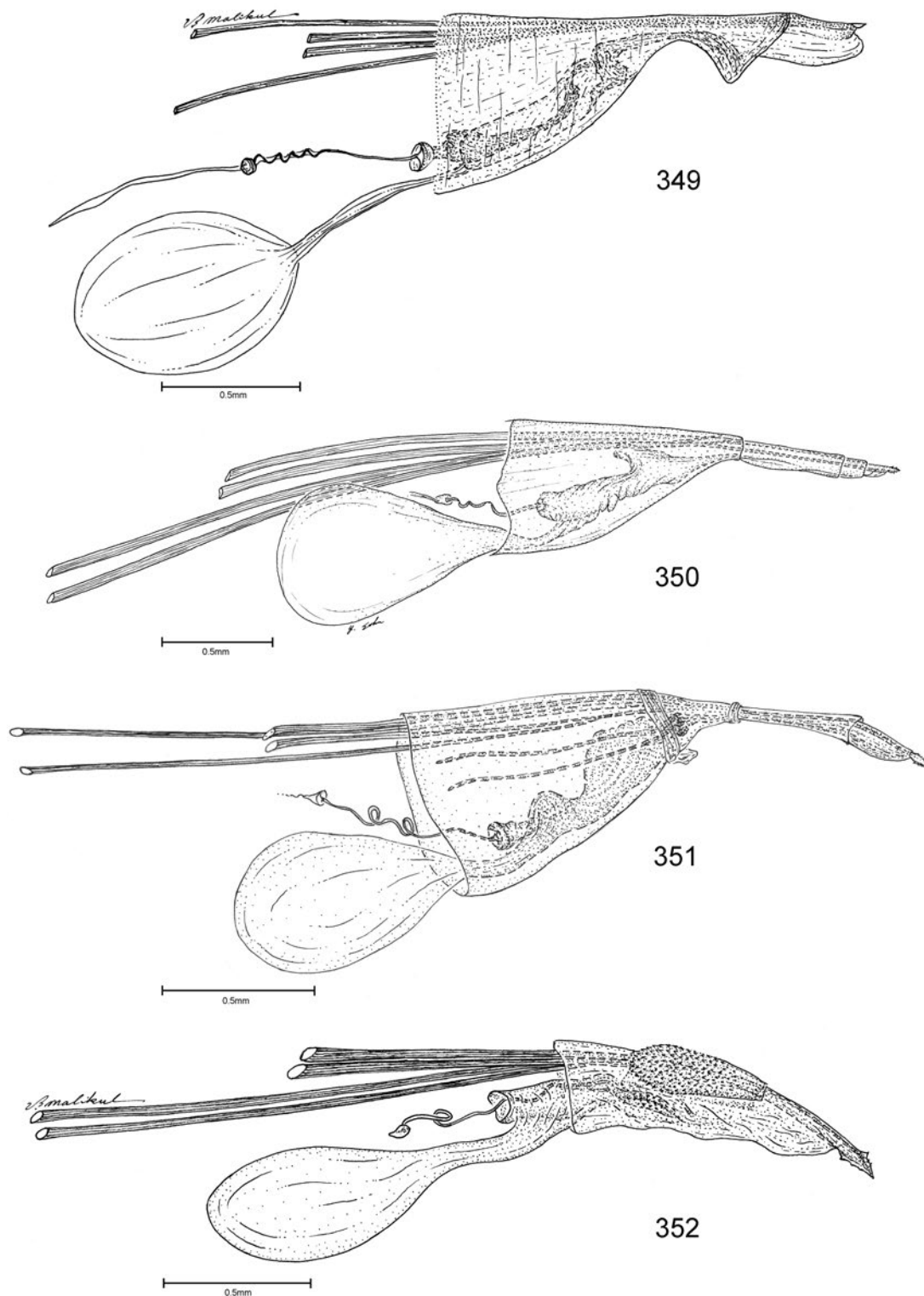
FIGURES 337–340. Lateral view of *Ceromitia* female genitalia (scale lengths=0.5 mm). 337, *C. parvipectena*. 338, *C. capitanea*. 339, *C. chionocrossa*. 340, *C. lizeri*.



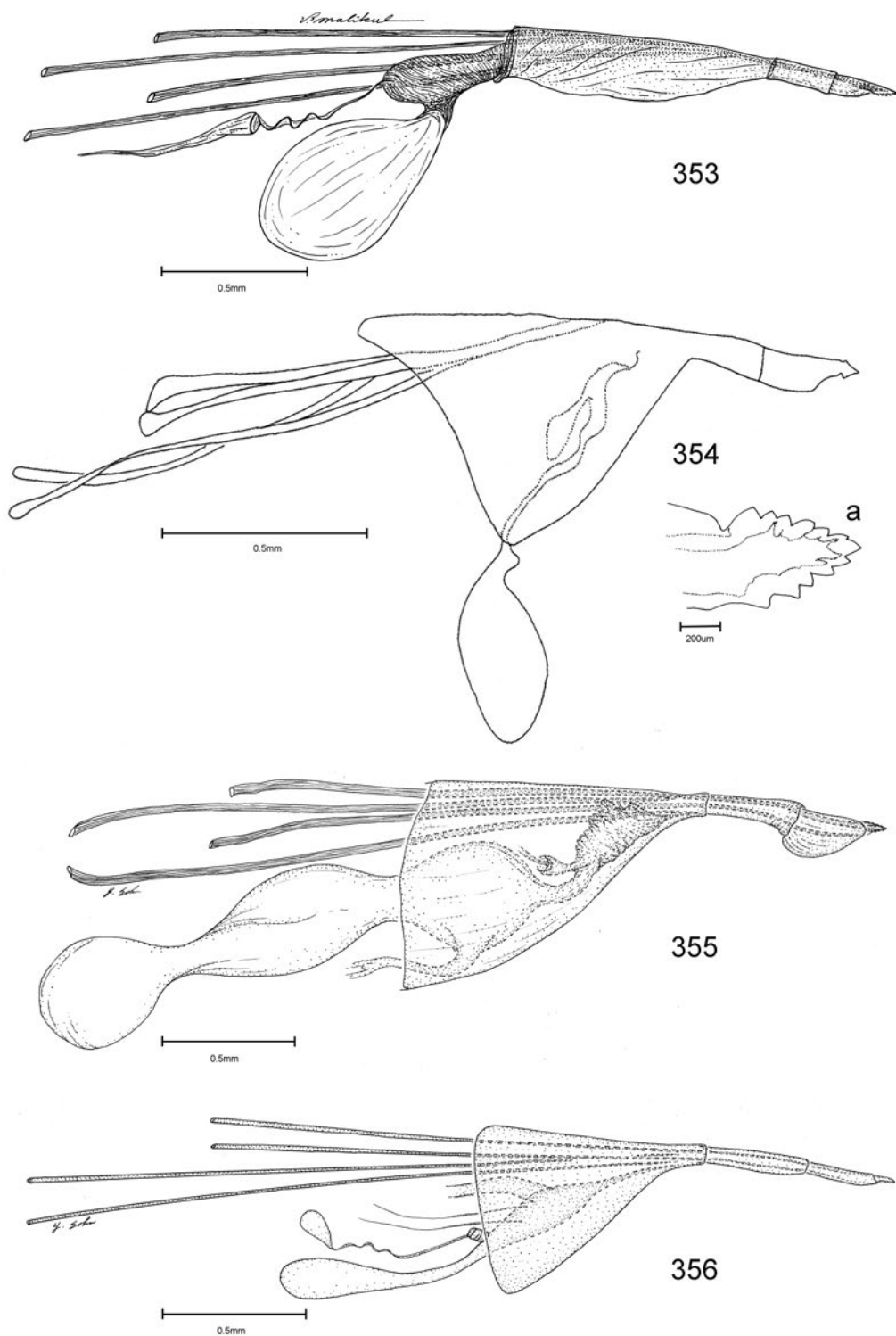
FIGURES 341–344. Lateral view of *Ceromitia* female genitalia (scale lengths=0.5 mm). 341, *C. pucaraensis*. 342, *C. flagellata*. 343, *C. phaeoceros*. 344, *C. fuscata*.



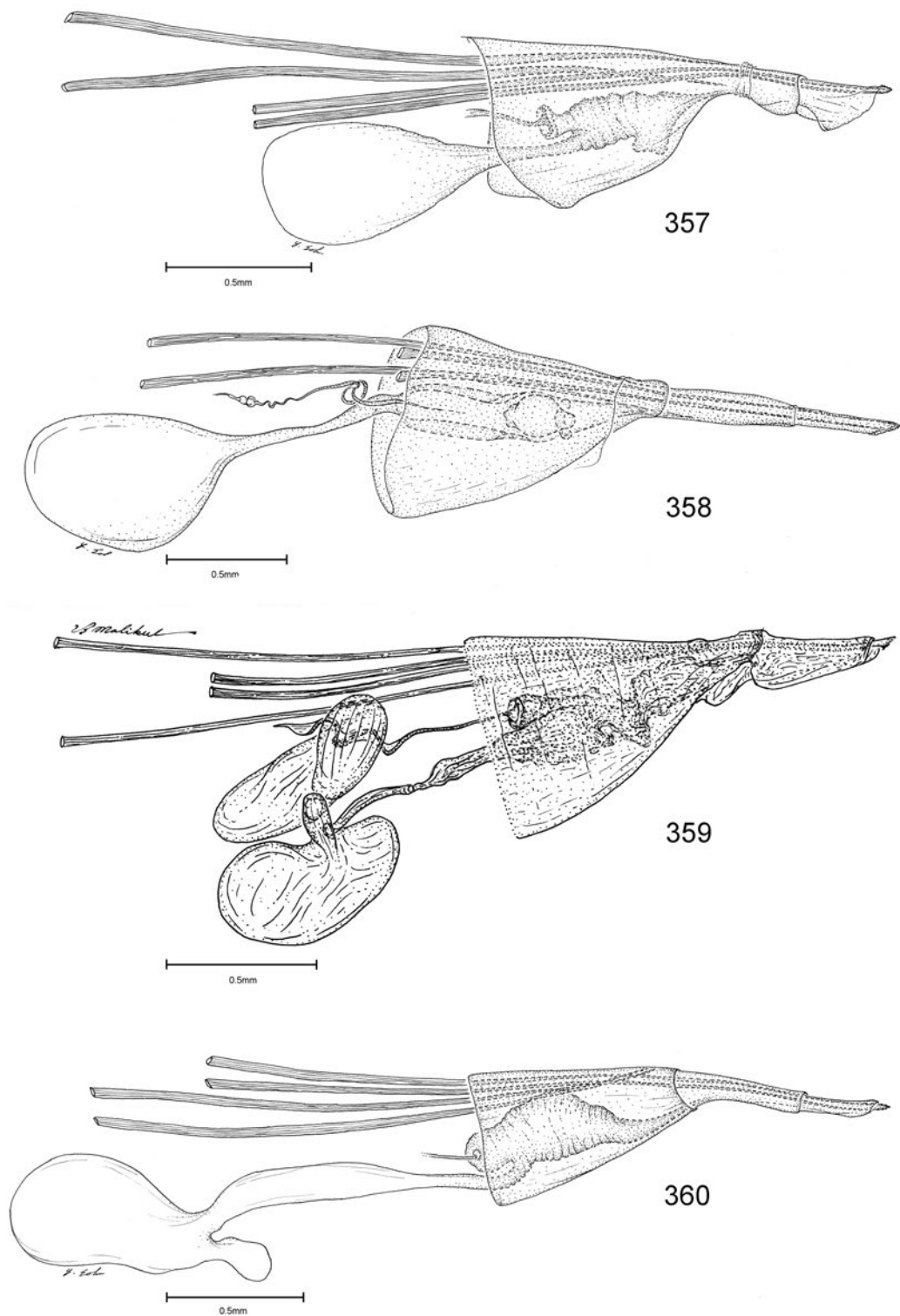
FIGURES 345–348. Lateral view of *Ceromitia* female genitalia (scale lengths=0.5 mm). 345, *C. karsholti*. 346, *C. viscida*. 347, *C. costaricensis*. 348, *C. aphyoda*.



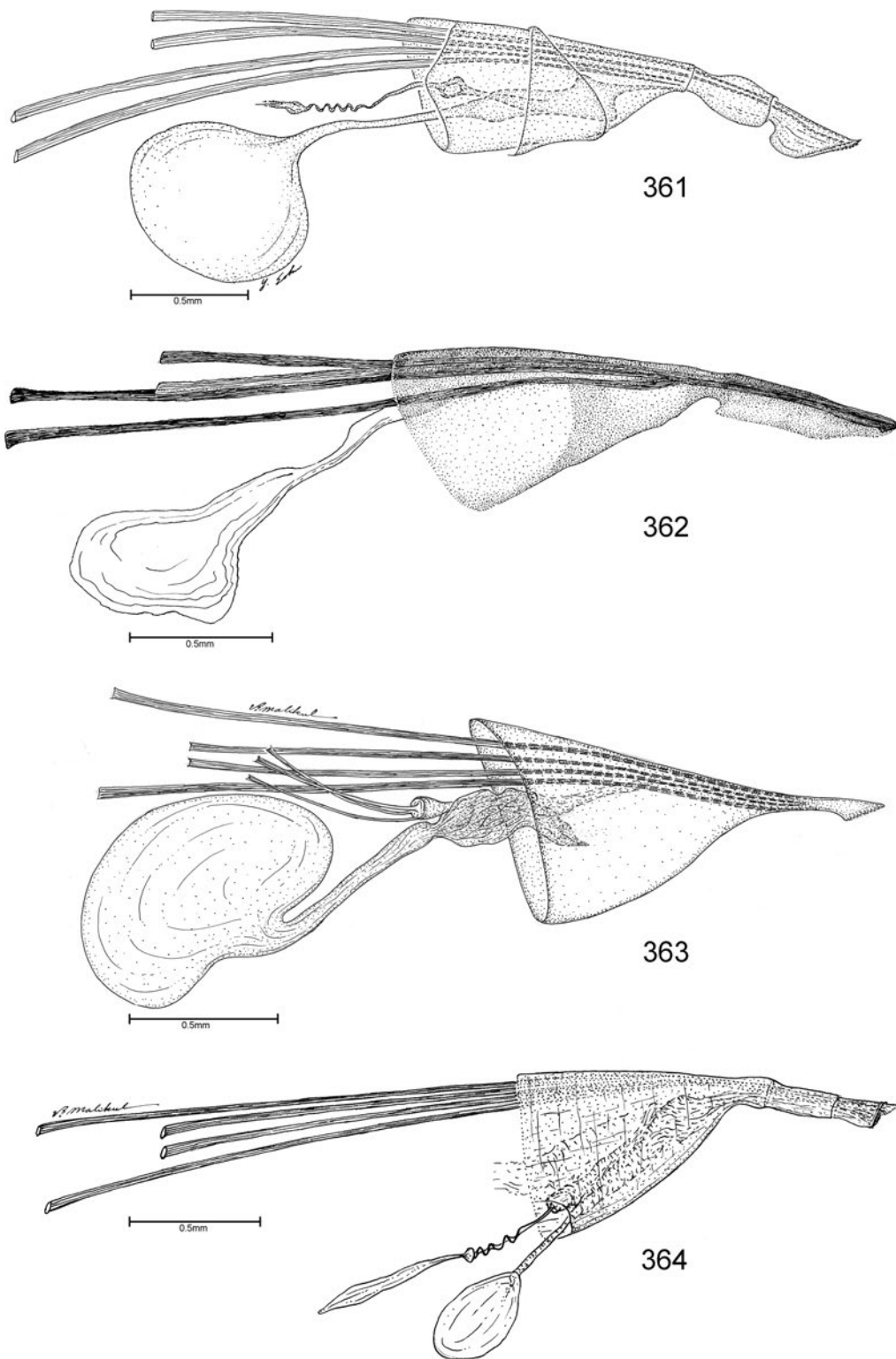
FIGURES 349–352. Lateral view of *Ceromitia* female genitalia (scale lengths=0.5 mm). 349, *C. fasciata*. 350, *C. braziliensis*. 351, *C. concava*. 352, *C. convexa*.



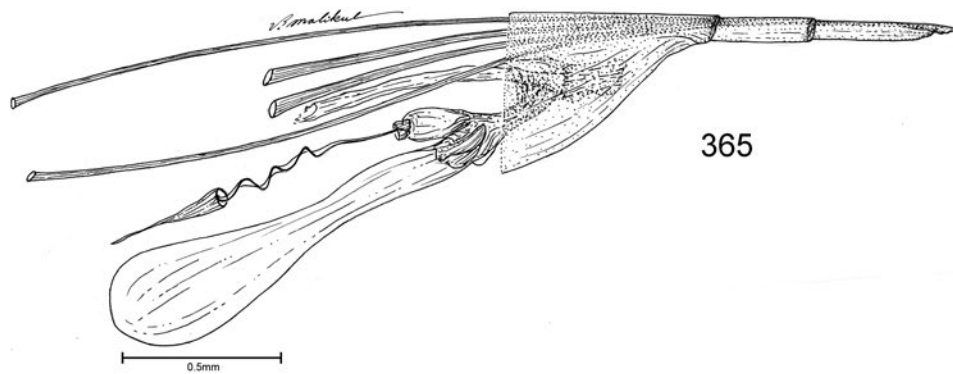
FIGURES 353–356. Lateral view of *Ceromitia* female genitalia (scale lengths=0.5 mm). 353, *C. inaequalis*. 354, *C. tubulifolia*: (a) apex of ovipositor (scale=200 µm) (from Parra and Ogden 2011). 355, *C. barilochensis*. 356, *C. latijuxta*.



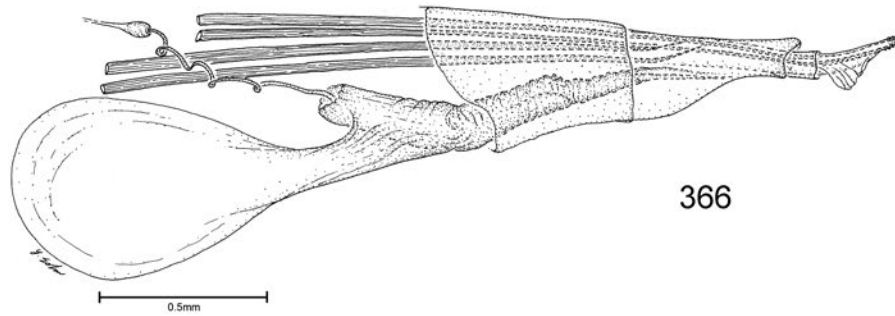
FIGURES 357–360. Lateral view of *Ceromitia* female genitalia (scale lengths=0.5 mm). 357, *C. petila*. 358, *C. beckeri*. 359, *C. latibasis*. 360, *C. latapicula*.



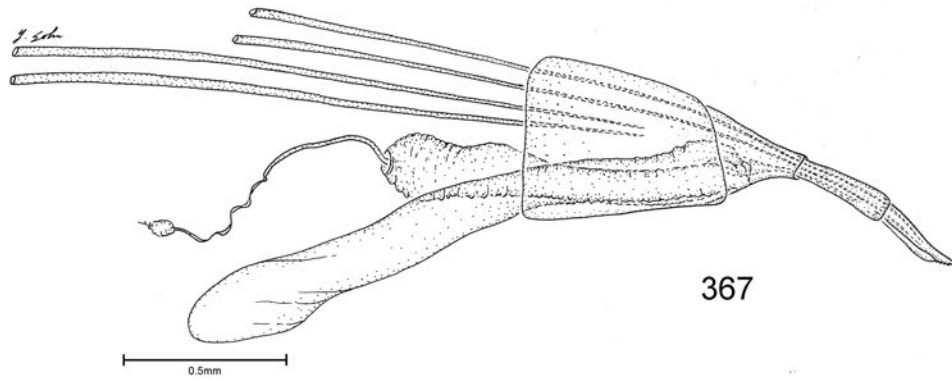
FIGURES 361–364. Lateral view of *Ceromitia* female genitalia (scale lengths=0.5 mm). 361, *C. exserta*. 362, *C. schajovskoi*. 363, *C. cerastia*. 364, *C. brevipectinella*.



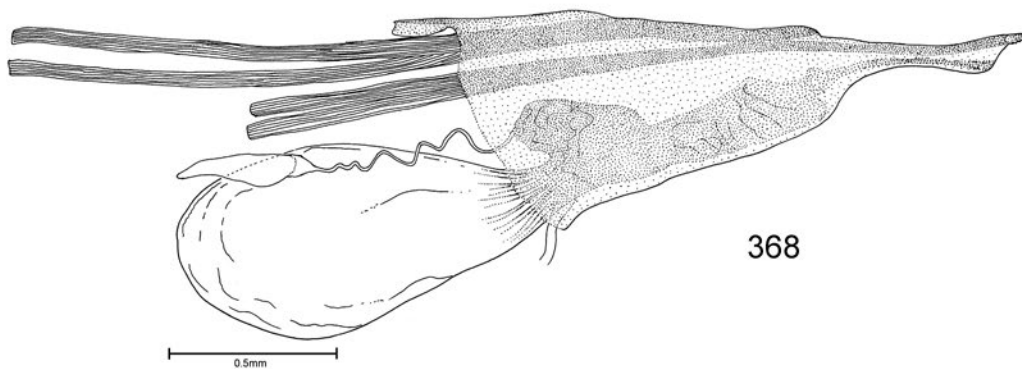
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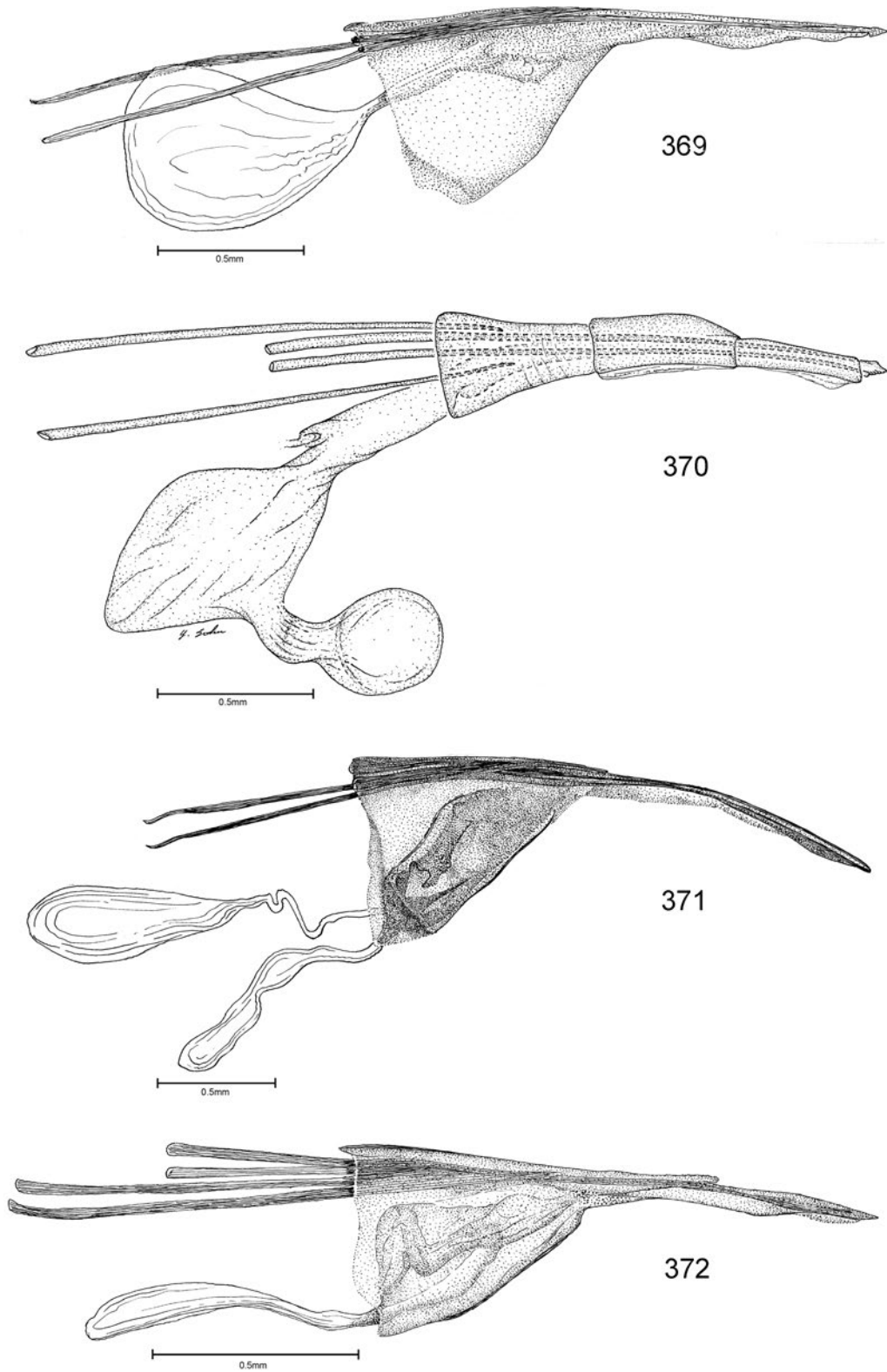


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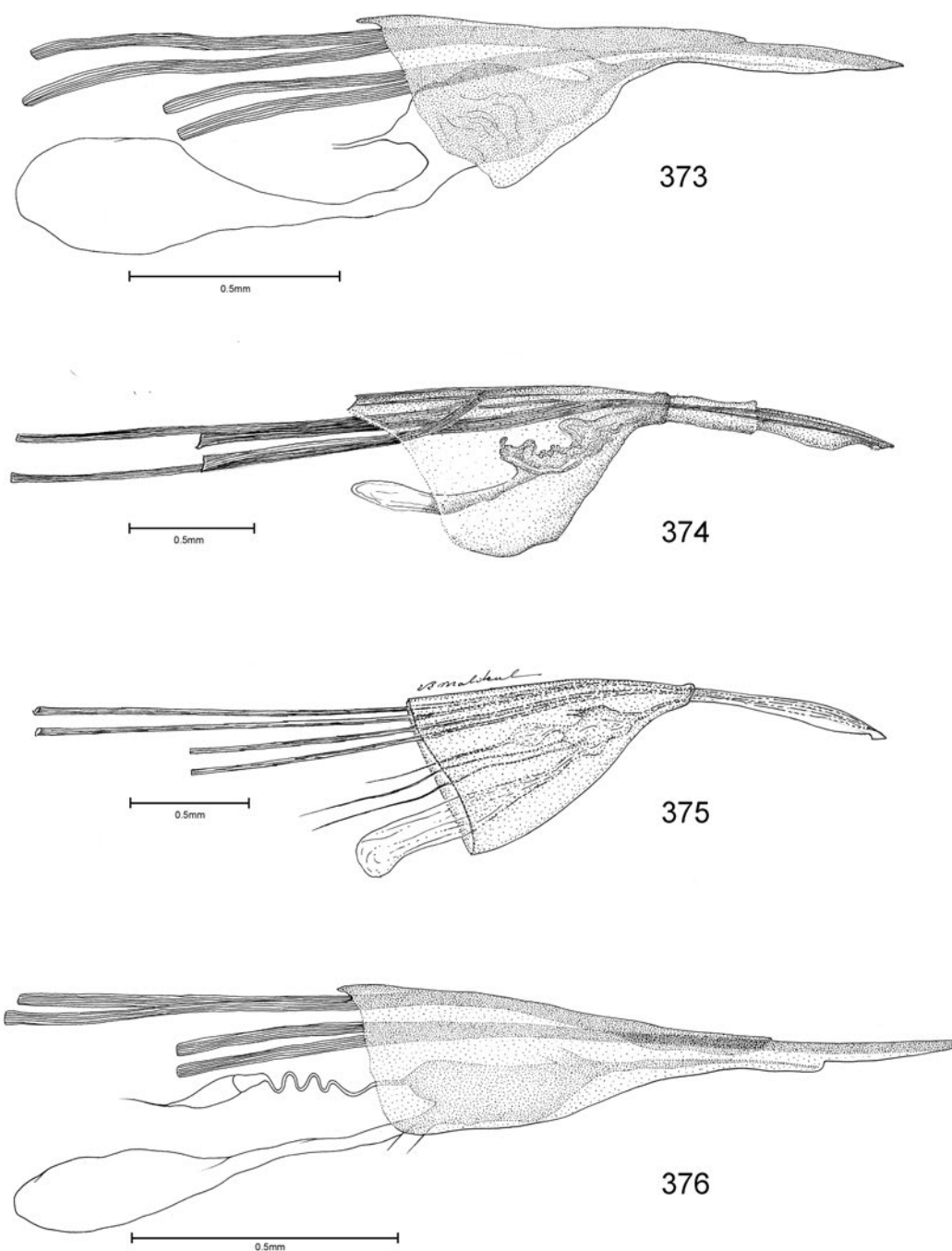


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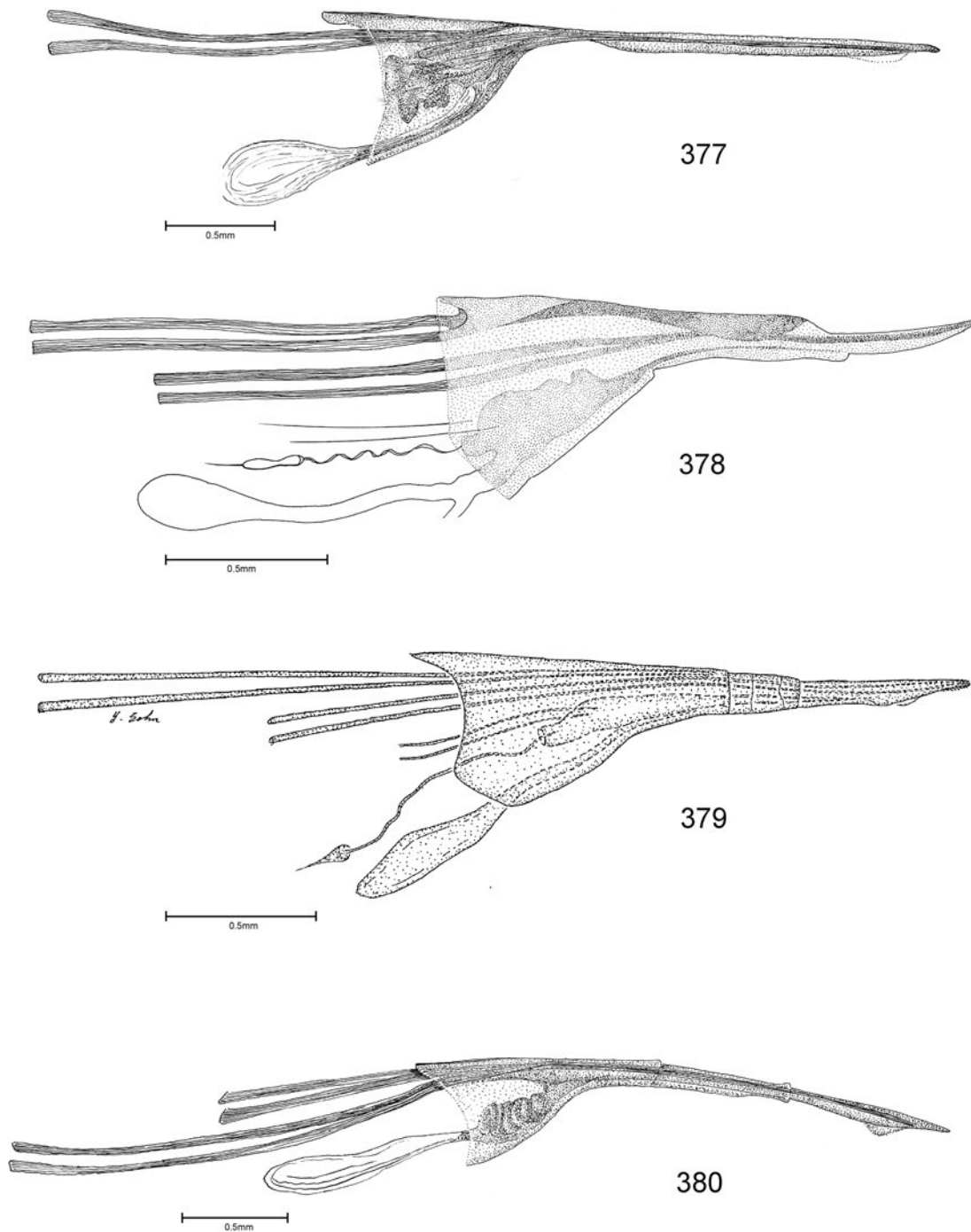
FIGURES 365–368. Lateral view of *Ceromitia* female genitalia (scale lengths=0.5 mm). 365, *C. nielseni*. 366, *C. lobata*. 367, *C. ovata*. 368, *C. unipectinella*.



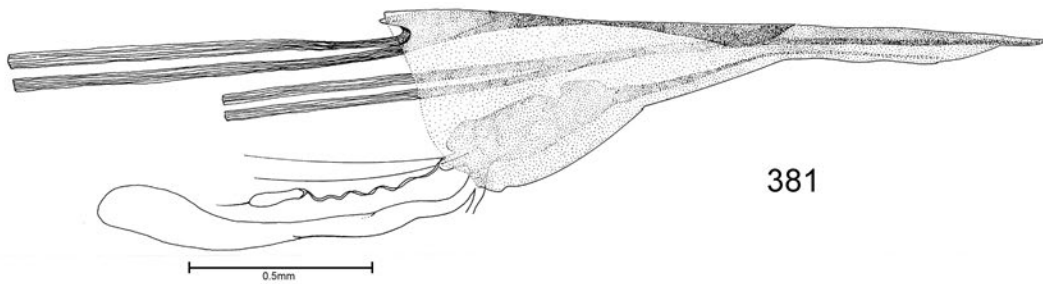
FIGURES 369–372. Lateral view of *Ceromitia*, *Nemophora*, and *Adela* female genitalia (scale lengths = 0.5 mm). 369, *C. eccentrica*. 370, *C. laticlavata*. 371, *N. bellela*. 372, *A. punctiferella*.



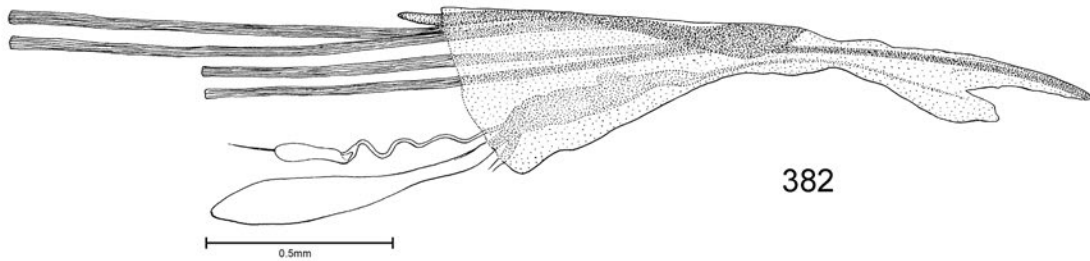
FIGURES 373–376. Lateral view of *Adela* female genitalia (scale lengths=0.5 mm). 373, *A. singulella*. 374, *A. caeruleella*. 375, *A. aethiops*. 376, *A. septentrionella*.



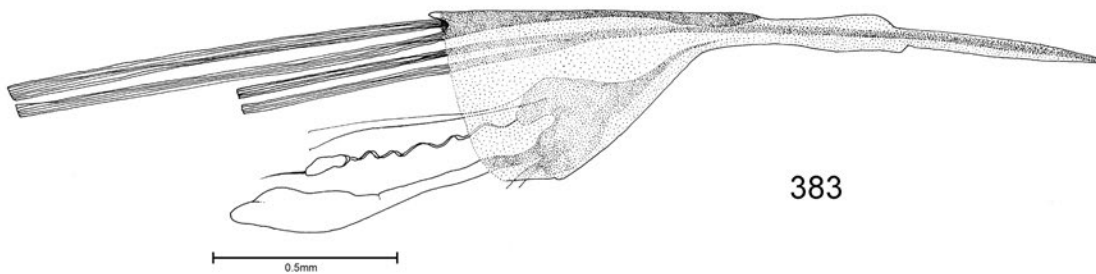
FIGURES 377–380. Lateral view of *Adela* female genitalia (scale lengths = 0.5 mm). 377, *A. purpurea*. 378, *A. trigrapha*. 379, *A. eldorada*. 380, *A. flammeusella*.



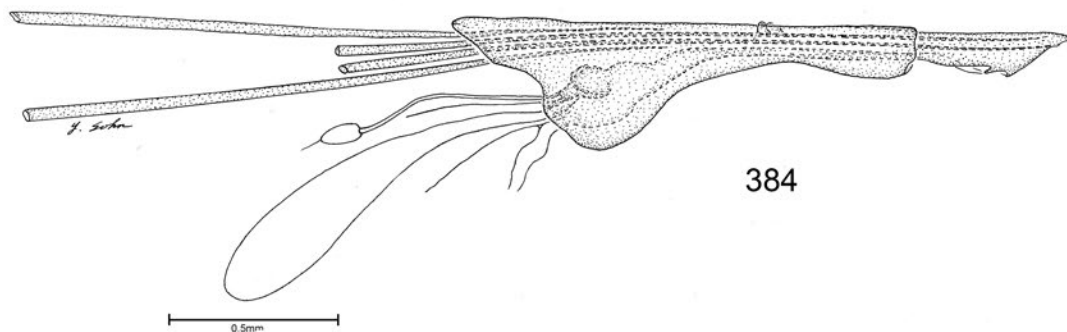
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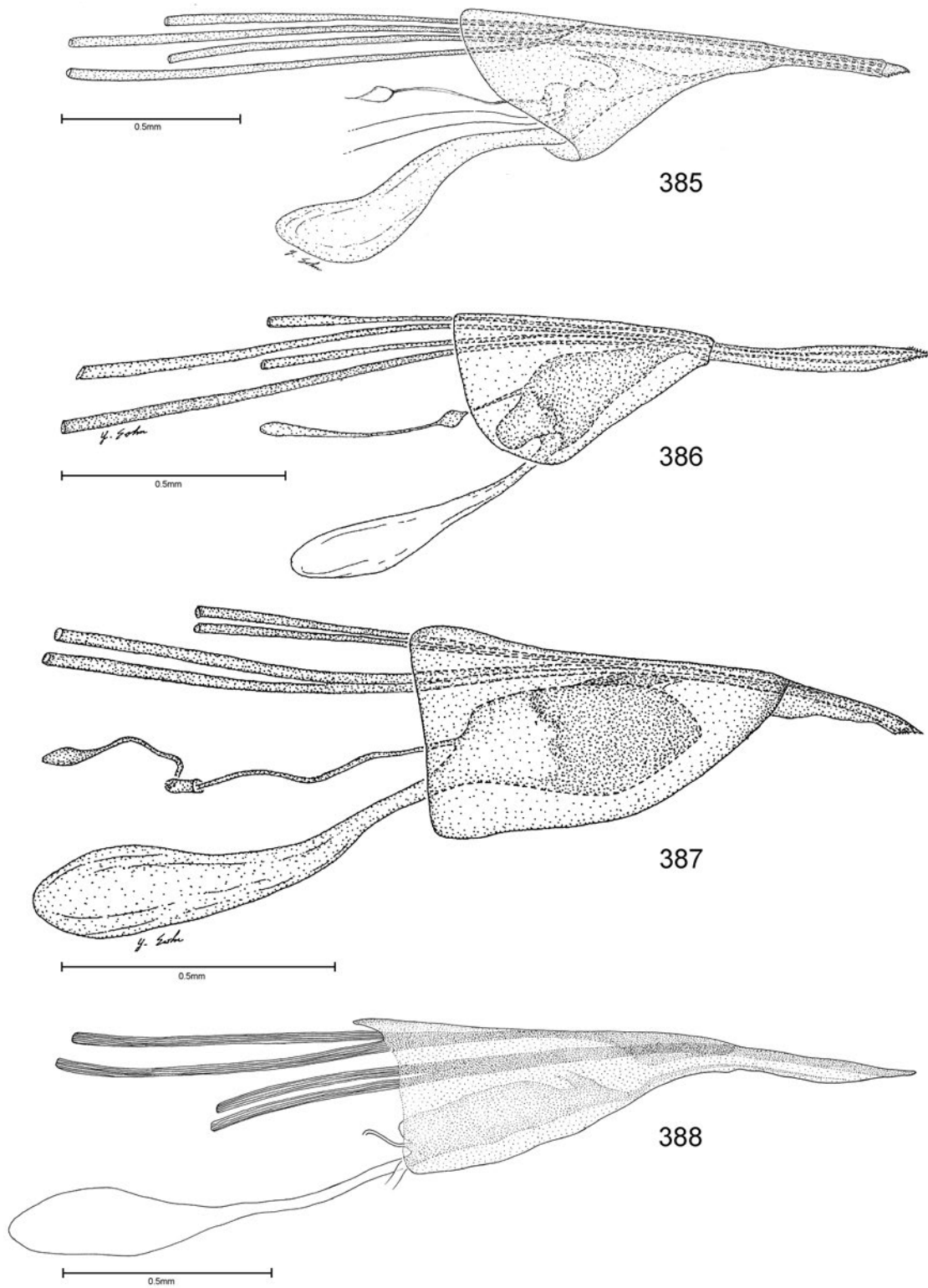


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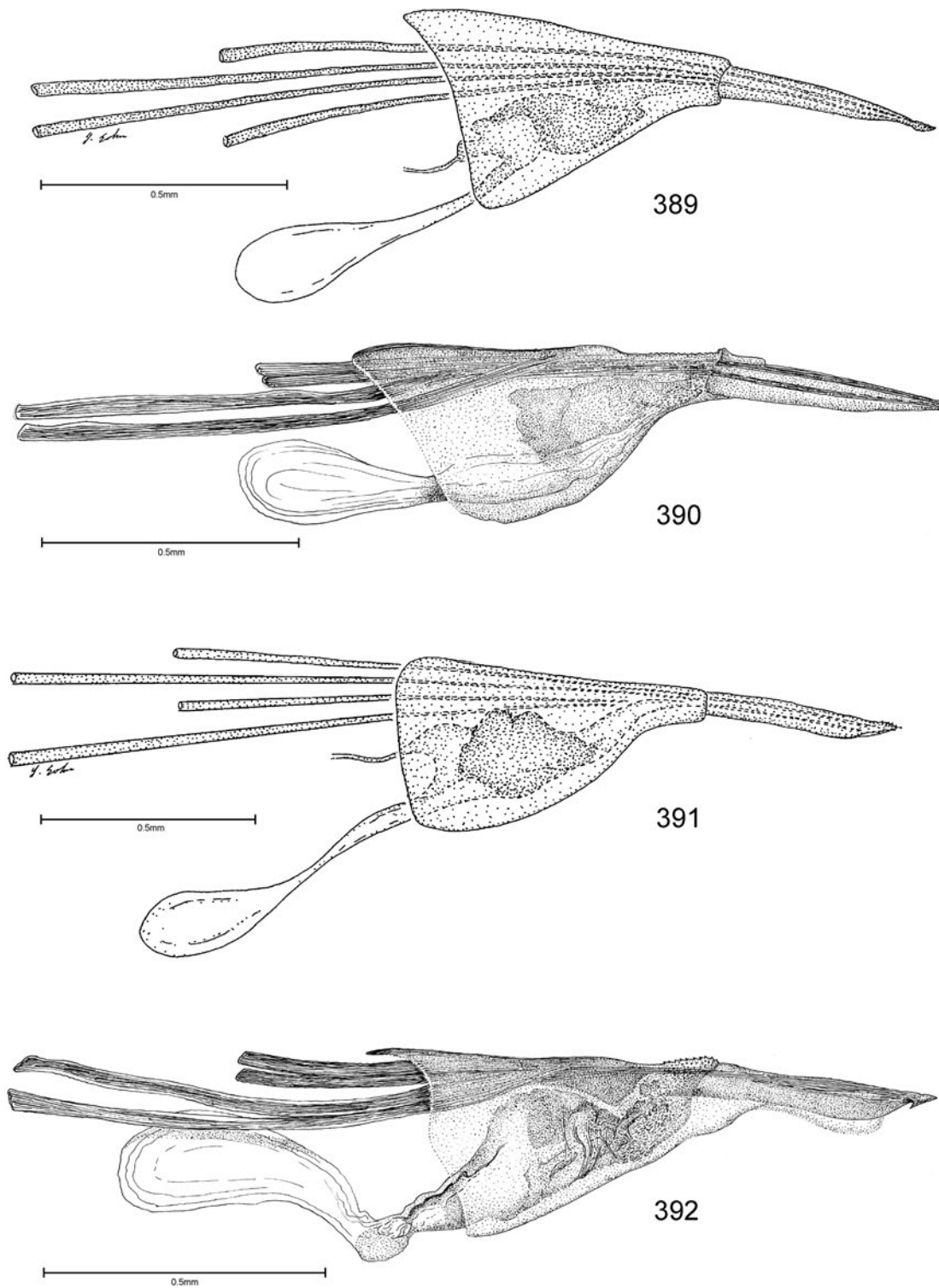


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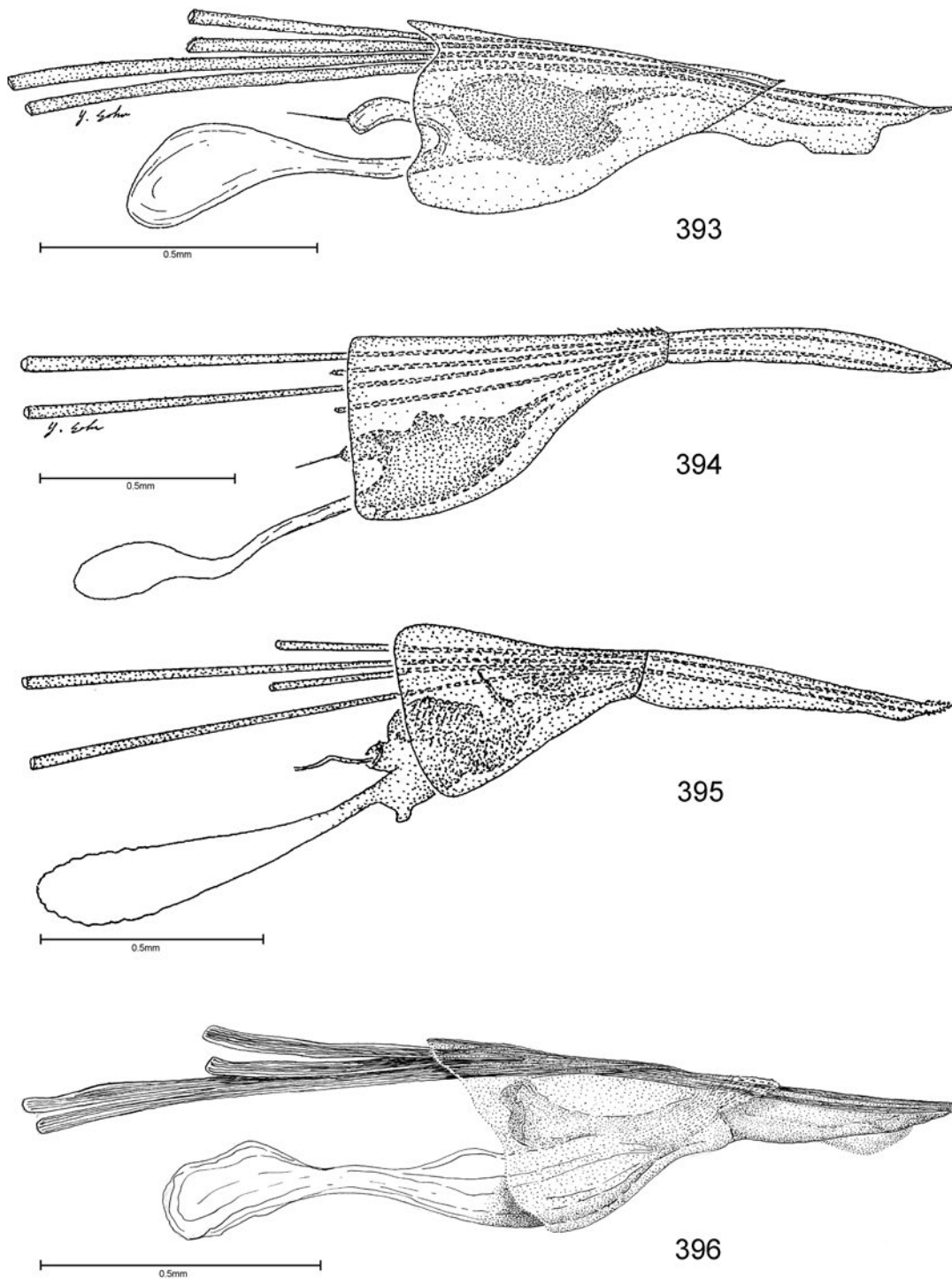
FIGURES 381–384. Lateral view of *Adela* female genitalia (scale lengths=0.5 mm). 381, *A. thorpella*. 382, *A. oplerella*. 383, *A. ridingsella*. 384, *A. astrella*.



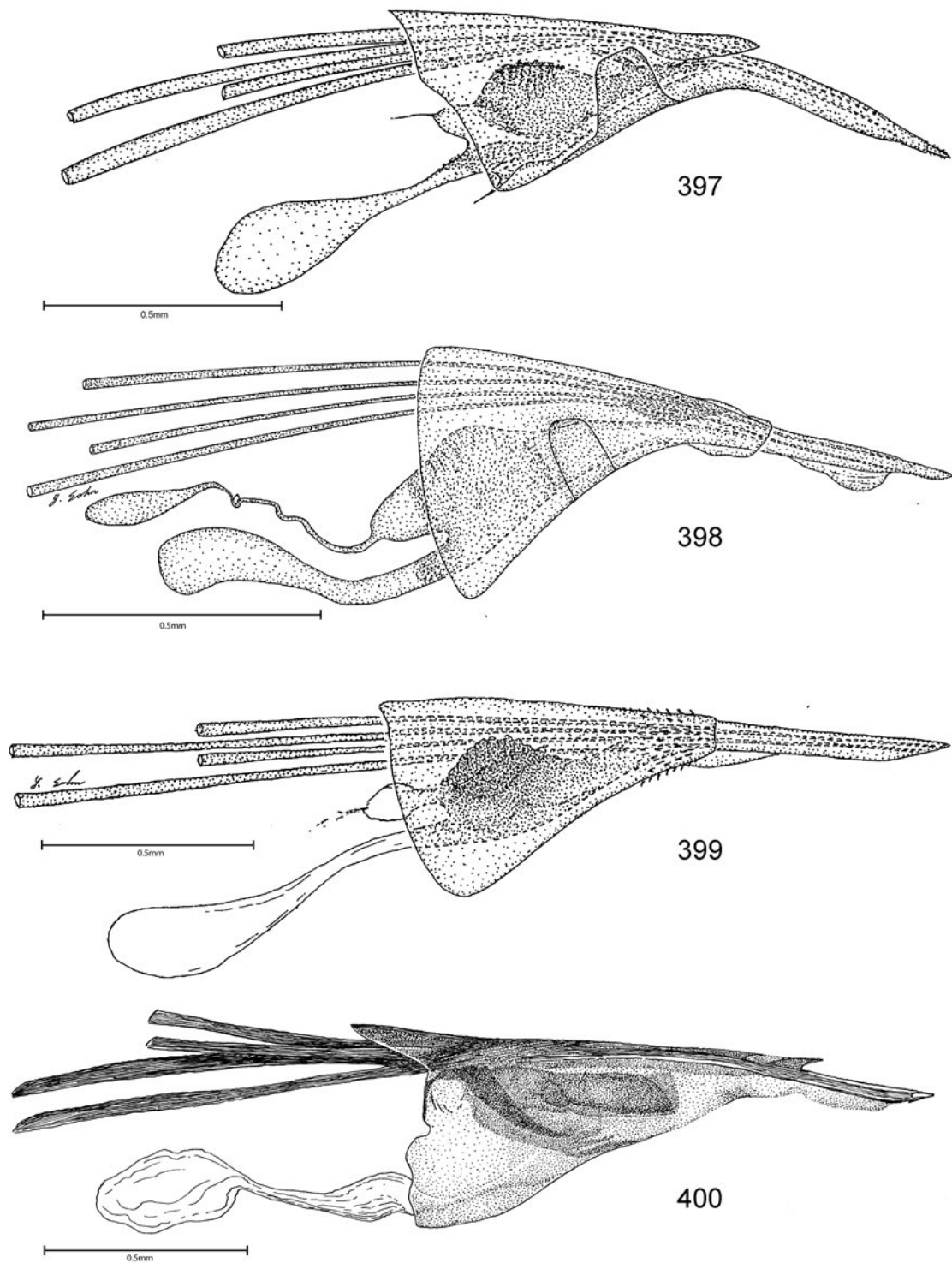
FIGURES 385–388. Lateral view of *Adela* and *Cauchas* female genitalia (scale lengths=0.5 mm). 385, *A. striata*. 386, *C. dietziella*. 387, *C. alaskae*. 388, *C. vittata*.



FIGURES 389–392. Lateral view of *Cauchas* female genitalia (scale lengths = 0.5 mm). 389, *C. spinulosa*. 390, *C. recurvata*. 391, *C. cockerelli*. 392, *C. simplicella*.

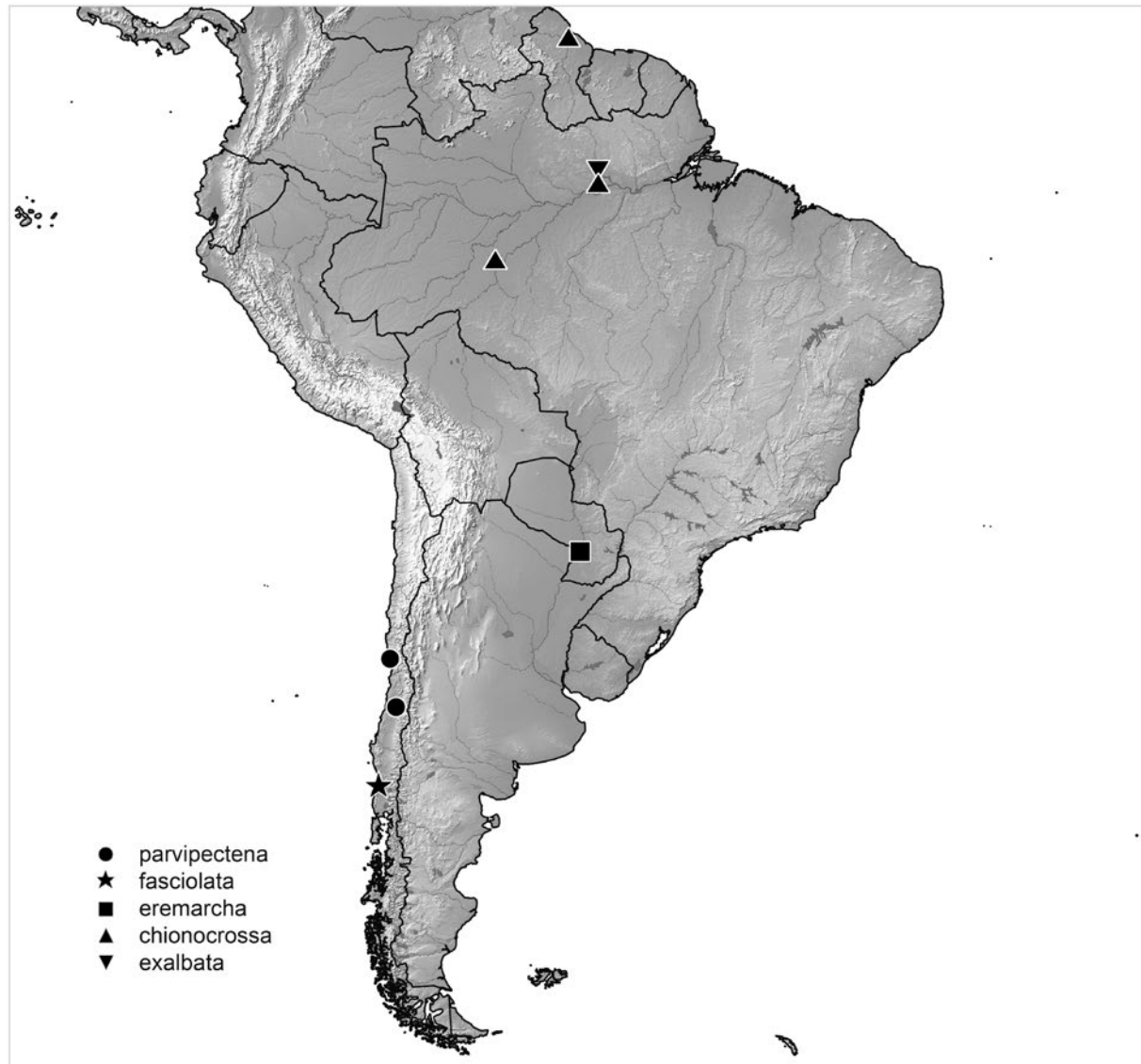


FIGURES 393–396. Lateral view of *Cauchas* female genitalia (scale lengths = 0.5 mm). 393, *C. sedella*. 394, *C. cyanella*. 395, *C. trifascia*. 396, *C. lobata*.

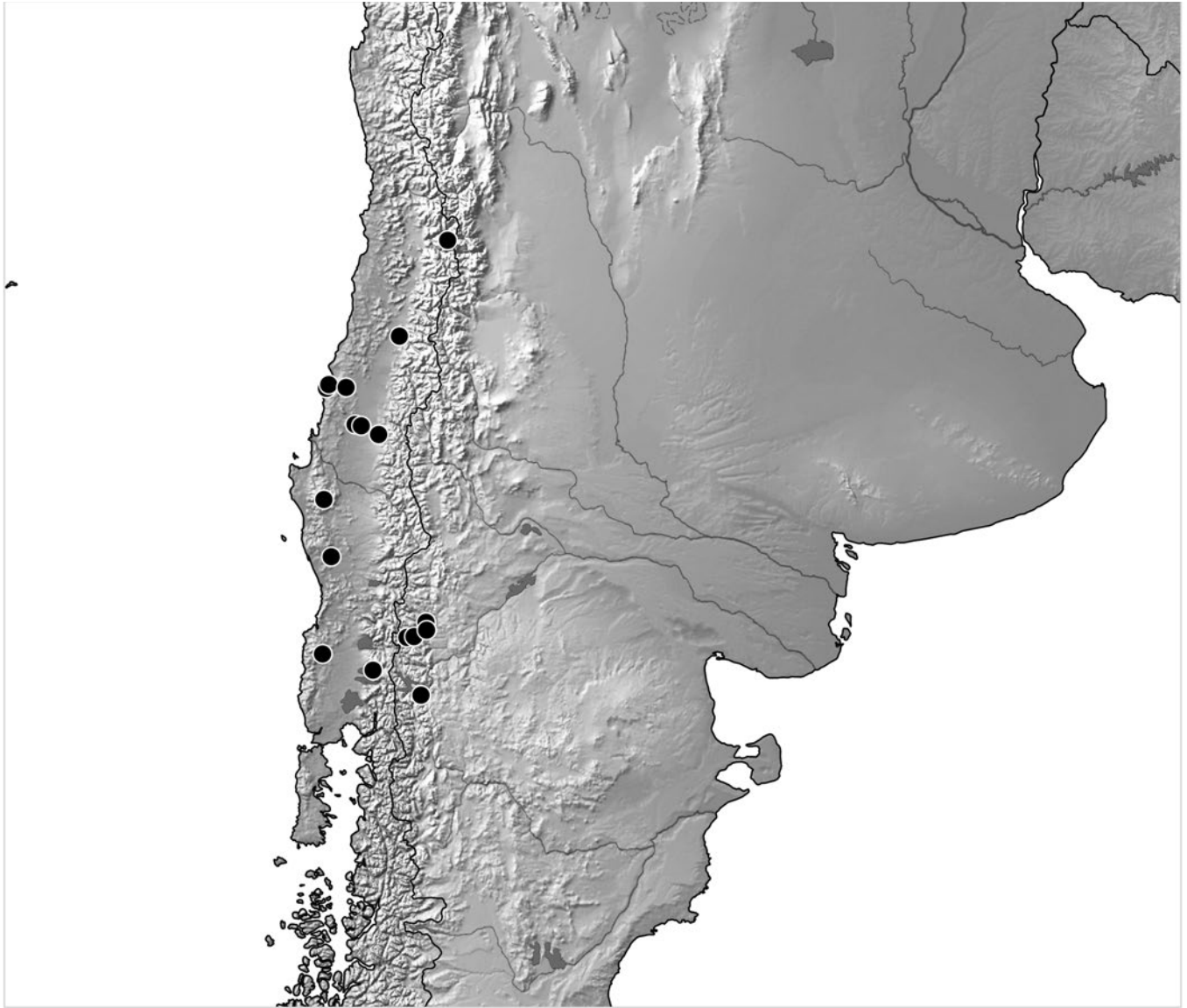


FIGURES 397–400. Lateral view of *Cauchas* female genitalia (scale lengths=0.5 mm). 397, *C. excavata*. 398, *C. wielgusi*. 399, *C. clarkei*. 400, *C. elongata*.

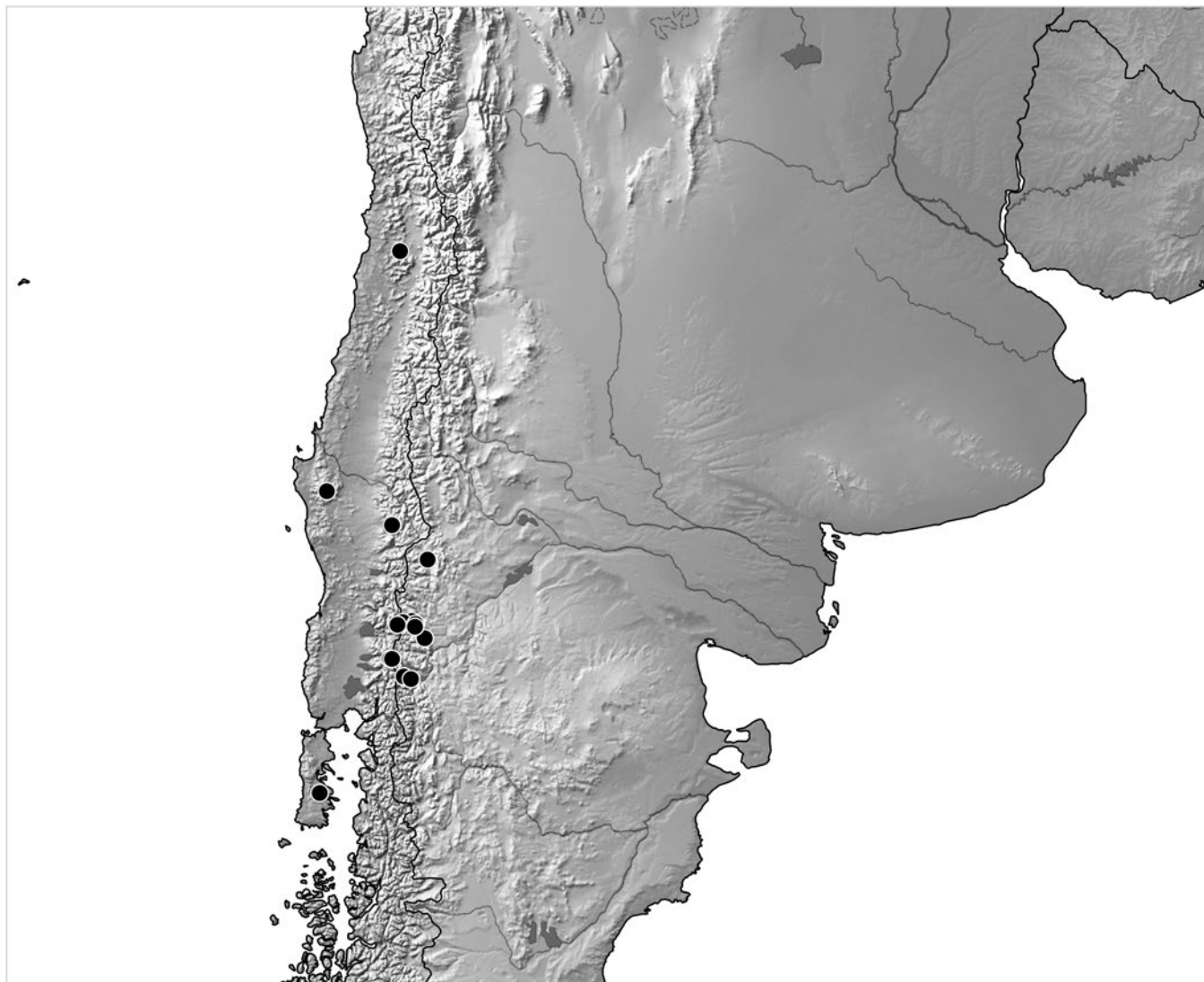
Maps



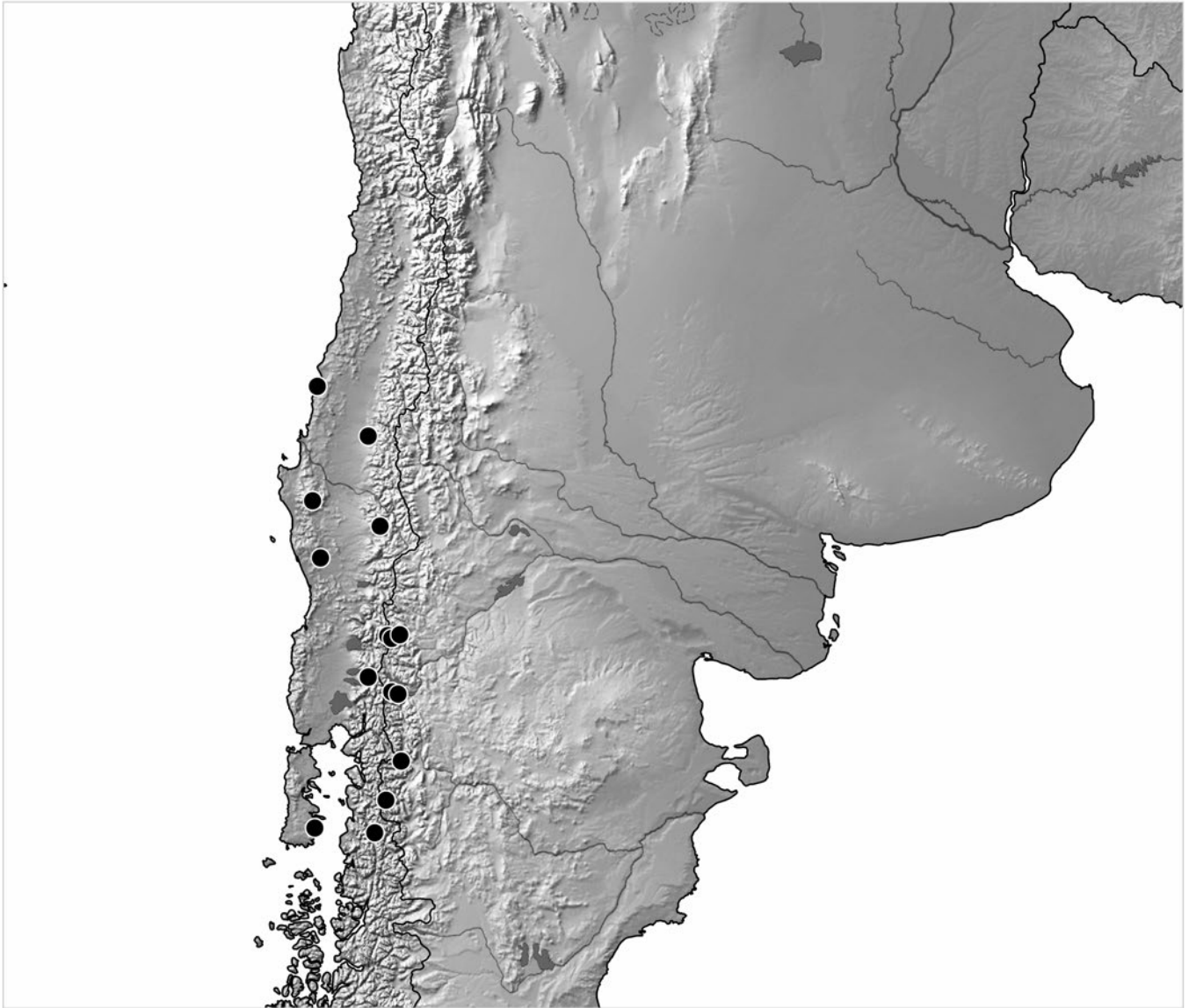
MAP 1. Distribution of New World *Ceromitia*: *C. parvipectena*, new species; *C. fasciolata* (Butler); *C. eremarcha* (Meyrick); *C. chionocrossa* (Meyrick); *C. exalbata* (Meyrick).



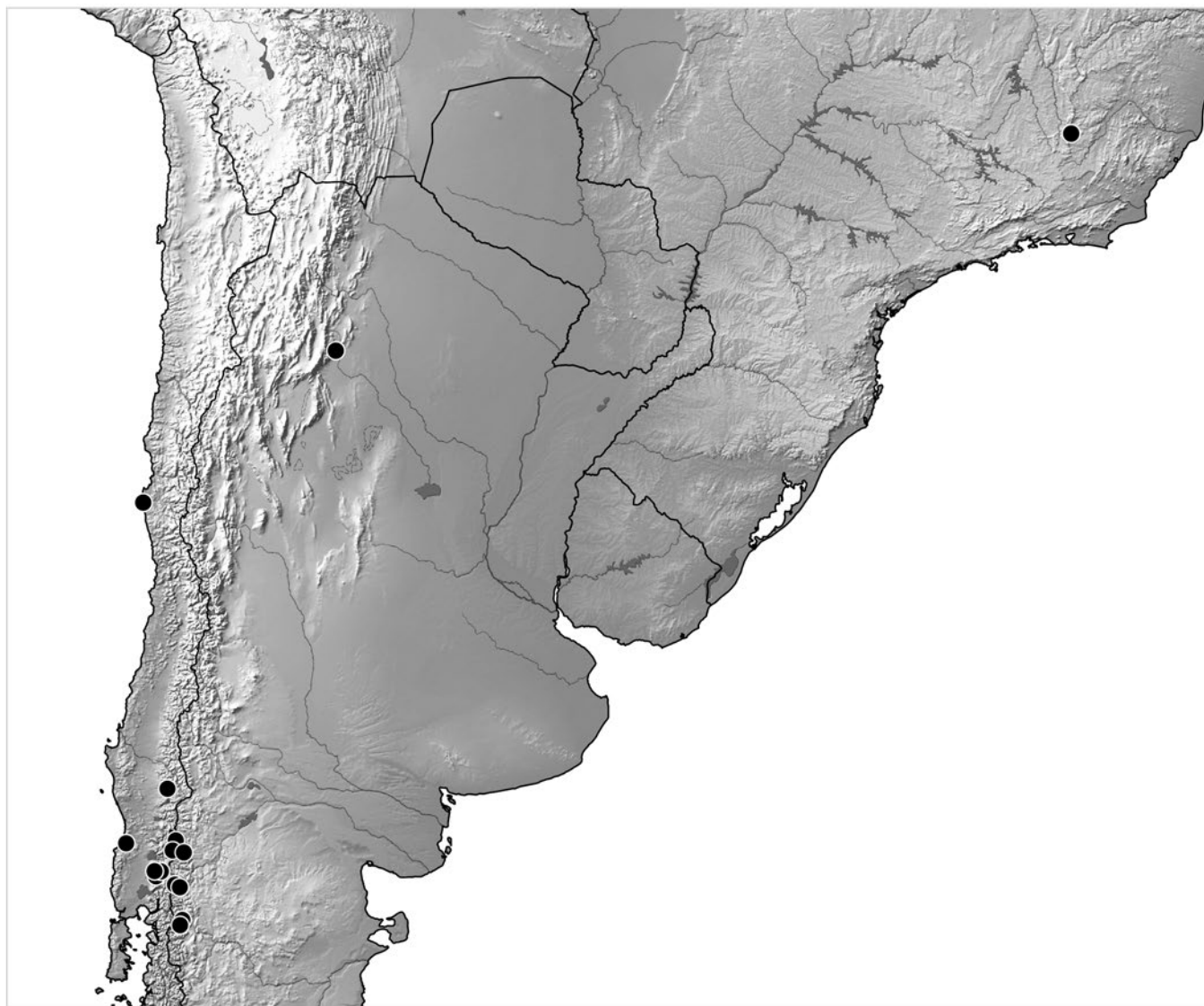
MAP 2. Distribution of New World *Ceromitia capitanea*, new species.



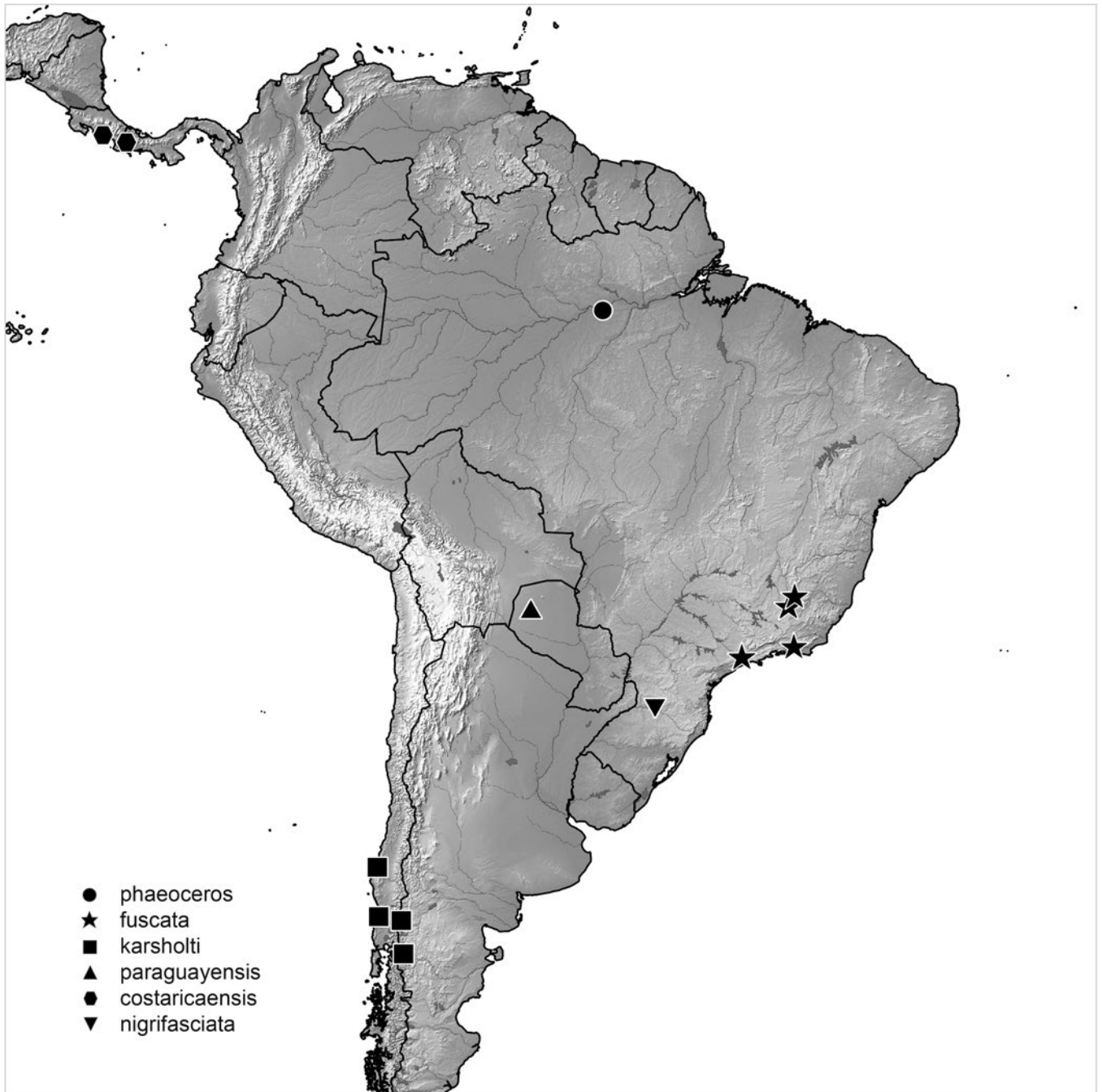
MAP 3. Distribution of New World *Ceromitia lizeri* Pastrana.



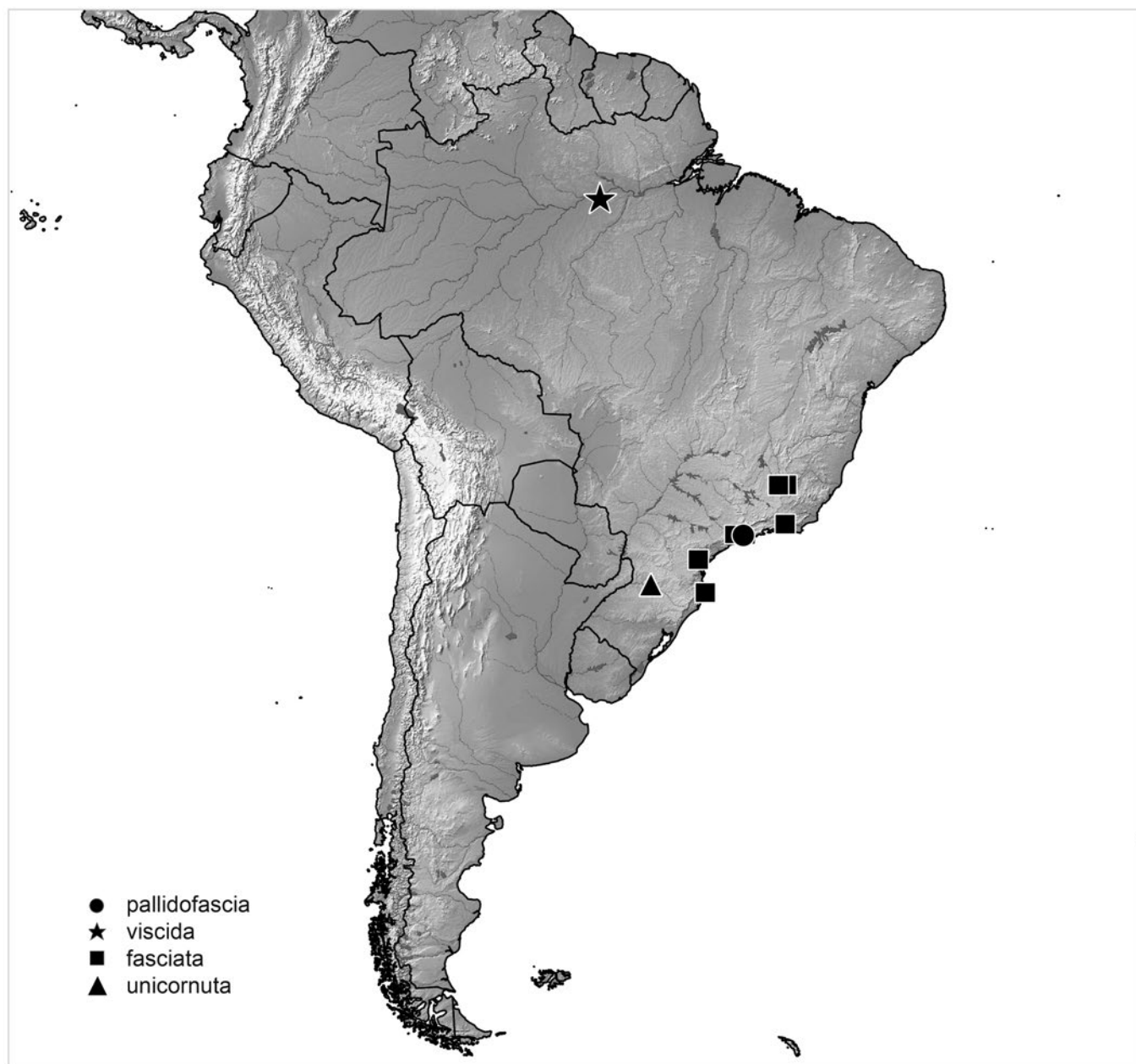
MAP 4. Distribution of New World *Ceromitia pucaraensis* Pastrana.



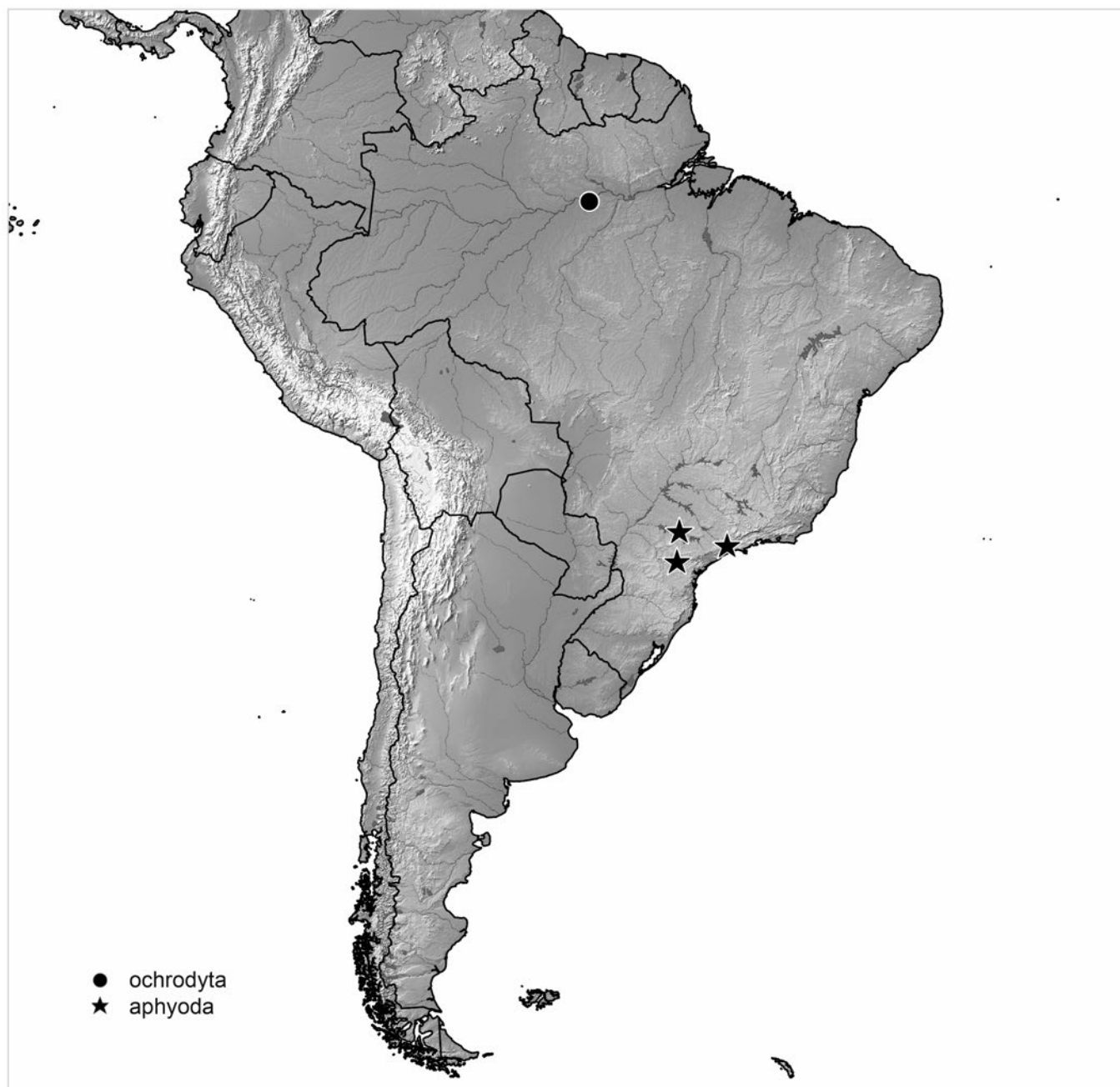
MAP 5. Distribution of New World *Ceromitia flagellata*, new species.



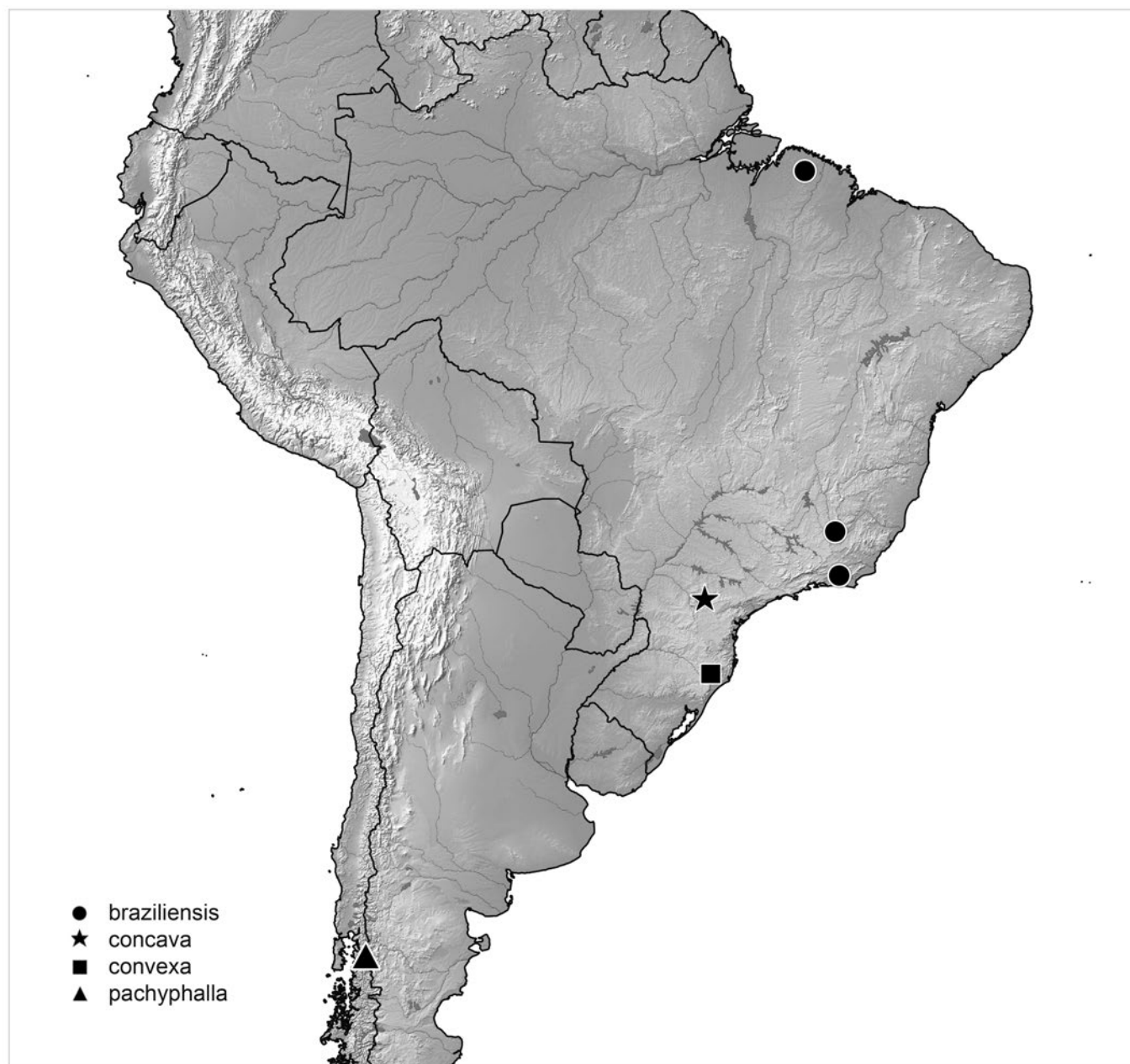
MAP 6. Distribution of New World *Ceromitia*: *C. phaeoceros* Meyrick; *C. fuscata*, new species; *C. karsholti*, new species; *C. paraguayensis*, new species; *C. costaricensis*, new species; *C. nigrifasciata*, new species.



MAP 7. Distribution of New World *Ceromitia*: *C. pallidofascia*, new species; *C. viscida* Meyrick; *C. fasciata*, new species; *C. unicornuta*, new species.



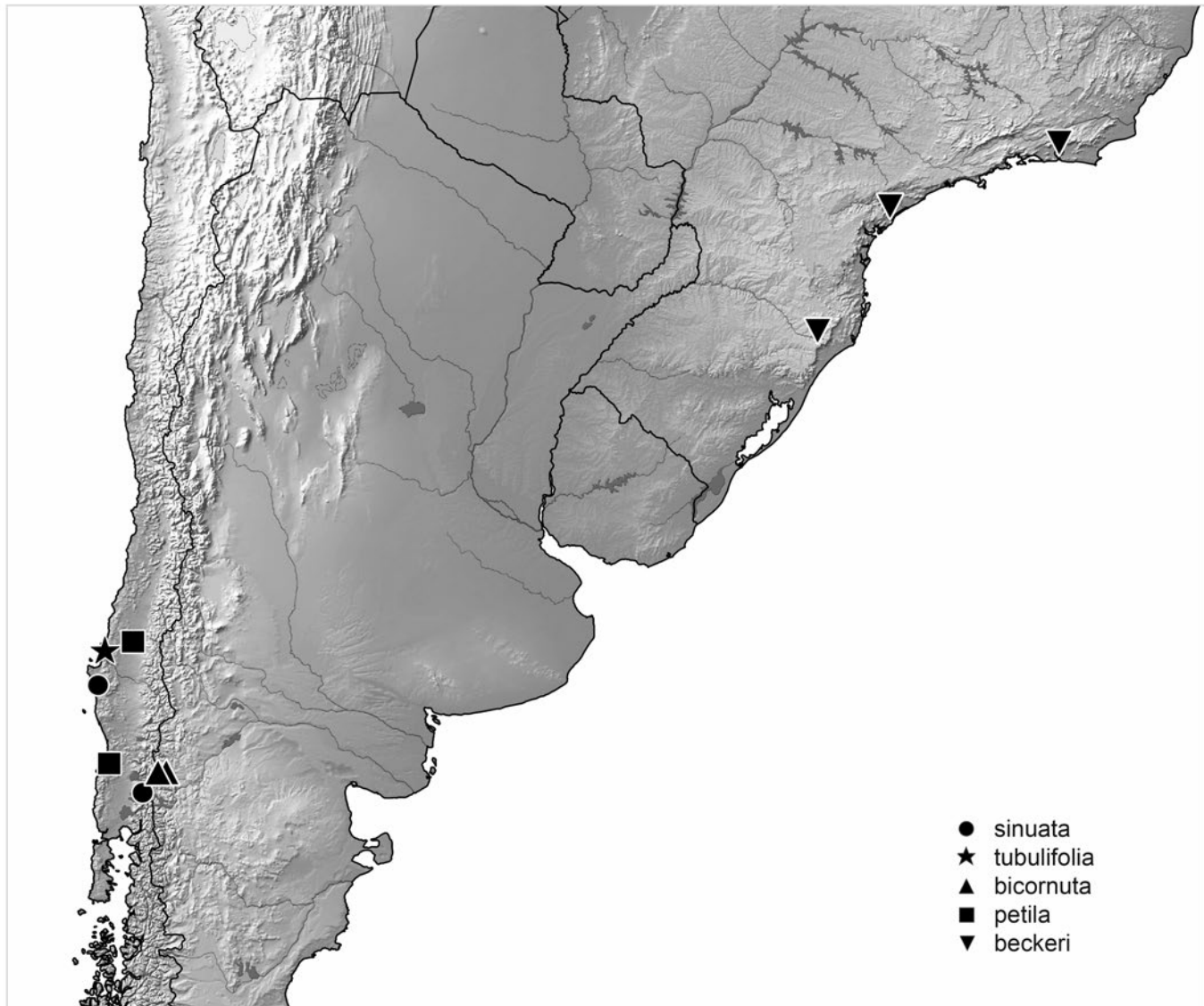
MAP 8. Distribution of New World *Ceromitia*: *C. ochrodyta* Meyrick; *C. aphyoda*, new species.



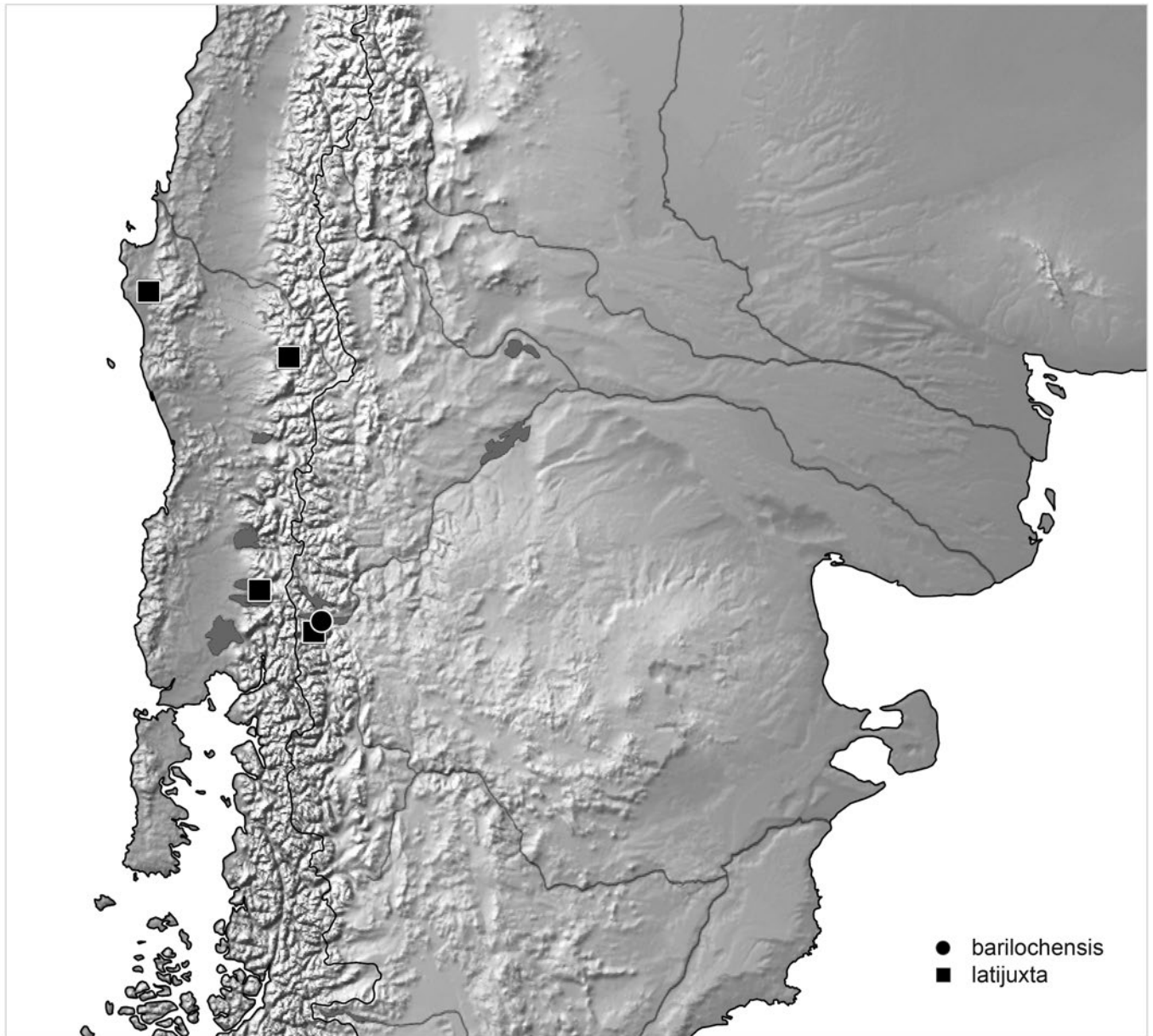
MAP 9. Distribution of New World *Ceromitia*: *C. braziliensis*, new species; *C. concava*, new species; *C. convexa*, new species; *C. pachyphalla*, new species.



MAP 10. Distribution of New World *Ceromitia*: *C. inaequalis*, new species; *C. furcata*, new species.



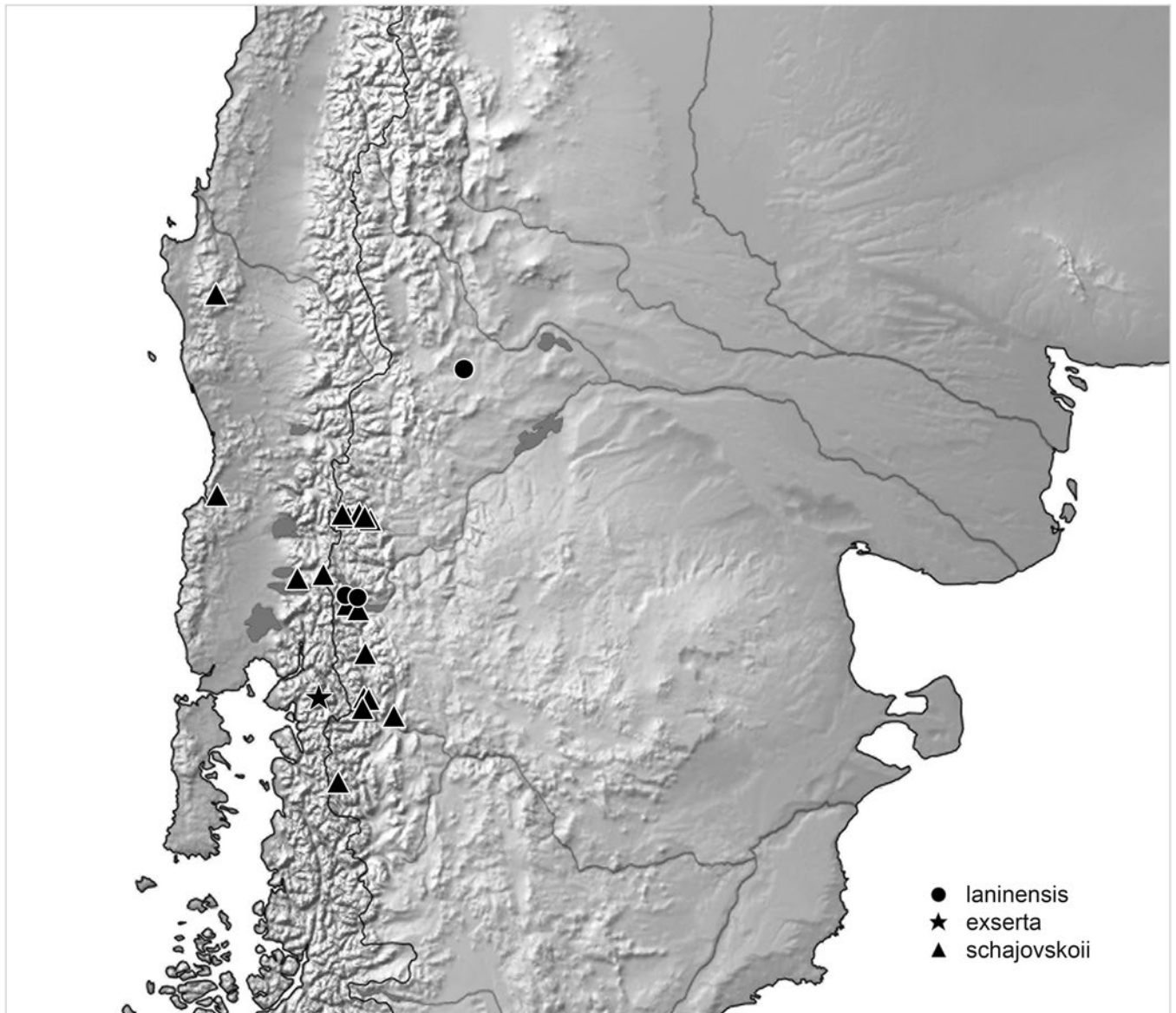
MAP 11. Distribution of New World *Ceromitia*: *C. sinuata*, new species; *C. tubulifolia* Parra & Ogden; *C. bicornuta*, new species; *C. petila*, new species; *C. beckeri*, new species.



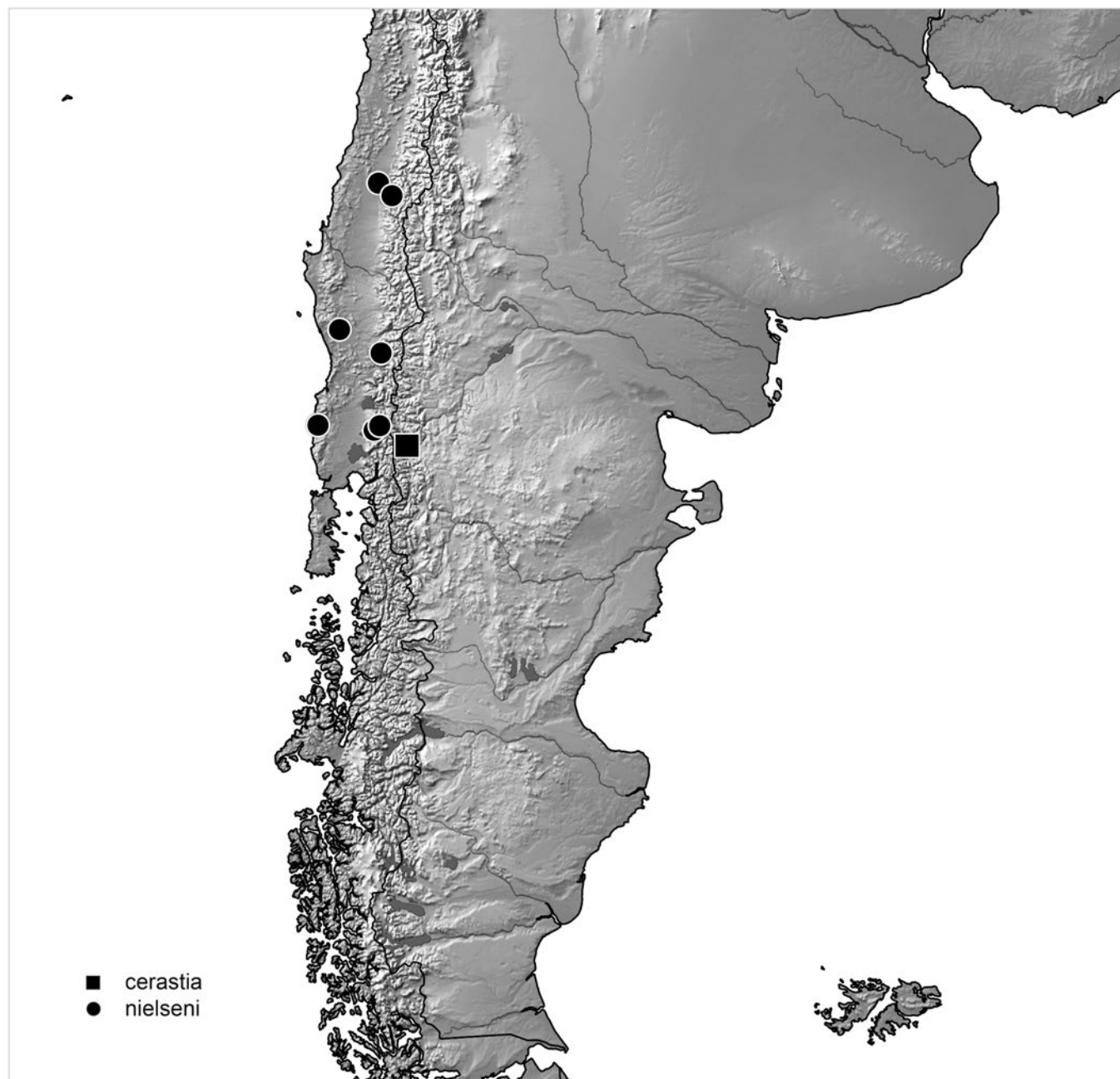
MAP 12. Distribution of New World *Ceromitia*: *C. barilochensis*, new species; *C. latijuxta*, new species.



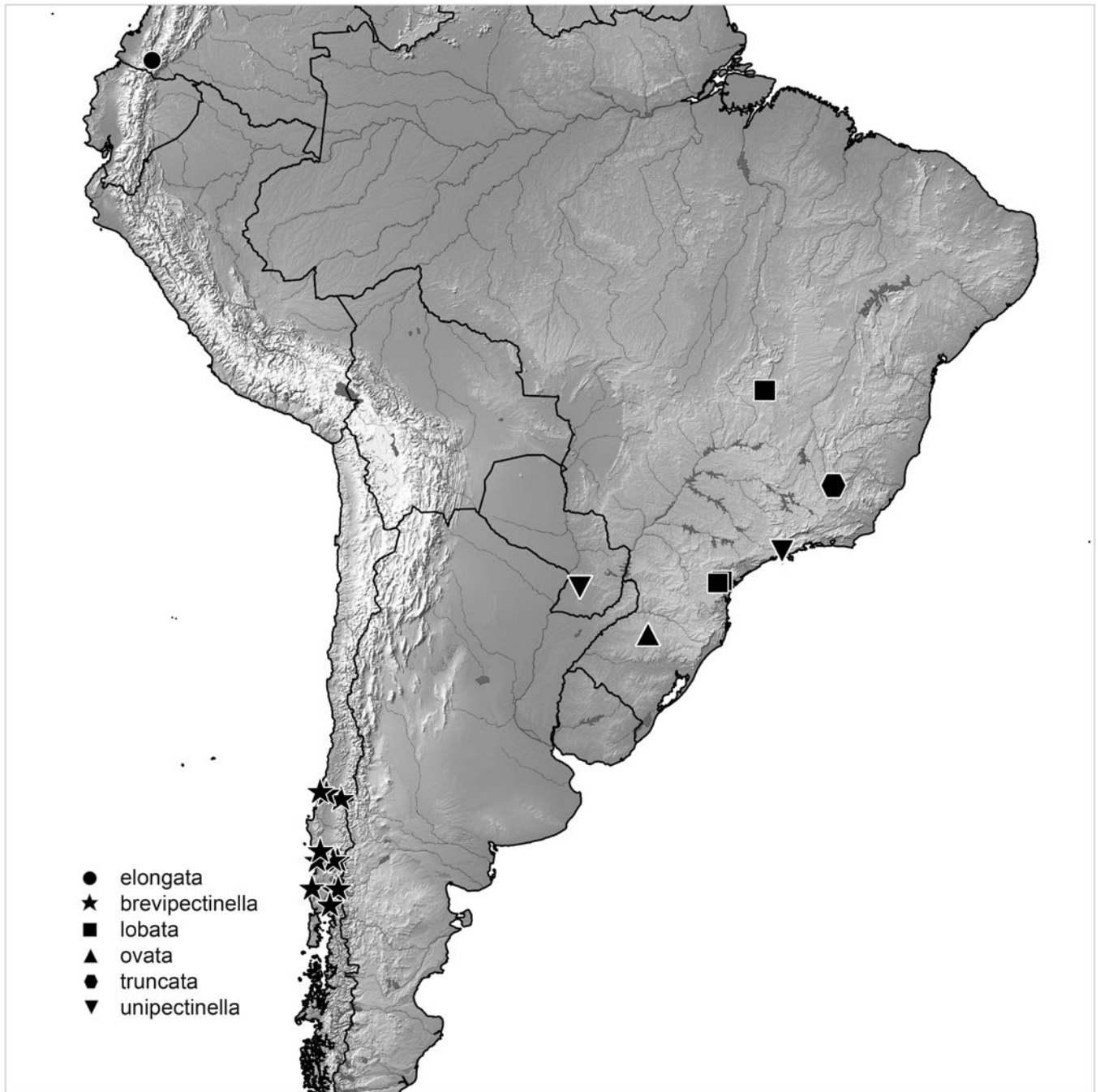
MAP 13. Distribution of New World *Ceromitia*: *C. latapicula*, new species; *C. latibasis*, new species; *C. sciographa* Meyrick.



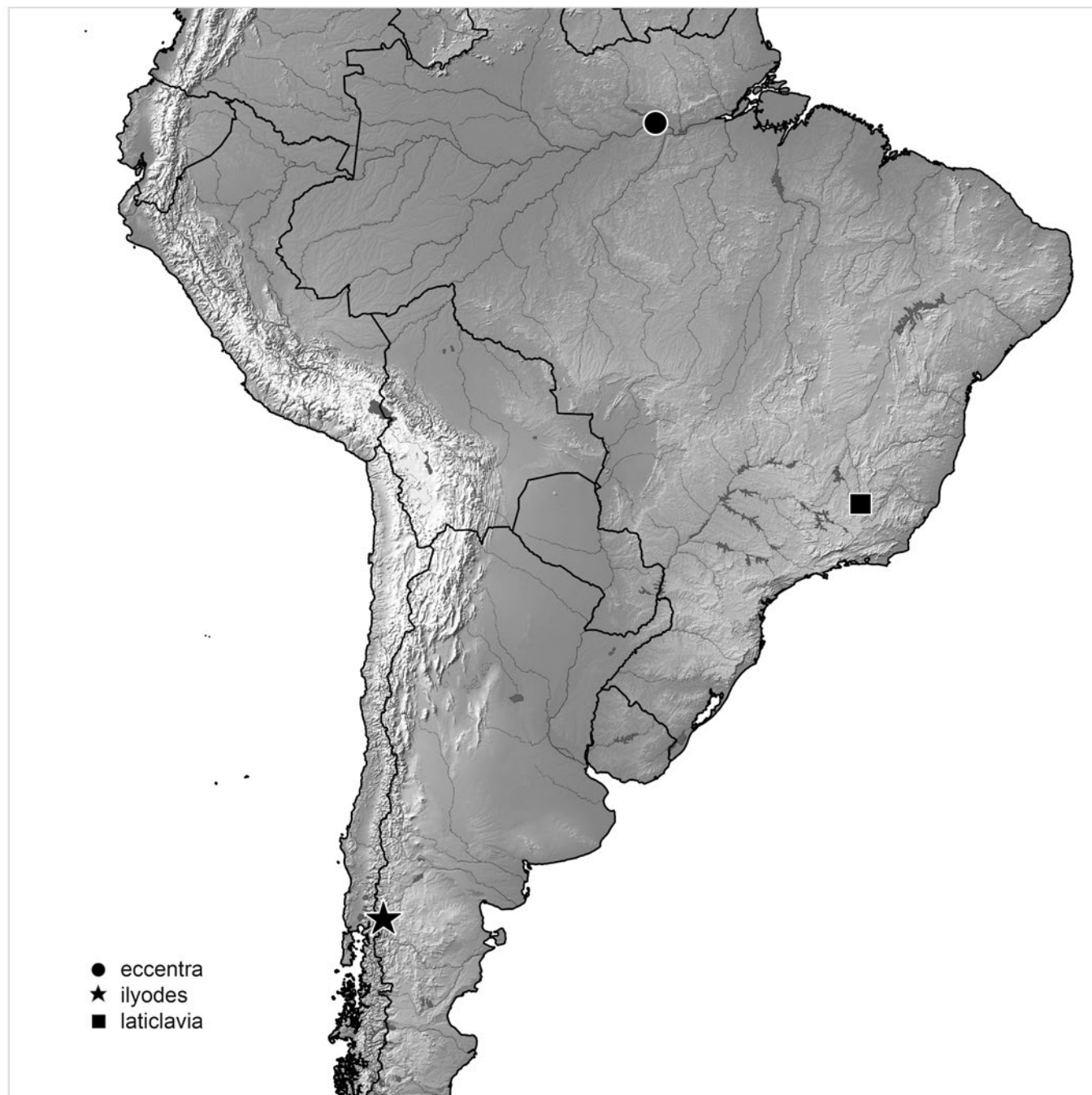
MAP 14. Distribution of New World *Ceromitia*: *C. laninensis* Pastrana; *C. exserta*, new species; *C. schajovskoi* Pastrana.



MAP 15. Distribution of New World *Ceromitia*: *C. cerastia*, new species; *C. nielsenii*, new species.



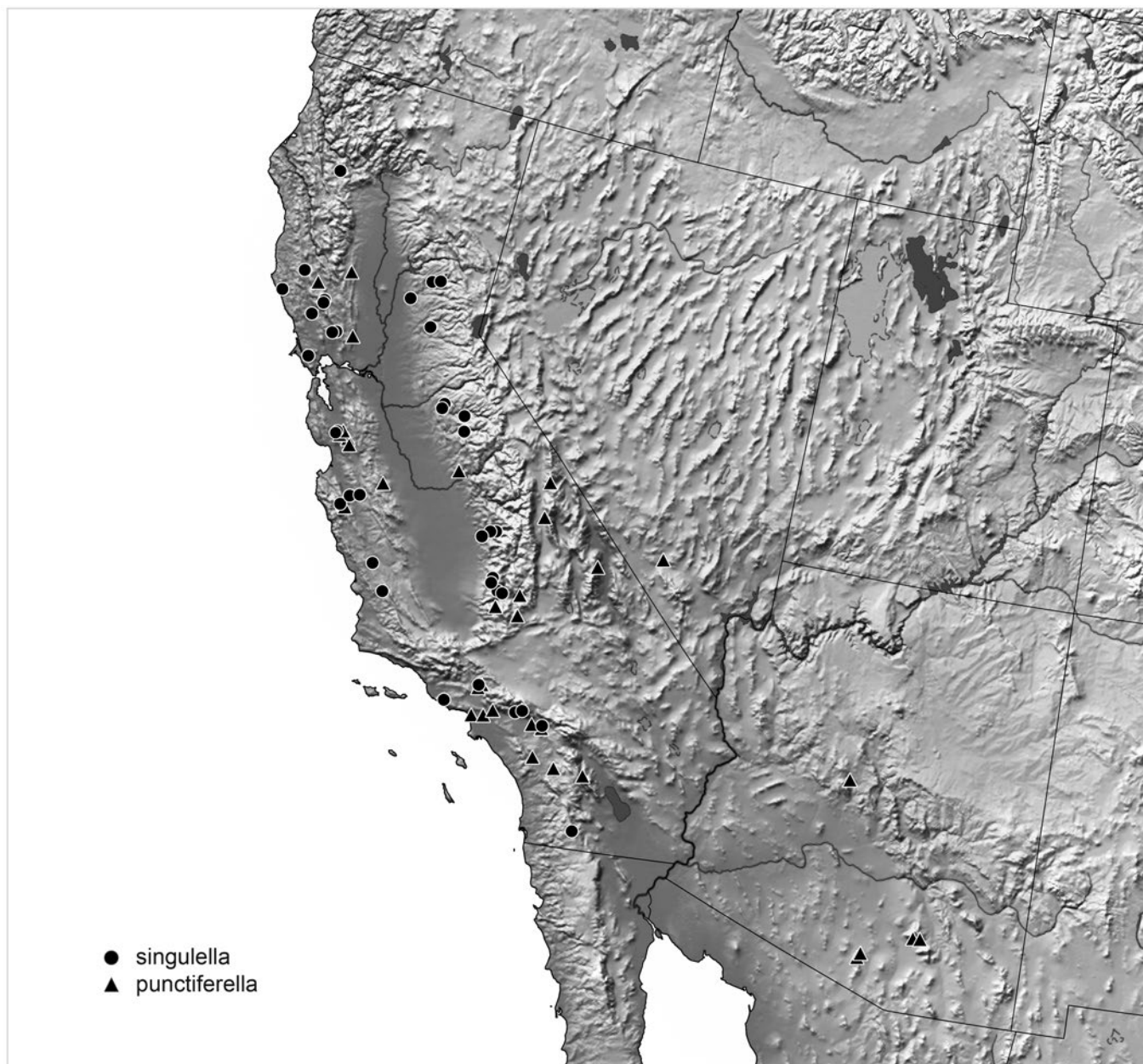
MAP 16. Distribution of New World *Ceromitia*: *C. elongata*, new species; *C. brevipectinella*, new species; *C. lobata*, new species; *C. ovata*, new species; *C. truncata*, new species; *C. unipectinella*, new species.



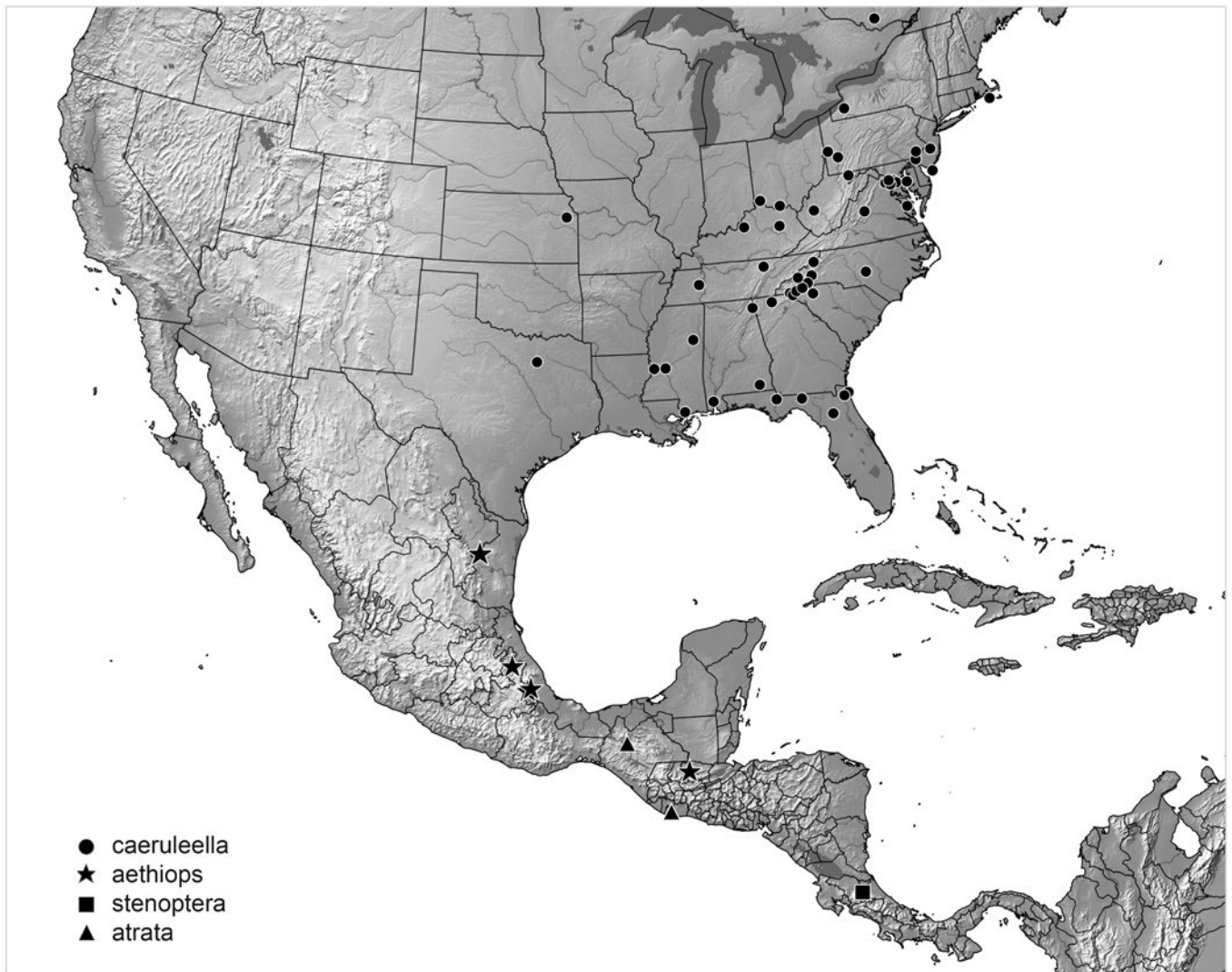
MAP 17. Distribution of New World *Ceromitia*: *C. eccentra*, new species; *C. ilyodes* (Meyrick); *C. laticlavia*, new species.



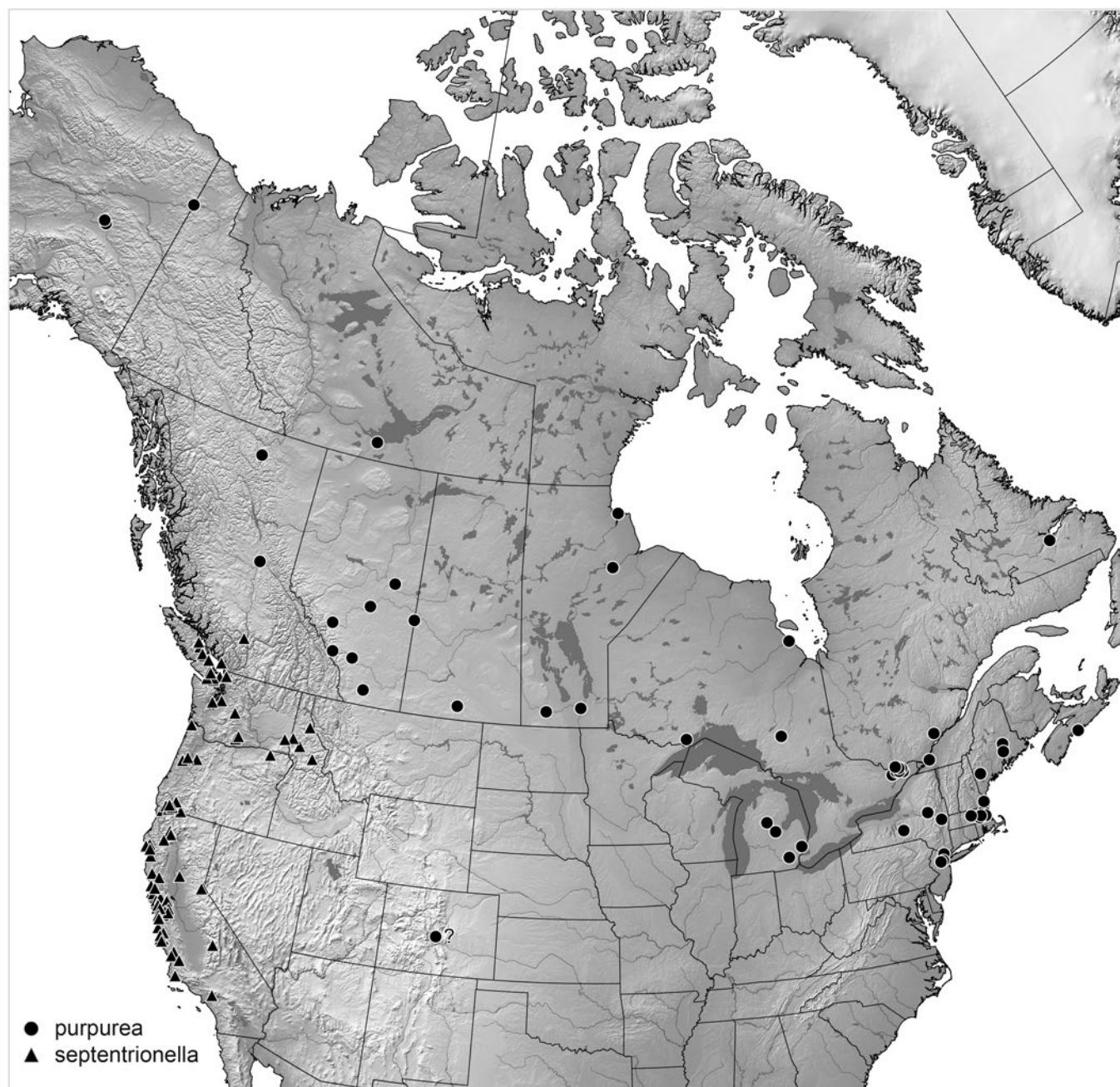
MAP 18. Distribution of New World *Nemophora bellela* Hoffmannsegg.



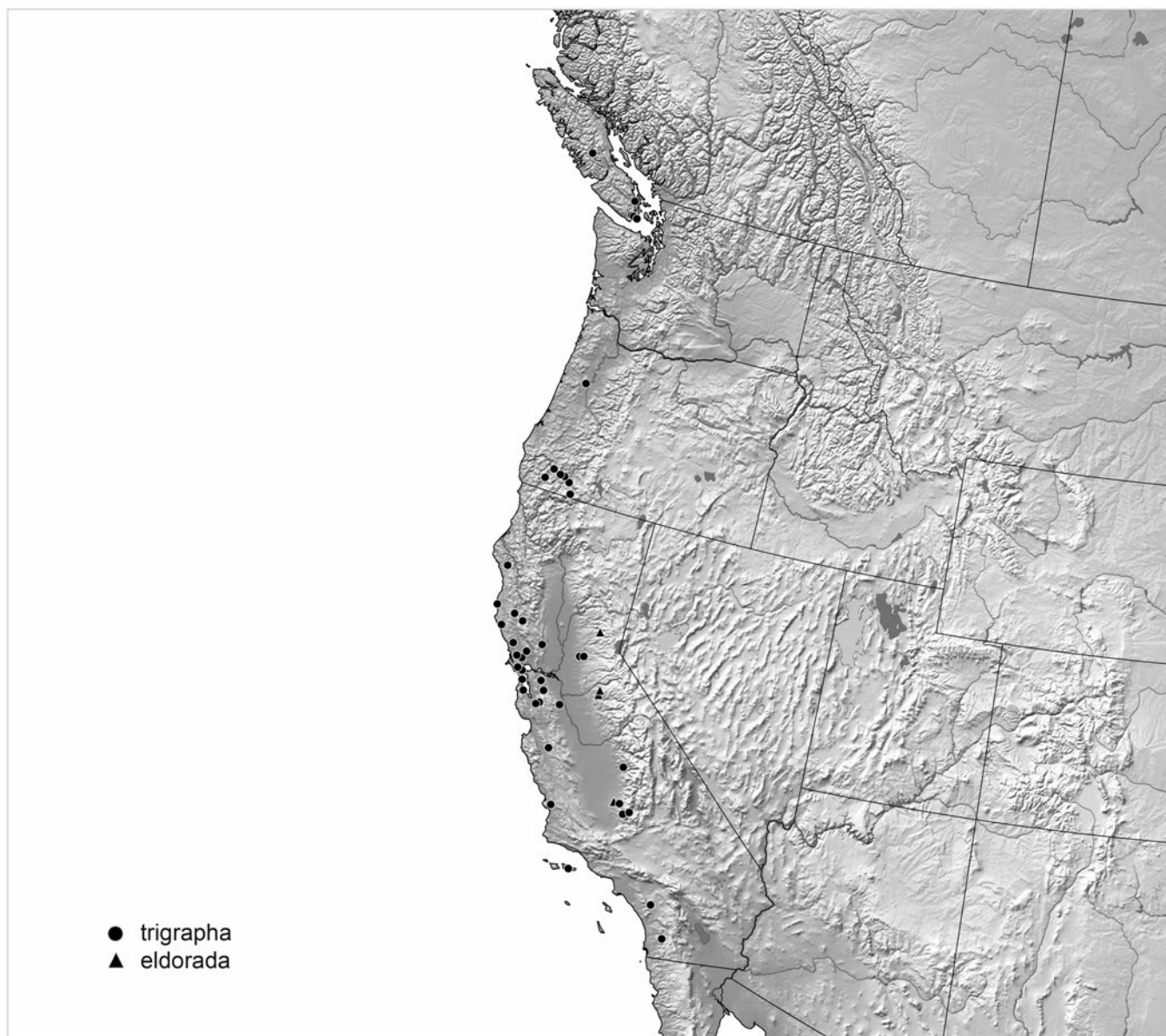
MAP 19. Distribution of New World *Adela*: *A. singulella* Walsingham; *A. punctiferella* Walsingham.



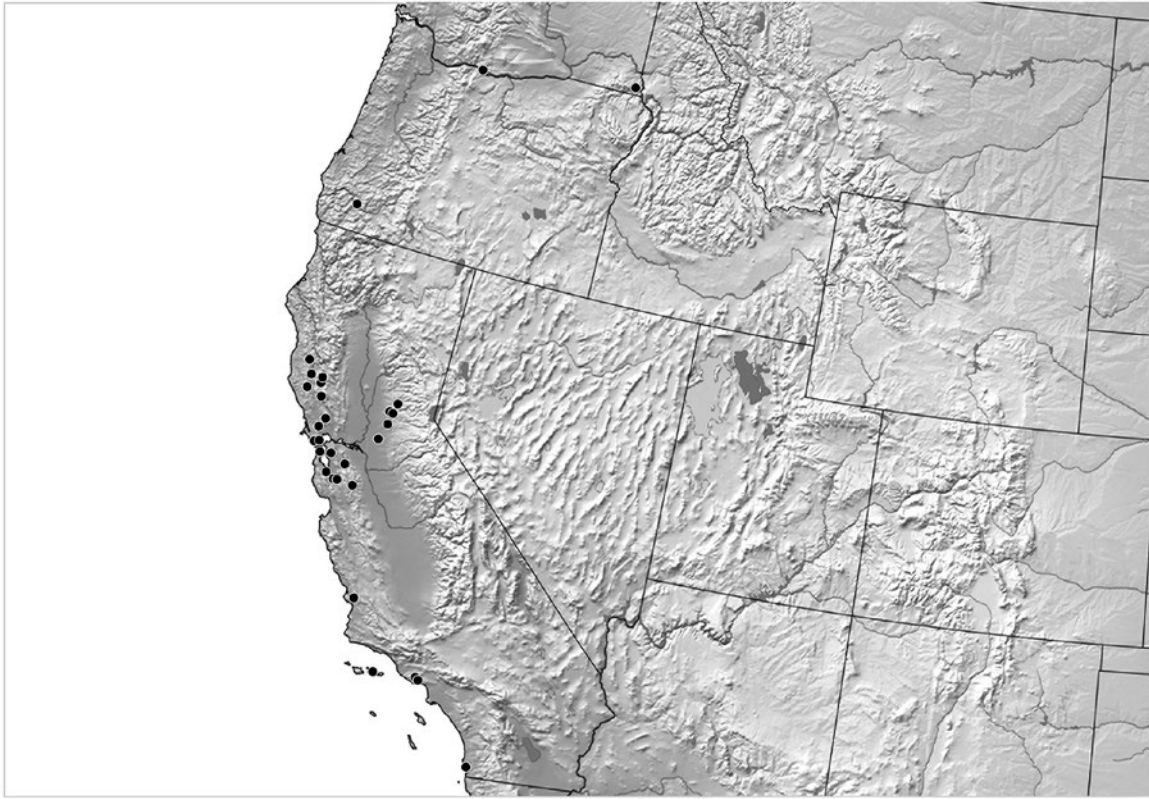
MAP 20. Distribution of New World *Adela*: *A. caeruleella* Walker; *A. aethiops* Rogenhofer; *A. stenoptera*, new species; *A. atrata*, new species.



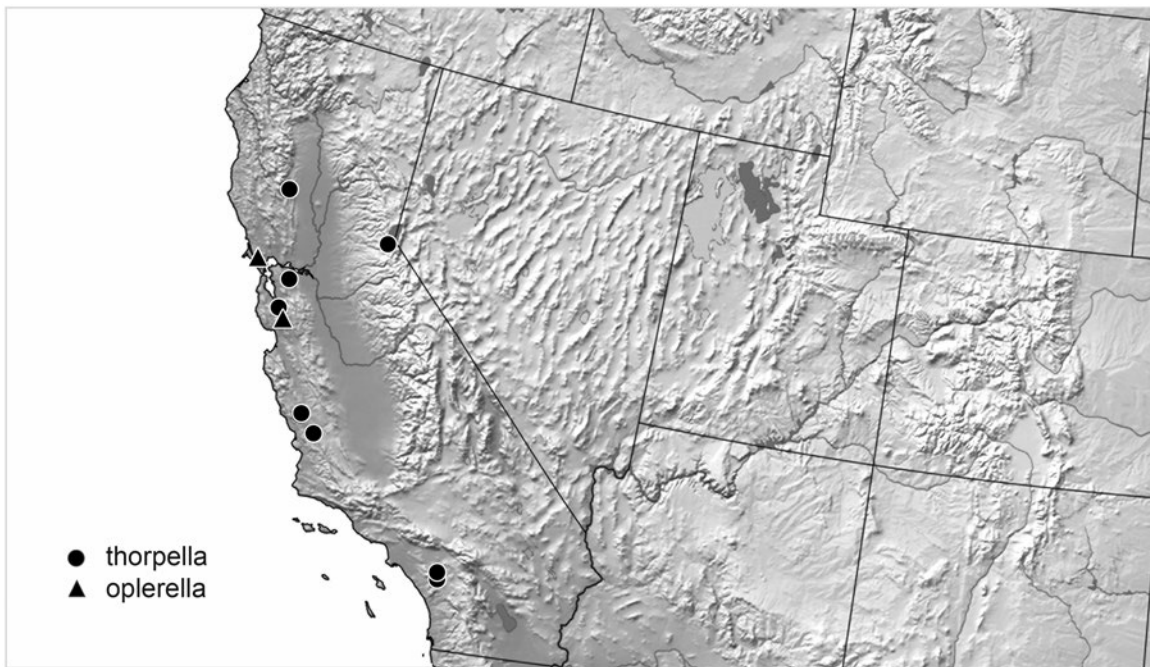
MAP 21. Distribution of New World *Adela*: *A. purpurea* Walker; *A. septentrionella* Walsingham.



MAP 22. Distribution of New World *Adela*: *A. trigrapha* Zeller; *A. eldorada* Powell.



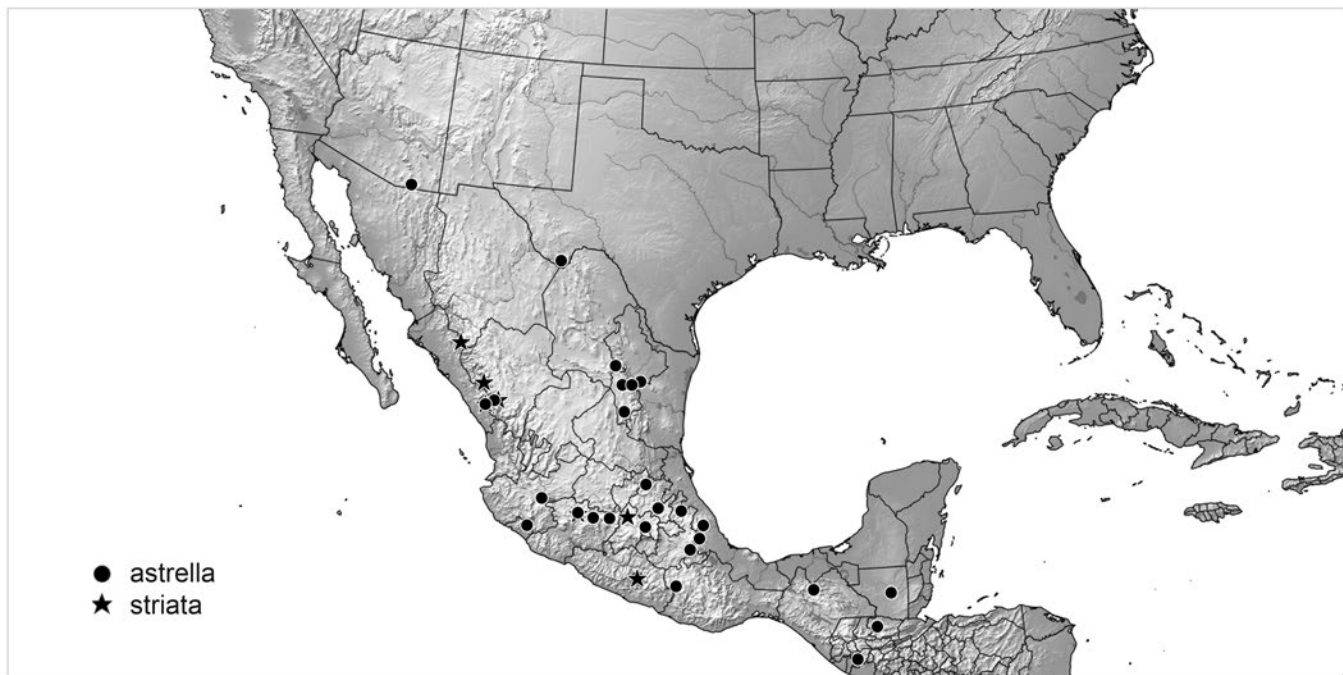
MAP 23. Distribution of New World *Adela flammeusella* Chambers.



MAP 24. Distribution of New World *Adela*: *A. thorpella* Powell; *A. oplerella* Powell.



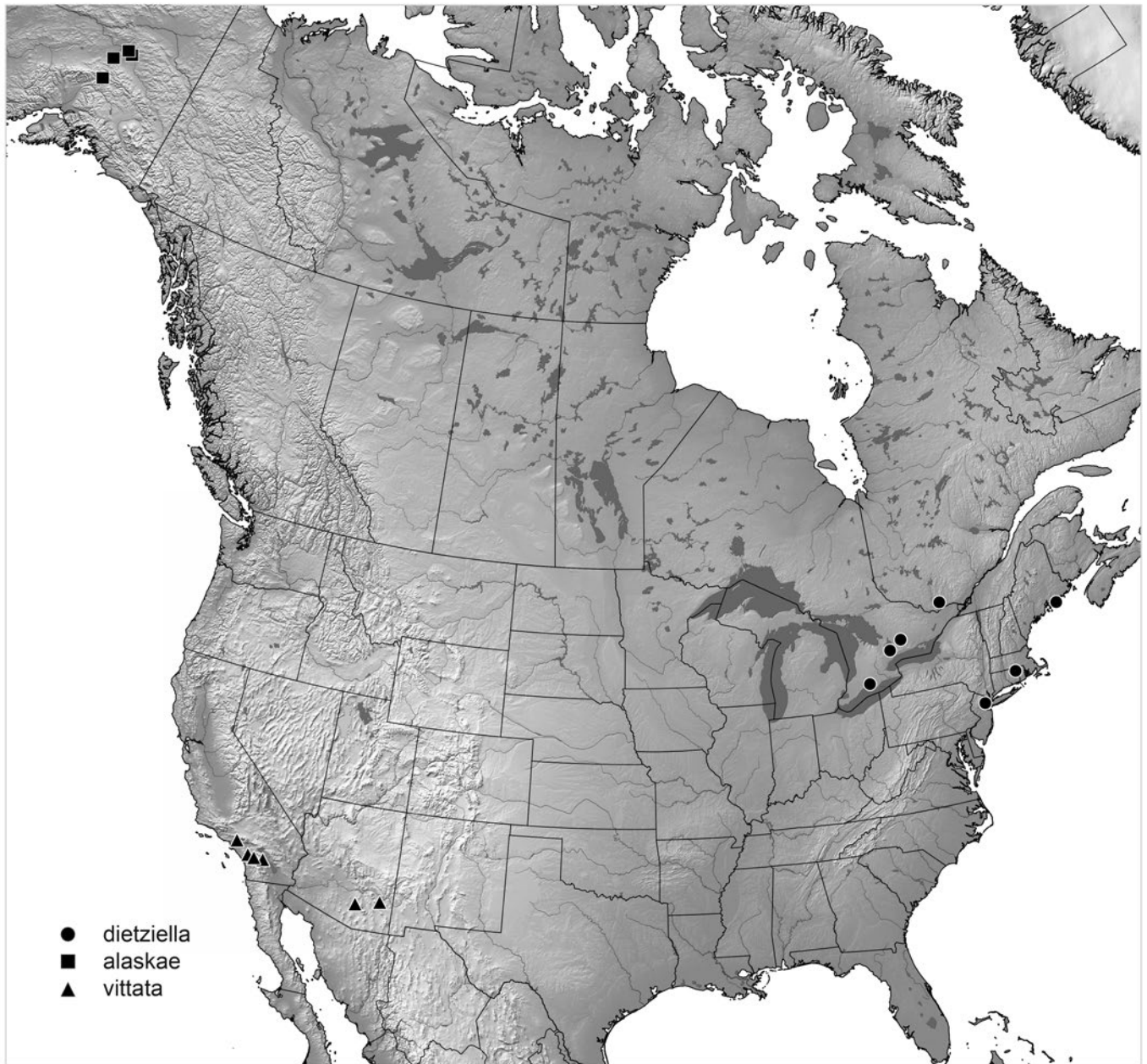
MAP 25. Distribution of New World *Adela*: *A. ridingsella* Clemens; *A. austrina*, new species.



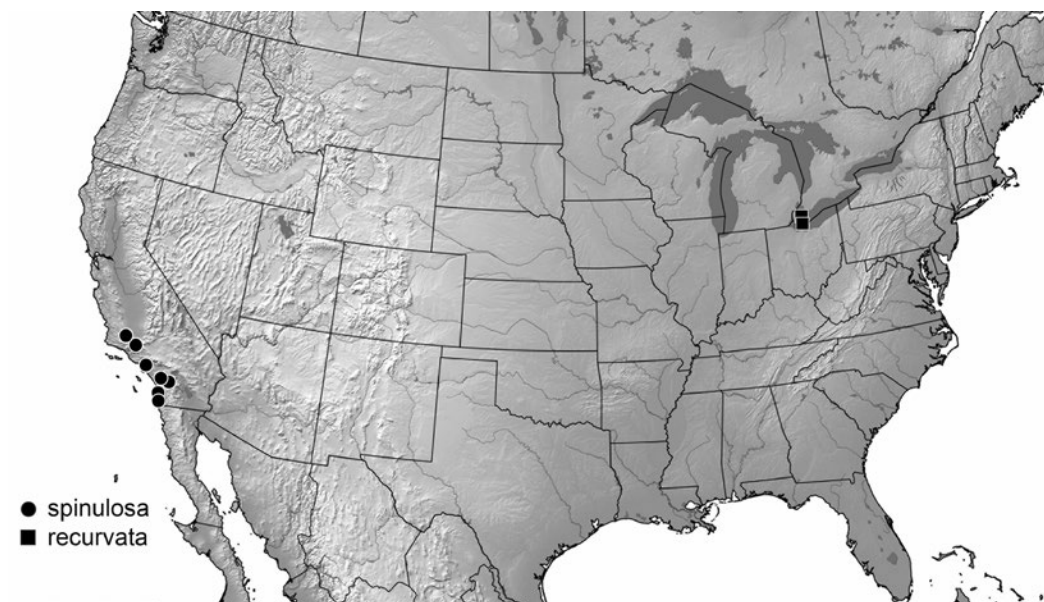
MAP 26. Distribution of New World *Adela*: *A. astrella* Walsingham; *A. striata*, new species.



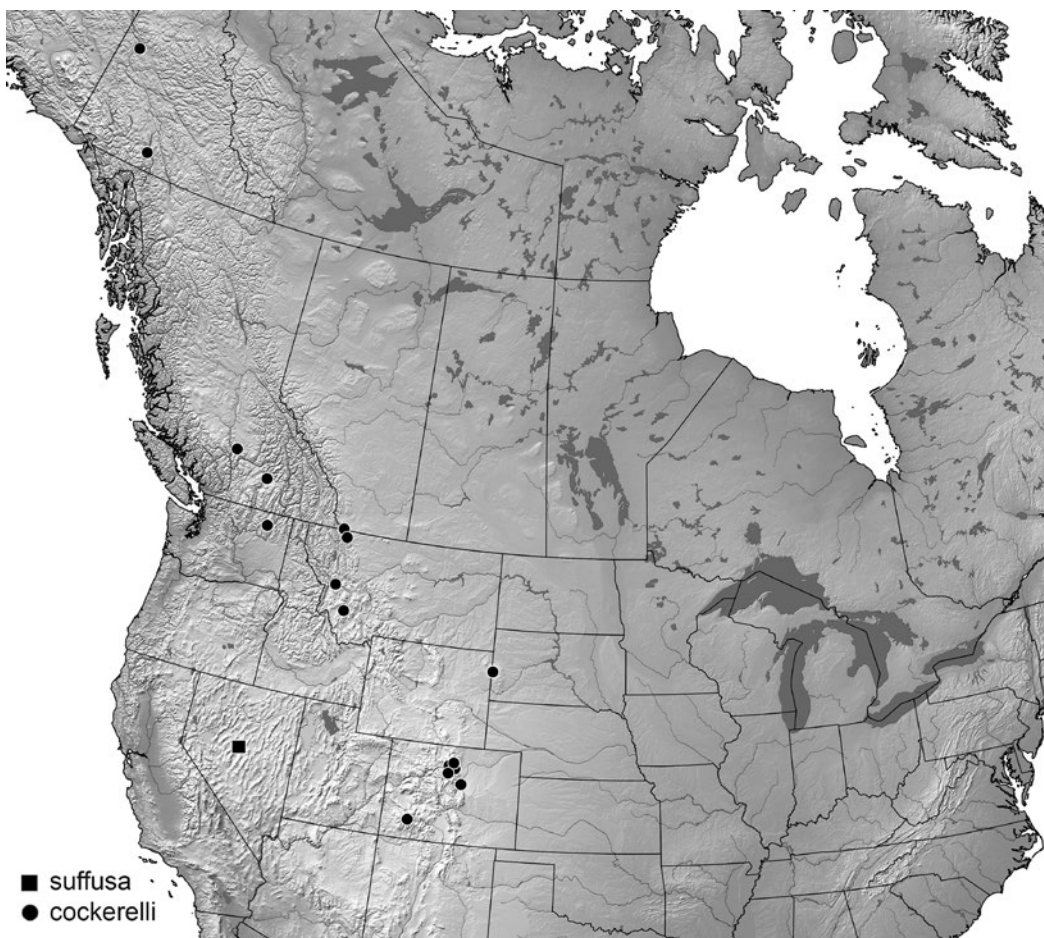
MAP 27. Distribution of New World *Adela*: *A. boliviella* Kozlov; *A. powelli*, new species.



MAP 28. Distribution of New World *Cauchas*: *C. dietziella* (Kearfott); *C. alaskae*, new species; *C. vittata*, new species.



MAP 29. Distribution of New World *Cauchas*: *C. spinulosa*, new species; *C. recurvata*, new species.



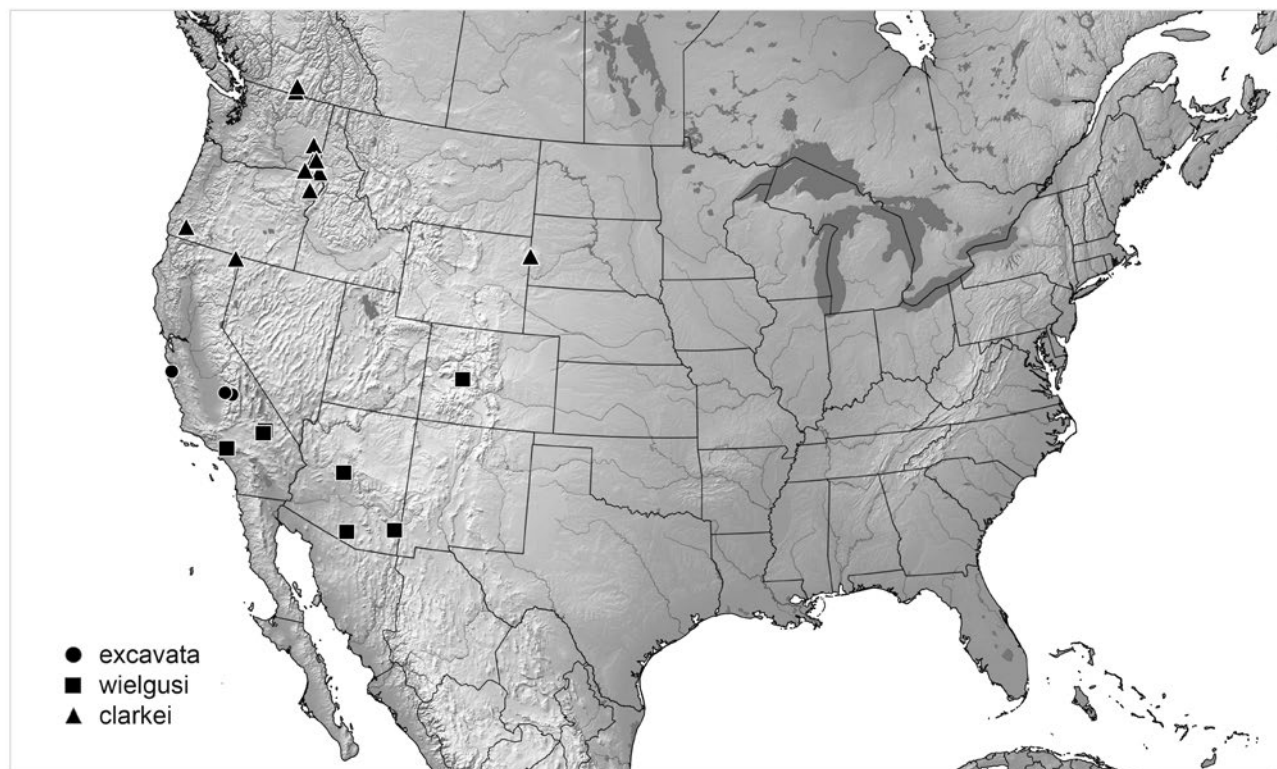
MAP 30. Distribution of New World *Cauchas*: *C. suffusa*, new species; *C. cockerelli* (Busck).



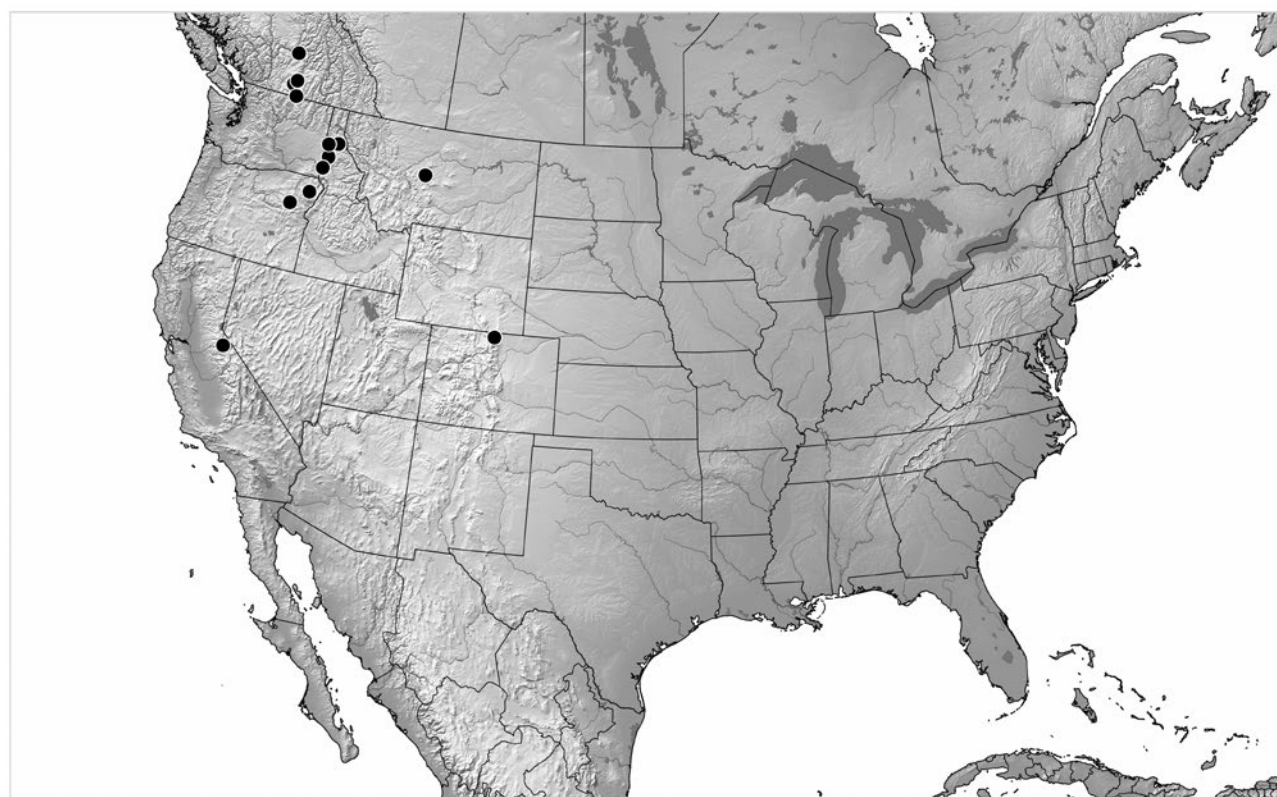
MAP 31. Distribution of New World *Cauchas*: *C. simpliciella* (Walsingham); *C. sedella* (Busck).



MAP 32. Distribution of New World *Cauchas*: *C. cyanella* (Busck); *C. trifascia*, new species; *C. lobata*, new species.



MAP 33. Distribution of New World *Cauchas*: *C. excavata*, new species; *C. wielgusi*, new species; *C. clarkei*, new species.



MAP 34. Distribution of New World *Cauchas elongata*, new species.

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