The Moths of North America

FASCICLE 8.1

TORTRICIDEA

Tortricidae (Part)

Sparganothini and Atteriini

Jerry A. Powell John W. Brown

2012

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The Moths of North America

FASCICLE 8.1

TORTRICOIDEA TORTRICIDAE (PART) TORTRICINAE (PART) SPARGANOTHINI AND ATTERIINI

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ABSTRACT

The North American members of the tortricid tribes Sparganothini and Atteriini are revised. Eighty-three species in 12 genera are included in Sparganothini; a single representative of Atteriini reaches the region north of Mexico. Twenty-one new species are proposed: Amorbia vero Powell and J. Brown (Florida); Coelostathma placidana Powell and J. Brown (Florida); Sparganothis robinsonana Powell and J. Brown (Texas); Sparganothis tessellata Powell and J. Brown (Alabama); Sparganothis minimetallica Powell and J. Brown (Florida); Sparganothis boweri Powell and J. Brown (Wisconsin); Sparganothis sullivani Powell and J. Brown (North Carolina); Sparganothis lindalinea Powell and J. Brown (Mississippi); Sparganothis mcguinnessi Powell and J. Brown (New York); Sparganothis niteolinea Powell and J. Brown (Florida); Sparganothis azulispecca Powell and J. Brown (Alabama); Sparganothis richersi Powell and J. Brown (Arizona); Cenopis unicolorana Powell and J. Brown (Alabama); Cenopis eulongicosta Powell and J. Brown (New Jersey); Cenopis vabroui Powell and J. Brown (Louisiana); Platynota polingi Powell and J. Brown (Arizona); Platynota texana Powell and J. Brown (Texas); Platynota islameconae Powell and J. Brown (California); Platynota blanchardi Powell and J. Brown (Texas); Platynota zapatana Powell and J. Brown (Texas); and Platynota redingtonensis Powell and J. Brown (Arizona). The following new combinations are proposed: Cenopis matsudai (Yasuda), C. illustris (Razowski), C. ferreana (Busck), C. daphnana (McDunnough), and C. lamberti (Franclemont). The following new synonymies are proposed: Sparganothis salinana McDunnough with S. distincta Wlsm.; Sparganothis acerivorana MacKay with Cenopis pettitana (Rob.); Sparganothis albicaudana Busck with Cenopis mesospila (Zeller), the latter of which is a revised status; and Sparganothis scotiana McD. with Platynota exasperatana (Zeller). Keys to the adults of all genera and species are included. Adults of all species are illustrated in color, and male and female genitalia of all species are illustrated by line drawings or images.

TORTRICOIDEA

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PREFACE

This is the first fascicle of The *Moths of North America* that deals with the family Tortricidae. It is one of the largest moth families, exceeded in numbers of described species only by Noctuidae and Geometridae among Nearctic moths. Tortricidae represent 10–13% of the described moth species in North America and in state and local inventories, including numerous species of economic importance in agriculture and forestry. This fascicle provides a brief overview of the history of the systematics, phylogeny, and classification of the entire family and comprehensive treatments of the members of the tribes Sparganothini and Atteriini that occur north of the Mexican border. Both tribes attain their greatest diversity in the Neotropics; Atteriini are restricted to the New World, Sparganothini nearly so.

The 83 species treated (82 Sparganothini and one Atteriini) comprise a geographically widespread array of species and species complexes that range from southern humid tropical areas to northern boreal forests. Several are commonly encountered pest species; others are rarely collected, a few represented by specimens from the early part of the 20th century and unrecorded since. Many of the species conform to standard morphological concepts, exhibiting differences in forewing pattern that are corroborated by sometimes subtle differences in genitalia. In contrast, others have a bewildering array of forms that vary geographically with little or no difference in genitalia. The morphological circumscription of most species conforms to patterns illustrated by their DNA (cytochrome oxidase I, COI); however, for some species there is considerable conflict between these two data sources.

Although the classification of Tortricidae has remained fairly stable over the last few decades, our concepts of the phylogeny of taxa within the family have not. Regardless, Sparganothini and Atteriini are both well-defined groups, the monophyly of each is supported by numerous morphological and biological characters. Molecular studies suggest the two are sister groups.

The nucleus of the revision of the Sparganothini was a Ph.D. thesis completed in 1950 at Cornell University by the late R. L. Lambert. The thesis was a worldwide revision of the tribe, then considered the subfamily "Sparganothidinae." Subsequent to completion as his Ph.D. thesis, Lambert rewrote and modified portions of the text and figures, but his premature death in 1957 preceded completion of the revision for publication. The unfinished manuscript and specimens were transferred to T. N. Freeman, a tortricid specialist at the Canadian National Collection, Ottawa, and eventually to Powell at the University of California, Berkeley. In 1970–1971, while a visiting research fellow at the National Museum of Natural History (USNM), Smithsonian Institution, Powell studied the Neotropical species of Sparganothini, both the older material used by Lambert and more recent acquisitions at the USNM, as well as the type specimens at The British Museum of Natural History, London (now The Natural History Museum). The work resulted in considerable revision of Lambert's concepts because he had not seen the type specimens of many of the older Neotropical species and had misinterpreted application of some names. In 1985 and 1986, Powell described three new genera of Nearctic sparganothines and several of Lambert's new genera in order to create a more meaningful framework for the Neotropical fauna. However, little other progress was made on the Nearctic fauna, for which a reliable generic framework was already in place. Through support from the National Science Foundation, a PEET grant enabled postdoctoral and doctoral students, including Bernard Landry, Eugenie Phillips-Rodriguez, and James Kruse, to complete monographs of the primarily Neotropical genera Sparganothina and related taxa (2001), Amorbia (2007), and Sparganothoides (2009), respectively. Probably 90% of all specimens examined for those studies have been collected since Lambert's time. Meanwhile, when Brown came onboard with the U.S.D.A.'s Systematic Entomology Laboratory, USNM, in 1997, he and Powell joined forces to complete a revision of the Nearctic members, the product of which is this MONA fascicle.

Identification keys are included, but often it is easier to compare a specimen in-hand with the color images in the plates. We have tried to include a range of phenotypes for the more variable species, but not always the full range of variation for both sexes. Although illustrations of the genitalia are provided for each species, the genitalia of many are so similar that they provide less than compelling characters for separating closely related species.

The label data used to generate the distribution maps from the specimens examined of previously described species are available on-line at the website of The Wedge Entomological Research Foundation [www.wedgefoundation.org]. Label data for the 21 species newly described are provided in the text and the database.

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Images of the adults were skillfully captured by Jocelyn Gill (Canadian National Collection of Insects and Arachnids), and most drawings of genitalia were prepared by Kuniko Arakawa. Plates were arranged with the assistance of Marie Metz, Taina Litwak, and Lucrecia Rodriguez. Additional graphic support was received from Marie Metz, Diana Marquez, Jadranka Rota, Gary Oulette, and David Adamski. Distribution maps were prepared by Mark Metz.

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SUPERFAMILY

TORTRICOIDEA (continued)

FAMILY

TORTRICIDAE (continued)

Tortricoidea, consisting of the single family Tortricidae, are a monophyletic lineage currently considered to be comprised of three subfamilies - Chlidanotinae, Tortricinae, and Olethreutinae — into which the 20 currently recognized tribes are placed (Table 1) (Horak and R. Brown 1991; Horak 1998; Horak 2006). Adults are fairly homogeneous in basic structure but vary greatly in superficial appearance, size, form, and color: most are smallto-medium-small nocturnal moths with slightly upturned or porrect, beaklike labial palpi and a characteristic resting posture, in Tortricinae with the wings held flattened rooflike over the abdomen resulting in a bell-shaped silhouette. Females possess modified ovipositor lobes (papillae anales) that are flat, setate pads facing ventrally, usually having the outline of shoe soles (plate 21). The family is worldwide in distribution, reaching its greatest species richness in the New World tropics. Recent cataloging places the number of species worldwide at about 9,730, with 5,000 species of Tortricinae, 4,400 Olethreutinae, and 330 Chlidanotinae (J. Brown 2005) (Table 1). Approximately 1,200 named species occur in America north of Mexico, of which about 375 are Tortricinae, 820 Olethreutinae, and 5 Chlidanotinae.

Many tortricids are important pests of agricultural, forest, and ornamental plants. And some,

such as the spruce budworm (Choristoneura fumiferana (Clemens)) and codling moth (Cydia pomonella (Linnaeus)), are among the most wellstudied insects on the planet because of the considerable economic damage caused by their larvae. The common name "leafrollers" has been applied to the family owing to the larval habit of shelter-building by folding or rolling leaves of the food plant. However, the larvae of tortricids employ a wide range of feeding strategies, and the family includes gall-inducers, root-borers, fruitborers, seed-predators, flower-feeders, and leaftiers. Some of the more unusual feeding modes include leaf-litter feeding (e.g., Epitymbiini), feeding as inquilines in the galls of other insects (e.g., Cydia Hübner and Andrioplecta Obraztsov), and predators of coccids (e.g., Accra Razowski, Pammene Hübner, and Andrioplecta). The larvae of Sparganothini and Atteriini are external feeders within silk-lined shelters on foliage or inflorescenc-

In general, members of the subfamily Tortricinae tend to be polyphagous, whereas most Olethreutinae have narrower host ranges; food plants are unknown for most Chlidanotinae. Dicotyledons are the most widely used hosts, but there are species-groups and genera throughout the family that specialize on gymnosperms, particularly conifers. The use of monocotyledons as host plants is rare. Few taxonomic groups within Tortricidae exhibit true host specialization, but the following are examples where there is a degree of fidelity. Members of the primitive tortricid tribe Phricanthini are associated with the primitive plant family Dilleniaceae (Horak 1998). Members of the

Australian genus Arotrophora Meyrick are associated primarily with the plant family Proteaceae (Common 1963). Larvae of the Australian tribe Epitymbiini feed primarily in leaf-litter of Myrtaceae (Eucalyptus L'Her. and relatives) (Horak and Common 1985; Powell and Common 1985). Most members of the worldwide tribe Cochylini as well as most species of Eucosma Hübner are associated with the plant family Asteraceae although there are many deviations from this pattern (Razowski 1970; Horak and R. Brown 1991). Members of the worldwide genus Bactra Stephens are associated with the monocotyledon genera Cyperus Linnaeus, Scirpus Linnaeus, and Typha Linnaeus, which occur primarily in marshes and other mesic habitats.

HISTORY OF THE CLASSIFICATION OF TORTRI-CIDAE. Guenée (1845) was probably the first to propose a classification for Tortricidae, dividing the family into ten subgroups based on superficial and/or conspicuous external characters. Although many of Guenée's groups were polyphyletic assemblages of similar appearing genera and species, his groups, which are roughly equivalent to modern tribes, persisted as the primary taxonomic levels or groupings within the family. Stainton (1859), Meyrick (1883, 1895, 1913), and Kennel (1908-1921) further refined the classification of the family based on wing venation, male secondary sexual structures, and other external features. Pierce and Metcalfe (1922) were the first to explore in detail the potential of the male and female genitalia for deciphering relationships; they divided the "Tortricidae" (= Tortricinae) into three groups: Archipidii (= Archipini), Cnephasidii (= Cnephasiini), and Peroneidii (= Tortricini). Heinrich (1923, 1926) reinforced the taxonomic value of genitalia, using these structures, along with traditional characters, in his monographic treatments of the North American Olethreutinae. Busck (1940) reviewed the genera of Sparganothini and suggested that they represented a tribe within the Tortricinae rather than a distinct subfamily, and Obraztsov (1949, 1954-1957) cataloged the Palearctic fauna, relying primarily on established categories. Although somewhat resolved by the 1950s, some debate remained as to whether Tortricinae and Olethreutinae constituted a single family or separate families.

Swatschek (1958) and MacKay (1959, 1962) provided details of the larvae of tortricids, Swatschek focusing on the Palearctic fauna and MacKay on the Nearctic. Both concluded that larval characters are extremely similar between Olethreutinae and Tortricinae and that the two cannot be separated on the basis of larvae alone. Diakonoff (1961) provided his views on the family, proposing that Tortricidae is comprised of three subfamilies: Tortricinae, Olethreutinae, and Chlidanotinae; however, he continued the long-standing exclusion of the Cochylini (referred to as Cochylidae or Phaloniidae) owing to their divergent genitalia and venation. Powell (1964a) was the first to emphasize biological features, synthesizing morphological and biological characters into a more eclectic classification, providing one of the first clearly articulated hypotheses of the evolution of North American Tortricinae.

In the 1970s, European workers became enamored with a new data set — the musculature of the male genitalia. In general, phylogenies based on these characters deviated from those proposed previously. Kuznetsov and Stekolnikov's (1973, 1977) phylogenies for the Palearctic Tortricidae did not receive widespread or lasting acceptance probably because hypothesized relationships among many taxa were based on symplesiomorphies (shared ancestral characters) rather than synapomorphies (shared derived characters).

Razowski (1976) provided a thorough review of the nomenclature and classification of the family and proposed a phylogeny based primarily on the morphology of the male genitalia, including musculature. He considered biological features to be characteristic of species-groups or genera rather than tribes; wing venation, likewise, was considered to be of value only at the generic level. Secondary sexual characters of the male were considered too unreliable to be meaningful in a phylogenetic context even at the subtribal level.

In one of the few examinations of tortricoid phylogeny based on molecular data, Pashley (1983) confirmed the long accepted separation of the Olethreutinae and Tortricinae as distinct taxa.

In 1982 Roeloffs and R. Brown presented an exciting new and independent data set — the chemical structure of pheromones. Whittle et al. (1987) and Horak et al. (1988) provided additional information on pheromones, filling in gaps in this

growing data set. Arn et al. (2010) list more than 100 genera of tortricids for which pheromones are known and/or synthesized. The phylogenetic distribution of specific pheromone structures, in particular the length of the primary carbon chain and the predominance of specific isomers, is relatively consistent with the developing broad picture of tortricoid phylogeny (Safonkin 2007) but has not yet proved useful in resolving problems of relationship below the subfamilial level. Nonetheless, pheromone chemistry is employed as an important tool in discrimination of cryptic species (e.g., Powell and De Benedictis 1995).

In 1991, Horak and R. Brown presented a hypothesis of the phylogeny of the tribes of Olethreutinae, based on a synthesis of morphological, biological, and biochemical information. Although they discussed characters of the Tortricinae in detail, they provided no hypothesis of relationships within that subfamily.

Understanding of relationships within the subfamily Chlidanotinae was derived quite independently, as Diakonoff (1961) and Heppner (1978) sorted out a broad array of similar appearing genera, providing appropriate familial assignment for many taxa whose relationships had remained obscure since their original descriptions. Tuck (1981), Razowski (1988), J. Brown (1990), and Poinar and J. Brown (1993) reviewed relationships among the three tribes of the Chlidanotinae, based entirely on morphology, resulting in a compelling hypothesis of the phylogeny of the chlidanotine tribes (Chlidanotini, Hilarographini, and Polyorthini).

Although Tortricidae are widely accepted as comprising a monophyletic lineage, owing to the rather homogeneous morphology, few characters have been identified that convincingly support this view. Perhaps the most convincing synapomorphy is the modified ovipositor lobes (papillae anales) that are rotated 90° from the lateral position to form flat pads facing ventrally (Horak 1998), usually having the outline of shoe soles, although laterally facing pads are common in some genera of Olethreutinae, e.g., Eucosma. Larval characters provide at least three potential synapomorphies for the family and the pupa possibly a fourth. The presence of the D2 setae on a shared, common dorsal pinaculum on A9 is nearly unique to the family, and virtually all tortricid larvae possess this

condition. A secondary reversal to the putative primitive state (i.e., on separate pinacula) may be found in a few species of Cydia Hübner and possibly other internal-feeding species in which the pinacula are much reduced and/or unsclerotized. The presence of a distinctive anal fork may represent a synapomorphy for the family as well. Although larvae of many families possess a similar structure for ejecting frass from the larval feeding site, the morphology of the tortricid anal fork is unique. However, this structure is putatively lost secondarily many times throughout the family; so, it is a less reliable character. The position of the SD1 seta on A8 (anterior, slightly dorsoanterior, or slightly ventroanterior to the spiracle) separates most tortricid larvae from those of many related microlepidoptera; hence this character state could be interpreted as a synapomorphy. There are a few deviations from this pattern, such as some species of Cydia, the cone-feeding Eucosma bobana Kearfott group, and others, in which the seta is nearly dorsad of the spiracle; but these are assumed to represent secondary modifications. In the pupa, the presence of two distinct rows of spines across the dorsum may represent a synapomorphy for the family.

PHYLOGENY OF THE SUBFAMILY TORTRICINAE. Early workers discussed the evolution of characters and hypothesized relationships among groups based on intuition; however, limited meaningful progress was made toward unraveling relationships among the tribes of the Tortricinae until the early part of the 20th century. Pierce and Metcalfe (1922) recognized three tribes (Archipini, Cnephasiini, and Tortricini), and this arrangement was followed by Obraztsov (1954-1957). Diakonoff (1961) recognized the Tortricinae as consisting of six tribes: Ceracini, Archipini, Sparganothidini (with the subtribe Anacrusina), Cnephasiini, Epitymbiini, and Tortricini. MacKay (1962) presented a thorough review of characters of the larvae of North American tortricids; she treated four tribes in Tortricinae (Tortricini, Cnephasiini, Archipini [as Archipsini], and Sparganothini). Although Mac-Kay considered both the Olethreutinae and Tortricinae to be monophyletic, treating them as distinct subfamilies, she stated that "... no larval characters as yet known separate the olethreutid and tortricid groups" (MacKay 1962). MacKay

presented no illustration of hypothesized phylogenetic relationships among tribes, but she presented a "sequence of tribes" for the Tortricinae: Tortricini-Cnephasiini-Archipini-Sparganothini, which she stated may represent a "... true phylogenetic order." Cochylini and Euliini were not discussed because at the time Cochylini were considered a distinct family (i.e., Cochylidae or Phaloniidae), and Euliini had not been recognized as distinct from Cnephasiini.

Focusing on biological characters, Powell's (1964a) phylogeny (Figure 1) represented a synthesis of biological (emphasizing oviposition patterns) and morphological characters, endowing his results with a greater degree of robustness. The relationships proposed by Powell, which are well supported by characters that are clearly defined, are identical to those suggested by MacKay. For the most part, character state homology and polarity are highly compatible with our current understanding of character state distributions.

The habit of internal feeding formerly was considered the ancestral condition for tortricids based on the internal feeding habits of Cossidae and Sesiidae (Powell 1964a), which were thought to be likely sister-groups to Tortricidae. However, owing to the widespread occurrence of an anal fork (a comblike structure used to eject frass from the larval feeding site) in the larvae of many disparate tortricid tribes, it now is assumed that external feeding is the primitive or ancestral condition (requiring an anal fork), and that the anal fork has been lost secondarily in those groups specialized to feed internally (e.g., many Olethreutinae). R. Brown (1987) concluded that internal feeding is secondarily derived in the Tortricidae and is not homologous with the internal feeding behavior of Cossoidea, Sesioidea, some Gelechioidea, and some other more primitive Lepidoptera.

A second character for which the polarity has been re-assessed is the costal fold of the male forewing. Owing to its widespread occurrence in

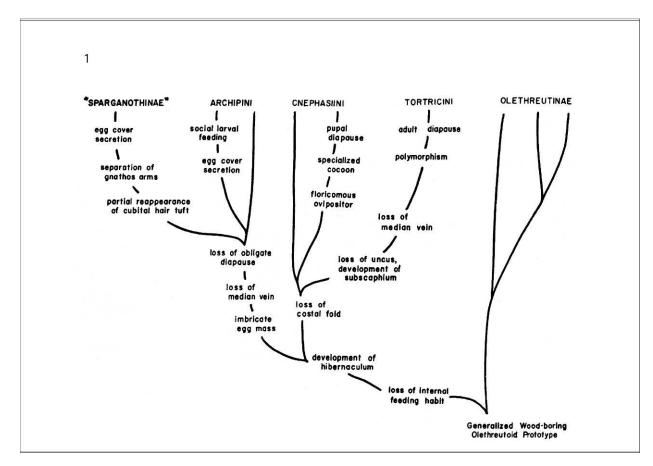


FIGURE 1: HYPOTHESIZED RELATIONSHIPS AMONG TRIBES OF TORTRICINAE (POWELL, 1964).

many genera throughout the family, the costal fold was assumed to represent a ground plan character. However, based on its absence among the most primitive members of the subfamily (i.e., Phricanthini, Schoenotenini, Tortricini), coupled with detailed morphological studies by R. Brown (1983) that indicate it is unlikely to be homologous among many of the taxa that possess it, we believe this structure has evolved multiple times within each subfamily. For example, its shared absence in Cnephasiini and Tortricini may not be evidence of the relationship between the two (i.e., its absence may represent either a symplesiomorphy for the two or independent losses within each lineage).

Based on morphology of the male and female genitalia, with an emphasis on musculature of the male genitalia, Kuznetsov and Stekolnikov (1973, 1977, 1984) and Razowski (1976, 1981) provided phylogenies for the Palearctic Tortricidae, examining a broader range of taxa than either MacKay or Powell, but focusing on a narrower range of characters. The trees or diagrams produced by these authors are less informative because they do not identify the characters that support specific branches, and they did not differentiate between synapomorphic vs. symplesiomorphic states, with many taxa grouped by shared loss.

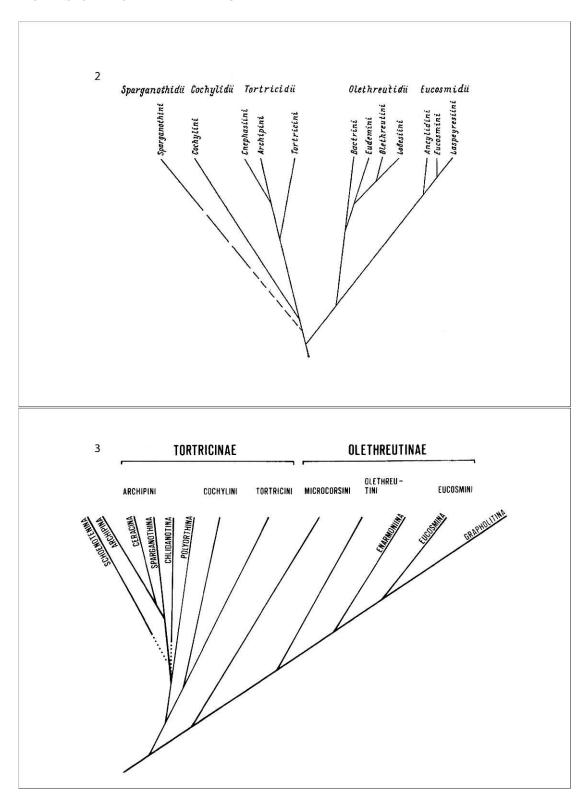
Kuznetsov and Stekolnikov's (1973) first hypothesized phylogeny (Figure 2) included five of the 10 taxa now recognized as tribes in the Tortricinae (Sparganothini, Cochylini, Cnephasiini, Archipini, and Tortricini) and divided the subfamily into three "supertribes" — Sparganothidii (Sparganothini), Cochylidii (Cochylini), and Tortricidii (Cnephasiini, Archipini, and Tortricini). In this scheme, both Olethreutinae and Tortricinae were presumed to be monophyletic. Hypothesized relationships among tortricine taxa deviated considerably from those proposed by MacKay and Powell, with Archipini and Sparganothini in different supertribes. Cochylini were treated as a tribe within the Tortricinae for the first time, and this hypothesis was adopted by most subsequent workers.

Razowski's (1976) phylogeny (Figure 3) included a slightly wider range of taxa — six of the 10 taxa now considered to represent tribes in the Tortricinae. He hypothesized that Tortricidae consisted of two subfamilies, both of which were assumed to be monophyletic. Tortricinae were divided into three tribes: Tortricini, Cochylini,

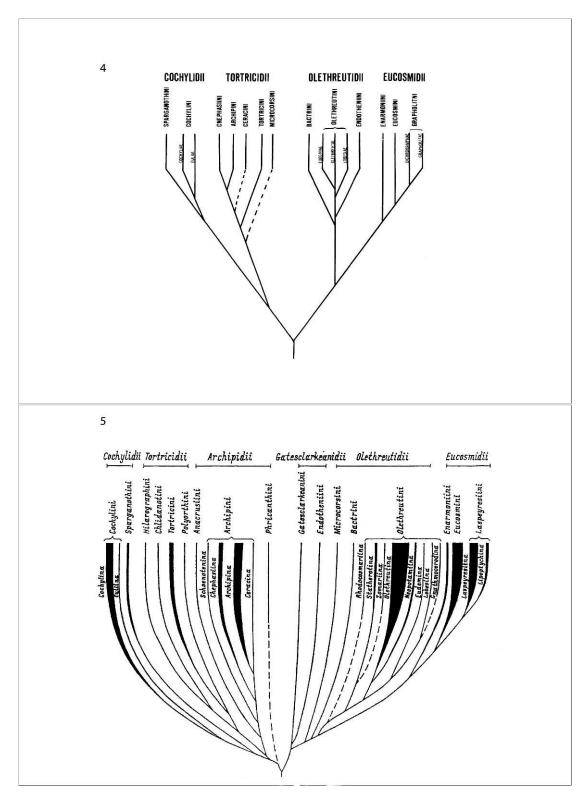
and the greatly expanded Archipini. The Chlidanotini and Polyorthini, currently considered to be members of the subfamily Chlidanotinae, were treated as terminal taxa for the first time, but they were included in the broad concept of Archipini, as were all tortricine tribes but Tortricini and Cochylini. This phylogeny is somewhat consistent with that proposed by MacKay (1962) and Powell (1964a) in the hypothesized relationship between Archipini (with Ceracini, an Indo-Australian group, considered the sister group of the Archipini) and Sparganothini, but the hypothesized relationship of Tortricini to these tribes is considerably different, and Cnephasiini were considered part of Archipini.

A later phylogeny by Kuznetsov and Stekolnikov (1977) (Figure 4) included seven of the 10 recognized tribes, with Tortricinae divided into two supertribes — Cochylidii and Tortricidii. Interesting aspects of this hypothesis are as follows: Cochylini were retained as a tribe within the Tortricinae; Euliini were recognized for the first time, but as a subtribe (i.e., Euliae) of Cochylini; and Microcorsini were transferred (incorrectly) from Olethreutinae to Tortricinae. The major shortcoming of this work is that characters supporting the branching patterns were not clearly stated.

In their continuing synthesis, Kuznetsov and Stekolnikov (1984) proposed a modified arrangement (Figure 5), including all currently recognized tribes of Tortricinae (except Epitymbiini), again strongly emphasizing the musculature of the male genitalia. Although superficially similar to the arrangement of Razowski (1976) with three main groups — Archipini (= Archipidii), Cochylini (= Cochylidii), and Tortricini (= Tortricidii) — each of the groups included different tribes (or subtribes) than those of Razowski. Interesting features of this phylogeny include: 1) the monophyly of both Tortricinae and Olethreutinae, again with Tortricinae including the currently recognized subfamily Chlidanotinae; 2) the retention of Cochylini as a tribe within Tortricinae; and 3) the position of Phricanthini as a distinct group of questionable placement. Because Phricanthini had not been recognized as a tribe until 1981 (Diakonoff 1981), Kuznetsov and Stekolnikov's (1984) work was the first to attempt to place this unusual group in the overall context of the subfamily.



FIGURES 2–3: HYPOTHESIZED RELATIONSHIPS AMONG TRIBES OF TORTRICIDAE. 2. KUZNETZOV AND STEKOLNIKOV (1973). 3. RAZOWSKI (1976).



FIGURES 4–5: HYPOTHESIZED RELATIONSHIPS AMONG TRIBES OF TORTRICIDAE. 4. KUZNETZOV AND STEKOLNIKOV (1977). 5. KUZNETZOV AND STEKOLNIKOV (1984).

In 1991, Horak and R. Brown presented an excellent review of the morphology, biology, and biogeography of tortricid tribes, dividing the family into the three currently recognized subfamilies. While they provided a detailed working hypothesis of the phylogeny of the Olethreutinae, suggesting that Eucosmini and especially Grapholitini were para- or polyphyletic, no such hypothesis was presented for Tortricinae or Chlidanotinae.

Whereas most of the tribes of Tortricinae are well defined or at least have a core group of genera that form the nucleus of a monophyletic tribe, relationships among them have remained somewhat unresolved, with considerable disagreement among the competing hypotheses. However, based on current molecular studies by the NSF-funded Lepidoptera Tree-of-Life group (University of Maryland), a clearer picture of relationships within the subfamily is beginning to emerge. Preliminary studies indicate that the subfamily as currently defined is indeed monophyletic. Although the monophyly of Olethreutinae and Chlidanotinae is assumed to be well supported by morphological characters, recent molecular analyses suggest that Chlidanotinae may be paraphyletic (C. Mitter, personal communication).

MATERIALS AND METHODS. We examined more than 17,000 specimens of Sparganothini deposited in major institutional and private collections; abbreviations of depositories are listed in the Notes. Slides of genitalia and wing venation were prepared as summarized in J. Brown and Powell (1991, 2000). Preliminary drawings of genitalia were prepared using a microprojector; final drawings were inked while examining slides of genitalia using dissecting and compound microscopes. Males of a few species required two slide-mounted preparations, one for the genital capsule and the other for the aedeagus. These are indicated in the figure legends. A few illustrations of genitalia are digital images, rather than drawings, captured with a Microtopics digital imaging system. Extended depth-of-field photographs of the labial palpi were created with a Nikon digital camera mounted on a Leica dissecting scope and processed using automontage software; composite images were further enhanced using Photoshop® and Adobe Illustrator® software. Reference to length of labial palpus includes all three segments. Terminology for wing venation and structures of the male and female genitalia follows Horak (1984).

We examined the type specimens of all species deposited in the AMNH, EME, BMNH, MCZ, and USNM. Several of the types of species described by Robinson (1869) and supposedly deposited in ANSP could not be found. In a few cases, lectotypes are designated, when necessary to provide nomenclatural stability, but in other cases they are not.

REARING. Females collected at lights or by diurnal netting were placed individually in 15-dram plastic vials with a small wick of damp cotton. In the field they were transported in a camp cooler and removed each evening to expose them to natural light during crepuscular and overnight hours. Gravid females of sparganothine moths usually deposit eggs on smooth surfaces in the absence of any plant stimulus, which is typical of generalist feeding Tortricinae. Each female was assigned a rearing lot number, which reflects the collection date (e.g., 72G3 = 1972, July, 3rd collection). First instar larvae were offered green leaves, usually Quercus Linnaeus or Prunus Linnaeus or synthetic diet (modified Shorey diet, see J. Brown and Powell, 2000 for formulation). After 3–4 weeks larvae were transferred to 1-ounce cups with diet (5-6 per cup). Late instar larvae usually were placed individually or in pairs in new containers to avoid cannibalism and crowding by excessive silk that might interfere with moth emergence.

Larval collections in the field were made by inspecting plants for silk-tied shelters; larvae collected in this manner were maintained in polyethylene plastic bags lined with paper towels and provided fresh foliage as needed. Each collection of larvae was assigned a rearing lot number as described above. The data are summarized in a Microsoft Access Database maintained in the Essig Museum of Entomology, University of California, Berkeley.

DISTRIBUTION. We adopt the traditional approach for the *Moths of North America* (MONA) series, treating the species of Sparganothini and Atteriini that occur in North America north of Mexico. Had we expanded the geographic coverage to include Nearctic Mexico, at least double the number of species would have been included.

SUBFAMILY

Tortricinae (continued)

TRIBE

Sparganothini Druce, 1912

Type genus: Sparganothis Hübner, [1825] 1816

Sparganothidae Walsingham, 1913

Sparganothinae Busck, 1940

Sparganothidini Diakonoff, 1961 (part)

Sparganothidina Diakonoff, 1961

Sparganothini Kuznetsov and Stekolnikov, 1973

Niasomini Powell, 1964b

With 241 described species in 18 genera, Sparganothini are among the smallest of the 10 tribes that comprise Tortricinae (Table 1); however, based on specimens in collections, an appreciable percentage of the tribe is undescribed. The monophyly of the group is supported convincingly by both morphological and biological characters: 1) subbasally attached socii (i.e., with a portion of the socii extending posteriad to the point of attachment and a portion extending anteriad) and bearing long scales; 2) reduction or loss of the gnathos; 3) a centrally spined transtilla; 4) aedeagus with a bundle of deciduous cornuti; and 5) eggs laid in imbricate patches and covered with a conspicuous colleterial secretion. The tribe occurs almost exclusively in the New World, with five species of Sparganothis Hübner and two species of Cenopis Zeller in the Palearctic, and Lambertiodes Diakonoff with two species in India, Nepal, and China (Table 2).

Most early authors treated sparganothine species as members of Tortricidae. Walsingham (1913–1914) proposed the family Sparganothidae for *Aesiocopa Zeller*, *Coelostathma*, *Sparganothis*, *Amorbia*, and *Platynota* (along with several other genera that are now considered unrelated to the tribe, e.g., *Atteria* Walker, *Homona* Walker, *Epagoge* Hübner) based primarily on the forked R₄ + R₅ of the forewing and the presence of a hindwing

TABLE 1 SUBFAMILIAL AND TRIBAL GROUPS, WITH ESTIMATES OF THE DESCRIBED WORLD FAUNA (BASED ON BAIXERAS ET AL., 2011)

Chlidanotinae	
Polyorthini	157
Chlidanotini	111
Hilarographini	67
Tortricinae	
Phricanthini	21
Tortricini	435
Cnephasiini	214
Epitymbiini	103
Ceracini	29
Archipini	1,693
Atteriini	76
Sparganothini	219
Schoenotenini	204
Euliini	853
Cochylini	1,076
Olethreutinae	
Microcorsini	36
Olethreutini	1,114
Bactrini	165
Enarmoniini	346
Eucosmini	1,664
Grapholitini	909

TABLE 2 GENERA OF SPARGANOTHINI, WITH GENERAL GEOGRAPHIC DISTRIBUTION AND SPECIES RICHNESS

Aesiocopa	Neotropical	1
Amorbia	Nearctic/Neotropical	33
Amorbimorpha	Nearctic/Neotropical	4
Anchicremna	Neatropical	2
Coelostathma	Nearctic/Neotropical	7
"Coelostathma"	Neotropical	5
Cenopis	Nearctic/Palearctic	18
Lambertiodes	Indo-Australian	2
Niasoma	Nearctic	1
Paramorbia	Neotropical	3
Platynota	Nearctic/Neotropical	33
Rhynchophyllis	Neotropical	1
Sparganopseustis	Nearctic/Neotropical	15
Sparganothina	Neotropical	25
"Sparganothina"	Neotropical	10
Sparganothis	Nearctic/Palearctic	35
Sparganothoides	Nearctic/Neotropical	32
Syllonoma	Nearctic	1
Synalocha	Nearctic	1
Synnoma	Nearctic	1
Unplaced	Neotropical	11

cubital pecten in some species. This treatment was not followed by North American lepidopterists, who either ignored sparganothines as a distinct taxon (e.g., Barnes and McDunnough 1917; McDunnough 1939) or treated them as a subfamily (e.g., Busck 1940). The latter concept was adopted by Obraztsov (1949, 1954-1957) and followed by Lambert (1950) in his widely known, but unfinished and unpublished revision of the group and by Powell (1964a). In 1961, Diakonoff treated the group as a tribe, and in nearly all treatments since then (e.g., MacKay 1962; Kuznetsov and Stekolnikov 1973, 1984; Razowski 1975), Sparganothini have been accorded tribal status. Swatschek (1958) deviated from this pattern, following the classification of Kennel (1910) synonymizing Sparganothini with Archipini. Although Busck (1940) considered Niasoma to be a sparganothine, Lambert (1950) and Obraztsov (unpublished) did not; and on this basis Powell (1964a, 1983b) proposed the tribe Niasomini to accommodate this highly divergent, monotypic genus. Subsequently, Powell (1985) concluded that Niasoma and three other moderately divergent monotypic genera (i.e., Synalocha, Synnoma, and Syllonoma), are placed most appropriately in Sparganothini.

Revisions of the tribe to date include Busck's (1940) review of North American members, Lambert's (1950) unpublished revision of the world fauna, Yasuda's (1975) treatment of the Japanese fauna, and Razowski's (1975) review of the Palearctic members. More recently, Powell (1986) described several new Neotropical genera in an attempt to establish a framework classification for the tribe based on the much more diverse Neotropical fauna. Stimulated by an NSF-PEET grant (National Science Foundation, Partnerships for Enhancing Expertise in Taxonomy) awarded to Felix Sperling and Jerry Powell at the University of California, Berkeley, significant strides were made toward understanding the diversity and systematics of the group, with graduate and postdoctoral students having completed revisions of Sparganothina (Landry and Powell 2001), Amorbia (Phillips-Rodriguez and Powell 2007), and Sparganothoides (Kruse and Powell 2009). Sparganopseustis and Neotropical *Platynota* are the major lineages still in need of systematic treatment.

Adults of Sparganothini are remarkably uniform in morphology, and differences in genital

structures sometimes are subtle or absent among congeners. In contrast, intraspecific variation in forewing maculation is common in many species. Owing to the absence of genital characters that support differences in forewing color and pattern, possibly some of the "species" treated herein actually represent species-complexes that require molecular, pheromonal, or biological data to resolve. We have not previously encountered a group of microlepidoptera with numerous examples of sympatric pairs of phenotypically recognizable entities that appear to be identical structurally.

LIFE HISTORY. Although considerable biological information is available for a few Nearctic sparganothines owing to their pest status, complete life histories are unknown for most. The flattened, elliptical eggs are laid in imbricate clusters, usually of 25–120 eggs, although clusters may be smaller; typically, they become successively fewer with the age of the female. Eggs are green, gray, yellow, or orange, varying among genera, and usually covered with a colorless or white colleterial secretion (black in Synnoma) that extends beyond the edge of the egg mass. The larvae of most Sparganothini are polyphagous leaf-rollers, and the tribe includes a variety of economically important plant pests, such as the chokecherry leafroller (Cenopis directana), sulfur leafroller (Sparganothis sulfureana), tufted apple bud moth (Platynota idaeusalis), omnivorous leafroller (Platynota stultana), Mexican leafroller (Amorbia emigratella), and others. In the Palearctic, Sparganothis pilleriana is a pest of grape vines (Stellwaag 1928; Razowski 1975) and trees, including pine (Swatschek 1958; Sierpinski 1962). The larvae of most Sparganothini feed primarily on the foliage, flowers, and fruit of many families of dicotyledenous plants in shelters made from one or more of the host plant leaves; however, some also feed on conifers, and a few species are believed to specialize on conifers. Although most species are polyphagous, exceptions include Niasoma, Synnoma, and Synalocha, which are aberrant in that the larvae feed in silken tubes and live gregariously on their asteraceous hosts (Chrysothamnus Nuttall, Ericameria Nuttall, and Gutierrezia Lagasca and Segura) (Powell 1976a; Edwards and Wangberg 1985). Platynota larreana (and probably several related species) is a specialist on Larrea Cavanilles (Zygophyllaceae) in

the southwest deserts. Under outbreak conditions, larvae of *Amorbia emigratella* may defoliate trees and feed on fruit in Hawaii (Zimmerman 1978); larvae of *Platynota stultana* frequently are encountered on fruit.

An obligate diapause occurs in *Sparganothis senecionana* and *S. tunicana*; newly hatched larvae construct individual hibernacula of silk, in which they estivate and pass the dry season. Pupation by all sparganothines usually takes place within the folded leaf shelter.

Adults of almost all species are nocturnal and are attracted to lights; a very few species are diurnal, e.g., Synnoma lynosyrana and Synalocha gutierreziae, and females of the former do not fly (Powell 1976a). Seasonality, voltinism, and patterns of adult emergence are species specific; many species are multivoltine and active throughout the growing season, others have an obligate single generation. For some wide ranging species, flight period and adult activity vary throughout their range. For example, in the coastal lowlands of southern California, Amorbia cuneana may be present throughout the year, but in central coastal California there are two well-defined generations, and at higher elevations, populations are univoltine, with adults restricted to the summer months. Some Sparganothini are univoltine with an obligate diapause, usually as first instar larvae (e.g., Sparganothis senecionana).

DESCRIPTION AND CHARACTERS. Although a few species are comparatively large for tortricids, most Sparganothini are small moths with forewing lengths ranging from 5–15 mm. In most species the forewing ground color is somber, featuring shades of orange, yellow, gray, and brown. A few species have more complex patterns with stripes or fasciae. Like most other tortricines, the wings are held flattened-rooflike over the abdomen, often giving a bell-shaped silhouette when at rest. Adults of most species have conspicuous, elongate, porrect labial palpi and a hood or cap of scales on the vertex of the head protruding over the frons (plates 4-6). Males of many species have a forewing costal fold and long antennal sensillae. Reference to a "well-developed costal fold" in text descriptions implies a fold that is comprised of a conspicuous cuticular flap along the costa of the forewing beneath which are differentiated scales. Several

genera have raised scales on the forewing of both sexes. Sexual dimorphism in forewing pattern and size may be subtle (e.g., *Coelostathma*, *Sparganothoides*) or dramatic (e.g., *Platynota*, *Synnoma*). Structural features of adult Sparganothini are described below.

Head: Compound eyes well developed, naked, with elongate scales around dorso-posterior margin. Ocellus well developed to greatly reduced or absent. Chaetosemata present. Frons with simple overhanging tuft of scales or highly modified in males, with a dense band of forward-projecting scales forming a horseshoe-shaped hood over lower frons (plate 3, figure 1); lower frons in some species weakly or partially scaled revealing the underlying membrane. Antenna of male ciliate, fasciculate to pectinate, with scaling in two bands (rarely one band) per flagellomere, usually with elongate sensory setae ½-3 times (or greater) the flagellomere diameter; setae short, unmodified in female. Labial palpus elongate, porrect, in some species sexually dimorphic; segment II 2-5 times horizontal diameter of compound eye, slightly expanded distally. Maxillary palpus minute or rudimentary.

Thorax: Dorsum without posterior crest; legs unmodified. Forewing (plate 1, figures 1–6; plate 2, figures 1–6) with or without raised scale tufts; costal fold in male present or absent; broad, length 2.4–2.6 times width; length of discal cell ½–5/8 times length of forewing; chorda always absent; M-stem (if present) usually between M₁ and M₂; R₃ separate from R₄; R₄ and R₅ almost always stalked to about the middle of their length, R₄ to costa, R₅ to termen; CuP variable from present, to weak at margin, to absent. Hindwing usually with cubital pecten in both sexes (sometimes reduced or absent); male without costal hair pencil but with one in anal fold (plate 2, figures 2, 4) well developed in *Cenopis* and many Platynota; all major veins present except humeral vein; CuP variable from present to vestigial; base of Rs lost; Sc+R and Rs often stalked; M2 and M3 approximate or separate at base. Frenulum with one acanthus in male, three in female (rarely asymmetrical, with two and three or three and four in female) (Monsalve et al. 2011).

Abdomen: Dorsal pits present or absent in both sexes, single (many *Amorbia* and *Coelostathma*) (plate 3, figures 4, 5) or paired (many *Spaganopseustis*) (plate 3, figure 6), on one or more of segments 2–9. No enlargement of segment VIII in

male; corethrogyne oviposition scaling absent in female. Male genitalia usually with long, extremely slender uncus, without ventral tuft of setae; socius usually large, flat, kidney bean shaped, extending dorsad beyond its point of attachment (i.e., the dorsal lobe of the socius extending beyond the top of the tegumen), with dense, elongate scaling, frequently with elongate, slender, lateral or subapical, secondary arm ending in free, usually setate, terminal process (previously interpreted as free distal arms of gnathos), sometimes enlarged distally (e.g., Sparganothoides); gnathos reduced or absent; transtilla a well-developed, lateral band, variable from finely dentate to densely spined; valva simple, large, subrectangular, rounded apically, pulvinus present, costa narrowly sclerotized or undifferentiated; sacculus variable, usually simple. Aedeagus pistol shaped or curved, usually without external spurs; vesica nearly always with dense bunch of deciduous cornuti, attached laterally to vesica near base of cornutus. Female genitalia with weakly sclerotized papillae anales, without differentiated "floricomous" setae; sterigma a finely scobinate flat pocket with a large cup-shaped ostium bursae; colliculum usually present as a narrow ring with narrow split mid-ventrally; ductus bursae narrow, usually well differentiated from corpus bursae; bulla seminalis frequently present from narrow ductus seminalis originating immediately anteriad of colliculum; corpus bursae globose; signum a straight or curved, well-sclerotized band or crease, infrequently an invaginated horn or absent altogether.

The presence of a pair of elongate, slender or distally clubbed processes from the base of the socii (hereafter referred to as secondary arms of the socii) may define a monophyletic group within Sparganothini (e.g., *Platynota, Sparganothis, Sparganothoides, Aesiocopa, Synnoma*, and *Sparganopseustis*). Although previously considered modified arms of the gnathos, Dugdale (c.f., Powell 1986) indicated that the processes are almost certainly accessory arms of the socii based on their point of origin (i.e., from the socius base sclerite rather than from the gnathos base sclerite). The presence of a rudimentary gnathos in some Sparganothini, not associated with the above process, provides additional evidence for this interpretation.

IMMATURE STAGES. Larvae and pupae of various species have been described and illustrated by

Fullaway (1911), Craighead (1950), MacKay (1962), Zimmerman (1978), and Sandberg and Passoa (1989). The descriptions below are composite, based on our reared specimens and published literature.

Eggs are flattened, scalelike, and elliptical in outline, ½-1½ mm in diameter. They are moderately convex or have a pronounced central convexity, slightly iridescent, and finely reticulated. Color of the eggs varies among genera; gray, green, or orange when first laid. Embryonic development proceeds without a quiescent period or diapause, except in *Synnoma*, whose eggs diapause through winter. Development to eclosion occurs in 9–18 days at ambient temperature.

Larvae of Sparganothini lack apomorphic characters to define the tribe; however, the larvae of most species are characterized by the widely separated SV setae on A9, which occurs rarely in other Tortricinae. Larvae have typical tortricine characters: a trisetose L-group on the prothorax; setae L2 and L1 on the same pinaculum and below the spiracle on A1-A8; tiny SD2 seta on same pinaculum as the large SD1 seta above the spiracle on A1-A7; seta SD1 anteriad or slightly dorsoanteriad of spiracle on A8; D2 setae on the same dorsal pinaculum on A9; seta SD1 and seta D2 on separate pinacula on A9; SV-group on A1, 2, 7, 8, 9 is 3:3:3:2:2; and distance between V setae on A9 usually greater (1.5-2.0 times) than on A8. In addition, the head has seta P1 closer to seta P2 than to seta Adf2, and the D and SD pinacula on meso- and metathorax usually are elongated posteriorly. Crochets are bi- to triordinal, and an anal fork is always present.

Pupae are usually typically tortricine, without an apical projection from the head or hooked process at cremaster (although in P. idaeusalis one pair of setae at the termination of the cremaster is modified into a pair of stout spinelike processes). The wings reach the anterior or middle portion of abdominal segment 4, and the spiracles are moderately small. Abdominal dorsal pits (for those species that possess them as adults) are conspicuously developed as broad, lateral grooves with a lobelike dorsal protuberance. There are two rows of spines dorsally on A2-A9; the posterior row is weaker but usually consists of more spines. The cremaster is well developed (plate 3, figures 10–12), rectangular or spoon shaped, and usually has four pairs of long, hooked setae.

TORTRICOIDEA

KEY TO SEPARATE SPARGANOTHINI AND ATTERIINI	7. A single mid-dorsal pit on A2 (rarely on A3 and/ or A4 as well) (plate 3, figure 4)
1. Male genitalia with gnathos well developed, arms joined distally (plate 20, figure 3); female with conspicuous corethrogyne scales on venter	 Paired (or coalesced) subdorsal dorsal pits on A2 (plate 3, figure 6)
of abdominal segments 7 and 8 Atteriini (page 142)	8. Forewing length less than 8.0 mm Coelostathma p. 37
2. Male genitalia with gnathos greatly reduced or absent (plate 7, figure 1); female lacking conspicuous corethrogyne scales on venter of abdominal segments 7 and 8 Sparganothini	— Forewing length greater than 10.0 mm
(page 27)	9. Forewing of male with costal fold; signum of female genitalia variable from a curved sclerotized band near junction of ductus and corpus bursae to absent
KEY TO GENERA OF SPARGANOTHINI	p. 115
 Raised scale tufts absent or weakly developed on forewing on fresh specimens	— Forewing of male without costal fold; signum a small hornlike sclerite near middle of corpus bursae)
forewing on fresh specimens	10. Head and palpi with long, shaggy black and white scaling (plate 4, figures 5, 6) Synnoma
2. Abdominal dorsal pits absent	p. 140 — Head and palpi without modified scaling 11
3. Male genitalia without secondary arms of socii (plate 7, figures 1–6); female genitalia with distinct notch at middle of anterior edge of sterigma (plate 21, figures 1–5) <i>Amorbia</i> (part)	11. Labial palpus > 4.0 times diameter of compound eye
p. 27 — Male genitalia with secondary arms of socii (plate 9, figures 1–6); female genitalia without distinct notch at middle of anterior edge of sterigma	12. Hindwing orange or orange brown Niasoma p. 143 — Hindwing gray brown Synalocha p. 144
4. Uncus bifurcate in apical two-thirds (plate 9,	р. 144
figure 1)	GENUS
p. 49 — Uncus not bifurcate apically (plate 9, figures 2– 6)	Amorbia Clemens
5. Secondary arms of socii with conspicuous clublike distal expansion (plate 8, figures 4–6)	Amorbia Clemens, 1860, Proceedings of the National Academy of Sciences, Philadelphia, 1860 : 352.
Sparganothoides p. 43	Type species: <i>Amorbia humerosana</i> Clemens, 1860, by original designation.
— Secondary arms of socii without clublike distal expansion	Amorbia was revised by Phillips-Rodriguez and
6. Male head with complex hood (plate 3, figure 1); hindwing with anal hairpencil Cenopis p. 92	Powell (2007) who treated 29 species; four occur in our area. The genus ranges from southern Canada to Brazil, reaching its greatest species richness in the
— Male head without complex hood; hindwing without hairpencil (except for distincta) Sparganothis	northern portion of the New World tropics. Three species were listed by Powell (1983b) in the <i>Check List of the Lepidoptera of America north of Mexico</i> ;

p. 51

now our fauna includes six species, which are nearly

allopatric. Adults of *Amorbia* are among the largest North American tortricid moths, usually with a diffuse or somber forewing pattern. All but one of our species (i.e., A. knudsoni) have a single middorsal pit on abdominal segment 2 (and sometimes on additional segments; visible in spread specimens and dissections), and males lack a forewing costal fold. Sexual dimorphism is slight to moderate: females average larger in forewing length; forewing pattern and color frequently are slightly different; and males possess elongate antennal sensillae. The common eastern species, Amorbia humerosana, historically was regarded as a minor pest of apple and pine (Riley 1886; Frost 1923, 1926). The widespread western species, Amorbia cuneana, is a minor pest of avocado in California (Busck 1929). Amorbia emigratella, the Mexican leafroller, is a minor pest of numerous ornamental, agricultural, and native plants in Hawaii (Busck 1910; Zimmerman 1978) and Mexico.

Amorbia can be distinguished from Platynota, Niasoma, Syllonoma, Synnoma, and Synalocha by the absence of raised scales on the forewing, the reduction or loss of ocelli, the separate origin of forewing veins R₄ and R₅ in the male (stalked in the other genera), and the absence of the accessory arms of the socii. Amorbia can be distinguished superficially from Coelostathma by its much larger size, and from Sparganothis by a number of characters, including the presence of dorsal pits and the absence of the accessory arms of the socii. Even in the New World tropics, most species of Amorbia can be distinguished from members of related genera (except Coelostathma) by the presence of a distinct rounded pit (or depression) on the mid-dorsum of abdominal segments 2, 3, or 4 (or on all three), although this feature is lost in at least two small clades of Neotropical Amorbia (Phillips-Rodriguez and Powell 2007). Although Coelostathma and Amorbia are extremely dissimilar superficially (e.g., forewing length, forewing pattern, etc.), the two genera share a variety of characters that suggest a close phylogenetic relationship: a single middorsal abdominal pit (on A2 and sometimes on other segments) (plate 3, figure 4); a large, curved, band-shaped signum; a distinctly U-shaped anterior edge of the sterigma; and the absence of secondary arms of the gnathos. Although interspecific differences in male and female genitalia of our species of Amorbia are not

as conspicuous as in many other tortricid genera, the species are somewhat distinct in forewing color and size, and in geographic distribution. It is possible that in one or more of our species, uniformity in genitalia may conceal cryptic species suggested by geographic variation in forewing pattern (e.g., *A. humerosana*) and/or attraction to different synthetic pheromones (e.g., *A. cuneana*).

Structural characters of the genus are as follows: antennal scaling in two bands per flagellomere, sensillae about 3.0 (or more) times the width of the flagellomere in the male, short in the female; scaling on frons simple, without complex hood; labial palpus of North American species porrect, length about 1.5 times horizontal diameter of compound eye (plate 4, figures 1, 2); ocellus minute or absent. Forewing length 7-14 mm; costal fold present or absent in the males (absent in our species); raised scales absent or weakly developed (e.g., A. humerosana); R₄ and R₅ stalked in basal 0.6 in females, separate in males (unique in the tribe) (plate 1, figures 5, 6). Hindwing with Rs and M₁ approximate at base, CuA₁ and M₃ connate, and M₂ and M₃ approximate at base; cubital hair pecten usually absent (but well developed in our species) in both sexes. Abdomen with a single middorsal pit on A2 (plate 3, figure 4) in all but A. knudsoni and frequently on other segments as well. Female lacking enlarged corethrogyne scaling. Male genitalia (plate 7, figures 1–6) with uncus long, slender; socius large, flat, ovate, lacking armlike distal extensions, with long densely spaced scales; gnathos extremely reduced or absent; transtilla a simple, narrow, dentate band; pulvinus well developed; valva large, subrectangular, simple, usually with tiny subapical notch at distal termination of costa; sacculus a sclerotized band restricted to basal 3/4 of valva. Aedeagus curved or pistol shaped; vesica with dense bundle of 15-20 short, deciduous cornuti. Female genitalia (plate 21, figures 1–6) with sterigma bilobed, with distinct U-shaped notch mesially at anterior edge; ductus bursae elongate, slender; corpus bursae roundoblong; signum a long, broad, curved band in posterior region of corpus bursae.

According to MacKay (1962), the larvae of *Amorbia* are identified by the following characters: V1 setae on A9 about twice as far apart as those on A8; dorsal and subdorsal pinacula on the mesothorax elongated posteriorly; all pinacula large;

spinules long and slender; anal shield strongly tapered posteriorly; anal setae extremely long, with L1 setae more than twice as long as anal segment; and D1 setae on anal shield closer to corresponding SD1 setae than to each other. Consistent throughout the genus, SV-group on A1,2,7,8,9 is 3:3:3:2:2; D2 setae on segment A8 are slightly closer together than D1 setae; D1 seta on segment A9 always on its own pinaculum; crochets triordinal; and anal fork always present and well developed. The head almost always bears a dark genal band that is contiguous with a similar band extending posteriad along the lower edge of the prothoracic shield. This distinctive pattern on the head and shield, together with the extremely elongate anal setae, usually serve to differentiate the larvae of Amorbia from all other sparganothines.

The pupae of our species (except *A. knudsoni*) have a large, conspicuous pit at mid-dorsum on A2–7. Each pit lies below a sclerotized, hourglass-shaped or bilobed process that appears to be species-specific in shape (plate 3, figures 7–9). Hence, the pupae of most *Amorbia* are easily distinguished from those of other North American tortricid genera.

KEY TO SPECIES OF AMORBIA

1.	Abdominal dorsal pit absent knudsoni
	p. 36
_	Abdominal dorsal pit present (plate 3, figure 4) 2
2.	Forewing ground color mostly gray, gray brown, or speckled gray, with some slightly raised, curled black scales (plate A, figures 16–20); basal one-fourth of antenna with distinct white dorsal scaling; southeastern Canada, eastern and midwestern United States, Texas to northern Florida
_	Forewing ground color mostly yellow, orange, or orange brown, no slightly raised, curled black scales; basal one-fourth of antenna with paleorange or orange-brown scaling; southwestern Canada and western United States, to Texas Florida
3.	Forewing length usually \leq than 9 mm in males and \leq 11 mm in females 4 Forewing length usually $>$ 10 mm in males and $>$ 12 mm in females

 4. Forewing orange or orange brown; southern Texas and Florida
5. West Coast of United States and Baja California, ranging eastward to Idaho cuneana (part) p. 29
— Mountains of southern Arizona (rarely in southern California) synneurana p. 31
6. Forewing orange brown with variably developed pattern, usually with short, darker brown patch from near midcosta; hindwing with conspicuous dark scaling in apical region (plate A, figures 21–24); Texas and rarely Arizona emigratella p. 34
— Forewing uniformly tan with minute gray spots in distal and costal areas; hindwing lacking conspicuous dark scaling in apical region (plate A, figures 25–26); Florida
Amorbia cuneana (Walsingham) PL. A, FIGS. 1–10 (adult); PL. 7, FIG. 1 (♂

Amorbia cuneana (Walsingham)
PL. A, FIGS. 1–10 (adult); PL. 7, FIG. 1 (♂gen.); PL. 21, FIG. 1 (♀ gen.); MAP 1 (RWH 3749).

Hendecastema cuneanum Walsingham, 1879, Illustrations of Typical Specimens of Lepidoptera Heterocera in the Collection of the British Museum, 4: 4.

Type locality: western slopes of Mount Shasta, California. [BMNH]

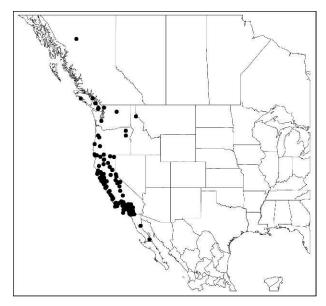
NOTE—The three male and one female syntypes are in The Natural History Museum.

Hendecastema cuneanum var. adumbrana Walsingham, 1879, Illustrations of Typical Specimens of Lepidoptera Heterocera in the Collection of the British Museum, 4: 5.

Type locality: western slopes of Mount Shasta, California. [BMNH]

NOTE—The single male and female syntypes are in The Natural History Museum.

Amorbia cuneana; Fernald, 1882, Transactions of the American Entomological Society 10: 19. COMBINATION.



MAP 1. DISTRIBUTION OF MATERIAL EXAMINED OF AMORBIA CUNEANA

Amorbia cuneana var. adumbrana; Fernald, 1882, Transactions of the American Entomological Society 10: 19. COMBINATION.

Amorbia cuneana adumbrana; Fernald in Dyar, 1902 [1903], Bulletin of the U.S. National Museum **52**: 485. SUBSPECIES.

Amorbia adumbrana (= cuneana); Powell, 1983b, Check List of the Lepidoptera of America north of Mexico: 41. Synonymy.

Amorbia essigana Busck, 1929, The Monthly Bulletin, Department of Agriculture, State of California, 18: 276.

Type locality: Chula Vista, San Diego County, California. [USNM]

NOTE—The holotype male was reared from avocado leaves on 8 December 1928 by R. McLean.

Amorbia essigana (= cuneana); Powell 1983b, Check List of the Lepidoptera of America north of Mexico: 41. Synonymy.

Amorbia cuneana is a large (forewing length 10.0–17.5 mm) and phenotypically variable species. In montane, northern, and inland populations, males typically have a tan forewing (length 10–14.5

mm) with a rust mark at mid costa and rust terminal fringe, whereas the female forewing (length 13.5–17.5 mm) usually is unicolorous rust to tan. In coastal populations in California, however, especially in urban areas, there are diverse color forms — males pale tan with typical rust pattern through shades of rust, to dark gray brown. These various ground colors may have numerous short transverse striae. Females are consistently rust orange to dark rust brown, often with obscure markings as in the male. The darker phenotype is more prevalent in the southern portion of its range, where it comprises 10-15% of populations. There are two pheromone "races" (e.g., Hoffman et al. 1983; Bailey et al. 1986; Bailey et al. 1988), one likely representing A. essigana Busck, which was described as a pest of avocado (Persea americana Miller, Lauraceae), but the taxonomy and nomenclature have not been established for the pheromone types. Although preliminary molecular data (COI) likewise suggest two distinct haplotypes, the geographic distribution of the different haplotypes is not concordant with the different pheromone types. In the absence of convincing genital characters to separate these forms, we provisionally treat them as a single species.

Male (plate 7, figure 1) and female (plate 21, figure 1) genitalia of *A. cuneana* are similar to those of other United States species in the genus; males have a slightly broader distal half of the valva, and the articulation of the base of the uncus with the dorsum of the tegumen is distinct. Because the species is nearly allopatric with its congeners, it can be identified reliably by locality alone. On the basis of its similar appearance and genitalia, Phillips-Rodriguez and Powell (2007) synonymized *A. synneurana* from Arizona with *A. cuneana*. However, the two are distinguishable on the basis of slight but consistent differences in genitalia, and freshly emerged specimens of the two differ in phenotype. Hence, we treat the two as distinct species.

The larvae of *A. cuneana* and its junior synonym, *A. essigana*, were described by MacKay (1962). The last instar is 22–25 mm in length. The head ranges from 1.8–2.3 mm in length and 2.1–2.9 mm in width; it is brownish yellow, with an area of dark pigment at the base of the antenna; the stemmatal area is blackish; and there is a lateral black, brown, or nearly obsolete genal bar. The

prothoracic shield is brownish yellow, bordered laterally by a narrow, dark-brown band; the thoracic legs are brown. The body is pale yellow or pale green, and the pinacula are pale or slightly darkened. The integumental spinules are long and slender, darker than the ground color. The arrangement of setae (i.e., chaetotaxy) is as described for the genus.

Eggs of A. cuneana are laid in imbricate clusters of 40-120 or more per patch, with successively fewer in later oviposition bouts. The larvae are polyphagous leaf-rollers usually feeding on evergreen trees and shrubs with broad, smooth leaves in both native and urban situations, including manzanita and madrone (Arctostaphylos and Arbutus, Ericaceae), Heteromeles, Pyracantha, Lyonothamnus, and Prunus (Rosaceae), in addition to avocado (Persea americana, Lauraceae), and rarely on conifers (Abies and Pseudotsuga, Pinaceae). Walsingham (1879) indicated that specimens were collected among thickets of manzanita (Arctostaphylos glauca Lindley), and we have reared A. cuneana from manzanita at the type locality, Mount Shasta. Busck (1929) reported A. essigana as a pest of avocados in southern California. Parasitoids of A. cuneana in California avocado orchards are discussed by Oatman et al. (1983) and Honda (2005).

A three-year blacklight survey (1995–1998) in coastal San Diego County, California, vielded adults of A. cuneana from every month of the year (although no single year yielded adults from all months), with a peak flight in May and June (J. Brown and Bash 2000). While these findings indicate that the species is multivoltine in the lowlands, it is likely that it is univoltine (e.g., June through September) at higher elevations (e.g., San Bernardino Mountains, Sierra Nevada, Mount Shasta). Records from the San Francisco Bay area (Berkeley) define two distinct broods per year with flights from late April to July and late August to November. Although the peak dates vary from year to year, there is a gap during July-September of 22-122 days (mean of 81).

Amorbia cuneana ranges along the West Coast of North America from British Columbia to southern California (map 1). It has been recorded as far east as Idaho. It is more frequently collected in urban areas than in areas dominated by native vegetation. In southern California A. cuneana

ranges from the coastal lowlands to about 2,500 m elevation in the San Bernardino Mountains. [Specimens examined: 248 &, 218 &, 25 slides]

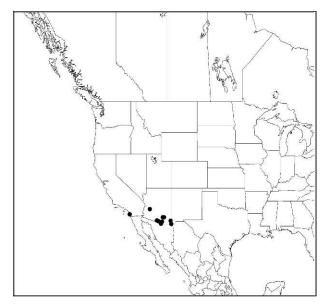
Amorbia synneurana Barnes and Busck PL. A, FIGS. 11–15 (adult); PL. 7, FIG. 2 (\eth gen.); PL. 21, FIG. 2 (\updownarrow gen.); MAP 2 (RWH 3750).

Amorbia synneurana Barnes and Busck, 1920, Contributions to the Natural History of the Lepidoptera of North America, 4: 211. Type locality: USA, Arizona, Redington. [USNM]

NOTE—The holotype is a female.

Adults of A. synneurana are rust to brownish tan when freshly emerged, fading to pale tan in flown individuals, not dark or bright rust as in A. cuneana. The outer costal mark in males is highly variable from distinct to indistinct. The forewing in females is pale rust brown on the basal half and tan from the mid-dorsal margin through the terminal area, interrupted by indistinct, dark-gray shades, similar to several Neotropical species, but not to A. cuneana. Females are more variable in forewing maculation than males and frequently have a more conspicuous pattern of red-brown streaks. The hindwing is whitish yellow. A. synneurana is slightly smaller (forewing length 8.0-14.0 mm; males average 8.6 mm and females 10.8 mm) than A. cuneana. A. synneurana is mostly allopatric with its congeners; it is known primarily from Arizona, but probably ranges south into northern Mexico. Phillips-Rodriguez and Powell (2007) treated A. synneurana as a synonym of A. cuneana; however, the genitalia of the two can be distinguished by subtle features described herein. In addition, limited molecular data (COI) indicate that the two are distinct (divergence of >4%). Hence, we treat them as separate species.

In the male genitalia (plate 7, figure 2) the transtilla is slightly less spiny and the valva slightly more rounded than in *A. cuneana* and *A. humerosana*. Although closest to those of *A. cuneana*, the male genitalia of *A. synneurana* can be distinguished from the latter by the more coalesced junction of the base of the uncus with the dorsum of the tegumen. The female genitalia of *A. synneurana* can be distinguished from those of *A. synneurana* can be distinguished from those of *A.*

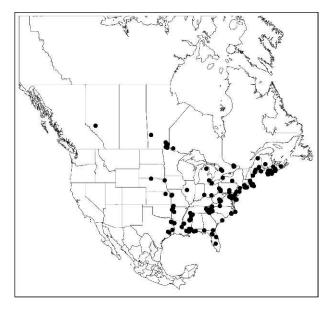


MAP 2. DISTRIBUTION OF MATERIAL EXAMINED OF AMORBIA SYNNEURANA

cuneana by subtle differences in the U-shaped notch at the middle of the sterigma (plate 21, figure 2): widened anteriorly in *A. cuneana* and slightly narrowed anteriorly in *A. synneurana*.

The life history of A. synneurana is incompletely known. We collected adults in the Baboquivari Mountains in August associated with hackberry (Celtis, Ulmaceae), Prosopis (Fabaceae), and other desert shrubs, and reared larvae on synthetic diet, which suggests they are polyphagous. Eggs deposited in early August produced adults in late September, and we obtained two generations without indication of diapause. The species appears to be double brooded, flying in April through May and again in August through October, typical of many Tortricinae in southeastern Arizona. In contrast to A. cuneana, which exhibits broad elevational adaptation, A. synneurana occurs primarily in the mountainous regions of southern Arizona, including the Baboquivari, Santa Rita, and Peloncillo mountains (map 2). We have collected it as low as 800 m in the Baboquivari Mountains. It has been collected rarely in coastal San Diego County, California. [Specimens examined: 41 \Im , 110 \Im , 7 slides]

Amorbia humerosana Clemens PL. A, FIGS. 16–20 (adult); PL. 1, FIGS. 5, 6 (venation); PL. 3, FIGS. 4, 7 (dorsal pits); PL.



MAP 3. DISTRIBUTION OF MATERIAL EXAMINED OF $AMORBIA\ HUMEROSANA$

4, FIGS. 1, 2 (palpi); PL. 7, FIG. 3 (♂ gen.), PL. 21, FIG. 3 (♀ gen.); MAP 3 (RWH 3748).

Amorbia humerosana Clemens, 1860, Proceedings of the National Academy of Sciences, Philadelphia, **1860**: 352.

Type locality: [Easton, Pennsylvania]. [ANSP]

NOTE—The lectotype female was designated by Darlington (1947: 100).

Amorbia humerosana is the largest tortricine in the eastern United States (forewing length 10.5–16.0 mm). The valva of the male genitalia are longer and relatively more attenuate apically than in other species of Amorbia (plate 7, figure 3). Although the genitalia are uniform over the broad geographic distribution, there is considerable phenotypic variation in forewing maculation within and between populations.

Whereas Amorbia humerosana is easily distinguished from other sparganothines in America north of Mexico by its size and gray coloration, the forewing pattern and hues of gray are variable. Most populations include some individuals having dark gray concentrated into a broad triangle along the costa extending into the distal portion of the cell. This pattern occurs in both sexes and varies from scarcely discernible to distinct and strongly contrasting with a pale ground, reminiscent of a

large *Acleris*. The expression of the costal triangle is most pronounced in Louisiana and Mississippi, where specimens with the triangle are more numerous in collections and distinct from the typical form, with few intermediates.

A distinctive population occurs at Conroe, Montgomery County, Texas, in which the moths are larger (forewing length in male 12.5-14.0 mm, mean 13.1 mm, n=10; female 14.5-16.0 mm, mean 14.2 mm, n=10) and darker gray than in other regions. Specimens are variably mottled but do not show a tendency toward a dark costal triangle (n=44 male, 14 female). Flight records are March and early April, spanning 1966-1969 (A. Blanchard); however, capture records may reflect sampling error.

Molecular analysis based on the mitochondrial gene COI indicate a high level of genetic similarity (i.e., divergence of less than 0.01) among a sample of 23 specimens from New Brunswick (n = 2), Quebec (n = 1), Ontario (n = 12), and Tennessee (n = 8).

Eggs are approximately ½ mm in diameter, apple green, and slightly pointed at one end. They are laid in a compact imbricate mass containing an average of 65 eggs and covered with a milky white colleterial secretion (Frost 1926).

Frost (1926), Craighead (1950), and Chapman and Lienk (1971) described the larva of A. humerosana, and it is likely that the larva described by MacKay (1962) as "near humerosana" represents A. humerosana as well. Chapman and Lienk (1971) provide a color illustration of the head and thorax. The last instar is about 25 mm in length. The head is light to dark brown or blackish with a darker genal bar and an adjacent white or cream band. The thoracic shield is pale brown with darker lateral margins; the thoracic legs are light brown; and the prothoracic pinacula are brownish. The body is light green, with large, conspicuous pinacula that are paler than the body color. The integumental spinules are long and slender, darker than the body color, making them easily observed. The anal shield is brown, and the anal fork is well developed. Crochets are biordinal to triordinal in a complete circle.

The pupa is 11–12 mm in length (Frost 1926, Chapman and Lienk 1971), chestnut brown, and distinctly tapered caudally. The spiracles are large and conspicuous, with six pairs visible. There are

two transverse rows of spines on A2–8, and a middorsal pit on A2–7 (plate 3, figure 4). The cremaster is well developed with 4 pairs of hooked setae, typical of most Tortricinae.

Oviposition occurs in May and June; eggs are laid on the upper surface of leaves. Larvae hatch in 11–18 days, depending on temperature (Chapman and Lienk 1971). First instars are very active, wriggling and descending on a silken thread when disturbed. The larval stage lasts 51–95 days (mean = 60 days), with larvae later in the year requiring longer developmental times. Captures of adults range primarily from April through July, but in Texas records are primarily from March with many fewer specimens from February and April; in Mississippi most records are from April and May. Although Chapman and Lienk (1971) indicate that it is univoltine throughout its range, it is possible that there is more than one brood in Florida.

The larvae are polyphagous leaf-rollers; the species has been referred to as the pine amorbia (Riley, 1886), the dusky leaf-roller (Frost 1926), and the white-lined leaf-roller (Chapman and Lienk 1971) in the agricultural literature. In 1918 the species was discovered on apple (Malus domestica Borkhausen, Rosaceae) (Frost 1926), and subsequently became a pest of that crop. Other hosts include conifers, i.e., balsam fir (Abies balsamea (Linnaeus) Miller, Pinaceae) and spruce (Picea sp., Pinaceae), and numerous families of dicotyledonous plants: Asteraceae (goldenrod, Solidago sp.), Betulaceae (alder, Alnus sp.; birch, Betula sp.), Caprifoliaceae (arrow-wood, Viburnum dentatum Linnaeus), Ericaceae (sourwood, Oxydendrum arboreum (Linnaeus) de Candolle, Fagaceae (chestnut, Castanea dentata (Marshall) Borkhausen), and Salicaceae (willow, Salix sp.; poplar, Populus sp.) (Craighead 1950, MacKay 1962). Frost (1926) lists sumac (Rhus sp., Anacardiaceae), poison-ivy (Toxicodendron pubescens Miller, Anacardiaceae), huckleberry (Gaylussacia sp., Ericaceae), spice-bush (Lindera benzoin (Linnaeus) Blume, Lauraceae), and pine (Pinus sp., Pinaceae). In a report of the Canadian Forest Insect Survey, Prentice (1966) reported 23 different hosts, of which the five most common were conifers: white spruce (Picea glauca (Moench) Voss), jack pine (Pinus banksiana Lambert), red spruce (Picea rubens Sargent), balsam fir (Abies

balsamea (Linnaeus) Miller), and tamarack (Larix laricina (Du Roi) K. Koch).

Amorbia humerosana ranges from Nova Scotia across southern Canada to Alberta and according to Prentice (1966) to southern British Columbia; throughout northeastern and eastern United States; south to Florida; and west to Texas (map 3). There are no records west of Michigan in the northern United States, even though the Canadian Forest Insect Survey reported humerosana near the United States border from Manitoba to British Columbia. As for *A. cuneana*, this species is encountered in urban areas as well as native situations. [Specimens examined: 255 3, 325 4, 12 slides]

Amorbia emigratella Busck

PL. A, FIGS. 21–24 (adult); PL. 3, FIG. 8 (pupal pits); PL. 7, FIG. 4 (δ gen.); PL. 21, FIG. 4 (Υ gen.); MAP 4

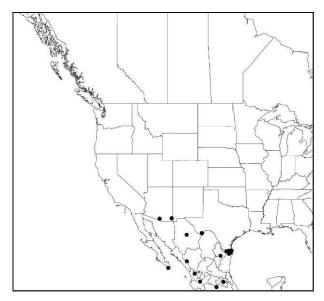
Amorbia emigratella Busck, 1910, Proceedings of the Entomological Society of Washington, 11: 201.

Type locality: Hawaiian Islands, Oahu, Tantalus. [USNM]

NOTE—Busck (1910) did not indicate how many specimens he examined. A male labelled "co-type" in the USNM collection is here designated LECTOTYPE to ensure stability of the name.

NOTE—Although described from Hawaii (Mt. Tantalus and Mikiki in Honolulu), *A. emigratella* is native to Mexico and Central America. It was first discovered in Hawaii at Honolulu in 1902 by R. C. L. Perkins, who found it to be common on orange trees (Zimmerman 1978). In his description of *A. emigratella*, Busck (1910) indicated that the species had long been known from Mexico, and undoubtedly was introduced inadvertently into Hawaii from there. Nonetheless, he included only specimens from Hawaii in his description, disregarding specimens from Mexico, which resulted in a type locality of Hawaii, where the insect is not native.

Adults of *Amorbia emigratella* from America north of Mexico are considerably smaller (forewing length 8.0–9.0 mm, mean = 8.3 mm in males; 10.0–12.0 mm, mean = 10.6 mm in females) than those of *A. cuneana*, *A. humerosana*, *A. synneurana*, and *A. vero*. However, specimens from Hawaii are as large or larger (especially females) than other *Amorbia*. The species can be distinguished super-



MAP 4. DISTRIBUTION OF MATERIAL EXAMINED OF AMORBIA EMIGRATELLA

ficially from most other *Amorbia* in the United States by the somber orange-tan forewing.

In the male genitalia (plate 7, figure 4) the basal expansion of the uncus is less pronounced than in *A. cuneana*, and the valva is shorter than in *humerosana*. The female genitalia (plate 21, figure 4) are similar to those of other *Amorbia*, with the mesial U-shaped notch of the sterigma slightly narrowed anteriorly. In the United States, this species has been recorded primarily in southern Texas, where it appears to be resident.

The larva of A. emigratella was described by MacKay (1962). The last instar is about 25 mm in length. The head ranges 1.6-1.8 mm in length and 2.0-2.1 mm in width; it is brownish yellow, with a dark genal bar and a dark stemmatal area. The prothoracic shield is yellowish, bordered laterally by a narrow, dark band; the D and SD pinacula of T2 and T3 are slightly elongated posteriorly; and the thoracic legs are yellowish or brownish. The body color is green, with moderately large pinacula that are concolorous with the body. The integumental spinules are slender, concolorous with the ground color, but easily observed. The chaetotaxy is as described for the genus. In three pupal exuviae examined, mid-dorsal pits are conspicuous on segments A2–8 (plate 3, figure 8).

Amorbia emigratella is known as the Mexican leafroller. According to specimen label data

(USNM), in southern Texas it has been reared from carrot (Daucus carota subs. ativus (Hoffman) Arcangeli, Apiaceae), goldenrod (Solidago sp., Asteraceae), cotton (Gossypium sp., Malvaceae), Rio Grande ash (Fraxinus velutina Torrey, Oleaceae), dock (Rumex sp., Polygonaceae), blackberry (Rubus sp.; Rosaceae), lantana (Lantana camara Linnaeus; Verbenaceae), lippia (Lippia alba (Miller) N. E. Br. ex Britton & P. Wilson, Verbenaceae). Zimmerman (1978) reports the following hosts for this species in the Hawaiian Islands: Brassica oleracea Linnaeus (broccoli) (Brassicaceae), Carica papaya Linnaeus (papaya) (Caricaceae), Bassaia sp. (Chenopodiaceae), *Ipomoea batatas* (Linnaeus) (Lamarck) (sweet potato) (Convolvulaceae), Acacia koaia Hillebr., Arachis hypogaea Linnaeus (peanut), Chamaecrista leschenaultiana (de Candolle) O. Degener, Gliciridia sepium (Jacquin) Kunth, *Ulex europaeus* Linnaeus (gorse), *Sophora* sp., Phaseolus spp. (garden beans) (all Fabaceae), Persea americana Miller (avocado) (Lauraceae), Dracaena sp. (Liliaceae), Gossypium sp. (cotton) (Malvaceae), *Psidium guajava* Linnaeus) (guava) (Myrtaceae), Phaius sp. (Orchidaceae), Passiflora sp. (Passifloraceae), Zea mays Linnaeus (corn) (Poaceae), Macadamia sp. (Proteaceae), Rosa sp., Rubus spp. (blackberry), Rubus hawaiiensis A. Gray (all Rosaceae), Gardenia sp. (Rubiaceae), Citrus sinensis (Linnaeus) Osbeck (orange) (Rutaceae), Dodonaea viscosa Jacquin. (Sapindaceae), Lycopersicon esculentum Miller (tomato), Solanum melongena Linnaeus (eggplant), Solanum tuberosum Linnaeus (potato) (all Solanaceae), Theobroma cacao Linnaeus (cocoa) (Sterculiaceae), Wikstroemia foetida (Linnaeus) A. Gray (Thymelaeaceae), Pipturus sp. (Urticaceae), and other plants. We have seen recent records of the species on tea (Camellia sinensis (Linnaeus) Kuntze, Theaceae) from Hawaii. In Hawaii the larvae infest not only ornamental and crop plants, but may inflict considerable damage to native species in mountain forests as well (Zimmerman 1978).

Fullaway (1911) described the early stages based on observations of this species on the Hawaiian Islands. Eggs are deposited in typical imbricate patches of 65–120 eggs usually on the upper surface of leaves of the host plant. The eggs are greenish and covered with a whitish colleterial secretion that extends beyond the egg patch. Eggs are flat, elliptical, about 1 mm long, slightly

iridescent, and finely reticulated. The egg stage lasts about ten days. Larvae roll the edges of leaves (especially young growth) or web together adjacent leaves. Fruit also is damaged if the rolled leaf is near or in contact with it. Larval feeding disfigures, injures, or even defoliates the host plants. In Hawaii, larvae complete development in 28–35 days. Pupation takes place within the folded leaf on the host plant and lasts about 10 days (Fullaway 1911, Zimmerman 1978).

Zimmerman (1978) listed parasitoids and predators of A. emigratella in Hawaii: Bracon omiodivorum (Terry) (Braconidae), Brachymeria obscurata (Walker) (Chalcididae), Echthromorpha agrestoria fuscator (Fabricius) (Ichneumonidae), Ephialtes hawaiiensis (Cameron) (Ichneumonidae), and Trichogramma minutum Riley (Trichogrammatidae). Predators include Argentine ant (Iridomyrmex humilis Mayr) (Formicidae), Odynerus rudolphi Perkins (Vespidae), Pachodynerus nasidens (Latreille) (Vespidae), Pheidole megacephala (Fabricius) (Formicidae), and Xiphidiopsis lita Hebard (Tettigoniidae).

Amorbia emigratella may fly throughout the year in Texas, but records are absent from January and September, and are few from February and June.

Amorbia emigratella ranges from southern Texas, where it has been collected infrequently, to Costa Rica (Phillips-Rodriguez and Powell 2007); there are three records from the mountains of southern Arizona. It is recorded from most states in eastern and western Mexico. It is adventive in the Hawaiian Islands. [Specimens examined: 59 δ , 46 \circ , 10 slides]

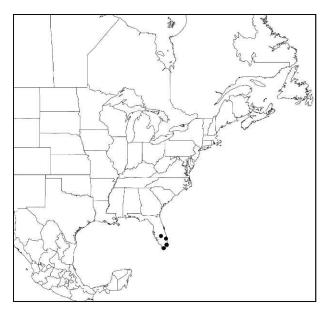
Amorbia vero Powell and J. Brown, NEW SPECIES

PL. A, FIGS. 25, 26 (adult); PL. 3, FIG. 9 (pupal pits); PL. 7, FIG. 5 (δ gen.); PL. 21, FIG. 5 (Υ gen.); MAP 5

Amorbia vero Powell and J. Brown. Type locality: Florida, Indian River County, Vero Beach. [USNM]

NOTE—The specific epithet is derived from the type locality of Vero Beach, Florida.

The short series of A. vero (n = 7) is remarkably uniform in facies compared with other species in the genus. The nearly tan forewing with minute



MAP 5. DISTRIBUTION OF MATERIAL EXAMINED OF $AMORBIA\ VERO$

steel-gray dots is unique among our Amorbia species. The small, subbasal flange near the base of the uncus is unique to this species. It is possible that A. vero is a Caribbean species reaching its northernmost distribution in southern Florida, but we have not seen additional material of it from the Caribbean. Phillips-Rodriguez and Powell (2007) included these specimens under A. emigratella, which they resemble superficially and in male genitalia. The single known pupa of A. vero is easily distinguished from that of A. emigratella (three specimens examined, plus illustration by Zimmerman, 1978) by the digitate anterior process of the first abdominal dorsal pit compared with the evenly curved bandlike process of the pit in A. emigratella (plate 3, figures 7–9).

Description. Male. Head: Frons with sparse, smooth scaling below mideye, white; roughened above forming tan-brown hood; labial palpus short, about 1.5 times diameter of compound eye, pale yellow mesially, tan brown laterally; antennal scaling tan brown, sensillae about 3 times width of flagellomere. Thorax: Tan brown, some scales tipped with white. Forewing length 10.5-12.0 mm (mean = 11.1 mm; n = 4); forewing tan with minute steel-gray spots in costal and distal portions. Hindwing whitish; apex with small blotch of light brown. Abdomen: Tan brown. Genitalia (plate 7, figure 5) with uncus slender, curved; basal

portion expanded; small flange subbasally extending posteriad from near base of uncus; socius unmodified; transtilla a weakly undulate, spiny band, spines weakest or absent mesially; valva slightly longer than in other species, costa slightly arched, sacculus undulate ventrally, well defined, confined to basal ½ of valva, with short, free, triangular distal process. Aedeagus curved; vesica with 15–20 short, slender cornuti.

Female. Head and thorax: Essentially as described for male. Abdomen: Genitalia (plate 21, figure 5) with papillae anales unmodified; sterigma with a pair of deep, lateral, rounded pockets surrounding U-shaped notch at middle; ductus bursae ca 1.8 times length of papillae anales; corpus bursae rounded, diameter about equal to length of ductus bursae, signum a large, broad, rounded band that is slightly narrower than in other species.

TYPES. Holotype: 3. Vero Beach, [7 m], [27.638°N, 80.398°W], [Indian River Co.], Florida; 15 Oct–15 November 1940; J. R. Malloch. USNM. Paratypes: 3 3 4 4 4 Florida. Same locality as for holotype; 15 October–15 November 1940, April 1941; J. R. Malloch (3 3). Homestead, Dade Co.; 23 July 1958; D. O. Wolfenbarger (1 3). Miami, Dade Co.; [no date]; on flowers of avocado [no collector] (3 3). Port Sewall, Martin Co.; 28–31 March 1949; [no collector] (1 3). Archbold Biol. Station, Highlands Co.; 24 January 1967; S. W. Frost (1 4). Near Lake Placid, Archbold Biol. Station, Highlands Co.; 5 June 1986 (JAP86F15); J. Powell (1 4). AMNH, EME, USNM.

Three specimens were reared from flowers of avocado in Miami, Florida; beyond that, nothing is known of the life history. Adults have been collected in April, October, and November.

This species is known only from Florida (map 5). [Specimens examined: $9 \, \delta$, $2 \, 9$, $6 \, \text{slides}$]

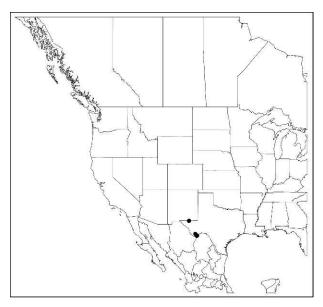
Amorbia knudsoni Phillips-Rodriguez and Powell

PL. A, FIGS. 27, 28 (adult); PL. 7, FIG. 6 (δ gen.); PL. 21, FIG. 6 (Υ gen.); MAP 6

Amorbia knudsoni Phillips-Rodriguez and Powell, 2007, *Zootaxa*, **1670**: 28.

Type locality: USA, Texas, Brewster Co., Big Bend National Park, Green Gulch, 5,400'. [USNM]

NOTE—The species was named in honor of E. C. Knudson who collected much of the type series in western Texas.



MAP 6. DISTRIBUTION OF MATERIAL EXAMINED OF AMORBIA KNUDSONI

Amorbia knudsoni is most similar to the Neotropical species A. laterculana (Zeller) (Phillips-Rodriguez and Powell 2007). A. knudsoni can be distinguished from all other North American Amorbia by the absence of the abdominal dorsal pit. The male genitalia are distinguished by the presence of "struts" of the socii (sensu Phillips-Rodriguez and Powell 2007), the deep subterminal excavation of the sacculus, and the absence of external spines on the aedeagus (Phillips-Rodriguez and Powell 2007). Female genitalia are distinguished by the large, triangular, sublateral pockets of the sterigma.

Forewing length is 12.0-14.5 mm (mean = 13.5mm; n = 10); the ground color is pale yellow with basal, median, and postbasal fascia of variable intensities of light brown. In the male genitalia (plate 7, figure 6) the uncus is slender and curved; the basal portion is expanded; and struts of the socii are present. The transtilla is weakly undulate and spiny, with the spines weakest mesially. The valvae are as in other species, with the costa slightly arched. However, the sacculus is more undulate ventrally, with a deep rounded subterminal excavation and a short, free, triangular distal process. The aedeagus is curved, and the vesica has 15-20 short, slender cornuti. In the female genitalia (plate 21, figure 6) the ostium bursae is not sclerotized, and the sterigma has a pair of deep, subtriangular lateral pockets. The signum is a large, curved band near the junction of the corpus bursae and the ductus bursae, typical of the genus.

Nothing is known of the biology of *A. knudsoni*. Adults have been collected from May to August. This species is known only from the Chisos and Guadalupe mountains of west Texas at elevations of 1,700-1,900 m (map 6). [Specimens examined: 9 3,59,4 slides]

GENUS

Ceolostathma Clemens

Coelostathma Clemens, 1860, Proceedings of the National Academy of Sciences, Philadelphia, **1860**: 355.

Type species: Coelostathma discopunctana Clemens, 1860, by original designation and monotypy.

Coelostathma comprises 12 described species (one newly described here) distributed from eastern Canada and United States through the Caribbean and Central America to Brazil (Powell et al. 1995). Seven of them are unambiguously assigned to Coelostathma, and five were assigned provisionally (i.e., as "Coelostathma") to the genus by Landry and Powell (2001). There are many additional undescribed species in collections from the Caribbean and Central and South America (Venezuela, Ecuador, Argentina). Two species occur in America north of Mexico: C. discopunctana Clemens and C. placidana, new species.

Adults of Coelostathma are among the smallest in the tribe. They are characterized by a whitish to fawn-brown forewing with a simple pattern of one or two darker fasciae and usually with a small dark dot at the apex of the discal cell. Coelostathma are distinguished superficially from all other North American sparganothine genera by their small size, the absence of raised scales, and a falcate forewing apex. They share several characters with Amorbia: the presence of a mid-dorsal pit on segment AII in both sexes (J. Brown and Miller 1999), the absence of secondary arms of the socii, and signum when present is a curved band. Our United States species of Coelostathma are similar to Sparganothoides lentiginosana in forewing maculation and size; the three species co-

occur in the southeastern United States. However, *Coelostathma* can be distinguished from *Sparga-nothoides* superficially by the absence of a costal fold in the male and the presence of an abdominal dorsal pit in both sexes. The genitalia are not similar between the two genera. Landry and Powell (2001) suggest that *Coelostathma* is the sister-group to *Sparganothina*; however, they were unable to determine whether either genus as currently defined is monophyletic. Species of "*Coelostathma*" (sensu Landry and Powell 2001) all lack the dorsal pit; however, both United States species possess a pit.

Structural characters of the genus are as follows: antennal scaling in two bands per flagellomere, length of antennal sensillae about 2.5 times width of flagellomere in male, short, unmodified in female; scaling on frons simple, without complex hood; labial palpus upturned, length about 1.5 times horizontal diameter of compound eye, with minimal dimorphism (plate 4: figures 3, 4); ocellus moderate to large; proboscis functional; forewing length 6-11 mm (plate 2, figure 1); apex falcate; costal fold absent in male; raised scales absent; R₄ and R₅ stalked in basal 3/3, with common base stalked with R₃ in basal ½ (unique in the tribe). Hindwing with Rs and M_1 stalked in basal $\frac{1}{3}$. (shared with Sparganothina), M2 and M3 separate at base, and CuA₁ originating along cell about 3/3 distance from basal origin of CuA₂ to base of M₃ (unique in the tribe); cubital hair pecten absent in both sexes. Abdomen usually with mid-dorsal pit at anterior edge of A2 (plate 3, figure 5) in both sexes (present in our two species); female lacking enlarged corethrogyne scaling. Male genitalia with uncus slender, simple to slightly hooked; socius large, flat, triangular to subquadrate; gnathos absent; transtilla a simple and narrow centrally spined band; valva short, somewhat rounded, with attenuate apex; sacculus usually slender, well defined. Aedeagus curved to straight; vesica with patch of 12-20 slender cornuti. Female genitalia with sterigma bilobed or with U-shaped mesial notch on anterior edge; ductus bursae moderately long, slender, well differentiated from corpus bursae; corpus bursae oblong; signum a long band, variable from strongly curved to nearly straight (rarely absent). Sexual dimorphism slight, restricted to subtle differences in forewing color and pattern, forewing length (females average slightly larger in some species), and antennal sensillae length (longer in males).

Larvae of Coelostathma have not been reported previously. The following description is based on larvae reared from eggs deposited by a female C. discopunctana in Fairfax, Virginia. General: Last instar 12–14 mm in length, semi-translucent pale gray green, densely covered with fine spinules, which are absent from pinacula; pinacula moderately small; chaetotaxy typically tortricine, with trisetose L-group on prothorax; setae L1 and L2 on shared pinaculum below spiracle on A1-8; D2 setae on shared dorsal pinaculum on A9; and seta D1 and SD1 on widely separate pinacula on A9. Head with dark genal bar and dark stemmatal patch. Prothorax with L pinaculum longitudinally elongate, rectangular, strongly sclerotized; shield with weak, broad, irregularly triangular patch near lateral edge; spiracle large, round. Meso- and metathorax with dorsal pinacula expanded posteriorly. Abdominal segments 1–7 with small rounded spiracles; A8 with large oval spiracle, about three times as large as other spiracles, with SD1 seta slightly dorsoanterior of spiracle on large pinaculum; SV on segments 1, 2-6, 7, 8, 9 is 3:3:3:2:2; V setae on A9 2.5-3.0 times as far apart as V setae on A8 and about 2.0 times as far apart as those on A7. Anal shield triangular with patch of small brown dots near anterior edge; anal setae extremely long, with L1 setae about twice as long as anal segment; anal fork well developed with 7–8 tines.

KEY TO SPECIES OF COELOSTATHMA

- Male and female forewing pale tan or whitish, usually with diffuse brown blotch near middle of dorsal margin, frequently with faint brownish specklike striae throughout; female genitalia lacking signum (plate 22, figure 1) placidana p. 40
- Male forewing pale tan or whitish, usually with a broad, variably developed transverse fascia; female forewing usually light brown throughout, with fascia represented by darker brown scaling; female genitalia with large curved, bandlike signum (plate 22, figure 2) discopunctana p. 38

Coelostathama discopunctana Clemens, 1860 PL. A, FIGS. 29–31 (adult); PL. 2, FIG. 1 (venation); PL. 3, FIG. 5 (dorsal abdominal

pit); Pl. 4, FIGS. 3, 4 (labial palpus); Pl. 8, FIG. 1 (♂ gen.); Pl. 22, FIG. 1 (♀ gen.); MAP 7 (RWH 3747).

Coelostathma discopunctana Clemens 1860, Proceedings of the National Academy of Sciences, Philadelphia, **1860**: 355.

Type locality: USA [Pennsylvania?]. [ANSP] NOTE—The lectotype male was designated by Darlington (1947: 100).

Tortrix discopunctana Robinson, 1869, Transactions of the American Entomological Society 2: 276. COMBINATION.

Amphisa discopunctana Fernald, 1882, Transactions of the American Entomological Society 10: 19. COMBINATION.

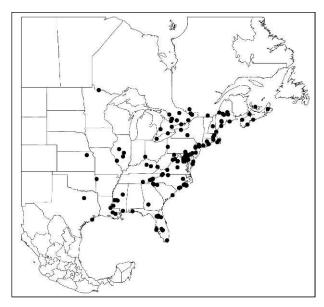
Coelostathma discopunctana; Fernald in Dyar, 1902 [1903], Bulletin of the U.S. National Museum **52**: 477. COMBINATION.

Coelostathma discipunctana Walsingham 1913–1914, Biologia Centrali-Americana, Insecta, Lepidoptera-Heterocera, Vol. IV, Tineina, Pterophorina, Orneodina, and Pyralidina and Hepialina (part): 209.

NOTE—Coelostathma discipunctana is an unjustified emendation.

Coelostathma discopunctana is a small, fawn-colored species with a falcate forewing apex. Males have a tan-brown median fascia and a small brown dot near the apex of the discal cell. Females are more variable in forewing maculation, with the ground color tan to pale red brown, frequently obscuring the pattern elements. Females have a slightly greater forewing length (6.9–7.4 mm vs. 6.5–6.8 mm in males) and lack the elongate antennal sensillae of males. Coelostathma discopunctana can be distinguished from C. placidana by the external characters described in the key and by genital characters illustrated in plate 8, figure 1 and plate 22, figure 1.

In the male genitalia (plate 8, figure 1) the uncus is extremely long, slender, and curved from a broadened base. The socii and gnathos are unmodified. The transtilla is a slender, uniform,



MAP 7. DISTRIBUTION OF MATERIAL EXAMINED OF COELOSTATHMA DISCOPUNCTANA

spiny band. The valvae are obovate with a distinctly acute apex; the costa is differentiated by sclerotization; and the sacculus is well defined, extending about ½ the distance from the base to the apex of the valva, becoming free and slender and tapering to a point. The aedeagus is curved, and the vesica has 15–20 short, slender cornuti. In the female genitalia (plate 22, figure 1) the sterigma is weakly bilobed; the ductus bursae is slender, with a sclerotized region just anteriad of the antrum; and the corpus bursae is irregularly rounded, with the signum in the form of a broad, curved band in the caudal region of the corpus bursae.

Fernald (1882) cited "clover" (presumably Trifolium, Fabaceae) as the food plant of C. discopunctana. Specimen label data and unpublished notes by Busck (USNM) indicate the species feeds on various herbs: *Impatiens* sp. (Balsaminaceae), clover (Trifolium sp., Fabaceae), orchid (Habenaria sp.; Orchidaceae), and strawberry (Fragaria x ananasa, Duchesne ex Rosnier, Rosaceae). A female captured in late September in Fairfax, Virginia, deposited patches of 20, 18, 7, 6, 5, and 4 eggs over a one-week period. The patches were round and covered with an inconspicuous, nearly clear colleterial secretion that extended slightly beyond the egg patch. Larvae hatched in 6-7 days and developed slowly on Fragaria sp. (Rosaceae) indoors. Early instars are translucent

pale tan, later instars are pale gray green, with small, blackish pinacula that contrast with the ground color. The head is amber with a distinctive genal bar and a dark stemmatal patch. Typical of most sparganothines, larvae construct an open silken chamber on the host, incorporating leaves. The first pupa was present by mid-November (45–50 days following oviposition), and the other larvae (n = 5) pupated by early December (65–70 days following oviposition). Owing to the paucity of acceptable larval food plant material in December, it is unlikely that larvae are able to continue developing in the wild. Hence, a winter quiescent period is likely.

Capture dates for adults range from late February to late September, with the majority of specimens taken from May through August; earlier records are from the extreme southern portion of its range. Although more often recorded in undisturbed habitats, *C. discopunctana* also occurs in urban areas. Collection records from year-round sampling at specific locations (e.g., Great Smoky Mountains National Park, Tennessee; Plummers Island, Maryland; and Fairfax, Virginia) indicate two (or more) broods with a peak in May and early June and a second peak in late July and August.

Coelostathma discopunctana is recorded from Nova Scotia, Quebec, and Ontario, south through the eastern United States to Florida, and west to Minnesota, Kansas, and Texas (map 7). [Specimens examined: $250 \, \delta$, $152 \, \circ$, $12 \, \circ$ slides]

Coelostathma placidana Powell and J. Brown, NEW SPECIES

PL. A, FIGS. 32–33 (adult); PL. 8, FIG. 2 (3 gen.); PL. 22, FIG. 2 (% gen.); MAP 8

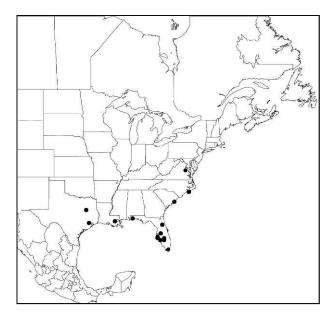
Coelostathma placidana Powell and J. Brown.

Type locality: Pensacola, [Escambia County], Florida. [USNM]

NOTE—The specific epithet refers to the collecting site of Lake Placid.

Coelostathma sp.: Kimball, 1965, Arthropods of Florida and Neighboring States, The Lepidoptera of Florida, volume 1: 264.

Coelostathma placidana can be distinguished from other species in the genus by its more



MAP 8. DISTRIBUTION OF MATERIAL EXAMINED OF $COELOSTATHMA\ PLACIDANA$

complex sacculus which includes a slender, elongate subbasal secondary process, and the absence of a signum in the female genitalia. It usually can be distinguished superficially from *C. discopunctana* by the presence of an irregular brownish blotch near the lower middle of the forewing in both sexes (weak or absent in some specimens).

Description. Male. Head: Frons with sparse, smooth scaling below mideye, pale yellow, roughened above, white; labial palpus short, about 1.5 times diameter of compound eye, white mesially, white and brown laterally; antennal scaling tan, sensillae about 2.5 times width of flagellomere. Thorax: Beige. Forewing length 5.7–6.5 mm (mean = 6.1 mm; n = 8) in males, 5.5–6.5 mm (mean = 5.9 mm; n = 9) in females; forewing pale beige or whitish, with striae of fine brownish specks; a small, ill-defined, brown blotch between discal cell and dorsal margin about 3/5 distance from base to apex. Hindwing white. Abdomen: Dorsum tan; venter white. Genitalia (plate 8, figure 2) with uncus slender, shorter than that of C. discopunctana; transtilla without spine; socius and gnathos as described for genus; valva obovate, costa differentiated, sacculus well defined, extending about 1/3 distance to apex of valva, with a free, digitate, subbasal process extending across face of valva. Aedeagus weakly curved; vesica with 15-20 short, slender cornuti.

Female. Head and thorax: Essentially as described for male, except antennal sensillae shorter, sparser. Abdomen: Genitalia (plate 22, figure 2) with sterigma weakly bilobed; ductus bursae slender, with sclerotized region just anteriad of antrum; corpus bursae irregularly round obovate; signum lacking.

TYPES. Holotype: &. Pensacola, [Escambia Co.], Florida; 26 January 1962; Shirley Hills. USNM. Paratypes: 32 ♂, 29 ♀. Florida. Punta Gorda, [Charlotte Co.]; 5 March 1956; H. Ramstadt (1 ♂). Royal Palm St. Park, Collier Co.; 18 March 1939; J. Bradley (3 ♂). Fisheating Creek, Palmdale, Glades Co.; 7–10 May 1964; R. Hodges (4 ♀). Lake Placid, Archbold Biological Station, Highlands Co.; 27, 29 March 1959, 4-5 April 1959, 8-15 May 1964, 16-22 May 1964; R. Hodges (6 ♀). Same locality; 9 January 1945; C. Remington (1 ♀). Same locality; 6 March 1945, 27 April 1947; J. Needham (3 ♀). Same locality; 6–7 June 1986; J. Powell (2 ♀). Parker Is[land], Highlands Co.; 26–29 May 1964; R. Hodges (1 ♀). Torreya State Park, Liberty Co.; 29 May 1952; O. Peck and J. McGillis (4 ♂). Same locality; 1 April 1952, 3 April 1952, 1 May 1952; G. Walley (2 ♂, 1 ♀). Oneco, Manatee Co.; May 1953, April 1954, May 1954; P. Dillman (8 δ , 1 \circ). Same locality; 27–31 March 1954; J. G. Franclemont (2 ♀). Paradise Key, Everglades Natl. Park, Miami-Dade Co.; 3 April 1952; G. Walley (1 ♀). St. Petersburg, [Pinellas Co.]; no date; no collector (1 ♂). Lake Alfred, [Polk Co.]; 7 July 1928; [designated type of "Coelostathma laurenceana" (a manuscript name) A. Busck, 1929]; L. Bottimer (1 &). Same locality; 5 August 1928; ["Cotype"], L. Bottimer (1 ♀). Siesta Key, Sarasota Co.; 31 January 1951, 26 April 1956, 14 May 1956; C. Kimball (2) δ , 1 \circ). Lakeland, [Polk Co.]; 13 January; G. Ainslie (1 \circ). Blue Springs St. Park, Volusia Co.; 12 June 1986; J. Heppner and Powell, JAP86F45 (1 ♀ for eggs). Same locality; emerged 5 and 10 August 1986; J. Powell (1 ♂, 1 ♀); reared on synthetic diet. Louisiana. Baton Rouge, East Baton Rouge Parish; 23 May 1970, 31 January 1971, 26 February 1972; G. Strickland (3 ♂, 1 ♀). Edgard, St. John Parish; 29 March 1976, 14 May 1981; V. Brou (2 &). North Carolina. North Harlowe, Craven Co.; 31 March 1980; J. B. Sullivan (1 &). South Carolina. McClellanville, [Charleston Co.]; 3 March 1971, 18 April 1974, 24 May 1972; R. Dominick and C. Edwards (3 ♂). Same locality; 1 May 1981; R. Hodges (1 ♀). Texas. Engeling WMA (wildlife management area). Tennessee Colony. Anderson Co.: 25 April 1982; E. Knudson (1 &). Houston, Harris Co.; 4 February 1967; A. and M. Blanchard (1 ♂). Virginia. Fort A.P. Hill, Jordon Crossing Pond, Caroline Co. 38°08.9'N, 77°22.5′W; 26 May 2009; O. S. Flint Jr. and S. M. Roble (1 3). CNC, CUIC, EME, FSCA, USNM, YPM.

One of three females that we confined for oviposition in Florida in June 1986 produced four small, nearly round patches of dull-green eggs, which were covered by a thin milklike colleterial solution that exceeded the patch by $\frac{1}{2}$ an egg diameter. Embryos developed to the first instar, but most were unable to eclose, possibly due to desiccation during transit. Two hatched successfully and were fed synthetic diet. They matured, and adults emerged in early August, 51–59 days following oviposition. Larvae of *C. placidana* likely are polyphagous leaf-rollers, possibly on herbaceous vegetation. Adults have been recorded from January (n = 4), February (n = 3), March (n = 18), April (n = 8), May (n = 24), June (n = 4), July (n = 1), and August (n = 1), probably representing at least two broods.

Coelostathma placidana occurs from Virginia to Florida and west to Texas (map 8). It has been collected together with *C. discopunctana* at McClellanville (South Carolina); Pensacola, Blue Springs St. Park, and Archbold Biological Station (Florida); and Edgard (Louisiana). [Specimens examined: 33 δ , 29 \circ , 9 slides]

GENUS

Sparganopseustis Powell and Lambert

Sparganopseustis Powell and Lambert, in Powell, 1986, Pan-Pacific Entomologist, **62**: 376.

Type species: *Sparganopseutis martinana* Powell, 1986, by original designation.

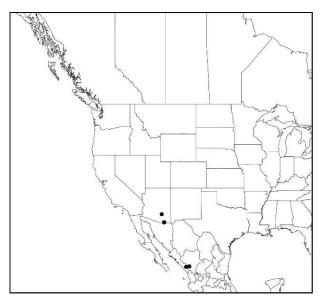
Sparganopseustis includes 12 described species (Powell et al., 1995) and a large number of undescribed species from Central and South America (Powell, 1986). The genus occurs from Ecuador north through Mexico, with a single species ranging into southern Arizona. Superficially many species of Sparganopseutis are characterized by a bright-yellow fringe that contrasts with a darker brown or maroon forewing ground color. Sexual dimorphism is pronounced: color pattern differs in all species; females average slightly larger than males in forewing length; and males of most species possess one or more secondary sexual structures, e.g., an expandable scale tuft on the labial palpus; an eversible, densely scaled coremata between A2 and A3 dorsally; or erect scaling on the dorsal hindwing. Morphologically the genus is defined by the derived socii-gnathos complex of the male genitalia (Powell 1986) in which the gnathos

is rudimentary, weakly sclerotized, joined to the socii by membranous connections, thence produced as narrow, elongate distal extensions of the socii rather than independent, paired, gnathoslike processes.

Structural characters of the genus are as follows: antennal scaling in two bands per flagellomere; antennal sensillae 1.60-1.75 times width of flagellomere in male, short in female; scaling on frons simple, without complex hood; labial palpus with segment II about 2.0 times horizontal diameter of compound eye; proboscis well developed, presumably functional; ocellus rudimentary to well developed. Forewing length 7–13 mm; costal fold absent in male; raised scales absent; R4 and R5 stalked or separate. Hindwing with cubital hair pecten lacking in male, absent to weakly developed in female. Abdomen with paired dorsal pits readily evident on A2 and sometimes on A3 as unscaled depressions, difficult to observe on descaled pelt, absent in many species (S. Cho, personal communication). Male genitalia with uncus weakly to moderately enlarged distally; socius large, bulbous, with elongate, narrow extension ventrally, finely setose distally; transtilla usually enlarged medially; valva ovoid, sacculus narrowly to broadly sclerotized to beyond middle of valva, with a pronounced emargination in some species, usually with free terminal tip. Aedeagus pistol shaped to evenly curved; vesica with 10-15 cornuti. Female genitalia with flat, rather ovoid papillae anales; sterigma a broad plate posterior to ostium bursae, sometimes weakly bowl shaped, but without lateral lobes; ductus bursae straight, membranous, widening anteriorly; corpus bursae large, with pronounced scobination; signum a curved band extending approximately ½ of perimeter of corpus bursae, usually with a small, membranous, basal pouch.

Sparganopseustis martinana Powell PL. A, FIGS. 34–36 (adult); PL. 2, FIG. 6(venation); PL. 3, FIG. 6 (abdominal pits); PL. 6, FIGS. 9, 10 (labial palpus); PL. 8, FIG. 3 (♂ gen.); PL. 22, FIG. 3 (♀ gen.); MAP 9

Sparganopseustis martinana Powell, 1986, Pan-Pacific Entomologist, **62**: 376. Type locality: 10 mi W El Salto, 8,000′, Durango, Mexico. [EME]



MAP 9. DISTRIBUTION OF MATERIAL EXAMINED OF SPARGANOPSEUSTIS MARTINANA

NOTE—The holotype male was collected on 1–2 August 1964 by J. Chemsak and J. Powell. Nine paratypes were collected in Sinaloa and Durango, Mexico.

Sparganopseustis martinana was described from the Sierra Madre Occidental west of Durango, Mexico. Adults of the United States population (Arizona) are morphologically (i.e., genitalia) indistinguishable from typical S. martinana, although most males of this population have a paler, more washed-out forewing pattern; in a few specimens the forewing is unicolorous tan with only a faint indication of the pattern. Females of the United States population lack the white costal markings of typical S. martinana. Specimens taken in April are comparable in size to those of the type series, but those collected in August are smaller (Powell 1986).

Sparganopseustis martinana is a medium-sized sparganothine: forewing length is 10.0–11.8 mm in males and 10.2–12.4 mm in females. In the male, the forewing ground color is rosaceous brown to pale purplish brown, uniformly mottled with indistinct transverse striae, and with two broad, parallel, transverse fasciae separated by a band of ground color, one from the costa well before the middle, angling outward to the cell, and the other from beyond the middle and extending toward the tornus. The hindwing is brownish to yellow brown and has the basal half covered by broad, erect, pale

androconial scales. In the female, the forewing is entirely pale rust brown with the striae slightly darker brown, and maculation is either absent or distinct, in the latter case with two white or ocherous costal triangular marks, one at mid-costa and the second smaller one just beyond the end of the discal cell.

The male genitalia (plate 8, figure 3) are characterized by a slender uncus, weakly enlarged distally; posteriorly enlarged socii, with the secondary arms clubbed and setate distally; medially enlarged transtilla, with an upturned process; and subrectangular valva, with a well defined, undulate sacculus ending in a free tip. The aedeagus is bent in the distal ¼, and the vesica has a dense bundle of slender cornuti. In the female genitalia (plate 22, figure 3) the sterigma is a narrow rectangular plate; the ductus bursae widens anteriorly, with a split colliculum near the ostium bursae; the corpus bursae is irregularly rounded with pronounced scobination; and the signum is in the form of a curved band.

The early stages of *S. martinana* have not been recorded. Adults have been collected in February, April, and August in Arizona and late July–early August, and October in Durango and Sinaloa. North of Mexico, *Sparganopseustis* is rarely collected, known only from the Huachuca Mountains and Mount Lemmon of southern Arizona (map 9). [Specimens examined: $17 \, \mathring{\circ}$, $8 \, \mathring{\circ}$, $2 \, \text{slides}$]

GENUS

Sparganothoides Lambert and Powell by James J. Kruse and Jerry A. Powell

Sparganothoides Lambert and Powell, in Powell, 1986, Pan-Pacific Entomologist, 62: 375.

Type species: *Sparganothis hydeana* Klots, 1936, by original designation.

Sparganothoides is primarily Neotropical, with 32 described species. It has its greatest species richness in the mountains of Mexico and Central America. With few exceptions, species of Sparganothoides occur between 1,000 and 2,800 m, in mixed hardwood and oak-pine habitats, both arid and mesic. The genus ranges from the southern United States to Venezuela (Kruse and Powell, 2009). The three species present north of Mexico

previously were treated as *Sparganothis* (Powell, 1983b). Superficially, most *Sparganothoides* have a somber pale-brown or grayish forewing, with few defined pattern elements. Compared to most other sparganothine genera, sexual dimorphism in size and color pattern is slight, but there are diverse male secondary characters.

Structural characters of the genus are as follows: antennal scaling in two bands per flagellomere, setae 1.5-3.0 times width of flagellomere in male, short in female; scaling of frons simple, without complex hood; labial palpus with second segment about 1.75 times eve diameter; proboscis well developed; ocelli well developed. Forewing length 7-12 mm; costal fold present or absent in male; raised scales absent; R4 and R5 stalked. Hindwing with cubital hair pecten well developed in both sexes. Abdomen without dorsal pits; female lacking enlarged corethrogyne scaling. Male genitalia with uncus slender, simple, or enlarged and/or forked distally; socii relatively short, secondary arms enlarged distally into broad, paddlelike, setate clubs; transtilla a simple, finely dentate band; valva large, rounded or rectangular, simple; sacculus narrowly sclerotized. Aedeagus slightly curved; vesica with dense group of small, deciduous cornuti. Female genitalia with wide, box-shaped sterigma, sclerotized dorsad and ventrad of ostium bursae, with lateral lobes weakly developed; ductus bursae comparatively short, gradually enlarged anteriorly; corpus bursae with undifferentiated scobination; signum long, nearly straight. Sexual dimorphism slight: size and color pattern similar, females average slightly larger in some species, males possess elongate antennal sensillae.

Larvae are characterized as follows. Head: Black or dark brown in early instars, becoming paler in late instars, dark to orange brown or tan in final instar; an irregular, dark area underlying stemmata and a well-defined lateral bar extending anteriorly from postgenal junction, more conspicuous in species with paler head capsule. Adfrontal sutures extending to vertical angle. Seta A2 about equidistant from A1 and A3; P1 closer to P2 than to Adf2; P1 closer to Adf2 than to F1. Stemmata prominent, similar in size, I and sometimes III slightly larger; II about equidistant between I and III. Body translucent pale yellow to pale orange in first instar, becoming tan to gray when feeding on

synthetic diet, grayish green to reddish brown when feeding on green or brown leaves. Pinacula slightly raised, brown to tan, degree of sclerotization of thoracic pinacula correlated with degree of sclerotization of thoracic shield; abdominal pinacula paler but visible, spinules of surrounding integument not visibly darker; no other integumental markings. Thorax: Shield dark brown to tan in final instar, varying among species, often paler anterodorsally, without darker markings. Seta SD2 closer to SD1 than to XD2, which is located at the anterior margin of the shield; lateral setae of prothorax on the same pinaculum and situated in nearly a straight line; pinacula of L, SD, and D groups of T2 and T3 elongated; SV group on T2 and T3 unisetose. Spiracle weakly oval, nearly circular. Abdomen: SV group on A1, 2, 7, 8, 9 with 3:3:3:2:2 setae (plesiomorphic in Sparganothini). D2 setae of A9 on a single, triangular pinaculum. V setae farther apart on A9 than on A8 (usually about 3:2). Anal shield paler than thoracic shield, brown to tan; its form characteristic for individual species, from broadly tapering to a rounded apex sometimes weakly constricted, to relatively narrow, strongly tapered to a point, with irregular rows of shallow indentations anteriorly in some species; setae long, SD1 and L1 longer than the segment (ca. 1 mm). Proleg and anal crotchets biordinal to partially triordinal, about 55-65 and 30–35 respectively. Anal comb well developed, base rectangular or trapezoidal, longer than wide, sometimes constricted below tines (n = 5-9 tines), which are strongly attenuated, spinelike, variable within and among species; in hydeana-group anal comb shorter, base about as long as tines, which are fewer (n = 5-6).

As for *Sparganothis* and *Platynota*, the body is generally bright to dark green with the dorsum darker, the result of dark colored minute spinules which densely cover the integument, so the faintly tan pinacula are distinctly visible as pale spots on the dark D and SD and often L areas (or 2 or 3 species of each genus lack the darker dorsal spicular tinge, but the pinacula lack dark sclerotization so are not obviously differentiated). Seta XD2 usually about equidistant from SD1 and SD2. Thoracic shield orange to pale tan, usually with the ventral and posterior margins broadly darker. SD1 microseta present on A1–8 or reduced to a trace on posterior segments, on the same pinaculum as SD.

Anal comb with base about as long as tines, which are less spinelike and blunt-tipped in the *hydeana*-group compared with those of other species-groups in the genus.

Knowledge of the biology of *Sparganothoides* is scant, but data based on laboratory-rearings are summarized by Kruse and Powell (2009). During the period 1972–1999, 103 females representing ten species were confined for potential oviposition. Seventy-three of the females deposited eggs, and progeny of 23 females representing eight species were successfully reared on synthetic diet.

Flight periods of the three species in America north of Mexico are well documented. Sparganothoides lentiginosana, the only species in the genus that occurs at low elevations, is widespread in the southeastern United States. Adults have been collected in every month except October and December indicating a multivoltine pattern. Larvae from eggs deposited in May (Arkansas) and September (Virginia) fed on synthetic diet, grew to maturity and metamorphosed without diapause. In the Southwest, adults of S. hydeana and S. machimiana have been recorded from June to September which typically is late in the dry season through the height of the summer rain season in most localities. Hence, there may be a single annual generation in these species.

Based on lab rearing, diapause does not occur at any stage. Larvae of the summer-fall flying species in Arizona sometimes pupated and eclosed in October–December but often partially grown siblings became quiescent through the winter, which is the dry season in Arizona. Thus a univoltine pattern may be typical for any species in montane habitats.

Adults of *Sparganothoides* are nocturnal, and both sexes are attracted to lights. Adults of a few species have been flushed from oaks (*Quercus*) or manzanita (*Arctostaphylos*) during the daytime in Arizona and Mexico, but these same species are recorded at lights.

Females deposit eggs in round to oval, imbricate patches characteristic of most Sparganothini. In contrast to many Archipini, which deposit a large patch of eggs (50–150 or more), followed by several successively smaller ones in subsequent nights, females of captive *Sparganothoides* produced only moderate to small masses (generally 5 to 30 eggs). Each patch is covered by a translucent secretion

that exceeds the perimeter of the patch by ½-1 egg width (Kruse and Powell 2009).

Eggs of *Sparganothoides* are peach or orange colored to rust or dark orange tan, in contrast to the green eggs of most *Sparganothis* and related genera. They are flattened, slightly convex and usually not as strongly overlapped within patches as in many other sparganothine and archipine species. They are slightly oval in outline and range from 0.85×1.20 to 0.90×1.25 mm in *S. machimiana*.

Because North American species of Sparganothoides historically were included in Sparganothis, they were assumed to be general foliage feeders. However, the absence of larval collections for the three widespread and sometimes abundant species in the southeastern and southwestern United States casts doubt on that hypothesis. Adults of S. hydeana and machimiana have been collected from trees (Quercus, especially Q. hypoleucoides A. Camus) and shrubs (Arctostaphylos sp., Ericaceae) in Arizona and Mexico on several occasions, but their larvae were not present among foliage-feeding microlepidoptera on those hosts. Hence, there is a similarity between Sparganothoides and Anopina Obraztsov (Tortricinae: Euliini). Anopina also has widespread United States species for which larvae have not been discovered in the field. Anopina species occur in similar montane elevations throughout Mexico, and the larvae prefer dead leaves and are capable of waiting long periods in dry conditions when food is unavailable. J. Brown and Powell (2000) suggest that larvae of Anopina are ground-dwellers that feed on fallen leaves, a habit that is typical of numerous Epitymbiini (Tortricinae) in Australia (Powell and Common 1985; Common 1990). The laboratory evidence for Sparganothoides is not as convincing as that for Anopina, but a ground-dwelling larval habitat seems plausible.

In the lab pupation occurs in a thin, tubular cocoon, within or near the last larval shelter, constructed between leaves or between leaves or diet fragments and sides of the container. Pupal development proceeded without diapause or lengthy quiescence in all species we observed. Development time was slower than many Tortricinae, ranging 11 to 20 days, usually 12–15, but was not monitored closely for the reared specimens.

KEY TO SPECIES OF SPARGANOTHOIDES

- Costal fold present in male; forewing length less than 8.0 mm; eastern United States lentiginosana p. 48
- Costal fold absent in male; forewing length greater than 10.0 mm; western United States 2

Sparganothoides hydeana (Klots) PL. A, FIGS. 37–39 (adult); PL. 8, FIG. 4 (\Im gen.); PL. 22, FIG. 4 (\Im gen.); MAP 10 (RWH 3730).

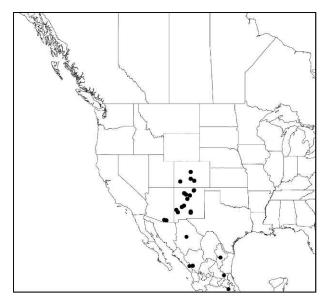
Sparganothis hydeana Klots, 1936, American Museum Novitates, **867**: 2.

Type locality: Tesuque Canyon, Sangre de Cristo Range, near Santa Fe, 9,200', [Santa Fe County], New Mexico. [AMNH]

NOTE—The holotype male, allotype female, and two paratypes are in the collection of the American Museum of Natural History (Klots, 1942: 414).

Sparganothoides hydeana; Powell, 1986, Pan-Pacific Entomologist, **62**: 376. COMBINATION.

Sparganothoides hydeana can be distinguished from the extremely similar *S. machimiana* by the location of the narrow line of sclerotization on the valva, which is approximately parallel to the venter of the valva in *S. hydeana* (plate 8, figure 4) and extends from the base of the sacculus toward the apex of the valva in *S. machimiana* (plate 8, figure 5). Adults of *S. hydeana* are medium sized, with



MAP 10. DISTRIBUTION OF MATERIAL EXAMINED OF SPARGANOTHOIDES HYDEANA

forewing length 10.4–11.7 mm (mean = 10.9 mm; n = 10) in males and 10.6–12.1 mm (mean = 11.3 mm; n = 10) in females, averaging larger than for *S. machimiana*. Males lack a costal fold in both species, in contrast to many *Sparganothoides* species. The forewing of *S. hydeana* is yellowish brown to brown, with faint scattered orangebrown and/or red-brown scales, slightly darker brown transverse reticulations, and a diffuse, roughly oval, brown patch at the apex of the discal cell and a poorly defined area of fuscous scaling extending from the patch to the inner margin.

In the male genitalia (plate 8, figure 4) the uncus is long and slender, weakly enlarged distally; the socii are comparatively short, with the secondary arms slender and abruptly angled near the middle, with a broadly spatulate distal portion bearing short, strong hairs. The transtilla is well developed with short spinelike teeth and a variably developed ventral process at the middle. The valvae are subrectangular, with a sclerotized indentation (crease) roughly parallel to the venter; and the sacculus is weak, confined to the basal portion of the valva. The aedeagus is weakly curved, attenuate distally, and rounded basally; the vesica has 10–13 short, slender cornuti, each with a minutely forked base.

In the female genitalia (plate 22, figure 4) the sterigma is a simple plate, concavely curved along the venter, with a pair of convergent lines of sclerotization extending posteriorly from the ostium bursae. The ductus bursae is relatively short, widening anteriorly; and the corpus bursae is irregularly rounded and bears a signum in the form of a weakly curved band.

Eggs are peach to brownish orange, turning yellowish during development. They are somewhat irregularly overlapped and laid in round patches with 1–39 eggs (mean = 11.1 eggs per patch, n = 22). Embryos are clearly visible through the translucent eggshell, and eye spots are visible after 48–72 hours. Eggs hatch in 10–12 days, longer in cooler temperatures. After hatching, larvae web edges of synthetic diet or leaves. Larvae fed well on synthetic diet and *Quercus lobata* Nee but would not accept *Prunus*. Larvae are slender and reddish brown; the anal comb has nine tines. Development time from oviposition to pupation ranged from 57 days to more than 6 months.

Larvae of this species probably are generalist feeders; however, adults frequently are associated with *Quercus* (adults flushed from *Q. hypoleucoides*) and *Arctostaphylos*. We collected adults from these two plant genera in Mexico on several occasions, but we did not encounter larvae among foliage-feeding microlepidoptera on these hosts.

In the southwestern United States, *S. hydeana* has been recorded from June to September, which in most years spans late in the dry season through the height of the summer wet season. Hence, there may be a single annual generation. Klots (1936) commented that *S. hydeana* was one of the most common microlepidoptera encountered at lights at the type locality in coniferous forest with quaking aspen above Santa Fe, New Mexico; and we found it to be similarly abundant near El Salto, Durango, Mexico, at 2,700 m in August. Label data on specimens from Colorado (2,200 m) indicate a "pinyon-juniper, oak-cottonwood, willow-*Rhus*" association.

Sparganothoides hydeana is known from the mountains of Colorado but it is more prevalent in New Mexico and Arizona (map 10) with a distribution extending south into Chihuahua, Sinaloa, Durango, Nuevo Leon, and San Luis Potosí, to Tlaxcala, Estado de Mexico, Distrito

Federal, Puebla, and Veracruz. [Specimens examined: 181 ♂, 27 ♀, 8 slides]

Sparganothoides machimiana (Barnes and Busck)

PL. A, FIGS. 40–42 (adult); PL. 6, FIGS. 7, 8 (palpi); PL. 8, FIG. 5 (♂ gen.); PL. 22, FIG. 5 (♀ gen.); MAP 11(RWH 3729).

Sparganothis machimiana Barnes and Busck, 1920, Contributions to the Natural History of the Lepidoptera of North America, 4: 211. Type locality: Paradise, Cochise Co., Arizona. [USNM]

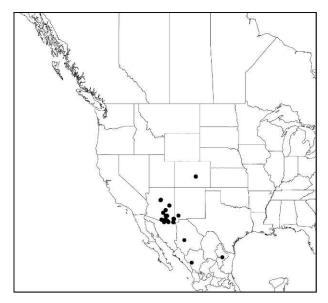
NOTE—The species was described from a holotype female collected in July.

Sparganothoides machimiana; Powell, 1986, Pan-Pacific Entomologist, **62**: 376. COMBINATION.

Sparganothoides machimiana and S. hydeana are similar in facies and genitalia. However, the two can be separated by a single feature of the male genitalia: S. hydeana has a line a sclerotization that roughly parallels the ventral edge of the valva from $\frac{1}{4}$ — its length, whereas in S. machimiana the line arches from the base of the sacculus through the middle of the valva, about $\frac{2}{3}$ the distance from the base to the apex.

Adults of *S. machimiana* average smaller than those of *S. hydeana*. The forewing length is 8.1–10.4 mm (mean = 9.4 mm; n = 10) in males and 9.2–10.8 mm (mean = 9.8 mm; n = 10) in females. The forewing ground color is pale ocherous brown to gray brown, evenly sprinkled with single scales of darker brown and dark fuscous but sometimes nearly unicolorous; and there is a series of faint small blackish dots along the costa and terminal edge, and a conspicuous, small round dot at the end of the discal cell.

In the male genitalia (plate 8, figure 5) the uncus is long, slender, and weakly enlarged distally; the socii are long and slender, and the secondary arms have a broadly spatulate distal portion. The transtilla is well developed with short spinelike teeth and variably developed ventral sclerotization. The valvae are subrectangular, with a sclerotized crease extending from near the base toward the



MAP 11. DISTRIBUTION OF MATERIAL EXAMINED OF SPARGANOTHOIDES MACHIMIANA

apex; and the sacculus is lightly sclerotized. The aedeagus is weakly curved, attenuate distally, and rounded basally; and the vesica has a bundle of 10–13 slender cornuti, each with a minutely forked base.

In the female genitalia (plate 22, figure 5) the sterigma is a simple, weakly bilobed plate; the ductus bursae is relatively short, widening anteriorly; and the corpus bursae is irregularly rounded, with the signum represented by a long, weakly curved band.

Eggs are peach to dark peach or orange to brownish orange, turning deep orange during development. They are strongly overlapped and laid in round patches of 1–50 eggs (mean = 13.3 eggs per patch, n = 29). Embryos are clearly visible through the translucent eggshell; black eyespots on the embryo are visible. Eggs measured $0.85-0.95 \times 1.20-1.25$ mm. They hatch in about 10 days, and the young larvae web edges of diet or leaves. Larvae are slender and reddish, and the anal comb has six tines. Development time from oviposition to pupation ranged from 45 days to more than nine months.

Early efforts to feed first instars of *S. machimi*ana dry season foliage of several trees and shrubs in Arizona failed, and subsequently we found that larvae eat only soft leaves, including dead and brown leaves. Newly hatched (3-day old) and 20-

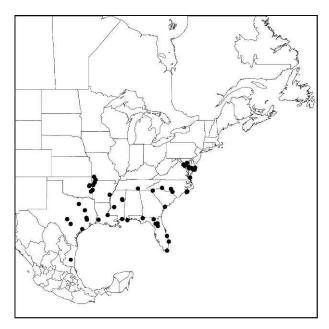
day old larvae of *S. hydeana* did not eat green leaves of *Prunus* (Rosaceae) (76J1, 76J12), whereas those offered only synthetic diet or both diet and *Quercus lobata* Nee (Fagaceae) survived to pupation (86H20, H23). First instar larvae of *S. machimiana* (86H7) given fresh leaves of *Quercus* or *Amorpha* (Fabaceae) in the absence of diet refused *Amorpha* and starved, whereas all other lots (n = 5) fed on summer leaves of *Quercus*; they were provided with additional summer leaves after 15, 30, 45, and 60 days with survivorship diminishing. Overwintering survivors (when soft green leaves of *Quercus* were not available) waited and eventually pupated.

Larvae (based on 20 individuals from Arizona-JAP 86H4, H7, H7.6, H7.7, 91H3, H6) have a distended length of 16–18 mm; the head capsule is 1.45–1.55 mm in width. Presumed penultimate instars were 12.0–12.5 mm in length and had a head capsule width of 1.2–1.3 mm (n = 2). Setae SD2 are usually absent, but rarely were represented by a non-seta bearing pinaculum on A1 (n = 1), on A1 and A2 (n = 1), or on A1–3 (n =1). The anal shield is relatively broad, slightly tapered, and weakly constricted laterally to a rounded caudal end, with no shallow pits or other sculpturing. The anal fork is small with five or six tines; the width of the base is variable.

Adults have been collected in July and August. Most collecting localities support mixed conifer forests and/or oak woodlands. *Sparganothoides machimiana* ranges from the mountains of southern Arizona and New Mexico at elevations of 4,800–5,400 feet (1,550–1,640 m), south to the mountains of Durango, Mexico, at 7,000–9,000 feet (2,140–2,750 m) (map 11). Similar to observations by Klots for *S. hydeana*, *S. machimiana* was the most abundant microlepidopteran species in a blacklight trap in oak woodlands at lower elevations in the Huachuca Mountains of southern Arizona and in Durango, Mexico, in August. [Specimens examined: 110 &, 108 &, 8 slides]

Sparganothoides lentiginosana (Walsingham)

PL. A, FIGS. 43–47 (adult); PL. 2, FIG. 5 (venation); PL. 6, FIGS. 5, 6 (palpi); PL. 8, FIG. 6 (δ gen.); PL. 22, FIG. 6 (Υ gen.); MAP 12 (RWH 3731).



MAP 12. DISTRIBUTION OF MATERIAL EXAMINED OF SPARGANOTHOIDES LENTIGINOSANA

Capua lentiginosana Walsingham, 1879, Illustrations of Typical Specimens of Lepidoptera Heterocera in the Collection of the British Museum, 4: 22.

Type locality: Texas. [BMNH] NOTE—There are two male syntypes.

Sparganothoides lentiginosana; Powell, 1986, Pan-Pacific Entomologist, **62**: 376. COMBINATION.

Sparganothoides lentiginosana is the smallest member of the genus (forewing length 6.0–7.0 mm in both sexes) and is similar in size and maculation to species of Coelostathma, with which worn individuals can be confused. S. lentiginosana can be distinguished from Coelostathma species by the presence of a costal fold on the forewing in males and the absence of abdominal dorsal pits in both sexes. It differs from other North American Sparganothoides by the poorly-developed cubital hair pecten on the male hindwing.

The forewing is light reddish brown to tan, with a diffuse, ill-defined, dark blotch from the apex of the discal cell to the dorsal margin, with small, dark-brown scale patches scattered throughout, frequently forming ill-defined, arched, punctate fasciae, particularly in the apical region.

In the male genitalia (plate 8, figure 6) the uncus is long and slender; the socii are relatively short, with the secondary arms slender, abruptly angled near the middle, and bearing an extremely broad, rectangular distal club; the transtilla is a uniform band with short spinelike teeth of variable length; the valva is subrectangular; and the sacculus is weak. The aedeagus is weakly curved, attenuate distally, and rounded basally; the vesica has 10–13 slender cornuti, each with a minutely forked base.

In the female genitalia (plate 22, figure 6) the sterigma is a bilobed plate, with the inner portion of the lobe extending dorsad as a narrow line of sclerotization; the ductus bursae is relatively short compared with that of congeners, widening anteriorly; and the corpus bursae is irregularly rounded, bearing a signum in the form of a large curved band.

The eggs are approximately 1.1 mm x 0.9 mm, pale cream, and laid in overlapping patches of 3–12 (n = 7). Larva. General: Length 11–13 mm (n = 4)JAP 91E78). Head: Capsule width 1.0-1.1 mm [believed to be final instar]; pale amber to tan; stemmata all about the same size, large and distinct; P1 usually closer to P2 than to Adf2. Thorax: Prothoracic shield pale amber to tan; D and SD pinacula on T2 and T3 not or only slightly elongated posteriorly, with some brownish pigment; SV group on T2 and T3 unisetose; spiracle circular. Abdomen: First instar translucent whitish yellow, second and later instars translucent tan; pinacula weakly defined. Setae SD2 absent on A1-8; SV group on A1,2,7,8,9 is 3:3:3:2:2; SD1 on A8 anterodorsad of spiracle; V1s on A9 farther apart than those on A8 and as far or farther apart than those on A7; D2s on A8 usually slightly closer together than D1s; crochets variably biordinal, partially triordinal, 46–49 on abdominal prolegs, 31-36 on anal proleg. Anal shield pale tan, weakly sclerotized, more rounded than tapered posteriad; D1s usually closer together than L1s and almost in a straight line with SD1s; anal setae subequal in length, longer than anal segment, anal comb well developed but sometimes absent.

Three adult females collected in Virginia laid patches of 3-11 eggs (n=5) on the sides of the vial within 3-4 days of capture. A few scales were incorporated into a thin layer of clear collaterial secretion that covered the eggs. Eggs hatched within 10-12 days of oviposition under ambient

temperature (65–75° F). First instars constructed webbing on the surface of the leaves on which they fed. A variety of leaves were offered simultaneously to the larvae. During the first rearing (1997), five larvae that selected *Achillea millefolium* Linnaeus (Asteraceae) survived; the other seven died during the second instar when the quality of the plant material they selected deteriorated, and the larvae did not search for alternate food. In subsequent rearings only *Achillea* was used, although this is an unlikely natural hostplant. Later instars fed on the leaf surface, usually constructing a tubelike structure of webbing and plant material, typical of most sparganothines.

There may be two or more annual generations. Adult captures extend from May to early October, with adults out as early as March in Texas. In northern Virginia this species flies from June through early October, and it is likely that its flight period elsewhere is narrower than the cumulative capture records suggest.

Sparganothoides lentiginosana occurs from Maryland south to Florida (Virginia, North Carolina, South Carolina), along the Gulf of Mexico (Mississippi, Arkansas, Louisiana) to Texas, Oklahoma, and Tamaulipas, Mexico (map 12). [Specimens examined: 169 ♂, 45 ♀, 7 slides]

GENUS

Amorbimorpha Kruse

Amorbimorpha Kruse, 2012, Zootaxa **3177:**. 34

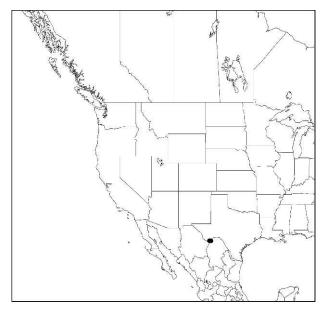
Type species: *Amorbimorpha powelliana* Kruse, 2012, by original designation.

Amorbimorpha was recently described by Kruse (2011) to accommodate two previously described and two new species. The genus is primarily Mexican in distribution, reaching its northern limits in Texas. According to Kruse (2012), there are at least 10 additional undescribed Neotropical species present in collections.

Adults of *Amorbimorpha* are somber colored — yellow, orange, brick red, brown, or gray — superficially similar to some *Amorbia* and *Sparganothoides*. The male genitalia of *Amorbimorpha* are most similar to those of *Sparganothoides* in the socius/gnathos complex. In *Amorbimorpha* the secondary arms are widened subapically and then

attenuate to a slender distal lobe. The socius/gnathos complex differs from those of *Sparganopseustis* and *Aesiocopa* in which there is a much stronger involvement of the socius. In *Amorbimorpha* and *Sparganothoides* the gnathos arms originate from the tegumen and are coalesced with the socius beyond that point. The prominent bifid uncus of *Amorbimorpha* is the most distinctive feature of the male genitalia. It is similar to that of some of species of *Sparganothoides*, but in the latter genus the bifid distal processes are longer and slenderer. The female genitalia of *Amorbimorpha* are similar to those of *Amorbia*, *Coelostathma*, and *Sparganothoides* in the presence of a large bandshaped signum in the corpus bursae.

Structural characters of the genus are as follows: antennal scaling in two bands per flagellomere, sensory setae about 1.5-2.5 times diameter of flagellomere in male, borne on raised ridges, unmodified in female; labial palpus porrect, enlarged near middle, slightly curved, rough scaled, segment II about 1.5 times horizontal diameter of compound eye; ocellus minute or absent; head without protuberances. Forewing length 9.7-16.8 mm; costal fold absent in male; venation as in Sparganothoides. Abdominal pits absent. Female lacking enlarged corethrogyne scaling. Male genitalia with uncus robust and prominent, heavily sclerotized in basal third, bifurcating at 1/3-1/2 length into two elongate lobes, usually flattened with a patch of setae ventrally. Socius kidneybean shaped with rounded or triangular anterior and posterior lobes; elongate gnathos arms arising from either side of the tegumen, curving toward transtilla, often angled at midpoint, weakly enlarged subapically; apical lobes symmetrical or slightly asymmetrical. Transtilla a simple band, often with median lobe; anterior margin occasionally reinforced with sclerotized crease, spinose over most of posterior margin. Valva large, simple, rounded or subrectangular; costa straight or concave, heavily sclerotized at the base, without sclerotized creases; sacculus sclerotized, extending at least 3/5 length of valva, straight, convex, or concave, without free distal process; pulvinus present; juxta large, broadly rounded at base, attached to adeagus by short, strongly sclerotized process. Aedeagus pistol shaped; basal portion straight or gently curved, usually longer than phallobase; apex of aedeagus



MAP 13. DISTRIBUTION OF MATERIAL EXAMINED OF AMORBIMORPHA MACKAYIANA

attenuate, rounded, without armature; vesica with dense bundle of 10–60 lanceolate, deciduous, weakly recurved, cornuti. Female genitalia with sterigma wide, variably shaped, usually well sclerotized dorsally and ventrally of ostium bursae, with narrow lateral lobes produced or absent; papillae anales parallel sided, rectangular, posterior lobes well developed, rounded, anterior lobes often narrower, rounded; ductus bursae comparatively long, often gradually enlarged anteriorly, without sclerotized areas; corpus bursae large, with undifferentiated scobination; cestum not developed; signum a long, nearly straight band, weakly or distinctly curved, distal margins attenuate or rounded.

Amorbimorpha mackayiana Kruse, 2012 PL. A, FIG. 48 (adult); PL. 9, FIG. 1 (♂ gen.); PL. 23, FIG. 1 (♀ gen.); map 13.

Amorbimorpha mackayiana Kruse, 2011, Zootaxa, 3177: 36.

Type locality: The Basin, Big Bend National Park, Brewster County, Texas. [CNC]

Amorbimorpha mackayiana exhibits exceedingly limited sexual dimorphism in contrast to its congeners; it is among the smallest species in the

genus. It lacks ocelli, which are present, although small, in many similar species, including *A. powelliana* Kruse from Nuevo Leon, Mexico, the most closely similar species.

Forewing length is 9.7–12.8 mm; the ground color is brownish orange with faint brown basal, median, and subterminal fasciae, usually most conspicuously developed at the costa. The hindwing is shining ivory white, uniformly and gradually yellowing in the distal areas.

In the male genitalia (plate 9, figure 1) the uncus is large and prominent with a strong base and widely separated distal arms from a bifurcation near the middle. The tegumen is large and angular, heavily curled at the base of the uncus; the gnathos arms are long and slender, angled near the middle, widened subapically, and attenuate distally; the transtilla is strongly sclerotized, unmodified, with short spines over most of the posterior margin. The valva is subrectangular, narrowing apically; the costa is slightly concave, sclerotized over its entire length; the sacculus is sclerotized over its entire length, slightly convex. The aedeagus is pistol shaped and attached to the juxta by a strong, tapered process; and the vesica has about 15 cornuti in a dense cluster.

In the female genitalia (plate 23, figure 1) the papillae anales are parallel sided, rounded posteriorly, and narrower anteriorly; and the sterigma is heavily sclerotized ventrally, concave anteriorly, and strongly lobed anterolaterally. The ductus bursae is moderately long, widened anteriorly; and the corpus bursae is large and rounded, with a band-shaped signum about 3–4 times as long as wide, straight on one side, curved on the opposite side, and attenuate at the apices.

This species is recorded only from the mountains of west Texas (primarily Big Bend National Park) at 5,200-6,000' elevation. Captures range from late March to early June and mid-September suggesting either two broods or multiple broods throughout the year. [Specimens examined: $10 \, \text{d}$, $4 \, \text{Q}$, $4 \, \text{slides}$]

GENUS

Sparganothis Hübner

Sparganothis Hübner, 1825 [1816], Verzeichniss bekannter Schmettlinge [sic]: 36.

Type species: *Tortrix pilleriana* [Denis and Schiffermüller], 1775, by subsequent designation by Fernald (1908).

Spargonothis Hübner, 1825 [1816], Verzeichniss bekannter Schmettlinge [sic]: 63.

NOTE—Spargonothis Hübner, 1825 [1816] is an incorrect subsequent spelling of Sparganothis Hübner, 1825 [1816].

Sparganothris Stephens, 1834, Illustrations of British Entomology (Haustellata), 4: 172.

NOTE—Sparganothris Stephens, 1834 is an incorrect subsequent spelling of Sparganothis Hübner, 1825 [1816].

Oenophthira Duponchel, 1845 [1844–1846], Catalogue méthodique des Lépidoptères d'Europe: 288.

Type species: *Tortrix pilleriana* [Denis and Schiffermüller], 1775, by monotypy.

Oenectra Guenée, 1845, Annales de la Societé Entomologique France, (2) 3: 142.

Type species: *Tortrix pilleriana* [Denis and Schiffermüller], 1775, by monotypy

Aenectra Doubleday, 1850, Synonymic List of British Lepidoptera: 21.

NOTE—Aenectra Doubleday, 1850 is an incorrect subsequent spelling of Oenectra Guenée, 1845.

Begunna Walker, 1863a, List of the Specimens of Lepidopterous Insects in the Collection of the British Museum, Catalogue of the Heterocera, 27: 189.

Type species: *Begunna xanthoides* Walker, 1863a, by monotypy.

Leptoris Clemens, 1865, Proceedings of the Entomological Society of Philadelphia, **5**: 139. Type species: Leptoris breviornatana Clemens, 1865, by monotypy.

Onectra Wocke, 1871, in Staudinger and Wocke, Catalogue der Lepidopteren des Europäischen Faunengebiets: 239.

NOTE—Onectra Wocke, 1871 is an incorrect subsequent spelling of Oenectra Guenée, 1845.

Oenophthera Meyrick, 1913 in Wytsman, Genera Insectorum, 149: 56.

NOTE—Oenophthera Meyrick is an incorrect subsequent spelling of Oenophthira Duponchel, 1845.

Sparganythis Matsumura, 1931, 6000 Illustrations of Insects of the Japan Empire: 1075.

NOTE—Sparganythis Matsumura, 1931 is an incorrect subsequent spelling of Sparganothis Hübner, 1825 [1816].

Sparganotis Kodama, 1956, Publications of the Entomological Laboratory of the University of Osaka Prefecture, 2: 5.

NOTE—Sparganotis Kodama, 1956 is an incorrect subsequent spelling of Sparganothis Hübner, 1825 [1816].

Sparganothis and Cenopis are the only sparganothine genera that are Holarctic in distribution; Lambertiodes occurs in India, Nepal, and China; all others are restricted to the New World. Sparganothis includes 30 species (including those described below), most of which are restricted to Canada and the United States. The type species, S. pilleriana, occurs across northern Europe and Asia, from England to Japan, and S. rubicundana and S. praecana are believed to be natively Holarctic. Three Nearctic species range south of the United States border — S. sulfureana into the Caribbean and Mexico, S. senecionana into Baja California, Mexico, and S. demissana into Tamaulipas, Mexico. At least two undescribed species are in collections from northern Mexico. Three North American species treated as Sparganothis by Powell (1983b) subsequently were transferred to Sparganothoides (Powell 1986, Kruse and Powell 2009).

Although the genus is fairly diverse in facies, it is remarkably homogeneous in morphological features, particularly the male and female genitalia. In contrast to the situation in most Tortricidae, the male and female genitalia are virtually indistinguishable among many species. Sexual dimorphism usually is limited to small differences: 1.) The sexes are similar in size, but males of *S. senecionana*, *S. tunicana*, and *S. vocaridorsana* are larger, whereas females are slightly larger in several other species; 2.) length of the labial palpi (usually slightly longer in females); 3.) length of the antennal sensillae (longer in males); and 4.) intensity of forewing pattern elements (females of many species have

partially obscured pattern elements, often essentially not developed).

Although Sparganothis previously included the species treated herein as Cenopis, a number of features suggest that the two are monophyletic sister groups. Cenopis can be defined by the deeply invaginated anal fold, bearing distinctive sex scales, of the male hindwing (although a similar, lessdeveloped modification is present in at least S. distincta, S. azulispecca, S. mcguinnessi, and S. niteolinea), and the presence of a well-developed pulvinus just below the transtilla (which is variably developed to absent in Sparganothis). The complex hood of the head and hindwing specializations of male *Cenopis*, which allow easy separation of males of Cenopis from Sparganothis, may represent derived features shared with Platynota, but this hasn't been confirmed through phylogenetic analysis. Sparganothis is characterized by the simple hood in the male, the absence of, or only weakly developed, sex scaling in the male hindwing, and a variably developed pulvinus.

Structural characters of the genus are as follows: antennal scaling in two bands per segment, seensillae about 0.5–2.5 times width of flagellomere in male, short, about 0.1 times width of flagellomere in female; scaling on upper portion of frons comprised of a tuft of large, flat scales of variable length protruding over lower frons to near middle of labial palpus (= simple hood); labial palpus (plate 6, figures 1-4) moderately long, segment II 1.5-2.0 times horizontal diameter of compound eye; proboscis developed, presumably functional; ocellus present, moderately large. Forewing (plate 2, figure 3) length 3.8–13.5 mm; costal fold present, reduced, or absent in male; upraised scales absent. Hindwing with cubital hair pecten in three tufts in both sexes; males without invaginated anal fold, but with anal roll and associated hairpencil in a few species (i.e., S. distincta, S. azulispecca, S. mcguinnessi, and S. niteolinea), although not as well developed as in Cenopis. Abdomen without dorsal pits. Male genitalia with uncus slender, simple, from variable base; socius large, flat, usually slender, especially anteriorly, with well-developed, free secondary arms expanded and densely setose distally; valva large, rectangular to obovate, rounded apically; inner base of valva occasionally with broad membranous, free, pulvinus. Aedeagus

TORTRICOIDEA

pistol shaped or evenly curved; vesica with 6–10 slender, deciduous cornuti. Female genitalia with simple sterigma; ductus bursae slender, coiled once or twice; corpus bursae oblong; signum variable.

In general males can be distinguished from those of *Cenopis* by the absence of the hindwing anal fold and associated hairpencil; the simple hood, which has complex scaling in *Cenopis*; and usually longer antennal sensillae.

KEY TO SPECIES OF SPARGANOTHIS

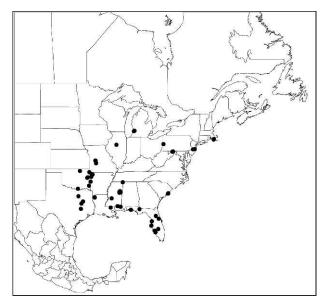
1.	Dark-gray moth with small eyes (diameter ½ times height of front) and very long labial palpus (segments II and III about three times frontal height)
_	Variously colored moths, but not dark gray, eyes larger (diameter 1.1–1.2 times height of front), labial palpus moderately elongated (II and III less than three times frontal height)
2.	Forewing pattern primarily longitudinal streaks, along costa, through cell, and sometimes along dorsal margin (plate B, figures 26, 27; plate C, figures 41, 42)
_	Forewing pattern not limited to longitudinal streaks; dominated by transverse fasciae, numerous transverse lines, uniformly reticulate, or unicolorous without pattern
3.	Forewing yellow or tan with one or two rust-colored longitudinal streaks, with streaks not reaching termen
_	Forewing ocherous with three well-developed longitudinal rust streaks extending from base to termen, sometimes partially obscured by rust irroration through the intervening ocherous field; streak along dorsal margin extending to and coalescing with terminal rust band (plate B, figure 27)
4.	Forewing yellow with two partially developed, dark-rust, longitudinal streaks (costal and median) not reaching termen, and a short pretornal line along dorsal margin (plate B, figure 26) bistriata p. 65
_	Forewing with a single longitudinal line or streak 5
5.	Forewing tan with a broad, well-defined rust-brown streak from base to apex (plate C, figures 41, 42) striata p. 87
_	Forewing pale tan or straw with an arrow rust line along low edge of cell richersi p. 85

6.	Forewing pattern predominately reticulate with
	thin rust lines and transverse striae on a pale to
	dark tan ground (plate A, figures 49, 50; plate B, figures 1–6; plate C, figures 4–6)
_	Forewing unicolorous or conspicuously pat-
	terned with transverse fasciae, lines, or blotches 10
7.	Forewing pattern nearly uniformly reticulate
	rust on pale tan (plate A, figures 49, 50; plate
_	B, figures 1–6) 8 Forewing pattern reduced to 5–6 variable, paral-
	lel, transverse rust lines reflecting metallic blue on
	a dark-tan ground (plate C, figures 4–6) niteolinea
	p. 78
0	Forming longth 0.0.10.5 mm
8.	Forewing length 8.0–10.5 mm 9 Forewing length 4.5–7.0 mm (plate B, figures 2–
	6) tessellata
	p. 57
9.	Forewing broad (length 2.3–2.4 x width); uni-
	formly covered by fine reticulated rust-brown lines; hindwing white to whitish gray (plate A,
	figures 49, 50) caryae
	p. 55
_	Forewing narrow (length 2.7 x width); reticula-
	tion of heavy lines partly concentrated into
	longitudinal line through cell; hindwing pale tan to grayish (plate B, figure 1) robinsonana
	p. 56
	p. 30
10.	Forewing shining tan with base, termen, and one
	or two transverse lines rust (plate B, figures 44–
_	50; plate C, figures 1–3)
	with rust, outwardly oblique fasciae or blotches 14
11.	Forewing length 6.0–8.7 mm; forewing with a
	transverse fascia outwardly angled from costa before middle to dorsal margin before tornus,
	termen narrowly rust; transverse fascia rarely
	broken or missing (plate B, figures 43–45) taracana
	p. 74
_	Forewing length 4.8-7.0 mm; forewing rust at
	base and termen, with 2–4 transverse rust lines,
	or one situated perpendicular to costa at end of cell
12.	Forewing with one transverse line, sometimes
	broken at end of cell, and termen rust (plate B,
	figures 46–48) sullivani
_	p. 76 Forewing with three or four transverse lines and
	termen rust (plate B, figures 49, 50; plate C,
	figures 1, 2; plate C, figure 3)

13.	Forewing with three transverse lines and termen rust (plate B, figures 49, 50; plate C, figures 1, 2); forewing length usually <6.0 mm; male hindwing without anal roll lindalinea p. 75	_	Forewing length 7.0–10.5 mm; hindwing in male with anal fold; forewing yellow brown; head, and thorax anteriorly and forewing costa basally dark rust (plate C, figures 43, 44); widespread
_	Forewing with four transverse lines and termen rust (plate C, figure 3); forwing length usually 7.0 mm or		p. 88
	greater; male hindwing with anal roll mcguinnessi p. 77	20.	Small moths, forewing length 3.8–5.4 mm; forewing ground color yellowish to mostly obscured by rust, variable pattern in distal half
14.	Forewing shining golden on basal ½, blending to metallic violet through middle ½, to golden in terminal area (plate B, figure 31) violaceana		reflecting metallic purplish (plate B, figures 24, 25) minimetallica p. 63
	p. 69	_	Larger moths, forewing length 5.5-13.0 mm;
_	Forewing without shining golden base and metallic violet middle		forewing ground color lemon yellow to ocher- ous, orange brown, or dark rust brown, usually with conspicuous outwardly angled median and
15.	Forewing primarily brownish with faint metallic bluish reflective reticulation, darker pattern consisting of an ill-defined post basal fascia		subapical fasciae (restricted to costal area in females of some species)
	from costa before middle to anal margin	21.	Forewing length 5.7–9.0 mm; forewing lemon
	(enclosing a paler ocherous area at base) and a		yellow to pale orange yellow, markings rust
	dark crescent-shaped region from apical area		colored, often reduced to broken lines or
	through tornus (plate B, figure 7) flavibasana		scattered spots in females
_	p. 58 Forewing uniformly colored or variously pat-		ous, rust, or brown; markings rust to dark
	terned with brownish to rust		brown, sometimes broken or restricted to costal area or obscure in females
16.	Forewing rose rust evenly sprinkled with metal-	22	Small maths foraging length 5.7.70 mm
	lic-blue flecks (plate C, figures 7, 8) azulispecca	22.	Small moths, forewing length 5.7–7.0 mm; forewing ground ocherous speckled with rust;
_	p. 80 Forewing tan, brown, or yellow patterned with		median fascia joined at dorsal margin to an
	rust, lacking blue flecks		outwardly angled fascia from apical area, dark rust reflecting metallic lavender in both sexes;
17.	Hindwing white; forewing lemon yellow with		hindwing dark gray (plate B, figure 23) lycopodiana
	variable pattern of purplish brown; basal blotch, often broadened to join a broad transverse fascia		p. 62 Mostly larger moths, forewing length 5.7–9.0
	across postmedian area, leaving a semicircular	_	mm; forewing lemon to pale orange yellow, basic
	costal patch of yellow (sometimes reduced to		pattern as in <i>lycopodiana</i> but fasciae usually
	mottled pattern or very faint) (plate C, figures		broken and/or reduced to isolated spots, espe-
	45–48) pulcherrimana p. 89		cially in females, subapical area not rust; not or only faintly reflecting metallic lavender; hind-
	Hindwing gray to dark brown; forewing, if		wing not as dark, gray to whitish (plate B,
	yellow, patterned with rust lines or reticulation 18		figures 8–22) sulfureana
			p. 59
18.	Forewing in both sexes unicolorous ocherous to	22	
	dark tan except costa at base darker; apex not produced	23.	Forewing pattern incomplete: median and sub- apical fasciae broken or reduced to costal area in
_	Forewing yellow, tan, or brown patterned with		males, reduced or absent in females
	rust to brown; females rarely faintly patterned,	_	Forewing median fascia usually complete to
	or if unicolorous, apex produced		dorsal margin in males, sometimes obscure in
19	Forewing length 5.0–8.5 mm; hindwing in male		darker rust-brown males and females
1).	without anal fold; forewing orange tan; head	24	Forewing broad (length 2.2–2.5 times width),
	and thorax dark gray basally; mostly Texas		pale tan, often speckled with brownish, median
	(plate B, figures 28, 29) demissana		fascia reduced to a subcostal spot and a poorly
	p. 67		defined pretornal blotch in male; rarely a

	preapical blotch; markings less well defined to lacking in females (immaculate in both sexes in the California race <i>inconditana</i>) (plate B, figures 33–37)	hoides
_	Forewing narrower (length 2.5–3.0 times width), tinged with rose rust, pattern reduced to poorly defined, midcostal and preapical blotches in both	p. 71
	sexes (plate B, figures 40–42) b	p. 72
25.	Forewing length 12–13 mm; forewing tan with a distinct pattern, well-defined, narrow median fascia and elongate, triangular preapical patch at costa in male, less contrasting but visible in female (plate C, figure 35) vocarido	
_	Forewing length 7.0–12.5 mm; forewing pattern similar to that of $S.\ vocaridorsana$ but distal markings not restricted to a subapical triangle .	p. 84
26.	Forewing length 7–9 mm; forewing dark rust brown, median fascia and subapical markings slightly darker, obscure; hindwing dark gray (plate C, figures 49, 50) (Hudson Bay to northern Alaska) rubicum	
_	Forewing length 7.0–12.5 mm; not as uniformly dark, at least the forewing ground color tan, ocherous, or rust brown; hindwing whitish to dark brown	p. 90 27
27.	Forewing length 10.5–12.5 mm; forewing pale ocherous, with distinct median fascia and preapical costal and subapical marks; pattern elements less distinct in female (plate B, figure 30)	sciana
_	Forewing length 7.0–11.5 mm; forewing tan, rust, or brown with pattern variable but distal markings not restricted to preapical area	p. 68
28.	Forewing length 7–9 mm (rarely 10 mm); forewing tan with strong, well-developed pattern, usually rust brown; median fascia complete, entire subapical and terminal areas dark; hindwing dark chocolate or rust brown to gray brown (plate C, figures 9–18) turn	
_	Forewing length 9.4–11.5 mm; forewing color and pattern highly variable, usually terminal area not completely dark, ground color defining a subterminal fascia (female often only faintly patterned)	p. 83
29	Western species (Alberta to Arizona and west):	

highly polytypic geographically (plate C, figures



MAP 14. DISTRIBUTION OF MATERIAL EXAMINED OF SPARGANOTHIS CARYAE

19–34) senecionana p. 81

Eastern species (Quebec, Ontario, and New England west to Colorado east of the Rocky Mountains) (plate C, figures 37–40) umbrana p. 86

Sparganothis caryae (Robinson) PL. A, FIGS. 49–50 (adult); PL. 9, FIG. 2 (\eth gen.); PL. 23, FIG. 2 (\updownarrow gen.); MAP 14 (RWH 3700).

Tortrix caryae Robinson, 1869, Transactions of the American Entomological Society, 2: 270.

Type locality: USA, Illinois. [AMNH]

NOTE—The lectotype male was designated by Klots (1942: 413).

Epagoge caryae; Fernald in Dyar, 1902 [1903], Bulletin of the U.S. National Museum, **52**: 475. COMBINATION.

Sparganothis caryae; Barnes and McDunnough, 1917, Check List of the Lepidoptera of Boreal America: 176. COMBINATION.

Sparganothis caryae can be distinguished from its congeners by the forewing color and pattern. The ground is pale yellow, evenly reticulated

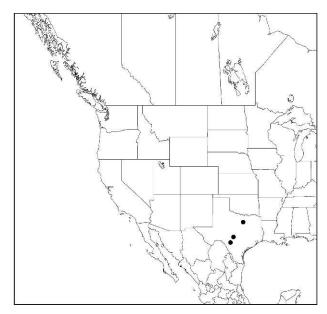
throughout with circles of pale reddish brown, usually most dense near the end of the discal cell, forming a darker spot. The hindwing is usually cream white. Females are conspicuously larger than males: forewing length is 7.0-9.0 mm (mean = 8.4 mm; n = 10) in males and 9.0-11.0 mm (mean = 10.1 mm; n = 10) in females. The male forewing costal fold is short but distinct; and the labial palpi are moderately long in the male and slightly longer in the female. Male antennal sensillae are short, about $\frac{1}{3}$ — $\frac{1}{4}$ times the width of the flagellomere.

In the male genitalia (plate 9, figure 2) the uncus is comparatively wide, arising from a broad, rounded base confluent with the dorsum of the tegumen, similar to that of *Platynota*; the socii are large, unmodified, with the secondary arms dilated and densely setose in the distal ½; the transtilla has a moderately broad, spiny mesial process; and the valvae are subrectangular, with a poorly defined sacculus. The aedeagus is evenly curved, with 5–6 long, slender cornuti in the vesica.

In the female genitalia (plate 23, figure 2) the sterigma has squarish "shoulders" at each anterolateral edge; the ostium bursae is moderately broad and shallow; the ductus bursae is moderately broad, widening anteriorly, and coiled one revolution; the colliculum is a complete ring separated from the sterigma by a short membranous gap; and the corpus bursae is moderate in size, rounded, with the signum in the form of an invaginated hollow thorn from a broad, irregularly rounded base, situated laterodorsad near the junction of the ductus bursae and corpus bursae.

In his original description, Robinson (1869) provided no clue as to why he named the species "caryae," but the name suggests that the species feeds on, or was collected on, Carya sp. (hickory). Fernald (1882) listed "Hickory?" as the host, probably based on the species name. Label data accompanying a specimen from New Lisbon, New Jersey, indicate that the specimen was reared from scrub oak (Quercus sp., Fagaceae). No other host information is available. Flight periods are apparently influenced by latitude: May–June and September in Texas; April–June in Florida and Louisiana; June–August in Arkansas and Oklahoma; and mid-July to early September northward (e.g., Maryland, New Jersey, Michigan).

Sparganothis caryae ranges from Maine to Florida west to Michigan, Arkansas, and Texas



MAP 15. DISTRIBUTION OF MATERIAL EXAMINED OF SPARGANOTHIS ROBINSONANA

(map 14). [Specimens examined: 174 δ , 49 \circ , 6 slides]

Sparganothis robinsonana Powell and J. Brown, NEW SPECIES

PL. B, Fig. 1 (adult); PL. 23, Fig. 3 ($^{\circ}$ gen.); MAP 15

Sparganothis robinsonana Powell and J. Brown.

Type locality: Fort Worth, [Tarrant Co.], Texas. [USNM]

NOTE—The species name is a patronym for C. T. Robinson, an American tortricid worker active during the latter part of the 19th century, and was proposed for this species by August Busck on three genital slides made between 1923 and 1936.

Sparganothis robinsonana is extremely similar in appearance to S. caryae from which it can be distinguished superficially by a narrower forewing (length 2.7 times its width), darker and heavier reticulation of the forewing, and a pale gray-brown hindwing. In contrast, S. caryae has a slightly broader forewing (length 2.3–2.4 times its width), fine and uniform reticulation of the forewing, and white to whitish-gray hindwing. These differences alone could be interpreted as geographic variation. However, the signum in the female genitalia of S. robinsonana consists of an elongate sclerotized

patch with a slender thorn from the end of the patch (plate 23, figure 3). In contrast, females of *S. caryae* have a somewhat hollow, thornlike signum (plate 23, figure 2). The male of *S. robinsonana* is unknown.

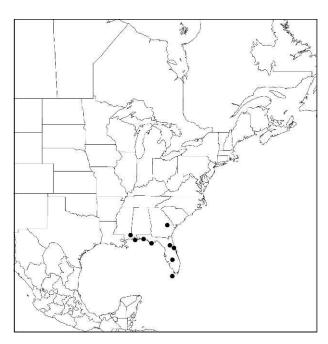
Description. Male unknown. Female. Head: Rough scaled, vertex and frons cream; labial palpus moderate, about 2.5 times horizontal diameter of compound eye, cream on inner surface, cream mixed with red brown on outer surface; antennal scaling cream, sensillae sparse, short. Thorax: Dorsum smooth scaled, mostly red brown with a few cream scales, tegula red brown basally, cream in distal 3. Forewing length 9.8-11.0 mm (mean = 10.2 mm; n = 7); forewing ground color cream, densely reticulated throughout with rust brown, resulting in a rust-brown wing with tiny cream spots; overall surface somewhat lustrousiridescent in fresh specimens. Hindwing pale gray brown. Abdomen: Cream. Genitalia (plate 23, figure 3) with sterigma rectangular with urn-shaped antrum; ductus bursae comparatively long, slender, coiled one revolution, with large, complete, welldefined colliculum immediately anteriad of antrum; cos bursae rounded, with signum in form of an elongate sclerotized patch with a slender thorn from end.

TYPES. **Holotype:** $\ \$. Fort Worth, [Tarrant Co.], Texas; 15 October 1963; E. Jäckh. USNM. **Paratypes:** 6 $\ \$. **Texas.** Kerrville, [Kerr Co.]; September 1906, September 1907, September 1908; H. Lacey (5 $\ \ \$). ConCan, Uvalde Co.; 12–15 October 1993; C. Bordelon (1 $\ \ \ \$). ECK, USNM.

Sparganothis tessellata Powell and J. Brown, NEW SPECIES

PL. B, FIGS. 2–6 (adult); PL. 9, FIG. 3 (\eth gen.); PL. 23, FIG. 4 (\updownarrow gen.); MAP 16

Sparganothis tessellata Powell and J. Brown. Type locality: Bon Secour National Wildlife Refuge, 30°14′10″N, 87°49′49″W, Baldwin Co., Alabama. [USNM]



MAP 16. DISTRIBUTION OF MATERIAL EXAMINED OF SPARGANOTHIS TESSELLATA

NOTE—The species name *tessellata* is Latin for a small cube as in tessellate or checkered, in reference to the forewing pattern. It is a manuscript name proposed by J. B. Heppner, who kindly turned over his specimens to us.

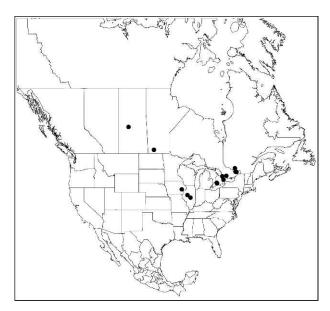
Sparganothis tessellata differs markedly in phenotype from all other described species of Nearctic Sparganothini. The forewing pattern resembles that of S. caryae and S. robinsonana being uniformly reticulate, but S. tessellata is a much smaller moth and is primarily dark rust colored. The similarity in forewing pattern with S. caryae and S. robinsonana is most likely convergence; the two species do not appear to be closely related. Male and female genitalia of S. tessellata are structurally simple, unmodified compared to congeners (i.e., lacking enlargement of the uncus, a spur on the secondary arm of the socius, bifid spination of the transtilla, modified sacculus, and elaborate sterigma, and no signum). But the male of S. robinsonana is unknown.

Description. Male. Head: Hood simple; frons fully scaled, roughened, ocherous tinged with rust laterally; labial palpus short, about 2.4 times horizontal diameter of compound eye, pale orange; antennal scaling pale tan tinged with rust on basal segments, sensillae about 1.0 times width of flagellomere. Thorax: Tegula scaling rust basally,

pale ocherous distally; mesonotum rust margined, ocherous medially. Forewing length 4.5-5.7 mm (mean = 4.7 mm; n = 10); costal fold absent; forewing more or less uniformly checkered with shining pale-ocherous scales, defined by a reticulate pattern of rust; in fresh specimens dominated by slightly raised lines of metallic lavender: submedian, transverse line angled outward to tornal area, meeting a partial transverse line from costa beyond cell, and a partial fascia in subterminal area; fringe pale ocherous with a rust-colored basal scale row; underside tan with weak indication of upperside darker pattern along costa and in disc. Hindwing without anal fold and associated hair pencil; whitish tinged with pale gray to ocherous. Abdomen: Dorsal scaling tan to pale rust tan; venter slightly paler. Genitalia (plate 9, figure 3) with uncus very slender; secondary arms of socii slender, without spurs, scarcely enlarged distally; transtilla with spinose median peak, not bifid; sacculus narrow, extending about 1/3. valval length. Aedeagus curved, unmodified, with two slender cornuti in the vesica.

Female. Head and thorax: Essentially as described for male, except antennal sensillae shorter, sparser; forewing length 5.7–7.0 mm (mean = 6.5 mm; n = 10). Abdomen: Genitalia (plate 23, figure 4) with anterior rim of sterigma narrowly sclerotized, otherwise sterigma a simple cup; ductus bursae without sclerotization, gradually enlarged to corpus bursae, one gradual revolution; signum poorly defined.

TYPES. Holotype: 3. Bon Secour National Wildlife Refuge, 30°14′10″N, 87°49′49″W, Baldwin Co., Alabama; 11-16 May 1994; R. L. Brown and D. Pollock. USNM. Paratypes: 40 ♂, 23 ♀. Alabama. Same locality, date, and collectors as for holotype; 11 δ , 7 \circ . Same locality, "fore dunes"; 15 May 1994; R.W. Hodges (6 ♂, 2 ♀). Same locality, BL trap on dunes; 12-16 September 1991; R. Brown and J. MacGown (1 8). Same locality; 8 September 1988, R. Brown & J. MacGown (1 ♂). Same locality; 14–15 June 1994; T. L. Schiefer (4 ♀). Florida. Cape San Blas dunes nr. Pt. St. Joe, Gulf Co.; 10 May 2002; J. Slotten (2 3, 6 ♀). Archbold Biological Station, Lake Placid, Highlands Co.; 8–15 May 1964; R. Hodges (1 ♀). Ocala National Forest, nr. Hopkin's Prairie, Marion Co.; 11–18 May 1979; Fairchild and Weems (3 ♂, 1 ♀). Ocala National Forest, NFR 75, Lake Delancy, Marion Co.; 22 June 1991; H. D. Baggett (1 ♀). Ocala National Forest, NFR 56, Lake Delancy, Marion Co.; 20 October 1991; H. D. Baggett (1 3). 5 mi W Miramar Beach, swept from Rosmarinus sp. on back dunes, Okaloosa Co.; 19 May 1969; H. Weems (4 ♂).



MAP 17. DISTRIBUTION OF MATERIAL EXAMINED OF SPARGANOTHIS FLAVIBASANA

Blue Spr. St. Park [W of Orange City], Volusia Co.; 10 June 1986; J. Powell (1 $\mathfrak P$). **Georgia.** ESE of Stillmore, [Emanuel Co.], r.f. pupa ex terminal web on stem of *Ceratiola ericoides* [Empetraceae]; 15 September 2007; A. Wheeler (1 $\mathfrak P$). **Mississippi.** 4.5 mi. NNW Lucedale, Grant Co.; 24–25 July 1989; T.L. Schiefer (10 $\mathfrak P$). CSU, EME, FSCA, MEM, USNM.

We have seen one specimen reared from a field-collected pupa from a stem of *Ceratiola ericoides* Michaux (Empetraceae). Most collections of adults originate from coastal or inland sand dune sites. Males were swept from *Rosmarinus* sp. (Lamiaceae), a possible larval host. The species may be a generalist in the dune habitat. Adults are recorded from May to September, with most of the collections in May, possibly a reflection of seasonal emphasis by collectors.

This species occurs in the Gulf coastal areas of Florida, Georgia, Alabama, and Mississippi (map 16). [Specimens examined: 40 &, 20 \, \varphi\$, 6 slides]

Sparganothis flavibasana (Fernald) PL. B, FIG. 7 (adult); PL. 9, FIG. 4 (\eth gen.); PL. 23, FIG. 5 (Υ gen.); MAP 17 (RWH 3717).

Oenectra flavibasana Fernald, 1882, Transactions of the American Entomological Society, 10: 69.

Type locality: Illinois. [USNM]

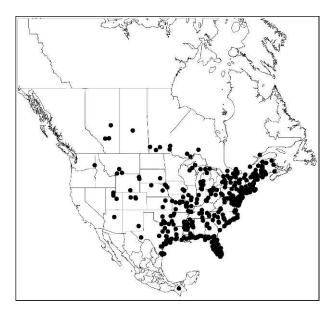
NOTE—The lectotype male was designated by J. Brown and Lewis (2000).

Sparganothis flavibasana; Fernald in Dyar, 1902 [1903], Bulletin of the U.S. National Museum **52**: 475. COMBINATION.

The distinctive forewing color and pattern distinguish this species from its congeners: the ground color is smoky tan to rust orange with inconspicuous pale-tan striae throughout. There is a small, ill-defined, paler brownish-ocherous patch at the base of the costa; a variably developed, redbrown to purple-brown fascia originating at the costa about 1/3 the distance from the base to the apex, extending to the dorsal margin about 1/5 the distance from the base to the apex; and the apical region and termen support a well-defined, redbrown to purple-brown patch. The markings usually are slightly more diffuse and less well defined in the female. Forewing length is 7.5–9.0 mm (mean = 8.3 mm; n = 10) in males and 9.0– 10.0 mm (mean = 9.5 mm n = 10) in females. The male forewing costal fold is short and narrow, but distinct; and the labial palpi are moderately long in the male and longer in the female. Male antennal sensillae are short in the male, about ½-5% times the width of the flagellomere.

In the male genitalia (plate 9, figure 4) the uncus is slender in the distal ½ and slightly broadened in the basal portion; the socii are large and unmodified, with the secondary arms comparatively slender and densely setose in the distal ¼; the transtilla has a well-developed, spiny, mesial process; and the valvae are comparatively elongate and subrectangular, with the termination of the sacculus represented by a well-defined triangular process about ⅓ the distance from the base to the apex of the valva. The aedeagus is comparatively short, evenly curved, with 7–8 slender, weakly undulate cornuti in the vesica.

The female genitalia (plate 23, figure 5) have an obovate sterigma; the ostium bursae is irregularly ovoid; the ductus bursae is moderately long, widening anteriorly, and broadly coiled two revolutions; the colliculum is well defined, separated from the sterigma by a short membranous gap; the corpus bursae is relatively small and irregularly rounded, with the signum a rugose band at the junction of the corpus and ductus bursae, reminiscent of that found in most species of *Cenopis*.



MAP 18. DISTRIBUTION OF MATERIAL EXAMINED OF SPARGANOTHIS SULFUREANA

Dates of capture extend from mid-June to mid-July with limited latitudinal influence. Previously published information (Forbes, 1923; MacKay, 1962; Godfrey et al., 1987) indicates that the larvae of *Sparganothis flavibasana* feed only on honey-suckle (*Lonicera* sp.; Caprifoliaceae), and specimen label data corroborate this, with over 20 specimens reared from different localities in Quebec and Ontario.

Sparganothis flavibasana ranges from southern Canada (Quebec to Saskatchewan) south to New York and Illinois (map 17). [Specimens examined: $60 \, \delta$, $57 \, 9$, $6 \, \text{slides}$]

Sparganothis sulfureana (Clemens)
PL. B, FIGS. 8–22 (adult); PL. 9, FIG. 5 (♂ gen.);
PL. 23, FIG. 6 (♀ gen.); MAP 18 (RWH 3695, 3696).

Croesia? sulfureana Clemens, 1860, Proceedings of the Academy of Natural Sciences, Philadelphia, 12: 353.

Type locality: [Easton, Pennsylvania]. [ANSP]

NOTE—The lectotype (abdomen lacking) was designated by Darlington (1947: 100)

Conchylis gratana Walker, 1863b, List of the Specimens of Lepidopterous Insects in the Collection of the British Museum, **28**: 359.

Type locality: North America [no locality data]. [BMNH]

Croesia? fulvoroseana Clemens, 1864, Proceedings of the Entomological Society of Philadelphia, 3: 516.

Type locality: [Easton, Pennsylvania]. [ANSP] NOTE—The lectotype male was designated by Darlington (1947: 100).

Croesia? virginiana Clemens, 1864, Proceedings of the Entomological Society of Philadelphia, 3: 517.

Type locality: Virginia. [ANSP]

NOTE—The lectotype female was designated by Darlington (1947: 101).

Croesia? gallivorana Clemens, 1864, Proceedings of the Entomological Society of Philadelphia, 3: 517.

Type locality: [Illinois]. [ANSP]

NOTE—The lectotype male was designated by Darlington (1947: 101).

Croesia gallicorana Clemens, 1864, Proceedings of the Entomological Society of Philadelphia, 3: 517.

NOTE—Croesia gallicorana Clemens, 1864, is an incorrect subsequent spelling of Croesia? gallivorana Clemens, 1864.

Tortrix (Dichelia) sulfureana var. belfrageana Zeller, 1875, Verhandlungen der Zoologisch-Botanischen Gesellschaft in Wien, **25**: 232.

Type locality: Texas. [BMNH]

NOTE—There are four syntypes – three males and one female.

Croesia virgineana Zeller, 1875, Verhandlungen der Zoologisch-Botanischen Gesellschaft in Wien, **25**: 230.

NOTE—Croesia virgineana Zeller, 1875, is an incorrect subsequent spelling of Croesia? virginiana Clemens, 1864.

Epagoge sulfureana; Fernald in Dyar, 1902 [1903], Bulletin of the U.S. National Museum 52: 476. COMBINATION.

Sparganothis sulfureana; Barnes and McDunnough, 1917, Check List of the Lepidoptera of Boreal America: 176. COMBINATION.

Sparganothis sulphureana Barnes and Busck, 1920, Contributions to the Natural History of the Lepidoptera of North America, 4: 31.

NOTE— Sparganothis sulphureana Barnes and Busck, 1920, is an incorrect subsequent spelling of Sparganothis sulfureana (Clemens, 1864).

Sparganothis euphronopa Meyrick, 1927, Exotic Microlepidoptera, 3: 370.

Type: Alpine, Texas. [BMNH]

NOTE—The lectotype female was designated by Clarke (1958: 219).

Sparganothis befrageana; Powell, 1983b, Check List of the Lepidoptera of America North of Mexico: 41. STATUS.

The remarkable variation in size and forewing pattern exhibited by the material examined indicates that S. sulfureana is either a highly variable species (both within and between geographic regions) or a complex of closely related species. This variation is manifested in the number of times the species has been described (i.e., synonyms). The male and female genitalia exhibit limited variation that generally is not consistent with forewing pattern differences or geography. For example, among individuals from the same locality, scobination on the aedeagus may be well defined, weak, or altogether absent, and the signum may be variably developed, with or without spinules. Although it is possible that S. lycopodiana, S. bistriata, and S. tristriata are part of this same species complex, the latter three exhibit considerably more uniformity in phenotype and greater fidelity to a limited geographic range. Also, the female genitalia of S. sulfureana are somewhat distinct from those of those species. The proposed synonymy of S. belfrageana is based on the fact that this phenotype occurs at many locations within the range of S. sulfureana—it is found from southern Canada to Florida, and west to the Mexican border (Texas). The female genitalia of S. sulfureana usually can be distinguished by the strongly pointed anterolateral margins of the

sterigma in contrast to the evenly rounded margins of most congeners; by the sclerotized posterior third of the ductus bursae; and by the small signum situated at the anterior end of the corpus bursae.

In general, the forewing ground color of S. sulfureana is pale to bright yellow, with highly variable orange-brown to reddish-orange reticulation throughout, and two transverse fasciae, together forming a somewhat V-shaped pattern. Both fasciae arise from a squarish blotch near the middle of the dorsal margin, one extending to the costa, intersecting it about 1/3 the distance from the base to the apex, and the second extending toward the apex, angled toward the termen at about $\frac{2}{3}$ its length. The hindwing is variable from immaculate white to gray. Forewing length is 6.0-9.0 mm in males and 7.0-11.0 mm in females. The male forewing costal fold is short and narrow, but distinct; and the labial palpi are moderately long in both sexes, slightly longer in the female. Male antennal sensillae are about ²/₃-³/₄ times the diameter of the flagellomere.

In the male genitalia (plate 9, figure 5) the uncus is slender and slightly enlarged and/or flattened apically; the inner margin of the socius is directed laterally in the distal ½, with the secondary arms only slightly expanded distally; the transtilla is enlarged medially, with a mesial spiny process; and the valvae are subrectangular, with a well-defined but short, weakly undulate sacculus. The aedeagus is evenly curved with 6–7 slender cornuti.

In the female genitalia (plate 23, figure 6) the sterigma is a broad rectangular plate, with elongate, pointed, anterolateral margins, and the ostium bursae represented by a large, urn-shaped bowl; the ductus bursae is sclerotized in the posterior ½, and the membranous portion coiled two revolutions. The corpus bursae is irregularly rounded with variable faint scobination; the signum is located near the anterior end of the corpus bursae in the form of a hollow thorn from a short, irregular, sclerotized band.

Sparganothis sulfureana was described from Pennsylvania and the type represents the prevalent form in the East, Northeast, and Midwest: the thorax and forewing are sulphur yellow with fine, rust-orange to rust-brown striae, and the hindwing is whitish to pale gray. In males there is a primary pattern consisting of variably complete and distinct, rust-brown, transverse fasciae from the costa in the

basal one-third angled outward beyond the middle and angled inward to converge just before the dorsal margin, forming a V- or Y-pattern; usually there are indistinct rust smudges in the preapical and tornal areas, but not a distinct terminal fascia. Females are typically larger than males and tend to have weaker markings with the primary pattern more often broken. In the Northeast (Nova Scotia, Quebec, Maine), many individuals lack the striae and primary pattern, so the whole disk is yellow, bordered along the costa and distally by rust clouding. The loss of the primary pattern is less frequent southward (Ontario to New York), and westward the ground color is paler, lemon yellow, not striate, and the pattern is reduced to thin lines. Specimens from Maryland and Virginia consistently have lemon-yellow but not striate forewing ground color, with a bold, distinct primary pattern, and the hindwings are usually darker gray. Those from the Southeast (South Carolina, three localities, n = 16) are smaller and darker yellow, more extensively striate, and this tendency increases in Florida (north Alachua County and south Highlands County), where the ground color is replaced by rust reticulation, lines along the veins joined by numerous cross striae.

Sparganothis belfrageana was described from central Texas (Bosque County) based on a short series of small individuals collected in late July having bright golden-yellow forewings lacking reticulation, the primary pattern rust with shining lilac iridescence, its fascia incomplete, broken into three spots, with the dorsal spot large and triangular, and the termen with a distinct rust fascia. This distinctive phenotype occurs throughout much of the range of *S. sulfureana* and may represent a distinct species.

Considering the overall range in variation, we see all degrees of intermediates between typical *S. sulfureana* and *S. belfrageana*. However, two specimens resembling the *belfrageana* form have been collected at the same locality and time (e.g., Archbold Biological Station, Florida) as densely reticulate examples. We reared several families from egg masses deposited by captive females from Maryland, Illinois, Florida, and Texas and found that individual females do not carry a wide range of genetic variation. Rather, each family, both males and females, resembles the mother in ground color, extent of reticulation, and degree of com-

pleteness of the primary pattern. Thus, our series from Lick Creek Park, Brazos County, Texas (n = 21) matches the description of *S. belfrageana*, whereas those reared from Florida (Archbold Biological Station) from three females (n = 50+) are all densely reticulated with the primary pattern obsolete. A reared series from Illinois, as well as series taken at light at single localities in southern Ontario and at Alexandria, Virginia, are uniform in having basic elements of the *S. belfrageana* form. We do not detect differences in seasonal variation between generations. All phases of phenotype occur in specimens collected in June and July, as well as their progeny.

Sparganothis sulfureana is the "false yellow-head" or "sulfur leafroller" of the older American economic literature (e.g., Beckwith, 1938). It is a polyphagous leaf-roller, reported from various crops, including celery (Apium graveolens Linnaeus, Apiaceae), cranberry (Vaccinium macrocarpon Aiton, Ericaceae), clover (Trifolium spp., Fabaceae), pines (Pinus spp., Pinaceae), corn (Zea mays Linnaeus, Poaceae), strawberry (Fragaria sp., Rosaceae) and apple (Malus domestica Borkhausen, Rosaceae), and tobacco (Nicotiana sp., Solanaceae). Native and weedy host plants include honey locust pigweed (Amaranthus retroflexus Linnaeus, Amaranthaceae), great burdock (Arctium lappa Linnaeus, Asteraceae), goldenrod (Solidago sp., Asteraceae), and horseweed (Conyza sp., Asteraceae), honey locust (Gleditsia sp., Fabaceae), primrose (Oenothera sp., Onagraceae), tall buttercup (Ranunculus acris Linnaeus, Ranunculaceae), willow (Salix sp., Salicaceae), and vervain (Verbena sp., Verbenaceae). Martin (1958) and Prentice (1966) recorded various coniferous and deciduous trees as hosts; Walsh (1867) reported it from galls of Salicis brassicoides (Walsh) (Cecidomyiidae) on *Salix* (Salicaceae).

It has been reported as an economically important pest of celery (Davis 1893), apple (Chapman and Lienk, 1971), cranberry (Franklin, 1907; Hardenburg, 1908; Beckwith, 1938; Marucci, 1953; Eck, 1990; Cockfield and Mahr, 1993; Cockfield et al., 1994a, b), and blueberry (Marucci, 1966). Apparently the summer generation is subject to occasional, localized outbreaks, causing serious damage to cranberries in Massachusetts, New Jersey, and Wisconsin. It is considered the second most widespread and destructive fruitworm in North America (Eck, 1990).

Beckwith (1938) provided the first complete review of the life cycle. Overwintering larvae produce pupae in early to mid-June, with first generation adults flying from mid-June through July; eggs of the second generation are deposited from 20 June to 5 July, with the first larvae appearing 1-15 July, the first pupae from 25 August to 15 September, and the first adults during 5–25 September; eggs are laid 6– 26 September, and first instar larvae are present around 15 September; larvae overwinter. There may be three broods in the southern portions of its range. According to Beckwith (1938), eggs hatch in 9–12 days; larval development is extremely variable in duration; and the pupal stage lasts 7-12 days. Damage to the food plant is caused in three ways: 1) by destroying the fruit buds in the spring; 2) by webbing and eating the foliage; and 3) by mining the fruit. Sandberg and Passoa (1989) provide an illustration of the venter of the head and mouthparts of the pupa.

Sparganothis sulfureana occupies much of the eastern half of North America. It has been recorded from Nova Scotia to Alberta, south to Florida and Texas, and west to Montana, Utah, and Arizona (map 18); there is a single record from the state of Washington. It also has been recorded from the Bahaman Islands and Bermuda (Ferguson et al., 1991), Cuba (USNM), Chiapas, Mexico (CNC), and Belize (USNM). [Specimens examined: 375 &, 290 \, 25 slides]

Sparganothis lycopodiana (Kearfott) PL. B, FIG. 23 (adult); PL. 9, FIG. 6 (♂ gen.); PL. 24, FIG. 1 (♀ gen.); MAP 19 (RWH 3697).

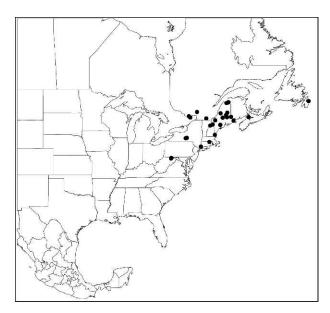
Epagoge lycopodiana Kearfott, 1907a, Canadian Entomologist, **39**: 2.

Type locality: Hurdman's Bridge, Ottawa, Ontario. [AMNH]

NOTE—The lectotype male (reared from *Lycopodium*, 9 August 1906) was designated by Klots (1942: 414).

Sparganothis lycopodiana; Barnes and McDunnough, 1917, Check List of the Lepidoptera of Boreal America: 176. COMBINATION.

Sparganothis lycopodiana is most similar to S. sulfureana, especially in features of the male and female genitalia; preliminary molecular data (based



MAP 19. DISTRIBUTION OF MATERIAL EXAMINED OF SPARGANOTHIS LYCOPODIANA

on cytochrome oxidase I) fail to distinguish the two. However, several lines of evidence suggest that the two are distinct: 1) *S. lycopodiana* can be distinguished by the deep purplish-brown color of the forewing markings; 2) its smaller size although some individuals of *S. sulfureana* are as small; 3) although polyphagous, typical *S. sulfureana* has not been reared from *Lycopodium*, whereas all reared *S. lycopodiana* have originated from that host; and 4) COI fails to distinguish *S. tristriata* from *S. sulfureana* and *S. lycopodiana* despite the fact that *S. tristriata* is distinct based on maculation and genitalia, suggesting that COI may not be reliable within this group.

In *S. lycopodiana* the ground color of the forewing is pale yellow, with fine orange reticulation, most dense in the apical one-half; pattern elements consist of purplish-brown lines within which lie conspicuous, narrow lines of iridescence. There is a narrow purplish-brown line in the subterminal region parallel to the termen, and a similarly colored parallel line just basad, the two lines separated by a region of orange reticulation. As in *S. sulfureana*, there are two transverse fasciae, together forming a somewhat V-shaped pattern, with both fasciae arising from an ill-defined squarish blotch just distad of the middle of the dorsal margin, one extending to the costa, intersecting it about ½ the distance from the base

to the apex, and the second intersecting the costa at about $\frac{3}{4}$ the distance from the base to the apex. The hindwing is always uniformly dark brown. Forewing length is 4.5–6.1 mm (mean = 5.5 mm; n = 10) in males and 6.5–7.0 mm (mean = 6.7 mm; n = 10) in females. The male forewing costal fold is short and narrow, but distinct; and the labial palpi are relatively long in both sexes, slightly longer in the female. Antennal sensillae are short in the male, about $\frac{1}{2}$ times the diameter of the flagellomere.

In the male genitalia (plate 9, figure 6) the uncus is slender from a rounded-triangular base; the socii are laterally divergent in the posterior ½, with the secondary arms rather long and slender; the transtilla is enlarged mesially, with a single spiny process; and the valvae are subrectangular, with a short sacculus. The aedeagus is evenly curved with 5–6 slender cornuti (deciduous, and lost in male illustrated) and a variable patch of external scobination subdistally.

In the female genitalia (plate 24, figure 1) the sterigma is a broad rectangular plate, with the ostium bursae represented by a large, urn-shaped bowl; the ductus bursae is moderately broad at the colliculum, narrow throughout the rest, and coiled two revolutions. The corpus bursae is irregularly rounded and lacks scobination, and the signum is in the form of a hollow thorn from an irregularly triangular, sclerotized band.

This species is associated with club moss (Lycopodium sp., Lycopodiaceae; n = 30+ rearing records). According to Kearfott (1907a), the type series consisted of 12 specimens "... bred by Mr. C. H. Young, from larvae feeding in Club Moss, Lycopodium, at Hurdman's Bridge, Ottawa, Canada." The association of this species with Lycopodium is corroborated by subsequent rearing by A. E. Brower and others. The use of a bryophyte as a larval host is extraordinary in Tortricidae, and the putative monophagy of S. lycopodiana is highly unusual within Sparganothis. Capture records extend from early July through mid-August.

Sparganothis lycopodiana is known only from southeastern Canada (Nova Scotia, Quebec and Ontario) and the northeastern United States (Maine, New Hampshire, Massachusetts, Connecticut, and Maryland) (map 19). [Specimens examined: $80\ \frac{3}{5}$, $73\ \frac{9}{5}$, $5\ \frac{1}{5}$ slides]

Sparganothis minimetallica Powell and J. Brown, NEW SPECIES



MAP 20. DISTRIBUTION OF MATERIAL EXAMINED OF SPARGANOTHIS MINIMETALLICA

Pl. B, figs. 24, 25 (adult); pl. 10, fig. 1 (3 gen.); pl. 24, fig. 2 ($^{\circ}$ gen.); map 20

Sparganothis minimetallica Powell and J. Brown.

Type locality: Big Pine Key [Key Deer Reserve], Monroe Co., Florida. [EME]

NOTE—The species name *minimetallica* refers to the diminuative size and metallic forewing pattern of this species.

Adults of *S. minimetallica* are the smallest in the genus, averaging just 4.7 and 5.0 mm forewing length in males and females, respectively. They resemble miniature *S. sulfureana* and may constitute a derivation of that species, having a yellow forewing with a "belfrageana"-like pattern mostly obscured by rust-colored scales. *Sparganothis minimetallica* can be distinguished from *S. sulfureana* by its smaller size and the absence of a forewing costal fold in the male.

Description. Male. Head: Hood simple; frons and vertex scaling weakly roughened, yellow, tinged with rust laterally; labial palpus comparatively short, about 1.3–1.5 times horizontal diameter of compound eye, scaling rust orange laterally, pale ocherous on inner surface; antennal scaling rust on scape and basal flagellomeres, pale tan distally, sensillae about 1.0 times width of flagellomere. Thorax: Dorsum yellow, tegulae tinged

with rust basally; venter shining whitish. Forewing length 3.8-5.4 mm (mean = 4.7 mm; n = 8), relatively narrow, length 2.9-3.0 times width; costal fold absent; forewing ground color yellow to dark ocherous with a reticulate pattern of shining metalliclike, rose-plum color, darker and more extensive in fresh specimens; metallic pattern well defined along costa, a transverse median fascia from before mid costa to dorsal margin just before tornus, there joined to a fascia from costa beyond cell, a prominent subterminal bar (pattern suppressed, washed out through middle of wing longitudinally in Miami-Dade County, Florida specimens); fringe ocherous; underside tan to gray with costa and fringe pale rust to yellowish. Hindwing white to gray with contrasting whitish fringe, without anal fold and associated hair pencil. Abdomen: Dorsum tan, venter paler, shiny. Genitalia (plate 10, figure 1) with uncus long and slender; socius comparatively narrow throughout, secondary arms enlarged distally, densely setose; transtilla with a single spiny mesial lobe; valva relatively short, broadest at base, attenuate distally, sacculus well defined, confined to basal 1/3 of ventral margin of valve. Aedeagus somewhat curved throughout; vesica with 8-10 cornuti (deciduous, and lost in male illustrated).

Female. Head and thorax: Essentially as described for male, except length of labial palpus slightly shorter, 1.5 times horizontal diameter of compound eye (eye slightly smaller in female); forewing length 4.5–5.4 mm (mean = 5.0 mm; n = 5). Abdomen: Genitalia (plate 24, figure 2) with sterigma subrectangular, antrum urn shaped; ductus bursae long, coiled one revolution, colliculum small, separated from ostium bursae by narrow portion of membranous ductus bursae; corpus bursae rounded, signum in the form of a small rounded sclerite with a slender hooked process.

TYPES. **Holotype:** δ . Big Pine Key [Key Deer Reserve], Monroe Co., Florida; 3 June 1986; J. Powell. EME. **Paratypes:** 7 δ , 4 \mathfrak{P} . **Florida.** Homestead, Miami-Dade Co.; 20 May 1958, 25 March 1959, 29 October 1959; D. O. Wolfenbarger (2 δ , 1 \mathfrak{P}). Same locality, date and collector as for holotype (1 δ , 1 \mathfrak{P}); JAP 86F4 (eggs), larvae reared on synthetic diet, emerged 27–31 July 1986; J. Powell (3 δ). Big Pine Key, Monroe Co.; 16 July 1971; Pierce (1 \mathfrak{P}). Big Pine Key, Watson's Hammock, Monroe Co.; 20 May 1990; B. Landry (1 δ). Big Pine Key, Pineland, Monroe Co.; 26 May 1990; B. Landry (1 \mathfrak{P}). EME, USNM.

No larval food plant is known. Eggs deposited in captivity early June in small round patches ($n=9,\ 10$) were green without a visible colleterial covering, and hatched in 10–11 days stored in a field camp cooler during days. No larvae were preserved, but we noted very little integumental color, even the head capsule, in late instars. Most larvae did not accept synthetic diet, but those that did produced larger specimens than field collected adults and pupated in 28 to 30 days. Adults emerged after about 13 days pupation (total time from egg deposition to adult = 52–56 days).

Three lab-reared males are larger than flown specimens of both sexes, with a mean forewing length of 5.3 mm. They are appreciably darker, with the forewing ground color dark ocherous and the metallic rose-plum pattern more extensive. Moreover, the hindwing is gray, contrasted with white in the field collected specimens. Two additional males from south Florida are similar but apparently represent diminutive forms of S. sulfureana: Dade Co., Long Pine Key, Everglades National Park, 5 June 1986 (J. Powell), which has reduced rose-plum in the forewing pattern, resembling forms of *sulfureana*; and Highlands Co., Sebring, 15 August 1942 (C. T. Parsons), as small as Florida Keys S. minimetallica with a forewing pattern similar to the Everglades specimen.

This species is recorded only from the extreme southern Florida mainland and the Florida Keys (Map 20).

[Specimens examined: $8 \, \delta$, $4 \, \circ$, $4 \, \circ$, $4 \, \circ$]

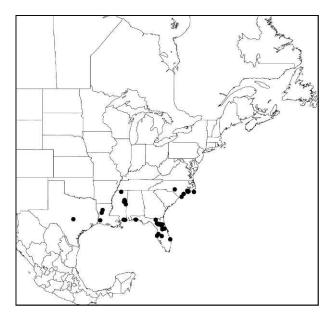
Sparganothis bistriata Kearfott PL. B, FIG. 26 (adult); PL. 10, FIG. 2 (♂ gen.); PL. 24, FIG. 3 (♀ gen.); MAP 21 (RWH 3698).

Sparganothis bistriata Kearfott, 1907b, Transactions of the American Entomological Society, **33**: 67.

Type locality: Florida. [AMNH]

NOTE—The lectotype male was designated by Klots (1942: 412).

Sparganothis bistriata has a pale yellow-orange to cream-yellow forewing with two conspicuous longitudinal red-brown lines (including irregular small patches of purple scales in fresh specimens)—one along the costa and the other through the middle of the discal cell. A small red-brown linear streak is near the middle of the dorsal margin. As



MAP 21. DISTRIBUTION OF MATERIAL EXAMINED OF SPARGANOTHIS BISTRIATA

for *S. tristriata*, the forewing bears irregularly scattered, angled and iridescent scales. The hindwing is pale grayish. Forewing length is 7.6-8.2 mm (mean = 8.0 mm; n = 10) in males and 9.6-11.0 mm (mean = 10.3 mm; n = 10) in females. The male forewing costal fold is extremely narrow or absent; the labial palpi are moderately long in the male, slightly longer in the female. Antennal sensillae are $\frac{3}{4}-\frac{4}{5}$ times the flagellomere diameter in the male.

Sparganothis bistriata is closely related to S. sulfureana and S. tristriata. It can be distinguished from S. tristriata by the unmarked apical ¼ of the forewing (i.e., the longitudinal lines attenuate well before the termen); much reduced longitudinal stripe along the dorsal margin of the forewing (usually not reaching the base); a shorter, stouter aedeagus; a shorter sterigma; and a slightly shorter antrum. Superficially, it differs from S. sulfureana in the presence of the two distinctive longitudinal red-brown lines on the forewing.

In the male genitalia of *S. bistriata* (plate 10, figure 2) the uncus is long and slender; the socii are slender and somewhat attenuate and divergent posteriorly, with the secondary arms moderately broad and densely setose distally; the transtilla has a moderately broad, spiny mesial process; and the valvae are rather short, broad basally and slightly narrowed distally, with a broad rounded apex and

a well-defined sacculus. The aedeagus is curved near the middle, with a patch of six slender cornuti in the vesica and some scobination in the distal ½.

In the female genitalia (plate 24, figure 3) the sterigma is unmodified; the antrum is short, rounded, urn shaped, densely spiculate on the inner surface, with a pair of posterior flaps curving laterad; the ductus bursae is moderately long and coiled two revolutions; the colliculum is elongate, attached directly to the ostium bursae; and the corpus bursae is rounded, with a signum that consists or an irregular sclerotized patch bearing a slender straight thorn. The signum is similar to that of *S. tristriata*, especially in the slender thorn, but that of *S. bistriata* has a larger sclerotized patch.

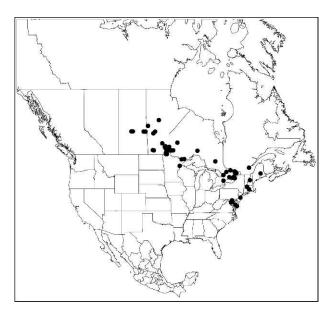
Nothing is known of the early stages of *S. bistriata*, but we suspect it to be a conifer feeder based on its similarity to *S. tristriata*. Cumulative capture records extend from March through December, with the majority of specimens taken from May to September. Regional data suggest two broods: July and September in Virginia and April–June and September–October in Florida.

Sparganothis bistriata apparently is restricted to the southeastern United States from Virginia (few records) to Florida (numerous records) and west to Texas (a single record) (map 21). Two records from Pennsylvania (AMNH) likely are mislabelled. Sparganothis bistriata appears to be allopatric with the related and more northern S. tristriata. Although both species have been collected in Virginia, S. bistriata is known only from the extreme southeastern portion. [Specimens examined: $52 \, \delta$, $50 \, \varphi$, $5 \, \text{slides}$]

Sparganothis tristriata Kearfott PL. B, FIG. 27 (adult); PL. 10, FIG. 3 (♂ gen.); PL. 24, FIG. 4 (♀ gen.); MAP 22 (RWH 3699).

Sparganothis tristriata Kearfott, 1907b, Transactions of the American Entomological Society, 33: 67.

Type locality: Duluth, Minnesota. [USNM] NOTE—The male lectotype (designated here) was selected by R. Lambert and labelled by Powell. According to the original description (Kearfott 1907b), this species was described from five specimens: four from Duluth, Minnesota and one from Plummers Island, Maryland, with "co-types" deposited in the USNM and the Fernald collection (subsequently transferred to the USNM). The USNM collection



MAP 22. DISTRIBUTION OF MATERIAL EXAMINED OF SPARGANOTHIS TRISTRIATA

includes two of the specimens from Duluth and the specimen from Plummers Island. Klots (1942: 416) indicated that there was a female "cotype" in the AMNH from Duluth. Hence, the location of the fifth co-type is unknown. The lectotype designated here was referred to as a syntype by J. Brown and Lewis (2000). A male labelled "Duluth, Min." (white label), "TYPE Collection of W.D. Kearfott" (red label), "Sparganothis tristriana Cotype Kearf." (white label), "S. tristriana genitalia on slide AB April 11, 1936" (white label), "LECTOTYPE Sparganothis tristriana Kft. by Lambert, JAP '65" (white label), "Genitalia Slide by A. Busck, USNM 88150" (green label), and "Lectotype USNM 67858" (red label), is designated the lectotype to ensure stability of the name.

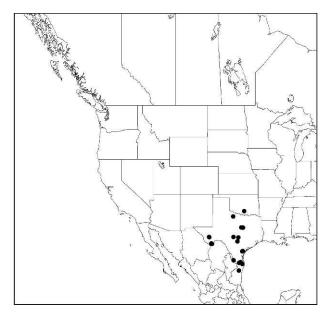
Sparganothis tristriata is closely related to S. sulfureana and S. bistriata. Superficially, the three species can be distinguished by forewing pattern. In S. tristriata the forewing is yellow to pale yellow orange, lightly and variably reticulated with orange, with three conspicuous longitudinal redbrown lines: one along the costa, one through the middle of the discal cell, and one along the dorsal margin, all of which extend to, or coalesce before, the termen. The entire forewing has a faint irregular pattern of iridescence; in fresh specimens there are scattered short raised scales, and much of the surface has a pearly iridescence. In specimens from New Jersey (USNM), the forewing is conspicuously more heavily reticulated with orange, diminishing the definition of the three

longitudinal lines. The hindwing is pale grayish in both sexes. Forewing length is 8.0-9.2 mm (mean = 8.5 mm; n = 10) in males and 8.0-10.9 mm (mean = 9.5 mm; n = 10) in females. The male forewing costal fold is absent; the labial palpi are only slightly longer in the female. Male antennal sensillae are about equal to the width of the flagellomere.

In the male genitalia (plate 10, figure 3) the uncus is long and slender from a broad, rounded base; the socii are slender and attenuate and divergent posteriorly, with the secondary arms moderately broad and densely setose in the distal one third; the transtilla has a spiny mesial process, with few larger spines; and the valvae are triangular, weakly narrowed from the base to the apex, with a broadly rounded apex and a well-defined sacculus confined to the basal ½ of the valva. The aedeagus is evenly curved, with a patch of 5–6 slender cornuti (deciduous, and lost in male illustrated) and external scobination similar to that in *sulfureana* and *bistriata*.

The female genitalia probably provide the best morphological features for separating *S. tristriata* and *S. sulfureana*. In *S. tristriata* (plate 24, figure 4) the sterigma is a weakly-bilobed lateral band, and with slightly angulate lateroanterior corners; the antrum is urn shaped, with a pair of short, posterior, laterally projecting, curved edges; the colliculum is comparatively long, subrectangular, and slightly narrowed near the middle, with a narrow line of sclerotization around the internal perimeter; the ductus bursae is long and coiled two revolutions; and the corpus bursae is round, with the signum in the form of an irregular, somewhat long-rectangular, rugose, sclerotized patch, with a slender attenuate spine projecting inward.

The vast majority of larval hosts recorded for *S. tristriata* are Pinaceae, with other families (i.e., Cupressaceae, Rhamnaceae, Rosaceae, Salicaceae) documented at much lower frequency. Host records compiled by Prentice (1966) from the Canadian Forest Insect Survey (n = 163 collections) showed a strong preference for pines (73%), especially *Pinus banksiana* Lambert (63%) and other conifers, spruce (*Picea*, 15%), and fir (*Abies*, 5%). There was one record of *Chamaecyparis thyoides* (L.) Britton et al. (Cupressaceae) and four incidental records for angiosperms.



MAP 23. DISTRIBUTION OF MATERIAL EXAMINED OF SPARGANOTHIS DEMISSANA

Based on collections in Canada (Prentice, 1966), larvae are present from late May to late September; the majority of these collections were from late June to early August. Pupae are present in late June to early August, and adults from late June to late August. These data suggest that the species is single brooded, with the overwintering stage unknown. A series of adults from many sites and dates collected by G. Balogh in Michigan indicates a flight period from mid-July to late August. Based on specimens we examined, the species may fly into September in some years (e.g., a syntype from Plummers Island).

Sparganothis tristriata has been recorded from Quebec and Maine to eastern Manitoba and Minnesota, ranging south along the eastern edge of the continent to Virginia (map 22). [Specimens examined: $120 \, \delta$, $42 \, \circ$, $10 \, \text{slides}$]

Sparganothis demissana (Walsingham) PL. B, FIGS. 28, 29 (adult); PL. 10; FIG. 4 (δ gen.); PL. 24, FIG. 5 (φ gen.); MAP 23 (RWH 3703).

Cenopis demissana Walsingham, 1879, Illustrations of Typical Specimens of Lepidoptera Heterocera in the Collection of the British Museum, 4: 19.

Type locality: Texas. [BMNH]

NOTE—Cenopis demissana Walsingham was described from one male and two female syntypes. We examined the specimens and find no reason to designate a lectotype.

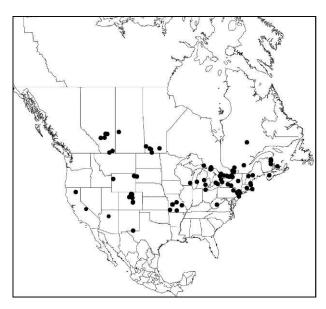
Epagoge demissana; Fernald in Dyar, 1902 [1903], Bulletin of the U.S. National Museum **52**: 476. COMBINATION.

Sparganothis demissana; Barnes and McDunnough, 1917, Check List of the Lepidoptera of Boreal America: 176. COMBINATION.

Sparganothis demissana is one of the smaller species in the genus, characterized by a bright, shiny, pale-rust to yellow-orange forewing, weakly striated throughout with slightly darker yellow orange; the basal ½ of the costa often has some darker brown scales. The hindwing is cream white. Forewing length is 6.0-7.0 mm (mean = 6.3 mm; n = 10) in males and 7.0–8.5 mm (mean = 8.0 mm; n = 10) in females. The male forewing costal fold is absent; the labial palpi are shorter than in other species of Sparganothis in both sexes, slightly longer in the female. Antennal sensillae are 1/10-4/5 times the width of the flagellomere in the male. The combined characters of the forewing pattern, small size, and short labial palpi combine to distinguish this species from its congeners. The comparatively thicker uncus and elongate signum serve to distinguish the male and female genitalia from those of congeners.

In the male genitalia (plate 10, figure 4) the uncus is broader and slightly shorter than in other species of *Sparganothis*; the socii are slender and attenuate posteriorly, with the secondary arms widely dilated and densely setose distally; the transtilla has a moderately broad, bilobed spiny process mesially; and the valvae are nearly parallel sided and rounded apically, with a narrow, undulate sacculus. The aedeagus is relatively short and curved near the middle, with four slender cornuti in the vesica.

In the female genitalia (plate 24, figure 5) the sterigma is unmodified; the antrum is round-ovoid; the ductus bursae is coiled one or two revolutions; the colliculum is joined to base of the sterigma; and the corpus bursae is large and ovate, with the signum in the form of a long, nearly straight,



MAP 24. DISTRIBUTION OF MATERIAL EXAMINED OF SPARGANOTHIS UNIFASCIANA

weakly spinulose band, extending about ½ the length of the corpus bursae. The unusual signum is unique in *Sparganothis* and reminiscent of that found in the tribe Cnephasiini.

This species appears to have two generations per year, the first in March through June and the second in August and September. Nothing is known of the larval biology.

Sparganothis demissana occurs primarily in Texas, with single records from Oklahoma and Tamaulipas, Mexico (map 23). [Specimens examined: $35 \ \delta$, $27 \$ $10 \$ slides]

Sparganothis unifasciana (Clemens) PL. B, FIG. 30 (adult); PL. 10, FIG. 5 (\eth gen.); PL. 24, FIG. 6 (Υ gen.); MAP 24 (RWH 3711).

Croesia? unifasciana Clemens, 1864, Proceedings of the Entomological Society of Philadelphia, 3: 516.

Type locality: [Easton, Pennsylvania]. [AMNH]

NOTE—The lectotype male was designated by Darlington (1947: 100).

Tortrix puritana Robinson, 1869, Transactions of the American Entomological Society, **2**, 271.

Type locality: Massachusetts. [ANSP]

Oenectra unifasciana; Fernald, 1882, Transactions of the American Entomological Society, 10: 20. COMBINATION.

Sparganothis unifasciana (= puritana Robinson); Fernald in Dyar, 1902 [1903], Bulletin of the U.S. National Museum, **52**: 476. COMBINATION, SYNONYMY.

Superficially, S. unifasciana is similar to Sparganothis vocaridorsana. It can be distinguished from the latter by its smaller size, brighter yellow ground color, and much smaller, broken, subapical costal patch. In fresh specimens the orange scales of the oblique forewing fascia and subapical patch are curled, giving an iridescent appearance. S. unifasciana is a moderate-sized species with a forewing length of 9.8-11.0 mm (mean = 10.3mm; n = 10) in males and 9.9–11.9 mm (mean = 11.2 mm; n = 10) in females. The costal fold is absent in the male; the labial palpi are very long in both sexes (length about 3.0-4.0 times the horizontal width of the compound eye), slightly longer in females. Antennal sensillae are about 1.0-1.2 times the width of the flagellomere in the male.

In the male genitalia (plate 10, figure 5) the uncus is long and slender from a rounded base; the socii are moderately slender and attenuate posteriorly, with the secondary arms slightly broadened and densely setose in the distal ½; the transtilla is variable, but usually bilobed and strongly spiny mesially; and the valva is relatively short, broadest at the base and slightly narrowed distally, with a broadly rounded apex and a well-defined sacculus confined to the basal ½ of the valva, which bears an elevated subterminal flange. The aedeagus is slightly curved, with a group of eight slender cornuti in the vesica.

In the female genitalia (plate 24, figure 6) the sterigma is large with somewhat rounded lateral corners ventrally; the antrum is large, urn shaped; the ductus bursae is moderately narrow, broadening toward the corpus bursae, and coiled one revolution; the colliculum is ringlike, barely separated from sterigma by a short membranous region; and the corpus bursae is moderately large and rounded, with the signum reduced to an extremely slender, elongate crease near the junction with the ductus bursae.

Sparganothis unifasciana is a polyphagous leafroller. There are numerous single specimen records from herbaceous plants including goldenrod (Solidago sp., Asteraceae), everlasting (Gnaphalium sp., Asteraceae), and aster (Aster sp., Asteraceae), feverwort (Triosteum sp., Caprifoliaceae), catchfly (Silene sp., Caryophyllaceae), sweet-clover (Trifolium sp., Fabaceae), pasqueflower (Anemone patens Linnaeus, Ranunculaceae), buttercup (Ranunculus sp., Ranunculaceae), and speedwell (Veronica officinalis Linnaeus, Scrophulariaceae). Prentice (1966) reported it from conifers: Scot's pine (Pinus sylvestris Linnaeus, Pinaceae), jack pine, white spruce, and ash (Fraxinus sp., Oleaceae), and it has been recorded from beech (Fagus sp., Fagaceae). Pogue and Lavigne (1981) list *Trifolium* sp. (Fabaceae), Fraxinus sp. (Oleaceae), Pinus sp. and Picea glauca (Moench) Voss (both Pinaceae), Crataegus sp., Malus sp., Prunus virginiana Linnaeus, and Rubus sp. (all Rosaceae) as hosts. Wagner et al. (1995) report rearing 64 individuals from Quercus sp. (Fagaceae) and 6 individuals from Vaccinium sp. (Ericaceae) in Virginia.

Cumulative capture records extend from June through August, with a few September records from Canada. It is likely that this species is univoltine although larvae we reared on synthetic diet from eggs laid in northern Arizona in late July developed without diapause; so, the life cycle differs from that of *S. senecionana*. Reared adults emerged in November, 98–120 days following oviposition.

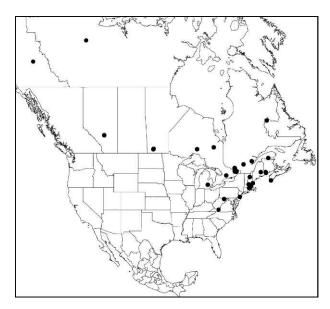
Sparganothis unifasciana spans nearly the entire continent, from Nova Scotia to Alberta, south to Tennessee, and west to southern New Mexico, northern Arizona, and northern California (Siskiyou and Inyo counties) (map 24). [Specimens examined: 45 & 25 & 8 slides]

Sparganothis violaceana (Robinson)
PL. B, FIG. 31 (adult); PL. 10, FIG. 6 (♂ gen.);
PL. 25, FIG. 1 (♀ gen.); MAP 25 (RWH 3710).

Tortrix violaceana Robinson, 1869, Transactions of the American Entomological Society, **2.** 271.

Type locality: Massachusetts. [AMNH]

NOTE—The lectotype male was designated by Klots (1942: 416).



MAP 25. DISTRIBUTION OF MATERIAL EXAMINED OF SPARGANOTHIS VIOLACEANA

Oenectra violaceana; Fernald, 1882, Transactions of the American Entomological Society, 10: 20. COMBINATION.

Sparganothis violaceana; Fernald in Dyar, 1902 [1903], Bulletin of the U.S. National Museum, **52**: 476. COMBINATION.

Sparganothis violaceana is easily distinguished from other species in the genus by its forewing pattern and color: shining yellow gold in the basal $\frac{1}{3}$, mostly pale violet in the distal $\frac{2}{3}$, and frequently with diffuse pale yellow-gold scaling in the apical region. It is a moderately large species, with forewing length of 9.0–11.0 mm (mean = 10.1 mm; n = 10) in males and 8.0–11.0 mm (mean = 9.5 mm; n = 10) in females. The male forewing costal fold is absent; the labial palpi are extremely long in both sexes, slightly longer in females. Male antennae are extremely slender, and the sensillae are short, about $\frac{1}{2}$ times the width of the flagellomere.

In the male genitalia (plate 10, figure 6) the tegumen is rectangular with rounded dorsal "shoulders" representing the bases of the gnathos, with a moderately long, slender uncus from a rounded base situated at the dorsum between bases of the gnathos; the socii are moderately slender and

somewhat parallel sided in the posterior ½, and the secondary arms are moderately broad and densely setose in the distal ½; the transtilla is variably bilobed mesially and spiny; and the valva is broadest at the base and nearly parallel sided, with a broadly rounded apex and a well-defined sacculus confined to basal ½, with a slightly elevated subterminal flange. The aedeagus is curved near the middle, and the vesica has a patch of six slender cornuti.

In the female genitalia (plate 25, figure 1) the sterigma is a broad rectangular plate; the antrum is cup shaped; the colliculum is a small, incomplete, weakly sclerotized ring, separated from the sterigma by a short membranous region; the ductus bursae is conspicuously broadened toward the corpus bursae and coiled one and one-half revolutions; and the corpus bursae is moderately large and rounded, with the signum represented by a small, sclerotized, J-shaped, longitudinal crease on the left side of the dorsum of the corpus bursae at the junction with the ductus bursae.

Adults have been captured primarily in May and June, with a few July records. Larval host plants evidently are unrecorded. We confined one female taken in a spruce bog near Almonte, Ontario in late May 1986; she deposited 82 eggs over a 3-day period in small patches of 10-24 eggs (mean = 16). The eggs were green with a conspicuous white, colleterial covering, like that of Amorbia. First instar larvae hatched in 10-11 days and fed on synthetic diet, reaching the final instar in July (25– 38 days). They constructed very dense silken tubes. in which they were not visible from above or below, unlike other Sparganothis we have reared. After specimens were harvested for preservation, about 15 larvae survived without further feeding. Apparently winter is passed as fully grown larvae in the dense tubular shelters; some were refrigerated for 45 days (September-October), and a few survivors were placed in an outdoor cage at Berkeley, California from December to April, but all desiccated and died.

Sparganothis violaceana occurs across the northern portion of the continent from Newfoundland to the Northwest Territories, ranging south in the East through Maine, New Hampshire, Massachusetts, and Connecticut to Maryland and Virginia (map 25). [Specimens examined: 25 δ , 15 \circ , 7 slides]

Sparganothis xanthoides (Walker)
PL. B, FIG. 32–37 (adult); PL. 12, FIG. 3 (venation); PL. 6, FIGS. 1, 2 (palpi); PL. 11, FIG. 1 (♂ gen.); PL. 25, FIG. 2 (♀ gen.); MAP 26 (RWH 3706).

Begunna xanthoides Walker, 1863a, List of the Specimens of Lepidopterous Insects in the Collection of the British Museum, Catalogue of the Heterocera, 27: 190.

Type locality: Vancouver Island, British Columbia. [BMNH]

Leptoris breviornatana Clemens, 1865, Proceedings of the Entomological Society of Philadelphia, 5: 140.

Type locality: [Easton, Pennsylvania]. [ANSP]

NOTE—The lectotype male was designated by Darlington (1947: 100).

Tortrix irrorea Robinson, 1869, Transactions of the American Entomological Society, 2: 274. Type locality: Br. [Brewsters], Putnam County, New York. [ANSP]

NOTE—The lectotype male was designated by Klots (1942: 414).

Oenectra inconditana Walsingham, 1879, Illustrations of Typical Specimens of Lepidoptera Heterocera in the Collection of the British Museum, 4: 16.

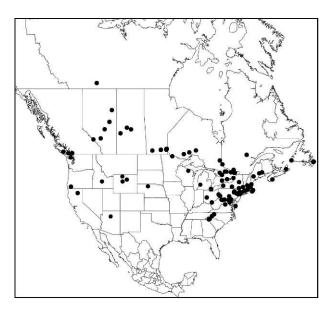
Type locality: Pitt River, California and Rouge [Rogue] River southern Oregon. [BMNH]

NOTE—Three male and one female syntypes are in The Natural History Museum. The male with a small, round "type ht" label is here designated the lectotype.

Oenectra xanthoides; Fernald, 1882, Transactions of the American Entomological Society, 10: 20. COMBINATION.

Sparganothis irrorea; Fernald in Dyar, 1902 [1903], Bulletin of the U.S. National Museum, **52**: 478. COMBINATION.

Leptoris breviornatana (= xanthoides); Fernald in Dyar, 1902 [1903], Bulletin of the U.S.



MAP 26. DISTRIBUTION OF MATERIAL EXAMINED OF SPARGANOTHIS XANTHOIDES

National Museum, **52**: 478. SYNONYMY.

Sparganothis inconditana; Fernald in Dyar, 1902 [1903], Bulletin of the U.S. National Museum, **52**: 478. COMBINATION.

Sparganothis xanthoides inconditana; Powell, 1983b, Check List of the Lepidoptera of America North of Mexico: 41. REVISED STATUS.

Sparganothis irrorea (= xanthoides); Powell, 1983, Check List of the Lepidoptera of America North of Mexico: 41. Synonymy.

Sparganothis xanthoides is a strongly dimorphic species. In the male the forewing ground color is straw yellow with a contrasting, oblique, diffuse brown blotch from the dorsal margin, about ¾ the distance from the base to the tornus; the blotch is well defined along the inner edge and diffuse along the outer. There is a small, similarly colored subapical patch, the diffuse lower margin of which infrequently blends with the upper margin of the blotch from the dorsal margin. There is a variably developed spot just below the costa about ¾ the distance from the base to the apex, representing an extension of the blotch from the dorsal margin. In the female the forewing pattern is similar but

usually nearly totally obscured by dense orangebrown overscaling, and in most specimens the blotch from the dorsal margin is extremely weak, extending to the costa about ½ the distance from the base to apex, in the form of a narrow, darker brownish line. In *inconditana*, which we consider a subspecies of *xanthoides* from northern California, the forewing is immaculate tan in both sexes. In forewing shape and genitalia, specimens of *inconditana* are indistinguishable from typical *xanthoides*.

Forewing length is 8.5-9.1 mm (mean = 8.7 mm; n = 10) in males and 9.5-11.5 mm (mean = 10.5 mm; n = 10) in females. The male forewing costal fold is absent, and the labial palpi are extremely long in both sexes, slightly longer in the female. Male antennal sensillae are short, about $\frac{1}{2}-\frac{5}{8}$ times the diameter of the flagellomere.

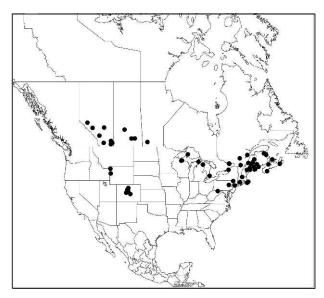
In the male genitalia (plate 11, figure 1) the uncus is long and slender from a semicircular base; the socii are slender and attenuate and divergent posteriorly, with the secondary arms broad and densely setose in the distal ½; the transtilla is somewhat variable, spiny and bilobed mesially; and the valvae are comparatively broad, with a well-defined sacculus confined to the basal ½ of the valva, bearing a weakly elevated subterminal flange. The aedeagus is slightly curved near the middle, with a patch of six long, slender cornuti.

In the female genitalia (plate 25, figure 2) the sterigma is broadly rounded anteriorly, with a narrow urn-shaped antrum; the ductus bursae broadens conspicuously toward the corpus bursae; and the corpus bursae is rounded with the signum in the form of an irregularly horn-shaped, invaginated sclerite.

Although this is one of the most abundant species in collections, nothing is known of the early stages. Capture dates range from late June through early August, probably representing a single brood. *Sparganothis xanthoides* has been recorded from Maine to British Columbia, ranging south to South Carolina in the East and northern California in the West, but is collected much less frequently in the Great Plains and Great Basin (map 26). [Specimens examined: 220 δ , 111 \circ , 15 slides]

Sparganothis boweri Powell and J. Brown, NEW SPECIES

PL. B, FIG. 38–42 (adult); PL. 11, FIG. 2 (δ gen.); PL. 25, FIG. 3 (Υ gen.); MAP 27



MAP 27. DISTRIBUTION OF MATERIAL EXAMINED OF SPARGANOTHIS BOWERI

Sparganothis boweri Powell and J. Brown. Type locality: Lake Katherine, Oneida Co., Wisconsin. [EME]

NOTE—The specific epithet is a patronym for Harold M. Bower (1888–1963), who made season-long collections of moths in northern Wisconsin for many years and sent extensive samples of microlepidoptera to the University of California, Berkeley (Powell 1964b).

Specimens of *Sparganothis boweri* have been mixed in collections with *S. xanthoides* for more than a century. Until *S. boweri* was collected in series in the absence of *S. xanthoides*, revealing that its phenotype is discrete and falls outside the range of variation of *S. xanthoides*, the separation was not recognized.

Sparganothis boweri can be distinguished from S. xanthoides by the narrower forewing (length 2.5–3.0 times width [average = 2.65] vs. 2.2–2.5 times width [average of 2.35] for xanthoides) and obvious differences in color and forewing pattern of males. Females of S. xanthoides average larger (forewing length 9.5–11.5 mm [average = 10.9 mm] vs. 9.1–11.0 mm [average = 9.8 mm] and broader (average length times width 2.9 in boweri vs. 2.6 in xanthoides). In both species the forewing color and shape is sexually dimorphic. Females are primarily brownish rust with an indistinct darker pattern that is similar to that of males and have a more pronounced, acute apex. The male forewing of S.

boweri is shining brownish tan shaded with rosaceous rust, with two short, dark-rust to blackish costal bars, whereas that of *S. xanthoides* is straw yellowish tan with variable dark-brown maculation dominated by a smudge in the dorsal area distally.

Description. Male. Head: Hood simple, erect scaling extended above from in fresh specimens, pale rust; labial palpus 3.5–4.0 times horizontal diameter of compound eye, scaling broadly expanded distally, pale rust tinged with gray basally; antennal scaling pale rust, sensillae about 0.5 times flagellomere width. Thorax: Forewing length 9.3-10.8 mm (mean = 10.1 mm; n = 10), length 2.5-3.0times width (mean = 2.7; n = 10); no costal fold; apex acute; forewing ground color dark tan to brownish, suffused with rosaceous rust, especially along costa and distally beyond cell; maculation dominated by two distinct to blurred, short, dark rust to blackish costal bars, before middle and beyond cell, extended to R or slightly into cell; often a diffuse rust shade from outer bar to apex; underside brown along veins and striate between them. Hindwing pale to dark gray or pale tan, fringe pale; underside with evenly spaced, darkgray striae in costal and terminal areas; no anal fold. Abdomen: Scaling tan, paler ventrally. Genitalia (plate 11, figure 2) with uncus extremely slender and short, not bent or broadened; valva broad, appearing denuded because the setae are unusually small, mostly visible only at high magnification (100X), sacculus variable, nearly undifferentiated. Aedeagus shape and size typical of genus; vesica with a patch of six slender cornuti (deciduous, and lost in specimen illustrated).

Female: Head and thorax: As for male, except forewing length 9.1–11.0 mm (mean 9.8 mm; n = 10), narrower than that of male, length 2.5–3.1 times width (mean = 2.8; n = 10), apex more acute than for male, subtended by concave termen; brownish rust, maculation of male weakly evident. Abdomen: Genitalia (plate 25, figure 3) similar to those of *S. xanthoides*, which tend to have more dense and conspicuous spiculae over ventral surface of corpus bursae and usually more densely lined with creases than for *S. boweri*; neither species has a defined signum (the dark structure shown at junction of ductus bursae in plate 25, figure 3 is a rugose patch accentuated by stain).

TYPES. Holotype: 3. Lake Katherine, Oneida Co., Wisconsin; July 22, 1961, H. M. Bower. EME. Paratypes: 111 ♂, 18 ♀. Alberta. Buffalo Lake Conservation Area; 20 June 2003; C. Bird and J. Powell (1 ♂). Calgary; 10 August 1905; H. Wooley-Dod (1 ♂). Dom. Range Station, Manyberries; 11 July 1951; D. F. Hardwick (1 ♂). 5 km NNE Nordegg, 1,380 m; 23 June 2003; J. Powell and D. Rubinoff (2 ♂). **Manitoba.** Brandon; 22–26 July 1925; J. J. DeGryse (1 ♂). Same locality; 4–31 July 1958; R. L. Hurley (1 ♂). Cadomin Road, 8 mi S Hinton; 16 July 1984; D. C. Ferguson (6 ♂). New Brunswick. Bathurst; 24 June 1941, 2 July 1943; J. McDunnough (2 ♂). Tabusintac; 27 June–3 July 1939; W. J. Brown (4 ♂). Newfoundland. Lethbridge; 5 August [no year]; [no collector] (1 ♂). **Nova Scotia.** Baddeck; 13 July 1936; T. N. Freeman (1 ♂). Baddeck Camp, Breton Id.; 13 July 1931; T. N. Freeman (1 ♂). Parrsboro; 6–24 July 1944; J. McDunnough (8 ♂, 5 ♀). Ottawa House, Parrsboro; 30 June–2 July 1944; J. McDunnough (4 ♂). White Pt. Beach, Queens Co.; 13–24 July 1934; J. McDunnough (5 ♂). Petite Riviere, Queens Co.; 14 July 1935; J. McDunnough (1 3). Ontario. Strathroy; 8 July 1926; H. F. Hudson (1 3). Prince Edward Island. Brackley Beach Natl. Park; 25 June 1940; J. McDunnough (1 ♂). Quebec. Harrington Lake, Gatineau Park; 21 June 1954; J. Martin (1 &). Knowlton; 27 July 1929; J. McDunnough (1 ♂). Lac Mondor, Ste. Flore; 13–20 May 1951, 15–20 July 1951; E. Munroe (6 ♂). Meach Lake, Ottawa Co.; 8–15 June [no year]; [no collector] (1 ♂). Saskatchewan. Indian Head; 8 July 1924, 22–26 July 1925; J. J. DeGryse (3 ♂, 1 ♀). Regina; 15 July 1904; "J.F." (1 ♂, 1 ♀). Saskatoon; 20 July 1924; K. M. King (1 ♂). Regina; 15 July 1904; no collector (1 ♂, 1 ♀). Colorado. Rocky Mountain National Park, below Chasm Lake, Boulder Co.; 29 July 1998; P. Opler (2 ♂). Mt. Evans, Clear Creek Co., 13,200′; 5 July 1996; E. Buckner and P. Opler (1 ♂). Grand County Road 50, 3.5 mi SW Fraser, Grand Co., T1S, R76W, S22, 8,800'; 20 August 1993; T. S. Dickel (13). Horseshoe Mountain Cirque, Park Co., 3,660 m; 13 July 2003; P. Opler (1 ♂). Pikes Peak, Teller Co., 3,620 m, T13S, R69W, S.36w; 15 July 1998; S. A. Johnson (1 ♂). Connecticut. N end Higby Mtn., Middlesex Co.; 22 August 1963; J. M. Burns (1 ♂). Maine. Bar Harbor, Hancock Co.; 7 August 1937; A. E. Brower (1 ♂). Pretty Marsh [near Mount Desert Island], Hancock Co.; 16 August 1942; A. E. Brower (1 ♂). Augusta, Kennebec Co.; 10 August 1939, 31 July 1940, 10 July 1944; A. E. Brower (4 &). Orono, Penobscot Co.; [no date]; no collector (1 ♂). Mount Katahdin, Piscataquis Co.; 9 July 1934; [no collector] (1 3). Greenville, Piscataquis Co.; 23 July [no year]; [no collector] (1 8). Dennistown, Somerset Co.; 15 July [no year]; [no collector] (1 ♂). Smithfield, Somerset Co.; 5 August 1939; [no collector] (1 ♂). Dennysville, Washington Co.; 19 July [no year]; [no collector] (1 &). Topsfield, Washington Co.; 3 August [no year]; [no collector] (1 δ). Maryland. Cunningham Swamp, Garrett Co.; 27 June 1995; J. Glaser (1 ♂). Massachusetts. Barnstable, Barnstable Co.; 25 July 1952; C. P. Kimball (1 3). Martha's Vineyard, Dukes Co.; 17 July 1941; F. M. Jones (1 ♂). Wichendon,

Worcester Co.; 23 June 1902; W. Kearfott (4 ♂). Michigan. T3N R1SW S34, Bog, Allegan Co.; 3 July 1994; G. Balogh (1 ♂). Thompson Harbor SP, Presque Isle Co.; 19 August 1994; G. Balogh (1 3). Drummond Is., Maxton Plain, Chippewa Co.; 9 August 2002; G. Balogh (1 3). 1 mi E Agate Harbor, Lk. Superior, rocky shore, Keweenaw Co.; 8–9 July 2001; G. Balogh (5 ♂). E of Pte. Auxchenes River, wetland, MacKinac Co.; 14 July 2001; G. Balogh (2 ♂). Pte. Auxchenes Bay, dunes, Mackinac Co.; ex Oenothera sp. crowns potted in dune sand; issued 8 January 1999; G. Balogh (1 ♂). New Jersey. Caldwell, Essex Co.; 5 July 1903; W. Kearfott (1 ♂). New York. Clayton, Picton Id., Jefferson Co.; 19 June 1965; B. Heineman (1 &). Liberty, Sullivan Co.; 28 June 1896; [no collector] (1 9). Pennsylvania. Ashley, Luzern Co.; 24 June 1904; Kearfott coll. (1 ♀). Hazelton, Luzern Co.: 19-20 June 1895, 3 July 1896, 1898, 1906; W. G. Dietz (6 ♂). **Wisconsin.** Lake Katherine, Oneida Co.; 20 July–11 August 1961; H. M. Bower (6 ♂, 9 ♀). W side Carlin Lake, Vilas Co.; 1 July 1986; G. Balogh (1 3). Wyoming. Jackson Hole, Teton Co.; 16–29 June 1961; H. E. Evans (1 ♂). AMNH, CSU, CNC, CSU, EME, USNM.

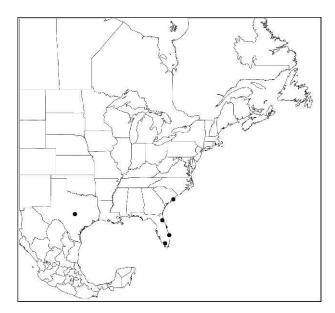
Seventeen males and one female from 12 localities in Maine, collected by A. E. Bower, were excluded from the type series because they are in poor condition.

Sparganothis boweri occurs across Canada from Nova Scotia and New Brunswick to Alberta, south to Maryland, and west to Wyoming and Colorado (map 27), broadly sympatric with S. xanthoides. The latter is more widespread, south to South Carolina and Kentucky and west to British Columbia, Oregon, and northern California. S. boweri appears to be univoltine, with collection records from mid-June to late August, but at the type locality the flight period was 20 July to 11 August during continuous and intensive sampling by H. M. Bower (Powell 1964b). The larval biology is poorly known. G. Balogh reared a specimen from potted Oenothera. We have not seen specimens that were reared from field-collected larvae and have not had the opportunity to obtain eggs from confined females. [Specimens examined: 112 δ , 18 \circ , 9 slides]

Sparganothis taracana Kearfott PL. B, Fig. 43–45 (adult); PL. 11, Fig. 3 (\eth gen.); PL. 25, Fig. 4 (\updownarrow gen.); MAP 28 (RWH 3702).

Sparganothis taracana Kearfott, 1907b, Transactions of the American Entomological Society, **33**: 66.

Type locality: Hastings, Florida. [AMNH]



MAP 28. DISTRIBUTION OF MATERIAL EXAMINED OF SPARGANOTHIS TARACANA

NOTE—The lectotype male was designated by Klots (1942: 415). Kearfott (1907b) indicates the species was described from 17 specimens. Klots (1942) indicates that there were eight paralectotypes in the American Museum of Natural History from Hastings, Florida and Burnet Co., Texas. Six paralectotypes in the National Museum of Natural History are from Florida and Texas.

Sparganothis procax Meyrick, 1912a, Entomologists' Monthly Magazine, 48: 34.

NOTE—Sparganothis procax is an unnecessary replacement name.

Sparganothis taracana is a moderately small species, with a forewing length of 6.2-7.2 mm in males and 6.3-7.5 mm in females. The species is characterized by a uniformly pale-tan ground color with a narrow, well-defined, straight, purplishbrown fascia at the termen. In some specimens (ca. 10%) there is a well-defined, slightly oblique, purplish-brown median fascia from before midcosta to about the middle of the dorsal margin. According to Kearfott (1907b), "...the varieties with and without the central fascia occur in both the spring and fall and in both Florida and Texas." The genitalia of S. taracana are fairly distinct: the male has an enlarged, club-shaped distal portion of the secondary arm of the socius and the female lacks a signum in the corpus bursae. The male forewing costal fold is absent. The labial palpi are

moderately elongate (2.2–2.4 times the horizontal diameter of the compound eye), conspicuously longer in the female (ca. 2.8 times the eye diameter) because the eye is smaller. Male antennal sensillae are short, about $\frac{1}{2}$ times the width of the flagellomere.

In the male genitalia (plate 11, figure 3) the uncus is slightly shorter than in most species, with the distal portion slightly dilated, and with fine setae on the ventral surface of the apex; the socii are moderately broad, somewhat blunt posteriorly, with the secondary arms short and conspicuously broadened and clublike distally; the transtilla is usually strongly biolobed mesially and spiny; and the valvae are comparatively short and broad, weakly subtriangular, broadest at the base and slightly narrowed to the apex, with a poorly defined sacculus. The aedeagus is weakly pistol shaped, with a patch of four slender cornuti.

In the female genitalia (plate 25, figure 4) the sterigma is typical of the genus, with a urn-shaped antrum; the ductus bursae is conspicuously broadened anteriorly, coiled one revolution; the colliculum is virtually unsclerotized; and the corpus bursae is rounded with no sclerotization or signum.

Nothing is known of the early stages. Adults have been captured from March through April and September to December in Florida and Texas, representing two broods. A single specimen has been collected in South Carolina.

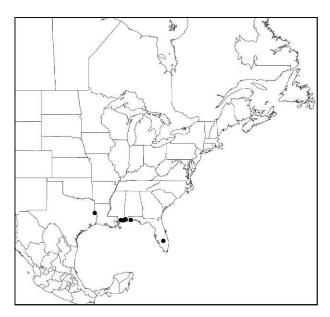
Sparganothis taracana occurs in the southeastern portion of the United States from South Carolina to Florida along the coast, and westward to Texas along the Gulf Coast (map 28). [Specimens examined: $9 \, \delta$, $3 \, 9$, $3 \, 9$, slides]

Sparganothis lindalinea Powell and J. Brown, NEW SPECIES

PL. B, FIGS. 49, 50, PL. C, FIGS. 1, 2 (adult); PL. 11, FIG. 4 (\eth gen.); PL. 25, FIG. 5 (\updownarrow gen.); MAP 29

Sparganothis lindalinea Powell and J. Brown Type locality: Grand Bay Savannah, Jackson County, Mississippi. [USNM]

NOTE—The species name *lindalinea* comes from the neo-Latin "linda," meaning pretty or cute, and the Latin "linea" or line, and refers to the fascia of the forewing.



MAP 29. DISTRIBUTION OF MATERIAL EXAMINED OF SPARGANOTHIS LINDALINEA

Sparganothis lindalinea is most similar to S. sullivani but is smaller and differs by having three complete transverse fasciae crossing the forewing and the termen rust colored. The male genitalia of S. lindalinea are nearly indistinguishable from those of S. sullivani, but the base of the uncus may be slightly more rounded in the latter.

Description. Male. Head: Hood simple; from scaling roughened, cream white; vertex brown laterally; labial palpus short, 1.6-1.7 times horizontal diameter of compound eye, white dorsally, brownish gray laterally; antennal scaling gray brown, sensillae very short, about 0.5 times width of flagellomere. Thorax: Dorsum rust, not reflecting metallic blue; venter brownish tan, legs dark brown ventrally. Forewing narrow, elliptical in outline, length 4.8–5.6 mm, rarely to 6.2 mm (mean = 5.1 mm; n = 10), length about 2.8 times width; costal fold absent; forewing ground color shining golden tan; pattern of purplish rust reflecting metallic-blue flecks, three transverse fascia: median one broadest at costa before its midpoint to slightly beyond mid dorsal margin, sometimes broken at CuP or in cell; second one at end of cell also broadest at costa; terminal one from before apex to M₃, contrasting with pale fringe; underside brown with pale-ocherous line below Sc and broadly along dorsal margin. Hindwing with anal fold, hairpencil absent; whitish to pale brownish gray;

fringe white; underside whitish, costal half tinged with gray brown in darker specimens. Abdomen: Dorsal and lateral scaling gray brown to pale brownish, venter pale tan mesially. Genitalia (plate 11, figure 4) with uncus long, slender throughout; socius conspicuously narrower in dorsal ½, secondary arms slightly enlarged and densely hairy in distal ½; transtilla with a single, broad spiny lobe; valva subtriangular, slightly attenuate distally, most similar to those of *S. minimetallica* and *S. sullivani*, with sacculus nearly straight in basal ½ of venter of valva, terminating in a weak triangular projection. Aedeagus weakly curved near middle; vesica with 5–7 slender cornuti.

Female. Head and thorax: Essentially as described for male. Forewing length 5.0–6.1 mm (mean = 5.4 mm; n = 7). Abdomen: Genitalia (plate 25, figure 5) with subrectangular sterigma bearing urn-shaped antrum; ductus bursae comparatively long, broadened anteriorly, coiled one revolution, colliculum comparatively long, but virtually unsclerotized as in S. sullivani; corpus bursae rounded, signum a very small sclerotized patch.

TYPES. Holotype: &. Grand Bay Savannah, Jackson Co., Mississippi, 30°27′31″N, 88°25′14″W; 28 August 1995; J. A. MacGown. USNM. Paratypes: 102 ♂, 6 ♀. Alabama. Theodore, Mobile Co.; 12 June 1917; Cornell U. Lot 542, Sub. 10; [no collector] (1 ♀). Florida. Pensacola, Escambia Co.; 28 June 1962; S. Hills (1 ♀). Nr. Hickory Landing Campground, NFR 101B, Apalachicola National Forest, Franklin Co.; 19 September 1990, 15 June 1991, 1 September 1991; J. S. Kutis (28 &). Same locality; 1 September 1991; H. D. Baggett (11 &). Fisheating Cr., Palmdale, Glades Co.; 7-10 May 1964; R. W. Hodges (1 3). Sumatra, Appalachicola Natl. Forest, NF Rd. 114, Liberty Co.; 21 October 1990, 13 April 1991; J. S. Kutis & W. D. Baggett (3 ♂). Holt, Blackwater Natl. For., jct. N.F. Rds. 21 × 86, Santa Rosa Co.; 20 October 1990; J. S. Kutis (1 ♂). **Mississippi.** Gulfport, Harrison Co.; 24 June 1931; F. H. Benjamin (1 &). Grand Bay Savannah, Jackson Co., 30°27′31″N, 88°25′14″W; 6 September 1994, 28 August 1995; J. A. MacGown (21 ♂, 3 ♀). Sandhill Crane National Wildlife Refuge, Jackson Co., 30°27′34″N, 88°41′28″W; 4 September 1994, 7 September 1994, 29 August 1995, 1 April 1996; J. A. MacGown (26 ♂, 1 ♀). Highway I–10, 1 mile W Ala[bama state line], Jackson Co.; 22 July 1989; T. L. Schiefer (10 &). CUIC, EME, MEM, USNM.

Additional specimen examined. **Texas.** Six Mile, Sabine Co.; 28 May 1989; E. C. Knudson (1 ♀). ECK.

The biology is unknown; the larvae have not been discovered. Adults have been recorded sparingly in all months from April to October, but in greatest numbers in June to early September. However, specimen numbers may be an artifact of collection bias as there have been more sampling nights from June to September.

The species ranges along the Gulf Coast from southern Mississippi to Florida (map 29); the conspecificity of the specimen from Texas is uncertain. A single male collected in April is appreciably larger (forewing length 6.2 mm) than any of a long series taken in August–September. [Specimens examined: $103 \, \text{ cms}$, $7 \, \text{ cms}$, 4 slides]

Sparganothis sullivani Powell and J. Brown, NEW SPECIES

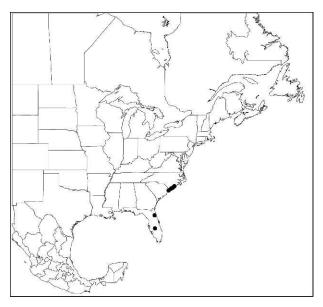
PL. B, FIGS. 46–48 (adult); PL. 11, FIG. 5 (δ gen.); PL. 25, FIG. 6 (Υ gen.); MAP 30

Sparganothis sullivani Powell and J. Brown. Type locality: Holly Shelter Gamelands, Pender Co., North Carolina. [USNM]

NOTE—The name is a patronym for J. B. Sullivan who collected the holotype and many of the paratypes.

Sparganthis sullivani is a diminutive species reminiscent of S. lindalinea, from which it differs by having a single transverse line on the forewing at the end of the discal cell, in contrast to three transverse lines in S. lindalinea.

Description. Male. Head: Hood simple; frons scaling roughened, whitish, vertex weakly to strongly brownish laterally; labial palpus relatively short, 1.5–1.7 times horizontal diameter of compound eye diameter, segment II drooping, scaling whitish, brownish laterally; antennal scaling pale tan, sensillae short, about 0.5 times width of flagellomere. Thorax: Dorsum rust-rose; venter brownish gray. Forewing narrow, length 5.0-6.5 mm (mean = 5.7 mm; n = 10), length about 2.9-3.0times width; costal fold absent; forewing ground color golden tan with markings similar to S. lindalinea, deep rust-rose, reflecting metallic blue, but lacking the median fascia; basal region deep rust rose, extending narrowly along basal ½ of costa, subterminal fascia well defined at costa, usually variously broken (reduced to 3 spots in holotype); termen deep rust rose from apex nearly to tornus; fringe pale tan; underside brownish gray, pale tan at dorsal margin and with a thin subcostal



MAP 30. DISTRIBUTION OF MATERIAL EXAMINED OF SPARGANOTHIS SULLIVANI

line. Hindwing lacking anal fold and associated hairpencil; pale gray; underside gray, costal half darker; fringe whitish. Abdomen: Dorsum pale brownish gray; venter paler mesially. Genitalia (plate 11, figure 5) with uncus long, slender throughout; socius conspicuously narrower and parallel in dorsal ½, secondary arms slightly enlarged and densely setose in distal ½; transtilla with a single broad spiny lobe; valva subtriangular, slightly attenuate distally, most similar to those of *S. minimetallica* and *S. lindalinea*, with sacculus nearly straight in basal ½ of venter of valva, terminating in a weak triangular projection. Aedeagus weakly curved near middle; vesica with 5–8 slender cornuti.

Female. Head and thorax: Essentially as described for male, except length of labial palpi about 1.9 times horizontal diameter of compound eye (eye diameter about 4/5 that of male); forewing length 5.4–6.0 mm (mean = 5.7 mm; n = 2). Abdomen: Genitalia (plate 25, figure 6) with sterigma subrectangular, antrum urn shaped; ductus bursae long, broadened anteriorly, coiled two revolutions, colliculum comparatively long, but virtually unslcerotized; corpus bursae rounded, signum lacking, but small section of wall of corpus bursae with patch of punctation.

TYPES. Holotype: &. Holly Shelter Gamelands, Pender Co., North Carolina; UV light trap in pine savannah; 9 May 1995; J. B. Sullivan. USNM. Paratypes: 24 ♂, 2 ♀. Florida. Sebring, Highlands Co.; 1 February 1943; C. T. Parsons (2 &). Louisiana. 4.2 mi NE Abita Springs, St. Tammany Parish; 24-30 March 1984, 12 April 1985, 8 September 1986; V. A. Brou (4 3). North Carolina. Leland, Brunswick Co.; 16–19 June 1946; O. Buchholz (5 ♂, 1 ♀). Green Swamp, Little Island, Brunswick Co.; 16 April 1995; J. B. Sullivan (3 ♂). Green Swamp, Big Island, Brunswick Co.; 15 Apr 1995; J. B. Sullivan (1 3). Holly Shelter Gamelands, Pender Co.; 12 April 1995, 2 May 1995, 9 May 1995, 12 April 1995, 2 May 1995, 7 August 1997; J. B. Sullivan (7 &). South Carolina. Myrtle Beach, Horry Co.; 1 July 1943, 19 August 1943, 8 October 1943; C. T. Parsons (2) ♂, 1 ♀). EME, MCZ, USNM, VBC.

The biology of this species is unknown; there are no reared specimens available and no putative larval host plant indicated on labels.

Adults have been taken in February (Florida), May to August, and October (in the Carolinas). *Sparganothis sullivani* ranges from coastal North Carolina to south-central Florida (map 30). [Specimens examined: $25 \, \delta$, $2 \, 9$, 4 slides]

Sparganothis mcguinnessi Powell and J. Brown, NEW SPECIES

PL. C, FIG. 3 (adult); PL. 11, FIG. 6 (♂ gen.); PL. 26, FIG. 1 (♀ gen.)

Sparganothis mcguinnessi Powell and J. Brown.

Type locality: Mashomak Preserve, Shelter Island, Suffolk Co., New York. [USNM]

NOTE—This species is a patronym for Hugh McGuinness, who is conducting an extensive inventory of the moths occurring at the Mashomak Preserve, which is maintained by The Nature Conservancy.

Sparganothis mcguinnessi is most similar to S. lindalinea, but the former has a larger mean forewing length (7.0 mm vs. 5.1 mm), a slightly darker hindwing, and four incomplete transverse fasciae (in pale specimens) rather than three complete fasciae as in S. lindalinea. In about half of the specimens examined, the forewing fasciae are obscured by dark overscaling that is concolorous with the fasciae. The male genitalia of S. mcguinnessi are nearly indistinguishable from those of S. sullivani and S. lindalinea.

Description. Male. Head: Hood simple; from scaling roughened, pale rust; labial palpus 1.6–1.7

times horizontal diameter of compound eye, cream on inner surface, rust externally; antennal scaling rust, sensillae very short, about 0.5 times width of flagellomere. Thorax: Dorsum rust; venter brownish tan, legs dark brown ventrally. Forewing narrow, elliptical in outline, length 6.7-7.5 mm (mean = 7.0 mm; n = 7), length about 2.8 timeswidth; costal fold absent; forewing ground color golden, variably overscaled with rust, with very small raised scales creating reflective metallic-blue flecks; oblique rust fasciae in subbasal, median, subterminal, and subapical regions, broadest at costa, usually attenuating before dorsum; underside brown with pale ocherous line below Sc and broadly along dorsal margin. Hindwing with anal roll and weakly developed hairpencil; pale brownish gray; fringe white; underside whitish, costal half tinged with gray brown in darker specimens. Abdomen: Dorsal and lateral scaling gray brown to pale brownish, venter pale tan mesially. Genitalia (plate 11, figure 6) with uncus long, slender throughout; socius narrow throughout, secondary arms slightly enlarged and densely setose on distal 1/2; transtilla spiny in mesial portion, without defined lobe; valva subtriangular, slightly attenuate distally, rounded apically, most similar to that of S. lindalinea, with sacculus nearly straight in basal ¼ of valva, terminating in a ventral triangular projection. Aedeagus weakly curved near middle; vesica with 10-12 uniformly slender cornuti.

Female. Head and thorax: Essentially as described for the male; forewing length 9.0 mm (n = 1). Abdomen: Genitalia (plate 26, figure 1) with sterigma subrectangular, antrum urn shaped; ductus bursae long, broadened anteriorly, coiled two revolutions, colliculum comparatively long, but virtually unsclerotized; corpus bursae rounded, signum represented by a small sclerotized patch.

TYPES. **Holotype:** δ . Mashomak Preserve, Shelter Island, Suffolk Co., New York; 8 August 2009; H. D. McGuinness. USNM. **Paratypes:** 6 δ , 1 \circ . New York. Same locality and collector as for holotype; 28 July 2008, 8 August 2009; H. D. McGuinness (6 δ). South end Long Pond, Sag Harbor, Suffolk Co.; 27 June 2010; H. D. McGuinness (1 \circ). EME, USNM.

The biology of *Sparganothis mcguinnessi* is unknown; adults have been recorded from June to October. The type series was collected at two

coarse sand habitats along the north shore of Shelter Island on Coecles Bay. The first, adjacent to Foxen Creek, is a rocky sand flat with sparse vegetation dominated by a low growing woody shrub, beach heath (*Hudsonia tomentosa* Nuttall; Cistaceae), and beach grass (*Ammophila breviligulata* Fernald; Poaceae). The second locality is a higher dune at Sungic Point, which is covered with *Ammophila*, bordered with bayberry (*Morella pensylvanica* (de Mirbel) Kartesz; Myricaceae), and interspersed with goldenrod (*Solidago*, 2 spp.; Asteraceae), *Lathyrus* (Fabaceae), and other herbaceous vegetation. Both sites originated or were augmented by dredging effluence more than 30 years ago.

Sparganothis niteolinea Powell and J. Brown, NEW SPECIES

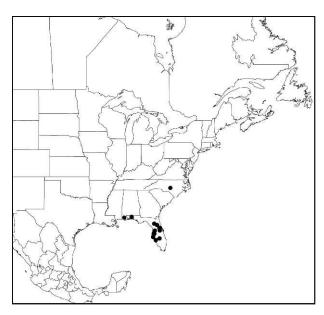
PL. C, FIGS. 4–6 (adult); PL. 12, FIG. 1 (δ gen.); PL. 26, FIG. 1 (φ gen.); MAP 31

Sparganothis niteolinea Powell and J. Brown. Type locality: Archbold Biological Station, Lake Placid, Highlands County, Florida. [USNM]

NOTE—The species name *niteolinea* is from the Latin "niteo," to shine or glitter, and "linea," meaning line.

In wing shape and color *S. niteolinea* resembles *S. azulispecca*, described herein. Both species differ from other *Sparganothis* in having nearly unicolorous rust forewings with shining scaling reflecting metallic blue and dark hindwings. *Sparganothis niteolinea* is smaller and has a rust-tan forewing with metallic scaling forming transverse lines rather than rose-rust forewings evenly sprinkled with metallic blue flecks. In both species the male hindwing has an anal roll and an accompanying hair pencil that is less developed than in species of *Cenopis*.

Specimens of this species have been present in collections for over 80 years. They were given a manuscript name by Busck in the 1930s, and a



MAP 31. DISTRIBUTION OF MATERIAL EXAMINED OF SPARGANOTHIS NITEOLINEA

different name by Lambert (1950), neither of which was published nor seemed appropriate to us.

Description. Male. Head: Scaling on vertex and crown rust colored, incompletely developed as a flat hood projecting outward, without lateral, horseshoe-shaped development; frons smooth scaled, yellow; labial palpus moderate, 2.2-2.5 times horizontal diameter of compound eye, scaling rust laterally, paler on inner surface; antennal scaling rust basally, gray distally, sensillae very short, 0.5 times width of flagellomere. Thorax: Dorsal scaling rust, darker anteriorly; venter shining white, legs dark rust ventrally. Forewing length 5.9-8.4 mm (mean = 6.9 mm; n = 10); costal fold absent, but costal area at base thickened by scaling; forewing broad, length 2.3-2.5 times width; ground color ocherous tan, pattern dull rust-plum colored with metallic blue reflections, forming four or five parallel, transverse lines from costa, where broadest, to dorsal margin, inner three angled outward; lines variously broken, especially in terminal area, less distinct on specimens having additional metallic striae between them; rarely four broad, discrete fasciae, well defined on unicolorous ground lacking any striae; fringe whitish with basal row of gray scales; underside ocherous, dark brown through middle of wing longitudinally. Hindwing gray, costal and anal areas whitish, with distinct anal roll and

weakly developed hairpencil; underside weakly mottled with brownish gray. Abdomen: Dorsal scaling brownish tan; venter pale tan. Male genitalia (plate 12, figure 1) with uncus long, slender; socius broadest near middle, attenuate distally, with secondary arms comparatively short and stout, densely setose in distal ½; transtilla with two patches of large spines weakly separated mesially; valva comparatively short, nearly straight in basal ½ of venter from base to termination of sacculus, sacculus terminating in a weak triangular process. Aedeagus curved at middle; vesica with 6–8 slender, straight cornuti.

Female. Head and thorax: Essentially as described for male, except labial palpus slightly longer in female and compound eye slightly smaller; forewing length 7.4–9.2 mm (mean = 8.4 mm; n = 10). Abdomen: Genitalia (plate 26, figure 2) with sterigma somewhat rectangular; antrum urn shaped; ductus bursae long, gradually broadening toward corpus bursae, with elongate, well-developed colliculum; corpus bursae rounded with signum in the form of an irregular sclerotized patch near junction with ductus bursae.

TYPES. Holotype: ♂. Archbold Biological Station, Lake Placid, Highlands Co., Florida; 30 March 1959; R.W. Hodges. USNM. Paratypes: 61 ♂, 11 ♀. Alabama. Plash Is., end Hwy. 6, Baldwin Co.; 16-19 June 1984; R.L. and B.B. Brown (1 3). Gulf Shore St. Pk., Baldwin Co.; 18 June 1984; R.L. and B.B. Brown (1 ♂). Florida. Gainesville, Alachua Co.; July 1927; J. S. Rogers (5 &). Punta Gorda, Charlotte Co.; 5 April 1948; H. Ramstadt (1 ♂). Withacoochee St. Forest, vic. Kirk Hill, Hernando Co.; 6 September 1986; D. Baggett (1 ♂, 2 ♀). Weeki Wachee Springs, Hernando Co.; 21 June 1960; J. F. May (1 ♀). Spring Hill, Hernando Co.; 3 December 1988; R. Leuschner (1 ♂), Archbold Biological Station, Lake Placid, Highlands Co.; 2 February 1959; S.W. Frost (1 3). Same locality; 28 March-4 April 1955, 30 March 1964; R.W. Hodges (7 ♂, 1 ♀). Temple Terrace, Hillsborough Co.; 10 August 1983; D. Baggett (3 δ , 1 \circ). University of South Florida Ecological Reserve, Hillsborough Co.; 21 September 1984; D. Baggett (1 8). Oneco, Manatee Co.; 26 March 1955; J. G. Franclemont (1 3). Ocala National Forest NFR 75, Lake Delancy, Marion Co.; 28 June 1991, 18 October 1990, 22-28 June 1991; D. Baggett (11 ♂, 1 ♀). Crestview, Okaloosa Co.; 15–16 October 1914; [no collector] (1 ♂). Orlando, Orange Co.; "2–18"; G. G. Ainslie (6 ♂). Winter Park, Orange Co.; May 1946; A. B. Klots (13, 12). Live Oak, Suwannee Co.; 6 April 1995; J. Slotten (3 &). Blue Spr. St. Park, Volusia Co.; 25 January 1984, 22 February 1984; [no collector] (4 &). Cassadaga, Volusia Co.; 1 December 1955, 6 February 1956, 17 November 1962, 28 November 1963,

28 June 1965; S.V. Fuller (4 ♂, 3 ♀). Blue Springs State Park, Volusia Co.; 25 January 1984, 22 February 1984, February 1985; D. F. Provont (5 ♂, 1 ♀). Edgewater, Volusia Co.; 27 June 1987; C. Stevens (3 ♂). CSU, EME, FSCA, MCZ, MEM, USNM.

Additional specimens examined. Florida. Spring Hill, Hernando Co.; 3 December 1988; R. Leuschner ($4 \, \delta$, $1 \, \circ$); not designated as paratypes, poor condition (USNM). North Carolina. Spout Spring, Harnett Co.; 25 August 1984; W. E. Steiner et al. ($1 \, \delta$); not designated paratype owing to uncertainty of conspecificity (USNM).

The specimen from North Carolina may represent the extreme in phenotypic expression of broad transverse fasciae and unicolorous forewing ground color. The distantly disjunct locality suggests the possibility of a differentiated population or sibling species.

Although this species has been known for more than 80 years and recorded throughout much of Florida and in nearly every month of the year, evidently the larvae have not been discovered, and there are no label data for host plants. There are numerous records during the spring months, when collectors tend to visit Florida, but also many in July–October. This species is recorded from Florida, where it is widespread, west to Alabama and north to North Carolina (map 31). [Specimens examined: 62 δ , 11 δ , 5 slides]

Sparganothis azulispecca Powell and J. Brown, NEW SPECIES

PL. C, FIG. 7, 8 (adult); PL. 12, FIG. 2 (δ gen.); PL. 26, FIG. 3 (Υ gen.); MAP 32

Sparganothis azulispecca Powell and J. Brown.

Type locality: Bon Secour National Wildlife Refuge, Baldwin Co., Alabama. [USNM]

NOTE—The species name *azulispeccca* is from the neo-Latin "azul," or blue, and "specca," referring to the metallic specks of the forewing pattern.

Sparganothis azulispecca resembles S. niteolinea but is larger and has rose-rust forewings evenly sprinkled with metallic blue flecks in both sexes, rather than tan with metallic scaling forming transverse lines as in the latter species.

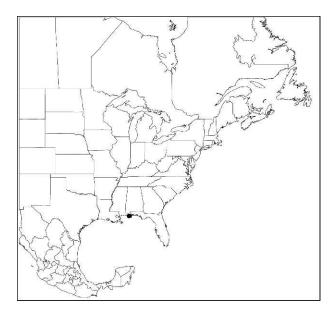
Description. Male. Head: Hood simple, crown scaling projecting above frons, without lateral extensions that would form a horseshoe-shaped hood; frons smooth scaled, whitish, vertex rust; labial palpus rose rust laterally, length about 2.5

times horizontal diameter of compound eye; antennal scaling rust, sensillae about 0.5 times width of flagellomere. Thorax: Forewing length 8.0-9.4 mm (mean = 8.9 mm; n = 7); costal foldabsent; ground color uniformly rose rust, evenly sprinkled with metallic blue scales; underside pale rust, with evenly spaced ocherous spots along costa. Hindwing rust brown, with well-developed anal roll enclosing a whitish hair pencil. Abdomen: Genitalia (plate 12, figure 2) with uncus long, slender; socius broadest near middle, attenuate distally, secondary arms relatively short and stout, densely setose in distal ½; transtilla weakly bilobed, densely covered by spines; valva relatively short, broad, sacculus well defined, restricted to basal 0.6. Aedeagus short, weakly curved; vesica with 8–10 slender cornuti.

Female. Head and thorax: Essentially as described for male, except lacking male secondary structures (e.g., hindwing anal fold); labial palpus not appreciably longer than for male, but compound eye slightly smaller so length relative to eye greater. Forewing length 9.4–10.6 mm (mean = 10.2 mm; n = 6). Abdomen: Genitalia (plate 26, figure 3) with sterigma rectangular with urn-shaped antrum; ductus bursae relatively long, narrowed posteriorly, gradually broadening anteriorly, coiled two revolutions, with colliculum weak, separated from antrum by short membranous region; corpus bursae rounded, signum in the form of a small folded-invaginated plate.

TYPES. Holotype: &. Bon Secour National Wildlife Refuge, Baldwin Co., Alabama, 30°13′43″N, 87°49′51″W, 13–16 May 1994, R. Brown and D. Pollock. USNM. Paratypes: 8 &, 8 &. Alabama. Same locality as for holotype; blacklight trap on dunes; 13–16 April 1993, 13–16 May 1994, 12–16 October 1991, 8–9 August 1994, 15 October 1996; T. L. Schiefer (6 &, 8 &). Gulf Shores State Park, Baldwin Co., 16–19 June 1984; R. and B. Brown (1 &). Plish Is[land], end of Highway 6, Baldwin Co.; 16–19 June 1984; R. and B. Brown (1 &). AMNH, CUIC, EME, MCZ, MEM, USNM.

There is no information on larval host plants. Adults have been taken on coastal foredunes of the Gulf of Mexico in April, August, and October, indicating a multivoltine life cycle. *Sparganothis azulispecca* is known only from the Gulf Coast of Alabama (map 32). [Specimens examined: $9 \, \delta$, $8 \, \circ$, $4 \, \text{slides}$]



MAP 32. DISTRIBUTION OF MATERIAL EXAMINED OF $SPARGANOTHIS\ AZULISPECCA$

Sparganothis senecionana (Walsingham) PL. C, FIGS. 19–34 (adult); PL. 12, FIG. 3 (δ gen.); PL. 26, FIG. 4 (φ gen.); MAP 33 (RWH 3714).

Oenectra senecionana Walsingham, 1879, Illustrations of Typical Specimens of Lepidoptera Heterocera in the Collection of the British Museum, 4: 17.

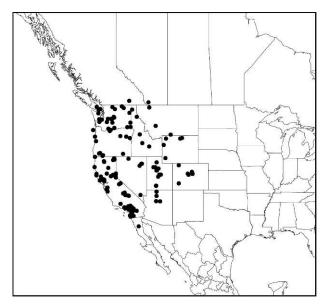
Type locality: Lake County to Mount Shasta, California. [BMNH]

NOTE—Three male and two female syntypes are in The Natural History Museum. The male from Mount Shasta with a round "Type HT" label is designated the lectotype.

Epagoge senecionana; Fernald in Dyar, 1902 [1903], List of North American Lepidoptera. Bulletin of the U.S. National Museum **52**: 475. COMBINATION.

Sparganothis senecionana; Barnes and McDunnough, 1917, Check List of the Lepidoptera of Boreal America: 176. COMBINATION.

Oenectra rudana Walsingham, 1879, Illustrations of Typical Specimens of Lepidoptera Heterocera in the Collection of the British Museum, 4: 17.



MAP 33. DISTRIBUTION OF MATERIAL EXAMINED OF SPARGANOTHIS SENECIONANA

Type locality: near San Francisco, California, and Rogue River, Oregon. [BMNH]

NOTE—Four syntype females are in The Natural History Museum. The male from Dry Creek, Sonoma Co., CA with a round "Type HT" label is here designated the lectotype.

Epagoge rudana; Fernald in Dyar, 1902 [1903], Bulletin of the U.S. National Museum **52**: 475. COMBINATION.

Sparganothis rudana; Barnes and McDunnough, 1917, Check List of the Lepidoptera of Boreal America: 176. COMBINATION.

Sparganothis senecionana (= rudana); Powell, 1983b, Check List of the Lepidoptera of America North of Mexico: 41. Synonymy.

Sparganothis senecionana is the most commonly collected species of Sparganothini in the western United States, and it is one of the most variable species in the genus, both geographically and within some populations. The forewing usually has a pale-yellow or tan ground color with a large, tan-orange, irregularly triangular blotch bordering the distal ½ of the costa, expanding near the apex to form a curved fascia paralleling the termen. There is a similarly colored, well-defined, oblique

fascia from the costa at about $\frac{1}{3}$ the distance from the base to the apex, that extends outward and usually terminates before reaching the dorsal margin. Forewing length is 7.0–12.5 mm, with males averaging slightly larger than females, 9.8 mm and 9.4 mm, respectively (n = 30 each). The male forewing lacks a costal fold; the labial palpi are conspicuously elongate in both sexes. Male antennal sensillae are long, about 1.5 times the width of the flagellomere.

In the male genitalia (plate 12, figure 3) the uncus is moderately long and slender from a rounded, shallowly W-shaped base; the socii are slender, attenuate posteriorly, with the secondary arms broad and densely setose in the distal ½; the transtilla is variable, but usually bears a single spiny mesial lobe; the valvae are broadest at the base and slightly tapered to the apex; the sacculus is well defined, confined to the basal ½ of the valva, broad at the base, with a weak, elevated subterminal flange. The aedeagus is weakly curved near the middle; the vesica has a bundle of six slender cornuti.

In the female genitalia (plate 26, figure 4) the sterigma is large and somewhat rounded, with rounded lateral "shoulders;" the antrum is large and rounded; the ductus bursae is moderately narrow, broadened toward the corpus, and coiled two revolutions; the colliculum is ringlike, barely separated from sterigma by a short membranous region; the corpus bursae is moderately large and rounded, with the signum an irregular, rugose band near the junction of the ductus bursae and corpus bursae.

There is pronounced geographic variation in size and color pattern as well as individually within some populations (plate C). The typical form, in the North Coast Ranges of California, has goldentan forewings with distinct rust to rust-brown pattern in males, an oblique fascia from costa at basal 1/3 toward tornus and a triangular patch at the distal \(\frac{1}{2} \) of costa, usually expanded to form a curved fascia paralleling the termen, sometimes filling the whole terminal area (figure 27). Females usually are darker with obscure remnants of the male pattern (figure 29). In most populations some individuals of both sexes have the forewing entirely rust (i.e., rudana). The scaling has a glossy sheen reflecting greenish in fresh specimens. The hindwing in most populations is pale gray. Variations on this color scheme occur through the Oregon Cascades to Washington, Idaho, Nevada, Utah,

and Colorado. In males from Arizona (Pinal County), the rust pattern tends to be broken into a checkered appearance. Populations along the Sierra Nevada west slope are similar to the typical form but have more extensive rust scaling (figure 34), and above timberline the moths are much darker, forewings brownish gray, markings dark brown, hindwings dark gray. Coastal populations differ: in the north the ground color is tan, not yellow or golden, and the markings dark rust brown. Around the San Francisco Bay area the forewing is pale grayish tan, usually strongly irrorate with transverse striae, and the maculation is brown (figures 28, 33). The beach populations at Pt. Reyes, Monterey Bay, and Morro Bay are the most distinctive, forewing white with well-defined, dark blood-red markings, more strongly contrasting progressively southward (figure 32), whereas senecionana in the Coast Range of Monterey Co. (Big Creek, Arroyo Seco) and the northern Channel Islands are bright ocherous to pale tan with narrow rust markings (figure 31). The forewings in interior Ventura Co. are white with narrow, pale-rust pattern, and on Santa Catalina Island they are white with short, narrow, dark-rust markings (figure 31), and about 1/3 of two samples (n = 50) are entirely rust. Individual size varies considerably between populations (e.g., males in north coastal counties of California average 11.3 mm, those at Pt. Reves 7.3 mm; n = 10).

Larvae of *S. senecionana* are highly polyphagous, feeding on the foliage and often the flowers of herbaceous vegetation (e.g., *Castilleja* and *Orthocarpus*, Scrophulariaceae; *Eschscholzia*, Papaveraceae; *Lomatium*, Apiaceae) and shrubs (*Arctostaphylos*, Ericaceae; *Ceanothus*, Rhamnaceae; *Ribes*, Grossulariaceae), including plants with chemical toxins usually avoided by generalists (*Lupinus*, Fabaceae; *Apocynum*, Apocynaceae; *Eriodictyon*, Hydrophyllaceae; even death camas, *Zigadenus*, Liliaceae), and occasionally on conifers (*Abies* and *Pseudotsuga*, Pinaceae).

Confined females of *S. senecionana*, like those of other *Sparganothis* and *Cenopis*, produce moderately large patches of pale-green eggs, typically covered with a milky colored colleterial cover that exceeds the egg mass perimeter. Larger masses are followed by smaller groups of eggs in subsequent days. Incubation requires 10–14 days, varying with temperature.

Newly hatched larvae of this and its sister species, P. tunicana, in contrast to all other sparganothines we have observed, construct flat, oval, silken hibernacula. In several trials during the 1960s-1970s, larvae in dry vials remained in the hibernacula through summer and fall but eventually desiccated. Later, we provided a piece of synthetic diet as a moisture source, either soon after emergence or after several weeks aestivation, and larvae responded, emerged from the hibernacula, and commenced feeding. For example, S. senecionana reared from Abies in Siskiyou Co., California (JAP 80G27), where the population experiences harsh winter conditions, mated and produced eggs at the end of July; after larvae constructed hibernacula, we provided synthetic diet on 11 August. It became moldy, with excess moisture condensation in the vial by August 24, when larvae began emerging. They failed to feed on Rubus, but those feeding on diet grew to at least the 3rd instar by mid-September. In another trial, at Big Creek, Monterey Co., California, a coastal site with mild winters, a field-collected female deposited eggs on 5 June (JAP 89F4); first instars produced hibernacula by 24 June, when we added diet. The vial was held at room temperature until 18 September, then in an unheated trailer lab; one larva emerged and began feeding on the diet by mid-October, and there were six third instar larvae by 3 November. The first larva pupated by 10 December, and adults emerged 19-22 January.

We extrapolate a life cycle as follows: at coastal sites in California, adults fly March to early June, first instar larvae aestivate through the summer dry season, then emerge in late fall after the winter rain season begins. They feed on various newly foliating plants, remain quiescent during colder winter periods, and reach maturity March to May. By contrast, at higher elevation, inland localities characterized by harsh winters, adults fly in June–July; first instar larvae in hibernacula pass the summer and early fall, and may either become active after early fall rains, or continue in diapause if cold temperatures prevail by the time the winter storm season commences, emerging in spring to feed on new growth in May–June.

The species flies from April to June near the coast and desert edges and from July to August at high elevations, but each population normally is univoltine; records at Palm Springs (Riverside Co.,

California) in October suggest that summer rains can trigger development of a second generation.

Sparganothis senecionana occurs throughout western North America from British Columbia to Baja California, Mexico, and through the Rocky Mountains from Alberta to Arizona (map 33). [Specimens examined: 325 ♂, 257 ♀, 12 slides]

Sparganothis tunicana (Walsingham) PL. C, FIGS. 9–18 (adult); PL. 12, FIG. 4 (♂ gen.); PL. 26, FIG. 5 (♀ gen.); MAP 34 (RWH 3713).

Dichelia tunicana Walsingham, 1879, Illustrations of Typical Specimens of Lepidoptera Heterocera in the Collection of the British Museum, 4: 20.

Type locality: Lake Co., California. [BMNH]

NOTES—Three male and two female syntypes are in The Natural History Museum.

Epagoge tunicana; Fernald in Dyar, 1902 [1903], Bulletin of the U.S. National Museum **52**: 475. COMBINATION.

Sparganothis tunicana; Barnes and McDunnough, 1917, Check List of the Lepidoptera of Boreal America: 176. COMBINATION.

Dichelia californiana Walsingham, 1879, Illustrations of Typical Specimens of Lepidoptera Heterocera in the Collection of the British Museum, 4: 21.

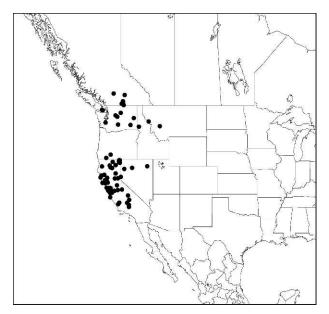
Type locality: Northern California, California. [BMNH]

NOTES—Three male and two female syntypes are in The Natural History Museum.

Sparganothis californiana; Barnes and McDunnough, 1917, Check List of the Lepidoptera of Boreal America: 176. COMBINATION.

Sparganothis californiana (= tunicana); Powell, 1983b, Check List of the Lepidoptera of Amnerica North of Mexico: 41. Synonymy.

Adults of *S. tunicana* are similar to some small, strongly marked individuals of *S. sencionana* but



MAP 34. DISTRIBUTION OF MATERIAL EXAMINED OF $SPARGANOTHIS\ TUNICANA$

are not as geographically variable as those of S. senecionana. Forewing ground color in S. tunicana is yellow orange; the distal ¼ of the wing and a well-defined, oblique fascia complete from the basal 1/3 of the costa to near the middle of the dorsal margin are dark brown to red brown. The hindwing is correspondingly dark brown to red brown, usually darker than in S. senecionana. In S. tunicana the forewing fascia extends from the costa to the dorsal margin (usually incomplete in S. senecionana). The pattern is usually darker and more defined in males than in females. Forewing length is 5.9-7.2 mm (mean = 6.7 mm; n = 10) in males and 7.2-8.9 mm (mean = 7.9 mm; n = 10) in females. In the male the costal fold is absent and the antennal sensillae are long, about 1.2–1.5 times the diameter of the flagellomere.

In the male genitalia (plate 12, figure 4) the uncus is moderately long and slender from a somewhat squarish base; the socii are moderately broad basally, narrowed in the posterior ½, and the secondary arms are long and slender, densely setose and only slightly expanded in the distal ⅓. The transtilla is variable, but usually has a single spiny mesial lobe. The valvae are comparatively long and parallel-sided, with a rounded apex; the sacculus is moderately well defined, confined to basal ⅔ of the valva, with a weakly elevated subterminal flange. The aedeagus is curved; the

vesica has a bundle of 6–8 slender cornuti (deciduous, and lost in the example illustrated).

In the female genitalia (plate 26, figure 5) the sterigma is large and somewhat rounded, weakly bilobed anterolaterally and urn shaped mesially; the ductus bursae is moderately narrow, coiled two revolutions; the colliculum is ringlike, barely separated from the sterigma by a short membranous gap; the corpus bursae is small, rounded; and the signum is in the form of a narrow, slightly sinuate band.

Sparganothis tunicana larvae are polyphagous on low growing, herbaceous plants, including Apiaceae, Asteraceae, Scrophulariaceae, and occasional monocots. We and others have reared it from numerous low architecture plants and rarely trees, cottonwood (Populus trichocarpa Torrey & A. Gray; Salicaceae) and ponderosa pine (Pinus ponderosa P. Lawson & C. Lawson; Pinaceae). LaGasa (in litt.) reports it from apples (Malus sp.; Rosaceae) in Washington. We obtained eggs from a female taken in May in Contra Costa County, California, and first instar larvae constructed silken hibernacula. Hence, presumably there is an obligate diapause, as in S. senecionana. Adults have been captured from May through July, apparently representing a single brood.

Sparganothis tunicana ranges from British Columbia and Montana south to Nevada and San Luis Obispo and Kern counties, California (map 34). [Specimens examined: 156 ♂, 117 ♀, 8 slides]

Sparganothis vocaridorsana Kearfott PL. C, Fig. 35 (adult); PL. 12, Fig. 5 (\eth gen.); PL. 26, Fig. 6 (\updownarrow gen.); MAP 35 (RWH 3712).

Sparganothis puritana var. vocaridorsana Kearfott, 1905, Canadian Entomologist, **37**: 89.

Type locality: Regina, Saskatchewan. [AMNH]

NOTE—The lectotype male was designated by Klots (1942: 416).

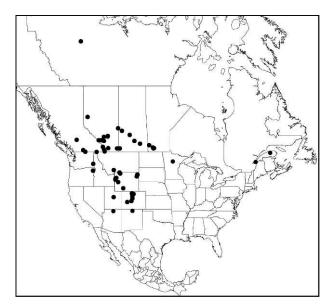
Sparganothis vocaridorsana; Barnes and McDunnough, 1917, Check List of the Lepidoptera of Boreal America: 176. STATUS.

Sparganothis vocaridorsana is somewhat similar to *S. unifasciana* and *S. senecionana*, from which it

differs by its conspicuously larger size and the large, triangular, subapical costal patch, which is smaller and broken in unifasciana, and the immaculate forewing terminal area, which in sencionana is broadly rust. The forewing ground color is pale vellow brown: a large, pale orangebrown, irregularly triangular patch borders the distal portion of the costa from about 3/3 the distance from the base to the apex. There is a similarly colored, variably developed, narrow transverse fascia from the costa at about 1/3 the distance from the base to the apex, extending outward to beyond the mid-dorsal margin. About half of the specimens we examined have a small, similarly colored, roundish spot near the end of the discal cell. The hindwing is pale to dark gray. Forewing length is 12.0-13.5 mm (mean = 12.8mm; n = 10) in males and 10.9–12.1 mm (mean = 11.5 mm; n = 5) in females. In the male the forewing costal fold is extremely short and narrow, and the antennae are extremely slender with moderately long sensillae. There is little or no sexual dimorphism in the length of the labial palpi. In contrast to many species in the genus, S. vocaridorsana is remarkably uniform in facies throughout its considerable geographic range.

In the male genitalia (plate 12, figure 5) the uncus is moderately long, slender from a broad base; the socii are moderately slender, slightly attenuate posteriorly, and the secondary arms are moderately broad, densely setose in the distal ½; the transtilla is variable, but usually bilobed mesially and spiny; the valva is subtriangular, broadest at the base and weakly tapered to the apex; the sacculus is well defined, confined to the basal ½ of the valva, broad, and rounded at the base, with a weak subterminal flange. The aedeagus is weakly curved, and the vesica has a bundle of six slender deciduous cornuti [estimated from the number of sockets].

In the female genitalia (plate 26, figure 6) the sterigma is large and subrectangular; the antrum is moderately small and ovoid; the colliculum is a short, weakly sclerotized, incomplete ring separated from the antrum by a narrow membranous gap; the ductus bursae is narrow, broadening toward the corpus bursae, and coiled two revolutions; the corpus bursae is large and rounded, with the signum reduced to an extreme-



MAP 35. DISTRIBUTION OF MATERIAL EXAMINED OF SPARGANOTHIS VOCARIDORSANA

ly slender, elongate crease near the junction with the ductus bursae.

According to specimen label data, *S. vocaridor-sana* has been reared from *Senecio* sp. (Asteraceae) (n = 1). One specimen was reared from the "apical gall of ?Compositae [= Asteraceae]." Cumulative capture records extend from June through early August, with a single record from late May.

Sparganothis vocaridorsana is primarily a western species, occurring mostly in boreal or high elevation situations. It has been recorded from Manitoba to British Columbia, south through eastern Washington, Oregon, Montana, Wyoming, and South Dakota, to northern Arizona and New Mexico (map 35). There also are scattered records from Minnesota, Northwest Territories (Great Bear Lake), and Quebec (Mount Albert, Gaspé Peninsula). [Specimens examined: 126 &, 10 \, 9, 6 slides]

Sparganothis richersi Powell and J. Brown, NEW SPECIES

PL. C, FIG. 36 (adult); PL. 12, FIG. 6 (& gen.)

Sparganothis richersi Powell and J. Brown. Type locality: Greer, Apache Co., Arizona. [USNM]

NOTE—The specific epithet is a patronym for Kelly Richers, an avid moth collector who has developed and maintained a database of California county

records of moths and served as Treasurer of the Lepidopterists' Society for many years.

Sparganothis richersi is a relatively large sparganothine, as large as S. vocaridorsana, with exceptionally long, porrect labial palpi, and uniformly pale-tan forewings that are weakly patterned by rust lines in the discal cell and along the dorsal margin. Superficially, it is easily distinguished from its congeners by the nearly uniform color of the forewings and the long labial palpi. The male genitalia can be distinguished by the broadened uncus that gradually tapers to a slightly enlarged and rounded apex, which is in contrast to the uniformly slender uncus from a broad base found in most species of Sparganothis. It has parallelsided valvae, which are more similar to those of *Platynota*, rather than subtriangular and distally tapered valvae as in most Sparganothis species.

Description. Male. Head: Hood simple; vertex pale tan, rust around base of antenna; labial palpus very long, 4.5 times horizontal diameter of compound eve, scaling rust with dark-gray infuscation exteriorly, pale yellowish interiorly; antennal scaling reduced, brown above, translucent whitish ventrally, sensillae very short, less than 0.5 times width of flagellomere. Thorax: Pronotal scaling uniformly pale straw colored, tegulae brown, rust distally; venter sparsely scaled, whitish; legs brown to mostly rust. Forewing uniform pale tan or straw colored; costa gray brown basally; a raised, metallic-gray dot on R at end of cell; maculation rust colored, faint to moderately well defined: in cell basally, a bar along CuP in distal half of cell, bordered on CuP by a row of metallicgray scales; narrow line of rust along distal half of costa and along dorsum, tornus, and termen, diminishing toward midtermen; underside mostly dark gray, rust along costa distally and tan toward termen. Hindwing without deep crease or specialized scaling in anal area; gray, darker along veins; underside gray, paler along veins and fringes. Abdomen: Brownish gray, scaling around genitalia paler, yellowish; underside pale brown. Genitalia (plate 12, figure 6) with broad uncus, gradually tapered distally, with slightly enlarged, rounded apex; socius narrow, exceeding tegumen but not uncus; transtilla with a compact cluster of small spines; valva parallel sided. Aedeagus short, gently curved; vesica with a dense bundle of 8-10 cornuti. Female unknown.

TYPES. **Holotype:** & Greer, Apache Co., Arizona, 8,500′ [2,600 m]; 29 July 2009; K. Richers. USNM. **Paratypes:** 4 & Same locality and collector as for holotype; 29, 30 July 2009. EME, KRC.

The three specimens were taken in a blacklight trap set in a meadow near the Little Colorado River. Many other lepidopterists have collected moths during the summer months at Greer and other localities in Apache and Greenlee Counties of eastern Arizona, so it is remarkable that a large and distinctive species of *Sparganothis* could be newly discovered in that region in 2009. [Specimens examined: 5 δ , 2 slides]

Sparganothis umbrana Barnes and Busck PL. C, Figs. 37–40 (adult); PL. 13, Fig. 1 (\eth gen.); PL. 27, Fig. 1 (\updownarrow gen.); MAP 36 (RWH 3715).

Sparganothis umbrana Barnes and Busck, 1920, Contributions to the Natural History of the Lepidoptera of North America, 4: 212. Type locality: Denver, Denver County, Colorado. [USNM]

Sparganothis putmanana Freeman, 1940, Canadian Entomologist, **72**: 208. Type locality: St. David's, Ontario. [CNC]

Sparganothis umbrana (= putmanana); Powell, 1983b, Check List of the Lepidoptera of America North of Mexico: 41. Synonymy.

Sparganothis umbrana is a yellow to sombercolored species with rather broad forewings. The ground color is pale yellow to pale yellowish brown. The postmedian fascia is represented by a large, orange-tan, irregularly triangular patch on the costa, and the median fascia is similarly colored, narrow, and usually incomplete, extending from the costa about 1/3 the distance from base to apex, to beyond the middle of the dorsal margin. In about 50% of the specimens we examined, there is a similarly colored, roundish spot near the end of the discal cell. The male has a simple hood, lacks a costal fold on the forewing, and has relatively short antennal sensillae. The labial palpi are conspicuously elongate in both sexes, slightly longer in the female. Forewing length is 12.0–13.5 mm (mean =

12.8 mm; n = 10) in males and 10.9–12.1 mm (mean = 11.5 mm; n = 5) in females.

In the male genitalia (plate 13, figure 1) the uncus is long and slender; the socii are comparatively slender and attenuate posteriorly, and the secondary arms are broad and densely setose in the distal 1/3. The transtilla is variable but usually is biolobed mesially and spiny. The valvae are broadest at the base and slightly tapered to the apex. The sacculus is well defined, confined to the basal 1/3 of the valva, broad, rounded at the base, and with a weak subterminal flange. The aedeagus is evenly curved, and the vesica has six (or more) slender cornuti (deciduous, and lost in the individual illustrated).

In the female (plate 27, figure 1) the sterigma is large, somewhat rounded, and weakly bilobed anteriorly. The antrum is large, ovoid, and somewhat urn shaped. The ductus bursae is moderately narrow, broadening toward the corpus bursae, and coiled one to one and one-half revolutions. The colliculum is ringlike, barely separated from the antrum by a short membranous region. The corpus bursae is rounded, and the signum is reduced to an extremely slender, elongate crease or lacking entirely.

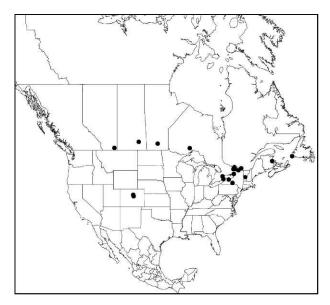
Details of the life history are unknown. Sparganothis umbrana (also reported as S. putmanana) is a general feeder in southern Ontario - Freeman (1940) reported hosts including several Rosaceae, e.g., blackberry (Rubus idaeus Linnaeus), cherry (Prunus serotina Ehrhart), rose (Rosa sp.), as well as aster (Aster sp., Asteraceae) and red oak (Quercus rubra Linnaeus, Fagaceae). Capture records are from July and August.

Sparganothis umbrana ranges across southern Canada from Newfoundland to Alberta, south to Colorado east of the Rocky Mountains, and to New York in the East (map 36). [Specimens examined: $50 \, \delta$, $13 \, \circ$, $4 \, \text{slides}$]

Sparganothis striata (Walsingham)
PL. C, FIGS. 41, 42 (adult); PL. 13, FIG. 2 (♂ gen.); PL. 27, FIG. 2 (♀ gen.); MAP 37 (RWH 3709).

Oenectra striata Walsingham, 1884, Transactions of the Entomological Society of London, 1984: 126.

Type locality: Montana. [BMNH]



MAP 36. DISTRIBUTION OF MATERIAL EXAMINED OF SPARGANOTHIS UMBRANA

Sparganothis striata; Fernald in Dyar, 1902 [1903], Bulletin of the U.S. National Museum, **52**: 478. COMBINATION.

Sparganothis striata is a relatively large and distinctive species that is unlikely to be confused with its congeners. The forewing is mostly straw yellow with a bold orange-brown longitudinal stripe that originates at the base of the wing and extends to the apex along the anterior margin of the discal cell and is confluent with a slightly broader, concolorous, subrectangular apico-costal blotch near the apex; the entire wing surface has bluish refracting scales that are most dense on the orange-brown stripe. Forewing length is 10.0–11.5 mm (mean = 10.8 mm; n = 10) in males and 8.0– 11.8 mm (mean = 10.5 mm; n = 10) in females. Males have a simple hood and moderately long antennal sensillae (ca. 1.0 times the width of the flagellomere and with a curved tip), and the labial palpi are long in both sexes. The male genitalia (plate 13, figure 2) are somewhat similar to those of S. vocaridorsana, but the valva is more attenuate distally with a narrower apex in the latter. The female genitalia (plate 27, figure 2) are like those of many congeners.

A series (n = 25) of this species was reared by J. F. G. Clarke (USNM) from tarragon (*Artemisia*

dracunculus Linnaeus, Asteraceae) at Snake River, Washington; MacKay (1962) reported that the species "ties leaves with heavy webs" on the host. No other hosts are documented, and the geographic distribution suggests that *S. striata* may be a specialist on sagebrush. Adults have been captured in June and July.

The larva was described by MacKay (1962), although the chaetotaxy was not illustrated. General: Length 13 mm. Head: Length 1.26 mm, width 1.53 mm, brownish yellow, with stemmata II, IV, and V outlined by dark pigment. Thorax: Prothoracic shield pale, concolorous with abdominal segments; tarsi of thoracic legs slightly darker. Abdomen: Pale, unicolorous; pinacula moderately large; spinules minute, concolorous with integument; anal fork well developed.

Sparganothis striata is a western species, recorded from North Dakota west to eastern British Columbia, and south to Texas and southern California (map 37). In the southwestern portion of its range it occurs primarily in semi-arid montane habitats (e.g., San Bernardino, San Jacinto, and Laguna mountains, southern California). [Specimens examined: $81 \, \delta$, $37 \, \circ$, $8 \, \text{slides}$]

Sparganothis distincta (Walsingham) PL. C, FIGS. 43, 44 (adult); PL. 13, FIG. 3 (\eth gen.); PL. 27, FIG. 3 (\updownarrow gen.); MAP 38 (RWH 3704).

Oenectra distincta Walsingham, 1884, Transactions of the Entomological Society of London, **1884**: 126.

Type locality: Arizona. [BMNH]

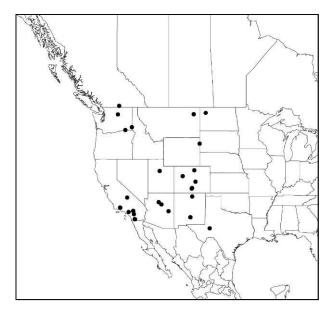
NOTE—The single male and three female syntypes are in The Natural History Museum.

Sparganothis distincta; Fernald in Dyar, 1902 [1903], Bulletin of the U.S. National Museum, **52**: 478. COMBINATION.

Sparganothis solidana Freeman, 1941, Canadian Entomologist, 73: 126.

Type locality: Brackley Beach, Prince Edward Island. [CNC]

Sparganothis distincta (= solidana); Powell, 1983b, Check List of the Lepidoptera of America North of Mexico: 41. SYNONYMY.

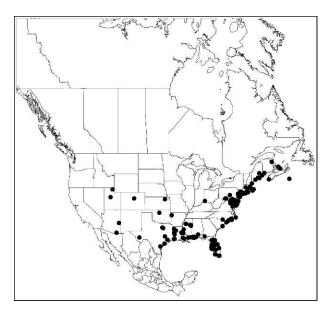


MAP 37. DISTRIBUTION OF MATERIAL EXAMINED OF SPARGANOTHIS STRIATA

Sparganothis salinana McDunnough, 1961, American Museum Novitates, **2040**: 8. NEW SYNONYMY.

Type locality: Argyle, Yarmouth County, Nova Scotia. [CNC]

Sparganothis distincta is widespread and commonly collected in eastern North America, but is recorded less frequently west of the Mississippi River. It has a pale-rust or orange-brown forewing, with a reticulated pattern of refractive scales and with no conspicuous pattern elements. The hindwing is pale gray brown or pale orange brown. Sparganothis distincta can be distinguished from most other Sparganothis species by the presence of a hindwing anal fold in the male, similar to that of Cenopis males. In S. distincta the fold is not as well developed as it is in *Cenopis* and it encloses a weak scale brush. Forewing length is 7.0-10.0 mm (mean = 8.8 mm; n = 10) in males and 9.5-10.5mm (mean = 10.2 mm; n = 10) in females. The male forewing lacks a costal fold but has a thickened patch of short scales at the base; the hindwing cubital pecten is comprised of three tufts in both sexes, with the basal-most tuft in the male concealed in the anal fold. The labial palpi are long in both sexes. Male antennal sensillae are short and



MAP 38. DISTRIBUTION OF MATERIAL EXAMINED OF SPARGANOTHIS DISTINCTA

straight, about $\frac{1}{2}$ - $\frac{5}{6}$ times the width of the flagellomere.

In the male genitalia (plate 13, figure 3) the uncus is long and slender; the socii are comparatively short, reaching to about ½ the distance to the apex of the uncus, and the secondary arms are broad and densely setose in the distal ⅓. The transtilla is variable, but usually weakly biolobed mesially and spiny; the valvae are nearly parallel sided, slightly broader at the base, rounded apically; the sacculus is ill defined, confined to the basal ⅓ of the valva. The aedeagus is curved near the middle; the vesica has a bundle of 6–8 slender, deciduous cornuti.

Female genitalia (plate 27, figure 3) have a large, subrectangular sterigma; a large urn-shaped antrum; a moderately narrow ductus bursae, broadening toward the corpus bursae and coiled one revolution; a ringlike colliculum, separated from the antrum by short membranous region; moderately large and rounded corpus bursae; and a signum in the form of a curved, narrow band or elongate crease near the junction with the ductus bursae, similar to that in species of *Cenopis*.

Sparganothis distincta has been reared from goldenrod (Solidago sp., Asteraceae). According to Freeman (1941), McDunnough reared this species from pupae found in tied leaves of Solidago

sempervirens Linnaeus, further implicating goldenrod as the larval host. Adults have been captured in June and July.

Sparganothis distincta occurs commonly from the Maritime Provinces, Quebec, and Ontario south along the eastern part of the continent to Florida and west to Louisiana. West of the Mississippi River it is collected considerably less frequently, with scattered records from Kansas to Utah and Arizona (type locality), Colorado, and Utah (map 38). [Specimens examined: 227 &, 149 \$\nabla\$, \$8 slides]

Sparganothis pulcherrimana (Walsingham) PL. C, FIGS. 45–48 (adult); PL. 13, FIG. 4 (\Im gen.); PL. 27, FIG. 4 (\Im gen.); MAP 39 (RWH 3701).

Cenopis pulcherrimana Walsingham, 1879, Illustrations of Typical Specimens of Lepidoptera Heterocera in the Collection of the British Museum, 4: 126.

Type locality: Texas. [BMNH]

Dichelia pulcherrimana; Fernald, 1882, Transactions of the American Entomological Society, 10: 21. COMBINATION.

Epagoge pulcherrimana; Fernald in Dyar, 1902 [1903], Bulletin of the U.S. National Museum, **52**: 475. COMBINATION.

Sparganothis pulcherrrimana; Barnes and McDunnough, 1917, Check List of the Lepidoptera of Boreal America: 176. COMBINATION.

The forewing pattern of S. pulcherrimana has the middle two-thirds of the wing mostly red brown with a large, distinct, white subtriangular patch bordering the middle of the costa and is superficially similar to that of *Cenopis niveana*. The forewing of S. pulcherrimana usually has a broad white terminal area and a white spot at the middle of the dorsal margin. The hindwing is immaculate white. Males of S. pulcherrimana lack the complex hood and the anal fold with a hairpencil characteristic of *Cenopis* species. The forewing length is 12.0-13.5 mm (mean = 12.8 mm; n = 10) in males and 10.9-12.1 mm (mean = 11.5 mm; n = 10) in

females. The male lacks a costal fold and instead has an extremely short patch of scales at the base of the forewing; and the labial palpi are long in both sexes. Male antennal sensillae are straight, about 1.0 times the width of the flagellomere.

In the male genitalia (plate 13, figure 4) the uncus has a rounded base and is short; the socii are slender, with the secondary arms weakly clubbed and densely setose in the distal ½; the transtilla is slightly bilobed and densely spined mesially; the valvae are broadest at the base and slightly narrower in the distal ½, the apex is rounded; the sacculus is well defined, confined to the basal ½ of the valva, with an ill-defined triangular process near its termination. The aedeagus is somewhat evenly curved; the vesica has a bundle of 6–8 slender, cornuti (deciduous, and lost in the specimen illustrated).

In the female genitalia (plate 27, figure 4) the sterigma is unmodified; the ostium bursae is large and ovoid; the ductus bursae is moderately narrow, broadening toward the corpus bursae, and coiled one revolution; the colliculum is ringlike, separated from the sterigma by a short membranous gap; the corpus bursae is large and rounded, with the signum in the form of an ovoid sclerotized patch near the junction of the corpus bursae and the ductus bursae.

Two specimens without locality data and one specimen from Ohio were reared from hackberry (*Celtis occidentalis* Linnaeus, Ulmaceae); no other host information is available; so, this may be a host specialist, exceptional in *Sparganothis*. Adults have been captured in June and July in the North, and in April in Texas.

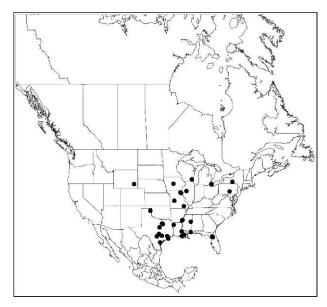
Sparganothis pulcherrimana is known from southern Ontario and Wisconsin, south to Mississippi and west to Wyoming (map 39). [Specimens examined: $61 \, \text{\r{o}}$, $27 \, \text{\r{o}}$, $4 \, \text{slides}$]

Sparganothis rubicundana (Herrich-Schäffer)

PL. C, FIGS. 49–50 (adult); PL. 13, FIG. 5 (\eth gen.); PL. 27, FIG. 5 (\updownarrow gen.); MAP 40 (RWH 3705).

Lozotaenia rubicundana Herrich-Schäffer, 1856, Systematische Bearbeitung der Schmetterlinge von Europa, **6**: 155.

Type locality: Silesia (Poland?). [BMNH]



MAP 39. DISTRIBUTION OF MATERIAL EXAMINED OF SPARGANOTHIS PULCHERRIMANA

Sparganothis rubicundana; Obraztsov, 1957, Tijdschrift voor Entomologie **99**: 154. COMBINATION.

Sparganothis hudsoniana Freeman, 1940, Canadian Entomologist, 72: 206.

Type locality: Churchill, Manitoba. [CNC]

Sparganothis rubicundana (= hudsoniana); Powell, 1983b, Check List of the Lepidoptera of America North of Mexico: 41. SYNONYMY.

Sparganothis hudsoniana was described from a small series of specimens from Manitoba and Northwest Territories, Canada. Freeman (1940) did not diagnose the species, and the description and illustration could refer to any of numerous species of Sparganothis. Based on the wing color and pattern and genitalia, Powell (1983b) synonymized hudsoniana with the European S. rubicundana, and J. Brown (2005) considered it to be a North American subspecies of S. rubicundana.

According to Razowski (2002), who illustrates the adult and genitalia of both sexes of *rubicundana*, the wingspan is 15–17 mm in males and 19–22 in females. Forewing ground color is rust mixed with brown, with faint striae. There is a faint darker median fascia and a concolorous semicir-

cular patch on the costa about ¾ the distance from the base to the apex. The hindwing is pale gray brown. In the male the costal fold is absent and the curve-tipped antennal sensillae are moderately long —about 1.25 times the width of the flagellomere.

The male genitalia (plate 13, figure 5) have the uncus long and slender; the socius tapered apically; the valva are moderately broad, with the saccular margin rounded near the middle; and the transtilla is bilobed and strongly spined mesially. In the female genitalia (plate 27, figure 5) the sterigma is short with broad proximal corners and the signum is minute.

In Europe, the species is reported from the mountains of Silesia (Poland), Fennoscandia, northern European Russia, the mountains of Siberia, and the Russian Far East (Chukota to South Primorsk) (Razowski, 2002). In addition to the types of *S. hudsoniana* from Churchill and Great Bear Lake, we have seen North American specimens from Alaska and Nunavut (i.e., Geillini Lake, 60°17′N, 95°37′W) (map 40).

Kuznetsov (1994) indicated that the species is almost certainly polyphagous; he reported the larvae on *Vaccinium myrtillus* Linnaeus in May and June. Adults fly in July and August; all North American records are from July. [Specimens examined: $9\ \frac{3}{5}$, $2\ \frac{9}{5}$,

Sparganothis praecana (Kennel) pl. D, fig. 1 (adult); pl. 13, fig. 6 (\eth gen.); pl. 27, fig. 6 (\updownarrow gen.); map 41

Tortrix cinereana Zetterstedt, 1840, Insecta Lapponica Descripta: 978.

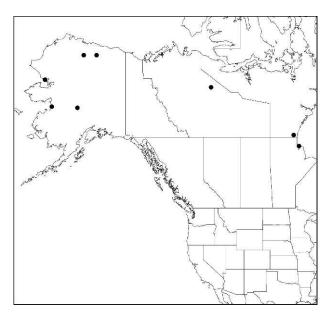
Type locality: Lappland [Norway]. [UZIL] NOTE— *Tortrix cinereana* Zetterstedt, 1840 is preoccupied by *Tortrix cinereana* Haworth [1811].

Dichelia praecana Kennel, 1900, Deutsche Entomologische Zeitschrift, Iris, 13: 125. Type locality: Siberia, Russia. [MNHU]

Dichelia praecana var. abiskoana Caradja, 1916, Deutsche Entomologische Zeitschrift, Iris, 30: 45.

Type locality: Abiskojokk, Finland. [MGAB]

Dichelia lapponana Caradja, 1916, Deutsche Entomologische Zeitschrift, Iris, 30: 45.



MAP 40. DISTRIBUTION OF MATERIAL EXAMINED OF SPARGANOTHIS RUBICUNDANA

Type locality: Norway. [MGAB]

Sparganothis praecana habeleri Lichtenberger, 1997, Zeitschrift der Arbeitsgemeinschaft Österreichischer Entomologen, **49**: 1.

Type locality: Wölzer Tauern, Styria, Austria. [Lichtenberger Collection]

Sparganothis praecana is a boreal-alpine species of the Palearctic region, reported from the Alps (Austria), northeastern Europe, southern Siberia, Mongolia, and Kamchatka (Russia) (Razowski 2002). A series of specimens (n = 8) from Swim Lakes and La Force, Yukon (CNC), and one specimen from Aklavik, Northwest Territory appear to be conspecific with S. praecana, and these specimens represent the first North American records of this species (map 41); hence, it apparently has a Holarctic distribution.

Sparganothis praecana cannot be confused with any other North American Sparganothis species owing to its moderately large size (forewing length 12.0–13.0 mm), somber color, slender antennae, and extreme northern distribution.

The forewing ground color is pale brownish gray with various olive or ferruginous scaling. The markings are represented by a variably defined (usually ill-defined) median fascia, a diffuse spot at

the end of the discal cell, and a subapical blotch, all slightly darker than the ground color. In the male genitalia (plate 13, figure 6) the uncus is long and slender, the socii are rounded posteriorly with the secondary arms enlarged in the distal ½ and densely hairy in the distal 1/4, and the transtilla is broad and weakly bilobed mesially, densely covered with spines. The valvae are comparatively short and broad, rounded apically, and with a poorly defined sacculus. The aedeagus is slightly curved near the middle, and the vesica bears a patch of 6–8 slender cornuti (deciduous, and lost in the specimens illustrated). In the female genitalia (plate 27, figure 6) the sterigma is subrectangular with rounded proximal corners, and the antrum is urn shaped. The ductus bursae is comparatively broad, gradually widening to the corpus bursae, and coiled one revolution. The corpus bursae is round and lacks a signum.

According to Razowski (2002), the early stages are undescribed. In his description of *S. praecana habeleri*, Lichtenberger (1997) reported larva from leaves of *Betula pendula* Roth (Betulaceae), *Vaccinium corymbosum* Linnaeus, and *Rhododendron* sp. (both Ericaceae). In Europe adults fly in June and July; the North American records are from June.

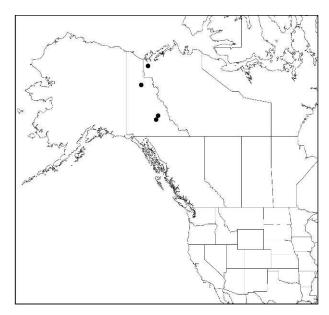
GENUS

Cenopis Zeller

Cenopis Zeller, 1876, Verhandlungen der Zoologisch-Botanischen Gesellschaft in Wien, **25**: 239.

Type species: *Tortrix pettitana* Robinson, 1869, by subsequent designation (Fernald, 1908: 41).

Cenopis was described by Zeller (1876), with Tortrix pettitana designated as the type species by Fernald (1908). Although frequently considered a synonym of Sparganothis (e.g., Powell 1983b, J. Brown 2005), males of Cenopis always can be distinguished from those of Sparganothis by the complex scaling (hood) of the head (plate 3, figure 1) and the deeply invaginated or folded anal area of the hindwing (plate 2, figure 2) bearing a distinctive hairpencil. The genus almost certainly represents a monophyletic group on the basis of the modification of the hindwing and the unusual attachment of the uncus to the dorsum of the



MAP 41. DISTRIBUTION OF MATERIAL EXAMINED OF SPARGANOTHIS PRAECANA

tegumen. Females do not share a corresponding synapomorphy. In Cenopis the basal part of the uncus is enlarged and is connected to the tegumen dorsally, separated by a distinct suture. In contrast, the basal part of the uncus in Sparganothis is confluent with the dorsum of the tegumen, without a conspicuous point of articulation. The complex hood of the male head in Cenopis, contrasted with simple in Sparganothis, may represent a synapomorphy for Cenopis and Platynota. As presently defined, Cenopis includes 16 species restricted to North America and two species from the Far East (i.e., C. matsudai (Yasuda), NEW COMBINATION, and C. illustris (Razowski), NEW COMBINATION), all of which most recently (e.g., Powell 1983, J. Brown 2005) were treated as Sparganothis. The genus is fairly diverse in facies, but homogeneous in morphological features, particularly those of the male and female genitalia.

Structural characters of the genus are as follows: antennal scaling in two bands per flagellomere, setae ½-½ times width of flagellomere in male, short, unmodified in female; scaling on frons forming a complex hood in male (plate 3, figure 2), a semicircular or horseshoe-shaped projection identical to that in many species of *Platynota*, unmodified in female; labial palpus (plate 5: figures 7–10) moderately long, segment II 1.5–2.0 times

horizontal diameter of compound eye, with minimal sexual dimorphism; proboscis developed, presumably functional; ocellus present, moderately large. Forewing (plate 2, figure 2) length 6.5-13.5 mm; costal fold in male short, narrow; upraised scales absent. Hindwing with cubital hair pecten well developed in both sexes; invaginated anal fold and associated hairpencil in male. Abdomen without dorsal pits; female lacking enlarged corethrogyne scaling. Male genitalia (plate 14, figures 1-6) with uncus slender from variable base, with attachment to dorsum of tegumen separated by membranous suture; socius large, flat, kidney bean shaped, with well-developed, slender, free secondary arms anteriorly; gnathos rudimentary or absent; valva large, rectangular, rounded apically; pulvinus well developed, situated immediately below transtilla. Aedeagus pistol shaped to evenly curved, without external spines or spurs; vesica with 6-10 slender, deciduous cornuti. Female genitalia (plate 28, figures 1-6) with simple sterigma; ductus bursae slender, usually coiled once; corpus bursae oblong; signum situated at the junction of the ductus bursae and corpus bursae, extending into the ductus bursae; signum a narrow, elongate, somewhat cylindrical, slightly crenulate band, frequently with a weak expansion of sclerotization at the anterior end bearing a tiny thorn projecting inwardly from the wall of the corpus bursae. Sexual dimorphism usually limited to male secondary features, differences in size (i.e., females are generally larger, in contrast to males being larger in Sparganothis), and intensity in some forewing pattern elements.

The "hood" on the upper portion of the frons of the head is complex as in several species of *Platynota* (plate 3, figure 1) and is comprised of a horseshoe-shaped band of long, dense, forward-projecting scales, all ending together in a slightly curved manner, forming a tunnel shaped cavity, lined interiorly by a compact row of coppery scales. In *Sparganothis* the hood is simple, comprised of a large tuft of uneven scales protruding over the lower frons. Males of *Cenopis* always have a well-developed pocketlike anal fold on the hindwing (plate 2, figure 2) accommodating a dense patch of long, slender sex scales (= hair-pencil), which is lacking in some species of *Sparganothis*, although partially developed and

lacking an enclosed hairpencil in S. distincta, S. azulispecca, S. mcguinnessi, and S. niteolinea.

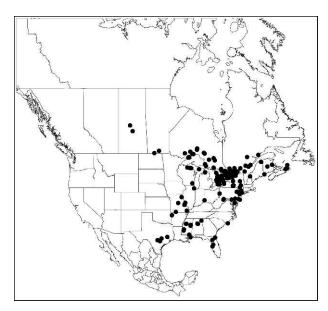
Within species of *Cenopis*, there are two fairly distinctive shapes of the uncus, although the character states are highly qualitative. In one group of species the base is more bulbous or rounded (i.e., *C. petittana*, *C. niveana*, *C. reticulatana*, *C. ferreana*, *C. unicolorana*, *C. lamberti*, *C. daphnana*, and *C. diluticostana*) and in the other group it is more flattened or subrectangular (i.e., *C. saracana*, *C. directana*, *C. chambersana*, *C. cana*, *C. vabroui*, *C. mesospila*, *C. karacana*, and *C. eulongicosta*).

The signum in the female genitalia has two generalized forms. In *C. pettitana* and *C. niveana* it is a relatively straight rugose band, slightly expanded from the posterior end to the anterior end, extending from the junction of the corpus bursae and ductus bursae into the corpus bursae. In *C. lamberti*, *C. diluticostana*, *C. unicolorana*, *C. directana*, *C. saracana*, *C. mesospila*, *C. eulongicosta*, *C. cana*, *C. vabroui*, *C. daphnana*, *C. karacana*, and *C. chambersana* it is an angled-sinuate band situated at the junction of the corpus bursae and ductus bursae.

KEY TO SPECIES OF CENOPIS

1.	Hindwing usually white to pale cream
	wii 0
2.	Forewing with brown fasciae enclosing pale-yellow, semicircular area of ground color at midcosta; termen completely yellow (plate D, figures 9–11) niveana
	p. 96
_	Forewing without distinct white or pale-yellow semicircular patch at midcosta, or if present then termen not completely yellow
3.	Forewing ground color straw yellow, with a triangular brown blotch near middle of dorsal margin; oblique fascia from blotch to costa faint or obsolete (plate D, figures 39–41) mesospila
_	p. 108 Forewing ground color yellow, orange, gray, or brown; if triangular blotch present at dorsal margin, it represents a portion of an oblique forewing fascia
4.	Forewing with oblique fascia incomplete 5

_	Forewing with well-defined oblique fascia complete (from costa to dorsal margin)	base to about ½ distance from base to apex 12 — Forewing with variable ground color, without fine, narrow costal line 13
5.	Forewing white or pale yellow, usually with few ill-defined markings (plate D, figures 2–8) pettitana (part)	12. Forewing unicolorous pale cream, usually lacking markings (plate D, figures 24–26) unicolorance p. 103
_	Forewing mostly orange or pale orange brown, usually with a small, ill-defined, darker dot near apex of discal cell (plate E, figures 2–4) chambersana p. 114	 Forewing bright yellow with small brown costal patch at terminus of fine costal line, brown blotch at outer portion of dorsal margin, and shaded terminal region (plate D, figures 17, 18)
6.	Forewing yellow, uniformly reticulated with orange throughout	
_	Forewing white, yellow, orange, gray or brown, lacking uniform orange reticulation (plate D, figures 2–8) pettitana (part) p. 94	13. Forewing length > 10.0 mm (plate D, figures 42, 43)
7.	Forewing with a large subrectangular patch on distal half of dorsal margin representing termination of oblique forewing fascia, width ½-½ length of margin (plate D, figures 15, 16) ferreana	 14. Ground color of forewing mostly pale yellow (plate D, figures 49, 50; plate E, figure 1) karacana p. 113 — Ground color of forewing mostly orange to tan
_	p. 100 Forewing with a smaller subrectangular patch at middle of dorsal margin representing termination of oblique forewing fascia, width less than ½ length of dorsal margin (plate D, figures 12–14) reticulatana p. 98	or brown
8.	Forewing brown with two dark purple-brown, curved fascia, one from near middle of costa, the other from apical region; forewing length usually 7.0 mm or less (plate D, figures 20–23) diluticostana p. 102	p. 105 — Forewing ground color usually tan or brown 16 16. Forewing with quadrate blotch in distal half of dorsal margin extending nearly to subapical
	Forewing without purple-brown fascia; forewing length usually longer than 7.0 mm	blotch from costa (plate D, figures 33–38) saracana p. 107
9.	Forewing pattern elements mostly gray on a pale whitish-gray ground color	— Forewing without distinct quadrate blotch in distal half of dorsal margin (plate D, figure 19)
10.	Larger species (forewing length 8.5–11 mm); forewing with broad, often poorly defined, darker gray maculation and thin, transverse striae (plate D, figures 44–46)	Cenopis pettitana (Robinson), revised Combination pl. D, figs. 2–8 (adult); pl. 14, fig. 1 (♂gen.); pl. 28, fig. 1 (♀ gen.); map 42 (RWH
	p. 111 Small species (forewing length 7.0–8.7 mm); forewing with pale gray, almost white ground, and smaller, more distinct maculation, and lacking fine striae (plate D, figures 47, 48) vabroui p. 112 Forewing yellow or pale cream, with a fine,	3725). Tortrix pettitana Robinson, 1869, Transactions of the American Entomological Society 2: 269. Type locality: "Canada West, Ohio, Illi-
	narrow brown line extending along costa from	nois." [ANSP]



MAP 42. DISTRIBUTION OF MATERIAL EXAMINED OF CENOPIS PETTITANA

NOTE—The lectotype male (without data; undissected) was designated by Klots (1942: 415).

Cenopis pettitana; Zeller, 1876, Verhandlungen der Zoologisch-Botanischen Gesellschaft in Wien, **25**: 239. COMBINATION.

Sparganothis pettitana; Barnes and McDunnough, 1917, Check List of the Lepidoptera of Boreal America: 176. COMBINATION.

Sparganothis acerivorana MacKay, 1952, Canadian Entomologist, **84**: 233. NEW SYNON-YMY.

Type locality: Kingsmere, Quebec. [CNC]

MacKay (1952) recognized two species within what formerly was regarded as "Sparganothis pettitana." She indicated that larvae of the two are ". . . easily separated by appearance and by host. . . " – C. pettitana primarily on basswood (Tilia sp.) and C. acerivorana primarily on maple (Acer spp.). She added that occasional examples of A. acerivorana are reared from Tilia. Although larval chaetotaxy is virtually identical between the two, she stated that the prothoracic shield and pinacula of the prothorax are considerably more strongly marked in C. acerivorana, and that the

socii of *C. acerivorana* are shorter and broader, resulting in a "... smaller, neater, more compact structure than that of *S. pettitana*." In addition, she stated that the uncus of *C. acerivorana* is usually shorter in relation to the length of the socii. However, we found all of these differences highly quantitative, and it is virtually impossible to distinguish between them. Based on MacKay's (1952) figures, the forewing pattern of *C. acerivorana* appears to be better developed than that of *C. pettitana*, with a complete diagonal fascia from the costa to the dorsal margin in the male. However, forewing pattern is highly variable among all populations of both forms.

McDunnough (1961) questioned the validity of S. acerivorana, indicating that a series of Sparganothis from Nova Scotia resembling S. pettitana could not be associated with basswood because the plant does not occur in Nova Scotia. He further stated that the genitalia of those specimens did not match MacKay's drawings of either C. pettitana or C. acerivorana, suggesting that differences noted by MacKay (1952) more likely represent variation within C. pettitana. We are unable to distinguish the two, and preliminary DNA analyses (using the mitochondrial gene COI) provide little evidence for their separation. However, the DNA data fail to distinguish C. pettitana from C. niveana, which we consider a separate species. We opt for a conservative approach and treat *pettitana* and *acerivorana* as a single species but continue to recognize C. niveana as distinct based on its more uniform phenotype.

Most specimens of *Cenopis pettitana* can be distinguished from congeners by their relatively large size, pale forewing color, and simple markings (or lack thereof) although there is considerable variation in forewing color and markings. Neither the male nor female genitalia can be distinguished reliably from those of other species. The crenulate, rope-shaped signum of the female typically lacks a sclerotized patch at the anterior end and is nearly identical to that of *C. niveana*. Male genitalia (plate 14, figure 1) are characterized by the large, rounded base of the uncus and the long, slender, drawn-out apex of the uncus.

The male forewing is pale to bright yellow, rarely white (< 2% of long series from Ontario), with the markings variable from totally absent to well defined. Usually, there is an incomplete, oblique, orange-brown fascia from the costa about

 $\frac{1}{3}$ the distance from the base to the apex, extending to about the middle of the dorsal margin; and a variably developed, orange-brown patch comprised of small, interrupted spots and dashes at the costa about $\frac{2}{3}$ the distance from the base to the apex. The female forewing is typically white, ranging to faintly yellow (<10%), almost always lacking pattern elements. Forewing length is 9.0–11.0 mm (mean = 10.0 mm; n= 10) in males and 12.0–14.0 mm (mean = 13.1 mm; n = 10) in females. The costal fold is short in the male, extending about $\frac{1}{3}$ the length of the forewing.

In the male genitalia (plate 14, figure 1) the uncus is long and slender from a broadened, slightly rounded base; the socii are large, elongate ovoid, and the secondary arms are slender, densely setose distally; the transtilla has a small spiny mesial lobe, with spines restricted primarily to the dorsum of the lobe; and the valva are subrectangular, rounded apically, with a weak sacculus. The aedeagus is evenly curved, with eight long, slender cornuti in the vesica (deciduous, and lost in specimen illustrated).

In the female genitalia (plate 28, figure 1) the sterigma is a broad lateral band; the ostium bursae is rounded, especially ventrally, with a sclerotized ridge along the lateral flaps; the ductus bursae is moderately broad, coiled one revolution; the colliculum is extremely weak; and the corpus bursae is large and ovate, with the signum in the form of a long, rugose band.

The larva of C. pettitana (and its synonym acerivorana) was described and illustrated by MacKay (1952, 1962). The last instar larva averages 25 mm in length and is rather slender; the body is green or yellowish green, the pinacula are slightly paler than the body color; the setae are moderate in length; and the spinules are dense and slender, concolorous with the body. The head averages 1.9 mm in width, usually brownish with a distinct dark stemmatal area and a lateral bar extending from the postgenal suture; the head often is overlaid with a dark reddish-brown pattern, or infrequently entirely dark brownish black. The prothoracic shield is yellow, with a distinct brown or black V-shaped posterior mark on either side of the middorsal line; the shield sometimes has dark posterior and/or lateral margins. The thoracic legs are brown to dark brown. On the abdomen, the distance between the V setae on A9 is about 1.5 times that of the V setae on A8; the anal shield is brownish yellow, rounded posteriorly or only slightly tapered; all setae on the shield are about the same length; the anal fork is moderately developed, but not prominent.

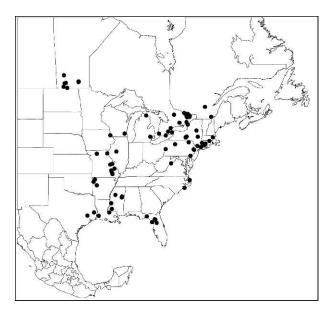
According to MacKay (1952), the primary host of C. pettitana is basswood (Tilia americana Linnaeus; Tiliaceae), whereas that of its synonym C. acerivorana is maple (i.e., Acer glabrum Torrey, A. spicatum Lamarck, A. saccharum Marshall, A. rubrum Linnaeus, A. grandidentatum Nuttall, Aceraceae). In the Canadian Forest Insect Survey, Prentice (1966) reported larval hosts as 60% Tilia, 28% Acer, and 12% several deciduous trees, but no conifers. Other reported hosts include alder (Alnus sp.) and American hornbean (Carpinus caroliniana Walter, Betulaceae), oak (*Quercus* spp., Fagaceae), trembling aspen (*Populus tremuloides* Michaux, Salicaceae), and American elm (Ulmus americana Linnaeus, Ulmaceae) (Schaffner 1959, Kimball 1965, Goodfrey et al. 1987, Wagner et al. 1995). Larvae are leaf-rollers; the pupa is found either within a rolled leaf or within a small purselike shelter within a larger shelter formed by the rest of the leaf. Pupation requires 7–10 days, with adults emerging from mid-June to early July, with a few records from August.

Cenopis pettitana is one of the most frequently collected species of Cenopis in the eastern part of North America, with capture records extending from the southern half of central and eastern Canada (Nova Scotia, Quebec, Ontario, Manitoba, and Saskatchewan) through central (Wisconsin, Ohio, Illinois) and eastern United States (Maine, Vermont, New York, Pennsylvania, New Jersey, North Carolina) south to Florida, Alabama, and Mississippi, and west to Texas (map 42). [Specimens examined: 235 ♂, 212 ♀, 27 slides]

Cenopis niveana Walsingham, REVISED COMBINATION

PL. D, FIGS. 9–11 (adult); PL. 14, FIG. 2 (♂ gen.); PL. 28, FIG. 2 (♀ gen.); MAP 43 (RWH 3727).

Cenopis niveana Walsingham, 1879, Illustrations of Typical Specimens of Lepidoptera Heterocera in the Collection of the British Museum, 4: 19.



MAP 43. DISTRIBUTION OF MATERIAL EXAMINED OF CENOPIS NIVEANA

Type locality: Canada [presumably Manitoba]. [BMNH]

Teras niveana; Fernald, 1882, Transactions of the American Entomological Society 10: 6. COMBINATION.

Sparganothis niveana; Barnes and McDunnough, 1917, Check List of the Lepidoptera of Boreal America: 176. COMBINATION.

Cenopis groteana Fernald, 1882, Transactions of the American Entomological Society, **10**: 69. Type locality: Ohio. [USNM]

Cenopis niveana; Fernald in Dyar, 1902 [1903], Bulletin of the U.S. National Museum **52**: 476. REVISED COMBINATION.

Sparganothis groteana; Barnes and McDunnough, 1917, Check List of the Lepidoptera of Boreal America: 175. COMBINATION.

Sparganothis groteana (= niveana); Powell, 1983b, Check List of the Lepidoptera of America North of Mexico: 41. Synonymy.

Cenopis niveana has two distinct forms in both sexes; intermediates occur but at very low frequen-

cy. In one form (mostly females) the forewing is pale yellow with a well-defined, reddish-brown, roughly V-shaped marking intersecting the costa at about ½ and ½ the distance from the base to the apex, isolating a pale-yellow, semicircular patch near midcosta; the costa sometimes has a thin brownish line in the basal region. In the other form (mostly males) the entire middle 1/3 of the forewing is brown (varying from pale orange tan to dark brown), concolorous with the V-shaped marking, leaving an isolated yellow semicircular patch near midcosta, a yellow patch at the base, and a yellow terminal region. In both forms, the forewing pattern of this species is unmistakable. In specimens from Marion County, Florida (n = 3) and Logan County, Arkansas (n = 3), the yellow or white ground color of the forewing is replaced by light orange tan or pinkish tan. A few unusually heavily marked individuals of C. pettitana approach the darker form of C. niveana, but C. niveana usually can be distinguished by the distinct yellow or white terminal region. Preliminary molecular analyses based on the mitochondrial gene cytochrome oxydase I indicate that C. pettitana and C. niveana are extremely closely related with a sequence divergence of less than 1%. As indicated above, the signa of the female genitalia of the two species are nearly identical. Forewing length is 8.0–8.5 mm in males (mean = 8.3 mm; n = 8) and 8.0–10.0 mm (mean = 9.2 mm; n = 8) in females. The male forewing costal fold is well developed but short, extending about 1/2 the length of the forewing.

The male genitalia (plate 14, figure 2) have a long, moderately stout uncus from a rounded base, which is considerably broader than that of most congeners; large, unmodified socii, with the secondary arms slightly dilated distally and densely setose in the distal ¼; the transtilla with a single spiny mesial process; and subrectangular valvae with a poorly defined sacculus. The aedeagus is evenly curved, with 7–8 long, slender cornuti in the vesica.

In the female genitalia (plate 28, figure 2) the sterigma is a broad lateral band, slightly lobed at the anterior corners; the ostium bursae is urn shaped; the ductus bursae is long, widening anteriorly, and coiled one revolution; the colliculum is poorly defined, separated from the sterigma by a short membranous gap; the corpus bursae is

large and irregularly rounded; and the signum is a moderately long, rugose band, slightly curved in the proximal $\frac{1}{10}$.

The larvae of *Cenopis niveana* are solitary leaf-rollers. According to specimen label data (USNM), adults have been reared from American hop-hornbean (*Ostrya virginiana* (Miller) K. Koch, Betulaceae) (n = 11). Prentice (1966) reported ironwood (n = 3) and sugar maple (*Acer saccharum* Marshall, Aceraceae) (n = 1) as hosts in Canada. The species is apparently single brooded, with the flight period highly dependent upon latitude: adults have been collected from mid-June through late July in the northern part of its range (Canada and northeastern United States) and from April and May in the southern United States (i.e., Florida, Mississippi, Louisiana, and Texas).

Cenopis niveana ranges from southern Canada (Quebec, Ontario, Manitoba) south to Pennsylvania, Illinois, and Missouri, and along the eastern seaboard from New York to Florida, and west to Texas (map 43). [Specimens examined: $12\ 3$, $10\ 9$, 4 slides]

Cenopis reticulatana (Clemens), REVISED COMBINATION

PL. D, Figs. 12–14 (adult); PL. 14, Fig. 3 (δ gen.); PL. 28, Fig. 3 (φ gen.); MAP 44 (RWH 3720).

Pyralis fulgidipennana Blanchard, 1850, in Castelnau, Historie naturelle des Animaux articules 3(2): 548. UNUSED SENIOR SYNONYM Type locality: USA. [MNHN]

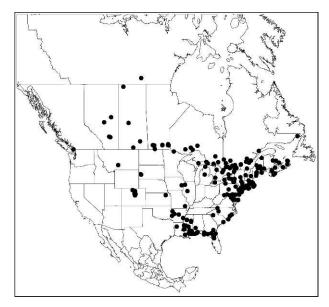
Croesia reticulatana Clemens, 1860, Proceedings of the Academy of Natural Sciences, Philadelphia, 12: 353.

Type locality: [Easton, Pennsylvania]. [ANSP]

NOTE—The lectotype female was designated by Darlington (1947: 100).

Teras subauratana Walker, 1863b, List of the Specimens of Lepidopterous Insects in the Collection of the British Museum, 28: 289. Type locality: Nova Scotia. [BMNH]

Cenopis reticulatana; Fernald, 1882, Transactions of the American Entomological Society, **10**: 20. COMBINATION.



MAP 44. DISTRIBUTION OF MATERIAL EXAMINED OF CENOPIS RETICULATANA

Sparganothis reticulatana; Barnes and McDunnough, 1917, Check List of the Lepidoptera of Boreal America: 176. COMBINATION.

Cenopis subauratana; Fernald, 1882, Transactions of the American Entomological Society, 10: 20. COMBINATION.

Cenopis subauratana (= reticulatana); Fernald in Dyar, 1902 [1903], Bulletin of the U.S. National Museum, **52**: 476. SYNONYMY.

Cenopis reticulatana can be recognized by its distinctive forewing color and pattern. The ground color is pale yellow, evenly reticulated with orange or yellow orange throughout (although the density of reticulation is variable); there are three diagonal purplish-brown lines from the costa: one at about ½ the distance from the base to the apex, terminating in a triangular patch in the distal ½ of the dorsal margin; the second from the distal edge of an irregularly rectangular costal patch about ½ the distance from the base to the apex, intersecting the first line at the apex of a triangular patch on the dorsal margin; and the third from the basal edge of the irregularly rectangular patch

described above, extending toward the tornus, roughly parallel to the first. As noted by McDunnough (1961), the reticulation is denser in females, giving them a much darker look. Forewing length is 7.0-10.0 mm (mean = 8.6 mm; n = 10) in males and 8.5-10.5 mm (mean = 9.3 mm; n = 10) in females. Specimens from Colorado have a slightly greater forewing length and a more pale-orange reticulation than those from the northern and eastern portions of its range. The male costal fold of the forewing is well developed, extending about 0.15 the length of the forewing.

In the male genitalia (plate 14, figure 3) the uncus is long and slender from a large ovoid base; the socii are large and rounded posteriorly, and the secondary arms are slender and densely setose distally; the transtilla has a single spiny process confined to the middle; and the valvae are subrectangular, rounded apically, with the sacculus in the form of a short, ventrally projecting, triangular process near the middle. The aedeagus is evenly curved, with 8–10 long, slender cornuti.

In the female genitalia (plate 28, figure 3) the sterigma is a broad lateral band, with weakly scobinate lateral extensions on each side of the ostium bursae; the ostium bursae is round ovoid; the ductus bursae is moderately narrow, long, and coiled one revolution; the colliculum is separated from the base of the sterigma by a short membranous portion of the ductus bursae; and the corpus bursae is large and ovate, bearing a signum comprised of a short, broad, subtriangular, spinulose band.

The larva of C. reticulatana was described by MacKay (1962) from four last instars and one last instar integument reared from eggs of an identified female. Chapman and Lienk (1971) provide additional details on the early stages. General: Last instar 14-20 mm in length (females usually larger than males); body pale, pinacula moderate in size, concolorous with body; setae long; spinules dense, minute, with bases darker on dorsum than on venter. Head: Length 1.1 mm, width 1.2-1.3 mm; brownish yellow, with weak, brownish stemmatal patch; brownish bar extending anteriorly from postgenal juncture, usually distinct on early instars and lacking in last instar. Thorax: Prothoracic shield brownish yellow, with a large area of brown pigment on each side; thoracic legs pale. Abdomen: Distance between V1 setae on A9 usually 1.5–2.0 times that on A8; anal shield brownish yellow, distinctly tapered posteriorly, with L1 setae about twice as long as anal segment and about same distance apart as D1 setae; anal fork well developed. The pupa is dark brown.

Cenopis reticulatana is a general feeder and has been recorded from the following hosts (Prentice 1966, von Aderkas and Peterson 1987, USNM specimens): Asteraceae: aster (Aster sp.); thistle (Cirsium sp.); Betulaceae: alder (Alnus incana (Linnaeus) Moench); white birch (Betula populifolia); Ericaceae: huckleberry (Vaccinium sp.); Fagaceae: American beech (Fagus grandifolia Ehrhart); Myricaceae: bayberry (Morella sp.); Oleaceae: white ash (Fraxinus americana Linnaeus); Onagraceae: fireweed (Chamerion angustifolium (Linnaeus) Holub); Orchidaceae: ramshead lady's slipper (Cypripedium arietinum R. Brown); Rosaceae: apple (Malus domestica Borkhausen), blackberry (Rubus sp.), avens (Geum virginianum Linnaeus), pin cherry (Prunus pensylvanica Linnaeus), chokecherry (Prunus virginiana Linnaeus); Verbenaceae: vervain (Verbena sp.); Salicaceae: largetooth aspen (Populus grandidentata Michaux); Pteridophyta: Matteuccia struthiopteris (Linnaeus) Todaro.

This species appears to be single brooded, with adults captured primarily in July and August (occasionally as early as June and as late as September) in the more northern portions of its range, and in May through June in the South (e.g., Alabama and Florida). We reared larvae of C. reticulatana on synthetic diet from eggs deposited by females from southern Illinois, southern Maryland, and northern Virginia in 1985, 1997, and 2005. Eggs hatched in about 10–12 days. Larvae grew slowly, and emergence in the Illinois colony occurred 1-26 October, 90-116 days following oviposition. The group from Maryland eclosed between 11 November and 7 December, 99-123 days after oviposition. There was no evidence of diapause, but overwintering may be accomplished by pupae.

Cenopis reticulatana ranges across southern Canada from Nova Scotia to Alberta, south to Florida, Alabama, Mississippi, Louisiana, and Texas, and west to Colorado (map 44). Although most common in natural habitats, it is occasional in urban habitats as well. [Specimens examined: 227 ♂, 105 ♀, 15 slides]

Cenopis ferreana (Busck), NEW COMBINA-TION, REVISED STATUS

PL. D, Figs. 15, 16 (adult); PL. 14, Fig. 4 (♂ gen.); PL. 28, Fig. 4 (♀ gen.); MAP 45 (RWH 3720, part)

Sparganothis ferreana Busck, 1915, Proceedings of the Entomological Society of Washington, 17: 86.

Type locality: Ilion, Herkimer County, New York. [USNM]

Sparganothis ferreana (= reticulatana); Powell, 1983b, Check List of the Lepidoptera of America North of Mexico: 41. Synonymy.

Although treated as a junior synonym (i.e., form) of C. reticulatana by Powell (1983b), C. ferreana is distinct in facies and genitalia. Preliminary molecular analyses (i.e., using the mitochondrial gene COI) are inconclusive because the only specimens available are too old and produced incomplete sequences of COI. The male genitalia of C. ferreana lack the triangular process of the sacculus usually present in C. reticulatana, and the juxta is a weakly folded plate rather than a simple shield as in C. reticulatana. The forewing pattern of C. ferreana is fairly distinct from its congeners, as well, although some strongly marked individuals of C. reticulatana are similar. The ground color is pale yellow to pale yellow orange, faintly and irregularly reticulated with orange brown, with two diagonal orange-brown fascia from the costa: a narrow one at about 1/3 the distance from the base to the apex, extending outward, terminating in a large rectangular patch occupying the distal ½ of the dorsal margin, and a second broader fascia from an irregular rectangular costal patch about 1/10-1/10 the distance from the base to the apex, extending inward, intersecting the first at a rectangular patch on the dorsal margin; the two lines together isolate a large, semicircular patch of ground color at midcosta, which is more ovoid oblong than rounded in females. Forewing length is 7.5-8.0 mm (mean = 7.8 mm; n = 8) in males and 9.0-9.5mm (mean = 9.2 mm; n = 4) in females. The costal fold of the forewing is well developed in the male, extending about 0.14 the length of the forewing.

In the male genitalia (plate 14, figure 4) the uncus is long and slender; the socii are large,



MAP 45. DISTRIBUTION OF MATERIAL EXAMINED OF CENOPIS FERREANA

rounded posteriorly, with moderately slender secondary arms that are densely setose distally; the transtilla has a single, broad, spiny lobe; and the valvae are subrectangular and rounded apically, with a weakly defined sacculus. The aedeagus is evenly curved, with 8–10 long, slender cornuti in the vesica.

In the female genitalia (plate 28, figure 4) the sterigma is relatively broad with short, weakly scobinate, lateral extensions on each side of the ovoid ostium bursae; the ductus bursae is moderately narrow, long, and coiled one revolution; the colliculum is separated from the base of the sterigma by a narrow membranous portion of the ductus bursae; and the corpus bursae is large and ovate, with the signum in the form of a relatively long, shallowly U-shaped, cylindrical band.

Nothing is known of the biology of this species. Adults have been collected from late May through July, mostly in June.

Cenopis lamberti (Franclemont), NEW COMBINATION

PL. D, FIGS. 17, 18 (adult); PL. 14, FIG. 5 (♂ gen.); PL. 28, FIG. 5 (♀ gen.); MAP 46

Sparganothis lamberti Franclemont, 1986, Proceedings of the Entomological Society of Washington, 88: 56.

Type locality: Cherry Hill Recreation Area, Route 107, 2,000′, Oconee Co., South Carolina. [USNM]

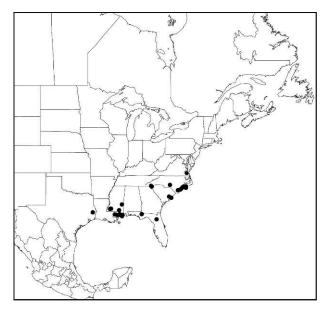
Adults of *C. lamberti* cannot be confused with any other species in the genus. The forewing color and pattern – bright yellow with a distinct brown costal triangle on the basal $\frac{1}{3}$, brown termen, and large brown blotch along the dorsal margin – immediately distinguish males of this species. In females the costal patch is absent, and there is a small brown dot at the upper edge of the discal cell. Forewing length is 7.5–9.0 mm (mean = 8.2 mm; n = 10) in males and 8.5–10.0 mm (mean = 9.5 mm; n = 10) in females. Males have a well-developed, but short costal fold.

The male genitalia (plate 14, figure 5) are similar to those of other *Cenopis* species with a long, slender uncus; large, elongate-ovoid socii, with slender secondary arms that are slightly swollen subapically and densely setose distally; a single spiny mesial process on the transtilla; and subrectangular valvae, rounded apically, with a weak sacculus. The aedeagus is evenly curved, with 8–10 long, slender cornuti in the vesica.

The female genitalia (plate 28, figure 5) have a relatively broad sterigma; a round-ovoid ostium bursae; a moderately narrow, short ductus bursae, coiled one revolution; a colliculum joined to the base of the sterigma; and a large, ovate corpus bursae, with the signum in the form of a short spinulose band. The shape of the signum, a somewhat sinuate, rugose band, is usually diagnostic for this species.

Adults have been collected from late May through early September, with most records from June through August; there is a single record from October (South Carolina). Capture records suggest two broods. It has been reared once in Mississippi from a larva collected on *Persea* sp. (Lauraceae) (MEM).

Cenopis lamberti ranges throughout the southeastern United States from Virginia, North Carolina, and South Carolina to Florida and west to



MAP 46. DISTRIBUTION OF MATERIAL EXAMINED OF CENOPIS LAMBERTI

Texas (map 46). [Specimens examined: 175 δ , 53 \circ , 9 slides]

Cenopis daphnana (McDunnough), NEW COMBINATION

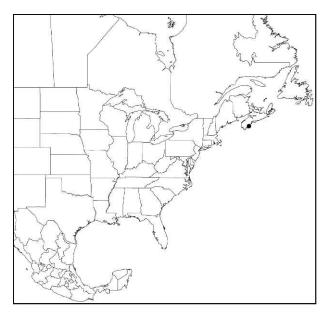
PL. D, FIG. 19 (adult); PL. 14, FIG. 6 (♂ gen.); PL. 28, FIG. 6 (♀ gen.); MAP 47 (RWH 3707).

Sparganothis daphnana McDunnough, 1961, American Museum Novitates, **2040**: 6.

Type locality: White Point Beach, Queens County, Nova Scotia. [CNC]

Cenopis daphnana is a fawn-brown species, superficially similar to some individuals of Sparganothis tunicana and S. umbrana. It is easily distinguished from those two species by its modifications characteristic of Cenopis. The male genitalia can be distinguished from its congeners by the short, broad sacculus with a distinct, free triangular process. According to McDunnough (1961), females are considerably larger than males, have a darker ground color, and have much longer labial palpi. Males have a well-developed costal fold, about ¼ the length of the forewing costa.

In the male genitalia (plate 14, figure 6) the uncus is long and slender from a rounded base; the socii are long, relatively narrow, and rounded posteriorly, with distally setose secondary arms; the transtilla has a single, triangular, spiny process;



MAP 47. DISTRIBUTION OF MATERIAL EXAMINED OF CENOPIS DAPHNANA

and the valva is subrectangular and rounded apically, with a nearly straight ventral margin between the distal end of the sacculus and the apex; the sacculus is short, broad, and well defined, bearing a distinct, free, upturned, triangular projection at about ¼ the distance from the base to the apex. The aedeagus is relatively short and straight, with 5–7 long, slender cornuti in the vesica (deciduous, and lost in the specimen illustrated).

In the female genitalia (plate 28, figure 6) the sterigma is relatively broad with short lateral extensions on each side of the ovoid ostium bursae; the ductus bursae is moderately narrow, long, and coiled one or two revolutions (McDunnough noted two coils in field-collected or mated specimens and one coil in reared, unmated specimens); the colliculum is split, separated from the base of the antrum by a narrow membranous portion of the ductus bursae; and the corpus bursae is large and ovate, with the signum in the form of a relatively long, narrow, crenulate rod, somewhat beak shaped at one end.

The type series was reared from *Chamaedaphne* sp. (Ericaceae), *Ilex* sp. (Aquifoliaceae), *Aronia melanocarpa* (Michaux) Elliott (Rosaceae), and *Morella gale* Linnaeus (Myricaceae) (McDunnough 1961). The larval head is brown to dark gray, the prothoracic shield is brown, and the body

is green with faint whitish subdorsal stripes and white pinacula.

This species is known from a long series collected at White Point Beach and Lake Kejimkujik, Nova Scotia in 1953–1956 (map 47). Adults were taken in July and August, probably representing a single brood. [Specimens examined: $10 \, \delta$, $2 \, \circ$, $3 \, \text{slides}$]

Cenopis diluticostana Walsingham, REVISED COMBINATION

PL. D, FIGS. 20–23 (adult); PL. 5, FIGS. 9, 10 (palpi); PL. 15, FIG. 1 (δ gen.); PL. 29, FIG. 1 (φ gen.); MAP 48 (RWH 3716).

Cenopis diluticostana Walsingham, 1879, Illustrations of Typical Specimens of Lepidoptera Heterocera in the Collection of the British Museum, 4: 18.

Type locality: "Eastern States of North America." [BMNH]

Cenopis quercana Fernald, 1882, Transactions of the American Entomological Society, **10**: 69.

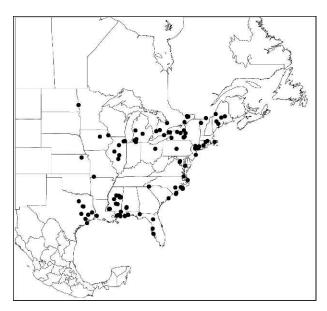
Type locality: Texas. [CUIC]

NOTE—The holotype apparently is destroyed; the label on a pin with no specimen indicates that it is the "type ♂." Lambert (1950) selected a specimen from Texas as the neotype, which is in the Cornell University Insect Collection.

Cenopis quercana (= diluticostana); Fernald in Dyar, 1902 [1903], Bulletin of the U.S. National Museum, 52: 476. SYNONYMY.

Sparganothis diluticostana; Barnes and McDunnough, 1917, Check List of the Lepidoptera of Boreal America: 176. COMBINATION.

Its diminutive size and distinctive forewing color and pattern distinguish this species from its congeners. The forewing ground color is variable, usually chestnut brown in the male, but varying from pale to dark chestnut brown on the basal ½ of the costal region, excluding the fascia, pale yellow orange, and with two broad, well-defined, purplish-brown fascia from the costa, one about ½-½ the distance from the base to the apex, and the second



MAP 48. DISTRIBUTION OF MATERIAL EXAMINED OF CENOPIS DILUTICOSTANA

about $\frac{3}{5}$ — $\frac{4}{5}$ the distance from the base to the apex. The female forewing pattern is similar to that of the male, except it is evenly overscaled with iridescent brick red, obscuring the pattern elements; the fasciae lack the iridescence. Forewing length is 6.0–7.0 mm (mean = 6.3 mm; n = 10) in males and 6.5–7.5 mm (mean = 7.2 mm; n = 10) in females. The costal fold is short in the male, but well developed, extending about 0.14 the length of the forewing.

In the male genitalia (plate 15, figure 1) the uncus is long and slender from a distinctly rounded base; the socii are large, unmodified, with the secondary arms comparatively slender, weakly undulate and densely setose in the distal ¼; the transtilla has a well-developed, spiny, mesial process; the valvae are comparatively long and subrectangular, with a poorly defined sacculus extending about ½ the length of the valva. The aedeagus is about ¾ the length of the valva and slightly curved, with 9–10 long, slender, weakly undulate cornuti in the vesica.

In the female genitalia (plate 29, figure 1) the sterigma is a broad lateral band with a weakly spiculate lateral lobe on each side of the ostium bursae; the ostium bursae is irregularly ovoid with tiny spines along the venter; the ductus bursae is moderately long, broadened anteriorly, and coiled one revolution near the middle; the colliculum is

well defined, separated from the antrum by a short membranous gap; and the corpus bursae is irregularly rounded, with a signum in the form of a rough, curved band, without an expanded sclerite.

Cenopis diluticostana is polyphagous, like most other Cenopis species. According to specimen label data (USNM), it has been reared from Vaccinium corymbosum Linnaeus (Ericaceae), oak (Quercus sp.) and American beech (Fagus grandifolia Ehrhart; Fagaceae), mock-orange (Philadelphus coronarius Linnaeus; Hydrangeaceae), white ash (Fraxinus americana; Oleagceae), apple (Malus domestica; Rosaceae), cultivated cherry (Prunus sp.; Rosaceae), and hawthorn (Crataegus sp.; Rosaceae). A pupa was collected on Syringa vulgaris Linnaeus (Oleaceae). Fernald (1882) reported it (as Cenopis quercana) from oak and cherry. Prentice (1966) recorded C. diluticostana from white ash and white birch (Betula populifolia). Wagner et al. (1995) reported rearing a single individual from Quercus sp. (Fagaceae). In Maine, adults have been collected from mid-July to early August (n = 40); in the more southern portions of its distribution, captures range from April to July, with an occasional specimen from March in the extreme southern portion of its range. In South Carolina, Alabama, Florida, and Texas most records are from Mav.

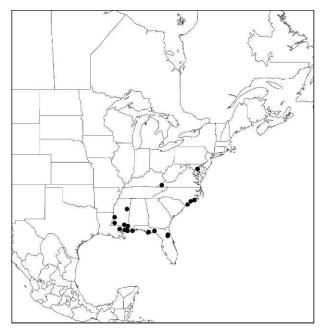
Cenopis diluticostana ranges from Maine to Minnesota, south to Florida, and west to Kansas, Missouri, and Texas (map 48). [Specimens examined: 73 δ , 29 \circ , 10 slides]

Cenopis unicolorana Powell and J. Brown, NEW SPECIES

PL. D, FIGS. 24–26 (adult); PL. 15, FIG. 2 (δ gen.); PL. 29, FIG. 2 (φ gen.); MAP 49

Cenopis unicolorana Powell and J. Brown. Type locality: Bon Secour N.W.R., Baldwin Co., Alabama. [USNM]

Males of *Cenopis unicolorana* usually have uniformly pale-cream forewings with a narrow brown line over the costal fold and rarely a faint broken, rust-brown fascia through the basal ½ of cell obliquely outward. This species is easily distinguished from its congeners by its large size, and with few exceptions, the uniformly pale-cream forewing in the male.



MAP 49. DISTRIBUTION OF MATERIAL EXAMINED OF CENOPIS UNICOLORANA

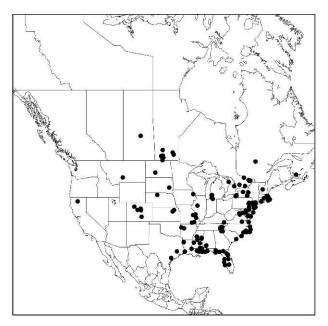
Description. Male. Head: Hood complex, mostly pale copper colored; from smooth scaled below hood, whitish; vertex pale vellow; labial palpus long, cream mesially, orange and cream laterally; antennal scaling red brown, senillae 0.5-0.7 times width of flagellomere. Thorax: Straw vellow with brown prothoracic collar. Forewing length 9.0-11.5 mm (mean = 10.0 mm; n = 10); forewing uniformly straw yellow cream, sometimes with faint yellow-gold reticulations throughout; costa with narrow brown line in basal $\frac{1}{4} - \frac{2}{5}$; rarely (n = 1) a partial rust-brown fascia through basal 1/3 of cell obliquely outward toward mid-dorsal margin; costal fold well developed, extending about 1/2 length of forewing. Hindwing straw yellow with pale gray-brown to grayish-pink overscaling with well-developed anal fold and associated hairpencil. Abdomen: Genitalia (plate 15, figure 2) with long, slender uncus from somewhat flattened base; socius large, rounded dorsally, secondary arms moderately slender, densely setose distally; transtilla with single, broad, spiny process; valva subrectangular, rounded apically; sacculus well defined, without triangular process; juxta a concave shield. Aedeagus pistol shaped; vesica with eight long, slender cornuti.

Female. Essentially as described for male, except lacking complex scaling of head; forewing length

12.5–14.5 mm (mean = 13.5 mm; n = 3); forewing varying from slightly more orange yellow to dark rust brown or irregularly, indistinctly streaked with rust throughout the discal cell; lacking the narrow basal costal line; lacking anal fold of hindwing. Genitalia (plate 29, figure 2) with sterigma a broad lateral band; ostium bursae urn shaped, sclerotized; antrum distinct, separated from base of sterigma by membranous portion of ductus bursae; ductus bursae moderately broad, long, coiled one revolution; corpus bursae large, ovate; signum a relatively long, weakly curved, rugose band, with accessory flange at one end.

TYPES. Holotype: &. Bon Secour N.W.R., Baldwin Co., Alabama, 30°15′09″N, 87°48′50″W; 11–16 May 1994; R. Brown and D. Pollock. USNM. Paratypes: 78 ♂, 71 ♀. Alabama. Same data as for holotype; R. Brown and D. Pollock (6 δ , 1 \circ). Same locality data as for holotype; 11 May 1994; R. Hodges (1 る). Florida. Goose Pasture, Jefferson Co.; 28 May 1989; D. Baggett (3 3). Apalachicola National Forest, 8 mi N Sumatra, Liberty Co.; 2 June 1990; D. Baggett (1 ♂). Palatka, Putnam Co.; at MV/UV light; 2 June 1992; D. Baggett (1 ♂). Louisiana. 4.2 mi NE Abita Springs, St. Tammany Parish; 30 May-24 June 1983, 26 May-14 June 1984, 3 June 1985, 2-8 June 1988, 29 May-20 June 1989, 26 May-6 June 1990, 26 May/19 June 1994, 22 May-3 June 1995, 31 May-29 June 1996, 1-12 June 1997, 19 May-18 June 1998; V. Brou (58 ♂, 68 ♀). Maryland. Hickory Point Cypress Swamp, Worcester Co.; 20 June 2001; J. Glaser (1 ♂). **Mississippi.** Paul Johnson State Park, Forrest Co.; 2-5 June 1996; R. Brown (1 ♀). Middleton Creek, T5N, R4E, Sec. 31S, Franklin Co.; 1 June 1992; T. Schiefer and R. Fontenot (1 &). 3 mi N Lucedale, George Co.; 18–30 June 1996; R. Kergosien (1 ♀). Long Beach, Harrison Co.; 28 June 1996; R. Kergosien (1 ♂). Ocean Springs, Jackson Co.; 3–5 June 1984; R. L. Brown (2 ♂). Gulf Island National Seashore, Jackson Co.; 3-6 June 1984; R. Brown and C. Baker (1 ♂). Big Black River at I-20, Warren Co.; 22 June 1996; R. Brown (1 ♂). North Carolina. 1 mi NE Pretty Pond, Leiophyllum/slash pine woodland, Brunswick Co.; 9 June 1995; J. B. Sullivan and R. Broadwell (1 &). Millis Road, Savannah, Carteret Co.; 17 June 1993; J. B. Sullivan (1 &). Sam Hatcher Road, Croatan National Forest, Carteret Co.; 22 June 2006; J. B. Sullivan (3 &). Camp Lejune, white cedar, Onslow Co.; 16 June 1995; J. B. Sullivan (1 &). Virginia. Powell Mountain Karst Preserve, Wise Co.; 1 July 2009; C. Hobson and J. Townsend (1 ♂). EME, MEM, JBS, USNM, VBC.

The early stages are unknown. Apparently restricted to the southeastern United States, it has been recorded from Maryland, Virginia, North Carolina, Alabama, Florida, and west to Louisiana



MAP 50. DISTRIBUTION OF MATERIAL EXAMINED OF CENOPIS DIRECTANA

(map 49). Although this is the largest *Cenopis* species and is widespread in the southeast, evidently it was not collected prior to 1983. [Specimens examined: 79 δ , 14 \circ , 5 slides]

Cenopis directana (Walker), REVISED COMBINATION

PL. D, FIGS. 27–32 (adult); PL. 15, FIG. 3 (δ gen.); PL. 29, FIG. 3 (φ gen.); MAP 50 (RWH 3722).

Teras directana Walker, 1863b, List of the Specimens of Lepidopterous Insects in the Collection of the British Museum, 28: 309. Type locality: Not given [North America]. [BMNH]

Cenopis testulana Zeller, 1876, Verhandlungen der Zoologisch-Botanischen Gesellschaft in Wien, 25: 241.

Type locality: Dallas, Texas. [MCZ]

NOTE—The specimen in the MCZ is here designated the lectotype.

Cenopis directana; Walsingham, 1879, Illustrations of Typical Specimens of Lepidoptera Heterocera in the Collection of the British Museum, 4: 17. COMBINATION.

Cenopis testulana (= ?directana); Walsingham, 1879, Illustrations of Typical Specimens of Lepidoptera Heterocera in the Collection of the British Museum, 4: 17. SYNONYMY.

Cenopis directana (= reticulatana), Fernald in Dyar, 1902 [1903], Bulletin of the U.S. National Museum **52**: 476. SYNONYMY.

Sparganothis directana (= reticulatana); Barnes and McDunnough, 1917, Check List of the Lepidoptera of Boreal America: 176. COMBINATION.

Sparganothis directana; McDunnough, 1939, Memoirs of the Southern California Academy of Sciences, 2 (1): 55. REVISED STATUS.

Sparganothis testulana (= directana); Powell, 1983b Check List of the Lepidoptera of America North of Mexico: 41. COMBINATION, SYNONYMY.

Cenopis directana is among the most variable species in the genus and may comprise a series of closely related sister species. The forewing ranges from cream tan to pale orange brown, reticulated throughout with faint, darker orange brown (although sometimes faint or restricted to the apical ¼ of the wing). It is never pale yellow (or canary yellow) as in C. pettitana. There is a broad, red-brown patch (representing an oblique submedian fascia) from the costa about 3/5 the distance from the base to the apex, attenuating near the posterior edge of the discal cell, forming a fairly distinct, elongate triangular patch that usually continues to the dorsum. Frequently there is an irregular, narrow, triangular blotch near the middle of the dorsal margin, with its attenuated apex meeting the apex of the costal triangular patch, forming a variably complete, oblique fascia. The female of C. directana typically has darker overscaling that obscures the forewing pattern elements. The hindwing also is variable from light cream to brownish yellow. Forewing length is 8.0-8.5 mm (mean = 8.0 mm; n = 10) in males and 8.0– 10.0 mm (mean = 9.0 mm; n = 10) in females. The male forewing costal fold is well developed, extending about 0.17 the length of the forewing.

Phenotypic variation in *Cenopis directana* is diverse, including individual, sexual dimorphism, and population level (i.e., geographic) in varying degrees. In contrast to the bewildering variation in the *Sparganothis sulfureana* complex, several geographically defined "races" are recognizable in *C. directana*, and in some instances pairs of these "races" are sympatric and fly synchronously, retaining their integrity over time. We have not identified diagnostic morphological characters that might confirm these entities as separate species.

Although Lambert (1950) treated *C. saracana* as a synonym of *C. directana*, the former can be distinguished by its pale yellow-tan forewing ground color and by the shape of the base of the uncus.

Typical Race: Cenopis directana was described by Walker on the basis of a specimen without locality data, but its identity was resolved by Walsingham (1879), who found the Walker type to be the same as C. testulana (Zeller) from Texas and considered the latter to be synonymous. Walsingham illustrated a male of C. directana with distinct forewing pattern similar to that expressed in widespread populations of the eastern United States, having pale to dark-rust forewings with minute, greenish metallic speckling. Males usually have a distinct, purplish-brown, outwardly directed, median fascia from the costa to the dorsal margin at about half length and a costal patch distally (plate D, figure 29). In most populations, this well-marked form is not prevalent; most males show varying degrees of indistinctness, ranging to specimens that show only a trace of the dark pattern. Females in these populations usually possess dark rust-brown forewings with only a faint, shining purplish indication of the male forewing pattern (plate D, figure 27). The hindwings are pale tan to rust tan. The typical race occurs widely over eastern North America, from southeastern Canada to Florida, west to the Great Lakes region and Texas.

Pale Race: There are populations consisting of males having whitish to tan or pale- ocherous forewings with rust- or purplish-brown maculation in the same pattern as the typical race but expressed consistently and strongly. Females are golden tan with a thin, faint pattern like that of the males or reduced to a trace. The hindwings are whitish to pale brownish, averaging darker in females. Such populations are widely scattered from southeastern Canada, New York, Pennsylva-

nia, North Carolina, Louisiana, Missouri, Texas and occur separately from the typical race or sympatric with it (e.g., Ithaca, New York; Highlands, North Carolina) or with the southeastern brown race (see following) (e.g., Abita Springs, Louisiana).

Southeastern Brown Race: Males of this form lack the rust coloration of the typical race, and are pale brown with dark-brown forewing maculation, often with the median fascia broken in the middle or restricted to the costal area (plate D: Figure 28). Females vary from pale brown with maculation similar to that of males to distinctly rust colored uniformly reticulated with shining purplish and no trace of the male maculation pattern. The brown race occurs in the southeast, Florida to Louisiana, in sympatry with the yellow race (see following) at the Archbold Biological Station, Lake Placid, Florida, and with the pale race at Abita Springs, Louisiana. Based on meager evidence (n = 2), the brown race occurs with the typical race at Highlands, North Carolina.

Florida Yellow Race: This form, which is strongly dimorphic, is known primarily from central Florida (St. Petersburg and Lake Placid). Males have pale-ocherous or tan forewings with variable, rust-brown to purplish-brown maculation and like that of the typical form, varying from strongly to faintly patterned (plate D, figure 31). The hindwing is pale gray to brownish with a pale fringe. Females have immaculate yellow forewings and brown hindwings, darker than those of the male. The stability of the brown and yellow races in sympatry at Lake Placid has been documented for 1947, 1959, 1961, and 1986. Collection records are May and June in Florida and Louisiana.

Colorado Race: Populations in the Rocky Mountain Region have pale-tan or brownish-tan forewings with the dark markings restricted to the costal area in males and usually immaculate, tan to dark rust-brown forewings in the female, whose pale individuals rarely have faint costal spots. The male maculation varies from spots or traces of them in the middle and distal portions of the costa to complete median and subterminal fasciae and extensive rust brown apically and broadly over the terminal area. Rarely, most of the forewing except basally is reddish brown. This form occurs in Colorado, southern Montana, and northern California, comprising a western race of the typical

form, and none of the other races described above occurs in the West.

The male genitalia (plate 15, figure 3) are characterized by a long, slender uncus from a squarish base; large, unmodified socii with the secondary arms densely setose in the distal half; a transtilla with a spiny mesial process; and subrectangular valvae with a poorly defined sacculus. The aedeagus is evenly curved, and the vesica has eight long, slender cornuti.

In the female genitalia (plate 29, figure 3) the sterigma is a broad plate; the ostium bursae is urn shaped; the ductus bursae is moderately long, widening anteriorly, and coiled one revolution; the colliculum is poorly defined, separated from the sterigma by a short membranous gap; and the corpus bursae is large and irregularly rounded, with the signum in the form of a moderately long, somewhat J-shaped band.

A small series of specimens (n = 4) from Lake Placid, Florida (USNM) was reared from Carya sp. (Juglandaceae); specimen data indicate that C. directana also has been reared from Prunus virginiana (Rosaceae) (North Dakota; USNM). In Canada, Prentice (1966) reported it from white spruce (*Picea glauca*, Pinaceae) (n = 1), white birch (Betula populifolia, Betulaceae) (n = 1), serviceberry (Amelanchier sp.) (n = 1), pin cherry (Prunus pensylvanica) (n = 1), and chokecherry (P. virginiana) (n = 11) [Rosaceae]. However, because Prentice's records may be based on collections of adults rather than rearings of larvae, it is possible that conifers may not be larval hosts. We reared C. directana from western chokecherry (P. emarginata (Douglas) Eaton) in California. Adults fly in April and May in Florida, July and August elsewhere, with a very few May and June records.

Eleven of 17 flown females of the yellow form that we confined at the Archbold Biological Station, Florida, deposited two or more small patches of eggs (n = 9–40, mean = 21 per patch) in early June. First instar larvae eclosed in 10–12 days, and none constructed hibernacula comparable to those of *Sparganothis senecionana*. Most of the larvae failed to feed on synthetic diet or soft oak leaves and died, but a few successfully developed, and adults emerged in mid-August. Hence, there appears to be no diapause prior to a summer generation in the Florida population. Failure to accept synthetic diet is characteristic of

food plant specialists and was surprising in view of the array of hosts recorded for *C. directana*.

Cenopis directana ranges from Prince Edward Island and Saskatchewan to Florida and west to Texas, Colorado, Montana, and northern California (map 50). Whereas eastern Nearctic specimens are abundant, those from the West are rare in collections. [Specimens examined: $212 \, \frac{\circ}{\circ}$, $73 \, \frac{\circ}{\circ}$, 18 slides]

Cenopis saracana Kearfott, Revised Combi-NATION

PL. D, FIGS. 33–38 (adult); PL. 15, FIG. 4 (\eth gen.); PL. 29, FIG. 4 (\updownarrow gen.); MAP 51 (RWH 3724).

Cenopis saracana Kearfott, 1907b, Transactions of the American Entomological Society, 33: 68.

Type locality: Essex County Park, hills above Montclair, Essex Co., New Jersey. [USNM]

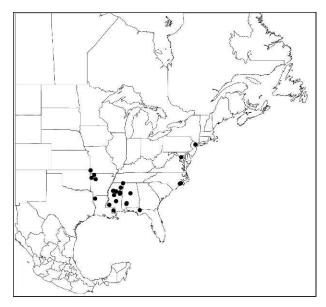
NOTE—The male specimen with the labels "Essex Co., N.J./[illegible date]/W.D.Kearfott" (white label); "TYPE/Collection of/W.D.Kearfott" (red label); "Cenopis/saracana/\$\delta\$ Type Kearf." (white label); "Kearfott Coll./Ac. 4667" (white label); "\$\delta\$ genitalia/ on slide/AB 9 May 1922" (white label); "\$p[arganothis]. /saracana/AB Kearf." (white label); genitalia slide/By AB \$\delta\$/USNM 25789", is designated the lectotype to ensure stability of the name.

Sparganothis saracana; Barnes and McDunnough, 1917, Check List of the Lepidoptera of Boreal America: 176. COMBINATION.

Sparganothis austera Meyrick, 1912a, Entomologists' Monthly Magazine, **48**: 34.

NOTE—Sparganothis austera Meyrick is an unnecessary replacement name for Cenopis saracana Kearfott.

Cenopis saracana usually can be distinguished from congeners by its forewing pattern although there appears to be some geographic variability. The forewing is pale yellow tan, with variable irregular, faint, transverse striae; there are brown rhomboidal patches at the costa about ½ and ½ the distance from the base to the apex; the distal patch is larger. Also there is a large squarish brown patch at the dorsum about ½ the distance from the base to the tornus, frequently joined with the more distal



MAP 51. DISTRIBUTION OF MATERIAL EXAMINED OF CENOPIS SARACANA

costal patch, forming a broad, irregular median fascia. Forewing length is 7.0-8.5 mm (mean = 8.0mm; n = 6) in males and 9.0–11.0 mm (mean = 10.9) mm; n = 4) in females. Small series of males from Brazos County, Texas (n = 4) and Oktibbeha County, Mississippi (n = 3) are uniformly smaller in forewing length (7.2–7.7 mm) and have the forewing pattern much reduced. Two males from Washington County, Arkansas, that appear to be conspecific with C. saracana have the forewing blackish brown in the basal two-thirds and dark gray in the distal one-third, and are suspected to represent melanic individuals. Females of C. saracana usually have a darker ground color with more dense reticulation, reducing the definition of the forewing pattern elements. The male costal fold is well developed, extending about 0.15 the length of the forewing. The genitalia of *C. saracana* are most similar to those of *C. directana* and *C. chambersana*, suggesting a close relationship among these species.

In the male genitalia (plate 15, figure 4) the uncus is long and slender from a flattened base; the socii are large, elongate-ovoid, with broad secondary arms that are densely setose in the distal ½; the transtilla has a single mesial lobe bearing long, thick spines; and the valvae are subrectangular, rounded apically, with a weakly developed sacculus. The aedeagus is evenly curved, with 8–10 long, slender, weakly undulate cornuti in the vesica.

In the female genitalia (plate 29, figure 4) the sterigma is simple and unmodified; the ostium bursae is large and elliptical; the ductus bursae is narrow, comparatively short, and coiled one revolution; the antrum is ringlike, separated from the sterigma by a short membranous portion of the ductus bursae; and the corpus bursae is moderately large and irregularly rounded, with the signum a long, U-shaped rugose band.

Host records include a specimen (USNM) labeled "borer in rose [Rosa sp., Rosaceae]" (Hyattsville, MD) and "...bred from larva twisting the leaves of common sassafras [Sassafras sp., Lauraceae]" (Kearfott 1907b). Adults fly from late May to early July in a single brood.

Cenopis saracana ranges from New Jersey and Maryland (rare), south through North Carolina (more common) and Florida (rare), and west to Arkansas, Mississippi, and Louisiana where it has been most often recorded (map 51). There is a single record from Missouri (USNM). [Specimens examined: 47 ♂, 25 ♀, 6 slides]

Cenopis mesospila (Zeller), NEW STATUS, REVISED COMBINATION

PL. D, FIGS. 39–41 (adult); PL. 15, FIG. 5 (\eth gen.); PL. 29, FIG. 5 (\updownarrow gen.); MAP 52 (RWH 3720 part, 3721).

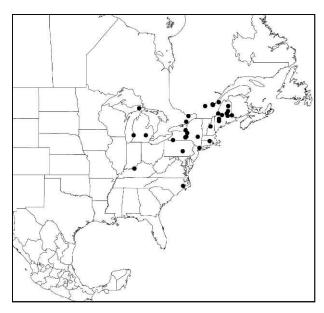
Cenopis reticulatana var. mesospila Zeller, 1876, Verhandlungen der Zoologisch-Botanischen Gesellschaft in Wien, 25: 233.

Type locality: Texas and Maine (from original description; no locality data on type specimen). [BMNH]

NOTE—A female cotype without locality data (BM slide 16,730) is here designated the lectotype to ensure stability of the name.

NOTE—The name *mesospila* has been treated most recently as a synonym of *C. reticulatana* (Powell 1983b, J. Brown 2005). However, examination of the type of *Cenopis reticulatana* var. *mesospila* in The Natural History Museum, London, revealed that it is conspecific with *C. albicaudana* and has priority – 1876 vs. 1915 – and is not conspecific with *C. reticulatana*.

Sparganothis reticulatana mesospila; Barnes and McDunnough, 1917, Check List of the Lepidoptera of Boreal America: 176. COMBINATION.



MAP 52. DISTRIBUTION OF MATERIAL EXAMINED OF CENOPIS MESOSPILA

Cenopis gracilana Walsingham, 1879, Illustrations of Typical Specimens of Lepidoptera Heterocera in the Collection of British Museum, 4: 18.

Type locality: New York. [BMNH]

Sparganothis gracilana (= sulfureana); Barnes and McDunnough, 1917 Check List of the Lepidoptera of Boreal America: 176. COMBINATION, SYNONYMY.

Sparganothis gracilana (= reticulatana); Powell, 1983 Check List of the Lepidoptera of America North of Mexico: 41. Synonymy.

Sparganothis albicaudana Busck, 1915, Proceedings of the Entomological Society of Washington, 17: 85. NEW SYNONYMY.

Type locality: Notch, Pennsylvania. [USNM]

Cenopis mesospila can be distinguished from its congeners by the forewing color and pattern: straw yellow with a well-defined brown triangular blotch near the middle of the dorsal margin. Some pale specimens of *C. reticulatana* are similar to *C. mesospila*; however, the two can be separated by the following: 1) the forewing

ground color of *C. mesospila* always is pale yellow, whereas that of *C. reticulatana* usually is evenly and conspicuously reticulated with orange or orange yellow; 2) the oblique fascia in the middle of the forewing nearly always is complete in *C. reticulatana* and rarely complete in *C. mesospila*; and 3) the triangular blotch on the dorsal margin usually is larger and better defined (or isolated) in *C. mesospila*.

The forewing of *C. mesospila* has a straw-yellow ground color, faintly reticulated with orange yellow and/or pale orange brown. There is an oblique, usually interrupted, brown fascia originating at a small brown rhomboidal patch at the costa about 1/3 the distance from the base to the apex, extending to near the middle of the dorsal margin, where it is represented by a well-defined, brown triangular patch; the fascia usually is faint in the middle portion of the wing. There is a narrow, variably developed, curved fascia in the distal ½ of the wing. Forewing length is 7.0-8.0 mm in males (mean = 7.6 mm; n = 10) and 8.5– 10.0 mm (mean = 9.0 mm; n = 10) in females. The male forewing costal fold is short but well developed, extending about 1/8 the length of the wing.

The male genitalia (plate 15, figure 5) are similar to those of congeners: a long, slender uncus; large, unmodified socii, with the secondary arms uniform in width and densely setose in the distal ½; transtilla with a spiny mesial process; and valva subrectangular with a poorly defined sacculus. The aedeagus is evenly curved with 7–8 long, slender, weakly undulate cornuti in the vesica.

In the female genitalia (plate 29, figure 5) the sterigma is broad with a squarish lobe at each lateral edge; the ostium bursae is moderately shallow; the ductus bursae is narrow, widening anteriorly, and coiled one revolution; the colliculum is separated from the sterigma by a short membranous gap; the corpus bursae is large and irregularly rounded; and the signum is a long, rugose, curved band, with a small, irregular, roughly triangular sclerite at the anterior end.

According to specimen label data (USNM, MEM), *C. mesospila* has been reared from maple (*Acer* sp.) (n = 4). In his original description of the species, Busck (1915) indicated that he reared *C. mesospila* (as *albicaudana*) from leaf-tying larvae on maple, together with the more common *C.*

pettitana. Wagner et al. (1995) reported rearing a single individual from *Quercus* sp. (Fagaceae) in Virginia. Adults have been collected in June and July (about 95% of specimens examined) with occasional records from early August (Maine), indicating a single brood.

Cenopis mesospila ranges from Quebec and Ontario, south to Kentucky and North Carolina (map 52). The majority of specimens we examined are from New York and Maine. [Specimens examined: $148 \ \delta$, $56 \$ 9, $12 \$ 8 slides]

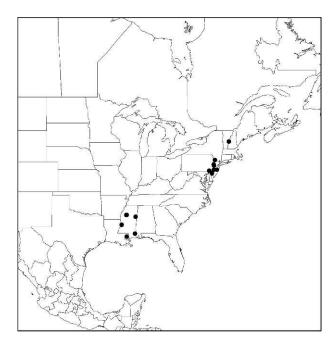
Cenopis eulongicosta Powell and J. Brown, NEW SPECIES

PL. D, FIGS. 42, 43 (adult); PL. 15, FIG. 6 (♂ gen.); PL. 29, FIG. 6 (♀ gen.); MAP 53

Cenopis eulongicosta Powell and J. Brown. Type locality: Stanton, Hunterdon Co., New Jersey. [USNM]

Cenopis eulongicosta is one of the largest species in the genus. It is easily distinguished by its size, somber orange-brown forewing, and elongate male antennal sensillae (ca. ¾ times the width of the flagellomere vs. about ¼ in most other species of Cenopis).

Description. Male. Head: Hood complex, dark red brown; frons smooth scaled below hood, pale orange brown; vertex red brown; labial palpus long, cream and orange brown mesially, mostly red brown laterally; antennal scaling orange brown, sensillae about 0.7 times width of flagellomere. Thorax: Red brown to pale orange brown. Forewing length 10.0-11.0 mm (mean = 10.3 mm; n = 5); pale orange brown, with brown striae; a broad, diffuse, brown fascia from costa about $\frac{1}{4}$ - $\frac{1}{2}$ distance from base to apex, terminating near middle of dorsal margin; a second narrow brown fascia from costa about $\frac{2}{3}$ distance from base to apex, intersecting previous fascia near dorsal margin; costal fold well developed, extending about 0.15 length of costa. Hindwing pale orange tan; with well-developed anal fold and associated hairpencil. Abdomen: Genitalia (plate 15, figure 6) with uncus long, slender; socius large, rounded dorsally, secondary arms moderately slender, densely setose distally; transtilla with single spiny mesial process; valva subrectangular, rounded apically; sacculus weakly defined, with small triangular process about ²/₃ distance from base to termination; juxta a



MAP 53. DISTRIBUTION OF MATERIAL EXAMINED OF CENOPIS EULONGICOSTA

concave shield. Aedeagus pistol shaped; vesica with 8–10 long, slender cornuti.

Female. Similar to male, but lacking complex scaling of head; forewing length 12.0–13.5 mm (mean = 12.5 mm; n = 6); lacking forewing costal fold; forewing darker rust brown, obscuring the dark pattern described for male; lacking hindwing anal fold. Genitalia (plate 29, figure 6) with sterigma a broad lateral band; ostium bursae ovoid, lightly sclerotized; ductus bursae narrow, long, coiled one revolution; colliculum weakly sclerotized, incomplete, separated from base of sterigma by membranous portion of ductus bursae; corpus bursae large, ovate; signum a relatively long, shallowly U-shaped or bent, rugose band with a weakly expanded patch of sclerotization at anterior end.

TYPES. **Holotype:** δ . Stanton, Hunterdon Co., New Jersey; 2 July 1970; J. Muller. USNM. **Paratypes:** 26 δ , 33 \circ . **Louisiana.** 4.2 mi NE Abita Springs, St. Tammany Parish; 10–18 June 1983, 17 June 1984, 31 May–3 June 1985, 3–10 June 1986, 26 June 1988, 6–14 June 1989, 6 June 1990, 2–4 June 1991, 18 June 1992, 9–19 June 1994, 15 June 1995, 15–22 June 1997, 3–18 June 1998, 3–4 June 1999; V. Brou (16 δ , 16 \circ). **Mississippi.** 3 mi N Lucedale, George Co.; 18–30 June 1996; R. Kergosien (3 δ). T21N, R2E, Sec. 12, T13N, R3E, Sec. 7, 13N, Grenada Co.; 18 June 1990; J. Pollock (1 \circ). Same locality; 21–28 May 1991, 5–11 June 1991; R. Brown (3 δ , 9 \circ). Big Black River at I–20, Warren

Co.; 22 June 1996; R. Brown (1 $\,^\circ$). New Hampshire. Lebanon, Grafton Co.; 30 July 1971; J. Muller (2 $\,^\circ$). New Jersey. Masonville, Burlington Co.; 22 July 1970; L. L. D. (1 $\,^\circ$). Seabrook, Cumberland Co.; 10 July 1968; L. L. D. (1 $\,^\circ$). Stanton, Hunterdon Co.; 2, 8, 30 June 1965; J. Muller (2 $\,^\circ$, 1 $\,^\circ$). Lakehurst, Ocean Co.; 7 July 1965; J. Muller (2 $\,^\circ$). High Point State Park, Sussex Co.; 10 July 1971; J. Muller (1 $\,^\circ$). EME, MEM, USNM, VBC.

Nothing is known of the biology of this species. Adults have been collected from late May to mid-July.

Cenopis eulongicosta is recorded from a disjunct geographical distribution, New Hampshire, New Jersey, Louisiana, and Mississippi (Map 53). It likely ranges throughout the eastern United States from New York through the Carolinas and east to Louisiana. Although this is one of the largest species of Cenopis and is widespread, evidently it was not discovered until 1965–1970, when J. Muller and "L.L.D." collected it in several New Jersey counties. [Specimens examined: 27 &, 33 \, \$\circ\$, \$\sides]

Cenopis cana (Robinson), REVISED COMBINATION

PL. D, FIGS. 44–46 (adult); PL. 16, FIG. 1 (\eth gen.); PL. 30, FIG. 1 (\updownarrow gen.); MAP 54 (RWH 3728).

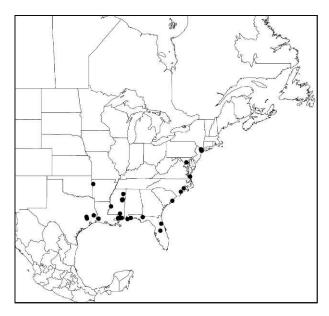
Tortrix cana Robinson, 1869, Transactions of the American Entomological Society, 2: 276.

Type locality: Pennsylvania. [ANSP]

Cenopis cana; Fernald, 1882, Transactions of the American Entomological Society 10: 21. COMBINATION.

Sparganothis cana; Barnes and McDunnough, 1917, Check List of the Lepidoptera of Boreal America: 176. COMBINATION.

Adults of *C. cana* are easily distinguished from congeners by their simple gray forewing color and pattern, which in males is somewhat reminiscent of members of *Syndemis* and some *Argyrotaenia*, and in females similar to *Amorbia humerosana*, but much smaller. Males have a complex hood and short antennal sensillae, about ¼ times the width of the flagellomere.



MAP 54. DISTRIBUTION OF MATERIAL EXAMINED OF CENOPIS CANA

The forewing is pale gray, with numerous irregular transverse darker striae. There is an irregular darker basal patch at the costa; an oblique, incomplete fascia from the costa about ½ the distance from the base to the apex, extending to near the middle of the dorsal margin, well defined at the costa and dorsal margin, and obsolete near the middle of the wing; and an irregular patch of darker scales at the costa about ²/₃ the distance from the base to the apex. Forewing markings frequently are less well defined in the female. Forewing length is 8.5-9.0 mm (mean = 8.9mm: n = 10) in males and 8.5–11.0 mm (mean = 10.0 mm; n = 10) in females. In the male the forewing costal fold is well developed, broad at the base, but short, extending about 1/8 the length of the forewing. The hindwing is pale grayish brown, white in the costal area.

In the male genitalia (plate 16, figure 1) the uncus is long and slender; the socii are large and unmodified, with the secondary arms uniform in width and densely setose in the distal ½; the transtilla has a single mesial spiny process; and the valvae are subrectangular, with a poorly defined sacculus. The aedeagus is evenly curved, with 7–8 long, slender, weakly undulate cornuti in the vesica.

In the female genitalia (plate 30, figure 1) the sterigma is a broad lateral band, sclerotized along

the lateral and anterior margins; the ostium bursae is broad and urn shaped; the ductus bursae is long and slender, widening anteriorly, and coiled one revolution; the colliculum is separated from the sterigma by a short membranous region; and the corpus bursae is large, irregularly rounded, with the signum in the form of a long, rough, crescent-shaped band, with a small, irregularly expanded sclerite at one end.

The early stages have not been reported, but a specimen reared by J. B. Sullivan in North Carolina (USNM) indicates the larva was collected and reared on sweet gum (*Liquidambar styraciflua* Linnaeus; Hammelidaceae). Adults have been collected primarily in May and June, with single records from April and August.

Cenopis cana occurs primarily in the Atlantic and southeastern states (Maryland, Virginia, North Carolina, South Carolina, Alabama, Mississippi, Louisiana), ranging west to Texas. There are a few records from New York and New Jersey (map 54), but in marked contrast to C. eulongicosta, none since about 1918. [Specimens examined: $33 \, \delta$, $21 \, 9$, $4 \, \text{slides}$]

Cenopis vabroui Powell and J. Brown, NEW SPECIES

PL. D, FIGS. 47, 48 (adult); PL. 16, FIG. 2 (♂ gen.); PL. 30, FIG. 2 (♀ gen.)

Cenopis vabroui Powell and J. Brown. Type locality: 4.2 mi NE Abita Springs, sec. 24, T6, SR12E, St. Tammany Parish, Louisiana. [USNM]

NOTE—The specific epithet is a patronym for Vernon A. Brou, Jr., the collector of the type series.

Cenopis vabroui resembles the sympatric C. cana and has nearly indistinguishable genitalia but is appreciably smaller, and the forewing ground color is paler gray with darker, more strongly contrasting maculation, which usually forms broken lines of discrete spots, especially in females. Sexual dimorphism in forewing length and maculation is conspicuous in C. cana, with females much larger with reduced markings, whereas dimorphism is virtually unnoticeable in C. vabroui. Based on a limited number of individuals, COI does not distinguish these two species; however, their sequence data place them within a cluster that also

includes C. directana, C. saracana, and C. mesospila.

Description: Male. Head: Frons with complex hood, scales shining brownish gray; vertex pale brownish gray; labial palpus relatively short, about 2.3 times horizontal diameter of compound eye, gray exteriorly, white on inner side; antennal scaling brownish gray, sensillae short, fine. Thorax: Mesonotum and tegula pale brownish gray. Forewing length 7.1-7.3 mm (mean 7.4 mm; n =10); forewing pale gray to whitish; fasciae and spots dark brownish gray, basal area with irregular fascia from costa to near dorsum, median fascia extending from costa before midwing to dorsum, complete or broken into spots on dorsum and near dorsum, post-median fascia represented by elongate blotch on costa, two smaller spots at end apical to discal cell median, or nearly complete (n = 10 of 19); termen with submarginal and marginal dark-gray lines; underside brownish gray with costal white spots between upper side maculation. Hindwing pale brownish gray; underside pale gray. Abdomen: Dorsum shining pale brownish gray. Genitalia (plate 16, figure 2) with uncus long and slender; socii large and unmodified, with the secondary arms uniform in width and densely setose in distal 1/4; transtilla with a single mesial spiny process; valva subrectangular, with poorly defined sacculus. Aedeagus evenly curved; vesica with 7–8 long, slender, weakly undulate cornuti.

Female. Head: Essentially as described for male, except lacking complex scaling of frons and antennal sensory setae minute, <1/2 width of flagellomere. Thorax: Mesonotum and tegula as described for male. Forewing length 7.6-8.7 mm (mean = 7.8 mm; n = 10); forewing similar to male but ground color usually slightly paler, nearly white, maculation darker and slightly more distinct, usually narrower, usually broken into discrete spots (n = 5 of 6). Abdomen: Dorsum shining pale brownish gray. Genitalia (plate 30, figure 2) with sterigma a broad lateral band, sclerotized along lateral and ventral margins; ostium bursae broad, urn shaped; ductus bursae long and slender, widening anteriorly, coiled one revolution, colliculum separated from sterigma by short membranous region; corpus bursae large, irregularly rounded, with signum in form of a long, rough, crescent-shaped band, with small, irregularly expanded sclerite at one end.

TYPES. **Holotype:** ♂. 4.2 mi NE Abita Springs, sec. 24, T6, SR12E, St. Tammany Parish, Louisiana; 18 May 1999; V. Brou. USNM. **Paratypes:** 22 ♂, 26 ♀. **Louisiana.**

Same locality data as for holotype; 1–16 May 1998, 2–6 May 1992, 16 May–19 June 1993, 11–26 May 1996; 30 April–30 May 1997, 1 May–7 June 1998; V. Brou (21 ♂, 26 ♀). Edgard, St. Tammany Parish; 1 May 1982; V. Brou (1 ♂). EME, MEM, USNM, and VBC.

The larval biology of this species is unknown. Adults have been collected from the end of April through May and rarely to mid-June, indicating a univoltine cycle.

The entire type series was collected by Vernon A. Brou, Jr., who singularly has increased our knowledge of Louisiana and Gulf States Lepidoptera, including an impressive inventory of tortricid moths at his home near Abita Springs. Inexplicably, only one specimen of C. vabroui was collected at the type locality prior to 1992, none before 1988, during several years of intense sampling. [Specimens examined: $23 \, \delta$, $26 \, \circ$, $4 \, \text{slides}$]

Cenopis karacana Kearfott, Revised Combi-NATION

PL. D, FIGS. 49, 50, PL. E, FIG. 1 (adult); PL. 16, FIG. 3 (\eth gen.); PL. 30, FIG. 3 (\updownarrow gen.); MAP 55 (RWH 3718).

Cenopis karacana Kearfott, 1907b, Transactions of the American Entomological Society, 33: 68.

Type: Essex County Park, Essex Co., New Jersey. [AMNH]

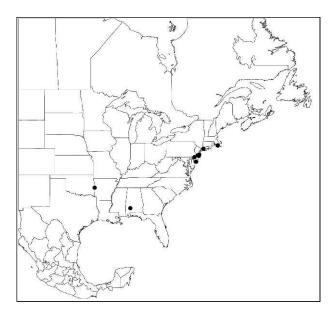
NOTE—The lectotype male was designation by Klots (1942: 414).

Sparganothis karacana; Barnes and McDunnough, 1917, Check List of the Lepidoptera of Boreal America: 176. COMBINATION.

Sparganothis tempestiva Meyrick, 1912a, Entomologists' Monthly Magazine, 48: 34.

NOTE— Sparganothis tempestiva Meyrick is an unnecessary replacement name.

Adults of *C. karacana* have a bright-yellow forewing with a variably developed, orange-brown fascia from the costa, about ½ the distance from the base to the apex. The fascia is broadest at the costa, almost always attenuating before reaching



MAP 55. DISTRIBUTION OF MATERIAL EXAMINED OF CENOPIS KARACANA

the dorsal margin, forming a slightly arched, slender triangular band. In related species the fascia usually intersects a similarly colored patch at the dorsal margin. There is a squarish orangebrown patch at the costa about $\frac{2}{3}$ the distance from the base to the apex. Forewing length is 7.5–8.5 mm (mean = 8.0 mm; n = 10) in males and 8.5–9.0 mm (mean = 8.7 mm; n = 10) in females. The forewing costal fold is well developed in the male, extending about 0.15 the length of the forewing.

In the male genitalia (plate 16, figure 3) the uncus is long and slender from a weakly dilated base; the socius is large, elongate-ovoid, with the secondary arms slightly broadened and densely setose distally; the transtilla has a single spiny mesial process; and the valva is subrectangular, rounded apically with a weakly sclerotized saccular margin. The aedeagus is evenly curved, with 8–10 long, slender cornuti in the vesica.

In the female genitalia (plate 30, figure 3) the sterigma is a broad lateral band; the ostium bursae is ovoid; the ductus bursae is moderately narrow, short, and coiled one revolution; the antrum is weakly sclerotized; and the corpus bursae is large and ovate, with the signum in the form of a long, shallowly U-shaped, rugose band.

The larva was described superficially by Kearfott (1907b). General: Length 12 mm; body pale

yellow with lighter subdorsal lines; head and prothoracic shield jet black separated by a whitish collar; pinaculum of L- and SV-groups on prothorax jet black; anal shield rounded, concolorous with body but slightly shiny.

Kearfott (1907b) stated that the larva rolls the side of a leaf into a tight cylinder. According to specimen label data, adults have been reared from larvae found on bayberry (Morella pensylvanica; Myricaceae) (AMNH), oak (Quercus sp.; Fagaceae) (AMNH), apple (Malus domestica; Rosaceae), and sheep-laurel (Kalmia angustifolia Linnaeus; Ericaceae); the lectotype was reared from oak (Kearfott 1907b). Adults have been captured primarily in June and July with a few May records.

Cenopis karacana is relatively rare in collections, occurring from Massachusetts, New York, and New Jersey south to Alabama and west to Arkansas (map 55). [Specimens examined: 36 δ , 17 \circ , 5 slides]

Cenopis chambersana Kearfott, Revised Combination

PL. E, FIGS. 2–4 (adult); PL. 16, FIG. 4 (♂ gen.); PL. 30, FIG. 4 (♀ gen.); MAP 56 (RWH 3723).

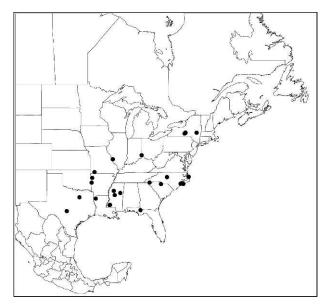
Cenopis chambersana Kearfott, 1907b, Transactions of the American Entomological Society, **33**: 93.

Type: Cincinnati, Ohio. [AMNH]

NOTE—The lectotype male was designated by Klots (1942: 413). Because the original description (Kearfott 1907b) indicated that the type specimens were collected June 12–July 6, the lectotype appears not to be part of the original series. However, Klots (1942) believed that Kearfott's published dates were in error, and that the lectotype is "undubitably valid."

Sparganothis chambersana; Powell, 1983, Check List of the Lepidoptera of America North of Mexico: 41. COMBINATION.

The genitalia of *C. chambersana* indicate a close relationship with *C. directana* and *C. saracana*. Superficially, *C. chambersana* can be distinguished from them and other species in the genus by the faint reticulation of the forewing, the numerous short striae from the costa, and the short orangebrown dash near the apex of the discal cell. *Cenopis chambersana* lacks the complete (or partially



MAP 56. DISTRIBUTION OF MATERIAL EXAMINED OF CENOPIS CHAMBERSANA

obsolete) arched fascia in the distal $\frac{1}{3}$ of the forewing and the oblique fascia in the middle of the forewing characteristic of many congeners. Forewing length is 8.5-10.5 mm (mean = 9.3 mm; n = 10) in males and 9.0-11.5 mm (mean = 10.3 mm; n = 10) in females. The costal fold is well developed in the male, extending about 0.15 the length of the forewing.

In the male genitalia (plate 16, figure 4) the uncus is long and slender from a slightly dilated, rounded base; the socii are large, elongate-ovoid, and the secondary arms are moderately broad, densely setose in the distal ½; the transtilla has a single mesial lobe bearing long spines; and the valva is subrectangular and rounded apically, with a weak sacculus. The aedeagus is evenly curved, with 8–10 long, slender cornuti in the vesica.

In the female genitalia (plate 30, figure 4) the sterigma is simple and unmodified; the ostium bursae is large and elliptical; the ductus bursae is moderately narrow and comparatively short, coiled one revolution; the colliculum is ringlike, separated from the sterigma by a narrow membranous portion of the ductus bursae; and the corpus bursae is moderately large and rounded, with the signum a long, shallowly U- or V-shaped rugose band.

Specimen label data indicate that *C. chambersa-na* has been reared from redbud (*Cercis canadensis*

Linnaeus, Fabaceae) in Missouri by Riley (USNM) and in Ohio by Braun (USNM). Adults have been captured primarily in July, with a few June (n = 3), May (n = 3), and August (n = 1) records.

Cenopis chambersana ranges from New York south through the Carolinas to Florida and west to Ohio, Missouri, Arkansas, and Texas (map 56). [Specimens examined: $47 \, \delta$, $15 \, \circ$, $10 \, \text{slides}$]

GENUS

Platynota Clemens

Platynota Clemens, 1860, Proceedings of the Academy of Natural Sciences, Philadelphia, **1860**: 347.

Type species: *Platynota sentana* Clemens, 1860, original designation.

NOTE— *Platynota sentana* Clemens, 1860 is a junior synonym of *Hypena? idaeusalis* Walker, 1859.

Platynota includes 33 described species; 19, including six newly described, are treated herein. Many undescribed species are known. Powell (1983b) listed 14 species occurring in America north of Mexico; Powell et al. (1995) listed 23 species from the Neotropics, with limited overlap between the two faunas. Platynota ranges from Canada to Argentina, with the greatest species richness in the southern United States, Central America, and the Caribbean. Most Platynota species have relatively long labial palpi (longer in females), raised scales on the forewings in both sexes (although lacking in a few species), and a well-developed costal fold in the male (narrow or absent in a few species). The genus includes several agricultural pests, including the tufted apple budmoth (Platynota idaeusalis), omnivorous leafroller (Platynota stultana), and Platynota rostrana, all of which are highly polyphagous. Platynota is assumed to be the sister-group to Sparganothis+Cenopis based on the modified scaling of the frons and features of the genitalia and larval chaetotaxy.

Structural characters of the genus are as follows: antennal scaling in two bands per flagellomere; setae highly variable in length from species to species, ½–2 times diameter of flagellomere width in male, short in female; labial palpus elongate, sexually dimorphic in most species (longer in females), segment II about 2.0–3.0 times horizontal

diameter of compound eye (plate 5, figures 1–6); males of several species with an unscaled area near subdorsal inner edge of segment II (plate 3, figures 2, 3); proboscis developed; ocellus well developed; scaling of frons simple or complex and hoodlike (plate 3, figure 1). Forewing (plate 2, figure 4) length 5-11 mm; costal fold present in male (narrow or absent in a few species); with raised scales present in both sexes of most species; all veins present and separate, except R₄ and R₅ stalked for basal 3/3. Hindwing with cubital hair pecten well developed in female, sometimes lacking in male; male often with variably developed anal fold, usually bearing modified scales. Abdomen without dorsal pits; female lacking enlarged corethrogyne scaling. Male genitalia with uncus elongate, spindle shaped in middle, narrower in distal 1/3; socius large, flat, kidney bean shaped, with long, slender secondary arms; gnathos reduced or absent; valva large, rectangular, weakly inflated, often with variably developed triangular process at termination of ill-defined sacculus; mesial base of valva with large, membranous pulvinus. Distal 1/3 of outer surface of valva covered with long scales in basal ½ (represented by longitudinal creases in slide-mounted preparations); distal ½ of inner surface of valva differentiated longitudinally by a distinct ridge through middle of valva parallel to costa, area between ridge and sacculus densely clothed in setae. Aedeagus evenly curved; vesica with a cluster of about 15-20 slender cornuti. Female genitalia with sterigma simple, ostium bursae usually represented by a large, urn-shaped region; colliculum split; ductus bursae long, slender, usually straight, rarely coiled one revolution; corpus bursae irregularly rounded; signum variable from a narrow crenulate band to an irregularly stellate sclerite, occasionally absent. Sexual dimorphism pronounced: females usually much larger than males; forewing pattern different; males frequently with long antennal sensillae, a naked region on the inner surface of segment II of labial palpi, complex scaling on the vertex of the head, a forewing costal fold, or secondary sexual structures on the hindwing, a fold in anal area enclosing specialized scaling.

The scaling of the hood on the vertex of the head is represented by two distinct forms in the male: simple and complex (plate 3, figure 1). In the complex form it is comprised of a strongly curved, horseshoe-shaped projection of scales, mostly of

the same length, lined internally with a row of copper-colored scales. In this form the frons usually has the dorsal half naked and the ventral half smooth scaled. In the simple form the hood consists of a large tuft of scales from the apex protruding over the frons, and the frons is unmodified. The complex hood appears to be associated with short antennal sensillae and an unscaled region on the labial palpus in the male (plate 3, figures 2, 3), but the three characters are not totally concordant.

According to MacKay (1962), the larvae of Platynota species are extremely similar to those of Sparganothis. Characters common to the two genera include the following: adfrontal setae attenuated posteriorly; P1 closer to P2 than to Adf2, and at a right or weakly acute angle formed with these two setae; stemmata 3 and 4 often ringed with darker pigment, which may extend to stemmata 5; spinnaret about 4–5 times longer than wide; D1 setae on meso- and metathorax dorsocaudal to D2 setae, and SD2 setae anterodorsal to SD1 setae; dorsal pinacula on the mesothorax distinctly elongated posteriorly, usually less so on metathorax; abdominal spiracles small; spiracle on A8 usually smaller than that on T1; SD1 setae on A8 more or less anterior to the spiracle; number of SV setae on A1, 2, 7, 8, 9 is 3:3:3:2:2; V setae on A9 usually 1.5–2.0 times as far apart as those on A8; spinules long and slender; anal shield strongly tapered posteriorly; anal setae long, with L1 setae about 1.5 times as long as anal segment; D1 seta on segment A9 always on its own pinaculum; crochets biordinal to partially triordinal; and anal fork always well developed.

We examined penultimate and/or final instar larvae of 11 species of *Platynota*: *P. flavedana* (Illinois), *P. idaeusalis* (West Virginia), *P. exasperatana* (Illinois), *P. stultana* (California), *P. islameconae* (California), *P. wenzelana* (Arizona and Sinaloa, Mexico), *P. rostrana* (Nuevo Leon, Mexico), *P. larreana* (California), and two presumably undescribed species (Guerrero, Mexico). All but *P. larreana* have a triangular, ventral extension of sclerotization of the prothoracic shield (e.g., as illustrated for *P. stultana* by MacKay, 1962: fig. 81) that is an integumental patch, not a raised structure like the prothoracic shield or pinacula. It is well defined in most *Platynota* species but is weakly pigmented in *P. idaeusalis*, *P.*

flavedana, and P. stultana. It may extend nearly to the L pinaculum (e.g., P. exasperatana) so that the T1 spiracle often is situated slightly posterior to the triangulate patch. In many specimens there is a shallow notch at the posterior edge of the extended coloration that accommodates the spiracle. Conversely, it may be quite short, barely exceeding the shield (undescribed species, Guerrrero, Mexico). This development is not consistently diagnostic for all Platynota, i.e., P. larreana have no trace of coloration below the shield. A possibly analogous development of the patch occurs in a few Sparganothis and Cenopis, e.g., S. flavibasana and C. directana (MacKay 1962: figs. 70, 72). The integumental coloring may extend around and beyond the shield anteriorly. The relative distance between the L- and SV-pinacula varies markedly between species of *Platynota*, and in some species the SV group pinaculum is deeply notched (undescribed species, Guerrero, Mexico) or split into anterior and posterior portions (P. rostrana, Nuevo Leon, Mexico) so that SV1 and SV2 are separate pinacula or SV1 is situated between them.

Larvae of *P. larreana* were field-collected in various instars (7 adults reared from the collection), whereas all the other *Platynota* species were reared from eggs provided by captive females or found in the field.

The known pupae of our species have two pairs of slightly curved, spiniform setae from the middle of the distal end of the cremaster. The mesial pair of setae in *P. idaeusalis* (plate 4: Figures 10–12) is conspicuously larger and broader than those of other *Platynota* for which we have examined pupae.

KEY TO SPECIES OF PLATYNOTA

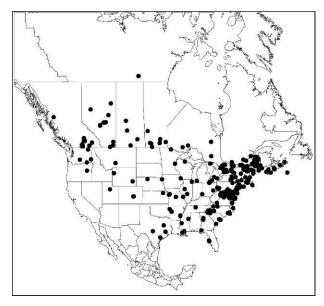
[NOTE: females of *polingi*, *blanchardi*, *yumana*, *redingtonensis*, and *zapatana* are unknown or unrecognized]

	Males 2 Females 20
2.	Scaling on upper frons (hood) complex (plate 3, figure 1); male antennal sensillae usually (but not
_	always) ≤½ times diameter of flagellomere
	flagellomere
3.	Length of costal fold $>\frac{1}{2}$ length of forewing 4

TORTRICOIDEA

_	Length of costal fold <1/2 length of forewing 5	11. Costal fold >0.6 length of forewing	
4.	Costal fold about ½ length of forewing; hindwing with row of comparatively broad creamorange scales along anal margin; eastern United States and Neotropics (plate E, figures 22, 24).	12. Costal fold about % length of forewing; distal end of secondary arms of gnathos weakly foot shaped (plate 19, figure 5) (southern Florida, Caribbean) (plate F, figures 28–30)	dana 139
_	Costal fold about ¾ length of forewing; hind-wing without row of dense cream-orange scales along anal margin; western United States and Mexico (plate E, figures 27, 28, 31) wenzelana p. 123	 Costal fold about ¾ length of forewing; distal end of secondary arms of gnathos either slightly or not enlarged (eastern United States to Costa Rica) (plate E, figures 49–50)	
5.	Antennal sensillae >½ times width of flagellomere (Texas and Arizona)	13. Forewing two toned, basal portion dark brown, distal portion pale orange brown to tan or yellowish (plate F, figures 17, 19); antennal sensillae approximately the same length as width of flagellomere; large spines extending	
6.	Forewing length >8.0 mm	across entire posterior margin of transtilla (plate 19, figure 3)	
7.	Subapical patch triangular (plate E, figures 42–44)	 Forewing variously patterned, but not distinctly two toned; antennal sensillae longer than width of flagellomere; spines restricted to mesial part 	136
	Subapical patch semicricular (plate E, figure 41)islameconae	of transtilla	14
8.	p. 128 Forewing length <5.5 mm, with distinct but incomplete subbasal fascia (Texas) (plate E, figures 34, 35) texana p. 128	 14. Forewing length ≤6.0 mm; hindwing bright orange (plate F, figures 2, 3) zapa p. Forewing length >6.0 mm; hindwing usually whitish, cream, or pale tan brown or orange brown 	132
_	Forewing length >6.5 mm, without distinct subbasal fascia (Arizona) (plate E, figure 33) polingi p. 125	Forewing mostly orange with or without variably defined pattern Forewing mostly grayish or brownish with	
9.	Vertex of head and dorsum of labial palpi usually gray; forewing usually without silverywhite blotch; forewing length usually >7.0 mm (plate E, figures 8–10) idaeusalis	semicircular patch from costa near middle (plate F, figures 12–16) virio	dana 136
_	p. 118 Vertex of head and dorsum of labial palpi usually with white scales; forewing usually with silvery-white blotch from costa; forewing length	Genitalia with projecting triangle or large spine at termination of sacculus Genitalia lacking well-defined termination of sacculus	
10.	usually <7.0 mm	17. Forewing with well-defined pattern including a small semicircular patch from costa about 0.7 distance from base to apex (plate E, figures 38, 40); short triangular process at termination of sacculus (plate 17, figure 6)	
_	p. 120 Forewing without pale patch at base; dorsum of labial palpi usually dark (plate E, figures 19, 20)	 Forewing with ill-defined pattern (plate F, figures 24–27); long, digitate process at termination of sacculus (plate 19, figure 4) nigrocer 	127 vina 138

18.	Forewing nearly uniformly orange yellow (plate F, figure 9) yumana	27.	Forewing ground mostly pale orange or orange brown
	p. 134		Forewing ground mostly dark gray with irregu-
	Forewing pale to dark orange with darker		lar white patches or blackish brown
	markings or pattern (sometimes faint)		1
	maximgs of pattern (comvines tame)	28.	Forewing ground color pale orange or orange
19.	Juxta with deep, V-shaped incision mesially		yellow; hindwing pale yellow (plate E, figures 36,
	(plate 18, figure 5) larreana		37, 39) labiosana
	p. 133		p. 127
	Juxta with broad U-shaped incision mesially	_	Forewing ground mostly orange brown; hind-
	(plate 19, figure 1) redingtonensis		wing orange (plate E, figures 45-48) flavedana
	p. 135		p. 130
20.	Signum absent or represented by small patch of	29.	Forewing with narrow, diagonal line of raised
	dimples or creases		scales near middle, dividing wing into basal gray
_	Signum well defined		portion and distal darker portion, and always
			lacking small pale dash near middle of costa
21.	Ground color of forewing mostly orange 22		(plate E, figures 5–7); forewing length usually
—	Ground color of forewing mostly brown (plate		>9.0 mm idaeusalis
	F, figures 18, 20, 21) stultana		p. 118
	p. 136	_	Forewing with or without narrow diagonal line
			of raised scales near middle, but always with
22.	Posterior 1/3 of ductus bursae broadened and		small, silver-white to cream dash from near
	with densely wrinkly surface (plate 32, figure 5)		middle of costa; forewing length usually <9.0
	nigrocervina p. 138		mm
_	Posterior 1/3 of ductus bursae not broadened and	30.	Forewing with small semicircular patch of pale
	without wrinkly surface (plate 31, figure 6; plate		or white scales at base of dorsal margin; dorsum
	32, figure 2)		of labial palpi usually whitish (plate E, figures
			14–16) exasperatana
23.	Distal portion of forewing whitish (plate E,		p. 120
	figure 41); anterior edge of sterigma concave	_	Forewing without pale patch at base of dorsal
	(plate 31, figure 6) islameconae		margin; dorsum of labial palpi usually dark
	p. 128		(plate E, figures 17, 18, 21) semiustana
—	Distal portion of forewing orange or orange		p. 121
	brown (plate F, figure 7); anterior edge of		Platinist ilanos dia (Wallson)
	sterigma convex (plate 32, figure 2) larreana		Platynota idaeusalis (Walker)
	p. 133		PL. E, FIGS. 5–10 (adult); PL. 2, FIG. 4
2.4			(venation); PL. 3, FIGS. 1, 3 (head); PL. 5,
24.	Signum in the form of a folded-invaginated sclerite near junction of corpus bursae and		FIGS. 1, 2 (palpi); PL. 16, FIG. 5 (& gen.); PL.
	ductus bursae		30, FIG. 5 (♀ gen.); MAP 57 (RWH 3740).
	Signum thorn- or hornlike		
	Signalii thorn- or normike		Hypena? idaeusalis Walker, 1859, List of the
25.	Forewing length >12.0 mm (plate E, figures 29,		Specimens of Lepidopterous Insects in the
	30, 32) wenzelana		Collection of the British Museum, Catalogue
	p. 123		
	Forewing length <10.0 mm		of the Heterocera, 19 : 839.
	Totowing length (10.0 mm)		Type
26.	Signum hornlike, situated near middle of corpus		locality: United States. [BMNH]
	bursae (plate 32, figure 3) viridana		
	p. 136		Platynota idaeusalis; Barnes and McDun-
	Signum thornlike, situated near junction of		nough, 1917, Check List of the Lepidoptera
	corpus bursae and ductus bursae (plate 31,		of Boreal America: 176. COMBINATION.
	figure 2) rostrana		
	p. 122		Platynota sentana Clemens, 1860, Proceed-
	p. 122		2,



MAP 57. DISTRIBUTION OF MATERIAL EXAMINED OF PLATYNOTA~IDAEUSALIS

ings of the Academy of Natural Sciences, Philadelphia, **1860**: 348.

Type

locality: USA [Pennsylvania?]. [ANSP]

NOTE—The lectotype male was designated by Darlington (1947: 101).

Platynota sentana (= idaeusalis); Barnes and McDunnough, 1917, Check List of the Lepidoptera of Boreal America: 176. SYNON-YMY.

Phylacteritis dioptrica Meyrick, 1922, Exotic Microlepidoptera, 2: 499.

Type

locality: Lake Muskoka, Ontario. [BMNH]

NOTE—The lectotype male was designated by Clarke (1958: 179).

Platynota dioptrica (= idaeusalis); McDunnough, 1939, Memoirs of the Southern California Academy of Sciences, 2 (1): 56. SYNONYMY.

Platynota idaeusalis is the most widespread member of the genus in North America, ranging

across the northern and eastern portions of the continent. It is similar to P. semiustana and P. exasperatana in several features: all three have a male costal fold of similar length; complex scaling on the frons in the male (plate 3, figure 1); an unscaled region near the subdorsal inner edge of segment II in the male (plate 3, figures 2, 3); extremely short sensillae on the male antenna; a similar anal fold in the hindwing with two distinct narrow sclerites at the base that are parallel when the fold is closed; and all have extremely similar male and female genitalia (plate 16, figures 5–6; plate 17, figure 1; plate 30, figures 5–6; plate 31, figure 1). Platynota idaeusalis usually can be distinguished from other predominately gray *Platynota* species by its larger size (forewing length 7.0–8.5 mm, mean = 8.0 mm, n = 10, in the male; 8.0-11.5 mm,mean = 9.0 mm, n = 10, in the female; although we have seen some very small males) and subtle differences in forewing pattern, which lacks white maculation. Males lack the white or cream scaling on the dorsum of the labial palpus, head, and thorax typical of *P. exasperatana*; both sexes of P. idaeusalis have a dark, round blotch near the distal end of the discal cell of the forewing; and females typically have a straight line of raised scales extending from the costa (about 1/3 distance from base to apex) to the dorsal margin (about ½ distance from base to tornus), differentiating a mostly gray basal 1/3 from the darker distal portion.

The larva of *P. idaeusalis* was described by MacKay (1962). The last instar is 13-18 mm in length. The head is about 1.0 mm in length and about 1.2 mm in width, brown, overlaid with a darker brown pattern; there is a distinct brown genal bar and a blackish blotch in the stemmatal area. The prothoracic shield is brown, with darker brown shading laterally; the prothoracic pinacula and thoracic legs are brown. The abdomen is gray or brownish green, often with vague pale longitudinal stripes subdorsally and laterally, with moderate-sized, cream-colored pinacula. The anal shield is distinctly tapered and concolorous with the body. The chaetotaxy is as described for the genus. The pupa is essentially as described for the genus, except

the cremaster is more squarish and bears 3 pairs of hooked setae: two pairs located subdorsally and one pair dorsally near the termination of the cremaster. The fourth pair is modified into a shorter, stouter, slightly curved process extending ventro-posteriad from the end of the abdomen (plate 3, figure 10). The latter character appears to be unique to this species; however, we have not seen the pupa of either *P. semiustana* or *P. exasperatana*.

Eggs of P. idaeusalis are green, laid in round, imbricate clusters, and covered with clear colleterial fluid. A captive female from Fairfax, Virginia deposited patches of 68, 50, and 38 eggs. According to Forbes (1923), the larvae live in a folded leaf or between two leaves, cutting a hole in the petiole of one leaf and feeding on the leaf blade when it is withered and dry. More often, larvae feed on fresh foliage. Although larvae are primarily leaf feeders, they also will feed on and damage fruit. In general, second generation larvae exhibit a greater propensity to feed on fruit (probably related to seasonal accessibility) and thus are more destructive in orchards (Hogmire and Howitt 1979). Additional details on the life history and damage can be found in Meagher and Hull (1986, 1987, 1991), Boyne et al. (1985), and Felland et al. (1996). The extensive use of organophosphate insecticides for control of this species has resulted in resistance to these chemicals in many populations (Knight et al. 1990, Biddinger et al. 1996, Meissner et al. 2000), exacerbating control strategies.

A highly polyphagous species, *Platynota idaeusalis* is known as the tufted apple bud moth in the economic literature (e.g., Chapman and Lienk 1971, Hogmire and Howitt 1979, Mawbry and Rock 1986, Meagher and Hull 1991, Rock et al. 1993 Meissner et al. 2000), and it is an economically important pest of apple (*Malus domestica*, Rosaceae) in the eastern United States. It has been reared from numerous other hosts, including goldenrod (*Solidago* sp., Asteraceae), black haw (*Viburnum prunifolium* Linnaeus, Caprifoliaceae), blueberry (*Vaccinium* sp., Ericaceae), clover (*Trifolium* sp., Fabaceae), Osage-orange (*Maclura pomifera* (Rafinesque-

Schmaltz) C. K. Schneider, Moraceae), bloodroot (*Sanguinaria canadensis* Linnaeus, Papaveraceae), blackberry (*Rubus* sp., Rosaceae), nightshade (*Solanum* sp., Solanaceae), and many herbs (Forbes 1923, MacKay 1962, Chapman and Lienk 1971). Prentice (1966) reported exceedingly few rearing records in forest situations in Canada: black ash (*Fraximus nigra* Marshall, Oleaceae) (n =1), willow (*Salix* sp., Salicaceae) (n =1), and jack pine (*Pinus banksiana* Lambert, Pinaceae) (n =1). The species is multivoltine, with capture dates ranging from March through September; the majority of records are from June and July.

Platynota idaeusalis ranges from Nova Scotia, Quebec, and Ontario, west to British Columbia, south into Oregon, and from Texas to Florida (map 57). It is absent from most of the West Coast and rare in the Rocky Mountains. Owing to its polyphagous nature, it is common in disturbed as well as natural situations. [Specimens examined: 625 ♂, 245 ♀, 25 slides]

Platynota exasperatana (Zeller) PL. E, FIGS. 11–16 (adult); PL. 16, FIG. 6 ($\mathring{\sigma}$ gen.); PL. 30, FIG. 6 ($\mathring{\varphi}$ gen.); MAP 58 (RWH 3743).

Tortrix (Platynota) exasperatana Zeller, 1876, Verhandlungen der Zoologisch-Botanischen Gesellschaft in Wien, **25**: 238.

Type

locality: Texas and New York. [BMNH]

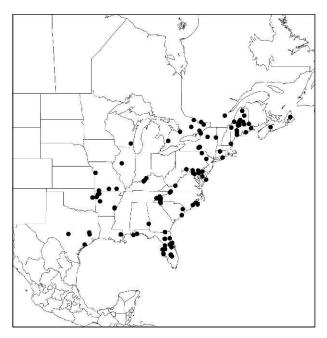
NOTE—There are one male and one female syntypes in The Natural History Musuem and the Museum of Comparative Zoology.

Platynota exasperatana; Fernald, 1882, Transactions of the American Entomological Society 10: 23. COMBINATION.

Sparganothis scotiana McDunnough, 1961, American Museum Novitates, **2040**: 3. NEW SYNONYMY.

Type

locality: Lake Kejimkujik, Queens County, Nova Scotia. [CNC]



MAP 58. DISTRIBUTION OF MATERIAL EXAMINED OF PLATYNOTA EXASPERATANA

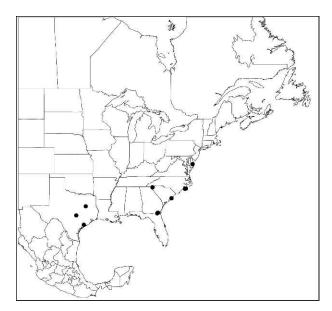
NOTE—In facies and genitalia, specimens of the type series of *Sparganothis scotiana* are indistinguishable from those of *Platynota exasperatana*. Hence, we propose the synonymy of the two.

Males of P. exasperatana, P. idaeusalis, and P. semiustana are extremely similar in facies and genitalia (plate 16, figures 5–6; plate 17, figure 1; plate 30, figures 5–6; plate 31, figure 1). Platynota exasperatana and P. semiustana usually are smaller than P. idaeusalis. Because each of the species is somewhat variable geographically and individually, in facies and in genital morphology, it is difficult to assign all specimens to one of the three taxa with confidence; it is particularly difficult to separate P. exasperatana and P. semiustana. Our inability to identify morphological characters that convincingly distinguish the latter two suggests the possibility that they may not be distinct species; however, elements of forewing pattern and preliminary molecular studies using mitochondrial gene COI provide some evidence that they probably are distinct but closely related. Platynota exasperatana usually can be distinguished from P.

semiustana by the presence of pale whitishyellow scaling on the dorsum of the second segment of the labial palpus and by the presence of a white (less frequently cream) blotch at the base of the dorsal margin of the forewing. Forewing pattern elements of *P. exasperatana* include a dark semicircular patch on the costa about \(\frac{1}{2} \) the distance from the base to the apex (as for Argyrotaenia spp.), bordered distally by white scaling that occupies the distal 1/3 of the forewing, and basally by a well-defined, narrow, oblique white bar. However, in many specimens, the white bar is variably overlaid with black or brown scales; when the white bar is ill defined, specimens have a somewhat two-toned appearance—dark in the basal \(\frac{1}{3} \) and light in the distal $\frac{1}{3}$.

Forewing length in *P. exasperatana* is 5.5–7.0 mm (mean = 6.3 mm; n = 10) in males, 6.0-8.0mm (mean = 7.3 mm; n = 10) in females. In fresh specimens, the forewing bears conspicuous, irregularly transverse rows of raised scale tufts. Males have a complex hood; the frons beneath the hood has a distinct membranous portion dorsally and a white-scaled region ventrally. The labial palpus of the male has a narrow unscaled region along the subdorsal mesial edge of segment II. Antennal sensillae of the male are extremely short, about 1/4 times the width of the flagellomere. The labial palpus is not particularly long in the male, longer in the female, about 3.0 times the horizontal diameter of the compound eye. As in P. idaeusalis, the male has a narrow fold in the anal region of the hindwing concealing a patch of white sex scales.

The early stages of *Platynota exasperatana* are unreported. However, Wagner et al. (1995) reported the discovery of three larvae under burlap during a survey in Rockbridge County, Virginia, and concluded that larvae feed on grasses and detritus. Throughout most of its geographic range, adults have been collected from late April through July (probably representing a single brood); there is a single record from August. In Texas, adults are active as early as March. In the Great Smoky Mountains of Tennessee, *P. idaeusalis* flies in late spring and early summer and again in August and Septem-



MAP 59. DISTRIBUTION OF MATERIAL EXAMINED OF PLATYNOTA SEMIUSTANA

ber; *P. exasperatana* flies in late June and July. They seldom are collected at the same time of year in any one area.

Platynota semiustana Walsingham Pl. E, Figs. 17–21 (adult); Pl. 17, Fig. 1 (\eth gen.); Pl. 31, Fig. 1 (\updownarrow gen.); MAP 59 (RWH 3747).

Platynota semiustana Walsingham, 1884, Transactions of the Entomological Society of London, **1884**: 128.

Type

locality: North Carolina. [BMNH]

As discussed above, *P. semiustana* and *P. exasperatana* are difficult to distinguish, and it is possible, but unlikely, that they represent extremes in variation within a single species. The absence of a white patch in the basal portion of the dorsal margin of the forewing and the dark-scaled labial palpus usually distinguish *P. semiustana* from *P. exasperatana*. Females of

P. semiustana frequently have more red-brown scaling on the forewing. Forewing length in P. semiustana is 5.5-7.0 mm (mean = 6.5 mm; n = 10) in males, 6.0-8.0 mm (mean = 7.5 mm; n = 10) in females. Males have a complex hood; the frons beneath the hood has a distinct membranous portion dorsally and cream-scaled region ventrally. The labial palpus of the male is dark scaled on the dorsum and has a narrow unscaled region along subdorsal inner edge of segment II. Antennal sensillae of the male are extremely short, about 1/4 times the width of the flagellomere. The labial palpus is about 1.5–2.0 times the horizontal diameter of the compound eye in the male, conspicuously longer in the female, about 3.0 times the horizontal diameter of the compound eye.

The early stages of *Platynota semiustana* are unreported. Throughout most of its distribution, adult captures range from late April through July, probably representing a single brood.

Platynota semiustana occurs in the southeastern United States, from North Carolina to Georgia and west to Texas (map 59). [Specimens examined: $9 \ 3, 16 \ 9, 12 \ \text{slides}$]

Platynota rostrana (Walker)
PL. E, FIGS. 22–26 (adult); PL. 5, FIGS. 5, 6 (palpi); PL. 17, FIG. 2 (♂ gen.); PL. 31, FIG. 2 (♀ gen.); MAP 60 (RWH 3745).

Teras rostrana Walker, 1863b, List of the Specimens of Lepidopterous Insects in the Collection of the British Museum, Catalogue of the Heterocera, 28: 290.

Type

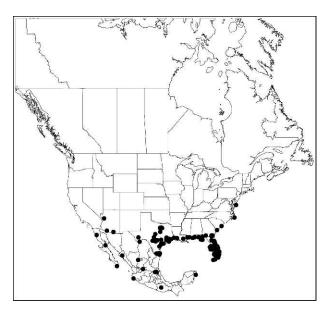
locality: United States. [BMNH]

Platynota rostrana; Fernald, 1882, Transactions of the American Entomological Society **10**: 23. COMBINATION.

Teras repandana Walker, 1863b, List of the Specimens of Lepidopterous Insects in the Collection of the British Museum, Catalogue of the Heterocera, 28: 292.

Type

locality: Santo Domingo, Dominican Republic, West Indies. [BMNH]



MAP 60. DISTRIBUTION OF MATERIAL EXAMINED OF $PLATYNOTA\ ROSTRANA$

Platynota repandana; Walsingham, 1891, Proceedings of the Zoological Society of London, 1891: 499. COMBINATION.

Platynota repandana (= rostrana); Powell, 1983b, Check List of the Lepidoptera of America North of Mexico: 41. Synonymy.

Teras connexana Walker, 1863b, List of the Specimens of Lepidopterous Insects in the Collection of the British Museum, Catalogue of the Heterocera, **28**: 293.

Type

locality: Venezuela. [BMNH]

Platynota connexana (= rostrana); Walsingham, 1879, Lepidoptera Heterocera in the British Museum, 4: 5. COMBINATION, SYNONY-MY.

Teras saturatana Walker, 1863b, List of the Specimens of Lepidopterous Insects in the Collection of the British Museum, Catalogue of the Heterocera, 28: 294.

Type

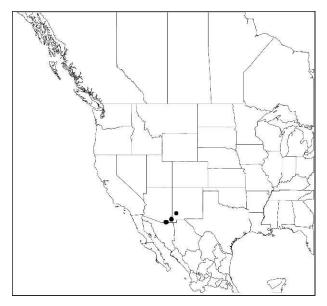
locality: Honduras. [BMNH]

Platynota saturatana (= rostrana); Powell, 1983b, Check List of the Lepidoptera of America North of Mexico: 41. Combination, Synonymy.

Males of P. rostrana and P. flavedana are extremely similar, especially when considering the broad range of variation in forewing maculation present in each. Both have extremely similar genitalia as well, with similar degrees of variation; in males the subbasal triangular projection or spine from the venter of the valva is moderately well developed in both species. Males of P. rostrana can be distinguished from those of P. flavedana by the complex scaling of the frons and the presence of long orange sex scaling along the anal margin of the hindwing. Females usually can be identified reliably by facies. Also, the signum of *P. rostrana* typically consists of a slender, straight, free spine (plate 31, figure 2), whereas that of P. flavedana is a somewhat wrinkled, curved, weakly dentate band (plate 32, figure 1).

The labial palpus in P. rostrana is about 1.5 times the horizontal diameter of the compound eye in the male and about 3.0 times the eye diameter in the female (plate 5, figures 5, 6); the male has a small unscaled region along the subdorsal inner edge of segment II. Antennal sensillae are short in the male, about ¼ times the width of the flagellomere. Forewing length is 6.0-7.0 mm (mean = 6.3 mm; n = 10) in males and 7.0-9.0 mm (mean = 7.7 mm; n = 10) in females. In the male, the basal 4/5 of the forewing is densely mottled with dark brown and/or red brown, and the distal ½ is pale whitish or yellowish, giving a two-toned aspect. The hindwing is pale tan, with a distinctly folded inner region indicated by an unscaled, membranous ridge. In the female, the forewing is light brown or pale orange brown, usually with one or more, fine, oblique lines from the costa to the dorsal margin, and the hindwing is distinctively pale orange brown.

The larva of *P. rostrana* was described by MacKay (1962). The last instar is 14–17 mm in length, with minute spinules, often darker than the body color of the dorsum. The head is 1.20–



MAP 61. DISTRIBUTION OF MATERIAL EXAMINED OF PLATYNOTA WENZELANA

1.28 mm in length and 1.36–1.40 mm in width: it is clear brownish yellow (almost orange), with a dark stemmatal area and no overlying pattern. The prothoracic shield, prothoracic pinacula, and thoracic legs are brownish yellow. The distance between the V setae on A9 is usually 1.5–2.0 times the distance between the V setae on A8; and the anal shield is pale brownish yellow. According to label data, Platynota rostrana has been reared from bag-pod sesbania (Sesbania vesicaria (Jacquin) Elliott, Fabaceae), avocado (Persea americana, Lauraceae), loquat (Eriobotrya japonica (Thunberg) Lindley, Rosaceae), orange (Citrus sinensis (Linnaeus) Osbeck, Rutaceae), grapefruit (Citrus paradisi MacFadyen, Rutaceae), peppers (Capsicum sp., Solanaceae), and lantana (Lantana camara Linnaeus, Verbenaceae). We have reared P. rostrana cohorts successfully on synthetic diet. Adults are multivoltine, with captures ranging from March through October.

Platynota rostrana occurs from Virginia to Florida, west to Arizona (map 60), and south throughout much of Central America and the Caribbean. [Specimens examined: 328 ♂, 283 ♀, 25 slides]

Platynota wenzelana (Haimbach)

PL. E, FIGS. 27–32 (adult); PL. 5, FIGS. 3, 4 (palpi); PL. 17, FIG. 3 (♂ gen.); PL. 31, FIG. 3 (♀ gen.); MAP 61(RWH 3744).

Amorbia wenzelana Haimbach, 1915, Entomological News, 26: 324.

Type

locality: Miller Canyon, Huachuca Mountains, Cochise County, Arizona. [ANSP]

Sparganothis wenzelana; Barnes and McDunnough, 1917, Check List of the Lepidoptera of Boreal America: 176. COMBINATION.

Platynota wenzelana; McDunnough, 1939, Memoirs of the Southern California Academy of Sciences, 2: 56. COMBINATION.

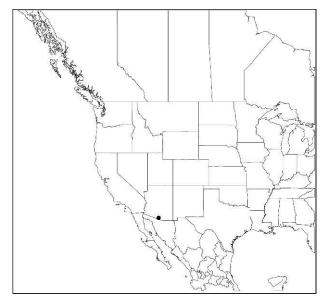
Platynota wenzelana is the largest member of the genus. In addition to its size, it is easily recognized by the extremely large costal fold, extending about 1/3 the length of the costa in the male and the distinct forewing pattern and coloration in both sexes. Males have a complex hood, a teardrop shaped naked region on the inner surface of the second segment of the labial palpus, and extremely short antennal sensillae. The forewing is tan to pale reddish tan, with a bold black fascia along the costa attenuating about ½ the distance from the base, a black patch in the basal one-sixth, and a diffuse, pale, red-brown blotch in the outer portion of the wing, extending from the dorsal margin to the edge of the costal fascia.

In the male genitalia (plate 17, figure 3) the uncus is swollen in the basal ½; the socii have long, slender secondary arms that are not expanded distally; and the transtilla has a rounded, spiny mesial lobe. The valvae are large and subrectangular; the costa and sacculus are weakly differentiated; and the sacculus has a distinct triangular process about ½ the distance from the base to the apex. The aedeagus is rather stout, curved in the distal ½; and the vesica has a bundle of about 15 long deciduous cornuti. The venter of A8 bears somewhat elongate, special-

ized scales that are apparent only during dissection.

Females are larger than males (forewing length 9.0-11.1 mm, mean = 9.8 mm, n = 10, in males; 10.6-12.0 mm, mean = 11.5 mm, n = 10, in females), with broader wings. The forewing is whitish tan with a diffuse brown, diagonal fascia extending from the costa (about 1/3 the distance from the base to the apex) to the dorsal margin just before the tornus; the hindwing is bronze. In the female genitalia (plate 31, figure 3) the sterigma is broadly cup shaped, somewhat straight along the anterior edge, with a broad, round urn-shaped antrum; the ductus bursae is slender, usually coiled one-half revolution (possibly an artifact of the male spermatophore), with a few transverse wrinkles, slightly broadened toward the corpus bursae, with a sclerotized region (colliculum) just anteriad of the antrum; the corpus bursae is irregularly rounded, bearing a small signum near the junction of the ductus bursae and corpus bursae in the form an irregularly shaped sclerite with a small, slender, straight spine. Although the cornuti of males are deciduous, mated females (i.e., spermatophores present) frequently lack cornuti in the corpus bursae, suggesting that males can effectively mate even after they have lost their cornuti.

Larval hosts have not been published, but three records from the mountains of southeastern Arizona, indicate the species is polyphagous: label data from a single male specify it was reared from Cercocarpus breviflorus A. Gray (Rosaceae) by R. Wielgus in the Chiricahua Mountains; in the Huachuca Mountains, McFarland reared one specimen from a larva found on poisonivy (Toxicodendron radicans (Linnaeus) Kuntze, Anacardiaceae); and we reared a series from an egg mass discovered on Amorpha Linnaeus (Fabaceae) by David Wagner. Early instar larvae fed on A. fruticosa Linnaeus and A. californica Nuttall leaves, even blackened ones, in preference to synthetic diet, which was accepted by late instars. We also reared a brood on synthetic diet from eggs laid by a female in Sinaloa, Mexico where the adults



MAP 62. DISTRIBUTION OF MATERIAL EXAMINED OF PLATYNOTA POLINGI

are darker colored but morphologically indistinguishable from Arizona specimens.

The life cycle may be univoltine in the northern portion of the range, with flight records in June–July in the Prescott, Arizona area and July–August in the mountains of southern Arizona. However, eggs deposited by a female collected in August produced adults in October, without indication of diapause, and one specimen was collected in Sonora in March.

Platynota wenzelana occurs in Sonora, Sinaloa, and Chihuahua, Mexico, and reaches its northern limit in the mountains of central Arizona (map 61). [Specimens examined: 22 ♂, 34 ♀, 10 slides]

Platynota polingi Powell and J. Brown, NEW SPECIES

PL. E, FIG. 33 (adult); PL. 17, FIG. 4 (♂ gen.); MAP 62

Platynota polingi Powell and J. Brown.

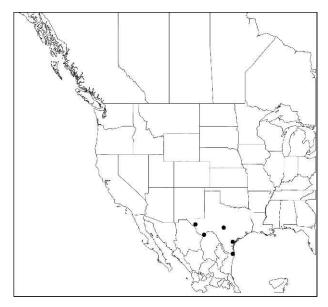
locality: Indian Oasis, Sells P.O., Pima County, Arizona. [USNM]

NOTE—The species name is a patronym for O. C.

Poling, a pioneer western North American Lepidoptera collector.

Platynota polingi is a small species with a forewing pattern most similar to that of P. labiosana. Lambert (1950) misidentified the two specimens that represent the type series of this species as P. wenzelana, which was known only from the female at the time; but they differ in having are a much smaller mean forewing length (6.8 mm vs. 9.8 mm), and a much shorter costal fold in the male forewing (1/4 vs. 1/3 the forewing length). Platynota polingi can be distinguished from P. labiosana by the complex hood in the male, which is simple in the latter. Platynota polingi is similar to P. texana in its small size, complex hood, and moderately long antennal sensillae of the male. The two species can be separated by facies as indicated in the key, and by the male genitalia: there is a well-developed triangular process at the termination of the sacculus in polingi that is absent in texana. Females of *P. polingi* are unknown.

Description. Male. Head: Hood complex; hood and vertex orange brown and brown; frons below hood with well-developed dorsal membranous region, white scaled below; labial palpus about 2.3 times horizontal diameter of compound eye, pale brown mesially, darker brown laterally, a narrow unscaled region near basal edge of segment II; antennal scaling orange brown; sensillae about 1.0–1.2 times width of flagellomere. Thorax: Dorsum orange brown and brown. Forewing length 6.5-7.2 mm (mean = 6.8 mm; n = 2); forewing ground color pale tan brown to orange brown; ill-defined brown fascia near middle of wing; faint, small, tan, semicircular patch from costa about ¾ distance from base to apex; a few scattered brown scales in terminal region near apex; costal fold broad, about 1/4 length of costa. Hindwing cream, with pale-brown mottling in distal one-half; anal fold not developed. Abdomen: Genitalia (plate 17, figure 4) with uncus possessing typical spindle-shaped mesial portion and slender terminal portion; gnathos represented by a weak, rudimentary sclerite; socius with large dorsal lobe; secondary arms uniformly slender; transtilla with a single mesial lobe bearing a group



MAP 63. DISTRIBUTION OF MATERIAL EXAMINED OF PLATYNOTA TEXANA

of large spines; valva subrectangular, comparatively long, slender, costa well defined, sacculus weakly differentiated, but with distinct triangular projection representing termination of sacculus; juxta simple. Aedeagus slender, relatively short, curved; vesica with 8–10 slender cornuti. Female unknown.

TYPES. **Holotype**: &. Indian Oasis, Sells P.O., Pima County, Arizona; 1–15 April 1922; O. C. Poling. USNM. **Paratype**: 1 &. Same data as for holotype. USNM.

Nothing is known of the early stages. The two adults were collected in April. *Platynota polingi* is known only from the type locality of Indian Oasis, Arizona (map 62). [Specimens examined: 2 δ , 2 slides]

Platynota texana Powell and J. Brown, NEW SPECIES

PL. E, FIGS. 34, 35 (adult); PL. 17, FIG. 5 (δ gen.); PL. 31, FIG. 4 (φ gen.); MAP 63

Platynota texana Powell and J. Brown.

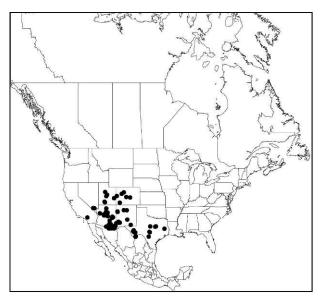
locality: Brownsville, Cameron Co., Texas. [CNC]

NOTE—The species name refers to the state of the type locality.

Platynota texana is the smallest North American member of the genus. The male has complex scaling of the frons and an unscaled region on the inner surface of the second segment of the labial palpus, typical of congeners with a much greater forewing length, e.g., P. idaeusalis, P. exasperatana, and P. wenzelana. These larger species usually have extremely short antennal sensillae (<½ time the flagellomere width), whereas the sensillae are relatively long (about 1.2 the flagellomere width) in P. texana.

Description. Male. Head: Hood complex; hood and vertex fawn; frons below hood with welldeveloped dorsal membranous region, white-scaled below; labial palpus about 2.5 times horizontal diameter of compound eye, whitish mesially, pale fawn laterally, a narrow unscaled region along subdorsal edge of segment II; antennal scaling tan, sensillae about 1.2 times width of flagellomere. Thorax: Pale tan, with some pale orange-brown scales. Forewing length 4.5-5.0 mm (mean = 4.8 mmm; n = 4); forewing ground color pale cream tan with light brown over scaling; well-defined, diagonal, brown submedian fascia from costa about 1/3-½ from base to apex, attenuate just below discal cell; small brown dot in basal 1/3, about 1/3 distance from costa to dorsal margin; faint, small, tan, semicircular patch from costa about 3/3 distance from base to apex; a few scattered brown scales in terminal region near apex; costal fold broad, about 1/4 length of costa. Hindwing cream, with palebrown mottling in distal one-half; sex scaling welldeveloped along anal margin. Abdomen: Genitalia (plate 17, figure 5) with uncus typically spindle shaped in mesial portion and slender in terminal portion; gnathos represented by a weak, rudimentary band; socius with large dorsal lobe; secondary arms uniformly slender; transtilla with a single mesial lobe bearing a group of large spines; valva subrectangular, comparatively long, slender, costa well defined, sacculus weakly differentiated, lacking terminal projection; juxta simple. Aedeagus slender, relatively short, curved; vesica with 8-10 slender cornuti.

Female. Head: Frons with sparse, smooth scaling below mideye, pale yellowish; roughened above, white; labial palpus about 3.0 times horizontal diameter of compound eye, pale white mesially, white and brown laterally; antennal scaling tan, sensillae extremely short. Thorax:



MAP 64. DISTRIBUTION OF MATERIAL EXAMINED OF PLATYNOTA LABIOSANA

Tan. Forewing length 5.5 mm (mean = 5.5 mm; n = 2); forewing pattern essentially as described for male. Hindwing whitish. Abdomen: Genitalia (plate 31, figure 4) with sterigma small, rounded, with a pair of lateral lobes, the bases of which extend anteriorly slightly beyond margin of segment VIII; colliculum small, elongate, ringlike, separated from ostium bursae by short membranous region; ductus bursae long, narrow, coiled near middle, widened only near junction with corpus bursae; ductus seminalis from anterior portion of ductus bursae; corpus bursae ellipsoid; signum a broad, conical plate, with base fused to a long, thin, curved horn.

TYPES. **Holotype:** \Im . Brownsville, Cameron Co., Texas; 15 February 1937; T. N. Freeman. CNC. **Paratypes:** 5 \Im , 3 \Im . **Texas.** Same locality data as for holotype; 27 March 1928; F. H. Benjamin (1 \Im). Same locality data as for holotype; 15, 17, 22 February 1937, 4 March 1937; T. N. Freeman (3 \Im , 2 \Im). Junction, Kimble Co.; 26 October 1973; A. and M. E. Blanchard (1 \Im). Orange, Orange Co.; 3 Aug 1974; R. Leuschner (1 \Im). CNC, USNM.

There is some variability in forewing maculation among the paratypes (i.e., in particular, the pattern of those from Junction and Orange deviate from that of the paratypes from Brownsville), and their conspecificity is equivocal. However, their similar

small size, collecting localities, and genitalia suggest they are all the same species.

Nothing is known of the early stages. Adults have been collected in February, March, August, and October. *Platynota texana* is known only from southern Texas (map 63). [Specimens examined: 6 \Im , 3 \Im , 7 slides]

Platynota labiosana (Zeller)

PL. E, FIGS. 36–40 (adult); PL. 17, FIG. 6 (3 gen.); PL. 31, FIG. 5 (\bigcirc gen.); MAP 64 (RWH 3738).

Teras labiosana Zeller, 1876, Verhandlungen der Zoologisch-Botanischen Gesellschaft in Wien, **25**: 237.

Type

locality: [Bosque Co.], Texas. [BMNH]

NOTE—Teras labiosana was described from three male and one female syntypes collected by Belfrage in Texas, June and July.

Platynota labiosana; Fernald, 1882, Transactions of the American Entomological Society, **10**: 22. COMBINATION.

Platynota labiosana is similar to many North American congeners but usually can be distinguished by its pale orange-tan forewing and pattern: a distinct brown semicircular costal patch at about ½ the distance from the base to the apex and an oblique, usually incomplete median fascia. The hindwing varies from pale yellow to orange in contrast to the dingy grayish hindwing of most other North American Platynota. In the male the costal fold extends about one-fourth the length of the forewing; the scaling on the frons is intermediate in its complexity, i.e., the hood is not as well defined as in P. idaeusalis and relatives; and the labial palpus is slightly longer than in *P. idaeusalis* and relatives, with an unscaled region similar to that found in the latter species. Forewing length is 6.0-7.8 mm in males and 7.0-9.0 mm in females.

In the male genitalia (plate 17, figure 6) the uncus is slender apically and slightly curved, dilated in the basal ½. The socii have a large dorsal lobe, and the secondary arms are long and slender. The transtilla has a rounded spiny process at the middle. The valva is subrectangular, the costa is differentiated, and the sacculus is weakly differentiated with a short, blunt, triangular

projection at its termination. The region between the base and terminal process of the sacculus is usually slightly concave, similar to that of *P. wenzelana*. The aedeagus is curved, and the vesica has 15–20 slender cornuti.

In the female genitalia (plate 31, figure 5) the sterigma is broadly cup shaped with a nearly straight posterior margin; the ductus bursae is slender, coiled one revolution, with a well-defined, split colliculum just anteriad of the antrum; and the corpus bursae is irregularly rounded, with the signum in the form of a short, wrinkled band near the junction of the ductus bursae and corpus bursae.

Platynota labiosana evidently is a general feeder; it was reared by Dyar in Colorado from Argemone sp. (Papaveraceae); by Bottimer in Texas from Eupatorium sp. (Asteraceae) and okra (Abelmoschus esculentus (Linnaeus) Moench, Malvaceae); and by Henne in northern Arizona from Penstemon sp. (Scrophulariaceae) and in California from Ipomopsis sp. (Polemoniaceae). Adults have been collected from April through September, probably representing two broods. Many Lepidoptera of the xeric American Southwest have an obligate spring brood and an opportunistic fall brood, depending on seasonal precipitation, and P. labiosana may conform to this pattern as well.

Platynota labiosana inhabits the more xeric areas of the southwestern United States, ranging from Colorado, south to Texas, and west to Inyo and Santa Barbara counties in California (map 64). Specimens from Baja California and Nuevo Leon, Mexico, also appear to represent this species. [Specimens examined: 612 ♂, 245 ♀, 12 slides]

Platynota islameconae Powell and J. Brown, NEW SPECIES

PL. E, FIG. 41 (adult); PL. 18, FIG. 1 (♂ gen.); PL. 31, FIG. 6 (♀ gen.)

Platynota islameconae Powell and J. Brown. Type

locality: Santa Cruz Island [lower Islay Canyon Rd.], Santa Barbara County, California. [EME]

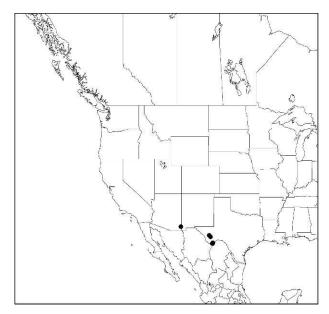
NOTE—The specific epithet is based on the island occurrence and on the larval host plant: isla = island, mecon = poppy.

Platynota islameconae is superficially similar to P. labiosana and P. blanchardi, but it is distin-

guished by its subdued forewing pattern that features a prominent, dark-gray shade through the disk, which obscures the pattern of related species; and the hindwing is white. In P. labiosana and relatives the forewing and hindwing ground color are more or less unicolorous yellowish to orange tan. The male genitalia of P. islameconae differ from those of *P. labiosana* and *P. blanchardi* by having slender, parallel-sided valvae and a simple sacculus that lacks a basal enlargement or free tip. The male genitalia are similar to those of P. texana, which is a much smaller species (forewing length 4.5–5.0 mm) from southern Texas that has a broad costal fold and a well-defined submedian fascia. P. islameconae is known only from Santa Cruz Island off the coast of southern California, whereas P. labiosana occurs on the adjacent mainland. The only other Platynota known from the California Channel Islands is P. stultana, which is an introduced (Powell 1983a), polyphagous species.

Description: Male. Head: Hood weakly developed, subtended by membranous or weakly scaled frons; labial palpus about 2.5 times diameter of compound eye, densely scaled, rust brown exteriorly, whitish mesially; antennal scaling faintly brownish, almost translucent, sensillae 1.0-1.1 times width of flagellomere. Thorax: Forewing length 8.5–9.0 mm (mean = 8.8 mm; n = 2); costal fold short, 1/5-1/4 forewing length; ground color pale tan with poorly defined, darker pattern consisting of an oblique, median fascia and a semicircular costal rust patch that is obscured by a patch of dark-gray upraised scales from below costa to cubital fold; underside pale ocherous tan with evenly spaced rust costal flecks. Hindwing lacking modified scaling in anal fold; white, tinged with faint, pale ocherous distally, fringe white; underside similar to upper side. Abdomen: Ocherous dorsally, darker ventrally. Genitalia (plate 18, figure 1) with uncus very slender, curved ventrad, not enlarged apically, slightly exceeding socii; socius greatly enlarged in distal half; secondary arms of gnathos not enlarged distally, with very small setae apically; transtilla with rounded spiny mesial process; valva slender, parallel sided, sacculus simple, not enlarged basally, without free tip. Aedeagus as in congeners.

Female: Head and thorax: Essentially as described for male. Forewing length 9.0 mm (n = 1); lacking costal fold; single specimen worn, lacking



MAP 65. DISTRIBUTION OF MATERIAL EXAMINED OF PLATYNOTA BLANCHARDI

frontal scaling, forewing color pattern similar to that of male but diffuse, lacking raised scales and prominent dark obfuscation. Abdomen: Genitalia (plate 31, figure 6) with sterigma broadly bilobed and with rounded lateral pockets; ostium bursae subtrapezoidal; ductus bursae slender, coiled one revolution, colliculum weak; corpus bursae obovate, signum in the form of a short thorn.

TYPES. **Holotype:** &. Santa Cruz Island [lower Islay Canyon Rd.], Santa Barbara Co., California; 23 May 1984; reared from seed pods of *Dendromecon harfordii*, em: 4 July 1984, J. Powell 84E79J; De Benedictis, J. Powell and D. Wagner. EME. **Paratypes:** 1 &, 1 \, \infty\$. Same locality data data as for holotype; em: 6, 16 July 1984. EME, USNM.

We found larvae of *P. islameconae* in May feeding in immature seed pods of island bushpoppy (*Dendromecon harfordii* Kellogg, Papaveraceae), an arborescent shrub, which was known as *D. rigida* var. *harfordii* at the time of our collection. The moths of Santa Cruz Island are not thoroughly known, but we have surveyed there in April–May in 1966, 1984, 2000, and 2001, encountering this species just once. An additional collection of larvae from the same site in 2001 produced only the widespread *Sparganothis senecionana*. We also reared the latter species from several Asteraceae on Santa Cruz Island. Although unlikely, *P.*

islameconae may be a host-specific, univoltine, summer-flying species. It may have remained undetected because no lepidopterist has surveyed the island during July–August. [Specimens examined: $2 \, \delta$, $1 \, \varphi$, $2 \, \text{slides}$]

Platynota blanchardi Powell and J. Brown, NEW SPECIES

PL. E, FIGS. 42–44 (adult); PL. 18, FIG. 2 (d gen.); MAP 65

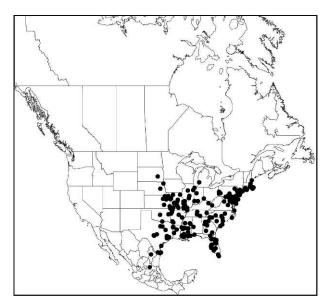
Platynota blanchardi Powell and J. Brown. Type

locality: Fort Davis, Jeff Davis Co., Texas. [USNM]

NOTE—The specific epithet is a patronym for André Blanchard, who was dedicated to documenting the lepidopteran fauna of Texas and who collected the holotype and several paratypes of the new species.

The forewing pattern of *P. blanchardi* is most similar to that of *P. labiosana*, with a well-defined semicircular subapical patch from the costa and an irregular, diagonal median fascia. However, in *P. blanchardi* the pattern is more well defined and in greater contrast to the pale ground color. Also, the subapical costal patch is bordered basally by a whitish or pale region accentuating the contrast between the markings and the ground color. The male has a complex hood, moderately long antennal sensillae, a well-developed triangular process representing the termination of the sacculus, and a concave saccular margin of the valva similar to that of *P. labiosana* and *P. wenzelana*.

Description. Male. Head: Hood complex; hood and vertex whitish to cream colored; frons below hood with naked dorsal region and white-scaled ventral region; labial palpus about 2.5 times horizontal diameter of compound eye, whitish mesially, cream to pale brownish cream laterally, a narrow unscaled region along subdorsal inner edge of segment II; antennal scaling pale brownish cream, sensillae 1.0-1.2 times width of flagellomere. Thorax: Dorsum whitish to cream colored. Forewing length 9.0-10.0 mm (mean = 9.5 mm; n = 10); forewing ground color whitish to cream with extremely light, pale reddish-brown suffusion in distal 1/3; diagonal median fascia from costa at about ½-½ from base to apex extending to dorsal margin, distinct and dark brown at costa, ill defined and pale orange brown from discal cell



MAP 66. DISTRIBUTION OF MATERIAL EXAMINED OF PLATYNOTA FLAVEDANA

to dorsal margin; a diffuse, narrow patch of darker scales near lower edge of discal cell; distinct, darkbrown, semicircular, subapical patch on costa about 3/3 distance from base to apex; whitish or cream area of ground color between median fascia and subapical semicircular patch; costal fold conspicuous, about 1/4 length of forewing costa. Hindwing cream, slightly darker in basal area; anal edge defined by narrow membranous ridge, but without distinct fold. Abdomen: Genitalia (plate 18, figure 2) with uncus possessing typical spindleshaped mesial portion and slender terminal portion; gnathos absent; socius with large dorsal lobe; secondary arms slender, slightly or not expanded distally; transtilla with a broad cup shaped mesial area bearing dense spines; valva subrectangular, costa well differentiated, sacculus weakly differentiated, with distinct terminal triangular projection, ventral edge of valva basad of terminal projection concave; juxta simple. Aedeagus slender, curved; vesica with 10-15 slender cornuti. Female unknown.

TYPES. **Holotype:** & Fort Davis, Jeff Davis Co., Texas; 3 April 1967; A. and M. E. Blanchard. USNM. **Paratypes:** 18 & **Arizona.** Foothills Road, mile post 4, N of Portal, Cochise Co., 4,600′, 31.963°N, 109.151°W; 12 August 2010; C. Schmidt and B. Walsh (1 &). **Texas.** Fort Davis, Jeff Davis Co.; 25 March 1968; A. and M. E. Blanchard (7 &). Big Bend National Park, Green Gulch, 5,400′, Brewster

Co.; 2 June 1973; A. and M. E. Blanchard (2 &). Same locality data; 3 May 1972; J. G. Franclemont (1 &). Big Bend National Park, Oak Spring, Brewster Co.; 8 May 1972; A. and M. E. Blanchard (1 &). Big Bend National Park, Basin, Brewster Co.; 29 March 1965; A. and M. E. Blanchard (2 &). Arguja Canyon, Davis Mts., Jeff Davis Co.; 1 April 1967; A. and M. E. Blanchard (1 &). Sunnyglen Ranch, Alpine Co. [presumably now Brewster Co.]; 1–7 April 1926, 20 May 1926, 15–30 July 1926, O. C. Poling (3 &). USNM.

Nothing is known of the early stages. Adults have been collected mostly from March to May; there are single records from July and August. *Platynota blanchardi* is known mainly from the type series collected in the Davis and Chisos mountains of southwestern Texas, but it also has been collected in high desert at the eastern base of the Chiricahua Mountains near Portal, Arizona (map 65). A small series (n = 6; USNM) from the central plateau of Mexico (i.e, Puebla, Tehuacan; Estado de Mexico, Lomas de Chapultepec) also appears to be conspecific with the type. [Specimens examined: 19 3, 4 slides]

Platynota flavedana Clemens PL. E, FIGS. 45–50 (adult); PL. 18, FIG. 3 (\eth gen.); PL. 32, FIG. 1 (\updownarrow gen.); MAP 66 (RWH 3732).

Platynota flavedana Clemens, 1860, Proceedings of the Academy of Natural Sciences, Philadelphia, 1860: 348.

Type

locality: [Pennsylvania?]. [ANSP]

NOTE—The lectotype female was designated by Darlington (1947: 101).

Sparganothis flavedana; Barnes and McDunnough, 1917, Check List of the Lepidoptera of Boreal America: 176. COMBINATION. Platynota flavedana; McDunnough, 1939, Memoirs of the Southern California Academy of Sciences, 2 (1): 56. COMBINATION.

Teras tinctana Walker, 1863b, List of the Specimens of Lepidopterous Insects in the Collection of the British Museum, Catalogue of the Heterocera, 28: 289.

Type

locality: USA. [BMNH]

NOTE—Two syntype males are deposited in The Natural History Museum.

Platynota tinctana; Fernald, 1882, Transactions of the American Entomological Society, **10**: 22. COMBINATION.

Platynota tinctana (= flavedana); Powell, 1983b, Check List of the Lepidoptera of America North of Mexico: 41. SYNONYMY.

Tortrix concursana Walker, 1863b, List of the Specimens of Lepidopterous Insects in the Collection of the British Museum, Catalogue of the Heterocera, 28: 324.

Type

locality: North America. [BMNH]

Platynota concursana (= flavedana); Fernald in Dyar, 1902 [1903], Bulletin of the U.S. National Museum, **52**: 476. SYNONYMY, COMBINATION.

Tortrix laterana Robinson, 1869, Transactions of the American Entomological Society, 2: 278.

Type

locality: Pennsylvania. [ANSP]

NOTE—The lectotype female was designated by Darlington (1947: 101).

Platynota laterana (= flavedana); Fernald in Dyar, 1902 [1903], Bulletin of the U.S. National Museum, **52**: 476. SYNONYMY, COMBINATION.

Platynota iridana Barnes and Busck, 1920, Contributions to the Lepidoptera of North America, 4: 212.

Type

locality: St. Petersburg, Hillsborough County, Florida. [USNM]

Platynota iridana (= flavedana); Powell, 1983b, Check List of the Lepidoptera of America North of Mexico: 41. SYNONYMY.

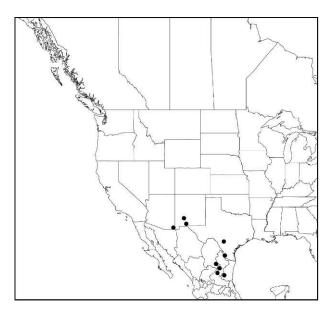
Adults of *Platynota flavedana* are most similar to those of *P. rostrana*; the male genitalia of the

two (plate 17, figure 2; plate 18, figure 3) are virtually indistinguishable, but females usually can be separated by the shape of the signum: an invaginated, wrinkled, curved band in P. flavedana (plate 32, figure 1) and a slender spine in P. rostrana (plate 31, figure 2). Males of the two can be separated superficially by differences in the scaling of the frons, the width of the forewing costal fold, and secondary sex scales of the hindwing. The male of P. rostrana has a complex hood on the frons, whereas that of P. flavedana is simple. The costal fold of P. flavedana is slightly broader and more swollen subbasally than that of P. rostrana. In P. rostrana there is dense row of short orange scales along the edge of the anal fold of the hindwing; P. flavedana lacks the short orange scales and has a larger anal fold bearing a patch of very small orange scales.

The labial palpus in P. flavedana is about 1.5 times the horizontal eve diameter in the male, about 3.0 in the female. Antennal sensillae are short in the male, only about 1/4 times the width of the flagellomere. Forewing length is 6.0-7.0 mm (mean = 6.3 mm; n = 10) in males and 7.0-9.0 mm(mean = 7.7 mm; n = 10) in females. In the male, the basal ½ of the forewing is densely mottled with dark brown and/or red brown, and the distal ½ is pale whitish or vellowish, giving a two toned aspect. The hindwing is pale tan, with a distinct anal fold indicated by an unscaled, membranous ridge. In the female, the forewing is light brown or pale red brown, usually with one or more, fine, oblique lines from the costa to the dorsal margin each bearing a linear patch of raised scales.

The larva of *P. flavedana* was described by MacKay (1962). The last instar is 14–17 mm in length. The head is about 1.2–1.3 mm long and 1.3–1.4 mm wide, clear brownish yellow (almost orange), with a dark stemmatal area. The prothoracic shield is brownish yellow. The body is greenish with minute spinules; the distance between the V setae on A9 is usually 1.5–2.0 times that between the V setae on A8. The pupa is essentially as described for the genus; Sandberg and Passoa (1989) provide an illustration of the venter of the head and mouthparts.

Platynota flavedana is an omnivorous leafwebber. Bottimer (1926) reported the larvae on sunflower (Helianthus sp.; Asteraceae) and Yankeeweed (Eupatorium compositifolium Walter, Asteraceae); Wilde and Semel (1966) presented details



MAP 67. DISTRIBUTION OF MATERIAL EXAMINED OF PLATYNOTA ZAPATANA

of its life history on strawberry (Fragaria sp., Rosaceae). Two females collected in Purcellville, Virginia, September 2005, laid clusters of 25-52 eggs in linear or ovoid patches; e.g., one patch was 2-3 eggs wide and about 20 eggs long. Larvae hatched in 10-11 days. Specimen label data provide the following food plant records: red pine (Pinus resinosa Aiton, Pinaceae), pigweed (Amaranthus sp., Amaranthaceae), water-hemlock (Cicuta maculata Linnaeus, Apiaceae), milkweed (Asclepias sp., Asclepiadaceae), Aster sp. (Asteraceae), eastern parthenium (Parthenium integrifolium Linnaeus, Asteraceae), blueberry (Vaccinium sp., Ericaceae), peanut (Arachis hypogaea Linnaeus, Fabaceae), false indigo (Baptisia australis (Linnaeus) R. Brown, Fabaceae), alfalfa (Medicago sativa Linnaeus, Fabaceae), white sweet-clover (Melilotus alba Medikus, Fabaceae), bag-pod sesbania (Sesbania vesicaria Eliott, Fabaceae), cotton (Gossypium sp., Malvaceae), strawberry (Fragaria sp., Rosaceae), apple (Malus domestica Borkhausen, Rosaceae), rough cinquefoil (Potentilla norvegica Linnaeus, Rosaceae), peach (Prunus persica (Linnaeus) Batsch, Rosaceae), greenhouse roses (Rosa sp., Rosaceae), raspberry (Rubus sp., Rosaceae), ironweed (Veronica sp., Scrophulariaceae), mullein (Verbascum sp., Scrophulariaceae), boxthorn (Lycium sp., Solanaceae), and elm (Ulmus sp., Ulmaceae). The species is multivoltine

throughout most of its range, with the possible exception of the most northern limits, with captures ranging from April to September.

Platynota flavedana is known from New Hampshire to Florida, and west to Kansas and Texas (map 66). It ranges south through Central America to Costa Rica and the Caribbean. [Specimens examined: 543 3, 378 3, 15 slides]

Platynota zapatana Powell and J. Brown, NEW SPECIES

PL. F, FIGS. 1, 2 (adult); PL. 18, FIG. 4 (3 gen.); MAP 67

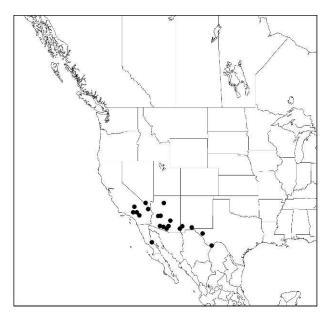
Platynota zapatana Powell and J. Brown. Type

locality: 1 mi SE Saltillo, Coahuila, Mexico. [EME]

NOTE—The specific epithet refers to Zapata, Texas, the locality for one of the paratypes.

Platynota zapatana is among the smaller species in the genus, and except for *P. texana*, it is the smallest member occurring north of Mexico. In addition to its small size, it can be distinguished from its congeners by its orange fore- and hindwings, and by the extremely elongate sensillae of the male antenna. The short, stout uncus is most similar to those of *P. viridana* and *P. nigrocervina*.

Description. Male. Head: Hood simple; vertex with dark-gray scales tipped with white; from beneath hood whitish and gray; labial palpus about 1.6-1.8 times horizontal diameter of compound eye, dark gray brown, some scales tipped with white, without unscaled region on inner surface of segment II; antennal scaling gray brown and white, sensillae about 3.0 times diameter of flagellomere. Thorax: gray brown dorsally, orange in posterior ¼ and posterior ½ of tegulae. Forewing length 5.2– 6.8 mm (mean = 6.2 mm; n = 10); forewing orange brown, with diffuse, transverse brown fascia from near midcosta to dorsal margin near tornus reflecting iridescent gray, bordered basally and distally by a few small scattered patches of raised scales (lost in older or flight-worn specimens); distal 1/4 with brown striae; brown semicircular patch from costa near apex; costal fold extremely narrow or absent. Hindwing bright brownish orange; anal fold absent. Abdomen: Male genitalia (plate 18, figure 4) with uncus short, stout; socius reduced, secondary arms slender, slightly club



MAP 68. DISTRIBUTION OF MATERIAL EXAMINED OF PLATYNOTA LARREANA

shaped distally; gnathos relatively well developed; transtilla with single large, broad, spiny lobe; valva subrectangular, apex rounded, costa differentiated, sacculus differentiated basally, without accessory projections; juxta a simple, slightly curved, rectangular plate with a shallow posterior mesial notch. Aedeagus curved, phallobase not conspicuously swollen; vesica with 8–10 long, slender deciduous cornuti. Female unknown.

TYPES. Holotype: 3. 1 mi SE Saltillo, Coahuila, Mexico; 23-26 September 1976; J. Chemsak and J. Powell. EME. Paratypes: 18 &. Coahuila. 1 mi SE Saltillo, blacklight; 23– 26 September 1976; J. Chemsak and J. Powell (5 る). Nuevo Leon. 40 mi S San Roberto, 6,000', diurnal; 22 September 1976; J. Chemsak and J. Powell (5 ♂). San Luis Potosí. 3 mi W Cedral, 6,000', diurnal: 21 September 1976; J. Chemsak and J. Powell (2 &). Tamaulipas. 4 mi NE Juanmave, diurnal; 20 September 1976; J. Chemsak and J. Powell (1 3). Arizona. Foothills Road, mile post 4, N of Portal, Cochise Co., 4,600', 31.963°N, 109.151°W, blacklight; 12 August 2010; C. Schmidt and B. Walsh (1 ♂). New Mexico. Mesilla Park, Dona Anna Co., 3,800' [1,170 m]; [no date]; T. Cockerell (1 3). Highway 51, SE Elephant Butte, Sierra Co.; 17 October 2001; G. Balogh (1 ♂). Texas. Sabinal, Uvalde Co.; April 1910; F.C. Pratt (1 ♂). Zapata, Zapata Co.; 18 September 1973; A. and M. E. Blanchard (1 3). EME, USNM.

Nothing is known of the biology of *P. zapatana*. Specimens have been collected in April and

August–September, suggesting two or more broods. Most of the adults collected in Mexico were taken diurnally in open *Larrea* desert with occasional mesquite and weedy Asteraceae.

Platynota zapatana is known from Coahuila, Nuevo Leon, San Luis Potosí, and Tamaulipas, Mexico, and from Texas, New Mexico, and Arizona, USA (map 67). There are several superficially similar (i.e., small, orange) populations throughout Mexico that may be conspecific with or closely related to *P. zapatana*. [Specimens examined: 19 & 3 slides]

Platynota larreana (Comstock) PL. F, Figs. 3–8 (adult); PL. 18, Fig. 5 (3 gen.); PL. 32, Fig. 2 ($^{\circ}$ gen.); MAP 68 (RWH 3735).

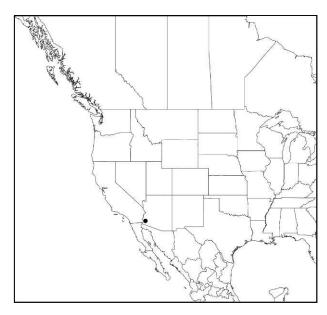
Sparganothis larreana Comstock, 1939, Bulletin of the Southern California Academy of Sciences, 38: 120.

Type

locality: Mojave Desert, California. [LACM]

Platynota larreana; Powell, 1983b, Check List of the Lepidoptera of America North of Mexico: 41. COMBINATION.

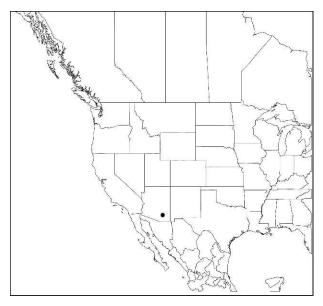
Platynota larreana is a medium-sized species that lacks the raised scales characteristic of most Platynota species, even when freshly eclosed. Forewing length is 7.0-10.0 mm (mean = 8.8mm; n = 10) in males and 6.5–9.5 mm (mean = 8.3) mm; n = 10) in females. The forewing varies from yellow orange to orange brown, with a narrow, darker brown, usually ill-defined, diagonal median fascia. The male has a simple hood, lacks the unscaled region of the labial palpus, and has moderately long antennal sensillae (ca. 1.5 times diameter of flagellomere). Typical populations of P. larreana occur in the Mojave Desert of southcentral California ranging eastward into Nevada and western Arizona and south through the Colorado Desert of southern California into adjacent Baja California, Mexico. Most specimens from Arizona (Mohave, Pima, and Yavapai counties), New Mexico, and Texas are smaller, paler yellow orange, and lack the diagonal median fascia. However, because the genitalia of the latter cannot be distinguished from those of typical P. larreana, we treat all as conspecific. In the male



MAP 69. DISTRIBUTION OF MATERIAL EXAMINED OF $PLATYNOTA\ YUMANA$

genitalia (plate 18, figure 5) the uncus is broadly spindle shaped in the middle, more so than in any other Platynota; the rudimentary gnathos is present as a moderately long, slender mesial projection; the secondary arms of the gnathos are only slightly (or not at all) expanded distally; and the transtilla, which is variable in most species, is moderately consistent within specimens examined, with the mesial ½ slightly rounded and strongly spined; the juxta has a deep, V-shaped posterior excavation mesially, similar to that of *P. stultana*. In the female genitalia (plate 32, figure 2) the signum usually is not developed, but occasionally it is represented by a slight dimple in the corpus bursae, and less frequently by a very small irregular patch of sclerotization. We include under this name all the Larrea-associated (Mojave Desert) specimens in which the juxta in the male genitalia has a deep U- or V-shaped mesial incision (which is somewhat variable), and the female genitalia have the urn-shaped mesial lobe surrounding the ostium bursae much reduced, with a sclerotized semicircular band, and no signum.

Platynota larreana, P. yumana, and P. redingtonensis are superficially very similar, the males of which can be distinguished only by the shape of the juxta. P. larreana shares with P. stultana a number of morphological features of the male genitalia that suggest a close relationship with that taxon as well:



MAP 70. DISTRIBUTION OF MATERIAL EXAMINED OF PLATYNOTA REDINGTONENSIS

nearly parallel-sided valvae with a broad, rounded apex; a deeply incised, V-shaped juxta; and a short, stout uncus.

According to Comstock (1939), the larva of *P. larreana* is light olive green without distinguishing markings; chaetotaxy is typical of the genus. The pupa is typically sparganothine, about 9 mm in length, and dark brownish black.

Larvae of P. larreana are leaf-tiers on creosote bush (Larrea tridentata (de Candolle) Coville, Zygophyllaceae) (Comstock 1939). Based on this unusual food plant and the distribution of the species, it is likely that P. larreana is one of few food plant specialists in the genus. Specimen label data indicate that it also has been reared from galls of Asphondylia auripila Felt (Diptera: Cecedidomyiidae) on creosote bush; Dammers' (LACM host index) records of butterflybush (Buddleja davidii Franchet, Loganaceae) and evening primrose (Oenothera sp., Onagraceae) probably are incorrect or do not refer to larval food plants. On Larrea, larvae tie several leaves together at the tip of a branch, forming a silken tube in the center of the bunch. Pupation occurs within the silken tube. Adults have been collected primarily in the spring: March and April, but May and June records are not unusual. Foliation of Larrea and probably larval activity respond to sporadic rainfall. For example, we found larvae in green foliage of Larrea in May 1969,

following exceptional winter rains, and adults emerged late May–June, whereas larvae we collected in late March 1970, produced moths in mid-April, following a poor rainfall winter. A late summer brood (August and September) occurs in some years.

Platynota larreana occurs in the Mojave Desert of southern California, ranging south into Baja California, Mexico, and as far east as Big Bend National Park, Brewster County, Texas (map 68). Larrea tridentata occurs throughout the known range of the moth. [Specimens examined: $117 \ 3, 25 \ 9, 15 \ \text{slides}$]

Platynota yumana (Kearfott) PL. F, Fig. 9 (adult); PL. 18, Fig. 6 (& gen.); MAP 69 (RWH 3734). NEW COMBINATION.

Sparganothis yumana Kearfott, 1907b, Transactions of the American Entomological Society, 33: 67.

Type

locality: "desert," Yuma County, Arizona. [USNM]

NOTE—Kearfott (1907) described *P. yumana* from one male and one female from Yuma Co., Arizona. Lambert (1950) designated the male as the lectotype (unpublished and invalid), and transferred the female to his new manuscript species, *Platynota "arizonensis*," an unavailable name (which we consider a small form of *A. larreana*). The male is here designated the lectoype to ensure stability of the name.

Because this species is represented by a single old specimen (the lectotype designated above), its position is enigmatic. It may be synonymous with *P. larreana*, but the genitalia suggest otherwise. *Platynota yumana* is superficially similar to *P. larreana* and *P. redingtonensis*, but the forewing is slightly more rounded and slightly paler in color—more yellow than the yellow orange of *P. larreana* and *P. redingtonensis*. The male genitalia of the lectotype (plate 18, figure 6) are distinguished from those two species by the conspicuously more narrow uncus and the unmodified juxta: that of *P. larreana* has a deep V- or U-shaped mesial incision posteriorly, and that of *P. redingtonensis* is broad and evenly rounded posteriorly.

Lambert (1950) placed *P. yumana* in a speciesgroup with *P. viridana* and *P. zapatana*. The male of *P. yumana* has a simple hood, lacks the bare patch on the labial palpi, has a short costal fold (extending about ¼ the length of the forewing), and has moderately long antennal sensillae in the male.

Nothing is known of the early stages, but *P. yumana* may be part of a complex of *Larrea*-feeding *Platynota* species. Much of the desert habitat around Yuma is dominated by creosote bush. The lectotype was collected in May. Attempts to rediscover this species in the vicinity of Yuma, Arizona in recent years have been unsuccessful (map 69). [Specimens examined: 1 δ ; 1 slide]

Platynota redingtonensis Powell and J. Brown, NEW SPECIES

PL. F, FIGS. 10, 11 (adult); PL. 19, FIG. 1 (δ gen.); MAP 70

Platynota redingtonensis Powell and J. Brown.

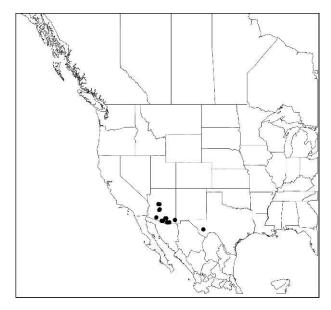
Type

locality: Redington, Arizona. [USNM]

NOTE—The specific epithet refers to the type locality of Redington, Arizona.

Superficially, *P. redingtonensis* is virtually indistinguishable from small, poorly marked individuals of *P. larreana* from Arizona. The male genitalia (plate 19, figure 1) are extremely similar to those of *P. larreana*, but the two specimens included under this name can be distinguished by the shape of the juxta: posteriorly rounded in *P. redingtonensis*, with a deep U- or V-shaped mesial incision in *P. larreana*. Although it is possible that the shape of the juxta represents geographic variation, this is an unlikely explanation given the limited variation in this character among specimens of *P. larreana* examined (n = 14). The female of *P. redingtonensis* is unknown.

Description. Male. Head: Hood simple; hood and vertex orange; frons below hood pale orange yellow; labial palpus about 1.5 times horizontal diameter of compound eye, whitish yellow mesially, pale orange laterally, without naked region on the inner surface of segment II; antennal scaling pale orange, sensillae about 2.0 times width of flagellomere. Thorax: Light brownish orange. Forewing length 5.0–6.0 mm (mean = 5.5 mm; n = 2); forewing nearly uniformly pale orange; a diffuse, faint, transverse, brownish-orange fascia from costa near middle; a faint subtriangular spot on apical portion of costa; a narrow brownish-orange line at termen; costal fold narrow, confined to basal ½. Hindwing white without anal fold.



MAP 71. DISTRIBUTION OF MATERIAL EXAMINED OF $PLATYNOTA\ VIRIDANA$

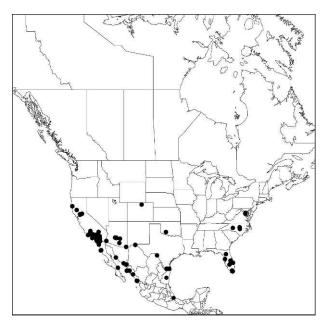
Abdomen: Pale orange-yellow. Male genitalia (plate 19, figure 1) with uncus short, stout, dilated mesially, ending in a short, pointed apical hook; socius stout, comparatively short, secondary arms slightly enlarged in distal ¼; transtilla with a single spinulose lobe at middle; valva subrectangular, comparatively narrow, costa differentiated, sacculus weakly differentiated, confined to basal ½ of valva; juxta wide, broadly rounded posteriorly with lateral edges forming posteriorly pointed processes. Aedeagus curved; vesica with 15–20 short, slender cornuti. Female unknown.

TYPES. **Holotype:** &. Redington, Arizona; [no date]; [no collector]. USNM. **Paratype:** 1 &. Same data as for holotype. USNM.

Nothing is known of the early stages, although this species appears to be a member of a possible *Larrea*-feeding complex that includes *P. larreana* and *P. yumana*.

Platynota redingtonensis is known only from Redington, Arizona (map 70), an historic collecting locality that no longer exists as a recognized place. Recent collecting in creosote bush scrub habitat in the general vicinity of historic Redington yielded no additional specimens of this species. [Specimens examined: 2 &, 2 slides]

Platynota viridana Barnes and Busck



MAP 72. DISTRIBUTION OF MATERIAL EXAMINED OF PLATYNOTA STULTANA

PL. F, FIGS. 12–16 (adult); PL. 19, FIG. 2 (δ gen.); PL. 32, FIG. 3 (Υ gen.); MAP 71 (RWH 3733).

Platynota viridana Barnes and Busck, 1920, Contributions to the Lepidoptera of North America, 4: 213.

Type:

Dewey, Yavapai Co., Arizona. [USNM]

Platynota viridana is a variable gray-brown species with a pale yellow-tan forewing with a pattern that includes a brown diagonal median fascia from the costa about ½ distance from the base to the apex, extending to the dorsal margin just before the tornus, and a well-defined, subapical, semicircular patch on the costa. There appear to be two races, the typical form in Yavapai County and in the Huachuca Mountains, Cochise Co., and a smaller, darker form to the west in the vicinity of Ajo, Pima County, and in Maricopa County. The smaller form is easily distinguished from typical P. viridana in size and forewing ground color, but the genitalia of both sexes are identical to those of typical *P. viridana*, and on this basis we consider the two forms conspecific.

Males have a simple hood; lack the naked region on the dorsomesial surface of segment II of the labial palpus; and the antennal sensillae are about 2.0 times the diameter of the flagellomere. Forewing length is 8.0-8.5 mm (mean = 8.2 mm; n =10) in males and 8.0-9.0 mm (mean = 8.6 mm; n = 10) in females. The male genitalia (plate 19, figure 2) have a short, stout uncus most similar to those of P. zapatana and P. nigrocervina, and the ventral edge of the valva is virtually devoid of the short subbasal process representing the termination of the sacculus. The latter character state is shared with P. zapatana, P. yumana, P. stultana, P. larreana, P. texana, and P. redingtonensis. In the female genitalia (plate 32, figure 3) the sterigma is broadly cup shaped, weakly bilobed on the anterior edge; the antrum is not as broad as in most congeners; the ductus bursae is conspicuously broader toward the corpus bursae; the corpus bursae is rounded with the signum in the form of a short, hollow horn.

Nothing is known of the early stages. Adults have been collected in July and August, suggesting a single late summer brood.

Platynota viridana is known from Yavapai, Pima, Cochise, and Maricopa counties, Arizona (map 71). Typical specimens occur at middle elevations (3,500'-5,000') (e.g., Dewey, Huchauca Mountains), whereas smaller, grayer specimens occur at lower elevation (1,800'-3,000'), desert habitats (e.g., Ajo). We have seen one small specimen from west Texas (Alpine) that appears to represent P. viridana as well. [Specimens examined: 40 δ , 4 ς , 8 slides]

Platynota stultana Walsingham PL. F, Figs. 17–21 (adult); PL. 19, Fig. 3 (δ gen.); PL. 32, Fig. 4 (φ gen.); MAP 72 (RWH 3736).

Platynota stultana Walsingham, 1884, Transactions of the Entomological Society of London, **1884**: 127.

Type

locality: Sonora, Mexico. [BMNH]

NOTE—*Platynota stultana* was described from four syntypes. Although a male specimen in The Natural History Museum is labeled "lectotype," we were unable to find its published designation.

Platynota chiquitana Barnes and Busck, 1920, Contributions to the Lepidoptera of North America, 4: 213.

Type

locality: Loma Linda, San Bernardino County, California. [USNM]

Platynota chiquitana (= stultana); McDunnough, 1939, Memoirs of the Southern California Academy of Sciences, 2: 56. SYNONYMY.

Adults of *Platynota stultana* are superficially similar to *P. flavedana* and *P. rostrana*, but males are slightly to much smaller, with a two-toned pattern: orange brown in the distal 0.4 and dark brown in the basal 0.6. The male has simple scaling on the frons, lacks the unscaled region on the inner surface of segment II of the labial palpus, and has a weakly serrate antenna with sensillae about 0.75–0.9 times the width of the flagellomere. Segment II of the labial palpus is about 2.5 times the horizontal diameter of the compound eye in the male and about 3.0 times that in the female. Forewing length is 4.5–6.0 mm (mean = 5.4 mm; n = 10) in males and 6.5–7.5 mm (mean = 7.0 mm; n = 10) in females.

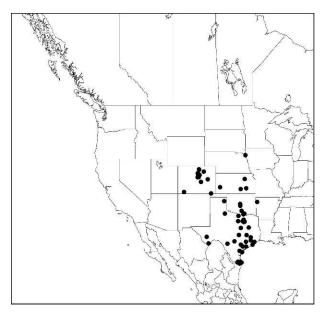
The large, V-shaped juxta of *P. stultana*, with a pair of elongate pointed processes on each side of the aedeagus (plate 19, figure 3), is similar to that of *P. larreana*. However, the transtilla of *P. stultana*, with large spines nearly throughout its width, is unique in the genus. The female genitalia (plate 32, figure 4) also are somewhat reminiscent of those of *A. larreana*, but the female genitalia of *P. stultana* are distinguished by the broadly U-shaped anterior portion of the sterigma, a semicircular arch posteriad of the small, circular ostium bursae, and a protruding rectangular plate near the posterior edge of segment seven. The signum is a small, irregular, wrinkled sclerite near mid-dorsum of the corpus bursae.

The larva of *P. stultana* was described by MacKay (1962). The last instar is 12–15 mm in length, yellowish white to cream, with moderately small pinacula that are concolorous with the body; all setae are relatively long. The head is 1.02–1.06 long and 1.15–1.25 mm wide, and brownish yellow, with a dark stemmatal area. A brown genal band is usually present on early instars and lacking in the last instar. The prothoracic shield is brownish yellow, often edged laterally and posteriorly with brown, reminiscent of the markings of species of

Amorbia. The prothoracic pinacula are yellowish or brown, and the thoracic legs are yellowish or brown. The D and SD pinacula on the meso- and metathorax are elongated posteriorly, often with brownish pigment. The distance between the V setae on A9 is usually 1.5–2.0 times that between the V setae on A8. The anal shield is concolorous with the body or brown, and the anal fork is well developed.

Platynota stultana is the "omnivorous leafroller" of American economic entomology literature (e.g., Shaw et al., 1983; Webster and Cardé, 1982, 1984; Webster, 1988; Yokoyama et al., 1999). This species frequently is intercepted at United States ports-of-entry in shipments of peppers (Capsicum sp., Solanaceae) from western Mexico, and historically it has been transported with agricultural shipments.

Larval hosts in natural situations are poorly known but include western ragweed (Ambrosia psilostachya de Candolle, Asteraceae), youngberries (Rubus sp., Rosaceae), Mexican palo-verde (Parkinsonia aculeata Linnaeus, Fabaceae), and gooseberry (Ribes sp., Grossulariaceae). Agricultural and ornamental host plants are better documented and include celery (Apium graveolens Linnaeus, Apiaceae), lettuce, (Lactuca sp.; Asteraceae), carnation (Dianthus carophyllus Linnaeus, Caryophyllaceae), sugar beet (Beta vulgaris Linnaeus, Chenopodiaceae), alfalfa (Medicago sativa, Fabaceae), walnut husks (Juglans sp., Juglandaceae), avocado (Persea americana, Lauraceae), asparagus (Asparagus officinalis Linnaeus, Liliaceae), cotton (Gossypium sp., Malvaceae), strawberry (Fragaria sp., Rosaceae), orange and grapefruit (Citrus spp., Rutaceae), bell peppers (Capsicum annuum Linnaeus, Solanaceae), tomato (Lycopersicon esculentun Miller, Solanaceae), and many others. Atkins et al. (1957) summarized larval host records, which include about 20 families of angiosperms. Records compiled by Powell (1983a) indicate P. stultana was introduced into southern California, where it was first collected in 1898. During subsequent decades this species adapted to urban situations and became a pest of citrus, avocado, and field crops including tomato and cut flowers. The omnivorous leaf-roller was recorded sporadically in greenhouses in the Sacramento Valley and San Francisco areas but did not appear in field situations north of the Transverse



MAP 73. DISTRIBUTION OF MATERIAL EXAMINED OF *PLATYNOTA NIGROCERVINA*

Range (Riverside, San Diego, Orange, Los Angeles counties) until after 1955; then it spread northward, gaining notoriety as a pest of grapes, and reached the northern Sacramento Valley and San Francisco Bay area by 1968. The geographic expansion of P. stultana in California in the 1960s was accompanied by the adaptation to a much greater taxonomic array of plants, including conifers (e.g., Pinus, Juniperus, and Taxus), monocotyledons (e.g., Zea and Sorghum), and additional dicotyledons (e.g., Phaseolus, Albizia, and Arachis). Platynota stultana is recorded on exotic representatives of many plant families, including Aquifoliaceae, Aizoaceae, Bignoniaceae, Celastraceae, Ebenaceae, Ginkgoaceae, and Theaceae (Powell 1983a). The species became a serious pest of grapes (Vitis sp.) in California in the late 1960s (Lynn 1969, Ali Niazee and Stafford 1972a, b) and continues to require control measures on that crop (Yokoyama et al. 1999, Yokoyama and Miller 2000).

Eggs are laid in imbricate masses on the host plant. They hatch in about a week, and the young larvae feed externally on leaves and move to protected places on the plant (e.g., abandoned shelters, overlapping leaves). Later instars make nests by webbing leaves and/or fruit (in grapes). In the San Joaquin Valley of central California,

studies have shown the presence of five generations with a high degree of overlap. Overwintering is accomplished in the third, fourth, or fifth instar in webbed nests made of folded leaves of the host and surrounding vegetation. There appears to be no winter diapause, with feeding continuing at a reduced rate (Ali Niazee et al. 1971, Ali Niazee and Stafford 1972a, b). Adults begin to emerge in March with successive generations emerging through October in most years.

Platynota stultana was described from Sonora. Mexico, and may have been native in Arizona. It has been introduced to distant places and is able to establish residency by its extremely polyphagous tastes. Now P. stultana occurs in the southeastern United States and as far south as Veracruz (map 72). The species was documented from Virginia and Washington, D.C. in the 1930s; and it was recorded sporadically in Florida in the 1940s and is recorded there more commonly now (USNM), where it apparently is established. It also has been recorded on one or more occasions from North Carolina, Oklahoma, and Colorado. Powell (1983a) chronicled its spread throughout California and its invasion into the urban environment. Miller and Hodges (1995) reported its introduction to Hawaii in the 1990s, and it recently has been reported from Europe (F. Groenen, personal communication). [Specimens examined: 260 ♂, 208 ♀, 25 slides]

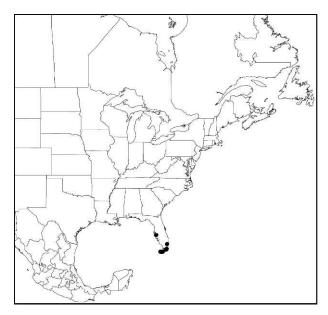
Platynota nigrocervina Walsingham PL. F, Figs. 22–27 (adult); PL. 19, Fig. 4 (\eth gen.); PL. 32, Fig. 5 (\updownarrow gen.); MAP 73 (RWH 3737).

Platynota nigrocervina Walsingham, 1895, Transactions of the Entomological Society of London, 1895: 496.

Type

locality: Laramie Co., Colorado. [BMNH]

Platynota nigocervina is similar to P. larreana in general appearance, but it can be distinguished by its larger size and forewing maculation: pale orange-tan ground color, with a broad, ill-defined, dark-brown median fascia, frequently forming a dark V-shaped patch from the costa. The forewing of P. nigrocervina typically bears small patches of raised scales, which apparently are absent in P.



MAP 74. DISTRIBUTION OF MATERIAL EXAMINED OF *PLATYNOTA CALIDANA*

larreana. These two species evidently are allopatric, with *P. larreana* occupying lower Sonoran creosote bush scrub (from California and Nevada to Texas) and *P. nigrocervina* occurring in more mesic habitats at higher elevations (from Utah and Colorado to Iowa and Arkansas).

Males have a simple hood, lack the unscaled region on the inner surface of the second segment of the labial palpus, and have moderately long antennal sensillae (1.0–1.25 times width of flagellomere). The labial palpus is equally long in both sexes, with segment II about 2.5 times the horizontal diameter of the compound eye. Forewing length is 6.0-7.0 mm (mean = 6.3 mm; n = 10) in males and 7.0-9.0 mm (mean = 7.7 mm; n = 10) in females. Specimens from Colorado are considerably larger than those from Oklahoma and Texas.

The male genitalia of *P. nigrocervina*, with a rather short, broad uncus and an extremely long, slender spine from the sacculus (plate 19, figure 4), cannot be confused with any other species of *Platynota*. Female genitalia (plate 32, figure 5) are similar to most congeners, with a broad cupshaped sterigma, a broadly urn-shaped antrum, and a short, well-defined colliculum. The posterior ¹/₃ of the ductus bursae is broadened and densely wrinkled, and the corpus bursae lacks a signum.

The larva of *P. nigrocervina* was described and illustrated by MacKay (1962) as *Sparganothis nigrocervina*. General: Length 19–20 mm. Head: Length 1.21–1.29 mm, width 1.29–1.51 mm, brownish yellow overlaid with a faint pattern; stemmatal area blackish and a dark genal bar. Thorax: Prothoracic shield pale, edged laterally with brown; L pinacula with little or no pigment; SV pinacula brownish; thoracic legs yellowish or brownish. Abdomen: Body color pale cream to pale yellowish green; pinacula nearly concolorous with body; spinules concolorous with body. Anal shield pale; anal fork well developed.

This species has been reared from a variety of plants in several families: pigweed (Amaranthus retroflexus Linnaeus, Amaranthaceae), dog-fennel (Eupatorium compositifolium, Walter, Asteraceae), sunflower (Helianthus sp., Asteraceae), peanut (Arachis hypogaea Linnaeus, Fabaceae), okra (Abelmoschus esculentus (Linnaeus) Moench, Malvaceae), cotton (Gossypium herbaceum Linnaeus, Malvaceae), prickly poppy (Argemone sp., Papaveraceae), poppy (Papaver sp., Papaveraceae), and strawberry (Fragaria sp, Rosaceae). MacKay (1962) listed corn (Zea mays Linnaeus, Poaceae), lantana (Lantana sp., Verbenaceae), and grape (Vitis vinifera Linnaeus, Vitaceae). Adults have been collected from April through September.

Platynota nigrocervina has an unusual distribution, ranging from Iowa and Kansas, south to Arkansas, Texas, and Oklahoma, and west to Colorado (map 73). [Specimens examined: 170 δ , 76 \circ , 15 slides]

Platynota calidana (Zeller)

PL. F, FIGS. 28–30 (adult); PL. 19, FIG. 5 (\eth gen.); PL. 32, FIG. 6 (\updownarrow gen.); MAP 74 (RWH 3739).

Cerorrhineta calidana Zeller, 1877, Horae Entomologicae Societas Rossicae, 13: 116. Type

locality: Cuba. [BMNH]

NOTE—One male and one female syntypes are in The Natural History Museum.

Platynota calidana; Powell, 1983b, Check List of the Lepidoptera of America North of Mexico: 41. COMBINATION.

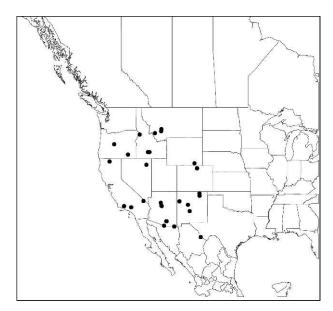
Adults of *P. calidana* are characterized by an orange-yellow to pale reddish-brown forewing, with a dark red-brown line along the costa and termen, a variable red-brown median fascia extending from the costa to the dorsal margin, and a red-brown blotch near the apex of the forewing. The male has a simple hood; the antennal sensillae are $\frac{1}{2}$ — it imes the diameter of the flagellomere; and the costal fold is extremely long, extending nearly to the apex. Forewing length is 7.0—8.0 mm in males (mean = 7.5, n = 5), 10 mm in females (n = 1). Its forewing coloration, extremely long costal fold of the male, and limited geographic range readily distinguish *P. calidana* from all other North American species of *Platynota*.

The male genitalia (plate 19, figure 5) are similar to those of other species of *Platynota*, but the uncus has a longer apical region distad of the spindle-shaped mesial portion, the sacculus is extremely short and lacks a distal triangular process, and the secondary arms of the socius end in a somewhat narrow, foot-shaped process. The last character is unique among North American members of the genus.

The female genitalia (plate 32, figure 6) have the sterigma somewhat pear shaped; the ductus bursae is long and narrow; and the corpus bursae is ellipsoid with the signum in the form of an elongate plate with a long blade armed with a few spinules on one side, similar to that of *P. rostrana*.

Little is known of the biology of *Platynota* calidana other than it is multivoltine. Specimens have been collected every month of the year on the Florida Keys. Dyar (1901) found larvae on *Eugenia* (Myrtaceae) that produced adults, which were identified as *P. calidana* by Fernald, with a query ["?"]. Females are rare at lights.

Platynota calidana was described from Cuba and is a Caribbean species; the intermittent collection records suggest it has colonized Florida sporadically (map 74). The earliest record was Dyar's collection of larvae on Eugenia at Lake Worth, Palm Beach County, in 1890 or 1900. Two specimens from Ft. Lauderdale, Broward County, are labelled "4.29.28" and "5.23.28," presumably indicating 1928 (Bates, MCZ). Evidently no Florida specimens were available to Lambert (1950), and the earliest modern record we have seen is April 1953, at Siesta Key, Sarasota County,



MAP 75. DISTRIBUTION OF MATERIAL EXAMINED OF SYNNOMA LYNOSYRANA

halfway up the peninsula on the west coast (Kimball, MCZ). *Platynota calidana* was often collected and apparently resident but unrecognized during the extensive blacklight trapping program in south Florida and the Keys orchestrated by Kimball in the 1950s to early 1970s (Kimball 1965). A seven-year gap was followed by three specimens in 1982–1983 (Dickel, FSCA) and apparently none since (Heppner, in litt.). We did not find *P. calidana* on the Florida Keys in June 1973 or 1986. Lambert (1950) cited a specimen from Nassau, Bahamas (BMNH). [Specimens examined: $46 \, \text{ color}$, $6 \, \text{ color}$, $4 \, \text{ slides}$]

GENUS

Synnoma Walsingham

Synnoma Walsingham, 1879, Illustrations of Typical Specimens of Lepidoptera Heterocera in the Collection of the British Museum, 4: 24. Type species: Synnoma lynosyrana Walsingham, 1879, by monotypy.

Synnoma, a monotypic genus for the species S. lynosyrana, is markedly divergent from most Sparganothini in biological and morphological features (Powell 1976a, 1985). The diurnal moths emerge in late fall and are sexually dimorphic; females are flightless. Adults are unique in having

long, white, straight, hairlike scales on the head and thorax (plate 4: Figures 5, 6). The male genitalia (plate 19, figure 6) are similar to those of many other members of the tribe, with a paddlelike distal expansion of the secondary arms of the socius similar to those of species of *Sparganothoides*. The female genitalia (plate 33, figure 1), with a very small hollow hornlike signum, are similar to those of species of *Synalocha*, *Syllonoma*, and *Niasoma*.

Structural characters of the genus are as follows: antennal scaling in one band per segment, setae 3.0–4.0 times width of flagellomere in male, shorter and sparser in female; labial palpus long, about 3.0 times horizontal diameter of compound eye in male, about 5.0 times diameter of compound eye in female (plate 4, figures 5, 6); proboscis rudimentary; ocellus conspicuous. Forewing (plate 1, figure 1) costal fold absent in male; raised scales in transverse bands in median and basal areas in female, primarily in basal portion in male; R4 and R₅ stalked. Hindwing with well-developed cubital hair pecten in both sexes. Abdomen lacking dorsal pits; female with moderately enlarged corethrogyne scaling; integument heavily sclerotized dorsally and ventrally, finely punctuate representing sockets of scales. Male genitalia (plate 19, figure 6) with uncus large, broadened basally; socii relatively short, secondary arms enlarged distally into broad, paddlelike, setose clubs; transtilla comparatively short, densely spined; valva long, rectangular, simple. Aedeagus long, arched; vesica lacking cornuti (17 preparations examined). Female genitalia (plate 33, figure 1) with relatively short apophyses; sterigma an evenly sclerotized plate; ductus bursae broad, without colliculum, gradually widening into weakly differentiated corpus bursae; corpus bursae without scobination; signum a small horn from a small, rounded, sclerotized patch. Sexual dimorphism is expressed in the elongate antennal sensillae of the male, the modified scaling on sternum VIII in the female, the overall forewing pattern and coloration, and the enormous abdomen of the functionally flightless female.

Synnoma lynosyrana Walsingham, 1879 PL. F, FIGS. 36–43 (adult); PL. 1, FIG. 1 (venation); PL. 4, FIGS. 5, 6 (palpi); PL. 19, FIG. 6 (\eth gen.); PL. 33, FIG. 1 (\updownarrow gen.); MAP 75 (RWH 3746).

Synnoma lynosyrana Walsingham, 1879, Illustrations of Typical Specimens of Lepidoptera Heterocera in the Collection of the British Museum, 4: 24.

Type locality: Siskiyou County, California. [BMNH]

NOTE—Synnoma lynosyrana was described from five male and two female syntypes in The Natural History Museum. Although a male is labelled "lectotype," we were unable to find a published designation.

Synnoma linosyrana Fernald, 1882, Transactions of the American Entomological Society, **10**: 19. EMENDATION.

NOTE—The host genus of *Synnoma* (i.e., *Linosyris*) was misspelled as *Lynosyris* by Walsingham (1879), hence, the specific epithet reflects this misspelling. Fernald (1882) recognized the misspelling and proposed the corrected name "*linosyrana*," consistent with the correct spelling of the plant genus. Current authors do not recognize this as a justified emendation.

The most distinctive and conspicuous feature of S. lynosyrana is the profusely scaled head and thorax (including legs), clothed in dense, short, black scales and long, straight white scales. Males have a forewing length of 8.0–10.0 mm (mean = 9.3 mm; n = 10) and females 7.0–10.0 mm (mean = 9.3 mm; n = 10). Males have an ocherous and paleorange forewing, speckled with groups of black scales, with two irregular, oblique, diffuse, silverywhite fasciae, one in the basal 1/3, the other just beyond the middle of the wing; the hindwing ranges from dark gray brown in northern populations to off-white in southern California. In females the forewing typically is darker, with dark-gray and pale-orange scales, and bears transverse bands of raised black scales; the hindwing has variable brown overscaling.

The male genitalia (plate 19, figure 6) are characterized by a large uncus that is extremely broad basally and narrower in the distal ½; relatively short socii, with the secondary arms enlarged distally into broad, paddlelike, setose clubs; a short, densely spined transtilla, rounded in the middle; and simple, long, parallel-sided valvae. Female genitalia (plate 33, figure 1) have relatively short, thick apophyses; an evenly sclerotized, broad, platelike, weakly bilobed sterigma, with a depressed area surrounding the ostium bursae; a broad ductus bursae, without a colliculum, that

widens gradually into a weakly differentiated corpus bursae; and a signum in the form of a short horn from a small, rounded, sclerotized patch.

MacKay (1962) provided a detailed description of the larva and an illustration of its chaetotaxy. The last instar is about 25 mm in length, slender, with a prognathous head and minute spinules. The head is 1.66-1.89 mm by 1.56-1.76 mm, brown, with a somewhat darker stemmatal region; the stemmata are all about the same size, large and distinct; and P1 is usually closer to P2 than to Adf2. The prothoracic shield is pale to dark brown; the D and SD pinacula on T2 and T3 are not, or only slightly elongated posteriorly, with some brownish pigment; and the spiracle on T1 is circular. The SV group on A1,2,7,8,9 is 3:3:3:2:2, with some variability on A9; SD1 seta on A8 is anterodorsad of the spiracle; the V setae on A9 are about 1.5 times farther apart than those on A8 and as far apart or farther apart than those on A7; the D2 setae on A8 are usually slightly closer together than the D1 setae; the crochets are variably biordinal or partially triordinal, 46-49 on the abdominal prolegs, 31–36 on the anal proleg. The anal shield is pale, more rounded than tapered posteriad; the D1 setae usually are closer together than the L1 setae and almost in a straight line with the SD1 setae; the anal setae are longer than the anal segment, and all about the same length; the anal comb is poorly developed.

The pupa is typically tortricine, without an apical projection from the head or hooked process from the cremaster. The wings reach the posterior edge of A3 in females, slightly beyond in males; and the spiracles are small. There are two distinct rows of spines dorsally on A2–A9; the posterior row has smaller teeth. The male has two distinct raised gonopores; the female has a raised pore and a longitudinal slit. The cremaster is well developed, square, blunt distally, with four pairs of very short, hook-tipped, spinelike setae.

Females of *S. lynosyrana* deposit eggs in elongate, overlapping clusters along the twigs of the host plant, usually about 4–5 cm below the flower head. In the laboratory, clusters ranged from 8 to 116 eggs. The female covers each egg with a black colleterial substance, unlike any other known member of the Tortricinae (Powell 1976a, 1985). The eggs either diapause or enter a

temperature regulated quiescence, probably until early spring. In the laboratory, eggs began to hatch in 36-40 days, which is considerably longer than for most Tortricinae. Larvae feed colonially from tough silken tubelike webs on the food plants, which include Chrysothamnus (i.e., C. sphaerospermum and C. viscidiflorus (Hooker) Nuttall)), Gutierrezia (i.e., G. sarothrae (Pursh) Britton & Rusby), and Ericameria (i.e., E. linearifolia (de Candolle) Urbatsch & Wussow and E. nauseosa (Pall. ex Pursh) G. L. Nesom & G. I. Baird) (all Asteraceae). Synnoma lynosyrana has one annual brood, with adults emerging from September to December. Walsingham (1879) collected larvae in early September that produced adults in October of the same year. We found larvae from June to September, which yielded adults in October, and we observed the males flying at midday in early November (Powell 1976a). During a two-year survey (1987-1988) in New Mexico, Richman et al. (1992) reported no adults until the first week of November.

In contrast to nearly all other Nearctic Tortricinae, the moths are diurnal, and females are flightless. Adults possess a rudimentary tongue and apparently do not feed; in the laboratory they lived 5–9 days (Powell 1976a). Richman et al. (1992) indicate that S. lynosyrana (along with Synalocha gutierreziae) can be numerous under certain circumstances in rangelands infested with snakeweed (Gutierrezia sp.), with populations fluctuating widely from year to year. Larval feeding apparently has little direct effect on plant mortality. Richman et al. (1992) reported that about 10% of field-collected pupae were parasitized, mostly by Glypta albitibia Dasch (Hymenoptera: Ichneumonidae). Powell (1976a) indicated that moths are rarely observed in the field, in part owing to their late seasonal occurrence and in part to their diurnal behavior, which precludes attraction to light. As a result, most specimens in collections were reared from field-collected larvae.

Synnoma lynosyrana was described from northern California and is known to occur widely in the arid regions (i.e., Great Basin and Mojave Desert) of the western United States. It has been found in sagebrush habitats from central Oregon, east to western Montana and south throughout the southwest to New Mexico and Texas (map 75). In the southern portion of its range, it appears always

to be associated with *Gutierrezia* species, even in the presence of *Chrysothamnus* or *Ericameria*; and in the North the reverse is true (Powell 1976a). [Specimens examined: 193 δ , 78 \circ , 25 slides]

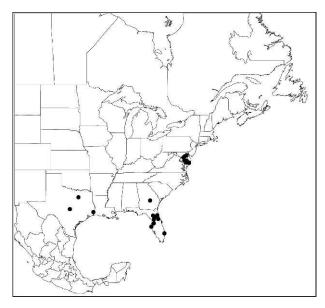
GENUS

Niasoma Busck

Niasoma Busck, 1940, Bulletin of the Southern California Academy of Sciences, 39: 95. Type species: Platynota metallicana Walsingham, 1895, by monotypy.

Niasoma is a poorly known, monotypic genus occurring in the southeastern United States. Both sexes have extremely elongate, slender labial palpi and dense clumps of raised scales on the forewing. Although the latter give adults a shaggy appearance similar to that Synnoma, Niasoma adults are more similar to species of Platynota in forewing color, pattern, and size. The genitalia are extremely divergent from other sparganothines, with a broad, thick uncus; short, digitate socii; and a pair of long, strong, curved, finely dentate processes from the base of the transtilla, reminiscent of some genera in Euliini (e.g., Paraptila Meyrick). Female genitalia are moderately divergent from other sparganothines, with the ductus bursae not clearly differentiated from the corpus bursae, and with a hollow, horn-shaped signum. On the basis of external characters, including wing venation, Walsingham (1895) and Busck (1940) considered Niasoma a sparganothine. However, on the basis of the highly modified genitalia, Niasoma was excluded from Sparganothini by Lambert (1950) and was considered by Obraztsov (unpublished) to represent a monobasic tribe, Niasomini; the latter treatment was validated by Powell (1983b). Subsequent studies by Powell (1985) revealed a close relationship among Niasoma, Synnoma, Synalocha, and Syllonoma and demonstrated that these four monotypic genera should be placed in Sparganothini. The flared aedeagus with one or more external spurs and the highly reduced socii suggest a close relationship between Synalocha and Niasoma.

Structural characters of the genus are as follows: antennal scaling in one band per flagellomere, antennal sensillae length about 2.0 times width of flagellomere in male, shorter and sparser in female;



MAP 76. DISTRIBUTION OF MATERIAL EXAMINED OF NIASOMA METALLICANA

labial palpus extremely elongate, segment II about 4.0 times diameter of compound eye, without sexual dimorphism (plate 4, figures 7, 8); proboscis small, possibly non-functional; ocellus large. Forewing (plate 1, figure 4) costal fold absent in male; rows of raised scales in transverse pattern; R₄ and R₅ stalked. Hindwing with cubital hair pecten well developed in both sexes. Abdomen lacking dorsal pits. Male genitalia (plate 20, figure 1) with uncus large, thick, keeled ventrally, weakly attenuate apically; socius short, digitate, sparsely setose; gnathos absent; transtilla slender in middle, with a large, weakly dentate, curved basal process; valva simple, rounded and somewhat membranous apically; costa arched, weakly sclerotized; sacculus well defined, confined to venter of valva, ending in free, rounded, densely spined tip. Aedeagus simple, stout, weakly curved in distal ½, flaring at tip, with 4-7 small teeth along one side in distal 1/4; vesica with small patch of four short, needlelike, deciduous cornuti. Female genitalia (plate 33, figure 2) with papillae anales simple; sterigma a broad, weakly sclerotized band, with a pair of large, subtriangular processes dorsomedially; area posteriad of antrum well sclerotized, with shallow, rounded V-shaped depression posteriorly; ductus bursae moderately long, uniform in width; corpus bursae a rounded sack; signum a small, attenuate, curved, hollow horn.

Niasoma metallicana (Walsingham)
PL. F, FIGS. 31–35 (adult); PL. 1, FIG. 4 (venation); PL. 4, FIGS. 7, 8 (palpi); PL. 20, FIG. 1 (♂ gen.); PL. 33, FIG. 2 (♀ gen.); MAP 76 (RWH 3694).

Platynota metallicana Walsingham, 1895, Transactions of the Entomological Society of London, 1895: 497.

Type locality: Florida. [BMNH]

NOTE—*Platynota metallicana* was described from 3 males and 1 female syntype. Although a specimen in The Natural History Museum is labeled "lectotype," we were unable to find its published designation.

Niasoma metallicana; Busck, 1940, Bulletin of the Southern California Academy of Sciences, 39: 95. COMBINATION.

Niasoma metallicana is superficially similar to some species of *Platynota* in coloration and size, but it is unique in maculation and in the darkorange hindwings. Walsingham (1895) remarked that "It is difficult to describe in words the rich colour combinations of metallic effects which distinguish this very beautiful and remarkable species. . ." The genitalia of neither the male nor female are similar to those of any other sparganothine. The thick vestiture of the body and the rows of raised scales on the forewings give it a shaggy appearance similar to that of Synnoma (Powell 1985). Forewing length ranges from 7.0-8.0 mm (mean = 7.4 mm; n = 10) in males and 8.0-9.5 mm(mean = 9.1 mm; n = 8) in females. Males of N. metallicana lack a forewing costal fold. Newly emerged specimens have highly exaggerated bunches or tufts of erect pale orange-yellow scales up to 1.5 mm in length protruding at right angles from the plane of the forewing (plate F, figure 35). In field-collected specimens the erect scales usually are represented by only a trace, most of them having been lost either in flight or handling (Powell 1985).

Larvae are described briefly by Powell (1985). Head with stemmata I, II, and VI smaller than III and IV, and setae P₁ closer to P₂ than in most other sparganothine genera. Mesothorax with the D and SD pinacula elongated posteriorly. Abdomen with SD₁ seta directly anteriad of spiracle on A8, and anal shield triangular posteriorly.

Niasoma metallicana has been reared from Eupatorium capillifolium (Lambert) Small (Asteraceae) in Florida by D. Habeck (Powell 1985), which is consistent with food plants of the other monotypic genera that may form a monophyletic group with Synalocha (i.e., all Asteraceae feeders).

Niasoma metallicana ranges from Florida across the Gulf States to southeastern Texas and north along the Atlantic coast to Maryland (map 76). It may be associated with coastal wetlands, in addition to other habitats. Adults apparently are multivoltine as are many species of Sparganothini in the southeastern United States, with captures ranging from March to October. [Specimens examined: 21 δ , 14 ς , 10 slides]

GENUS

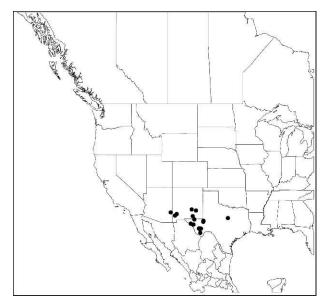
Synalocha Powell

Synalocha Powell, 1985, Journal of Research on the Lepidoptera, **24**: 62.

Type species: *Synalocha gutierreziae* Powell, 1985, by original designation and monotypy.

Adults of *Synalocha* are similar to those of *Platynota* in general facies and size. However, the genitalia of *Synalocha* are unique within the tribe, with reduced socii, a vinculum joined only by a membranous band mesially, a distally flared aedeagus, and an enlarged, sclerotized antrum (Powell 1985). *Synalocha* apparently is closely related to *Syllonoma*, which it resembles in wing venation and male genitalia, particularly the shape of the socii and aedeagus. There were no specimens of *S. gutierreziae* in North American collections prior to 1965, and specimens from Texas in the Meyrick collection at the British Museum had been misidentified as *Synnoma lynosyrana* (Powell 1985).

Structural characters of the genus are as follows: antennal scaling in one band per flagellomere, sensillae about 1.6 times width of flagellomere in male, minute in female; labial palpus moderately long, segment II about 3.0 times horizontal diameter of compound eye (plate 4, figures 9, 10); proboscis short, probably functionless; ocellus well developed. Forewing (plate 1, figure 2) costal fold absent in male; rows of raised scales in transverse pattern; all veins present and separate beyond discal cell, except R₄ and R₅ stalked in basal ½. Hindwing with cubital hair pecten well developed



MAP 77. DISTRIBUTION OF MATERIAL EXAMINED OF SYNALOCHA GUTIERREZIAE

in both sexes; abdomen lacking dorsal pits; female with moderately enlarged corethrogyne scaling. Male genitalia (plate 20, figure 2) with uncus short, tapered, curved, strongly sclerotized; socii buttonlike, flat, oval, setose, unscaled, secondary arms spinulose in distal portion; transtilla moderately broad, serrate, separate from pulvinus; valva simple; sacculus and costa narrowly sclerotized. Aedeagus strongly curved from short phallobase, flared distally, with blunt external spur; vesica with six elongate cornuti. Female genitalia (plate 33, figure 3) with papillae anales narrow, slightly narrowed mesially; sterigma a wide, simple bowl, with deep, enlarged antrum; ductus bursae long, broad, without colliculum, thickened basally and longitudinally with parallel ribs; corpus bursae weakly differentiated from ductus bursae, without scobination; signum a short horn without capitulum. Sexual dimorphism is apparent in the elongate antennal sensillae of the male and larger forewing length of the female.

Synalocha gutierreziae Powell PL. F, Figs. 44–46 (adult); PL. 1, Fig. 2 (venation); PL. 4, Figs. 9, 10 (palpi); PL. 20, Fig. 2 (δ gen.); PL. 33, Fig. 3 (γ gen.); MAP 77

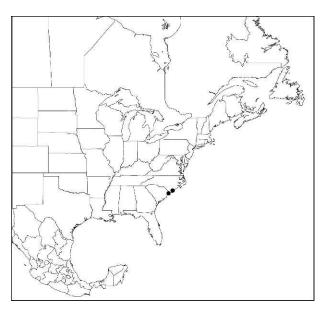
Synalocha gutierreziae Powell, 1985, Journal of Research on the Lepidoptera, 24: 62.

Type locality: 5 miles N Monahans, Ward County, Texas. [EME]

Adults are slightly variable in forewing maculation, usually shining pale tan, with a faint to moderately well-defined pattern of pale reddish brown, emphasized by scattered, slightly raised darker scales; the hindwing is dark gray brown. Forewing length is 6.5–7.9 mm (mean = 7.0 mm; n = 10) in males and 6.5–10.5 mm (mean = 8.4 mm; n = 6) in females. Male (plate 20, figure 2) and female (plate 33, figure 3) genitalia are described above.

Larva. Head: Stemmata I, II, and VI subequal or slightly larger than III-IV; adfrontals narrow basally, broader posteriorly, the sutures sinuate. Thorax: D and SD pinacula on T2 and T3 only slightly elongated posteriorly or not at all; SV group on T2 and T3 unisetose. Abdomen: SV group on A1,2,7,8,9 is 3:3:3:2:2; SD1 seta on A8 directly anteriad of spiracle; L3 seta on A9 sometimes absent; spiracles small, those of A3-7 about 0.04-0.05 mm in diameter, that on A8 about 0.12 mm; crochets variably biordinal, 42-48 on abdominal prolegs, 38-40 on anal proleg. Anal shield distinctly triangular posteriorly, strongly sclerotized laterally; D1 setae anteriad of and about as far apart as each is from its corresponding SD1 seta; anal fork well developed.

Descriptions of early stages by Edwards and Wangberg (1985) were summarized by Powell (1985). Eggs are green, deposited in shinglelike rows forming elongate clusters along the upper surface of the host leaf, and are covered by a whitish colleterial secretion. In the laboratory, the number of eggs ranged from 15 to 429 per mass, with a mean of 112. The egg stage lasts 9 to 12 days. Larvae reared in the laboratory had seven instars, each stage lasting 5.0 to 7.5 days. Larvae conceal themselves by tying leaves together; early instars skeletonize young leaves, and as they develop they begin to consume entire leaves. Like many tortricids, larvae eject the frass away from the shelter. Pupation occurs within a shelter of tied leaves in a cocoon comprised of a thin sheet of silk that lines the pupal chamber; the pupa is illustrated by Edwards and Wangberg (1985). Larvae have been collected in the field on Gutierrezia sarothrae and G. microcephalum (de Candolle) A. Gray (Asteraceae).



MAP 78. DISTRIBUTION OF MATERIAL EXAMINED OF SYLLONOMA LONGIPALPANA

Synalocha gutierreziae has multiple, overlapping generations each year, each of which lasts approximately ten weeks. Larvae have been collected from mid-March to the end of November in Texas, suggesting that there may be three to four generations each year. Development appears to continue as long as environmental conditions remain favorable. Capture records range from May to October. Males have been observed flying throughout the day, usually fluttering just above the host plant; females were never observed in flight. Moths were not observed to fly at night.

Because *Gutierrezia* species, commonly called snakeweeds, are known to be poisonous to livestock (Smith and Flores-Rodriguez 1989), Richman et al. (1992) investigated the potential of *S. gutierreziae* to control these rangeland weed pests. Although they reported that *S. gutierreziae* can be numerous under certain circumstances, it apparently has little effect on plant mortality.

Synalocha gutierreziae is known from central Texas to extreme eastern Arizona (map 77). [Specimens examined: 67 δ , 11 \circ , 6 slides]

GENUS

Syllonoma Powell

Syllonoma Powell, 1985, Journal of Research on the Lepidoptera, **24**: 65.

Type species: *Syllonoma longipalpana* Powell, 1985, by original designation and monotypy.

Syllonoma is a monotypic genus known only from the southeastern United States. The single included species is exceedingly rare in collections. Superficially, adults of Syllonoma longipalpana resemble females of Platynota idaeusalis, but Syllonoma has conspicuously longer labial palpi, which easily distinguish it from all other sparganothines, and males lack a costal fold. Adults of Syllonoma are also similar to Synalocha. The male genitalia of Syllonoma are distinguished from all other sparganothine genera by the broad, deeply cleft uncus, extremely reduced socii, and the large flaplike transtilla (Powell 1985).

Structural characters of the genus are as follows: antennal scaling in one band per segment, sensillae about 1.0 times width of flagellomere in dense whorls from ventral half of segment in male, shorter and sparser in female; labial palpus extremely elongate, porrect, segment II about 4.0 times the horizontal diameter of the compound eye; proboscis well developed; ocellus large. Forewing (plate 1, figure 3) costal fold absent in male; rows of raised scales in transverse pattern. Hindwing with cubital hair pecten well developed in both sexes. Abdomen lacking dorsal pits; female lacking enlarged corethrogyne scaling. Male genitalia (plate 20, figure 3) with uncus short, broad, curved, deeply cleft apically; socius reduced, with short, curved, distally setose, secondary arms; valva simple, with sclerotized sacculus extending across face to weakly sclerotized costal margin, basal 1/4 sclerotized. Aedeagus evenly curved; vesica with two slender cornuti. Female genitalia (plate 33, figure 4) with papillae anales narrow, slightly enlarged anteriorly; sterigma a shallow V-shaped ridge, sclerotized anteriorly to antrum, subtended by a second, external V-shaped ridge; antrum enlarged but not sclerotized; ductus bursae membranous, gradually widened anteriorly; corpus bursae well differentiated from ductus bursae; signum a single invaginated slender horn. Sexual dimorphism is apparent in the elongate antennal sensillae in the male and in the larger forewing length and slightly darker forewing pattern elements in the female.

Syllonoma longipalpana Powell PL. F, Fig. 47 (adult); PL. 1, Fig. 3 (venation); PL. 20, Fig. 3 (δ gen.); PL. 33, Fig. 4 (\circ gen.); MAP 78

Syllonoma longipalpana Powell, 1985, Journal of Research on the Lepidoptera, 24: 65. Type locality: Myrtle Beach, Horry County, South Carolina. [MCZ]

Adults have an ocherous forewing with scattered brown scales and three broad, dark-brown, transverse fasciae: one at the base, one from the costa outwardly angled to the dorsal margin before the tornus, and one subapically toward the termen above the tornus: the latter two are less distinct and coalesce toward the tornal area. In the male the forewing ground color is dark to bright ocherous tan with raised scale tufts and a slender line of brown scales along the termen just inside the fringe. In the female and in worn males the forewing ground color is darker brown with the transverse fasciae only weakly distinguishable. In both sexes the hindwing is pale brownish tan. Forewing length is 6.4 mm in males (n = 3) and 7.3-7.6 mm (n = 2) in females.

The early stages and food plant are unknown; the species likely is an Asteraceae-feeder. Specimens have been collected from June to early September.

Syllonoma longipalpana is a rarely collected species, known from only seven specimens taken in North and South Carolina (map 78). The three known localities are situated along 140 km of coastal wetland and beach habitat. [Specimens examined: $5 \, \delta$, $2 \, \varphi$, $5 \, \text{slides}$]

TRIBE

Atteriini Busck, 1932

Type genus: Atteria Walker, 1863b

Atteriidae Busck, 1932

Atteriini Powell, 1964a

Anacrusina Diakonoff, 1961, subtribe

Type genus: Anacrusis Zeller, 1877

Atteriini are one of the smallest and most well defined of the ten tribes that comprise Tortricinae. It includes 39 described species in eight genera (Powell et al. 1995), and there are numerous undescribed species and genera in collections. Its monophyly is supported convincingly by both morphological and biological characters (Powell 1986, Horak 1998). Definition of the tribe was obscured historically by the association of several genera with convergent forewing patterns (i.e., Atteria, Cerace Walker, Idolatteria Walsingham, Pseudatteria Walsingham), creating an assemblage of unrelated, presumably mimetic forms that now are included in four tribes (i.e., Atteriini, Archipini, Ceracini, and Polyorthini). Atteriini occur nearly exclusively in the New World tropics, with one species ranging north to the mountains of southern Arizona. The tribe includes some of the largest tortricid moths, with forewing lengths up to 22 mm. Most species are strongly dimorphic sexually: females are usually conspicuously larger and have large patches of highly modified corythrogyne scales on the venter of abdominal segments VI and VII; males have elongate antennal sensillae and sometimes a foreleg hairpencil (J. Brown 1990).

LIFE HISTORY. Although no details of the early stages have been published, Powell (1976b) described the oviposition pattern of *Templemania* Busck and has reared species of several genera on synthetic diet, suggesting that larvae are polyphagous (Horak 1998). Host records of species of *Anacrusis* Zeller in Costa Rica (Janzen and Hallwachs 2010) encompass several plant families, including Araliaceae, Combretaceae, Malvaceae, Piperaceae, and Rutaceae, providing additional evidence of polyphagy. Adults of most species are nocturnal and attracted to lights although adults of *Atteria* are diurnal, slow-flying in sunshine, with a bright forewing color and pattern, presumed to be mimetic with *Pseudatteria* (Polyorthini).

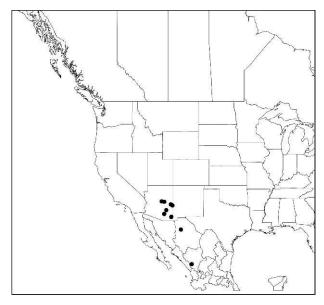
DESCRIPTION AND CHARACTERS. Most species are comparatively large and exhibit dramatic sexual dimorphism; the forewing costa, especially in the female, is strongly sinuate as in some Archipini (e.g., *Archips purpurana* (Clemens)). When at rest, the wings are held somewhat flattened-rooflike over the abdomen, giving a bell-shaped silhouette.

Head: Compound eyes well developed, naked, with elongate scales around dorso-posterior margin. Ocellus well developed or reduced. Scaling on frons appressed or roughened above middle, without hood. Antenna in male somewhat squaretoothed with long sensillae, fasciculate to bipectinate, with scaling in one or two rows per flagellomere; sensillae shorter and sparser in female. Labial palpus 1.0–2.0 times horizontal diameter of compound eye, rather slender, ascending, weakly curved. Maxillary palpus very small, not visible on whole specimen. Chaetosemata well developed.

Thorax: Forewing without raised scale tufts; costal fold absent in male. Forewing broad, length 2.4–2.6 times width, frequently with sinuate costa; length of discal cell ½– $\frac{1}{2}$ times length of forewing; R_3 separate from the stalked $R_4 + R_5$; R_4 to costa, R_5 to termen; M_3 and CuP separate. Hindwing without cubital pecten; ten veins present (including CuP), humeral vein absent; base of Rs fused with R_1 . Frenulum with one acanthus in male, three acanthae in female.

Abdomen: Dorsal pits absent. Female with elaborate, differentiated corythrogyne scaling on S6 and 7. Male genitalia (plate 20, figure 4) with uncus well developed, strongly sclerotized, without ventral tuft of setae; saccus not differentiated; socius large, densely scaled, not produced posteriorly beyond attachment, not fused to gnathos; gnathos arms strongly sclerotized, smooth, joined distally; transtilla a well-developed, complete, lateral band, not joined to pulvinus; valva simple, large, costal and saccular margins nearly parallel, rounded apically, not plicate, pulvinus usually absent, costa narrowly sclerotized or undifferentiated; sacculus variable, usually simple. Aedeagus without external spurs, pistol shaped, slightly to strongly bent; vesica with few, slender, deciduous cornuti attached laterally to vesica near their base. Female genitalia (plate 33, figure 5) with papillae anales broad, comparatively well sclerotized, with simple, undifferentiated setae; sterigma a simple broad band; ductus bursae narrow, well differentiated from corpus bursae; corpus bursae large, globose, without accessory pouch; signum a large, hollow keel projecting inwardly, without capitulum.

IMMATURE STAGES. The eggs are flattened, scalelike, and elliptical in outline, 0.9–1.5 mm in



MAP 79. DISTRIBUTION OF MATERIAL EXAMINED OF TINACRUCIS NOROESTA

diameter. They are moderately convex, slightly iridescent, and finely reticulated, laid in an imbricate, overlapping pattern in large patches, presumably a trait that is homologous with that of Archipini and Sparganothini. Females possess enormous patches of specialized corythrogyne scales covering the venter of A7 and A8. Those on A7 are long, slender, dark, velvety appearing scales; they are spread over the egg mass and its periphery. Those on A8 are thicker and brownish black and curved at the tips; they are glued to the substrate in a series of upright clumps that surround the egg mass. Most atteriines are nocturnal, but Atteria species are diurnal, evidently specific batesian mimics of Pseudatteria, although their unpalatability remains untested. Embryonic development proceeds without a quiescent period or diapause. Development to hatching occurs in 9-10 days at ambient temperature.

Larvae are typically tortricine with a trisetose L-group on the prothorax; setae L2 and L1 on the same pinaculum and below the spiracle on A1–A8; tiny SD2 on same pinaculum as the large SD1 above the spiracle on A1–A7; SD1 anteriad or slightly dorsoanteriad of spiracle on A8; D2 setae on the same pinaculum on A9; SD1 and D2 on separate pinacula on A9; SV-group on A1, 2, 7, 8, 9 is 3:3:3:2:2; and distance between V setae on A9

greater (1.5–2.0 times) than on A8. Crochets are bito triordinal, and an anal fork is always present.

Pupae are typically tortricine, without an apical projection from the head. The wings reach the anterior or middle portion of A4, and the spiracles are small. There are two rows of spines dorsally on A2–A9; the posterior row on each segment is weaker but usually consists of more spines. The cremaster is long, cylindrical, distally rounded, with four pairs of long, hooked setae.

GENUS

Tinacrucis Powell

Tinacrucis Powell, 1986, Pan-Pacific Entomologist, **62**: 386.

Type species: *Homona aquila* Busck, 1914, by original designation.

Tinacrucis was described by Powell (1986) for five Central American species originally described in Tortrix Linnaeus and Homona Walker (Powell, 1986; Brown, 2005). Although species of Tinacrucis are superficially very similar to those of Tina Powell, they may be most closely related to Anacrusis Zeller. Tinacrucis is distinguished by its greatly enlarged eighth abdominal segment in the male, which forms a dorsal hood over the genitalia, and by lacking a well-defined sacculus. The sinuate costa of the forewing is similar in both sexes, in contrast to the condition in Anacrusis. Both genera possess remarkably dimorphic forewing patterns and elaborate antennal sensillae in the male.

Structural characters of Tinacrucis are as follows: antennal scaling in two rows per flagellomere, setae in dense whorls, 1.0-2.5 times width of flagellomere in male, shorter and sparser in female; scaling on frons simple; labial palpus short, upturned, thickly scaled, segment II slightly enlarged distally, segment III small, about 1/4 as long as II, nearly concealed by scaling of II; proboscis developed, presumably functional; ocellus absent in most species. Forewing length 10-22 mm; costa weakly to strongly sinuate; costal fold absent in male; upraised scales absent. Hindwing with cubital pecten absent in both sexes. Abdomen lacking dorsal pits; female with enlarged corethrogyne scaling; male segment VIII enlarged forming dorsal hood over genitalia. Male genitalia with uncus narrow, slightly to greatly enlarged apically,

with ventral setae; socius large, triangular, with broad scales and finer setae; gnathos well developed with elongate apex: transtilla narrow with a pair of dentate projections near middle, valva broad, curved posteriorly; pulvinus absent. Aedeagus slender, without external spines or spurs; vesica with 14-16 spinelike cornuti, attached laterally near base to vesica. Female genitalia with sterigma a shallow bowl with large lateral lobes; ductus bursae slender, not coiled; corpus bursae oblong, signum usually a scobinate patch preceded anteriorly by a small blind pouch. Sexual dimorphism extreme: most females have longer and broader forewings than males; forewing pattern differs markedly; males have elaborate antennal sensillae; and females have specialized corythrogyne scaling.

Tinacrucis noroesta Powell PL. F, FIGS. 48–50 (adult); PL. 1, FIG. 3 (venation); PL. 20, FIG. 4 (\eth gen.); PL. 33, FIG. 5 (\updownarrow gen.); MAP 79

Tinacrucis noroesta Powell, 2009, Journal of the Lepidopterists' Society, 63: 27.

Type: Summerhaven, 7,800′, Santa Catalina Mountains, Pima County, Arizona. [EME]

On the basis of forewing length (male 14.7–16.3 mm; n = 25, female 17.0–19.7 mm; n = 6), this is the largest tortricine moth in America north of Mexico. Males have a relatively narrow forewing with a sinuate costa, pale beige to yellowish reticulated with rust lines and irregularly mottled with rust brown. Females are larger with broader wings, pale chocolate to rust brown with faint darker and white banding in costal area when fresh and have huge masses of modified scales on S7 and 8. The male (plate 20, figure 4) and female (plate 33, figure 5) genitalia are distinct from those of all other North American tortricids. Those of the male can be distinguished by the combination of the apically lobed uncus, the unusual scaled and setose socius, the bilobed, mesially spined transtilla, the lateral attachment of the cornuti to the vesica, and the parallel-sided valva. Those of the female can be distinguished by the combination of the bilobed sterigma and the hollow, elongate cone-shaped signum.

Nearly all records are from July or August, with one specimen taken in June (Durango, Mexico)

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MONOCHROME PLATES

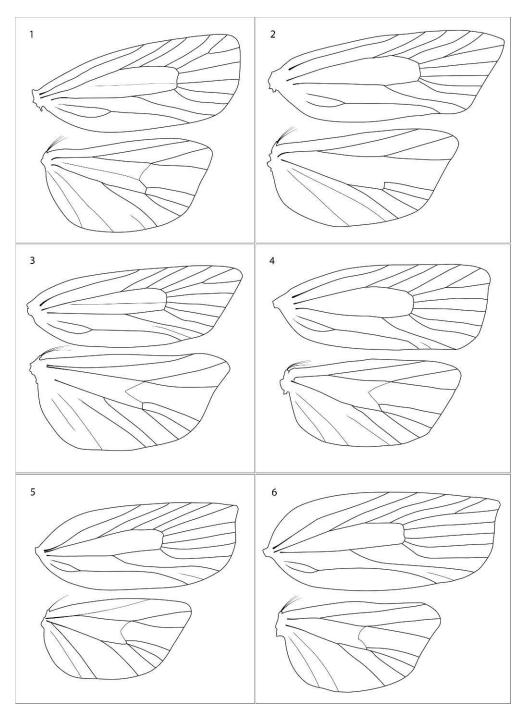


PLATE 1. WING VENATION

1. Synnoma lynosyrana (female). (p. 141). 2. Synalocha gutierreziae (female). (p. 144). 3. Syllonoma longipalpana (female). (p. 147). 4. Niasoma metallicana (female). (p. 144). 5. Amorbia humerosana (male). (p. 32). 6. A. humerosana (female).

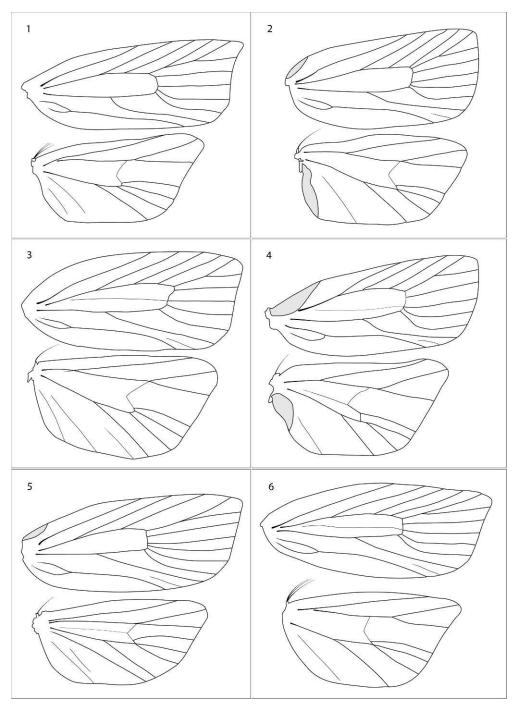


PLATE 2. WING VENATION

1. Coelostathma discopuntana (female). (p. 37). 2. Cenopis pettitana (male). (p. 94). 3. Sparganothis xanthoides (male). (p. 71). 4. Platynota idaeusalis (male). (p. 118). 5. Sparganothoides lentiginosana (male). (p. 48). 6. Sparganopseustis martinana (female). (p. 42).

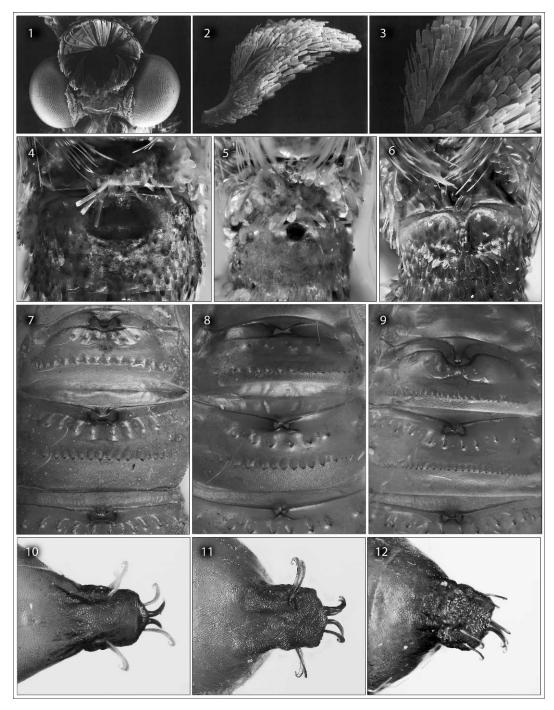


PLATE 3. MORPHOLOGICAL FEATURES OF ADULTS AND PUPAE

1. Complex scaling of head of male *Platynota idaeusalis*, labial palpi removed. (p. 118). 2. Labial palpus of male *Platynota idaeusalis*. 3. Close-up of unscaled region of labial palpus of male *Platynota idaeusalis*. 4. Dorsal pit of second abdominal segment of *Amorbia humerosana*. (p. 32). 5. Dorsal pit of second abdominal segment of *Coelostathma discopunctana*. (p. 37). 6. Subdorsal pits of second abdominal segment of *Sparganopseustis martinana*. (p. 42). 7. Dorsal pits of pupa (segments 2–4) of *Amorbia humerosana*. 8. Dorsal pits of pupa (segments 2–4) of *Amorbia emigratella*. (p. 34). 9. Dorsal pits of pupa (segments 2–4) of *Amorbia vero*. (p. 35). 10. Pupal cremaster *Platynota idaeusalis*. 11. Pupal cremaster of *Platynota flavedana*. (p. 130). 12. Pupal cremaster of *Platynota stultana*. (p. 136).

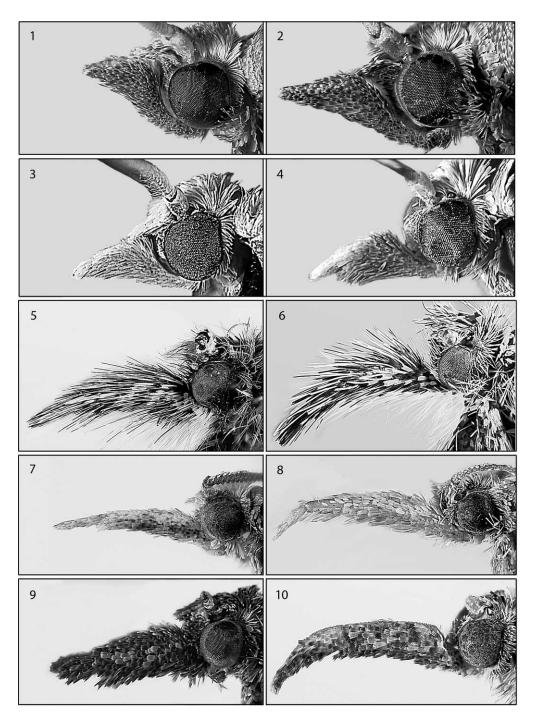


PLATE 4. LABIAL PALPI

1. Amorbia humerosana, male. (p. 32). 2. Amorbia humerosana, female. 3. Coelostathma discopunctana, male. (p. 37). 4. Coelostathma discopunctana, female. 5. Synnoma lynosyrana, male. (p. 141). 6. Synnoma lynosyrana, female. 7. Niasoma metallicana, male. (p. 144). 8. Niasoma metallicana, female. 9. Synalocha gutierreziae, male. (p. 145). 10. Synalocha gutierreziae, female.

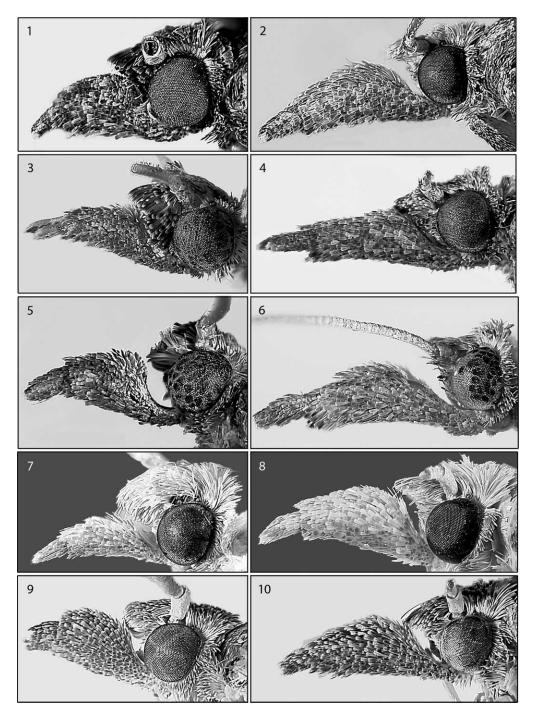


PLATE 5. LABIAL PALPI

1. Platynota idaeusalis, male. (p. 118). 2. Platynota idaeusalis, female. 3. Platynota wenzelana, male. (p. 123). 4. Platynota wenzelana, female. 5. Platynota rostrana, male. (p. 122). 6. Platynota rostrana, female. 7. Cenopis reticulatana, male. (p. 98). 8. Cenopis reticulatana, female. 9. Cenopis diluticostana, male. (p. 102). 10. Cenopis diluticostana, female.

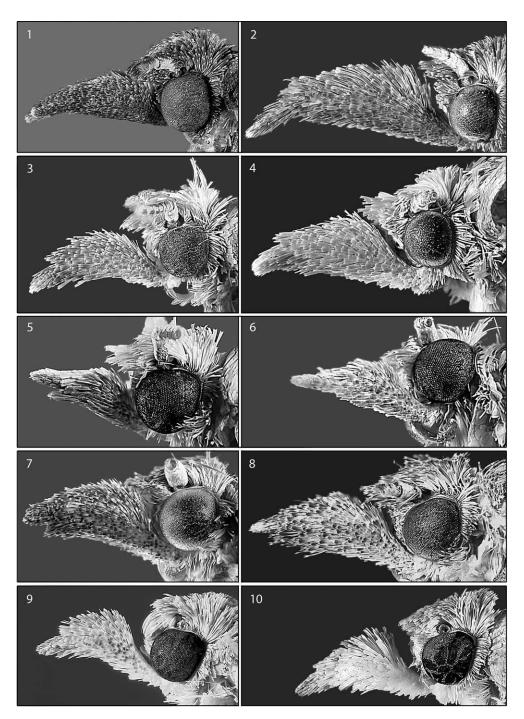


PLATE 6. LABIAL PALPI

1. Sparganothis xanthoides, male. (p. 71). 2. Sparganothis xanthoides, female. 3. Sparganothis senecionana, male. (p. 81). 4. Sparganothis senecionana, female. 5. Sparganothoides lentiginosana, male. (p. 48). 6. Sparganothoides lentiginosana female. 7. Sparganothoides machimiana, male. (p. 47). 8. Sparganothoides machimiana, female. 9. Sparganopseustis martinana, male. (p. 42). 10. Sparganopseustis martinana, female.

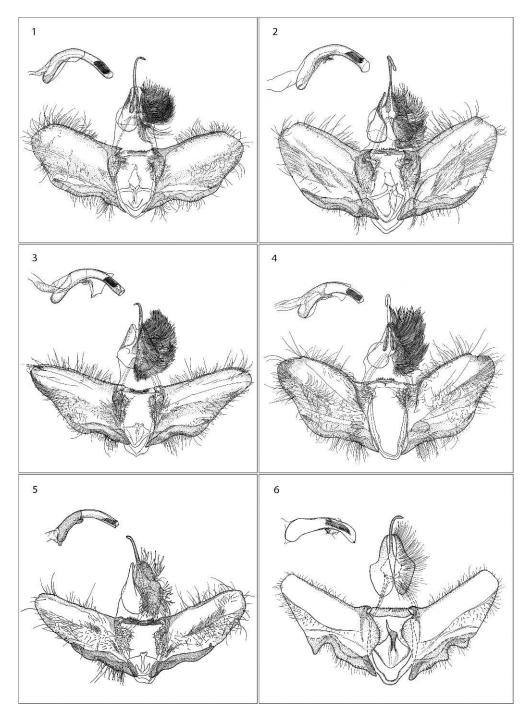


PLATE 7. MALE GENITALIA

1. Amorbia cuneana (Walsingham), Miramar, San Diego Co., California; USNM 92,703. (p. 29). 2. Amorbia synneurana Barnes and Busck, Madera Canyon, Santa Rita Mts., Santa Cruz Co., Arizona; USNM 92,723. (p. 31). 3. Amorbia humerosana Clemens, Montgomery Co., Maryland; USNM 92,712. (p. 32). 4. Amorbia emigratella Busck, Kaui, Hawaii; USNM 92,717 and 92,750. (p. 34). 5. Amorbia vero Powell and J. Brown, Vero Beach, Indian River Co., Florida; USNM 88,463. (p. 35). 6. Amorbia knudsoni Phillips-Rodriguez and Powell, Green Gulch, Big Bend National Park, Brewster Co., Texas; USNM 95,320. (p. 36).

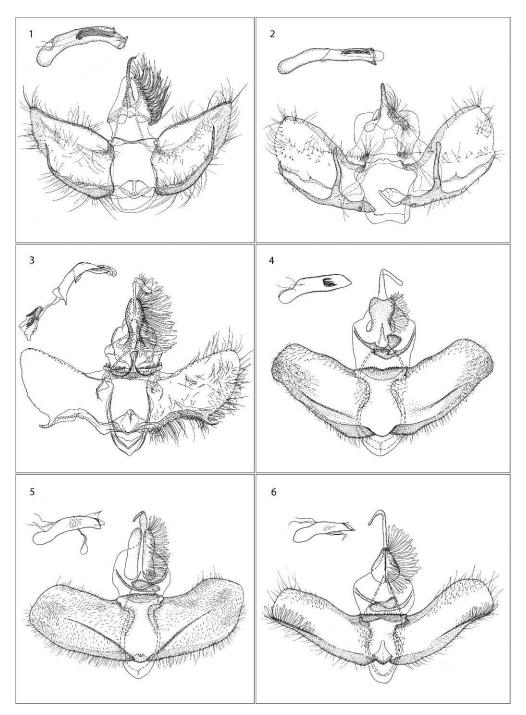


PLATE 8. MALE GENITALIA

Coelostathma discopunctana Clemens, Rutherford neighborhood, Fairfax Co., Virginia; JAP 5,817; and Plummers I., Montgomery Co., Maryland; USNM 27,341. (p. 37).
 Coelostathma placidana Powell and J. Brown, Pensacola, Escambia Co., Florida; USNM 88,299. (p. 40).
 Sparganopseustis martinana Powell, reproduced from Powell (1986). (p. 42).
 Sparganothoides hydeana (Klots), Little Tesuque Cañon, vic.
 Santa Fe, Santa Fe Co., New Mexico; USNM 88,474. (p. 45).
 Sparganothoides machimiana (Barnes and Busck), Paradise, Cochise Co., Arizona; USNM 88,479. (p. 47).
 Sparganothoides lentiginosana (Walsingham), Kerrville, Kerr Co., Texas; USNM 88,301. (p. 48).

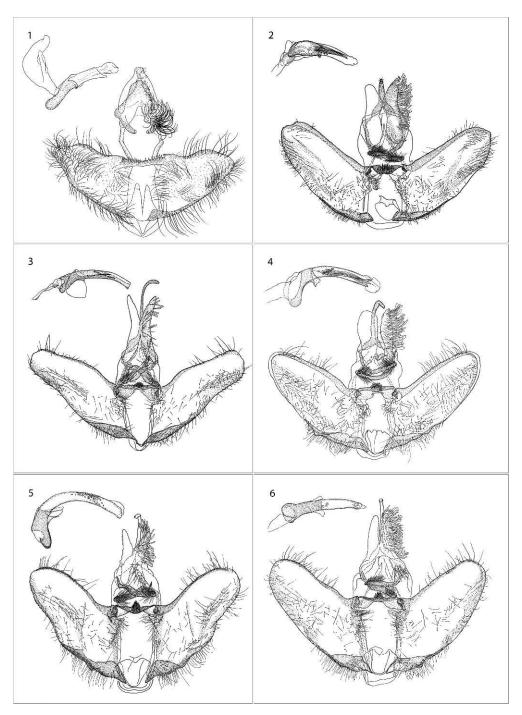


PLATE 9. MALE GENITALIA

1. Amorbimorpha mackayiana Kruse, Big Bend National Park, Brewster Co., Texas; USNM 118,839. (p. 50). 2. Sparganothis caryae (Robinson), Lake Placid, Archbold Biological Station, Highlands Co., Florida; USNM 94,083. (p. 55). 3. Sparganothis tessellata Powell and J. Brown, 5 mi W Miramar Beach, Walton Co., Florida; JAP 3,459. (p. 57). 4. Sparganothis flavibasana (Fernald), Ottawa, Ontario; USNM 94,108. (p. 58). 5. Sparganothis sulfureana (Clemens), Devil's Den State Park, Washington Co., Arkansas; USNM 95,085. (p. 59). 6. Sparganothis lycopodiana (Kearfott), Lincoln, Penobscot Co., Maine; USNM 95,091. (p. 62).

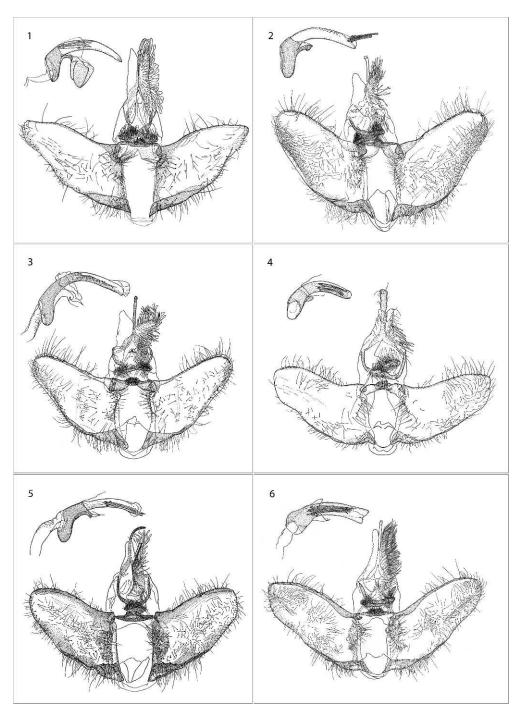


PLATE 10. MALE GENITALIA

1. Sparganothis minimetallica Powell and J. Brown, Big Pine Key, Monroe Co., Florida; JAP 7,751. (p. 63). 2. Sparganothis bistriata Kearfott, St. Petersburg, Pinellas Co., Florida; USNM 88021. (p. 65). 3. Sparganothis tristriata Kearfott, Lakehurst, Ocean Co., New Jersey; USNM 95,116. (p. 66). 4. Sparganothis demissana (Walsingham), Chisos Mountains, Brewster Co., Texas; USNM 94,099. (p. 67). 5. Sparganothis unifasciana (Clemens), Ithaca, Six Mile Creek, Tompkins Co., New York; USNM 82,541. (p. 68). 6. Sparganothis violaceana (Robinson), Sebec Lake, Piscataquis Co., Maine; USNM 95,095. (p. 69).

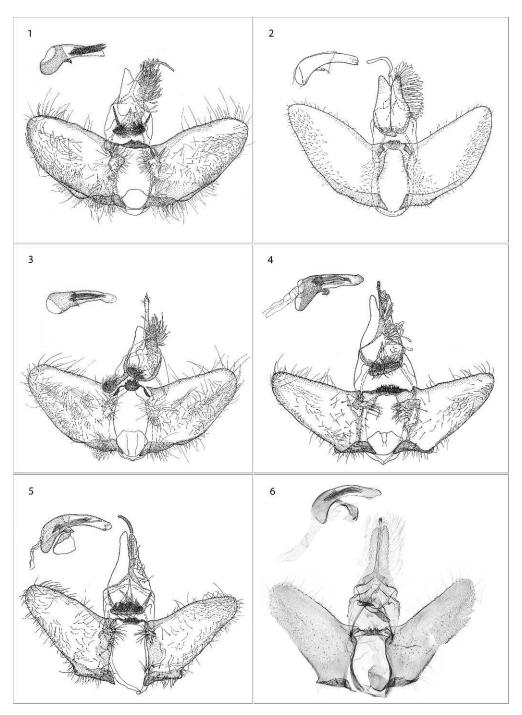


PLATE 11. MALE GENITALIA

1. Sparganothis xanthoides (Walker), Decatur, Macon Co., Illinois; USNM 26,719. (p. 71). 2. Sparganothis boweri Powell and J. Brown, 3.5 mi SW Frazier, Grand Co., Colorado; USNM 126,404. (p. 72). 3. Sparganothis taracana Kearfott, Hastings, St. Johns Co., Florida; USNM 26,707. (p. 74). 4. Sparganothis lindalinea Powell and J. Brown, Gulfport, Harrison Co., Mississippi; JAP 8,739. (p. 75). 5. Sparganothis sullivani Powell and J. Brown, Sebring, Highlands Co., Florida; JAP 7,754. (p. 76). 6. Sparganothis meguinnessi Powell and J. Brown, Mashomak Preserve, Shelter Island, Suffolk Co., New York; USNM 118,588. (p. 77).

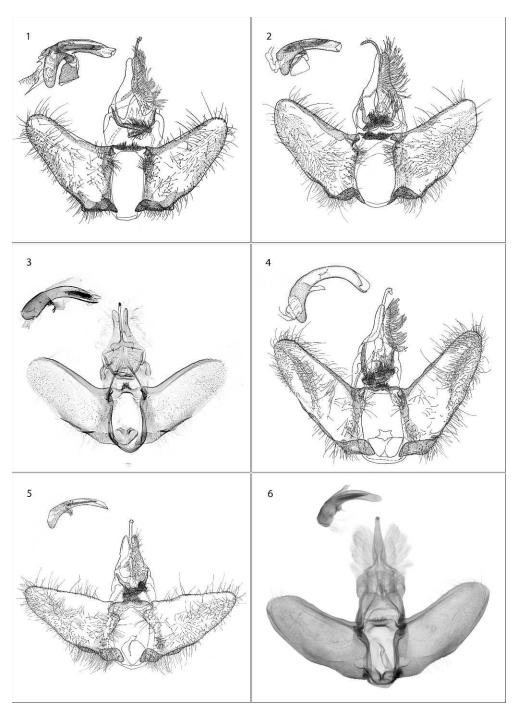


PLATE 12. MALE GENITALIA

1. Sparganothis niteolinea Powell and J. Brown, Lake Placid, Archbold Biological Station, Highlands Co., Florida; JAP 8,356. (p. 78). 2. Sparganothis azulispecca Powell and J. Brown, Bon Secour N.W.R., Baldwin Co., Alabama; JAP 7,800. (p. 80). 3. Sparganothis senecionana (Walsingham), Borderfield St. Park, San Diego Co., California; USNM 142,047. (p. 81). 4. Sparganothis tunicana (Walsingham), Alberton, Mineral Co., Montana; USNM 95,119. (p. 83). 5. Sparganothis vocaridorsana, Kearfott, British Columbia; USNM 26,743. (p. 84). 6. Sparganothis richersi Powell and J. Brown, Greer, White Mts., Apache Co., Arizona; JAP 9570. (p. 85).

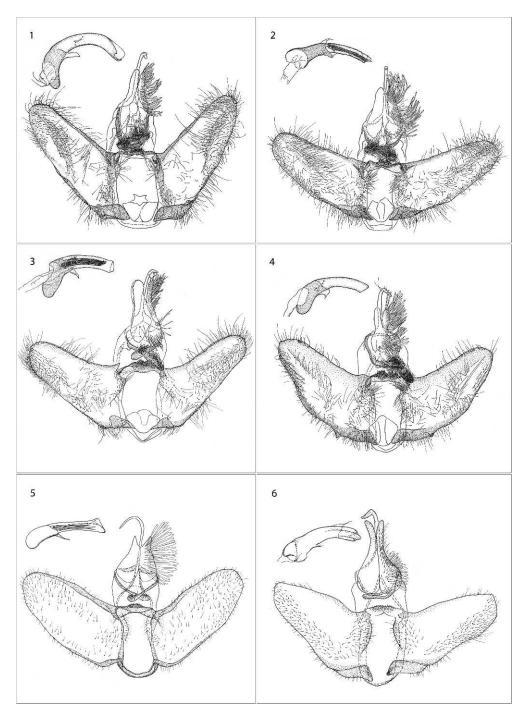


PLATE 13. MALE GENITALIA

1. Sparganothis umbrana Barnes and Busck, Denver, Denver Co., Colorado; USNM 26,753. (p. 86). 2. Sparganothis striata (Walsingham), Snake River, Whitman Co., Washington; USNM 95,101. (p. 87). 3 Sparganothis distincta (Walsingham), Virginia; USNM 26,713. (p. 88). 4. Sparganothis pulcherrimana (Walsingham), Oak Station, Montgomery Co., Pennsylvania; USNM 26,706. (p. 89). 5. Sparganothis rubicundana (Herrich-Schäffer), Geillini Lake [Stone Mts., ca 50 mi W of northwest portion of Denali NP], Alaska; USNM 124,545. (p. 90). 6. Sparganothis praecana, (Kennel), Swim Lakes, Yukon; USNM 95,284. (p. 91).

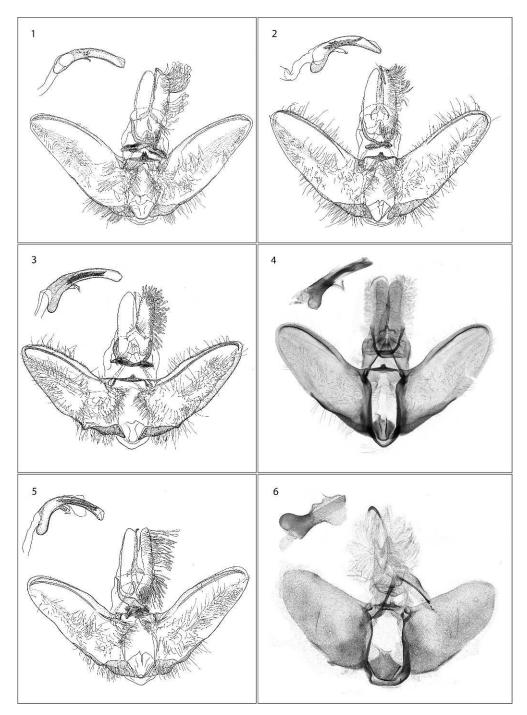


PLATE 14. MALE GENITALIA

1. Cenopis pettitana (Robinson), Ithaca, Six Mile Creek, Tompkins Co., New York; USNM 94,124. (p. 94). 2. Cenopis niveana Walsingham, Ithaca, Tompkins Co., New York; USNM 88,766. (p. 96). 3. Cenopis reticulatana (Clemens), Ithaca, Tompkins Co., New York; USNM 95,059. (p. 98). 4. Cenopis ferreana (Busck), Roxbury, Suffolk Co., Massachusetts; USNM 88,072. (p. 100). 5. Cenopis lamberti (Franclemont), Haywood Landing, Jones Co., North Carolina; USNM 94,119. (p. 100). 6. Cenopis daphnana (McDunnough), White Point Beach, Queens Co., Nova Scotia; USNM 124,943. (p. 101).

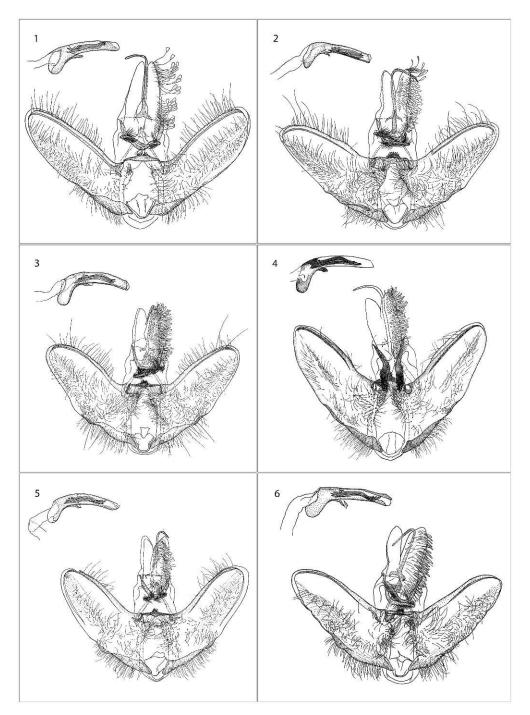


PLATE 15. MALE GENITALIA

1. Cenopis diluticostana Walsingham, Decatur, Macon Co., Illinois; USNM 26,757. (p. 102). 2. Cenopis unicolorana Powell & J. Brown, Bon Secour National Wildlife Reserve, Baldwin Co., Alabama; JWB 1,027. (p. 103). 3. Cenopis directana (Walker), Devil's Den State Park, Washington Co., Arkansas; USNM 88,777. (p. 105). 4. Cenopis saracana Kearfott, Devil's Den State Park, Washington Co., Arkansas; USNM 2,914. (p. 107). 5. Cenopis mesospila Zeller, Ithaca, Tompkins Co., New York; USNM 88,629. (p. 108). 6. Cenopis eulongicosta Powell & J. Brown, Stanton, Hunterdon Co., New Jersey; USNM 88,161. (p. 110).

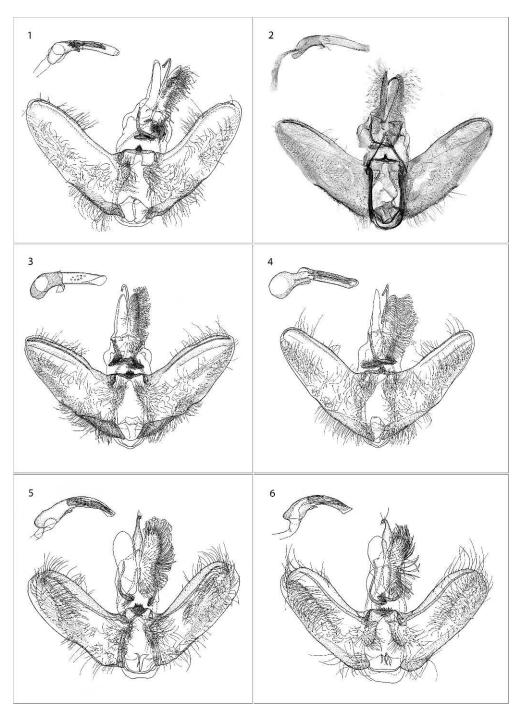


PLATE 16. MALE GENITALIA

1. Cenopis cana Kearfott, Walker Co., Texas; USNM 88,627. (p. 111). 2. Cenopis vabroui Powell and J. Brown, 4.2 mi NE Abita Springs, St. Tammany Par., Louisiana; USNM 118,589. (p. 112). 3. Cenopis karacana Kearfott, Lacy, Ocean Co., New Jersey; USNM 95,077. (p.113). 4. Cenopis chambersana Kearfott, Barry Co., Missouri; USNM 26,064. (p. 114). 5. Platynota idaeusalis (Walker), 1 km E Fairfax City, Fairfax Co., Virginia; USNM 92,714. (p. 118). 6. Platynota exasperatana (Zeller), Devil's Den State Park, Washington Co., Arkansas; USNM 27,348; and Beaufort, Carteret Co., North Carolina; USNM 92,769. (p. 120).

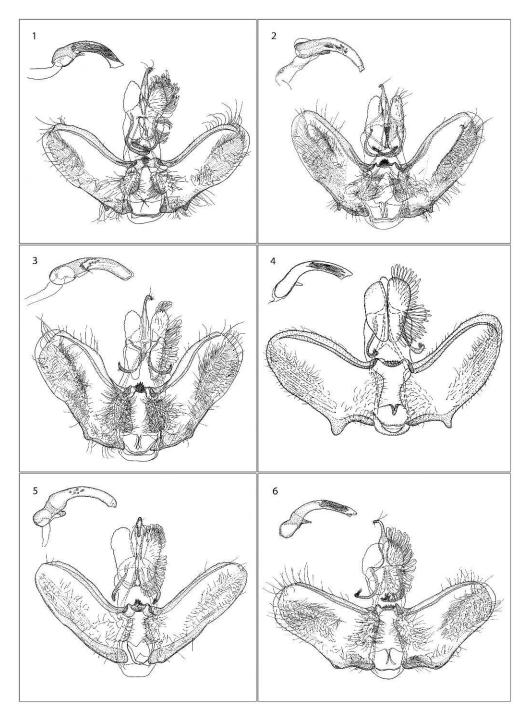


PLATE 17. MALE GENITALIA

1. Platynota semiustana Walsingham, McClellanville, Co., South Carolina; USNM 94,118. (p. 121). 2. Platynota rostrana (Walker), Beaufort, Carteret Co., North Carolina; USNM 92,748. (p. 122). 3. Platynota wenzelana (Haimbach), Carr Canyon, Huachuca Mountains, Cochise Co., Arizona; USNM 94,116. (p. 123). 4. Platynota polingi Powell & J. Brown, Indian Oasis, Pima Co., Arizona; USNM 87,913. (p. 125). 5. Platynota texana Powell and J. Brown, Brownsville, Cameron Co., Texas; USNM 94,113. (p. 126). 6. Platynota labiosana (Zeller), Madera Canyon, Santa Rita Mountains, Santa Cruz Co., Arizona; USNM 94,111. (p. 127).

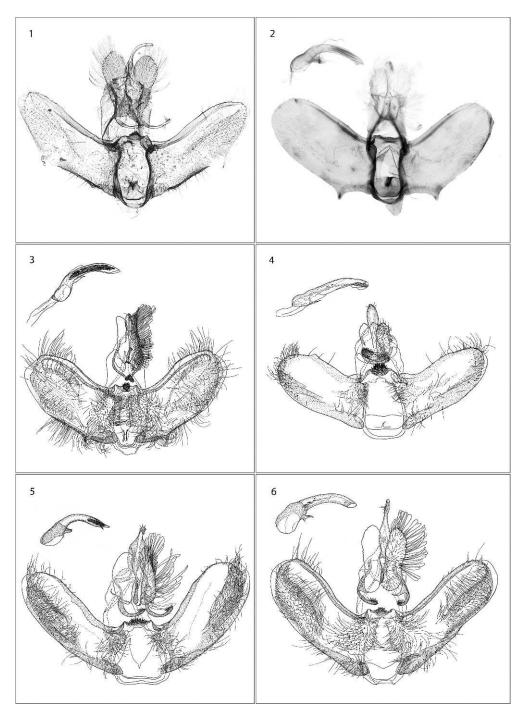


PLATE 18. MALE GENITALIA

1. Platynota islameconae Powell & J. Brown, Santa Cruz I., Santa Barbara Co., California; JAP 9,338. (p. 128). 2. Platynota blanchardi Powell & J. Brown, Fort Davis, Jeff Davis Co., Texas; USNM 88,169; and Alpine, Brewster Co., Texas, USNM 88,198. (p. 129). 3. Platynota flavedana Clemens, Devil's Den State Park, Washington Co., Arkansas; USNM 92,710. (p. 130). 4. Platynota zapatana Powell & J. Brown, Uvalde Co., Texas; USNM 87,905. (p. 132). 5. Platynota larreana (Comstock), Rock Corral, San Bernardino Co., California; USNM 27,009. (p. 133). 6. Platynota yumana (Kearfott), desert, Yuma, Yuma Co., Arizona; USNM 87,926. (p. 134).

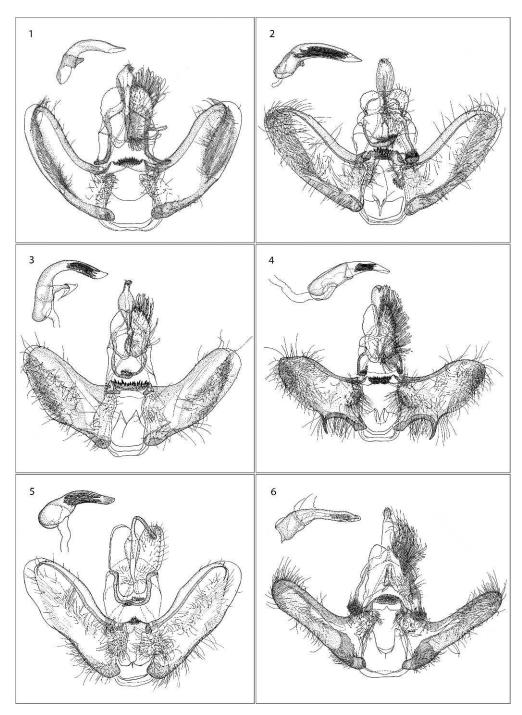


PLATE 19. MALE GENITALIA

1. Platynota redingtonensis Powell and J. Brown, Redington, Pima Co., Arizona; USNM 87,927, 88,037. (p. 135). 2. Platynota viridana Barnes and Busck, Huachuca Mountains, Cochise Co., Arizona; USNM 88,493 and 87,861. (p. 136). 3. Platynota stultana Walsingham, Nogales, Santa Cruz Co., Arizona; USNM 88,132. (p. 136). 4. Platynota nigrocervina Walsingham, 8 mi NE Sinton, Welder Wildlife Refuge, San Patricio Co., Texas; USNM 88,427. (p. 138). 5. Platynota calidana (Zeller), Key Largo, Monroe Co., Florida; USNM 92,763. (p. 139). 6. Synnoma lynosyrana Walsingham, Beaver Head Co., Montana; USNM 88,110. (p. 141).

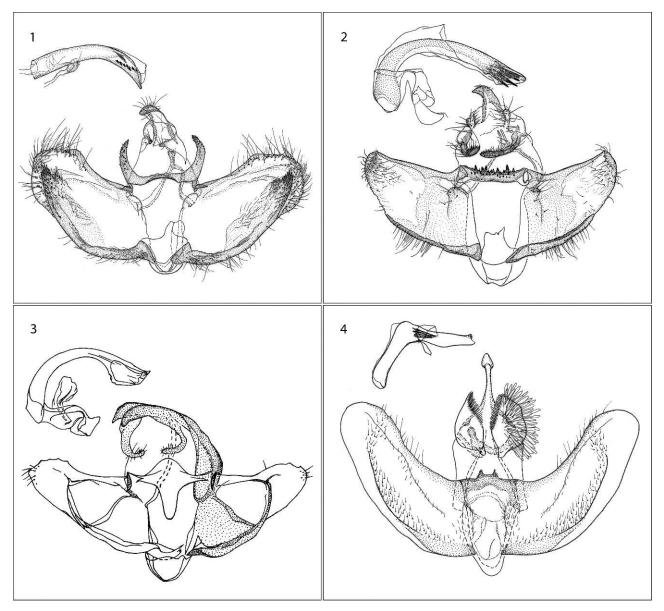


PLATE 20. MALE GENITALIA

1. Niasoma metallicana (Walsingham), Dade City, Pasco Co., Florida; USNM 27,052. (p. 144). 2. Synalocha gutierreziae Powell, Cherry Canyon, Guadalupe Mts., Culberson Co., Texas; USNM 88,486. (p. 145). 3. Syllonoma longipalpana Powell, reproduced from Powell (1985). (p. 147). 4. Tinacrucis noroesta Powell, Summerhaven, Mount Lemmon, Pima Co., Arizona; USNM 124,524. (p. 149).

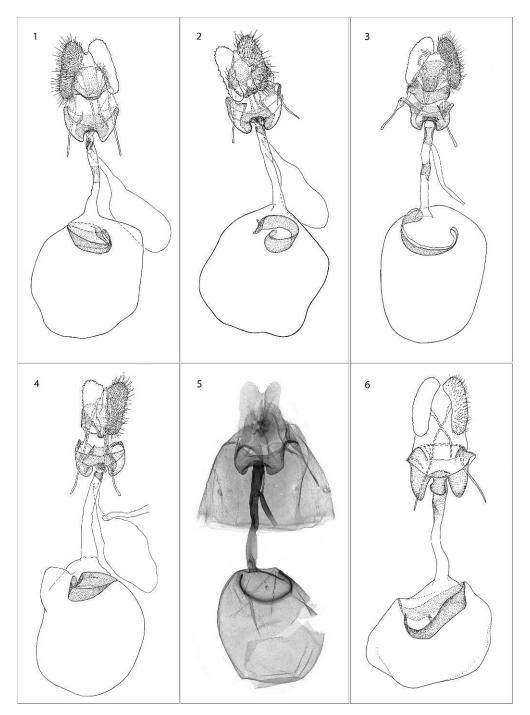


PLATE 21. FEMALE GENITALIA

1. Amorbia cuneana (Walsigham), Naval Air Station Miramar, San Diego Co., California; USNM 92,704. (p. 29). 2. Amorbia symmeurana Barnes & Busck, Madera Canyon, Santa Cruz Co., Arizona; USNM 92,722. (p. 31). 3. Amorbia humerosana Clemens, Montgomery Co., Maryland; USNM 92,713. (p. 32). 4. Amorbia emigratella Busck, Santa Ana Refuge, Hidalgo Co., Texas; USNM 27,400. (p. 34). 5. Amorbia vero Powell & J. Brown, Archbold Biological Research Station, Highlands Co., Florida; USNM 118,827. (p. 35). 6. Amorbia knudsoni Phillips-Rodriguez & Powell, Guadalupe Mts., Culberson Co., Texas; USNM 124,552. (p. 36).

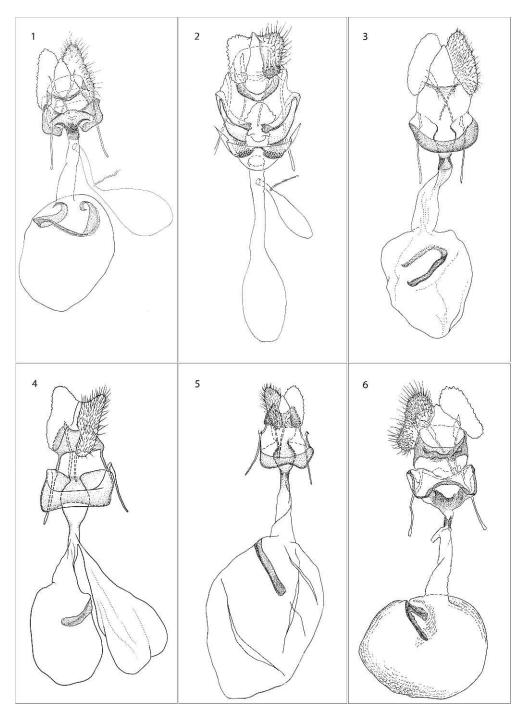


PLATE 22. FEMALE GENITALIA

1. Coelostathma discopunctana Clemens, Dallas, Texas; USNM 88,296. (p. 37). 2. Coelostathma placidana Powell & J. Brown, Lake Placid, Archbold Biological Research Station, Highlands Co., Florida; USNM 88,484. (p. 40). 3. Sparganopseustis martinana Powell, 10 mi W El Salto, Durango; USNM 124,550. (p. 42). 4. Sparganothoides hydeana (Klots), Telluride, San Miguel Co., Colorado; USNM 88,467. (p. 45). 5. Sparganothoides machimiana (Barnes & Busck), Paradise, Cochise Co., Arizona; USNM 88,480. (p. 47). 6. Sparganothoides lentiginosana (Walsingham), Wedge Plantation, McClellanville, Co., South Carolina; USNM 95,118. (p. 48).

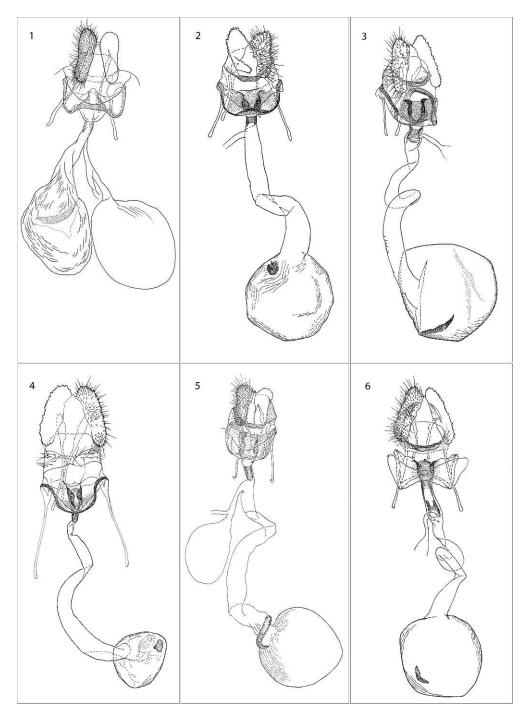


PLATE 23. FEMALE GENITALIA

1. Amorbimorpha mackayiana Kruse, Big Bend National Park, Brewster Co., Texas; USNM 118,839. (p. 50). 2. Sparganothis caryae (Robinson), Devil's Den State Park, Washington Co., Arkansas; USNM 94,077. (p. 55). 3. Sparganothis robinsonana Powell & J. Brown, Kerrville, Kerr Co., Texas; USNM 94,087. (p. 56). 4. Sparganothis tessellata Powell & J. Brown, Bon Secour National Wildlife Refuge, Baldwin Co., Alabama; USNM slide 88,042. (p. 57). 5. Sparganothis flavibasana (Fernald), [no locality data] "Barnes Collection"; USNM 94,109. (p. 58). 6. Sparganothis sulfureana (Clemens), Devil's Den State Park, Washington Co., Arkansas; USNM slide 95,086. (p. 59).

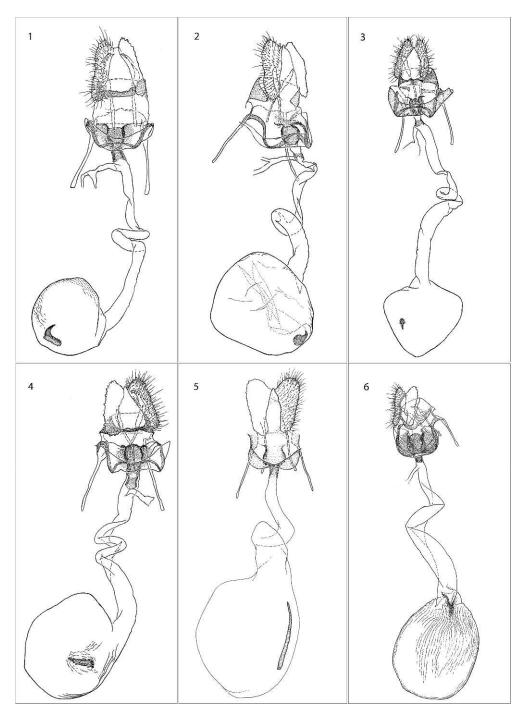


PLATE 24. FEMALE GENITALIA

1. Sparganothis lycopodiana (Kearfott), Augusta, Kennebec Co., Maine; USNM 95,092. (p. 62). 2. Sparganothis minimetallica Powell & J. Brown, Big Pine Key, Monroe Co., Florida; JAP 8,738. (p. 63). 3. Sparganothis bistriata Kearfott, Croatan National Forest, Carteret Co., North Carolina; USNM 95,111. (p. 65). 4. Sparganothis tristriata Kearfott, Lakehurst, Ocean Co., New Jersey; USNM 95,117. (p. 66). 5. Sparganothis demissana (Walsingham), 8 mi NE Sinton, Welder Wildlife Refuge, San Patricio Co., Texas; USNM 124,638. (p. 67). 6. Sparganothis unifasciana (Clemens), Ithaca, Six Mile Creek, Tompkins Co., New York; USNM slide 82,540. (p. 68).

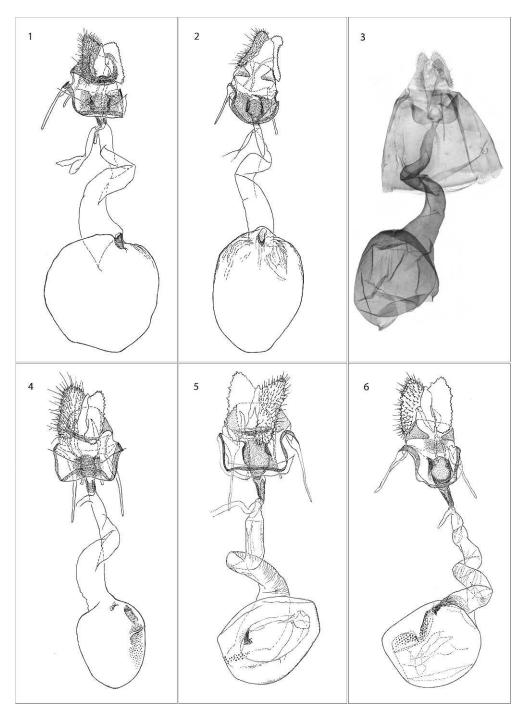


PLATE 25. FEMALE GENITALIA

1. Sparganothis violaceana (Robinson), Passadumkeag, Penobscot Co., Maine; USNM 95,096. (p. 69). 2. Sparganothis xanthoides (Walker), Highlands, Macon Co., North Carolina; USNM 82,542. (p. 71). 3. Sparganothis boweri Powell & J. Brown, New York; USNM 126,424. (p. 72). 4. Sparganothis taracana Kearfott, Wedge Plantation, McClellanville, South Carolina; USNM 95,098. (p. 74). 5. Sparganothis lindalinea Powell & J. Brown, Grand Bay Savannah, Jackson Co., Mississippi; JAP 8,742. (p. 75). 6. Sparganothis sullivani Powell & J. Brown, Leland, Brunswick Co., North Carolina; JAP 8,741. (p. 76).

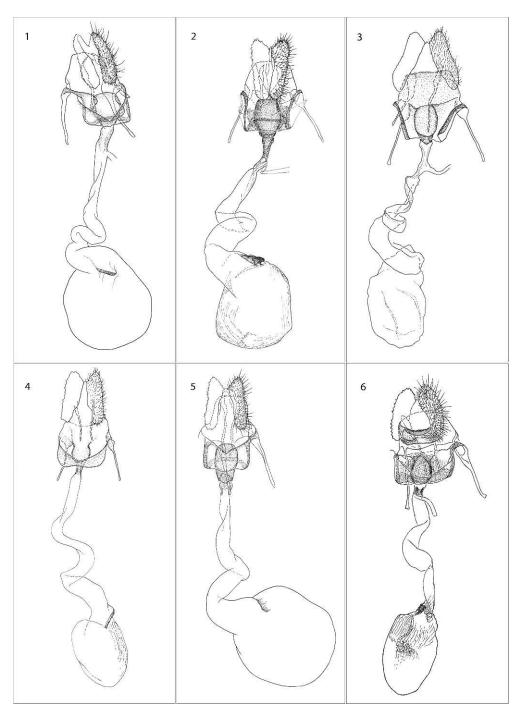


PLATE 26. FEMALE GENITALIA

1. Sparganothis mcguinnessi Powell & J. Brown, S end Long Pond, Sag Harbor, Suffolk Co., New York; USNM 118,812. (p. 77). 2. Sparganothis niteolinea Powell & J. Brown, Withlacoochee St. Forest, Hernando Co., Florida; JAP 8,357. (p. 78). 3. Sparganothis azulispecca Powell & J. Brown, Bon Secour National Wildlife Refuge, Baldwin Co., Alabama; JAP 8,745. (p. 80). 4. Sparganothis senecionana (Walsingham), Mt. Ashland Road, Jackson Co., Oregon; USNM 124,629. (p. 81). 5. Sparganothis tunicana (Walsingham), Wawawai, Whitman Co., Washington; USNM 118,852. (p. 83). 6. Sparganothis vocaridorsana Kearfott, Hardy Work Center, Remington Co., South Dakota; USNM 95,084. (p. 84).

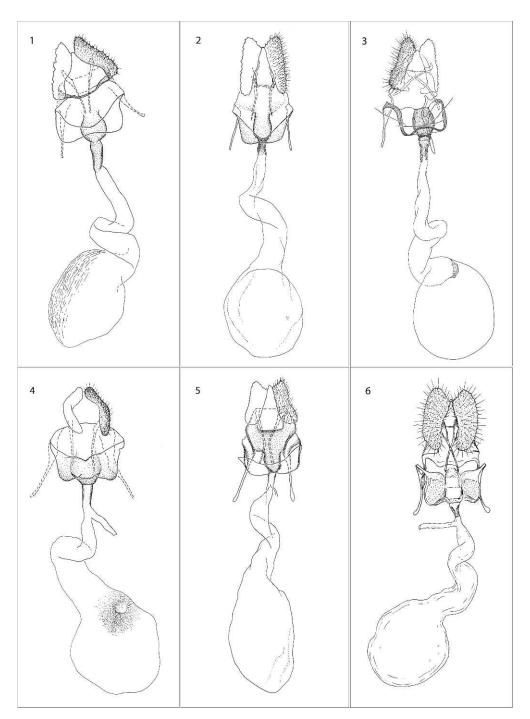


PLATE 27. FEMALE GENITALIA

1. Sparganothis umbrana Barnes & Busck, Burlington, Chittenden Co., Vermont; USNM 124,560. (p. 86). 2. Sparganothis striata (Walsingham), Walnut Canyon, Coconino Co., Arizona; USNM 124,631. (p. 87). 3. Sparganothis distincta (Walsingham), Long Island, New York; USNM 118,861. (p. 88). 4. Sparganothis pulcherrimana (Walsingham), Brazoria Co., Texas; USNM 124,619; and San Antonio, Bexar Co., Texas; USNM 124,648. (p. 89). 5. Sparganothis rubicundana (Herrich-Schäffer), Churchill, Manitoba; USNM 124,546. (p. 90). 6. Sparganothis praecana (Kennel), Sweden; from Razowski (2002). (p. 91).

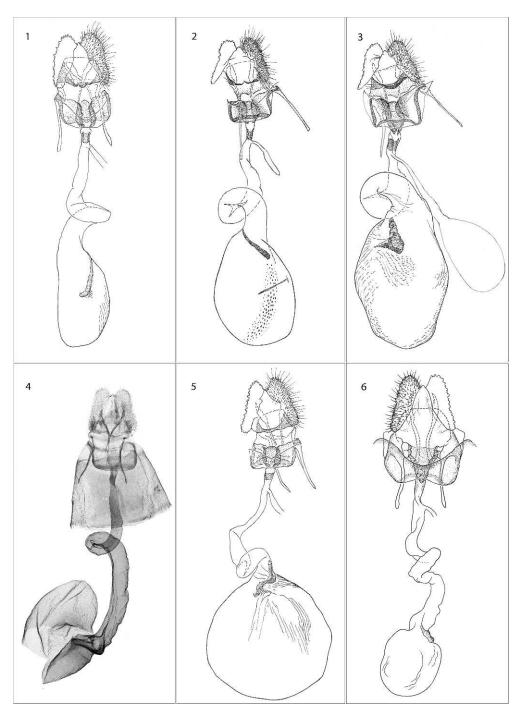


PLATE 28. FEMALE GENITALIA

1. Cenopis pettitana (Robinson), Ithaca, Six Mile Creek, Tompkins Co., New York; USNM 94,125. (p. 94). 2. Cenopis niveana Walsingham, Ithaca, Six Mile Creek, Tompkins Co., New York; USNM 95,080. (p. 96). 3. Cenopis reticulatana (Clemens), Ithaca, Tompkins Co., New York; USNM 95,060. (p. 98). 4. Cenopis ferreana (Busck), Devil's Den State Park, Washington Co., Arkansas; USNM 118,822. (p. 100). 5. Cenopis lamberti (Franclemont), Cherry Hill Recreation Area, Oconee Co., South Carolina; USNM 94,120. (p. 100). 6. Cenopis daphnana (McDunnough), Queens Co., Nova Scotia; USNM 137,077. (p.101).

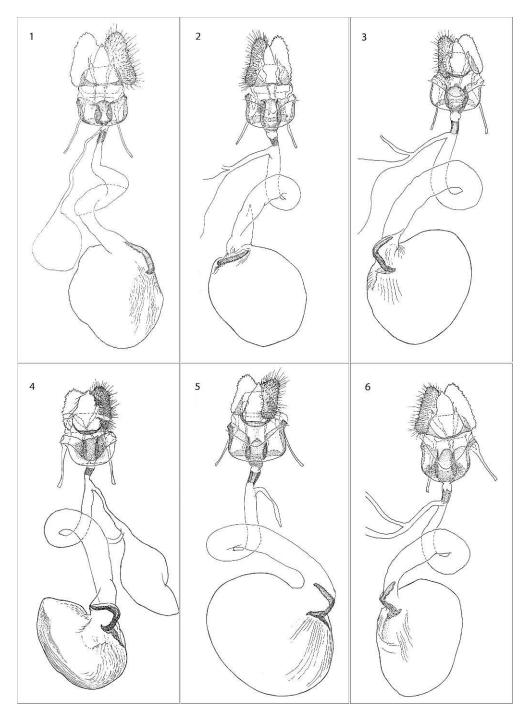


PLATE 29. FEMALE GENITALIA

1. Cenopis diluticostana Walsingham, [no locality data]; USNM 26,760. (p. 102). 2. Cenopis unicolorana Powell & J. Brown, Paul Johnson St. Park, Forrest Co., Mississippi; JWB 1,028. (p. 103). 3. Cenopis directana (Walker), Devil's Den State Park, Washington Co., Arkansas; USNM 88,778. (p. 105). 4. Cenopis saracana Kearfott, Highlands, Macon Co., North Carolina; USNM 88,787. (p. 107). 5. Cenopis mesospila Zeller, Ithaca, Six Mile Creek, Tompkins Co., New York; USNM 88,630. (p. 108). 6. Cenopis eulongicosta Powell & J. Brown; Lebanon, Grafton Co., New Hampshire; USNM 88,162. (p. 110).

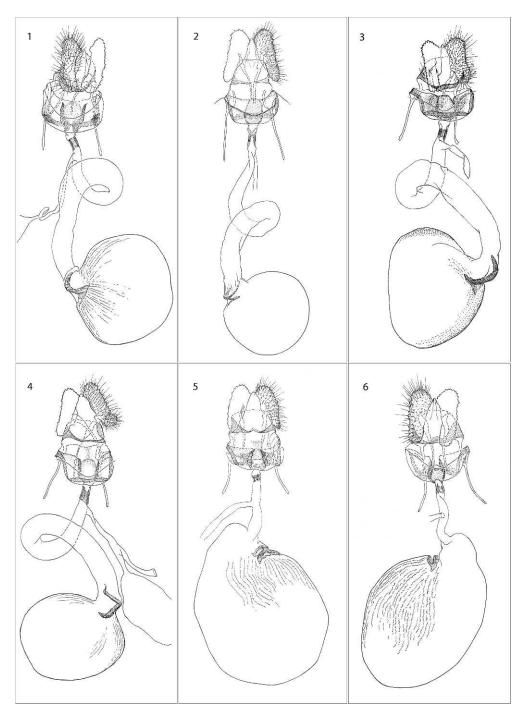


PLATE 30. FEMALE GENITALIA

1. Cenopis cana (Kearfott), Huntsville State Park, Walker Co., Texas; USNM 88,628. (p. 111). 2. Cenopis vabroui Powell & J. Brown, 4.2 mi NE Abita Springs, St. Tammany Par., Louisiana; USNM 118,590. (p. 112). 3. Cenopis karacana Kearfott, Martha's Vineyard, Dukes Co., Massachusetts; USNM 88,696. (p. 113). 4. Cenopis chambersana Kearfott, near Warsaw, Benton Co., Missouri; USNM 26,065. (p. 114). 5. Platynota idaeusalis (Walker), Jackson Co., North Carolina; USNM 92,764. (p. 118). 6. Platynota exasperatana (Zeller), Carteret Co., North Carolina; USNM 92,770. (p. 120).

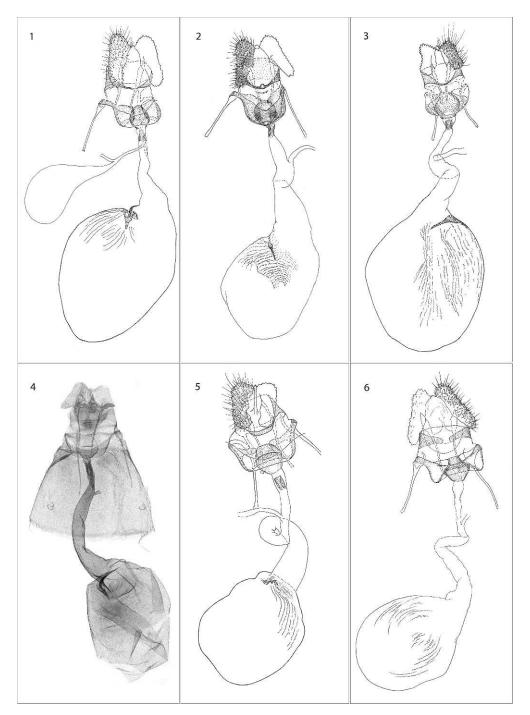


PLATE 31. FEMALE GENITALIA

1. Platynota semiustana Walsingham, Deutschburg, Jackson Co., Texas; USNM 94,112. (p. 121). 2. Platynota rostrana (Walker), Fort Macon State Park, Carteret Co., North Carolina; USNM 92,752. (p. 122). 3. Platynota wenzelana (Haimbach), Madera Canyon, Santa Cruz Co., Arizona; USNM 87,863. (p. 123). 4. Platynota texana Powell & J. Brown, Orange, Orange Co., Texas; USNM 118,828. (p. 126). 5. Platynota labiosana (Zeller), Huachuca Mts., Cochise Co., Arizona; USNM 94,110. (p. 127). 6. Platynota islameconae Powell & J. Brown, Santa Cruz I., Santa Barbara Co., California; JAP 9,243. (p. 128).

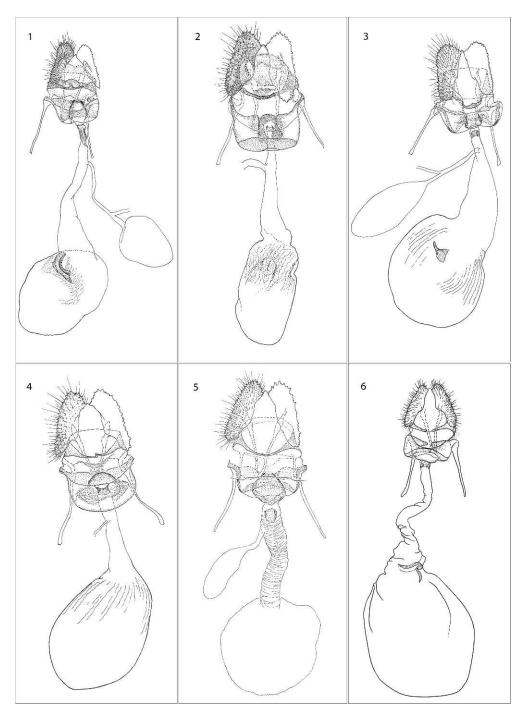


PLATE 32. FEMALE GENITALIA

1. Platynota flavedana Clemens, Magazine Mt., Logan Co., Arkansas; USNM 92,711. (p. 130). 2. Platynota larreana (Comstock), Mojave Desert, near Llano, Los Angeles Co., California; USNM 92,733. (p. 133). 3. Platynota viridana Barnes & Busck, Tucson, Pima Co. Arizona; USNM 94,117. (p. 136). 4. Platynota stultana Walsingham, Phoenix, Maricopa Co., Arizona; USNM 92,761. (p. 136). 5. Platynota nigrocervina Walsingham, Platte Canyon, Jefferson/Douglas Cos., Colorado; USNM 88,088. (p. 138). 6. Platynota calidana (Zeller), Archbold Biological Research Station, Highlands Co., Florida; USNM 118,829. (p. 139).

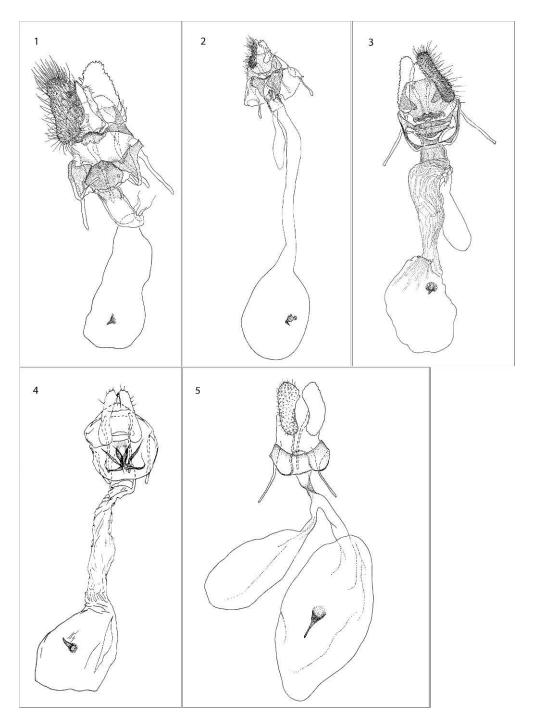


PLATE 33. FEMALE GENITALIA

1. Synnoma lynosyrana Walsingham, Little Rock, Los Angeles Co., California; USNM 88,113. (p. 141). 2. Niasoma metallicana (Walsingham), Mauriceville, Orange Co., Texas; USNM 92,734. (p. 144). 3. Synalocha gutierreziae Powell, Alpine, Brewster Co., Texas; USNM 88,494. (p. 145). 4. Syllonoma longipalpana Powell, from Powell (1985). (p. 147). 4. Tinacrucis noroesta Powell, Summerhaven, Mount Lemmon, Pima Co., Arizona; USNM 124,548. (p. 149).

COLOR PLATES

TORTRICOIDEA

PLATE A

TORTRICOIDEA

TORTRICIDAE SPARGANOTHINI

figs 1-50

- Amorbia cuneana (Wlsm.), 3. Conn Creek, Rutherford, Napa Co., California, 15 September 1985, D. C. Ferguson, USNM. (p. 29).
- 2. Amorbia cuneana (Wlsm.), ♂. Camp Baldy, San Bernardino Mts., San Bernardino Co., California, 16–23 July 1919, Barnes Collection, USNM. (p. 29).
- 3. Amorbia cuneana (Wlsm.), ♂. San Diego, San Diego Co., California, Barnes Collection, USNM. (p. 29).
- Amorbia cuneana (Wlsm.), ♀. Three Arch Bay Beach, Orange Co., California, 1 May 1935, Grace H. & John L. Sperry, USNM. (p. 29).
- Amorbia cuneana (Wlsm.), Ş. Mt. Shasta, Siskiyou Co., California, 5 July 1958, J. A. Powell, EME. (p. 29).
- Amorbia cuneana (Wlsm.), ♂. Berkeley, Alameda Co., California, July 1991, D. Rubinoff, EME. (p. 29).
- 7. Amorbia cuneana (Wlsm.), & Berkeley, Alameda Co., California, 12 May 1990, J. A. Powell, EME. (p. 29).
- 8. Amorbia cuneana (Wlsm.), 3. Berkeley, Alameda Co., California, 16 May 1958, J. A. Powell, EME. (p. 29).
- Amorbia cuneana (Wlsm.),
 \(\begin{align*} \). Huckleberry Preserve, near Redwood Canyon, 420 m, Alameda Co., California, 30 September 1984, D. Wagner, EME. (p. 29).
- 10. *Amorbia cuneana* (Wlsm.), ♂. Rowdy Cr., 6 mi E Smith River, Del Norte Co., California, 27 July 1990, D. C. Ferguson, USNM. (p. 29).
- 11. Amorbia synneurana B. and Bsk. ♀. Madera Canyon, Santa Rita Mts., Santa Cruz Co., Arizona, 25 August 1959, R. W. Hodges, USNM. (p. 31).
- 12. Amorbia synneurana B. and Bsk. ♀. Brown Canyon, Baboquivari Mts., Pima Co., Arizona, 8 August 2005, J. A. Powell, EME. (p. 31).
- 13. Amorbia synneurana B. and Bsk. ♀. Madera Canyon, Santa Rita Mts., Santa Cruz Co., Arizona, 26 August 1959, R. W. Hodges, USNM. (p. 31).
- 14. Amorbia synneurana B. and Bsk. ♀. Madera Canyon, Santa Rita Mts., 4,880′, Santa Cruz Co., Arizona, 12 October 1959, R. W. Hodges, USNM. (p. 31).
- 15. Amorbia synneurana B. and Bsk. ♂. Brown Canyon, Baboquivari Mts., Pima Co., Arizona, 8 August 2005, D. and J. Powell, EME. (p. 31).
- 16. Amorbia humerosana Clem. ♀. Conroe, Montgomery Co., Texas, 12 March 1967, A. and M. E. Blanchard, USNM. (p. 32).
- 17. Amorbia humerosana Clem. ♂. Seashore State Park, Nansemond Co., Virginia, 1–4 April 1975, D. and M. Davis, USNM. (p. 32).
- 18. Amorbia humerosana Clem. & Conroe, Montgomery Co., Texas, 13 March 1969, A. and M. E. Blanchard, USNM. (p. 32).
- 19. Amorbia humerosana Clem. ♂. Arlington, Arlington Co., Virginia, 21 May 1951, J. G. Franclemont, USNM. (p. 32).
- Amorbia humerosana Clem. 3. Hoffman, Richmond Co., North Carolina, 10 May 232, J. Glaser, USNM. (p. 32).
- 21. Amorbia emigratella Busck. & Santa Ana Refuge, Hildago Co., Texas, 4 November 1974, A. and M. E. Blanchard, USNM. (p. 34).
- 22. Amorbia emigratella Busck. & San Benito, Cameron Co., Texas, 16–23 July 1919, Barnes Collection, USNM. (p. 34).
- 23. Amorbia emigratella Busck. ♀. Cameron Co., Texas, 18 September 1965, A. and M. E. Blanchard, USNM. (p. 34).
- 24. Amorbia emigratella Busck. ♂. Cameron Co., Texas, 25 July 1964, R.O. Kendall, USNM. (p. 34).
- 25. Amorbia vero Powell and J. Brown. & Holotype. Vero Beach, Indian River Co., Florida, 15 October–15 November 1940, J. R. Malloch, USNM slide 88,463, USNM. (p. 35).
- 26. Amorbia vero Powell and J. Brown. ♂. Paratype. Vero Beach, Indian River Co., Florida, 15 October–15 November 1940, J. R. Malloch, USNM. (p. 35).

- 27. Amorbia knudsoni Phillips and Powell. ♂. Smith Canyon, Guadalupe Mts., 5,750′, Culberson Co., Texas, 22 May 1973, D. C. Ferguson, USNM. (p. 36).
- 28. *Amorbia knudsoni* Phillips and Powell. ♀. Smith Canyon, Guadalupe Mts., 5,750′, Culberson Co., Texas, 22 May 1973, D. C. Ferguson, USNM slide 124,522, USNM. (p. 36).
- 29. Coelostathma discopunctana Clem. ♂. Easton Neck, Long Island, Suffolk Co., New York, 10 June 1971, E. Jäckh, USNM. (p. 37).
- 30. Coelostathma discopunctana Clem. ♂. Big Meadows, Shenandoah National Park, Madison Co., Virginia, 12 August 1972, E. Jäckh, USNM. (p. 37).
- 31. Coelostathma discopunctana Clem. Q. Six Mile Creek, Ithaca, Tompkins Co., New York, 21 June 1957, J. G. Franclemont, USNM. (p. 37).
- Coelostathma placidana Powell and J. Brown. S. Paratype. Lake Placid, Archbold Research Station, Highlands Co., Florida, 5 April 1959, J. G. Franclemont, USNM. (p. 40).
- Coelostathma placidana Powell and J. Brown. ♀. Paratype. Lake Placid, Archbold Research Station, Highlands Co., Florida, 21–22 May 1964, R. W. Hodges, USNM. (p. 40).
- 34. Sparganopseustis martinana Powell. & 10 mi W El Salto, 9,000', Durango, 11 August 1964, J. E. H. Martin, CNC. (p. 42).
- 35. Sparganopseustis martinana Powell. ♀. 10 mi W El Salto, 9,000′, Durango, 11 August 1964, J. E. H. Martin, SWC slide 1028, EME. (p. 42).
- 36. Sparganopseustis martinana Powell. ♀. 10 mi W El Salto, 8,800′, Durango, 1 August 1964, J. Powell, EME. (p. 42).
- 37. Sparganothoides hydeana (Klots). S. Hayden Cr., Coaldale, 6,800', Fremont Co., Colorado, 9 July 1982, R. W. Hodges, USNM. (p. 45).
- 38. Sparganothoides hydeana (Klots). ♀. Hayden Cr., Coaldale, 6,800′, Fremont Co., Colorado, 9 July 1982, R. W. Hodges, USNM. (p. 45).
- Sparganothoides hydeana (Klots). J. Hayden Cr., Coaldale, 6,800', Fremont Co., Colorado, 9 July 1982, R. W. Hodges, USNM. (p. 45).
- 40. Sparganothoides machimiana (B. and Bsk.). ♀. West Fork, 16 mi SW Flagstaff, 6,500′, Coconino Co., Arizona, 15 July 1961, R. W. Hodges, USNM. (p. 47).
- 41. Sparganothoides machimiana (B. and Bsk.). ♂. Pinery Camp, Chiricahua Mts., 6,800′, Cochise Co., Arizona, 26 July 1965, R. H. Leuschner, USNM. (p. 47).
- Sparganothoides machimiana (B. and Bsk.). ♀. 2.3 mi up Carr Canyon Rd., Huachuca Mts., Cochise Co., Arizona, 3–5 August 2005, J. Brown, USNM. (p. 47).
- 43. Sparganothoides lentiginosana (Wlsm.). ♂. 1 km E Fairfax City, Fairfax Co., Virginia, 26–27 August 2005, J. Brown, USNM. (p. 48).
- 44. Sparganothoides lentiginosana (Wlsm.). ♂. 1 km E Fairfax City, Fairfax Co., Virginia, 14–15 June 2005, J. Brown, USNM. (p. 48).
- Sparganothoides lentiginosana (Wlsm.). ♀. Conroe, Montgomery Co., Texas, 28 March 1974, A. and M. E. Blanchard, USNM. (p. 48).
- Sparganothoides lentiginosana (Wlsm.). ♀. Hogtown Cr., 5 mi W Gainesville, Alachua Co., Florida, 11 March 1975, J. B. Heppner, FSCA. (p. 48).
- 47. Sparganothoides lentiginosana (Wlsm.). ♀. Anthony, Marion Co., Florida, 22 March 2001, D. C. Ferguson, USNM. (p. 48).
- Amorbimorpha mackayiana Kruse.
 Paratype. The Basin, Big Bend National Park, Brewster Co., Texas, 4 May 1959, M. R. MacKay, CNC. (p. 50).
- 49. Sparganothis caryae (Rob.), ♀. Hartford, Sebastian Co., Arkansas, 8 May 1966, R. W. Hodges, USNM. (p. 55).
- 50. Sparganothis caryae (Rob.), ♂. Devil's Den State Park, Washington Co., Arkansas, 18 June 1966, R. W. Hodges, USNM. (p. 55).

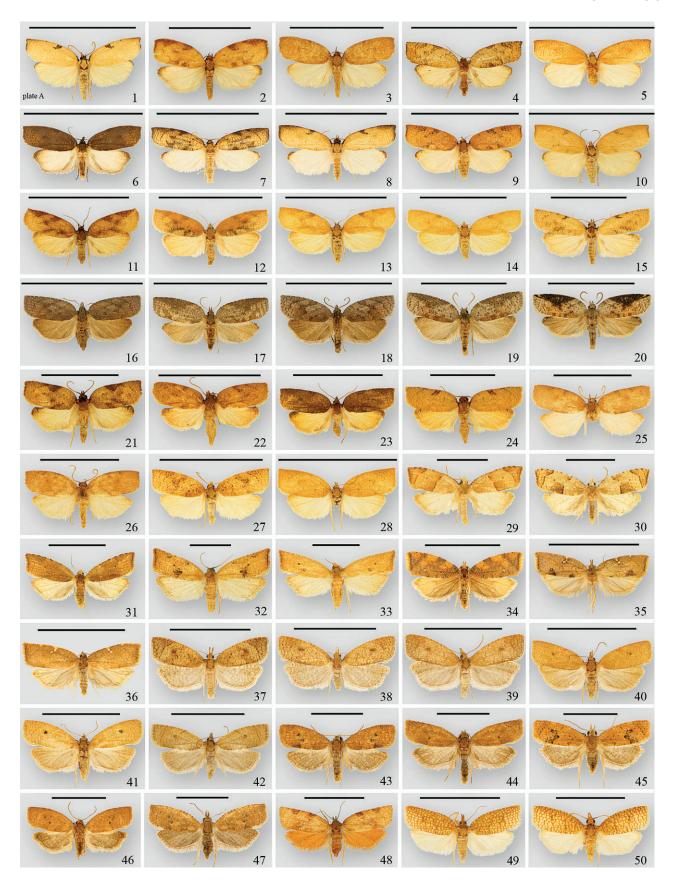


PLATE B

TORTRICOIDEA

TORTRICIDAE SPARGANOTHINI

figs 1-50

- 1. Sparganothis robinsonana Powell and J. Brown. \(\begin{align*} \). Holotype. Fort Worth, Tarrant Co., Texas, 15 October 1963, E. Jäckh, USNM. (p. 56).
- 2. Sparganothis tessellata Powell and J. Brown. ♀. Paratype. Bon Secour National Wildlife Refuge, Baldwin Co., Alabama, 11–16 May 1994, R. W. Hodges, USNM. (p. 57).
- 3. Sparganothis tessellata Powell and J. Brown. & Paratype. Watson's Hammock, Big Pine Key, Monroe Co., Florida, 20 May 1990, B. Landry, USNM slide 95,103, USNM. (p. 57).
- Sparganothis tessellata Powell and J. Brown. 3. Paratype. 4.5 mi NNW Lucedale, T1S R6W sec 6SE, George Co., Mississippi, 24–25 July 1989, T. L. Schiefer, MEM. (p. 57).
- Sparganothis tessellata Powell and J. Brown. S. Paratype. Bon Secour N.W. Refuge, Baldwin Co., Alabama, 15 May 1994, R. W. Hodges, EME. (p. 57).
- Sparganothis tessellata Powell and J. Brown. Q. Paratype. Bon Secour N.W. Refuge, Baldwin Co., Alabama, 14 June 1994, D. M. Pollock, EME. (p. 57).
- 7. Sparganothis flavibasana (Fern.). Q. Ottawa, Ontario, June 1918, W. Kearfott, USNM. (p. 58).
- 8. Sparganothis sulfureana (Clem.). 3. Decatur, Macon Co., Illinois, 1–7 June 1919, Barnes Collection, USNM. (p. 59).
- Sparganothis sulfureana (Clem.). J. Penhurst Park, Smith's Parish, Bermuda, 19 October 1987, D. C. Ferguson, USNM. (p. 59).
- 10. Sparganothis sulfureana (Clem.). ♂. 7.75 mi N Big Timber, near Big Timber Creek, Sweet Grass Co., Montana, 5 August 1969, J. G. Franclemont, USNM. (p. 59).
- 11. Sparganothis sulfureana (Clem.). Q. Six Mile Creek, Ithaca, Tompkins Co., New York, 14 September 1958, J. G. Franclemont, USNM. (p. 59).
- 12. Sparganothis sulfureana (Clem.). ♂. Deutschburg, Jackson Co., Texas, 18 September 1973, A. and M. E. Blanchard, USNM. (p. 59).
- 13. Sparganothis sulfureana (Clem.). ♀. Oneco, Manatee Co., Florida, 29 March 1954, J. G. Franclemont, USNM. (p. 59).
- Sparganothis sulfureana (Clem.). ♂. Archbold Biological Research Station, Lake Placid, Highlands Co., Florida, 1–7 May 1964, R. W. Hodges, USNM. (p. 59).
- Sparganothis sulfureana (Clem.). ♂. McKee-Lesher Wildlife Management Area, 4 km W Seneca, Montgomery Co., Maryland, 29 August 1997, J. Powell & J. Brown, EME. (p. 59).
- Sparganothis sulfureana (Clem.). \(\begin{align*} \text{S. Marion N.F., N of Wando, Berkeley Co., South Carolina, 15 June 2002, J. Powell and D. Wagner, EME. (p. 59).
- 17. Sparganothis sulfureana (Clem.). Q. Glenn Farm, 8 km W Magnolia, Putnam Co., Illinois, 24 July 1985, J. Powell, EME. (p. 59).
- 18. Sparganothis sulfureana (Clem.). ♀. Glenn Farm, 8 km W Magnolia, Putnam Co., Illinois, 24 July 1985, J. Powell, EME. (p. 59).
- 19. Sparganothis sulfureana (Clem.). & Archbold Biological Station, near Lake Placid, Highlands Co., Florida, 6 June 1986, J. Powell, EME. (p. 59)
- Sparganothis sulfureana (Clem.). ♀. Archbold Biological Station, near Lake Placid, Highlands Co., Florida, 6 June 1986, J. Powell, EME. (p. 59).
- 21. Sparganothis sulfureana (Clem.). & Lick Cr. Park, 6 mi SE College Station, Brazos Co., Texas, 17 May 1991, J. Powell, EME. (p. 59).
- 22. Sparganothis sulfureana (Clem.). ♀. Lick Cr. Park, 6 mi SE College Station, Brazos Co., Texas, 17 May 1991, J. Powell, EME. (p. 59).
- 23. Sparganothis lycopodiana (Kft.). ♂. Radisson, Onondaga Co., New York, 11 July 1977, E. Jäckh, USNM. (p. 62).
- 24. Sparganothis minimetallica Powell and J. Brown. ♂. Paratype. Pinelands, Big Pine Key, Monroe Co., Florida, 25 May 1990, B. Landry, JAP slide 8,738, EME. (p. 63).

- 25. Sparganothis minimetallica Powell and J. Brown. 3. Paratype. Watson's Hammock, Big Pine Key, Monroe Co., Florida, 20 May 1990, B. Landry, EME. (p. 63).
- Sparganothis bistriata Kft. \(\begin{aligned} \text{. Wedge Plantation, McClellanville, Charleston Co., South Carolina, 12 August 1968, D. C. Ferguson, USNM. (p. 65).
- 27. Sparganothis tristriata Kft. &. Temagami, Ontario, em: 22 July 1942, Forest Insect Survey, CNC. (p. 66).
- 28. Sparganothis demissana (Wlsm.). & Laguna Park, Bosque Co., Texas, 15 May 1971, A. and M. E. Blanchard, USNM. (p. 67).
- 29. Sparganothis demissana (Wlsm.). & Dugout Wells, Chisos Mountains, 3,000', Brewster Co., Texas, 4 June 1973, R. W. Hodges, USNM. (p. 67).
- Sparganothis unifasciana (Clem.). J. Hochderffer Hill, 13 mi NW Flagstaff, 7,700', Coconino Co., Arizona, 24 July 1989, J. Powell, EME. (p. 68).
- Sparganothis violaceana (Rob.). 3. Armdale, Halifax Co., Nova Scotia, 5
 June 1950, D. C. Ferguson, USNM. (p. 69).
- 32. Sparganothis xanthoides (Wlk.). & Warrior Mt. Wildlife Manangement Area, Alleghany Co., Maryland, 9 July 2001, J. Glaser, USNM. (p. 71).
- 33. Sparganothis xanthoides (Wlk.). Q. Highlands, 3,865', Macon Co., North Carolina, 19 July 1958, J. G. Franclemont, USNM. (p. 71).
- 34. Sparganothis xanthoides (Wlk.). ♂. Highlands, 3,865′, Macon Co., North Carolina, 25 July 1958, J. G. Franclemont, USNM. (p. 71).
- 35. Sparganothis xanthoides (Wlk.). 3. Vernon, British Columbia, 22 June 1927, E. P. Venables, EME. (p. 71).
- 36. Sparganothis xanthoides inconditana (Wlsm.). ♂. Bartle, Siskiyou Co., California, 18 July 1936, E. C. Johnston, EME. (p. 71).
- 37. Sparganothis xanthoides inconditana (Wlsm.). 3. 8 mi NW Chester, Plumas Co., California, 18 August 1958, J. Powell, EME. (p. 71).
- 38. Sparganothis boweri Powell and J. Brown. ♀. Paratype. 2.2 mi W Copper Harbor, Keweenaw Co., Michigan, 11 July 2001, G. Balogh, EME. (p. 72).
- 39. Sparganothis boweri Powell and J. Brown. ♂. Paratype. Middle River, Victoria Co., Nova Scotia, 27 July 1970, D. C. Ferguson, USNM. (p. 72).
- 40. Sparganothis boweri Powell and J. Brown. ♂. Paratype. Tuscarora Lake, Madison Co., New York, 5 July 1975, E. Jäckh, USNM. (p. 72).
- 41. Sparganothis boweri Powell and J. Brown. ♂. Paratype. Lake Katherine, Oneida Co., Wisconsin, 18 July 1961, H. M. Bower, EME. (p. 72).
- 42. Sparganothis boweri Powell and J. Brown. ♀. Paratype. Lake Katherine, Oneida Co., Wisconsin, 30 July 1961, H. M. Bower, EME. (p. 72).
- 43. Sparganothis taracana Keafott. ♂. St. Petersburg, Pinellas Co., Florida, 2 February 1930, USNM slide 26,710, USNM. (p. 74).
- 44. Sparganothis taracana Kft. ♀. McClellanville, Charleston Co., South Carolina, 2 August 1974, R. B. Dominick, USNM slide 95,098, USNM. (p. 74).
- 45. Sparganothis taracana Kft. ♀. Paradise Beach, Escambia Co., Florida, 10 October 1947, S. S. Nicolay, EME. (p. 74).
- Sparganothis sullivani Powell and J. Brown. J. Paratype. Holly Shelter, Pender Co., North Carolina, 2 May 1995, J. B. Sullivan, USNM. (p. 76).
- 47. Sparganothis sullivani Powell and J. Brown. 3. Paratype. Holly Shelter, Pender Co., North Carolina, 9 May.1995, J. B. Sullivan, EME. (p. 76).
- Sparganothis sullivani Powell and J. Brown. 3. Paratype. Leland, Brunswick Co., North Carolina, 17 June 1946, O. Buchholz, JAP slide 8,791, EME. (p. 76).
- 49. Sparganothis lindalinea Powell and J. Brown. ♂. Paratype. Grand Bay Savannah, Jackson Co., Mississippi, 28 August 1995, J. A. MacGown, EME. (p. 75).
- Sparganothis lindalinea Powell and J. Brown. ♂. Paratype. Grand Bay Savannah, Jackson Co., Mississippi, 28 August 1995, R. L. Brown & D. Pollock, EME. (p. 75).

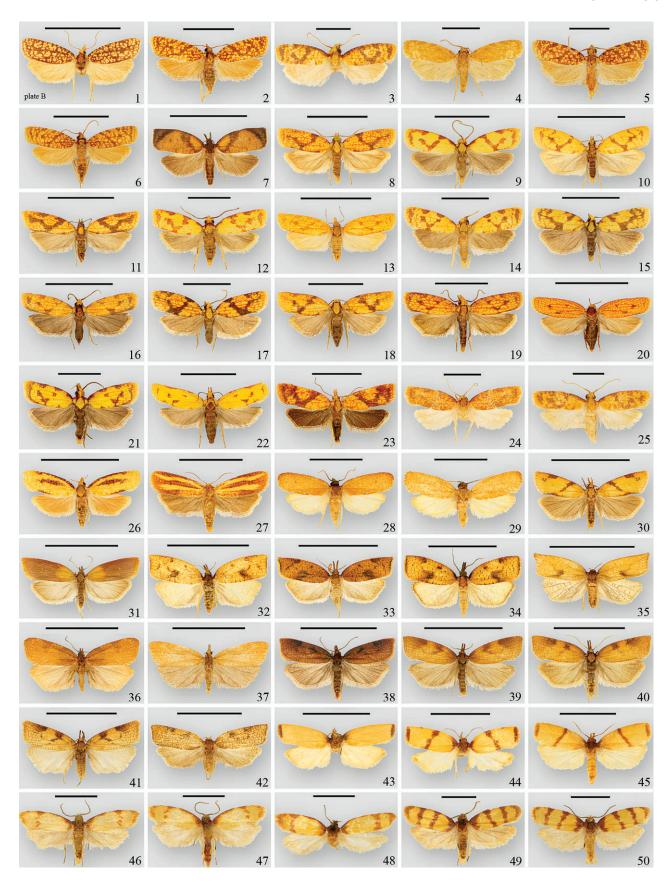


PLATE C

TORTRICOIDEA

TORTRICIDAE SPARGANOTHINI

figs 1-50

- 1. Sparganothis lindalinea Powell and J. Brown. 3. Paratype. Fisheating Cr., Palmdale, Glades Co., Florida, 7–10 May 1964, R. W. Hodges, USNM. (p. 75).
- 2. Sparganothis lindalinea Powell and J. Brown. ♀. Paratype. Pensacola, Escambia Co., Florida, 29 June 1962, S. Hills, EME. (p. 75).
- Sparganothis mcguinnessi Powell and J. Brown. J. Paratype. Mashomak Preserve, Shelter Island, Suffolk Co., New York, 28 July 2008, H. D. McGuinness, USNM. (p. 77).
- Sparganothis niteolinea Powell and J. Brown. J. Paratype. Ocala National Forest, National Forest Road 765, Lake Delancy, Marion Co., Florida, 18 October 1990, H. D. Baggett, EME. (p. 78).
- Sparganothis niteolinea Powell and J. Brown.
 P. Paratype. Ocala National
 Forest, NFR 765, Lake Delancy, Marion Co., Florida, 28 June 1991, H.
 D. Baggett, EME. (p. 78).
- Sparganothis niteolinea Powell and J. Brown. J. Paratype. Ocala National Forest, NFR 765, Lake Delancy, Marion Co., Florida, 22 June 1991, H. D. Baggett, EME. (p. 78).
- Sparganothis azulispecca Powell and J. Brown. J. Paratype. Bon Secour N.W.R., Baldwin Co., Alabama, 13–16 May 1994, R. L. Brown and D. Pollock, MEM. (p. 80).
- 8. Sparganothis azulispecca Powell and J. Brown. ♀. Paratype. Bon Secour N.W.R., Baldwin Co., Alabama, 11–16 May 1994, R. L. Brown and D. Pollock, MEM. (p. 80).
- Sparganothis tunicana (Wlsm.). J. Ritter, Grant Co., Oregon, 20 July 1962, J. H. Baker Collection, USNM. (p. 83).
- 10. Sparganothis tunicana (Wlsm.). 3. 2 mi W Mazama, Okanogan Co., Washington, 29 July 1962, J. F. G. Clarke, USNM. (p. 83).
- 11. Sparganothis tunicana (Wlsm.). \(\foatsize \). Rock Lake, Whitman Co., Washington, 21 June 1934, J. F. G. Clarke, USNM. (p. 83).
- 12. Sparganothis tunicana (Wlsm.). ♀. Mission Canyon, Santa Barbara Co., California, 11 July 1914, Lowrie, USNM. (p. 83).
- 13. Sparganothis tunicana (Wlsm.). S. Spring Creek, Baker, Baker Co., Oregon, 20 July 1970, J. H. Baker, USNM. (p. 83).
- 14. Sparganothis tunicana (Wlsm.). \(\text{\text{\$\geqref{1}\$}} \). \(\text{\$\geqref{1}\$} \). \(\text{\$\geqref{1}\$} \) \(\text{\$\geqref{1}\$} \)
- 15. Sparganothis tunicana (Wlsm.). 3. Rush Creek, 9 mi NE Adin, Modoc
- Co., California, 12 June 1974, J. Powell, EME. (p. 83). 16. *Sparganothis tunicana* (Wlsm.). \(\begin{align*} \text{2.} & 1.2 & mi & N & Plantation, Sonoma Co., \)
- California, 23 June 1957, J. A. Powell, EME. (p. 83). 18. *Sparganothis tunicana* (Wlsm.). Q. Rush Creek, 9 mi NE Adin, Modoc
- Co., California, 12 June 1974, J. Powell, EME. (p. 83).
 19. *Sparganothis senecionana* (Wlsm.). ♂. Monachee Meadows, 8,000′, Tulare Co., California, 8–14 July [no year], USNM. (p. 81).
- 20. Sparganothis senecionana (Wlsm.). & 3 mi N San Bernardino, 1,700', San Bernardino Co., California, 2 May 1967, D. Davis, USNM. (p. 81).
- 21. Sparganothis senecionana (Wlsm.). 3. 3 mi E of Davis Creek, Warner Mts., 5,500′, Modoc Co., California, 8–15 July 1922, A. W. Lindsey, USNM. (p. 81).
- Sparganothis senecionana (Wlsm.). ♀. 3 mi E of Davis Creek, Warner Mts., 5,500′, Modoc Co., California, 8–15 July 1922, A. W. Lindsey, USNM. (p. 81).
- 23. Sparganothis senecionana (Wlsm.). Q. Placer Co., California, [no date], USNM. (p. 81).
- 24. Sparganothis senecionana (Wlsm.). & Mt. Pinos, 7,600', Kern Co., California, 18 June 1977, C. P. McGill, USNM. (p. 81).

- 25. Sparganothis senecionana (Wlsm.). \(\Pi \). Mt. Ashland, 4,300', Jackson Co., Oregon, em: 22 May 1970, J. F. G. Clarke, USNM. (p. 81).
- 26. Sparganothis senecionana (Wlsm.). 3. Argus Mts., Inyo Co., California, 31 May 1940, D. Meadows, EME. (p. 81).
- 27. Sparganothis senecionana (Wlsm.). 3. 6 mi SE Yorkville, Mendocino Co., California, 18 May 1966, A. J. Slater, EME. (p. 81).
- 28. Sparganothis senecionana (Wlsm.). 3. Arroyo Mocho, 20 mi S Livermore, Alameda Co., California, 24 May 1957, J. Powell, EME. (p. 81).
- Sparganothis senecionana (Wlsm.). ♀. San Bruno Mts., San Mateo Co., California, 3 May 1963, J. Powell, EME. (p. 81).
- 30. Sparganothis senecionana (Wlsm.). Q. jct. highways 92 and 280, San Mateo Co., California, 4 April 1990, J. Powell, EME. (p. 81).
- 31. Sparganothis senecionana (Wlsm.). ♀. Big Creek Reserve, U.C. Natural Lands Reserve, 10 m, Monterey Co., California, 5–8 June 1989, em: 2 February 1990, Y-S. Hsu and J. Powell, EME. (p. 81).
- 32. Sparganothis senecionana (Wlsm.). \(\mathbb{S} \). Morro Bay State Park, San Luis Obispo Co., California, 3 May 1974, J. Powell, EME. (p. 81).
- 33. Sparganothis senecionana (Wlsm.). ♂. Little Harbor, Santa Catalina Island, Los Angeles Co., California, 3 May 1978, J. Powell, EME. (p. 81).
- 34. Sparganothis senecionana (Wlsm.). & 7 mi E Downieville, Sierra Co., California, 3 June 1984, J. Powell and J. De Benedictis, EME. (p. 81).
- Sparganothis vocaridorsana Kft. 3. 2 mi SE Sumpter, Baker Co., Oregon, 18 June 1970, J. F. G. Clarke, USNM. (p. 84).
- 36. Sparganothis richersi Powell and J. Brown, ♂. Paratype. Greer, 8,500′, Apache Co., Arizona, 30 July 2009, K. Richers, USNM. (p. 85).
- 37. Sparganothis umbrana B. and Bsk. 3. Burlington, Chittenden Co., Vermont, 23 June 1969, USNM. (p. 86).
- 38. Sparganothis umbrana B. and Bsk. 3. Burlington, Chittenden Co., Vermont, 23 June 1969, USNM. (p. 86).
- 39. *Sparganothis umbrana* B. and Bsk. ♀. Burlington, Chittenden Co., Vermont, 22 June 1969, reared from *Lotus* sp., G., Neilson, USNM. (p. 86).
- 40. Sparganothis umbrana B. and Bsk. ♀. Holotype. St. Davids, Ontario, 22 June 1932, W. L. Putnam, CNC. (p. 86).
- 41. Sparganothis striata (Wlsm.). Q. Zapata Ranch, 7,900', Alamosa Co., Colorado, 26 June 1982, R. W. Hodges, USNM. (p. 87).
- 42. Sparganothis striata (Wlsm.). ♂. Snake River, opposite Clarkston, Whitman Co., Washington, 29 June 1933, J. F. G. Clarke, USNM. (p. 87).
- 43. Sparganothis distincta (Wlsm.). & Van Cortlandt Park, Bronx Co., New York, 23 June 1971, E. Jäckh, USNM. (p. 88).
- 44. Sparganothis distincta (Wlsm.). ♀. Vaughn Wildlife Management Area, Worcester Co., Maryland, 15 September 1998, J. Glaser, USNM. (p. 88).
- 45. Sparganothis pulcherrimana (Wlsm.). \(\begin{align*} \text{Big Oak Tree State Park,} \) Mississippi Co., Missouri, 28 May 1985, G. Balogh, USNM. (p. 89).
- 46. Sparganothis pulcherrimana (Wlsm.). ♂. 4.9 mi W Wheatland Hartley Shelterbelt, Platte Co., Wyoming, 30 June 1980, M. G. Pogue, USNM. (p. 89)
- 47. Sparganothis pulcherrimana, ♀. Canadian, Hemphill Co., Texas, 2 June 1970, A. and M. E. Blanchard, USNM. (p. 89).
- 48. Sparganothis pulcherrimana (Wlsm.). ♂. W. Anthony Rd, 1.4 mi WSW of Anthony, Marion Co., Florida, 4 April 2000, D. C. Ferguson, USNM. (p. 80)
- 49. Sparganothis rubicundana (Herrich-Schäffer). ♂. Churchill, Manitoba, 15 August 1937, W. J. Brown, USNM slide 124,546, CNC. (p. 90).
- 50. Sparganothis rubicundana (Herrich-Schäffer). ♀. Vågå, 600 m, Norway, 11 July 1953, I. Svensson, USNM. (p. 90).



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- 1. Sparganothis praecana (Kennel). ♂. Nuolja R., alp, Norway, 26 July 1958, I. Svensson, USNM. (p. 91).
- 2. *Cenopis pettitana* (Rob.), ♀. Radisson, Onondaga Co., New York, 3 July 1977, E. Jäckh, USNM. (p. 94).
- 3. Cenopis pettitana (Rob.), Q. Devil's Den State Park, Washington Co., Arkansas, 13 June 1966, R. W. Hodges, USNM. (p. 94).
- 4. *Cenopis pettitana* (Rob.), ♀. Six Mile Creek, Ithaca, Tompkins Co., New York, 22 June 1957, J. G. Franclemont, USNM. (p. 94).
- 5. Cenopis pettitana (Rob.), & Devil's Den State Park, Washington Co., Arkansas, 12 June 1966, R. W. Hodges, USNM. (p. 94).
- 6. Cenopis pettitana (Rob.), & Canadian, Hemphill Co., Texas, 29 May 1970, A. and M. E. Blanchard, USNM. (p. 94).
- 7. Cenopis pettitana (Rob.), ♂. McLean Bogs Reserve, Tompkins Co., New York, 11 July 1956, J. G. Franclemont, USNM. (p. 94).
- 8. Cenopis pettitana (Rob.), & west side Carlin Lake, T43N R6E sec. 17, Vilas Co., Wisconsin, 30 June 1987, G. Balogh, USNM. (p. 94).
- 9. Cenopis niveana Wslm, ♂. Devil's Den State Park, Washington Co., Arkansas, 9 June 1966, R. W. Hodges, USNM. (p. 96).
- 10. Cenopis niveana Wslm., \$\varphi\$. McLean Bogs Reserve, Tompkins Co., New York, 11 July 1956, J. G. Franclemont, USNM. (p. 96).
- 11. Cenopis niveana Wslm., 3. Jockvale, Ontario, 19 June 1943, J. McDunnough, CNC. (p. 96).
- 12. Cenopis reticulatana (Clem.), ♂. Elk Neck State Forest, Cecil Co., Maryland, 10 July 1997, J. Glaser, USNM. (p. 98).
- 13. Cenopis reticulatana (Clem.), ♀. Bon Secour National Wildlife Refuge, Baldwin Co., Alabama, 11 May 1994, R. W. Hodges, USNM. (p. 98).
- 14. Cenopis reticulatana (Clem.), ♀. T41N R4W sec 27, Mackinac Co., Michigan, 14 August 1988, G. Balogh, UNSM. (p. 98).
- 15. Cenopis ferreana (Bsk.), 3. Highlands, 3,865', Macon Co., North Carolina, 19 July 1958, J. G. Franclemont, USNM. (p. 100).
- 16. Cenopis ferreana (Bsk.), 9. T18N R14E sec 23, Oktibbeha Co., Mississippi, 9 June 1988, R. L. and B. B. Brown, MEM. (p. 100).
- 17. Cenopis lamberti (Franclemont), ♂. Paratype. Cherry Hill Recreation Area, Route 107, 2,000′, Oconee Co., South Carolina, 7 August 1958, J. G. Franclemont, USNM. (p. 100).
- 18. Cenopis lamberti (Franclemont), ♀. Paratype. Cherry Hill Recreation Area, Route 107, 2,000′, Oconee Co., South Carolina, 19 August 1958, J. G. Franclemont, USNM. (p. 100).
- 19. *Cenopis daphnana* (McD.), ♂. White Beach, Queens Co., Nova Scotia, 30 July 1954, J. McDunnough, CNC. (p. 101).
- Cenopis diluticostana Wlsm., ♀. Plummers Island, [Potomac River], Montgomery Co., Maryland, 20 July 1962, R. W. Hodges, USNM. (p. 102).
- 21. *Cenopis diluticostana* Wlsm., 3. Radisson, Onondaga Co., New York, 6 July 1977, E. Jäckh, USNM. (p. 102).
- 22. Cenopis diluticostana Wlsm., ♀. Van Cortlandt Park, The Bronx, Bronx Co., New York, 20 May 1970, E. Jäckh, USNM. (p. 102).
- Cenopis diluticostana Wlsm., ♂. Bon Secour National Wildlife Refuge, Baldwin Co., Alabama, 11 May 1994, R. W. Hodges, USNM. (p. 102).
- 24. Cenopis unicolorana Powell and J. Brown, ♀. Paratype. Bon Secour National Wildlife Refuge, Baldwin Co., Alabama, 13–16 May 1994, R. L. Brown and D. Pollock, MEM. (p. 103).
- 25. Cenopis unicolorana Powell and J. Brown, ♂. Paratype. Bon Secour National Wildlife Refuge, Baldwin Co., Alabama, 11–16 May 1994, R. L. Brown and D. Pollock, MEM. (p. 103).
- 26. Cenopis unicolorana Powell and J. Brown, &. Paratype. Bon Secour

- National Wildlife Refuge, Baldwin Co., Alabama, 11 May 1994, R. W. Hodges, USNM. (p. 103).
- 27. Cenopis directana (Wlk.), \$\oints\$. Highlands, 3,865', Macon Co., North Carolina, 18 July 1958, J. G. Franclemont, USNM. (p. 105).
- 28. Cenopis directana (Wlk.), ♂. Lake Placid, Archbold Biological Research Station, Highlands Co., Florida, 22 April 1959, R. W. Hodges, USNM. (p. 105).
- 29. Cenopis directana (Wlk.), ♂. Six Mile Creek, Ithaca, Tompkins Co., New York, 17 July 1957, J. G. Franclemont, USNM. (p. 105).
- 30. Cenopis directana (Wlk.), ♀. Bon Secour National Wildlife Refuge, Baldwin Co., Alabama, 14 May 1994, R. W. Hodges, USNM. (p. 105).
- 31. Cenopis directana (Wlk.), ♂. Lake Placid, Archbold Biological Research Station, Highlands Co., Florida, 8–15 May 1964, R. W. Hodges, USNM. (p. 105).
- 32. Cenopis directana (Wlk.), & .5 mi E McCloud, Siskiyou Co., California, 7 July 1957, J. Powell, EME. (p. 105).
- Cenopis saracana Kft., S. Devil's Den State Park, Washington Co., Arkansas, 1 July 1966, R. W. Hodges, USNM. (p. 107).
- 34. Cenopis saracana Kft., \$\opin\$. Devil's Den State Park, Washington Co., Arkansas, 11 July 1966, R. W. Hodges, USNM. (p. 107).
- 35. Cenopis saracana Kft., ♀. Highlands, 3,865′, Macon Co., North Carolina, 23 July 1958, J. G. Franclemont, USNM. (p. 107).
- 36. Cenopis saracana Krt., ♀. Highlands, 3,865′, Macon Co., North Carolina, 19 July 1958, J. G. Franclemont, USNM. (p. 107).
- 37. Cenopis saracana Krt., Q. Six Mile Creek, Ithaca, Tompkins Co., New York, 21 June 1957, J. G. Franclemont, USNM. (p. 107).
- 38. Cenopis saracana Krt., \(\begin{align*} \) Six Mile Creek, Ithaca, Tompkins Co., New York, 14 June 1957, J. G. Franclemont, USNM. (p. 107).
- 39. *Cenopis mesospila* Zell. ♂. Eatons Neck, Long Island, Suffolk Co., New York, 25 June 1971, E. Jäckh, USNM. (p. 108).
- Cenopis mesospila Zell. d. Six Mile Creek, Ithaca, Tompkins Co., New York, 6 July 1957, J. G. Franclemont, USNM slide 88,630, USNM. (p. 108)
- 41. *Cenopis mesospila* Zell. 3. McLean Bogs Reserve, Tompkins Co., New York, 16 July 1956, J. G. Franclemont, USNM. (p. 108).
- 42. Cenopis eulongicosta Powell and J. Brown, ♀. Paratype. T21N R2E sec 12,13N and R3E sec 7S 18N, Grenada Co., Mississippi, 21–28 May 1991, R. L. Brown, MEM. (p. 110).
- Cenopis eulongicosta Powell and J. Brown, ♂. Paratype. T21N R2E sec 12,13N and R3E sec 7S 18N, Grenada Co., Mississippi, 5–11 June 1991, R. L. Brown, MEM. (p. 110).
- 44. Cenopis cana (Rob.), 3. Bon Secour National Wildlife Refuge, Baldwin Co., Alabama, 14 May 1994, R. W. Hodges, USNM. (p. 111).
- Cenopis cana (Rob.), & Conroe, Montgomery Co., Texas, 28 April 1968,
 A. and M. E. Blanchard, USNM. (p. 111).
- 46. Cenopis cana (Rob.), ♀. McClellanville, Charleston Co., South Carolina, 8 June 1972, R. B. Dominick and C. R. Edwards, USNM. (p. 111).
- 47. Cenopis vabroui Powell and J. Brown, ♀. Paratype. 4.2 mi NE Abita Springs, T6, SR12E, sec 24, St. Tammany Parish, Louisiana, 16 May 1998, V. A. Brou, USNM. (p. 112).
- 48. *Cenopis vabroui* Powell and J. Brown, δ. Paratype. 4.2 mi NE Abita Springs, T6, SR12E, sec 24, St. Tammany Parish, Louisiana, 8 May 1998, V. A. Brou, EME. (p. 112).
- Cenopis karacana Kft., ♀. Highlands, 3,865′, Macon Co., North Carolina,
 July 1958, R. W. Hodges, USNM slide 88,670, USNM. (p. 113).
- Cenopis karacana Kft., J. Wrangle Brook Rd., Lakehurst, Ocean Co., New Jersey, 24 June 1955, J. G. Franclemont, USNM. (p. 113).



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- Cenopis karacana Kft., d. Lakehurst, Ocean Co., New Jersey, 4 July 1909,
 W. D. Kearfott, USNM slide 88,965, USNM. (p. 113).
- Cenopis chambersana Kft., ♀. Near Warsaw, Benton Co., Missouri, 20 June 1970, J. R. Heitzman, USNM slide 26,065, USNM. (p. 114).
- 3. *Cenopis chambersana* Kft., \(\foatsize \). Six Mile Creek, Ithaca, Tompkins Co., New York, 6 July 1957, J. G. Franclemont, USNM slide 87,964, USNM. (p. 114).
- Cenopis chambersana Kft. J. Six Mile Creek, Ithaca, Tompkins Co., New York, 6 July 1957, J. G. Franclemont, USNM. (p. 114).
- 5. Platynota idaeusalis (Wlk.), \$\varphi\$. Highlands, 3,865', Macon Co., North Carolina, 4 July 1958, J. G. Franclemont, USNM. (p. 118).
- 6. *Platynota idaeusalis* (Wlk.), ♀. Tuscarora Lake, Madison Co., New York, 25 June 1975, E. Jäckh, USNM. (p. 118).
- 7. Platynota idaeusalis (Wlk.), \(\begin{aligned} \text{Armdale, Halifax Co., Nova Scotia, 28} \)
 July 1967, D. C. Ferguson, USNM. (p. 118).
- 8. *Platynota idaeusalis* (Wlk.), & Highlands, 3,865', Macon Co., North Carolina, 15 July 1958, J. G. Franclemont, USNM. (p. 118).
- 9. Platynota idaeusalis (Wlk.), & Highlands, 3,865', Macon Co., North Carolina, 3 July 1958, J.G. Franclemont, USNM. (p. 118).
- 10. *Platynota idaeusalis* (Wlk.), 3. Hackberry Lake, Valentine N.W.R., Cherry Co., Nebraska, 8 June 1983, R. W. Hodges, USNM. (p. 118).
- 11. Platynota exasperatana (Zell.), 3. Devil's Den State Park, Washington Co., Arkansas, 4 June 1966, R. W. Hodges, USNM. (p. 120).
- 12. *Platynota exasperatana* (Zell.), 3. Devil's Den State Park, Washington Co., Arkansas, 11 June 1966, R.W. Hodges, USNM. (p. 120).
- 13. *Platynota exasperatana* (Zell.), 3. Lake Winnipesaukee, Long Island, Belknap Co., New Hampshire, 4 August 1972, E. Jäckh, USNM. (p. 120).
- 14. Platynota exasperatana (Zell.). Q. Sycamore Landing, Montgomery Co., Maryland, 24 July 1976, D. C. Ferguson, USNM. (p. 120).
- 15. Platynota exasperatana (Zell.), ♀. Dimock, Susquehanna Co., Pennsylvania, 13 August 1989, D.F.B., USNM. (p. 120).
- 16. Platynota exasperatana (Zell.), ♀. Highlands, 3,865′, Macon Co., North Carolina, 4 August 1958, J. G. Franclemont, USNM. (p. 120).
- 17. Platynota semiustana Wlsm., \$\varphi\$. Deutschburg, Jackson Co., Texas, 14 March 1974, A. and M. E. Blanchard, USNM. (p. 121).
- 18. Platynota semiustana Wlsm., ♀. Okefenokee National Wildlife Refuge, Charlton Co., Georgia, 16 April 1991, D. C. Ferguson, USNM. (p. 121).
- 19. *Platynota semiustana* Wlsm., ♂. Cherry Hill Recreation Area, Route 107, 2,000′, Oconee Co., South Carolina, 11 August 1958, J. G. Franclemont, USNM. (p. 121).
- Platynota semiustana Wlsm., & Fairfield Plantation, McClellanville, Charleston Co., South Carolina, 1 May 1981, R. W. Hodges, USNM slide 88,174, USNM. (p. 121).
- Platynota semiustana Wlsm., Q. Deutschburg, Jackson Co., Texas, 14 March 1974, A. and M. E. Blanchard, USNM slide 94,112, USNM. (p. 121).
- Platynota rostrana (Wlk.), ♀. Lake Placid, Archbold Biological Research Station, Highlands Co., Florida, 2 April 1959, R. W. Hodges, USNM. (p. 122).
- Platynota rostrana (Wlk.), ♂. Oneco, Manatee Co., Florida, 2 April 1954,
 J. G. Franclemont, USNM. (p. 122).
- 24. Platynota rostrana (Wlk.), & Lake Placid, Archbold Biological Research Station, Highlands Co., Florida, 1–7 March 1964, R. W. Hodges. (p. 122).
- 25. Platynota rostrana (Wlk.), ♀. Frisco, Dare Co., North Carolina, 24 March 1975, D. C. Ferguson, USNM. (p. 122).
- Platynota rostrana (Wlk.), ♀. Oneco, Manatee Co., Florida, 2 April 1954,
 J. G. Franclemont, USNM. (p. 122).
- Platynota wenzelana (Haim.), S. Madera Canyon, Santa Rita Mts., 4,880', Santa Cruz Co., Arizona, 1 July 1959, J. G. Franclemont, USNM. (p. 123).

- 28. Platynota wenzelana (Haim.), & Madera Canyon, Santa Rita Mts., 4,880', Santa Cruz Co., Arizona, 15 June 1963, J. G. Franclemont. (p. 123)
- Platynota wenzelana (Haim.), ♀. Madera Canyon, Santa Rita Mts., 5,800′, Santa Cruz Co., Arizona, 7 July 1960, J. G. Franclemont, USNM. (p. 123).
- 30. Platynota wenzelana (Haim.), ♀. Madera Canyon, Santa Rita Mts., 5,600′, Santa Cruz Co., 2 September 1959, R.W. Hodges, USNM. (p. 123).
- 31. Platynota wenzelana (Haim.). 3. Carr Canyon, Huachuca Mts., Cochise Co., Arizona, 31 July 1986, D. Wagner, EME. (p. 123).
- 32. Platynota wenzelana (Haim.), \(\varphi\). Carr Canyon, Huachuca Mts., Cochise Co., 31 July 1986, D. Wagner, EME. (p. 123).
- 33. *Platynota polingi* Powell and J. Brown, ♂. Holotype. Indian Oasis, Sells P.O., Pima Co., Arizona, 1–15 April 1922, O. C. Poling, USNM slide 87,913, USNM. (p. 125).
- 34. *Platynota texana* Powell and J. Brown, ♂. Holotype. Brownsville, Cameron Co., Texas, 4 March 1937, T. N. Freeman, CNC. (p. 126).
- 35. *Platynota texana* Powell and J. Brown, 3. Paratype. Brownsville, Cameron Co., Texas, 26–28 April [no year], F. H. Benjamin, USNM slide 94,113, USNM. (p. 126).
- 36. *Platynota labiosana* (Zell.), ♀. Madera Canyon, Santa Rita Mts., 5,600′, Santa Cruz Co., Arizona, 17 May 1963, J. G. Franclemont, USNM. (p. 127).
- Platynota labiosana (Zell.), Q. Madera Canyon, Santa Rita Mts., 4,880', Santa Cruz Co., Arizona, 3 June 1963, J. G. Franclemont, USNM. (p. 127).
- 38. *Platynota labiosana* (Zell.), ♂. Santa Cruz Co., Madera Canyon, Santa Rita Mts., 4,880′, Santa Cruz Co., Arizona, 7 May 1963, J. G. Franclemont, USNM. (p. 127).
- Platynota labiosana (Zell.), ♀. Madera Canyon, Santa Rita Mts., 4,880′, Santa Cruz Co., Arizona, 12 October 1959, R. W. Hodges, USNM. (p. 127)
- 40. Platynota labiosana (Zell.), ♂. Madera Canyon, Santa Rita Mountains, 4,880′, Santa Cruz Co., Arizona, 5 September 1959, R. W. Hodges, USNM. (p. 127).
- 41. *Platynota islameconae* Powell and J. Brown, ♂. Paratype. Central Valley, Santa Cruz Island, Santa Barbara Co., California, 22–24 May 1984, J. Powell and J. De Benedictis, EME. (p. 128).
- 42. *Platynota blanchardi* Powell and J. Brown, & Paratype. Fort Davis, Jeff Davis Co., Texas, 25 March 1968, A. and M. E. Blanchard, USNM. (p. 129)
- 43. *Platynota blanchardi* Powell and J. Brown, ♂. Paratype. Fort Davis, Jeff Davis Co., Texas, 25 March 1968, A. and M. E. Blanchard, USNM. (p. 129).
- 44. *Platynota blanchardi* Powell and J. Brown, ♂. Paratype. Fort Davis, Jeff Davis Co., Texas, 25 March 1968, A. and M. E. Blanchard, USNM. (p. 129).
- 45. *Platynota flavedana* Clem. ♀. Colesville, Montgomery Co., Maryland, 3 September 1980, D. C. Ferguson, USNM. (p. 130).
- Platynota flavedana Clem. ♀. Devil's Den State Park, Washington Co., Arkansas, 11 June 1966, R. W. Hodges, USNM. (p. 130).
- 47. Platynota flavedana Clem. ♀. Pueblo Del Sol, Huachuca Mts., Cochise Co., Arizona, 24 September 1985, R. S. Wielgus, USNM. (p. 130).
- 48. *Platynota flavedana* Clem. ♀. T7S R16W Sec 7, Cass Co., Michigan, 31 July 1987, G. Balogh, USNM. (p. 130).
- Platynota flavedana Clem. ♂. Wedge Plantation, McClellanville, Charleston Co., South Carolina, 4 June 1978, D. C. Ferguson, USNM. (p. 130).
- 50. *Platynota flavedana* Clem. ♂. W Friendship, Howard Co., Maryland, 21 May 1975, D. C. Ferguson, USNM. (p. 130).

TORTRICOIDEA



PLATE F

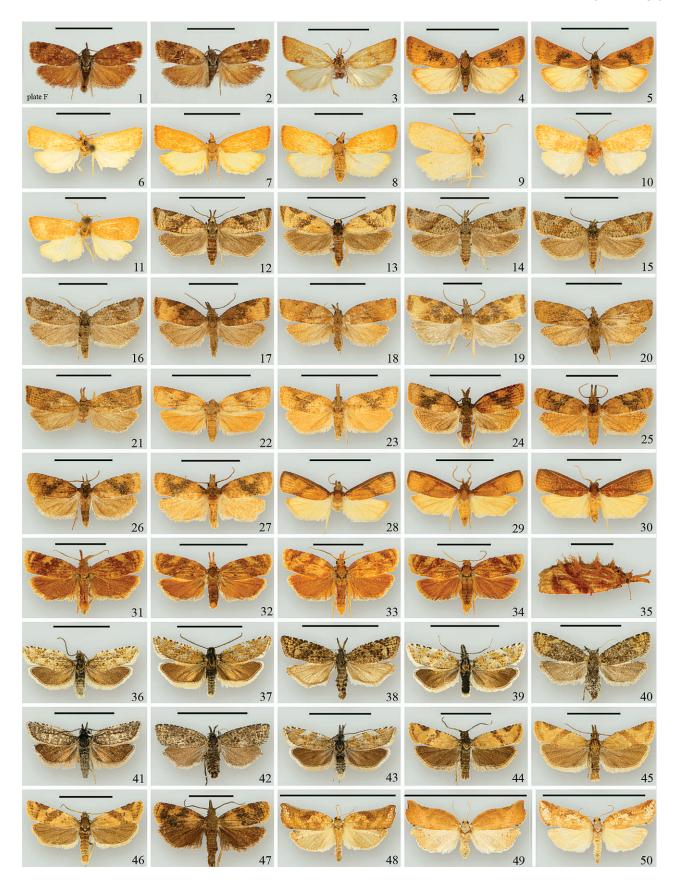
TORTRICOIDEA

TORTRICIDAE SPARGANOTHINI AND ATTERIINI

figs 1-50

- 1. *Platynota zapatana* Powell and J. Brown, & Paratype. 4 mi NE Juamave, Tamaulipas, 20 September 1976, J. A. Powell, EME. (p. 132).
- Platynota zapatana Powell and J. Brown, ♂. 40 mi S San Roberto, 6,000′, Nuero Leon, 22 September 1976, J. Powell and J. Chemsak, EME. (p. 132).
- 3. *Platynota larreana* (Comstock), ♀. near Llano, Mohave Desert, [Los Angeles Co., em: 25 April 1938, J. A. Comstock, LACM. (p. 133).
- 4. *Platynota larreana* (Comstock), ♂. Freeman, Kern Co., California, Hopkins # 32777, 31 March 1942, C. B. Eaton, USNM. (p. 133).
- Platynota larreana (Comstock), d. Near Llano, Mojave Desert, Los Angeles Co., California, 17 April 1938, J. A. Comstock, USNM. (p. 133).
- Platynota larreana (Comstock), ♂. Mohave Co., Arizona, 8–15 June 1919, USNM slide 87,929, USNM. (p. 133).
- Platynota larreana (Comstock), S. East of Phoenix, Superstition Mts., King's Ranch Resort, Maricopa Co., Arizona, 12 May 1963, E. Jäckh, USNM. (p. 133).
- 8. Platynota larreana (Comstock), \(\begin{align*} \). Thunderbird Regional Mountain Park, Maricopa Co., Arizona, 23 May 1975. R. S. Wielgus and F. F. Hasbrouck, USNM. (p. 133).
- 9. Platynota yumana (Kft.), 3. Holotype. Desert, Yuma Co., Arizona, 10 September 1928, USNM slide 87,926, AMNH. (p. 134).
- 10. Platynota redingtonensis Powell and J. Brown, ♂. Paratype. Redington, Pima Co., Arizona, [no date], USNM slide 87,927, USNM. (p. 135).
- 11. Platynota redingtonensis Powell and J. Brown, ♂. Holotype. Redington, Pima Co., Arizona, [no date], USNM slide 88.037, USNM. (p. 135).
- 12. Platynota viridana B. and Bsk., ♂. Pueblo Del Sol, Huachuca Mts., Cochise Co., Arizona, 30 April 1985, R. S. Wielgus, USNM. (p. 136).
- 13. Platynota viridana B. and Bsk., & Pueblo Del Sol, Huachuca Mts., Cochise Co., 10 April 1986, R. S. Wielgus, USNM. (p. 136).
- Platynota viridana B. and Bsk., ♂. White Tanks Regional Mountain Park, Maricopa Co., Arizona, 21 March 1976, R. S. Wielgus, USNM. (p. 136).
- 15. *Platynota viridana* B. and Bsk., ♂. White Tanks Regional Mountain Park, Maricopa Co., Arizona, 21 March 1976, R. S. Wielgus, USNM. (p. 136).
- 16. Platynota viridana B. and Bsk., ♂. White Tanks Regional Mountain Park, Maricopa Co., Arizona, 21 April 1976, R. S. Wielgus, USNM. (p. 136).
- 17. Platynota stultana Wlsm., ♂. La Tuna Canyon, 1,200′, Los Angeles Co., California, 28 June 1941, W. H. Evans, USNM. (p. 136).
- 18. *Platynota stultana* Wlsm., ♀. El Segundo Dunes, Los Angeles Co., California, 18 May 1988, R. H. Leuschner, USNM. (p. 136).
- 19. *Platynota stultana* Wlsm., & Santa Ana Refuge, Hildago Co., Texas, 4 September 1974, A. and M. E. Blanchard, USNM slide 88,930, USNM. (p. 136)
- Platynota stultana Wlsm., ♀. Torrey Pines State Reserve, Sorrento Valley Marsh, San Diego Co., California, 10–17 June 2005, N. Bloomfield, USNM. (p. 136).
- 21. Platynota stultana Wlsm., Q. Nogales-Bamoa, Sinaloa, 11 April 1933, USNM. (p. 136).
- 22. Platynota nigrocervina Wlsm., ♀. Boulder, Boulder Co., Colorado, 8 August [no year], T. D. A. Cockerell, USNM. (p. 138).
- 23. Platynota nigrocervina Wlsm., \$\varphi\$. Platte Canyon, Jefferson/Douglas cos., Colorado, [no date], Oslar, USNM. (p. 138).
- 24. *Platynota nigrocervina* Wlsm., &. Bishop, Marshall Co., Oklahoma, 31 July 1973, D.C.A., USNM. (p. 138).
- Platynota nigrocervina Wlsm., ♂. Seguin, Guadalupe Co., Texas, 4 August 1974, R. H. Leuschner, USNM. (p. 138).

- 26. Platynota nigrocervina Wlsm., 3. Oklahoma City, Oklahoma Co., Oklahoma, 23 June 1955, D. R. Davis, USNM. (p. 138).
- Platynota nigrocervina Wlsm., S. Oklahoma City, Oklahoma Co.,
 Oklahoma, 30 August 1955, D. R. Davis, USNM. (p. 138).
- 28. *Platynota calidana* (Zell.), 3. Big Pine Key, Monroe Co., Florida, 11 January 1983, D. C. Ferguson, USNM slide 87,873, USNM. (p. 139).
- 29. Platynota calidana (Zell.), &. Big Pine Key, Monroe Co., Florida, 11 January 1983, D. C. Ferguson, USNM. (p. 139).
- 30. Platynota calidana (Zell.), &. Big Pine Key, Monroe Co., Florida, 11 January 1983, D. C. Ferguson, USNM. (p. 139).
- 31. Niasoma metallicana (Wlsm.), & Eastern Neck Wildlife Reserve, Kent Co., Maryland, 8 August 2004, J. Glaser, USNM. (p. 144).
- 32. *Niasoma metallicana* (Wlsm.), \$\varphi\$. Decoursey Bridge Road, Dorcester Co., Maryland, 13 August 1992, J. Glaser, USNM. (p. 144).
- 33. *Niasoma metallicana* (Wlsm.), ♂. Eastern Neck Wildlife Reserve, Kent Co., Maryland, 8 August 2004, J. Glaser, USNM. (p. 144).
- 34. Niasoma metallicana (Wlsm.), ♂. Eastern Neck Wildlife Reserve, Kent Co., Maryland, 9 August 2004, J. Glaser, USNM. (p. 144).
- Niasoma metallicana (Wlsm.), J. Edgelift, Alachua Co., Florida, 21 July 1982, J. Gillmore, EME. (p. 144).
- 36. Synnoma lynosyrana Wlsm., & E Gooding, Gooding Co., Idaho, 25 August 1956, R.A. Mackie, EME. (p. 141).
- 37. Synnoma lynosyrana Wlsm., ♂. Springer, Colfax Co., New Mexico, 25 October 1921, USNM. (p. 141).
- 38. Synnoma lynosyrana Wlsm., ♀. Springer, Colfax Co., New Mexico, 25 October 1920, C. N. Ainslie, USNM. (p. 141).
- 39. Synnoma lynosyrana Wlsm., ♂. 4 mi W Whitehall, Jefferson Co., Montana, 3 August 1971, W. H. Burleson, USNM. (p. 141).
- 40. Synnoma lynosyrana Wlsm., ♀. 1 mi E Laramie, Albany Co., Wyoming, 19 September 1980, M. G. Pogue, USNM. (p. 141).
- 41. Synnoma lynosyrana Wlsm., 3. 8 mi SE Gorman, Los Angeles Co., California, 5 November 1974, J. A. Powell, EME. (p. 141).
- 42. *Synnoma lynosyrana* Wlsm., ♀. 10 mi NE Weed, Siskiyou Co., California, 23 August 1958, J. A. Powell, EME. (p. 141).
- 43. Synnoma lynosyrana Wlsm., &. Point of Rocks, Sweetwater Co., Wyoming, 4 September 1967, J. A. Powell, EME. (p. 141).
- 44. Synalocha gutierreziae Powell, ♂. State Route 90 at Gold Gulch Road, 6,325′, Grant Co., New Mexico, 9 August. 1999, D. J. Wright, USNM. (p. 145).
- 45. Synalocha gutierreziae Powell, ♂. 20 mi NNW Van Horn, Sierra Diablo, 6,000′, Culberson Co., Texas, 30 May 1973, R. W. Hodges, USNM. (p. 145)
- 46. Synalocha gutierreziae Powell, ♂. Cherry Canyon, Guadalupe Mts., 5,096′, Culberson Co., Texas 22 May 1973, R. W. Hodges, USNM. (p. 145).
- 47. Syllonoma longipalpana Powell, ♂. Holly Shelter grasslands, Pender Co., North Carolina, 28 June 1995, J. B. Sullivan, EME. (p. 147).
- 48. Tinacrucis noroesta Powell, 3. 10 mi W El Salto, 9,000', Durango, 5 July 1964, J. E. H. Martin, EME. (p. 149).
- 49. *Tinacrucis noroesta* Powell, \$\, Summerhaven, Catalina Mts., \$\, 8,200', Pima Co., Arizona, 2 September 1992, R. H. Leuschner, USNM. (p. 149).
- Tinacrucis noroesta Powell, S. Greer, 8,500', Apache Co., Arizona, 2 August 1989, D. C. Ferguson, USNM. (p. 149).



NOTES

1. ABBREVIATIONS	ΟF	INSTITUTIONAL	AND
PRIVATE COLLECTION	ONS	•	

- AMNH American Museum of Natural History, New York, NY, USA
- ANSP Academy of Natural Sciences, Philadelphia, PA, USA
- BMNH The Natural History Museum, London, England (formerly British Museum of Natural History)
- CAS California Academy of Sciences, San Francisco, CA, USA
- CBC private collection of Charles Bird, Winfield, Alberta, Canada
- CMNH Carnegie Museum of Natural History, Pittsburgh, PA, USA
- CNC Canadian National Collection of Insects and Arachnids, Ottawa, Canada
- CUIC Cornell University Insect Collection, Cornell University, Ithaca, NY, USA
- CSU Colorado State University, Fort Collins, CO, USA
- EKC private collection of Edward Knudson, Houston, TX, USA
- EME Essig Museum of Entomology, University of California, Berkeley, CA, USA
- FSCA Florida State Collection of Arthropods, Gainesville, FL, USA
- JBS private collection of J. Bolling Sullivan, Beaufort, NC, USA
- KRC private collection of Kelly M. Richers, Bakersfield, CA, USA
- LACM Los Angeles County Museum of Natural History, Los Angeles, CA, USA
- MEM Mississippi Entomological Museum, Mississippi State University, Mississippi State, MS, USA
- MCZ Museum of Comparative Zoology, Harvard University, Cambridge, MA, USA
- MGAB Muzeul de Istoria Naturala "Grigore Antipa, Bucharest, Romania
- MNHN Museum National d'Histoire Naturelle, Paris, France
- MNHU Museum für Naturkunde Leibniz-Institut für Evolutions- und Biodiversitätsforschung an der Humboldt-Universität zu Berlin, Germany
- SDNHM San Diego Natural History Museum, San Diego, CA, USA
- USNM United States National Museum of Natural History, Washington, DC, USA

VBC private collection of Vernon Brou, Abita Springs, LA, USA

VT Virginia Tech University, Blacksburg, VA, USA
YPB Peabody Museum, Yale University, New Haven,
CT, USA

2. COMMON NAMES

The use of an asterisk "*" in the text denotes a name listed in *Common Names of Insects & Related Organisms* 1989, published by the Entomological Society of America.

French-language common names have been taken from Benoit, P. et al., 1975, French Names of Insects in Canada published for the Quebec Society for the Protection of Plants, Quebec. The abbreviation "m" after a name indicates that it is masculine, "f" that it is feminine.

3. CITATIONS OF AUTHORITIES

Authors' names without parentheses indicate that the specific name is associated with the genus in which it was described.

Authors' names in parentheses indicate that the specific name has been transferred from the genus in which it was described to another genus.

4. WING LENGTH

Wing length is the measurement in millimeters from the base to the apex of the forewing.

5. LOCATION OF TYPE SPECIMEN

The current location of the type specimen is given by the appropriate abbreviation in Square brackets immediately following the type locality. The work "lost" indicates that it no longer exists or was not found.

6. NOMENCLATURE FOR LARVAL SETAE

Hinton's (*Trans. Royal Ent. Soc. London*, **97**: 1–37, 1946) terminology as modified by Stehr (Order Lepidoptera, *in* Stehr, F. W., *Immature Insects*, 288–304, 1987) is used to refer to larval setae.

CHECK LIST

TORTRICINAE

Sparganothini Druce, 1912

AMORBIA Clemens, 1860

Hendecastema Walsingham, 1879

Ptychamorbia Walsingham, 1891

cuneana (Walsingham, 1879)

adumbrana (Walsingham, 1879)

essigana Busck, 1929

synneurana Barnes and Busck, 1920

humerosana Clemens, 1860

emigratella Busck, 1909

vero Powell and J. Brown, 2012

knudsoni Phillips-Rodriguez and Powell, 2007

COELOSTATHMA Clemens, 1860

discopunctana Clemens, 1860

placidana Powell and J. Brown, 2012

SPARGANOPSEUSTIS Powell and Lambert, 1986

martinana Powell, 1986

SPARGANOTHOIDES Lambert and Powell, 1986

hydeana (Klots, 1936)

machimiana (Barnes and Busck, 1920)

lentiginosana (Walsingham, 1879)

AMORBIMORPHA Kruse, 2012

mackayiana Kruse, 2012

SPARGANOTHIS Hübner, [1825] 1816

Begunna Walker, 1863

Oenectra Guenée, 1845

Oenophthira Duponchel, 1845

Leptoris Clemens, 1865

Enoditis Meyrick, 1912

caryae (Robinson, 1869)

robinsonana Powell and J. Brown, 2012

tessellata Powell and J. Brown, 2012

flavibasana (Fernald, 1882)

sulfureana (Clemens, 1860)

gratana (Walker, 1863)

fulvoroseana (Clemens, 1864)

gallivorana (Clemens, 1864)

virginiana (Clemens, 1864)

belfrageana (Zeller, 1875)

euphronopa Meyrick, 1927

lycopodiana (Kearfott, 1907)

minimetalica Powell and J. Brown, 2012

bistriata Kearfott, 1907

tristriata Kearfott, 1907

demissana (Walsingham, 1879)

unifasciana (Clemens, 1864)

puritana (Robinson, 1869)

violaceana (Robinson, 1869)

xanthoides (Walker, 1863)

breviornatana (Clemens, 1865)

irrorea (Robinson, 1869)

a. inconditana (Walsingham, 1879)

boweri Powell and J. Brown, 2012

taracana Kearfott, 1907

lindalinea Powell and J. Brown, 2012

sullivani Powell and J. Brown, 2012

mcguinnessi Powell and J. Brown, 2012

niteolinea Powell and J. Brown, 2012

azulispecca Powell and J. Brown, 2012

senecionana (Walsingham, 1879)

rudana (Walsingham, 1879)

tunicana (Walsingham, 1879)

californiana (Walsingham, 1879)

vocaridorsana Kearfott, 1905

richersi Powell and J. Brown, 2012

umbrana Barnes and Busck, 1920

striata (Walsingham, 1884)

distincta (Walsingham, 1884)

putmanana Freeman, 1940

solidana Freeman, 1941

pulcherrimana (Walsingham, 1879)

rubicundana (Herrich-Schäffer, 1856)

a. hudsoniana Freeman, 1940

praecana (Kennel, 1900)

cinereana (Zetterstedt, 1840)

lapponana (Caradja, 1916)

abiskoana (Caradja, 1916)

hableri Lichtenberger, 1997

CENOPIS Zeller, 1875

pettitana (Robinson, 1869)

acerivorana (MacKay, 1952)

niveana Walsingham, 1879

groteana Fernald, 1882

reticulatana (Clemens, 1860)

fulgidipennana (Blanchard, 1850)

subauratana (Walker, 1863)

gracilana Walsingham, 1879

ferreana (Busck, 1915)

lamberti (Franclemont, 1986)

daphnana (McDunnough, 1961)

diluticostana Walsingham, 1879

quercana Fernald, 1882

unicolorana Powell and J. Brown, 2012

directana (Walker, 1863)

testulana Zeller, 1875

saracana Kearfott, 1907

austera (Meyrick, 1915)

mesospila Zeller, 1875

albicaudana (Busck, 1915)
eulongicosta Powell and J. Brown, 2012
cana (Robinson, 1869)
vabroui Powell and J. Brown, 2012
karacana Kearfott, 1907
tempestiva Meyrick, 1912
chambersana Kearfott, 1907

PLATYNOTA Clemens, 1960 idaeusalis (Walker, 1859) dioptrica (Meyrick, 1922) sentana Clemens, 1860 exasperatana (Zeller, 1875) semiustana Walsingham, 1884 rostrana (Walker, 1863) connexana (Walker, 1863) repandana (Walker 1963) saturatana (Walker 1863) wenzelana (Haimbach, 1915) polingi Powell and J. Brown, 2012 texana Powell and J. Brown, 2012 labiosana (Zeller, 1875) islameconae Powell and J. Brown, 2012 blanchardi Powell and J. Brown, 2012 flavedana Clemens, 1960 tinctana (Walker, 1863) concursana (Walker, 1863)

laterana (Robinson, 1869)
iridana Barnes and Busck, 1920
zapatana Powell and J. Brown, 2012
larreana (Comstock, 1939)
yumana (Kearfott, 1907)
redingtonensis Powell and J. Brown, 2012
viridana Barnes and Busck, 1920
stultana Walsingham, 1884
chiquitana Barnes and Busck, 1920
nigrocervina Walsingham, 1895
calidana (Zeller, 1877)

SYNNOMA Walsingham, 1879 **lynosyrana** Walsingham, 1879

NIASOMA Busck, 1940 metallicana (Walsingham, 1895)

SYNALOCHA Powell, 1985 **gutierreziae** Powell, 1985

SYLLONOMA Powell, 1985 **longipalpana** Powell, 1985

Atteriini Busck, 1932

TINACRUCIS Powell, 1986 noroesta Powell, 2009

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