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Global review of Vitaceae-feeding *Phyllocnistis* Zeller
(Lepidoptera: Gracillariidae), with corrected identification of
the invasive species in Europe and description
of a new species from the western USA

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Global review of Vitaceae-feeding *Phyllocnistis* Zeller (Lepidoptera: Gracillariidae), with corrected identification of the invasive species in Europe and description of a new species from the western USA

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Abstract. Species of *Phyllocnistis* Zeller (Lepidoptera: Gracillariidae) mining leaves of plants in the family Vitaceae are reviewed worldwide, including descriptions and illustrations of adults and leaf mines. Host plant and parasitoid records, distribution data, and DNA barcoding data are summarized for each species, with many new records provided. Four species are native to North America: *P. vitegenella* Clemens is transcontinental, but rare in the West; *P. vitifoliella* Chambers and *P. ampelopsiella* Chambers are strictly eastern; and *P. occidentalis* Eiseman and van Nieuwerkerken, **new species**, is strictly western. Three of these—*P. vitegenella*, *P. vitifoliella*, and *P. occidentalis*—are commonly found on *Vitis* L. They have been confused in recent decades, and due to a mistaken belief that they are synonymous, the species that has been spreading across Europe since the 1990s was misidentified as *P. vitegenella*, but it is in fact *P. vitifoliella*. The four North American species are best distinguished from one another by leaf mine characteristics and DNA barcodes. The four putative Asian species are *P. toparcha* Meyrick (India, Japan), *P. temperator* Meyrick (Indonesia), *P. vitella* Ermolaev (Russian Far East), and an unnamed species on *Ampelopsis* Michx. (Japan, Taiwan). More DNA barcoding data will be needed to clarify their statuses. Leaf mines found on *Rhoicissus* Planch. in South Africa and on *Cissus* L. in Gabon indicate that at least two undescribed species are present in Africa. Another undescribed species has been reared from *Apocissus* Jackes and Trias-Blasi in Australia.

Key words. Grape, Virginia creeper, leafminer, DNA barcoding, extended phenotype, misidentification, Eulophidae.

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Introduction

Phyllocnistis Zeller, 1848 (Lepidoptera: Gracillariidae) is a genus of very small, usually whitish moths with worldwide distribution (De Prins and De Prins 2026). It is the only genus in the subfamily Phyllocnistinae based on recent phylogenetic studies (Kawahara et al. 2016; Li et al. 2021), although De Prins et al. (2019) follow a different classification, not supported by the molecular phylogeny. The legless larvae form long, serpentine leaf mines, with a few species also mining in stems and fruits (Davis and Wagner 2011). Following three sap-feeding instars, the non-feeding fourth instar spins a cocoon at the end of the mine prior to pupation (Davis and Wagner 2011). Typically, *Phyllocnistis* larvae mine the epidermal cells of fresh growth, making silvery tracks resembling snail slime, but some species also feed on the green tissue below the epidermal cells.

De Prins and De Prins (2026) recognize 122 species. Morphologically the species are often very similar, and notoriously difficult to separate, including in their genitalia. Several species complexes have been discovered and resolved with the aid of DNA analyses (Davis and Wagner 2011; Brito et al. 2017a,b; Kirichenko et al. 2018b; Voith et al. 2023; Triberti et al. 2024). Numerous species remain to be described; based primarily on mine morphology

and host plants, Davis and Wagner (2011) estimated 60 *Phyllocnistis* species at Costa Rica's La Selva Biological Station alone, of which they recognized only a single previously known species, the recently introduced citrus leafminer *P. citrella* Stainton. As of 18 May 2026, the Barcode of Life Data System recognizes 181 different BINs (Barcode Index Numbers; Ratnasingham and Hebert 2013) identified as *Phyllocnistis*. Recorded hosts of the 122 described species are in over 35 different plant families, most commonly Salicaceae (14 species), Lauraceae (nine species), Asteraceae (eight species), and Vitaceae (six species) (De Prins and De Prins 2026), and we know of at least 20 more families on which presumed *Phyllocnistis* leaf mines have been observed. Of the Vitaceae feeders, three were described from the USA (*Phyllocnistis vitegenella* Clemens, 1859; *P. vitifoliella* Chambers, 1871; *P. ampelopsiella* Chambers, 1871) and three from Asia (*P. toparcha* Meyrick, 1918; *P. temperator* Meyrick, 1936; *P. vitella* Ermolaev, 1987).

Worldwide, 20 genera are recognized in the family Vitaceae. By far the greatest diversity is in Asia, where 18 genera are native, followed by Australia (eight), North America (seven), Africa (six), South America (four), and Europe (one) (POWO 2026). Of the genera native to North America, only *Parthenocissus* Planch. and *Vitis* L. are widespread on the continent. *Ampelopsis* Michx. is absent from Canada and the western USA; *Cissus* L. and *Nekemias* Raf. are restricted to the southern USA (the former also present in Mexico and Central America); *Ampelocissus* Planch. and *Apocissus* Jackes and Trias-Blasi are restricted to Mexico and Central America (POWO 2026). North of Mexico, the greatest species-level diversity is in *Vitis*, with 16 species recognized, followed by *Parthenocissus* (four), *Ampelopsis* (three), *Cissus* (two), and *Nekemias* (one). The Asian and Australian species *Causonis japonica* (Thunb.) Raf. is introduced in the southeastern USA (Moore and Wen 2017).

The *Vitis*-feeding *Phyllocnistis* species of North America have often been confused and misidentified, despite the fact that Chambers (1871) already described the differences in leaf mines clearly, and Forbes (1923) repeated these differences. The difficulty of distinguishing the adults, including by their genitalia, had led D.R. Davis to believe that *P. vitegenella* and *P. vitifoliella* may be synonyms, although he never formally proposed the synonymy (Eiseman and Davis 2023). As a consequence of this, the North American species that has been spreading across Europe over the past 30 years was misidentified as *P. vitegenella* at the time of its discovery in Italy (Posenato et al. 1997), without considering the leaf mine characteristics. As was suggested by Eiseman and Davis (2023) and will be seen here, it is in fact *P. vitifoliella*, and there is no evidence that true *P. vitegenella* occurs outside of North America. Initially DNA barcodes made the situation worse, as the commonest barcode sequence (BIN BOLD:AAI3014) was also misidentified as *P. vitegenella*. To understand the distribution of the North American species and the differences among them, we studied numerous leaf mines and obtained several DNA barcodes from larvae, pupae, or adults extracted or reared from each type. This led to the discovery of a fourth North American species from the western USA, and the confirmation that the species in Europe has been misidentified.

In addition to the North American species, we review what is known about the few Vitaceae feeders occurring on other continents.

Materials and Methods

Material. In order to be able to confirm or reject the separate identities of the various leaf mine types, in 2020 CSE collected live material (larvae, pupae) from leaf mines of each type on *Parthenocissus* and *Vitis* spp., and obtained other specimens (from these hosts as well as *Ampelopsis cordata* Michx.) from collaborators throughout the USA. Samples of these were sent to EvN for DNA barcoding. Other material was obtained during general leaf mine collecting and rearing by both authors between 2010 and 2024.

CSE: In the lists of material examined, each number with the prefix “#CSE” refers to one or more specimens resulting from the same collection event and emerging on the same day. The first date listed for each collection event indicates when the leaf mine was collected, and “em.” precedes the date of adult emergence; “ex” before a plant name indicates that the specimens were reared from this plant.

EvN: The sample numbers consist of a year and sequential number, followed by a code. For example, EvN no 2012087-2H indicates the 87th sample of 2012, second species of that sample (a sample typically comprises one host plant from one locality and date). The letter “H” stands for herbarium, usually referring to mines that were

collected vacated or with dead larvae/pupae; “M” stands for molecular sample, and “K” for rearing (“kweek” in Dutch). All material stored in the Naturalis Biodiversity Center receives a registry number starting with “RMNH.INS.”. This can refer to a single pinned adult, a barcoded larva/pupa, or a dried leaf mine sample in an envelope. Samples of larvae or pupae that have not yet been barcoded are stored in a -80°C freezer.

The following abbreviations are used for depositories of our specimens and other material examined or listed: ANSP = Academy of Natural Sciences of Drexel University, Philadelphia, PA, USA; CNC = Canadian National Collection of Insects, Arachnids & Nematodes, Ottawa, ON, Canada; CSEC = personal collection of C.S. Eiseman, Northfield, MA, USA; CUIC = Cornell University Insect Collection, Ithaca, NY, USA; EMEC = Essig Museum of Entomology, University of California, Berkeley, CA, USA; NHMUK = Natural History Museum, London, UK; RMNH = Naturalis Biodiversity Center, Leiden, the Netherlands; SEHU = Hokkaido University Insect Collection, Sapporo, Japan; USNM = United States National Museum, Washington, DC, USA; ZIN = Zoological Institute, Russian Academy of Sciences, St. Petersburg, Russia.

In addition to examining physical specimens, we examined photographs of adults and thousands of leaf mines available online in BugGuide, iNaturalist, and the Barcode of Life Data System (BOLD), and for Europe also [Observation.org](https://www.observation.org). In the “Material examined” sections, records from the first three websites are annotated, respectively, with “BG,” “iNat,” and “BOLD,” followed by a number or code. The full URL for each of these records can be obtained by adding the number or code to the end of <https://bugguide.net/node/view/> (for “BG” records), <https://www.inaturalist.org/observations/> (for “iNat” records), or <https://portal.boldsystems.org/record/> (for “BOLD” records). In general, the listing of photographed leaf mines is limited to the first known example for each novel host record. We have not listed the photographs on which all new distribution records are based; these can be found easily by visiting [www.BugGuide.net](https://www.bugguide.net) and [www.iNaturalist.org](https://www.inaturalist.org) and searching for the species in question. We reviewed and verified all BugGuide, iNaturalist, and [Observation.org](https://www.observation.org) observations for all species included in this study.

In the host lists, plant taxonomy follows POWO (2026). All plant names that are not immediately followed by a literature citation are new host records drawn from the lists of material examined. Similarly, all distribution records that are not immediately followed by a literature citation are new records. These are drawn from the lists of material examined as well as from BOLD (localities are summarized in the “DNA barcoding” sections), BugGuide, and iNaturalist. In the DNA barcoding sections, numbers preceded by “BIN BOLD:” are DNA Barcode Index Numbers registered in BOLD (Ratnasingham and Hebert 2013).

Collecting and rearing. Leaves containing live larvae or pupae were placed in snap cap plastic vials or resealable plastic bags, which were stored away from direct sunlight and checked daily. If deemed necessary, a moistened, crumpled piece of toilet paper was added to the container to prevent desiccation. A few larvae and pupae were extracted from their mines and preserved in 95% or 96% ethanol. Emerging adult moths and parasitoids were refrigerated overnight, then photographed alive using the setup described in Eiseman and Lonsdale (2018). Moths were then placed in a killing jar with ammonium carbonate, and then pinned, spread, and double-mounted. Pupal exuviae were stored in gel capsules pinned with the adults; one example of each species was later mounted on a point for examination and photography. Parasitoids were preserved in 95% ethanol. Some leaves that were still in good condition at the time of adult emergence were pressed and saved for later study; some that were found to contain dead larvae at the time of collection were also pressed for possible DNA barcoding; mines that were already vacated when found were likewise pressed when still fresh.

Examination of specimens. Measurements of adults and leaf mines were made by CSE using a Bausch & Lomb StereoZoom Microscope ($0.7\times$ – $3\times$, set to $1\times$) with an ocular micrometer. All other external examination of specimens was done by him using a Nikon SMZ18 stereo microscope; this was also used for dissections. Widths of the very narrow frass lines in *Phyllocnistis ampelopsiella* leaf mines were estimated by placing a glass micrometer disc with 0.1 mm increments over the mines, viewed using this microscope under higher magnification.

EvN measured mine width by taking photographs with a Zeiss Stemi SV11, measuring with tools in Carl Zeiss AxioVision software version 4.8 or 4.9. This was also his examination and dissection microscope.

Dissections. To examine genitalia, abdomens were removed and placed in a $\sim 20\%$ KOH solution at room temperature overnight. After initial cleaning with fine-tipped paintbrushes in 30% ethanol, each abdomen was placed

in a small dish of 88% lactic acid with a few drops of OG-6 solution for 9.5–15.5 hours for staining and to neutralize the KOH. After final cleaning, the genitalia were placed under a small piece of a broken microscope slide in 99.9% isopropanol for 23–63.5 hours. The genitalia were then transferred to 100% clove oil, in which they were left for 4.5–20.5 hours. They were then slide-mounted in Canada balsam (previously thinned with 100% orange oil). Dissections by EvN and colleagues (larvae, pupae, adults) were lysed with Proteinase K in buffer in an eppendorf vial for a few hours or overnight at ~56° C. The insect parts were taken out from the fluid, and from the lysate DNA was extracted in the molecular lab (see below). After cleaning and dehydrating in ethanol up to 96% or 100% and staining with phenosafranin (males, larvae) or chlorazol black E (females, larvae), the parts were embedded in euparal on slides.

Illustrations. Leaf mines were photographed by CSE at the time of collection, using either a Nikon D50 digital camera with a Nikon AF Micro Nikkor 105mm lens, a Canon EOS Rebel XSi SLR digital camera with MP-E 65mm macro lens and Macro Twin Lite MT-24EX flash unit, or a Google Pixel 7 smartphone. The Canon was also used to photograph live and pinned adults. Genitalia slides were photographed with a View4K digital camera mounted on an Accu-Scope EXC-350 compound microscope, sometimes using the InFocus software's "Extended Depth of Focus" feature. Cocoon cutters of pupae were photographed using a View4K mounted on the SMZ18 microscope.

Pressed leaf mines were photographed by EvN either with a Canon EOS 850D, or in more detail with a Zeiss Stemi SV11 and an AxioCam MRC 5 camera, using Carl Zeiss AxioVision software version 4.8 or 4.9. The same Zeiss system was used for photographing adults, using the Module Extended Focus, while C. Doorenweerd (Fig. 12) used the same camera attached to a motorized Zeiss SteREO Discovery V12, using the Module Extended Focus. Genitalia (Fig. 111, 112) were photographed on a manually operated Zeiss Axioskop-H with AxioCam 305 color camera, using Carl Zeiss ZEN 3.10 software.

Maps were prepared with QGIS 3.28.6.

DNA barcoding and analysis. Extracts of DNA were obtained by EvN non-destructively from larvae, pupae or adult abdomens, using the remaining cuticle for making a microscopic preparation; the associated leaf mines were kept as vouchers. A few extracts were obtained from adults by C. Doorenweerd, while preparing genitalia slides. For further details of our methods see van Nieuwerkerken et al. (2012a) and Doorenweerd et al. (2015). Neighbor-joining (NJ) trees, under the Pairwise Distance model, were prepared with tools in BOLDSYSTEMS Workbench (Ratnasingham and Hebert 2007) or with MEGA 12 (Kumar et al. 2024); other North American, European, and Asian *Phyllocnistis* DNA barcodes were obtained from BOLD and included in addition to our own (Fig. 113 and Supplementary Fig. 1). A Maximum Likelihood tree of available DNA barcodes of Holarctic species of *Phyllocnistis* (Fig. 114) was prepared with MEGA 12. We selected one to three samples of each BIN for this analysis. The phylogeny was inferred using the Maximum Likelihood method and Tamura-Nei (1993) model of nucleotide substitutions and the tree with the highest log likelihood (−7,225.82) is shown. The initial tree for the heuristic search was selected by choosing the tree with the superior log-likelihood between a Neighbor-Joining (NJ) tree and a Maximum Parsimony (MP) tree. The NJ tree was generated using a matrix of pairwise distances computed using the Tamura-Nei (1993) model. The MP tree had the shortest length among 10 MP tree searches, each performed with a randomly generated starting tree. The evolutionary rate differences among sites were modeled using a discrete Gamma distribution across 5 categories (+G, parameter = 0.1997). The analytical procedure encompassed 55 nucleotide sequences with 654 positions in the final dataset.

All DNA barcodes and GenBank registration numbers of Vitaceae-feeding *Phyllocnistis* are available in BOLD dataset DS-PHYLLVIT (<https://doi.org/10.5883/DS-PHYLLVIT>; Supplementary Table 1), whereas those that were used for the ML tree with other Holarctic *Phyllocnistis* can be found in DS-PHYCNI (<https://doi.org/10.5883/DS-PHYCNI>; Supplementary Table 2). Table 1 presents all Barcode Index Numbers of Vitaceae-feeding *Phyllocnistis* and close relatives, with distance statistics.

Table 1. Barcode Index Numbers of Vitaceae-feeding species of *Phyllocnistis* and some relatives, with statistics of distances and indication of Nearest Neighbors. Genera listed in the “Hosts” column are limited to those recorded for specimens associated with the listed BIN.

Taxon	Hosts	BIN	# members	Average distance	Max distance	Dist to NN	NN	Name NN
<i>Phyllocnistis vitegenella</i>	Vitis	BOLD:AAZ8318	13	0.1721	0.3591	5.1971	BOLD:AAH4505	<i>P. liquidambarisella</i>
<i>Phyllocnistis vitifoliella</i>	<i>Parthenocissus</i> , Vitis	BOLD:AAI3014	284	0.4384	1.7657	3.5514	BOLD:AFR8637	<i>P. occidentalis</i>
<i>Phyllocnistis occidentalis</i>	<i>Parthenocissus</i> , Vitis	BOLD:AED7708	17	0.2225	0.8026	1.7628	BOLD:AFR8637	<i>P. occidentalis</i>
<i>Phyllocnistis occidentalis</i>	unknown	BOLD:AFR8637	10	0	0	1.7628	BOLD:AED7708	<i>P. occidentalis</i>
<i>Phyllocnistis ampelopsiella</i>	<i>Parthenocissus</i>	BOLD:AAI3015	78	0.1827	1.4363	2.0599	BOLD:ABZ3983	<i>P. ampelopsiella</i>
<i>Phyllocnistis ampelopsiella</i>	<i>Nekemias</i>	BOLD:ABZ3983	11	0.2446	0.6117	2.0599	BOLD:AAI3015	<i>P. ampelopsiella</i>
<i>Phyllocnistis (Eubotrys)</i>	<i>Eubotrys</i>	BOLD:AHJ0048	1	—	—	2.7244	BOLD:ABZ3983	<i>P. ampelopsiella</i>
<i>Phyllocnistis ampelopsiella</i>	<i>Ampelopsis</i>	BOLD:AEI5900	13	0.3334	0.9631	2.2109	BOLD:AAI3015	<i>P. ampelopsiella</i>
<i>Phyllocnistis</i>	unknown	BOLD:ABA5650	3	0.4977	0.7645	3.2051	BOLD:ABZ3983	<i>P. ampelopsiella</i>
<i>Phyllocnistis</i>	unknown	BOLD:ABV1053	46	0.3687	1.9856	4.1667	BOLD:AAI3015	<i>P. ampelopsiella</i>
<i>Phyllocnistis liquidambarisella</i>	<i>Liquidambar</i> , <i>Syrax</i> (?)	BOLD:AAH4505	9	0.2294	0.6116	4.8450	BOLD:AAI3014	<i>P. vitifoliella</i>
<i>Phyllocnistis toparcha</i>	<i>Parthenocissus</i>	BOLD:ACY3695	1	—	—	7.6923	BOLD:AFE1644	<i>Phyllocnistis</i> Vietnam
<i>Phyllocnistis</i> Vietnam	unknown	BOLD:AFE1644	5	1.1160	2.2472	7.6923	BOLD:ACY3695	<i>P. toparcha</i>
<i>Phyllocnistis</i> Japan	<i>Ampelopsis</i>	BOLD:ACY3638	1	—	—	8.0128	BOLD:AGD4881	<i>Phyllocnistis</i> Thailand
<i>Phyllocnistis</i> Thailand	unknown	BOLD:AGD4881	1	—	—	6.4103	BOLD:AHB0958	unavailable private BIN

Results and Discussion

Species accounts are presented below in the order in which the species were first described, beginning with the North American species, followed by the Asian species, and concluding with undetermined and undescribed Asian, African, and Australian species, most of which are known only from larvae and leaf mines. Here we provide some general notes regarding adults, pupae, and distinguishing *Phyllocnistis* leaf mines from those of other Vitaceae-feeding insects.

Adults. *Phyllocnistis* adults (Fig. 1–21) have smooth head vestiture, distinguishing them from species of *Phyllospongyia* Hübner (Gracillariidae) that have superficially similar wing patterns but possess prominent tufts of piliform scales on their heads. The North American Vitaceae-feeding *Phyllocnistis* (Fig. 1–15) all have a wing pattern consisting of a white ground with more or less distinct blackish markings and yellow-orange patches. The costa is usually very narrowly edged with black at the base (Fig. 11), although this is often not visible in photos, particularly of live moths, due to the curvature of the wing. There are four roughly evenly spaced costal strigulae, beginning with an oblique one curving away from the costa at about the middle of the wing; the others are closer to perpendicular (with substantial intraspecific variation in their orientation) and mainly in the fringe. Just beyond the fourth strigula is a round apical dot, with four more strigulae in the fringe radiating from it: an apical pair forming a “V,” another straight one directed dorsally, and one arcing toward the tornus. The curved strigula sometimes unites distally with the fourth costal strigula to form a continuous preapical line, and there are a few silvery scales between this line and the apical dot. There is an oblique dorsal strigula opposite the second costal strigula, sometimes uniting with it to form a complete angulated or curved fascia. In individuals of all four species, there is sometimes a dorsal spot near the base of the wing, which does not occur in any other North American species. In *P. ampelopsiella* only, there is sometimes a broad, oblique black streak extending from the base of the costa to about the middle of the wing (Fig. 5, 6, 13). Occasionally in the other species there is an indistinct, elongate patch of darker scales in the middle of the wing, which may extend distally to the apex of the first costal streak (Fig. 8), but we have never observed it to extend proximally into the basal third of the wing. In all four species, there is substantial intraspecific variation in the distinctness and extent of the yellow-orange patches, but they are always restricted to the apical half of the wing. They may include proximal edging on the dorsal and costal strigulae, as well as a more extensive patch in the area bounded distally by the preapical line, dorsally by the curved line in the cilia, and proximally by a complete white band that separates the yellow-orange patch from the dorsal and second costal strigulae. A more or less distinct black or gray patch may be present in the dorsal half of the area between the white band and preapical line.

The North American Vitaceae feeders are here referred to collectively as the *P. vitegenella* complex, which also includes *P. liquidambarisella* Chambers, a leafminer of *Liquidambar styraciflua* L. (Altingiaceae). Chambers (1875a) did not bother to describe the adult of this species except to state, “I am unable to distinguish this species from *P. vitifoliella*, Cham., by any characters of the imago, or, indeed, in any way except by the mine.” DNA barcoding data support the inclusion of *P. liquidambarisella* in the *P. vitegenella* complex, along with an undescribed species feeding on *Eubotrys racemosa* (L.) Nutt. (Ericaceae) in the USA and undetermined (presumably undescribed) species obtained from Malaise traps in Costa Rica (Fig. 114). The only described North American species that does not belong to the *P. vitegenella* complex but can be confused with the included species is *P. populiella* Chambers, a leafminer of *Populus* L. (Salicaceae). It differs in having a fifth costal strigula that touches the apical dot, as well as (not mentioned by Chambers (1875a)) having the silvery scales on the anterior edge of the apical dot extended into a short stripe that crosses the preapical line. The remaining nine described North American species (including the introduced Asian species *P. citrella*) all differ in possessing a yellow to orange longitudinal fascia in the basal half of the wing, more or less distinctly edged with black above and below. This fascia is also present in the Asian Vitaceae feeders, although sometimes reduced to a short stripe or spot in the middle of the wing. The Asian species *P. toparcha* and *P. vitella* also differ from the *P. vitegenella* complex in having the fifth costal strigula that is present in *P. populiella*. The single known specimen of *P. temperator* has an extremely short costal marking in this position, but this is also true of one of our *P. vitegenella* specimens, so *P. temperator* is probably best considered as lacking this strigula.

For the most part, adults of the *P. vitegenella* complex can only be identified with certainty by DNA barcoding or by examination of the leaf mines from which they emerge. There are no obvious interspecific genitalic differences. All males have a broad, U-shaped vinculum, narrow tegumen, slender valvae with rounded apices, a membranous phallus with fine striations in the distal portion, and a long phallobase that is recurved/folded at the distal end; on abdominal segment 8 there is a pair of tufts of long, slender scales (Fig. 22–28). All females have an elongate corpus bursae that is evenly speckled with minute, narrow sclerites and bears a pair of crescent-shaped signa that each have a short median projection (Fig. 31–38); this is also true of *P. liquidambarisella*, based on an unpublished drawing provided by D.R. Davis. There is, however, interspecific variation in the sclerotization of female abdominal segment 7. Apart from the female of *P. liquidambarisella*, the only D.R. Davis genitalia drawings we have seen representing the *P. vitegenella* complex are those for a male he identified as *P. vitegenella*, but since his concept of that species included *P. vitifoliella* and *P. occidentalis*, new species, we cannot be certain which of the three species they truly represent.

Given the amount of intraspecific variation we have observed in wing patterns of the North American Vitaceae feeders, and among Japanese specimens identified as *P. toparcha*, it is doubtful that there are consistent differences in wing pattern among the Asian species, which were each described from just one or two specimens (Fig. 16–21). There are no DNA barcodes for the Asian species except for three Japanese specimens of *P. toparcha* (all from the same collection event) and another Japanese one from an unidentified mine on *Ampelopsis* Michx., and barcodes—along with documentation of leaf mine characteristics—are needed from throughout Asia to clarify how many species there are and how they can be distinguished.

Larvae. *Phyllocnistis* larvae lack legs and prolegs and are hypermetamorphic (Davis 1987; Davis and Wagner 2011). The three sap-feeding instars (Fig. 39, 40, 43–45) are strongly flattened, especially the head, which has two stemmata and a pair of well-developed lateral lobes on the labrum, and the last (9+10th) abdominal segment has a pair of prominent caudal processes. The fourth, nonfeeding instar (Fig. 41, 42) is cylindrical, with a head that lacks stemmata and mouthparts except for the spinneret, and the last abdominal segment lacks prominent caudal processes (Davis 1987; Davis and Wagner 2011). We have not compared the larvae of the Vitaceae-feeding species in detail, but at least the later instars of *P. vitegenella* are bright yellow, while those of the other three North American species are whitish. We are not aware of any larval descriptions for the Asian species, but we have seen one photograph of a yellow-tinted larva from India, which we presume to represent *P. toparcha*.

Pupae. Davis and Wagner (2011) found that one of the most useful morphological characters for species identification of *Phyllocnistis* is the shape of the frontal “cocoon cutter” process on the head of the pupa. We examined this structure on pupal exuviae of each of the four North American species and found it to be consistent in shape, being triangular in ventral view, with an anterior angle of slightly less than 90°, and with a row of about 20 teeth on each side (Fig. 52–55). The teeth on the examined individual of *P. vitegenella* are more irregular and number only about 16 on each side, but we doubt this is a specific difference. In any case, finding a reliable but difficult-to-observe distinguishing feature in the pupae of these species would be of little practical value, given that anyone collecting a pupa would have the opportunity to observe the leaf mine, which contains sufficient information to identify the species at a glance. Kobayashi and Hirowatari (2013) described the cocoon cutter of *P. toparcha* as a sharp triangular pyramid with a needle-like tip that curves dorsally. In reviewing our photographs that show pupae of the *P. vitegenella* complex, we found examples of *P. vitegenella*, *P. ampelopsiella*, and *P. occidentalis* that possess such a tip (Fig. 51); our impression is that this structure is always present in intact pupae (Fig. 46, 47) but frequently breaks off upon emergence from the mine (Fig. 48–50). Thus, the cocoon cutters of *P. toparcha* and other Asian Vitaceae feeders may not be readily distinguishable from those of the North American species.

Leaf mines. *Phyllocnistis* mines differ from those of all other Vitaceae-feeding insects in being little or no more translucent than the surrounding leaf tissue (Fig. 56), due to the larvae feeding only on the liquid contents of cells (other Vitaceae leafminers consume parenchyma, producing mines that are more or less transparent); in having a flat, elliptical eggshell on the leaf surface at the beginning (Posenato et al. 1997), although this is often difficult to detect (other Vitaceae leafminers insert their eggs in the leaf tissue); and, when complete, in having a terminal silk-lined pupal chamber, from which the pupal exuviae protrude upon emergence of the adult (no other Vitaceae leafminers pupate within their mines) (Fig. 58–64). The pupal chamber is 5–7 mm long and 1–2 mm wide; due to

the contracting of the silk as it dries, it typically causes the epidermis to wrinkle on the mined surface and results in a small buckle or fold in the leaf.

The four North American species are easily distinguished by their leaf mines. The mine of *P. vitegenella* is always on the upper surface and is superficial, resembling a snail trail, usually with no visible frass (sometimes a very fine central line) (Fig. 57, 65–70). Mines of the remaining species are deeper in the leaf tissue (following an initial “snail trail” portion), typically appearing whitish when fresh, with conspicuous frass. Those of the strictly western *P. occidentalis* occur on either leaf surface and have the frass in a narrow central line (Fig. 85–90). Mines of the strictly eastern *P. ampelopsiella* are similar but are always on the lower leaf surface and are usually highly contorted, forming a secondary blotch (Fig. 78–84). The mine of *P. vitifoliella*, native to eastern North America and introduced in Europe, is always on the upper surface, with frass in a variable pattern that ranges from occupying the central third (in which case it typically forms a double line) to the full width of the mine (Fig. 57, 60–62, 71–77). Among the Asian species, mines of *P. toparcha* (Fig. 95, 96, 99) and *P. vitella* are similar to those of *P. vitegenella* and may be indistinguishable from one another, but (at least in *P. toparcha*) they can occur on either leaf surface, and the pupal chamber (Fig. 97–99) is often away from the leaf margin (in *P. vitegenella* it is almost always in a small fold at the leaf margin (Fig. 58, 59, 65)). The mine of *P. temperatior* has not been described.

The only other lepidopteran Vitaceae leafminers, at least in the Holarctic region, are species of Heliozelidae (*Antispila* Hübner, *Aspilanta* van Nieukerken and Eiseman, and in the Old World only, *Holocacista* Walsingham and Durrant). Whereas *Phyllocnistis* mines are entirely linear, those of Heliozelidae are blotches, with or without initial linear portions, and the larvae excise elliptical leaf pieces from the completed mines to construct their pupal cases (van Nieukerken et al. 2012b; van Nieukerken and Geertsema 2015; van Nieukerken and Eiseman 2020). Forbes (1923, p. 152) and Powell and Opler (2009, p. 112) stated that *Lyonetia speculella* Clemens (currently considered a synonym of the somewhat polyphagous leafminer *L. prunifoliella* (Hübner) (Lyonetiidae)) feeds on grape, but this is apparently based on a misreading of the original description of that species. Clemens (1862, p. 134–135) followed his description of the adult of *L. speculella* by discussing an unidentified mine on grape leaves that he suspected was the work of a *Lyonetia* species. However, in this account he stated that “the larva much resembles *Phyllocnistis* in its habits” and that it “undergoes its transformation in the mine like a *Phyllocnistis* larva.” Most importantly, he concluded by stating that “Since writing the preceding remarks” he had examined a pupa obtained from one of the mines: “The neuration of the insect under consideration, was that of *Phyllocnistis* and so also was the ornamentation of the wing, and it appeared to me to be distinct from that of *P. vitegenella*, although very similar to it.” It is clear from his description of the mine that it was the work of the not yet described species *P. vitifoliella*, as noted by Chambers (1871, p. 206).

In the eastern USA, *Orchestomerus eisemani* Yoshitake and Anderson (Coleoptera: Curculionidae) forms entirely linear mines on *Parthenocissus* Planch. and very rarely *Vitis* L. (Eiseman 2014, 2022) (Fig. 56). These could conceivably be mistaken for mines of *Phyllocnistis vitifoliella*, but in addition to the *O. eisemani* mines being transparent and lacking a terminal pupal chamber, the larvae (which are yellow and more plump than *Phyllocnistis* larvae) usually feed in pairs, side by side, whereas *Phyllocnistis* larvae are always solitary. Larvae of *O. eisemani* also have the ability to exit and reenter leaves, unlike any other Vitaceae leafminer.

No other insect has been reared from leaf mines on Vitaceae in North America, Europe, or Asia. Mines presumed to have been made by *Liriomyza schmidtii* (Aldrich) (Diptera: Agromyzidae) have been found in Florida and North Carolina on *Cissus verticillata* (L.) Nicolson and C.E. Jarvis (Eiseman et al. 2019) and *Parthenocissus quinquefolia* (L.) Planch. (Eiseman 2024; Eiseman et al. 2026). This extremely polyphagous species forms epidermal mines that resemble snail trails and therefore are much like those of *P. vitegenella*, but for the lack of an eggshell and a pupal chamber. A lower-surface “snail trail” mine found on *Vitis* in Florida also possibly was made by this species (Carpenter 2025b). No occupied agromyzid mines have been found on these hosts, and the possible use of vitaceous plants by *L. schmidtii* needs further investigation. The only evidence of any *Phyllocnistis* using *Cissus* L. as a host is from Gabon (Africa; see below), and none has been found in North America. Other mines found in Florida on *C. verticillata* have been attributed to another polyphagous agromyzid, *L. trifolii* (Burgess), without substantiation (Williams 2021). These mines are certainly agromyzid, being shorter and more rapidly widening than *Phyllocnistis* mines, with a frass trail that alternates from side to side.

The following key to leaf mines occurring on Vitaceae in North America, Europe, and Asia is adapted from Eiseman (2024), which provides a separate key for each plant genus, as well as characters for distinguishing among North American Heliozelidae species.

1. Mine entirely linear 2
- Mine a blotch or linear-blotch; mature larva cutting an oval hole out of the leaf to make a pupal case ..
..... **Heliozelidae**
- 2(1). Mine visible from only one side of the leaf; larva solitary, pupating at the end of the mine (except in rarely
observed mines occurring only in southeastern USA) 3
- Mine full-depth, usually with two larvae feeding side by side; pupation external
..... **Orchestomerus eisemani Yoshitake and Anderson**
- 3(2). Mine distinct and whitish, with frass in strips that alternate from side to side; pupation external; Florida
..... **Liriomyza sp.**
- Without the above combination of characters: either the mine resembles a snail trail with frass incon-
spicuous or in a fine central line (pupation internal or external), or the mine is distinct and whitish
to brownish, with conspicuous frass that is mostly centrally deposited (pupation internal); wide-
spread 4
- 4(3). Mine on *Leea*; Indonesia **Phyllocnistis temperator Meyrick**
- Mine on other hosts 5
- 5(4). Mine superficial, resembling a snail trail, without conspicuous frass (rarely with frass in a fine central
line) 6
- Mine whitish to brownish, with frass in a distinct central line (or double line) or nearly filling the mine
..... 10
- 6(5). Mine beginning at a flat, elliptical eggshell glued to the leaf surface; larva with a head capsule, pupating
at the end of the mine 7
- Mine beginning at an inserted egg, not externally visible; larva without a head capsule, exiting to pupate;
southeastern USA **Liriomyza schmidtii (Aldrich)**
- 7(6). Mine strictly on the upper leaf surface; pupal chamber normally in a small fold at the leaf margin; North
America **Phyllocnistis vitegenella Clemens**
- Mine on either leaf surface; pupal chamber often away from the leaf margin; Asia 8
- 8(7). Russia (Primorsky Krai) **Phyllocnistis vitella Ermolaev**
- Elsewhere 9
- 9(8). Mine up to 1.8 mm wide **Phyllocnistis sp. “AmpelopsisJapan”**
- Mine up to 2.5 mm wide **Phyllocnistis toparcha Meyrick**
- 10(5). Mine whitish with frass in a narrow central line (≤ 0.2 mm); on either leaf surface. North America only
..... 11
- Mine tending to be more brownish, with the frass broadly deposited (trail ≥ 0.3 mm wide); strictly on the
upper leaf surface. North America and Europe **Phyllocnistis vitifoliella Chambers**
- 11(10). Western USA, east to Colorado; on either leaf surface
..... **Phyllocnistis occidentalis Eiseman and van Nieuwerkerken**
- East of the Rocky Mountains; exclusively on the lower leaf surface
..... **Phyllocnistis ampelopsiella Chambers**

***Phyllocnistis vitegenella* Clemens, 1859**

(Fig. 1, 2, 10, 22, 31, 35, 39–42, 46, 48, 52, 57–59, 65–70, 91)

Phyllocnistis vitegenella Clemens 1859: 327. Syntypes, Clemens No. 32: [USA: Pennsylvania, Easton], larva in mines on *Vitis cordifolia* in September and October, imago appears in September (2 syntypes in ANSP; see Busck 1903; 3 syntypes in NHMUK, De Prins and De Prins 2026) [not examined].

Phyllocnistis vitegenella. Chambers 1871: 206–207; Davis 1983: 11; Grehan et al. 1995: 7; Handfield 2002: 6; Robinson et al. 2002: 353, 707, 708; De Prins and De Prins 2005: 262; Eiseman and Charney 2010: 333–334; Heppner 2013: 79; Bodor 2014: 17; Pohl and Landry 2018: 56; Eiseman and Davis 2023: 55; Eiseman 2024: 304, 392, 929, 930, 931, 933, 938.

Phyllocnistis vitigenella. Clemens 1860: 15 [unjustified emendation]; 1862: 135; Clemens and Stainton 1872: 22–23, 25, 31, 39, 83, 109, 185; Zeller 1873: 314–315; Chambers 1874: 169; 1875a: 107; 1878: 109; 1880a: 192; 1880b: 67; Smith 1899: 484; Dyar 1902: 564; Busck 1903: 191; Smith 1910: 573; Forbes 1923: 154; Needham et al. 1928: 104–105, 282; Brower 1984: 44; Knudson and Bordelon 2002: 4; Robinson et al. 2002: 353, 708; James 2020: 3; 2022: 5.

Diagnosis. This is the only North American Vitaceae-feeding *Phyllocnistis* with a yellow larva (whitish in the other species). Compared with other species that make upper-surface mines, its mine is much more superficial, shining and resembling a snail trail for its entire length, and there is usually no visible frass, or rarely a very fine central frass line; occasionally there is a brown liquid suffusion (the frass is always distinct in the other species, ranging from narrow and central to filling the mine). Note that the early portions of *P. vitifoliella* and *P. occidentalis* mines also resemble snail trails, and early instars of *P. vitegenella* may not be strongly pigmented, so aborted or very young mines should be identified with caution. The pupal chamber of *P. vitegenella* is normally in a small fold at the leaf margin (almost always away from the leaf margin in the other species that form upper-surface mines). Mines of the Asian species *P. toparcha* and *P. vitella* resemble those of *P. vitegenella*, but at least in *P. toparcha* the pupal chamber is often away from the leaf margin and the mine can be on either leaf surface.

Material examined. CANADA. NOVA SCOTIA: Halifax, 44.66355, –63.67281, 26.viii.2022, A. Tinker-Tsavalas, completed mine on *Parthenocissus quinquefolia* (iNat 132465452); **ONTARIO:** Bruce Co., 44.9872, –81.2511, 31.x.2024, M. Butler, mine on *Vitis vinifera* (iNat 249904519); Ottawa, Pine Grove, Eastern Greenbelt parthway, 45.35636, –75.5943, 5.vii.2015, E.J. van Nieukerken, mines on *Vitis riparia* (several pressed mines, RMNH.INS.40066). **USA. ALABAMA:** Baldwin Co., Fairhope, Weeks Bay Nat Estuarine Reserve, 30.41992, –87.83226, 9.x.2010, E.J. van Nieukerken & C. Dooreenweerd, mines on *Vitis vulpina* (several pressed mines, RMNH.INS.43231); Mobile Co., 1911 Navco Rd., 30.6227, –88.10573, 30.v.2011, R. Zimlich, [at light] (1 adult, BG 522616, BOLD JSBIC017-11); **ARIZONA:** Pima Co., 32.09138, –110.45883, 17.vii.2020, ethan-k, completed mine on *Vitis arizonica* (iNat 53495497); **CALIFORNIA:** Humboldt Co., Humboldt Redwoods State Park, 40.2912, –123.9016, 11.ix.2022, C. & T. Van Loon, completed mine on *Vitis californica* (iNat 134693338); San Diego Co., Santa Margarita Reserve, 33.412, –117.237, 26.vii.2026, raderj, mines on *Vitis girdiana* (iNat 385550419); **COLORADO:** Jefferson Co., Chatfield State Park, 39.49492, –105.08847, 23.vii.2012, J.F. Landry, *Vitis riparia*, EvN no 2012087-2H (1 pressed mine, RMNH.INS.42191) [sympatric with *P. occidentalis*]; **GEORGIA:** Gwinnett Co., Peachtree Corners, 28.vi.2019, P. Chappell, completed mine on *Vitis rotundifolia* (BG 1684860); **MASSACHUSETTS:** Franklin Co., Northfield, 42.647065, –72.425001, 4.vii.2020, C.S. Eiseman & J.A. Blyth, ex *Vitis riparia*, #CSE6343 (1 larva [spinning stage], RMNH.INS.31515); same but em. 13.vii.2020, #CSE6387 (1♀, CUIC); same but em. 13.vii.2020, #CSE6391 (1♀, CUIC); same but em. 16.vii.2020, #CSE6404 (1♀, CUIC); 42.651575, –72.431255, 9.vii.2020, C.S. Eiseman, ex *Vitis labrusca*, #CSE6364 (2 larvae [feeding stage], RMNH.INS.31516, RMNH.INS.31517); 42.651694, –72.431027, 9.vii.2020, em. 16.vii.2020, C.S. Eiseman, ex *Vitis labrusca*, #CSE6403 (1♂, CUIC); same but em. 20.vii.2020, #CSE6422 (1♀, CUIC); 42.647151, –72.425437, 21.vii.2022, em. 26.vii.2022, C.S. Eiseman, ex *Vitis labrusca*, #CSE7657 (1♂, CUIC); 42.647050, –72.424942, 7.ix.2024, em. 16.ix.2024, C.S. Eiseman, ex *Vitis riparia*, #CSE9016 (1♀, CUIC); same but em. ~21.ix.2024, #CSE9025 (1♀, CUIC); 42.651642, –72.431349, 9.vii.2020, C.S. Eiseman, *Vitis labrusca*, #CE-2020-3 (pressed leaf with 2 larvae, RMNH.INS.48499); Nantucket Co., Nantucket, Norwood Farm, 26.vii.2014 (larvae), em. 14.viii.2014, C.S. Eiseman, ex *Vitis labrusca*, #CSE1325 (1♂, genitalia slide CE-2025-51; 1♀, genitalia slide CE-2025-58; CUIC); **NEW JERSEY:** Atlantic Co., Gallo-way, 39.44156, –74.47428, 1.vii.2024, davidenrique, completed mine on *Vitis aestivalis* (iNat 226797457); **NEW YORK:** New York Co., New York City, Carl Schurz Park, 40.773, –73.944, 21.vii.2020, S.J. Hewitt, mines on *Parthenocissus tricuspidata* (iNat 53880642); Central Park, 40.79462, –73.95185, 16.vii.2022, D.J. Ringer, completed

mine on *Ampelopsis glandulosa* (iNat 126554263); **NORTH CAROLINA:** Dare Co., Roanoke Island, 35.889744, -75.66154, 16.vii.1975, em. 29.vii.1975, G. Deschka (2 adults, BOLD GRAAM009-13, GRAAM010-13); **OREGON:** Josephine Co., Six Mile Day Use Recreation Area, 21.x.2012, C.S. Eiseman, mines on *Vitis californica* (iNat 325202110); **PENNSYLVANIA:** Chester Co., West Caln Township, 40.04734, -75.87116, 2.xi.2020, kidnemoth, mines on *Vitis cinerea* (iNat 64070796); Juniata Co., Thompsontown, 40.564047, -77.238013, 9.ix.2020 (larva), extracted 22.ix.2020, K. Wolgemuth, ex *Vitis*, BG 1889396, #CSE6602 (1 pupa, RMNH.INS.31536; leaf mine, RMNH.INS.48508); **RHODE ISLAND:** Bristol Co., Bristol, 41.651, -71.257, 30.vi.2022, em. 11.vii.2022, T. Irvine, ex *Vitis labrusca* (1 adult, iNat 146770517); Washington Co., Charlestown, Carter Preserve, 2.vii.2020, C.S. Eiseman, *Vitis labrusca*, #CE-2020-5 (pressed leaves with 6 larvae, RMNH.INS.48501); **TEXAS:** Wilson Co., Stockdale, 29.22938, -97.93914, C. Burrier, 16.iv.2023, completed mine on *Vitis mustangensis* (iNat 155223966).

Adult. Based on our examination of 10 physical specimens, the forewing length is 2.0–2.3 mm, and the wingspan is 4.3–5.0 mm. The following observations are based on these plus four photographed specimens. The antenna is usually silvery-white but occasionally blackish. Black edging at the base of the costa is absent, except for one male (CSE7657) that has faint edging on the left wing and a few darker scales on the right wing. One male (CSE1325) has a faint, extremely short marking suggestive of the fifth costal strigula that is present in other *Phyllocnistis* species; we have not seen this in any other specimens of the *P. vitegenella* complex. The dorsal spot is absent in all specimens except one male (CSE6403), in which the spot is distinct but narrow. The dorsal strigula is separate from the second costal strigula in all specimens. No specimens have a dark dorsal patch between the dorsal strigula and preapical line, except in one female (CSE9025) there is a faint hint of one at the proximal end of this area. The preapical line is broken in all specimens. In the female abdomen, sclerotization of segment 7 does not differ from that of the preceding segments.

Clemens (1859) described the antenna as “brownish silvery, fuscous at the tip.” According to his description, the forewing does have a blackish dorsal patch near the base, and apparently in his specimens the dorsal strigula merged with the second costal strigula (“a black line curving from the costa to the inner margin”). Chambers (1871) stated that the adult of *P. vitegenella* differs from *P. vitifoliella* only in having the antenna blackish above, and (consistent with the original description) in the forewing having a pale semi-oval blackish spot on the dorsal margin, and with the second costal strigula uniting with the dorsal one to form a narrow fascia. Chambers (1875a) considered *P. vitegenella* to be intermediate between the less boldly marked *P. vitifoliella* and the more boldly marked *P. ampelopsiella*, although he also reported that nearly half of the adults he reared from *P. ampelopsiella* mines were indistinguishable from *P. vitifoliella*. Chambers (1880a) stated, “The imago of *vitegenella* is like that of *vitifoliella* in size and lustre, but it has the basal streak and dorsal spot like *ampelopsiella*, only that they are not so heavy, not being either so dark or so large as in that species.” The reference to the basal streak is curious, since neither Chambers nor Clemens had previously mentioned there being one in *P. vitegenella*, and Chambers (1871) explicitly mentioned the presence of this streak as one of the features that distinguishes *P. ampelopsiella* from *P. vitegenella*. Chambers (1880a) went on to claim that the distinctions among adults of these three species are entirely consistent: “These differences do not grade into each other; they are always distinct and well marked. I have never seen a specimen (and I have seen hundreds, if not thousands) which could not at once be referred, without hesitation, to its appropriate form, or which showed the slightest indication of any other form than its own . . . The *vitegenella* mine has not been known to produce any thing but *vitegenella*.”

In Forbes’ (1923) key to *Phyllocnistis*, he relied entirely on the leaf mine to distinguish *P. vitegenella* from *P. vitifoliella*. In the species account for *P. vitegenella*, he wrote, “Imago often indistinguishable from the other white species, but usually with a gray, antemedial shade on inner margin and with heavier and more extensive black markings; the second fascia, however, in the fringe only.”

It has been suggested that the dorsal spot occurs only in the overwintering generation of the *P. vitegenella* complex (Hunt 2021), and the same has been said of *P. toparcha* (see below). However, the single specimen of *P. vitegenella* we have seen with a dorsal spot emerged as an adult in mid-July. It still may be true that the spot is more common in the overwintering generation, and the fact that just two of our specimens emerged as late as September may explain why we did not observe it more often. The original description, which mentions a dorsal spot, was based on adults that emerged in September (Clemens 1859).

Hosts. *Ampelopsis glandulosa* (Wall.) Momiy., *Parthenocissus quinquefolia* (L.) Planch., *P. tricuspidata* (Siebold and Zucc.) Planch., *Vitis aestivalis* Michx., *V. arizonica* Engelm., *V. californica* Benth., *V. cinerea* (Engelm.) Millardet, *V. girdiana* Munson, *V. labrusca* L., *V. mustangensis* Buckley, *V. riparia* Michx. (Handfield 2002; Robinson et al. 2002), *V. rotundifolia* Michx., *V. vinifera* L., *V. vulpina* L. (Clemens 1859, as *V. cordifolia*). Adults have only been reared from *Vitis* spp. (*V. labrusca*, *V. riparia*, *V. vulpina*), but we have seen mines with pupal chambers on all of the above hosts except *P. tricuspidata* and *V. vinifera*. On BugGuide and iNaturalist, there are over 1300 observations of leaf mines on *Vitis* spp. and fewer than 70 on the other hosts. A few sentences after Chambers (1874) wrote, “Dr. Clemens states that he bred [*Antispila isabella* Clemens] from the cultivated grape Isabella, which, if I am rightly informed, is supposed to be derived from *Vitis labrusca*. I have bred it from at least a dozen cultivated varieties, including Catawba, Hartford Prolific and Concord,” he noted, “Dr. C. records *Phyllocnistis vitigenella* from the leaves of *V. cordifolia* only, whilst I have found it in the leaves of a great many cultivated varieties, including those above named.” Forbes (1923) wrote that “sometimes [the mine of *P. vitigenella*] is formed on *Ampelopsis*, and then is much contorted.” This probably referred to native plants now classified as *Parthenocissus*, although mines have recently been documented on *A. glandulosa*, an introduction from Asia.

Leaf mine. The yellow larva forms a superficial, shining mine on the upper leaf surface, resembling a snail trail (Fig. 65–70). The width is variable; measured mines are between 1.5 and 2.2 mm at the widest. Although there is usually no visible frass, a very fine, dark, central line is rarely evident, as in the mine from Pennsylvania from which we obtained a pupa whose identity was confirmed by DNA barcoding (Fig. 69). Mines occasionally have a brown liquid suffusion (Fuchs 2024; Gallagher 2024), sometimes in addition to a fine central line (sidb 2024), and very old mines may discolor to dark brown (Carpenter 2025a; merestoo 2025), making it possible to confuse them with those of *P. vitifoliella* in low-quality photos. In our experience, the pupal chamber is always in a small fold at the leaf margin.

Clemens (1859) did not describe the mine under the heading “*P. vitigenella*,” but this was the only species he treated under the heading “PHYLLOCNISTIS Zeller,” where he wrote: “The mine is a linear tract just wide enough to accommodate the body, long and winding. The larva does not consume all the parenchyma of the leaf along its tract, but simply separates the upper epidermis, so that it is not transparent. When full grown the end of the mine is enlarged and the cocoon woven in a little pucker of the leaf within the mine.” Clemens (1862) discussed an unidentified leaf mine on grape that clearly represents *P. vitifoliella* (as noted by Chambers (1871)), writing: “It is very long, winding, linear and narrow, filled with blackish frass and hence easily seen, differing thus from a *Phyllocnistis* mine, which resembles the tracings left on leaves by snails.” This leaves no doubt that the species he described as *P. vitigenella* is the one that forms the superficial “snail trail” mines on grape leaves. Clemens also referred to the mine of *P. vitigenella* as “not unlike the tracings left by snails” in a letter dated 10 October 1859 (Clemens and Stainton 1872), in which he described the larva’s body as “shining, translucent, whitish on the sides and dark green in the middle.” This must have referred to an early instar, because the older larvae we have seen consistently have a strong yellow pigment. Chambers (1880a) similarly characterized the mine as “barely perceptible, like the track of a minute snail; that is, it looks like an indistinct line of slime, and not like a mine at all.” Needham et al. (1928) were the first to note that the larvae are yellowish, and also that they “usually form their pupating chambers at the leaf’s edge, but in large leaves they may spin under the cuticle an inch or more from the border.”

Phenology. In Pennsylvania, Clemens (1859) stated that larvae are present in September and October, with adults emerging in September. In Kentucky, Chambers (1871) reported finding larvae and pupae from May to November, and adults from June to November, the latter hibernating under bark. In Florida, mines have been observed in every month of the year, but two found in late March appear to be the earliest examples formed in the current season (Frade 2022; Ardew 2026). By the end of April, mines can be found as far north as North Carolina (harrier 2025). In New England, mines appear by late June. We have reared adults from the first generation of larvae in mid- to late July, and others in mid-August and mid- to late September.

Distribution. Canada: NB, NS, ON (Pohl and Landry 2018), QC (Handfield 2002); USA: AL, AR, AZ, CA, CO, CT, DC, DE, FL, GA, IA, IL, IN, KS, KY (Chambers 1871), LA, MA, MD, ME, MI, MO, MS, NC (Eiseman and Charney 2010), NE, NH, NJ (Smith 1899), NV, NY, OH, OK, OR, PA (Chambers 1871, probably referring to

the presumed type locality), RI, SC, TN, TX, VA, VT (Grehan et al. 1995), WI (Chambers 1871), WV. Previous records from Massachusetts (Zeller 1873) and Maine (Brower 1984) are questionable since they are based on caught specimens, and the basis for the previous Texas record (Knudson and Bordelon 2002) is unclear. It is also unclear why Heppner (2013) listed *P. vitegenella*, and not *P. vitifoliella*, as occurring in Florida, whereas Kimball (1965) and Heppner (2007) listed only *P. vitifoliella*; possibly this was a result of consultation with D.R. Davis, who planned to synonymize the two species (Davis in litt. to CSE, July 2019). All records of *P. vitegenella* from Europe are based on an initial misidentification by D.R. Davis (Posenato et al. 1997, 1998) and in fact refer to *P. vitifoliella*. The true *P. vitegenella* surely also occurs in northern Mexico, given that a mine was photographed close to the Mexican border at Big Bend National Park (Woo 2021). It is the only member of the *P. vitegenella* complex with a transcontinental distribution, and it appears to be much less common west of the Great Plains.

DNA barcoding. All specimens correctly identified as *P. vitegenella* are assigned to BIN BOLD:AAZ8318. There are 13 barcoded specimens in this BIN, which only since 2021 has been recognized as representing *P. vitegenella*. These include a larva collected from *Vitis riparia* in Massachusetts (CSE6343), a pupa collected from *Vitis* sp. in Pennsylvania (CSE6602), and the Alabama and North Carolina adults listed above, as well as eight adults from Malaise traps in Ontario, New York, and Virginia. A 307 bp sequence was obtained from a pupa we extracted from a mine on *Parthenocissus* collected in Colorado (CSE6475, RMNH.INS.31519); this has not been assigned to a BIN, but it perfectly matches sequences in BOLD:AAZ8318. However, based on the leaf mine characteristics (whitish with a distinct frass line; pupal chamber away from the leaf margin), we believe this specimen represents *P. occidentalis*, and the barcode may be a result of an error, such as contamination.

The nearest neighbor of BOLD:AAZ8318, differing by 5.2%, is BOLD:AAH4505. This BIN comprises nine specimens identified as *P. liquidambarisella*, most of them reared by D.R. Davis from *Liquidambar styraciflua*. As noted above, this species is externally identical to some adults of the Vitaceae-feeding species. Its close relationship to *P. vitegenella* is supported by both species having yellow larvae that form superficial “snail trail” mines, although the barcode of *P. liquidambarisella* is actually somewhat closer to BOLD:AAI3014 (differing by 4.84%). BOLD:AAI3014 represents *P. vitifoliella*, although most specimens were until recently misidentified as *P. vitegenella* (now mostly corrected). Curiously, one of the specimens in BOLD:AAH4505, reared by G. Deschka in South Carolina, is labeled “Mine in *Styrax grandifolia* Ait.” It is one of two such specimens in Deschka’s collection; the other yielded only a 307 bp sequence and has not been assigned to a BIN (C.L. Vaamonde in litt.). *Styrax grandifolius* Aiton (Ericales: Styracaceae) belongs to a different order from *Liquidambar* L. (Saxifragales), and given the similarity of “*Styrax*” to “*styraciflua*,” we consider it possible that this labeling was the result of a lapsus. We have seen no evidence that any North American insect mines leaves of *Styrax* other than an undetermined species of *Caloptilia* Hübner (Eiseman 2025c). No preserved leaves associated with these specimens were found in Deschka’s leaf mine collection at the State Zoological Collection Munich, Germany (A. Segerer in litt.).

Two other BINs include specimens that have been misidentified as *P. vitegenella*. All those in BOLD:AED7708 are from the western USA and are in fact *P. occidentalis*. BOLD:ADP7931 comprises a single sequence from Panama, and the specimen image shows a leaf mine on an undisclosed plant that begins with a tight spiral, unlike the mines produced by any species in the *P. vitegenella* complex. It differs from all other BINs by more than 8%.

Since all specimens in BIN BOLD:AAZ8318 are from east of the Great Plains, DNA barcodes should be obtained from western mines to confirm that they truly represent *P. vitegenella* and not a distinct, unnamed species. At present, however, we have no reason to doubt that there is a single transcontinental species responsible for upper-surface “snail trail” mines on Vitaceae.

Parasitoids. Two specimens of an undetermined species of *Chrysocharis* Förster (Eulophidae) were reared from pupal chambers in mines collected in Rhode Island (CSE6382, CNC; Eiseman 2025a).

Notes. De Prins and De Prins (2005) incorrectly stated that Chambers (1878) was the origin of the spelling “*Phyllocnistis vitigenella*.” The original spelling “*vitegenella*” was the result of a typographical error, which Clemens (1860) corrected to “*vitigenella*.” Clemens also corrected this error in pencil when he sent the newly published original description (Clemens 1859) to Stainton (Clemens and Stainton 1872, p. 83). The spelling “*vitigenella*” was used by all subsequent authors except Chambers (1871) until Davis (1983) reintroduced the original spelling. This decision was based on the International Code of Zoological Nomenclature, 2nd edition (ICZN 1961), article

32a(ii), which stated: “(a) Correct original spelling.—The original spelling of a name is to be retained as the ‘correct original spelling,’ unless (ii) there is in the original publication clear evidence of an inadvertent error, such as a lapsus calami, or a copyist’s or printer’s error (incorrect transliteration, improper latinization, and use of an inappropriate connecting vowel are not to be considered inadvertent errors)”. Although we know from external sources, cited above, that Clemens’ intention was to name the species “*vitigenella*”, this is not clear from the original publication. In the current Code (ICZN 1999), articles 32.2 and 32.5 state almost the same. The current Code, published in 1999, has a provision to retain an unjustified emendation, when it is in prevailing usage (Article 33.2.3.1). However, authors subsequent to Davis (1983) have followed suit, with the exceptions of Brower (1984) and James (2020, 2022), and thus Clemens’ (1860) unjustified emendation remains invalid.

***Phyllocnistis vitifoliella* Chambers, 1871**

(Fig. 3, 4, 11, 12, 23, 28, 32, 36, 43, 49, 53, 57, 60–62, 71–77, 92, 93)

Phyllocnistis sp. Clemens 1862: 135.

[*Phyllocnistis*] *L. vitifoliella* N. sp. Chambers 1871: 206. 2 syntypes: [USA: Kentucky, Covington / Wisconsin], larva mines “Wild Grape” (NHMUK, see Miller and Hodges 1990, De Prins and De Prins 2026) [not examined].

Phyllocnistis vitifoliella. Chambers 1871: 207, 208; 1874: 169; 1875a: 106, 107; 1878: 109; 1880a: 191–192; 1880b: 67; Frey and Boll 1878: 260; Dyar 1902: 564; Smith 1910: 573; Dozier 1920: 379; Forbes 1923: 154; Needham et al. 1928: 282; Kimball 1965: 284; Davis 1983: 11; Godfrey et al. 1987: 15; Grehan et al. 1995: 7; Handfield 1997: 31; Nielsen 1998: 5; Knudson and Bordelon 2002: 4; Robinson et al. 2002: 353, 707, 708; De Prins and De Prins 2005: 262; Heppner 2007: 243–244; Eiseman and Charney 2010: 333–334; Ferge 2010: 114; Bodor 2014: 17; Ferge 2015: 154, 164; Pohl and Landry 2018: 56; James 2020: 3; 2022: 5; Eiseman and Davis 2023: 55; Eiseman 2024: 304, 392, 929–930, 931, 933–934, 939.

Phyllocnistis vitegenella [misidentification]. Posenato et al. 1997: 75–77; 1998: 91–94; Marchesini et al. 2000: 93–96; Viliani 2002: 47–48; Baur 2005: 25, 26, 51; Reggiani and Boselli 2005: 71–72; Seljak 2005: 13–14; De Prins and Kawahara 2009: 113; Mattedi et al. 2009: 10; Lesar and Govedič 2010: 55; SwissLepTeam 2010: 50, 174; Cara and Jermini 2011: 224–227, 229; Duso et al. 2011: 203–205; van Nieukerken et al. 2012b: 30, 31, 32, 36, 61, 63, 67, 68; Cara et al. 2013: 75–79; Kawahara et al. 2013: 1214, 1215; Lips and Jermini 2013: 1–15; Bodor 2014: 17; Szabóky and Takács 2014: 467–469; Szabóky 2014: 173–174; van Nieukerken and Geertsema 2015: 42; Mikulás 2016: 16; Ureche 2016: 133–137; Brito et al. 2017a: 29, 30, 31; Chireceanu et al. 2017: 462, 464–465, 466; Bence 2018: 2–4; Kirichenko et al. 2018a: 95, 102; Pastorális and Buschmann 2018: 97, 201; Pastorális and Szeőke 2018: 14; Trencheva and Trenchev 2018: 264–267; Simonović and Graora 2019: 337–344; Laštůvka et al. 2021: 20–21; Laštůvka and Laštůvka 2021: 29, 96; Rákossy and Goia 2021: 30, 186, 274; Tokár et al. 2021: 8–9; Babytskiy et al. 2023: 6–7; Kirichenko et al. 2023: 20; Laštůvka et al. 2023: 36; Stark 2024: 20–21; Wiewel 2025: 5, 7–8.

Phyllocnistis vitigenella [misidentification, misspelling]. Cara et al. 2013: 80; Trencheva and Trenchev 2018: 265, 266, 267.

Phyllochnistis vitegenella [misidentification, misspelling]. Teski et al. 2024: 97–98.

Diagnosis. This species has a greenish-white larva that forms an upper-surface leaf mine with conspicuous frass. The frass may nearly fill the mine or may be in a relatively narrow central line (≥ 0.3 mm wide in the later portion), but not as narrow as that of *P. occidentalis*, with which it is not sympatric; *P. vitifoliella* occurs in eastern North America and is introduced in Europe. All other *Phyllocnistis* species that form upper-surface mines on vitaceous hosts, at least in the northern hemisphere, produce superficial “snail trail” mines, usually without any evident frass line. In *P. vitegenella*, the only one of these that is sympatric, the larva is yellow and the pupal chamber is almost always formed in a small fold at the leaf margin; in *P. vitifoliella* the pupal chamber is normally formed away from the leaf margin. The adult female of *P. vitifoliella* differs from the other eastern North American Vitaceae feeders in having abdominal segment 7 more strongly sclerotized than the other segments, and differs from *P. occidentalis* in having a broad band of stronger sclerotization (as opposed to a thin transverse line) at the anterior margin of this segment.

In Europe, adults of *P. vitifoliella* most resemble the poplar-feeding species *P. extrematrix* Martynova, *P. labyrinthella* (Bjerkander), and *P. unipunctella* (Stephens). *Phyllocnistis unipunctella* usually has a gray patch in the middle of the wing, and all three may have a patch on the dorsum, but that may also be absent. *Phyllocnistis labyrinthella*, which may be the same species as the Nearctic *P. populiella* (same BIN, BOLD:ACX5473), can be separated by the same characters: a fifth costal strigula that touches the apical dot, and the silvery scales on the anterior edge of the apical dot extending into a short stripe that crosses the preapical line. This fifth strigula is

also present in *P. extrematrix*, but not in *P. unipunctella*. Other European species, feeding on willows (*Saliaceae*: *Salix* L.), in most cases possess a longitudinal fascia in the basal half of the wing and have five costal strigulae, but there are exceptions.

Material examined. CANADA. ONTARIO: Cambridge Co., rare Charitable Research Reserve, Cliffs Forest, cedar stand, 43.3854, –80.3502, 18.viii.2015, rare BioBlitz collecting team, ex *Vitis* (1 pupa, BOLD RRINV2035-15); Lambton Co., Port Franks, 43.2314, –81.8903, K.H. Stead, 5.x.2013 (1 adult, BOLD KSLEP144-15); Norfolk Co., 42.671, –80.404, em. 16.vii.2024, E. Giles, ex *Vitis* (1 adult, iNat 258308797); **QUEBEC:** Brome-Missisquoi, St-Armand, Domaine S.Q.P.O., 45.033, –73.049, 11.v.2000, B. Landry, on *Betula papyrifera* trunk (1 adult, BOLD MNAP1053-13, CNCLEP00099211); Gatineau, Aylmer, 18 rue Washington, 45.398, –75.837, 30.v.1999, B. Landry, MVL (1 adult, BOLD MNAP1060-13, CNCLEP00099218); 48 rue du Couvent, 45.397, –75.849, 17.v.2004, J.F. Landry, at MVL (1 adult, BOLD MEC312-04, CNCLEP00003406); same but 27.vi.2006, J.F. Landry (1 adult, BOLD MNAD012-07, CNCLEP00027672); same but 15.ix.2006 (2 adults; BOLD MNAD051-07, CNCLEP00027711; BOLD MNAD052-07, CNCLEP00027712); same but 31.vii.2019, ex *Vitis riparia* [J.F. Landry in litt.] (1 larva, BOLD MNAS1459-19, CNCLEP00223558; 1 pupa, BOLD MNAS1460-19, CNCLEP00223559); Mer Bleue, 45.3935, –75.5007, 31.vii.2019, J.-F. Landry, L. Bartels & J. Mackey, ex *Vitis riparia* [J.F. Landry in litt.] (2 larvae, BOLD MNAS1461-19, MNAS1462-19, CNCLEP00223560–61; 1 pupa, BOLD MNAS1463-19, CNCLEP00223562); Mont-Saint-Hilaire, 845 Fontainebleau, 45.727, –73.368, 30.v.2007, L. Handfield (1 adult, BOLD CNCLA2037-13, CNCLEP00101461). **USA. ALABAMA:** Baldwin Co., Fairhope, Weeks Bay Nat Estuarine Reserve, 30.41992, –87.83226, 9.x.2010, E.J. van Nieuwerkerken & C. Doorenweerd, ex *Vitis vulpina* (pressed mines, RMNH.INS.43232, 1♀, WOGRA403-15, RMNH.INS.544310, genitalia slide CDGP0223); **CONNECTICUT:** New London Co., Connecticut College Arboretum, 10.ix.2011, em. 26.ix.2011, E.J. van Nieuwerkerken, ex *Vitis labrusca*, EvN no 2011193-1K (2♂, RMNH.INS.28228, RMNH.INS.28229; pressed mines, RMNH.INS.43418, RMNH.INS.43419). **FLORIDA:** Indian River Co., Fellsmere, St. Sebastian River Preserve State Park, 28.iii.2013, em. 6.iv.2013, C.S. Eiseman, ex *Vitis rotundifolia*, #CSE248 (1♂, CUIC; pressed mines, CSEC); **GEORGIA:** Murray Co., Chattahoochee Nat. Forest, Cohutta Overlook, 14.x.2010, E.J. van Nieuwerkerken, mines on *Vitis aestivalis* var. *bicolor*, EvN no 2010270-2K (1 pressed mine, RMNH.INS.43310). **ILLINOIS:** Lake Co., Winthrop Harbor, em. 22.vi.2020, J. Steffen, ex *Parthenocissus inserta* (1♂, CUIC); same but em. 24.vi.2020 (1♂, CUIC); **INDIANA:** Boone Co., Lebanon, 23.vi.2024, em. 2.vii.2024, ex *Vitis*, J. Jaskula (1 adult, BG 2407647, iNat 226894138); **IOWA:** Winneshiek Co., Plymouth Rock, 4.vi.2018, em. 15.vi.2018, MJ Hatfield, ex *Vitis* (1 adult, BG 1614563); 43.442361, –92.002867, 25.vi.2.vii.2019, C.S. Eiseman & J.A. Blyth, ex *Parthenocissus quinquefolia*, #CSE5402 (1♀, CUIC); **MARYLAND:** Calvert Co., Scientists Cliffs, 2179 Bluebell Rd., 38.52, –76.514, 8.viii.2006, J.F. Landry (1 adult, BOLD MNAC706-07, CNCLEP00027156); same but 10.viii.2007 (1 adult, BOLD MNAI463-09, CNCLEP00042746); **MASSACHUSETTS:** Franklin Co., Northfield, 5.ix.2013, em. by 23.ix.2013, C.S. Eiseman, ex *Vitis aestivalis* (1 adult, BG 877661); 42.647173, –72.425455, 11.vi.2020, C.S. Eiseman, ex *Vitis labrusca*, #CSE6251 (1 larva, RMNH.INS.31507); 42.646721, –72.425583, 16.vi.2020, C.S. Eiseman, ex *Vitis riparia*, #CSE6260 (1 larva, RMNH.INS.31509); 42.646721, –72.425583, 18.vi.2020, em. 25.vi.2020, C.S. Eiseman, ex *Vitis riparia*, #CSE6290 (4♂, genitalia slide CE-2025-50, CUIC; 2♀, genitalia slide CE-2025-56, CUIC; preserved mines; CSEC); 42.646618, –72.425058, 15.vi.2022, em. 22.vi.2022, C.S. Eiseman, ex *Vitis riparia*, #CSE7531 (1♂, CUIC); 42.647050, –72.424942, 7.ix.2024, em. 16.ix.2024, C.S. Eiseman, ex *Vitis riparia*, #CSE9018 (2♀, CUIC); **MISSISSIPPI:** Jackson Co., Pascagoula River Wildlife Man. Area, nr Wade Vancleave Rd, 30.62889, –88.61059, 10.x.2010, E.J. van Nieuwerkerken & C. Doorenweerd, ex *Vitis vulpina*, EvN no 2010229-K, em. 25.x.2010, (1♂, genitalia slide CDGP0224, WOGRA404-15, RMNH.INS.544311; 1♀, RMNH.INS.28113; 3 pressed mines, RMNH.INS.43253); **MISSOURI:** McDonald Co., 3.viii.2022, C. Wardlaw, completed mine on *Ampelopsis cordata* (iNat 129396605); **NEW YORK:** Columbia Co., Ghent, Wolfe planted meadow, 28.ix.2015, em. 30.ix.2015, C. Vispo, ex *Vitis aestivalis*, #CSE2187 (1♀, CUIC); Onondaga Co., Radisson, 43.18, –76.3, 2.viii.1977, E. Jackh, ex *Vitis* (1♂, BOLD LNAUY2911-19, DRD genitalia slide USNM 31670, USNMENT01736097); **NORTH CAROLINA:** Durham Co., Durham, 17 Acre Wood, 19.x.2020, T.S. Feldman, *Ampelopsis brevipedunculata*, #D2695 (3 vacated mines, RMNH.INS.48510); Wake Co., Raleigh, near Reedy Creek Road, 14.vii.2021, em. by 21.vii.2021, T.S. Feldman, ex *Ampelopsis brevipedunculata*, #CSE7266 (1♂, CUIC); **PENNSYLVANIA:** Bucks Co., Buckingham, 25.v.2019, em. 11.vi.2019, B. Keim, ex *Vitis riparia* (1 adult, BG 1692472); **RHODE ISLAND:** Bristol Co., Bristol,

29.viii.2021, em. 31.viii.2021, T. Irvine, ex *Vitis labrusca* (1 adult, BG 2079874); same but 4.ix.2021, em. 14.ix.2021 (1 adult, BG 2079878, iNat 104881111); **TENNESSEE**: Blount Co., Great Smoky Mts NP, Rich Mountain Gap, 2.x.2010, E.J. van Nieuwerkerken & C. Doorenweerd, *Vitis vulpina* (5 pressed mines, RMNH.INS.43060); **VERMONT**: Addison Co., Button Bay SP, Lake Champlain borders, 16.ix.2011, em. 26–28.ix.2011, E.J. van Nieuwerkerken, ex *Vitis riparia*, EvN no 2011253-5K (3♂, RMNH.INS.28299–RMNH.INS.28301; 3♀, RMNH.INS.28296–RMNH.INS.28298; leaf fragments with cocoons, RMNH.INS.37600); Chittenden Co., Essex, Woodside Park, 27.vi.2013, em. 30.vi.2013, C.S. Eiseman, ex *Parthenocissus quinquefolia*, #CSE614 (1♀, BG 871012, CUIC; pressed mine, CSEC); same but em. 1.vii.2013, #CSE635 (1♂ 1♀, CUIC; pressed mines, CSEC); Washington Co., Montpelier, North Branch Nature Center, 21.vii.2018, C.S. Eiseman & J.A. Blyth, ex *Parthenocissus quinquefolia*, #CSE4820 (1 pupa, RMNH.INS.31499). **AUSTRIA**. Graz, St. Peter, 47.05, 15.5, 10.ix.2019, H. Pichler (1 adult, BOLD DEEUR2337-19). **ITALY**. Val d'Aosta, Fénis, Cretes, 45.74163, 7.48944, 2.x.2018, E.J. van Nieuwerkerken, *Vitis vinifera*, EvN no 2018244-H (3 pressed mines, RMNH.INS.46507); Vicenza, Borghetto, 19.viii.2013, M. Baldessari, *Vitis vinifera* cv 'Pinot Grigio' (4 pressed mines, RMNH.INS.40795, RMNH.INS.40796). **SLOVENIA**. Primorska, Vipavska dolina, Selo (Ajdovscina), 45.889, 13.792, 12.viii.2007, S. Gomboc (1 adult, BOLD GRSLO545-11). **UKRAINE**. Kyiv, M.M. Gryshko National Botanical Garden, 50.40759, 30.56107, 7.x.2025, A. Levon, mines on *Vitis amurensis* (iNat 319751278).

Adult. Based on our examination of 28 physical specimens, the forewing length is 2.1–2.7 mm, and the wingspan is 4.7–5.8 mm. The following observations are based on these plus 22 photographed specimens. The antenna is usually silvery-white but occasionally blackish (sometimes with the basal portion pale and the remainder dark). In 30 specimens the dorsal spot is entirely absent, and in the remaining 20 it ranges from small and faint to large and bold. With the exception of one specimen that emerged on 1 July and has a very small and faint spot (CSE635), all of those with spots are from the overwintering generation (reared or collected between September and May). The dorsal strigula is separate from the second costal strigula in most specimens, but in four specimens the two strigulae are completely fused to form an angulated or curved fascia, and in several others the two strigulae nearly meet or are faintly joined. In two specimens (e.g. CNCLEP00101461), the dorsal strigula forms a complete angulated fascia with the *first* costal strigula, and is also (more faintly) joined with the second costal strigula. Twenty specimens have no trace of a dark dorsal patch between the dorsal strigula and preapical line, and the remaining specimens have at least a hint of one (e.g. a pale gray patch, or a few scattered dark scales); just five have a distinct blackish patch, and this is usually restricted to the proximal end of this area. The preapical line is unambiguously complete in 21 specimens, and in at least 12 others it is nearly complete, or the two strigulae are faintly connected. In the female, abdominal segment 7 is more strongly sclerotized than the preceding segments, with a broad band of particularly strong sclerotization at the anterior margin.

Chambers (1871) described the dorsal and second costal strigulae as separate (in contrast with *P. vitegenella*), and his description also implied that the preapical line is broken. His specimens lacked a dorsal spot, and since he stated that *P. vitegenella* differs in having the antennae blackish above, his general description of *P. vitifoliella* being “Glistening snowy white” apparently included the antennae. Chambers (1875a, 1880a) stated that the adult of *P. liquidambarisella* is indistinguishable from that of *P. vitifoliella*, and that adults reared from *P. ampelopsiella* mines are “almost as often” (Chambers 1875a) or “as frequently” (Chambers 1880a) indistinguishable from *P. vitifoliella* as they are matching his original description of *P. ampelopsiella*. Chambers (1880a) reiterated that the dorsal spot and basal streak of typical *P. ampelopsiella* “are always absent in *vitifoliella*, which has also a more silvery lustre.”

Although Forbes (1923) relied entirely on the leaf mine to distinguish *P. vitifoliella* from *P. vitegenella* in his key, his species account for *P. vitifoliella* notes, “the second fascia usually extending onto the wing membrane,” as opposed to “in the fringe only” for *P. vitegenella*.

Szabóky and Takács (2014) and Szabóky (2014) reported a wingspan of 5.5–6.5 mm for European specimens of *P. vitifoliella*, substantially larger than the range we observed in North American specimens. They stated that the preapical line is usually complete.

Hosts. *Ampelopsis cordata* Michx., *A. glandulosa* var. *brevipedunculata* (Maxim.) Momiy., *Parthenocissus inserta* (A. Kern.) Fritsch, *P. quinquefolia* (L.) Planch. (Bodor 2014, as *Ampelopsis quinquefolia*; Ureche 2016; Trencheva and Trenchev 2018), *Vitis aestivalis* Michx., *V. amurensis* Rupr., *V. labrusca* L., *V. riparia* Michx. (Ferge 2010;

Bodor 2014), *V. rotundifolia* Michx. (Heppner 2007), *V. vinifera* L. (Posenato et al. 1997, as “Cabernet” and “Chardonnay”; Lips and Jermini 2013; Szabóky and Takács 2014; Ureche 2016; Trencheva and Trenchev 2018; Simonović and Graora 2019; Stark 2024), *V. vulpina* L. (Chambers 1874, as “*V. cordifoliella*”; Frey and Boll 1878, as *V. cordifolia*); mines consistent with this species found on *V. tiliifolia* Humb. and Bonpl. ex Schult. in southern Mexico (TeamTzibim 2026). Mines on *Parthenocissus* are not uncommon in North America, and it is remarkable that this host association was never mentioned in the literature until the past decade when it has been documented in Hungary, Romania, and Bulgaria. Heppner (2007) inexplicably listed *Castanea* Daubenton, *Fagus* L., and *Quercus* L. (Fagaceae) as hosts for *Phyllocnistis vitifoliella*; we have seen no evidence that any North American *Phyllocnistis* feeds on these plants, although EvN and C. Dooreneewerd have reared a Taiwanese species from *Q. spinosa* David (BIN BOLD:ACU6227).

Leaf mine. Mines of *Phyllocnistis vitifoliella* (Fig. 71–77) are always on the upper leaf surface. Initially, they are epidermal and resemble snail trails, just as mines of *P. vitegenella* do for their entire length. Typically the early mine of *P. vitifoliella* alternates between the epidermal and parenchymal cells up to three times before transitioning permanently into the parenchyma, so that the otherwise conspicuous mine is interrupted by stretches where it is more difficult to discern. In our preserved mines, the width is 0.2 mm when the mine first enters the parenchyma, and is 0.7–2.0 mm just before the pupal chamber. The frass pattern is variable, but it often appears as a double line that occupies the middle third of the mine’s width (i.e., the frass line is typically ~0.3 mm wide in the later portion); sometimes it appears as a broad, solid line, nearly or fully as wide as the mine; sometimes it appears as tightly zigzagging arcs that span nearly the full width of the mine, composed of more or less distinct dots, as is common in *Stigmella* Schrank (Lepidoptera: Nepticulidae); and rarely there are brief stretches where it appears as stripes that alternate from side to side as in *Liriomyza* mines. In North America we have never seen dozens of mines per leaf as has been reported in Europe (see below), but we reared six adults from a single leaf of *Vitis riparia* (CSE6290). The pupal chamber is normally formed away from the leaf margin.

Clemens (1862) was the first to describe the mine, though he did not know what species was responsible for it: “It is very long, winding, linear and narrow, filled with blackish frass and hence easily seen . . . When the larva is full fed, it enlarges the mines [sic] at its extremity, without making the enlargement transparent, and making a fold in the leaf at this point, weaves its cocoon and undergoes its transformation in the mine . . . The larva is pale greenish, immaculate, long and very slender, with the anal segments very pointed.” The “fold” Clemens described is, in our experience, usually a slight buckling caused by the contracting of the silk in the cocoon; *P. vitifoliella* pupal chambers do not typically result in a true fold as with *P. vitegenella*. Chambers (1871) noted that the mine of *P. vitifoliella* is on the upper leaf surface and that it is the unidentified mine described by Clemens (1862), although Chambers somewhat inaccurately characterized Clemens’ description of a mine “in which the parenchyma is entirely eaten out, and the frass centrally deposited.” The mine is certainly deeper in the leaf tissue than that of *P. vitegenella*, but the parenchyma is not consumed, and the mine is not “transparent” as stated by Chambers (1871, p. 207). All descriptions and illustrations of “*Phyllocnistis vitegenella*” mines in Europe clearly represent *P. vitifoliella* (Posenato et al. 1997; Marchesini et al. 2000; Villani 2002; Reggiani and Boselli 2005; Seljak 2005; Mattedi et al. 2009; Cara and Jermini 2011; Lips and Jermini 2013; Bodor 2014; Szabóky and Takács 2014; Mikulás 2016; Ureche 2016; Chireceanu et al. 2017; Bence 2018; Trencheva and Trenchev 2018; Simonović and Graora 2019; Laštůvka et al. 2021; Tokár et al. 2021; Babytskiy et al. 2023; Wiewel 2025). European authors note that the mines are more than 10 cm long (Duso et al. 2011), up to 15 cm (Seljak 2005), and that there can be up to several dozen mines on a single leaf (Villani 2002; Seljak 2005).

Phenology. Chambers (1871) reported that larvae can be found from May to October, and that in Kentucky this species “is as abundant as *P. vitegenella*, all through the summer, in all of its stages, and can be found in winter abundantly hibernating under the loose bark of Hickory trees, and in similar situations in company with *P. vitegenella*, and occasionally *P. ampelopsifoliella* [sic].” In Florida, we found mines with pupal chambers in late March, and an adult emerged in early April. Larvae are active by mid-April as far north as North Carolina. In New England, there is one record of very early mines in Vermont on 28 May (Mitchell 2024), with the earliest reared adults emerging on 22 June in Massachusetts and 1 July in Vermont. We have also reared adults from mid- to late September in Massachusetts. In Italy, four to five generations per year have been reported, with the first mines appearing on newly opened leaves in early May, and with adults found overwintering under the bark

of grapevines (Posenato et al. 1997, 1998; Marchesini et al. 2000). According to Duso et al. (2011), some adults overwinter in conifer canopies.

Distribution. *Native range:* Canada: MB, NB, ON, QC (Handfield 1997). USA: AL, AR, CT, DC, DE, FL (Dozier 1920), GA, IA, IL, IN, KS, KY (Chambers 1871), LA, MA, MD, ME, MI (Nielsen 1998), MN, MO, MS, NC, ND, NE, NH, NJ (Smith 1910), NY (Forbes 1923), OH, OK, PA, RI, SC, SD, TN (Eiseman and Charney 2010), TX (Frey and Boll 1878), VA, VT (Grehan et al. 1995), WI (Chambers 1871), WV. The Illinois and Ohio records in Godfrey et al. (1987) and Ferge (2015) are based only on caught adults, and it is unclear what the Quebec and Michigan records in Handfield (1997) and Nielsen (1998) are based on, but in any case these are all now supported by observations of leaf mines. There are two observations of leaf mines consistent with *P. vitifoliella* from the Mexican state of Mexico (annieliveoak 2023; TeamTzibim 2026); these are far south of all other records of this species, and DNA barcoding is needed to confirm their identity. The report of “*Phyllocnistis vitifolia* Chambers” in California (Powell and Opler 2009) surely refers to *P. occidentalis*.

Introduction in Europe: The first *Phyllocnistis* mines on grape leaves were detected in Northeast Italy in 1994 (Posenato et al. 1997, 1998). The species responsible was identified as *P. vitegenella* by D.R. Davis, who stated in a letter to P. Triberti (29 October 1996) (received by EvN from Luca Mazzon): “I have identified your *Phyllocnistis* as *vitegenella* Clemens. The wing pattern matches our species on *Vitus* [sic] and the pupae are very similar to what I have reared with the exception that ours appear to have a more attenuated frontal spine (which is probably variable).” The misidentification is understandable, as Davis did not examine the leaf mines, and was for some time convinced that the two named *Vitis*-feeding species could not be separated by their genitalia, and thus had to be synonyms. Unfortunately the first DNA barcodes that became available in North America were also misidentified as *P. vitegenella*, supporting the incorrect identification in Europe.

After its discovery in Italy, *P. vitifoliella* was found in nearby Slovenia in 2004 (Seljak 2005), in southern Switzerland in 2009 (SwissLepTeam 2010; Cara and Jermini 2011), Croatia (Istria) in 2010 (Budinićak 2011), Hungary in 2013 or 2014 (Bodor 2014; Szabóky and Takács 2014; Hegyi and Rószahgyi 2015), and Romania in 2014 (Ureche 2016). In 2017 it arrived in Ukraine (Babytskiy et al. 2023); in 2018 in Bulgaria (Trencheva and Trenchev 2018); in 2019 in Austria (Buchner 2019; Stark 2024), Serbia (Simonović and Graora 2019), and Slovakia (Tokár et al. 2021); and in 2021 in Czechia (Laštůvka and Laštůvka 2021). Finally in 2025 it was observed in Germany (Wiewel 2025), Poland (piotr1410 2025), and France (Corsica) (van Dijk 2025). It may soon be expected in mainland France, becoming more widespread in Germany, and in the south most likely entering Greece.

DNA barcoding. All sequences of *Phyllocnistis vitifoliella* from both North America and Europe have been assigned to a single BIN, BOLD:AAI3014, with the maximum distance between barcodes being 1.77%. The 284 specimens include a larva collected from *Vitis labrusca* in Massachusetts (CSE6251), five larvae and pupae collected from *V. riparia* in Quebec (CNCLEP00223558–62), and other material from Canada (Ontario, Quebec), the USA (New York, Maryland, Virginia, Tennessee, Mississippi, Alabama, Florida), Austria, Italy, and Slovenia. A 574 bp sequence was obtained from a pupa collected from *Parthenocissus* in Vermont (CSE4820); this has not been assigned to a BIN, but is a 100% match to BOLD:AAI3014. The nearest neighbor of this BIN, differing by 3.55%, is BOLD:AFR8637, which we believe to represent *P. occidentalis*; see that species account for details.

Parasitoids. Several species of Eulophidae have been reared from *Phyllocnistis vitifoliella* in North America: *Closterocerus cinctipennis* Ashmead, *C. trifasciatus* Westwood, *Horismenus fraternus* (Fitch), *Pnigalio* sp. (Eiseman and Hansson 2026), and an undetermined *Chrysocharis* sp. (CSE6319, CNC; Eiseman 2025d). *Closterocerus trifasciatus* has also been reared from *P. vitifoliella* (as *P. vitegenella*) in Europe, along with other Eulophidae: *Burkseus vittatus* (Walker) (as *Cirrospilus vittatus*), *Chrysocharis nephereus* (Walker), *C. pentheus* (Walker), *Cirrospilus diallus* Walker, *C. cf. lyncus* Walker, *Diglyphus pusztensis* (Erdős and Novicky), *Euderus* sp., *Minotetrastichus frontalis* (Nees) (= *M. ecus* (Walker), = *M. rivillellae* (Rondani)), *Neochrysocharis chlorogaster* (Erdős), *N. formosa* (Westwood), *Pediobius saulius* (Walker), *Pnigalio pectinicornis* (Linnaeus), and *P. soemius* (Walker) (Marchesini et al. 2000; Baur 2005; Reggiani and Boselli 2005; Cara and Jermini 2011; Cara et al. 2013; Szabóky and Takács 2014). In addition to several of the above species, Lips and Jermini (2013) listed “*Closterocerus erxias*,” apparently referring to *Asecodes erxias* (Walker). Cara et al. (2013) also reared an undetermined *Eupelmus* sp. (Eupelmidae)

from *Phyllocnistis vitifoliella* in Switzerland, and Chireceanu et al. (2017) stated, without documentation, that unspecified ichneumonid parasitoids had been associated with this species in Europe.

Notes. Chambers (1871) described this species under the heading “PHYLLOCNISTIS” as “*L. vitifoliella*. N. sp.”, where “*L.*” must stand for *Lithocolletis*. This was obviously a lapsus, as he had just in the previous sentences compared the *Phyllocnistis* species with *Lithocolletis* species. From the heading and context it is clear that his intent was to name the species *Phyllocnistis vitifoliella*, which he cited further as *P. vitifoliella*.

Although this species has become abundant in European vineyards, with mines occurring on almost all leaves of infested vines in Italy (Posenato et al. 1998), it does not appear to cause economically significant damage (Villani 2002; Lips and Jermini 2013; Chireceanu et al. 2017; Laštůvka et al. 2021). In addition to the European misidentifications, this is also the species that Kawahara et al. (2013) identified as *Phyllocnistis vitegenella*, as evidenced by their inclusion of the specimen BOLD GREC093-12 in their Fig. 1. Their study reported adults of this species attracted to a synthetic pheromone for *P. citrella* in southern Florida.

Forbes (1923) stated that *P. vitifoliella* is “the commonest of the grape *Phyllocnistis*es,” and this is supported by observations on iNaturalist. We have verified 3368 North American records of *P. vitifoliella* and only 1353 of *P. vitegenella*, including observations from the west where *P. vitifoliella* does not occur.

***Phyllocnistis ampelopsiella* Chambers, 1871**

(Fig. 5–7, 13, 24, 33, 37, 47, 54, 56, 63, 78–84, 94)

P[hyllocnistis] ampelopsifoliella. Chambers 1871: 206. Unavailable name, mentioned in description of *P. vitifoliella*.

P[hyllocnistis] ampelopsiella. Chambers 1871: 207. Syntypes: [USA: Kentucky, Covington], larva mines the under surface of leaves of the Virginia Creeper (*Ampelopsis quinquefolia*) (1 syntype in NHMUK, see Miller and Hodges 1990, De Prins and De Prins 2026) [not examined].

Phyllocnistis ampelopsiella. Chambers 1875a: 107; 1877: 140; 1878: 109; 1880a: 191–192; 1880b: 67; Dyar 1902: 563; Smith 1910: 573; Forbes 1923: 154; Needham et al. 1928: 282; Davis 1983: 11; Brower 1984: 44; Handfield 1997: 31; De Prins and De Prins 2005: 248; Bodor 2014: 17; Pohl and Landry 2018: 56; Robinson et al. 2002: 353, 478, 592, 708; Eiseman and Charney 2010: 333; Eiseman and Davis 2023: 55; Eiseman 2024: 303, 392, 929, 930–931, 934–935, 939.

Phyllocnistis ampelopsiella [misspelling]. Knudson and Bordelon 2002: 4.

Diagnosis. This is the only species forming lower-surface mines on Vitaceae in eastern North America. *Phyllocnistis occidentalis*, with which it is not sympatric, sometimes forms mines on the lower leaf surface; these tend not to be as strongly contorted as those of *P. ampelopsiella*, but if the ranges of the two species were to overlap, DNA barcoding may be necessary to distinguish them (however, in the mines we have measured, the frass line of *P. ampelopsiella* is typically 0.01–0.03 mm wide, whereas that of *P. occidentalis* is 0.05–0.2 mm). In Asia, *P. toparcha* sometimes forms lower-surface mines, but these resemble snail trails and have no evident frass (*P. ampelopsiella* mines are whitish with a distinct central frass line). The oblique black basal streak on the forewing, when present, distinguishes adults of *P. ampelopsiella* from all other North American *Phyllocnistis*; in Asia, *P. toparcha* typically has a longitudinal fascia, but this is yellow with black edging.

Material examined. Canada. MANITOBA: Manitoba Tall Grass Prairie Preserve, Agassiz Trail (block SE24-2-6E), 49.135, –96.66, 16.vii.2007, J.-F. Landry & V. Nazari (1 adult, BOLD MNAF240-08, CNCLEP00040225); **ONTARIO:** Dunrobin, 122 Dunhaven Drive, 45.41, –76.058, 22.x.2007, L. Scott (1 adult, BOLD MNAI751-09, CNCLEP00038532); Nipissing Co., Algonquin Provincial Park, Basin Depot, 6.vii.2018, em. 14.vii.2018, C.S. Eiseman & J.A. Blyth, ex *Parthenocissus quinquefolia*, #CSE4757 (1♀, CUIC); Peel Co., Brampton, 43.689, –79.769, 21.viii.2021, M.H. King, mine on *Vitis* (iNat 99411180); Renfrew Co., Killaloe, Hagarty and Richards, 45.605, –77.590, 7.vii.2018, em. 15.vii.2018, C.S. Eiseman & J.A. Blyth, ex *Parthenocissus quinquefolia*, #CSE4764 (1♂, CUIC); **QUEBEC:** Gatineau, Aylmer, 48 Rue du Couvent, 45.397, –75.849, 16.ix.2011, J.F. Landry (1 adult, BOLD CNCLA2032-13, CNCLEP00090513); 48 Rue Notre-Dame, 22.x.1994, J.F. Landry (3 adults, BOLD CNCLA2033-13, CNCLA2034-13, CNCLA2036-13, CNCLEP00101457–58, CNCLEP00101460); Gatineau, Aylmer E, near Ottawa river, 45.39023, –75.79139, 23.viii.2015, E.J. van Nieukerken, *Parthenocissus inserta* (1 larva, RMNH.INS.30761; pressed mines, RMNH.INS.40248, RMNH.INS.40249). **USA. ALABAMA:** Bibb Co., Bibb County Glades preserve, 12.x.2010, 33.05765, –87.03441, E.J. van Nieukerken & C. Doorenweerd, mines on *Nekemias*

arborea (1 larva, RMNH.INS.18366; pressed mines, RMNH.INS.43278, RMNH.INS.43279); **FLORIDA**: Lee Co., Sanibel Island, Ding Darling Refuge, 30.xii.2019, em. 18.i.2020, T.S. Feldman, ex *Parthenocissus quinquefolia*, #CSE6017 (1♂, CUIC); **IOWA**: Winneshiek Co., 100 Acre Wood, 9.viii.2016, em. 16.viii.2016, MJ Hatfield, ex *Parthenocissus quinquefolia* (1 adult, BG 1286999); **MASSACHUSETTS**: Franklin Co., Northfield, 42.64743, -72.42504, 1.ix.2020, C.S. Eiseman, *Parthenocissus quinquefolia*, #CE-2020-1 (pressed mine with 1 larva, RMNH.INS.48497); Hampshire Co., Pelham, 88 Arnold Rd., 30.viii.2013, em. 3.ix.2013, C.S. Eiseman, ex *Parthenocissus quinquefolia*, #CSE868 (1♀, CUIC; 4 pressed mines, CSEC); same but em. 12.ix.2013, #CSE895 (1♀, genitalia slide CE-2025-57, CUIC; pressed mine, CSEC); #CSE897 (1♂, CUIC; pressed mine, CSEC), #CSE893 (1♂, genitalia slide CE-2025-52, CUIC; pressed mine, CSEC); same but em. 14.ix.2013, #CSE900 (1♀, CUIC); same but em. 18.ix.2013, #CSE909 (1 adult, lost); same but 4.ix.2013, em. 11.ix.2013, #CSE891 (1♂, CUIC; pressed mine, CSEC); same but 4.ix.2013, em. 18.ix.2013, #CSE908 (1 adult [abdomen missing], CUIC); same but 4.ix.2013, em. 20.ix.2013, #CSE915 (1♂, CUIC); same but 4.ix.2013, parasitoid em. 19.ix.2013 (1 pressed mine, CSEC); Plymouth Co., Bridgewater, 16.viii.2013, em. by 28.viii.2013, C.S. Eiseman, ex *Parthenocissus quinquefolia*, #CSE841 (2 adults [lost?], pupal skins, USNM; 2 pressed mines, CSEC); **MINNESOTA**: Anoka Co., Columbus, 45.2628, -93.0297, 16.viii.2023, csledge, completed mine on *Parthenocissus inserta* (iNat 179907391); **MISSISSIPPI**: Adams Co., Natchez, 31.56073, -91.39915, 21.vi.2020, T. Tillman, ex *Ampelopsis cordata*, #CSE6294 (2 pupae, RMNH.INS.31513-14; 7 pressed mines, RMNH.INS.48505); **NORTH CAROLINA**: Carteret Co., Fort Macon State Park, 29.v.2026, em. 21.vi.2026, T.S. Feldman, ex *Nekemias arborea*, #CSE10152 (1♀, 4 pressed mines, CSEC); Durham Co., Durham, 35.94802, -78.97670, 29.ix.2025, em. 9.x.2025, T.S. Feldman, ex *Parthenocissus quinquefolia* (1 adult, iNat 317799834); New Hanover Co., Fort Fisher Recreation Area, 20.vi.2026, T.S. Feldman, *Nekemias arborea*, D9033 (7 pressed mines, CSEC); Wilmington, 31.vii.2021, T.S. Feldman, completed mines on *Nekemias arborea* (BG 2014319); **OKLAHOMA**: Payne Co., Mehan, 36.014, -96.997, 11.vi.2017, em. 22.vi.2017, M.W. Palmer, ex *Parthenocissus quinquefolia*, #CSE4238 (1♀, CUIC); **PENNSYLVANIA**: Carbon Co., Jim Thorpe, Hickory Run State Park, 41.01188, -75.72880, 31.viii.2025, em. by 25.ix.2025, P. Dennehy, ex *Parthenocissus quinquefolia* (1 adult, iNat 316633842); Montour Co., Danville, Hess Recreation Area, 40.975, -76.622, 28.viii.2025, em. by 25.ix.2025, P. Dennehy, ex *Parthenocissus quinquefolia* (1 adult, iNat 316637126); **RHODE ISLAND**: Providence Co., Cumberland, High Rock Preserve, 41.956058, -71.429202, 9.ix.2020, em. 11.ix.2020, C.S. Eiseman & J.A. Blyth, ex *Parthenocissus*, #CSE6588 (1♀, CUIC); same but em. 19.ix.2020, #CSE6597 (1♀, CUIC); **VERMONT**: Washington Co., Montpelier, North Branch Nature Center, 16.viii.2020, extracted 22.viii.2020, C.S. Eiseman, ex *Parthenocissus*, #CSE6515 (2 pupae, RMNH.INS.31523-24).

Adult. Based on our examination of 15 physical specimens, the forewing length is normally 2.4–2.6 mm (2.0 mm in one male), and the wingspan is 4.8–5.7 mm (3.9 mm in the smallest male, but its wings are not fully spread); the female reared from *Nekemias* has a forewing length of 2.0 mm and a wingspan of 4.3 mm. The following observations are based on these plus nine photographed specimens. The antenna is usually black but can be paler, especially toward the base, and is rarely entirely white. In seven specimens the dorsal spot is entirely absent, and in the remaining 17 it ranges from small and faint to large and bold. In 11 specimens the basal streak is entirely absent, in nine it is present, and in four the basal half of the streak is absent but the distal portion is present. Most specimens examined are of the overwintering generation; the five that were reared between June and August all lack the dorsal spot and basal streak, but the adult caught in Manitoba in mid-July has a distinct dorsal spot and the distal portion of the basal streak is present, although faint. The dorsal strigula usually joins the second costal strigula to form a complete, angulated or curved fascia, but in some specimens these strigulae are separate or the connection is faint; rarely the dorsal strigula is instead, or additionally, joined with the first costal strigula. A gray to black dorsal patch is usually present between the dorsal strigula and preapical line, but this is entirely absent in four specimens and very faint in seven others. In all specimens except the one reared from *Nekemias*, the preapical line is complete, although in some cases it does not appear as a continuous line because it is confluent with the dorsal patch. In the female abdomen, sclerotization of segment 7 does not differ from that of the preceding segments.

The specimen(s) from which Chambers (1871) first described this species had a pale black dorsal spot, a distinct black basal streak, and a complete curved fascia formed by the united dorsal and second costal strigulae. Later (Chambers 1875a, 1880a), he reported that *Phyllocnistis ampelopsiella* mines just as often produce adults

that are indistinguishable from *P. vitifoliella*. He stated, “*Ampelopsiella* is a little larger and more coarsely scaled than *vitifoliella*, and has a dark fuscus streak extending from the base to the middle of the wing, and a dark fuscus spot on the dorsal margin before the middle. This streak and spot are always absent in *vitifoliella*, which has also a more silvery lustre” (Chambers 1880a). He claimed that there was no intergrading between these two forms, which is certainly contrary to our experience. Forbes (1923) considered a gray patch in the apical region to be diagnostic for *P. ampelopsiella*, but as noted above, we have seen multiple specimens of *P. vitifoliella* with this feature.

Hosts. *Ampelopsis cordata* Michx., *Nekemias arborea* (L.) J. Wen and Boggan, *Parthenocissus inserta* (A. Kern.) Fritsch, *P. quinquefolia* (L.) Planch. (Chambers 1871, as *Ampelopsis quinquefolia*). Chambers (1880a) wrote, “I have received, both from Miss Murtfeldt and Prof. Comstock, specimens of the true *ampelopsiella* [evidently meaning the diagnostic basal streak was present], from [sic] which they inform me were bred from grape leaves; but I do not know the character of the mines, nor the surface of the leaves, from which they were bred.” This may or may not be the basis for the record of *Vitis vinifera* L. as a host for *Phyllocnistis ampelopsiella* in Robinson et al. (2002). While we cannot entirely exclude the possibility that adults of the other eastern Vitaceae feeders can rarely have a basal streak on the forewing, we have seen photographs of a *Vitis* leaf in Ontario with an apparently predated mine of *P. ampelopsiella* (King 2021). Lower-surface mines possibly representing this species have been photographed in Miami, Florida on *V. rotundifolia* Michx. (Frade 2021a) and *Cissus verticillata* (L.) Nicolson and C.E. Jarvis (Frade 2021b), but they are not as contorted as is typical for *P. ampelopsiella*, and they are too old to assess the frass pattern; it is possible these are the work of another insect such as *Liriomyza schmidtii*. Although the mines on *Ampelopsis* and *Nekemias* certainly represent a species close to *P. ampelopsiella*, further investigation into whether there is more than one species involved is warranted (see DNA barcoding, below).

Leaf mine. The mines of *P. ampelopsiella* (Fig. 78–84) are always on the lower leaf surface and are usually highly contorted. In our preserved examples, the linear track is so convoluted that measuring its width is impossible except near the beginning, where it is 0.3–0.5 mm wide. The fact that the mine is entirely linear is evident due to the nearly continuous frass line, which is usually only 0.01–0.03 mm wide. The mine on *Nekemias arborea* from which a DNA barcode was obtained (RMNH.INS.43279, larva RMNH.INS.18366) has a frass line that is partially doubled, and in the part that is single, reaches a width of 0.13 mm. Mines on this host typically have a broken frass line toward the end, and this always exceeds 0.1 mm in width, sometimes with portions as wide as 0.4 mm. Mines of *P. ampelopsiella* are typically evident from above only by the slight buckling produced by the contracting silk in the pupal chamber, which is usually at or near the leaf margin. In the single example we have seen of a mine on a grape leaf (King 2021), there is brown discoloration on the upper surface corresponding with the later portion.

Chambers (1871, 1875a, 1878, 1880a) described the mine of this species four times, always as a white, convoluted track on the lower leaf surface that at least partly forms a secondary blotch: “the narrower line of which it is composed winds about over the same limited space, to such an extent that the mine looks like a large white blotch” (Chambers 1875a). His final account (Chambers 1880a) reads, “*P. ampelopsiella* (*vera*.), makes a whitish mine on the *under* side of *Ampelopsis* leaves. The mine, though what we call a linear one, is rather wide. It begins on the side of a vein near the margin, passes down the vein to the midrib, up the midrib to the next vein, up that vein to the margin, where it crosses the vein, passes down it again to the midrib, and so on until some times more than half of a leaf will be ruined. The track is whitish, with a narrow central black line of frass. In a single instance, I found a similar mine on the upper side of the leaf containing a dead larva.” We have never seen an upper-surface mine that could be attributed to this species, and we suspect what Chambers referred to was a mine of *P. vitegenella*—or perhaps *P. occidentalis*, since he made this statement after reporting *P. ampelopsiella* from Colorado (Chambers 1875b, 1877).

Phenology. Chambers (1871) stated that in Kentucky larvae can be found mining “through the summer, and until the fall of the leaves,” with adults overwintering. Mines have been found as early as 13 April in North Carolina and 22 May in Maryland, and by late June in Ontario and New York. Adults have emerged from collected mines in late June (Oklahoma), mid-July (Ontario), mid- to late August (Iowa, Massachusetts), early to mid-September (Massachusetts, Rhode Island), late September (Pennsylvania), early October (North Carolina), and mid-January (southern Florida).

Distribution. Canada: MB, ON (Pohl and Landry 2018), QC (Handfield 1997). USA: AR, CT, FL, GA, IA, IL, IN, KY (Chambers 1871), LA, MA, MD, MI, MN, MO, MS, NC, ND, NE, NJ (Smith 1910), NY, OH, OK, PA, RI, OK, TX (Knudson and Bordelon 2002), VA, VT, WI, WV. The record of Maine in Brower (1984), which is based on a single caught adult, requires confirmation given the number of obvious misidentifications of Gracillariidae in that publication. Although it would not be surprising to find *P. ampelopsiella* in Maine, no leaf mines have been documented that far northeast. The Colorado record of *P. ampelopsiella* in Chambers (1875b, 1877), which was apparently based only on observed leaf mines, probably refers to *P. occidentalis*. The only Mississippi record and both Missouri records are from *Ampelopsis cordata*, and all three Texas records on iNaturalist are from *Nekemias arborea* (the basis for the Texas record in Knudson and Bordelon (2002) is unclear); see discussion under DNA barcoding, below.

DNA barcoding. A pupa extracted from a leaf mine on *Parthenocissus* from Vermont (CSE6515) yielded a 658 bp sequence, which is 4.4% ambiguous and has not been assigned to a BIN; however, it is a 99.85% match to BOLD:AAI3015, which consists entirely of specimens identified as *Phyllocnistis ampelopsiella*. The BIN includes 78 specimens from Manitoba, Ontario, and Quebec, as well as one from China. The Chinese specimen (GenBank: MW136150.1) was obtained from gray mangrove (Acanthaceae: *Avicennia marina* (Forssk.) Vierh.) in Zhanjiang, Guangdong Province. It was associated with the study by Chen et al. (2017), who reported that the leafminers reared from this host were identified as *P. citrella*, and the photographed adult in their Fig. S1 certainly matches that species rather than *P. ampelopsiella*. We cannot explain the barcode, but we do not consider it to be evidence that *P. ampelopsiella* occurs in China.

The nearest neighbor of BIN BOLD:AAI3015 (2.06% difference) is BOLD:ABZ3983, comprising 11 specimens from Florida. Our sequenced larva collected from *Nekemias arborea* in Alabama showed a 99.7% match to this BIN. All of the Florida specimens were collected at Okaloacoochee Slough State Forest, Immokalee, Collier Co., on 10 September and 14 October 2011. Their Process IDs correspond with those shown as “*Phyllocnistis* new species 2” in Fig. 1 of Kawahara et al. (2013). These moths were attracted to a synthetic pheromone for *P. citrella*, along with three specimens that Kawahara et al. (2013) assigned to “*Phyllocnistis* new species 1” (collected at the same site, 30 September and 14 October 2011). The latter belong to BIN BOLD:ABV1053, whose nearest neighbor (4.17% difference) is BOLD:AAI3015. BIN BOLD:ABV1053 includes an additional 43 specimens from Malaise traps in Canada (Ontario) and the USA (Maryland, Missouri, New York, Virginia). The available images mostly show specimens in poor condition, but of the few whose forewing patterns can be seen clearly, none have a dorsal spot or a basal streak. Another related BIN is BOLD:AHJ0048, representing a single *Phyllocnistis* larva collected from a lower-surface leaf mine on *Eubotrys racemosa* (Ericaceae) in Massachusetts (S. Whitebread, in litt.); it also has BOLD:ABZ3983 as nearest neighbor (2.72% difference). Also BIN BOLD:ABA5650, comprising three Malaise trap specimens from Ontario, has the same nearest neighbor (BOLD:ABZ3983), differing by 3.21%.

A pupa extracted from a leaf mine on *Ampelopsis cordata* in Mississippi (CSE6294) has been assigned to BIN BOLD:AEI5900, again with BOLD:AAI3015 as nearest neighbor (2.21% difference). This BIN also includes 12 specimens from Malaise traps in Missouri and Louisiana. Although these are again rather poor specimens, some of them do display the dorsal spot and diagnostic basal streak of *P. ampelopsiella* (CBG 2024a, 2024b, 2024c). For now we consider this BIN and BIN BOLD:ABZ3983 (i.e., “*Phyllocnistis* new species 2” of Kawahara et al. (2013), here shown to be associated with *Nekemias*) to represent *P. ampelopsiella*, but this warrants further investigation. The status of BIN BOLD:ABV1053 (“*Phyllocnistis* new species 1”) is also unclear. Barcoding of additional larvae or pupae obtained from *Ampelopsis*, *Nekemias*, and *Parthenocissus* throughout the eastern USA—and from any *Phyllocnistis* mines that can be found near the sites where specimens in BOLD:ABV1053 and BOLD:ABA5650 were collected—would be illuminating. Potential other hosts to search on are Ericaceae and *Cornus* (see Discussion). All of the above BINs are closer to those associated with unidentified Costa Rican specimens than to the BINs associated with *P. vitegenella*, *P. vitifoliella*, and *P. occidentalis*.

Two additional BINs include specimens that have been [mis]identified as *P. ampelopsiella*. BIN BOLD:ADP7132 differs by >8% from all other BINs and includes five specimens obtained from lower-surface mines on *Marila laxiflora* Rusby (Calophyllaceae) (G. Lamarre, in litt.) in Panama; BIN BOLD:AEF0534 differs by >7% from all other BINs and includes five specimens obtained from upper-surface mines on *Trichilia*

prieureana A. Juss. (Meliaceae) (G. Lamarre, in litt.) in Cameroon and four specimens from Malaise traps in Ivory Coast. These are clearly all misidentified.

Parasitoids. We have reared undetermined Eulophidae in the genera *Cirrospilus* Westwood, *Pediobius* Walker, and *Pnigalio* Schrank, all from mines of *Phyllocnistis ampelopsiella* on *Parthenocissus quinquefolia* collected in Massachusetts (Eiseman and Hansson 2026).

Notes. Based on iNaturalist observations, this would seem to be a much rarer species than the other two eastern Vitaceae feeders, with just 344 records (some based on adults found at lights or overwintering under bark), versus almost four times that many for *P. vitegenella* and almost ten times as many for *P. vitifoliella*. However, whereas the latter two species form upper-surface mines that are easily detected by a casual observer, *P. ampelopsiella* forms lower-surface mines on leaves that are usually below eye level. We suspect it is at least as common as *P. vitegenella*, and this is supported by the number of specimens for each species represented by Malaise trap captures in BOLD.

Phyllocnistis occidentalis Eiseman and van Nieuwerkerken, new species

(Fig. 8, 9, 14, 15, 25–27, 34, 38, 44, 45, 50, 51, 55, 64, 85–90, 94)

P[hyllocnistis] ampelopsiella [misidentification]. Chambers 1875b: 304; 1877: 140.

Phyllocnistis vitifolia [misspelling and misidentification]. Powell and Opler 2009: 57, Plate 1.

Phyllocnistis sp. James 2020: 3; 2022: 1–13.

Diagnosis. This is the only species forming lower-surface mines on Vitaceae in western North America. Upper-surface mines differ from those of the only sympatric Vitaceae feeder, *Phyllocnistis vitegenella*, in being distinctly whitish (contrasting with the early portion that resembles a snail trail) with a prominent central frass line, and in having the pupal chamber usually formed away from the leaf margin. In the east, where *P. occidentalis* does not occur, the upper-surface mines of *P. vitifoliella* have a variable frass pattern, but when there is a solid central line it is always much wider than in *P. occidentalis* (at least 0.3 mm wide). The lower-surface mines of *P. ampelopsiella* are highly contorted, usually forming a secondary blotch except near the beginning, whereas *P. occidentalis* mines are clearly linear throughout, not forming a secondary blotch except when forced to due to limited space (e.g., when multiple larvae mine a single leaflet). The Asian species *P. toparcha* and *P. vitella*, as with *P. vitegenella*, form mines that resemble snail trails for their whole lengths. The adult female of *P. occidentalis* differs from *P. vitegenella* and *P. ampelopsiella* in having abdominal segment 7 more strongly sclerotized than the other segments, and differs from *P. vitifoliella* in having a thin transverse line of stronger sclerotization (as opposed to a broad band) near the anterior margin of this segment.

Material examined. *Holotype* (♂): **USA. NEVADA:** Douglas Co., Minden, 1682 Sunshine Rd., 39.015, –119.706, 7–11.viii.2020, em. 30.viii.2020, A. Jeton & D.J. Groffman, ex *Parthenocissus* (upperside), #CSE6541 (CUIC).

Paratypes (48♂♀): **USA. ARIZONA:** Cochise Co., Huachuca Mountains, Miller Canyon, 31.25, –110.16, 25.vii.1991, em. ?, ex *Vitis arizonica*, lot DRD 940.1 (1 adult, BOLD LNAUY2909-19, USNMENT01736095); Yavapai Co., Lower Wolf Creek Campground, 34.454244, –112.4594, 29.vii.2023, em. 6–7.viii.2023, C.S. Eiseman, ex *Vitis arizonica* (upperside), #CSE8381 (1♀, CUIC); **NEVADA:** Douglas Co., Minden, 1682 Sunshine Rd., 39.015, –119.706, 7–11.viii.2020, em. 25.viii.2020, A. Jeton & D.J. Groffman, ex *Parthenocissus* (underside), #CSE6523 (1♂, CUIC); em. 29.viii.2020, #CSE6532 (1♀, CUIC); em. 30.viii.2020, #CSE6536 (1♂, genitalia slide CE-2025-49, CUIC); #CSE6542 (1♂, CUIC); em. 31.viii.2020, #CSE6548 (1♂?, CUIC); #CSE6549 (1♀, CUIC); em. 2.ix.2020, #CSE6556 (1♂, CUIC); em. 4.ix.2020, #CSE6565 (1♂, CUIC); em. 5.ix.2020, #CSE6566 (1? [abdomen missing], CUIC); em. 8.ix.2020, #CSE6576 (1♀); same but upperside, em. 20.viii.2020, #CSE6509 (1♂, CUIC); em. 26.viii.2020, #CSE6524 (1♀, CUIC); #CSE6525 (1♂, CUIC); em. 28.viii.2020, #CSE6529 (1♀, CUIC); em. 29.viii.2020, #CSE6530 (1♂, CUIC); #CSE6531 (1♂, CUIC); em. 2.ix.2020, #CSE6555 (1♂, CUIC); em. 3.ix.2020, #CSE6559 (1♀, genitalia slide CE-2025-55, CUIC); same but from mixed collections of underside and upperside mines, em. 25.viii.2020, #CSE6522 (1♂, 1♂?, 1♀, CUIC); em. 31.viii.2020, #CSE6547 (1♂ 1♀, CUIC); #CSE6550 (3♂, CSE); em. 4.ix.2020, #CSE6564 (1♂ 1♀, CUIC); em. 9–10.ix.2020, #CSE6580 (1♀, CUIC); **OREGON:** Multnomah Co., Portland, 45.592728, –122.746597, 20.vi.2024, em. by 27.vi.2024, B. Hensley, ex *Vitis* (upperside), #CSE8855 (1♂, CUIC); **WASHINGTON:** Benton Co., Richland, Kitzke Cellars, 46.250136, –119.346294, 22.ix.2020, em. 24–29.ix.2020, D.G. James, ex *Vitis vinifera* ‘Sangiovese’ (underside), #CSE6610

(1♂, genitalia slide CE-2025-53, CUIC); em. 29.ix.2020, #CSE6615 (1♀, CUIC); em. 3.x.2020, #CSE6626 (1♀, CUIC); em. 3–4.x.2020, #CSE6625 (1♀ [partially emerged], RMNH.INS.31538, slide with adult and 2 pupal exuviae, RMNH.INS.31538.P); WSU-Tri-Cities, 46.329694, –119.269719, 20.ix.2020, em. 24–29.ix.2020, D.G. James, ex *Vitis vinifera* (upperside), #CSE6611 (2♂ 3♀?, CUIC); em. 24.ix–4.x.2020, #CSE6612 (1♀ [partially emerged], RMNH.INS.31537, slide with adult and pupal exuviae, RMNH.INS.31537.P); em. 30.ix.2020, #CSE6616 (2♀, CUIC); em. 1.x.2020, #CSE6619 (2♀, CUIC); #CSE6620 (1♂, CUIC); em. 4.x.2020, #CSE6631 (1♂?, CUIC).

Non-type material: **USA. ARIZONA:** Cochise Co., 31.88241, –109.20524, 7.ix.2019, J. Bailey, completed mine on *Parthenocissus inserta* (iNat 66943702); **CALIFORNIA:** San Diego Co., Mission Trails Regional Park, 32.84178, –117.03783, 12.x.2020, M. Basden, *Vitis girdiana* (underside and upperside), #MB-1 (5 pressed mines, RMNH.INS.48512); Yolo Co., 38.67767, –121.64475, 10.viii.2023, T. Iwane, completed mine on *Vitis californica* (iNat 178292189); **COLORADO:** Boulder Co., Boulder Mountain Park, 39.9974, –105.2925, 15.vii.2019, J. Shorma, mine on *Vitis riparia* (iNat 32755898); Denver Co., Denver, 39.665939, –104.896303, 29.vii.2020, preserved 14–18.viii.2020, S. Prado-Irwin, *Parthenocissus*, #CSE6475 (1 pupal skin, CUIC; 2 pupae, RMNH.INS.31519, RMNH.INS.31520; 8 pressed mines, RMNH.INS.48506); Jefferson Co., Chatfield State Park, 39.49492, –105.08847, 23.vii.2012, J.F. Landry, *Vitis riparia* (upperside), EvN no 2012087-2H (2 pressed mines, RMNH.INS.37599); **IDAHO:** Canyon Co., 43.5204, –116.5833, 18.ix.2021, em. by 23.ix.2021, pcastroville, ex *Vitis* (1 adult, iNat 98574985); **NEVADA:** Douglas Co., Minden, 1682 Sunshine Rd., 39.015, –119.706, 7–11.viii.2020, extracted 17.viii.2020, A. Jeton & D.J. Groffman, ex *Parthenocissus* (upperside), #CSE6499 (2 larvae, RMNH.INS.31521–22; 6 pressed mines, RMNH.INS.48507); em. 28.viii–9.ix.2020, #CSE6528 (4 pupae, RMNH.INS.31531–34); same but underside, em. 24.viii.2020, #CSE6518 (1 larva [nothing found in vial], RMNH.INS.31530); em. 30.viii.2020, #CSE6543 (1 adult [partially emerged], RMNH.INS.31535); same but from mixed collection of underside and upperside mines, em. 23–25.viii.2020, #CSE6516 (5 larvae, RMNH.INS.31525–29); **OREGON:** Clackamas Co., Milwaukie, 45.43395, –122.64468, 25.ix.2025, J. Ward, completed mine on *Vitis labrusca* (iNat 316670964); Multnomah Co., Portland, 45.48242, –122.62492, J. Ward, completed mines on *Vitis labrusca* (iNat 243011345); **WASHINGTON:** Benton Co., Richland, 46.32966, –119.26990, 27.ix.2020, monarchdavid, “damaging grapes” (1 adult, iNat 186123675).

Leaf mines have been documented in 174 iNaturalist observations, from the above states as well as New Mexico, Texas, and Utah, plus Chihuahua, Mexico: <https://www.inaturalist.org/observations?verifiable=any&field:CSE%20leafminer%20code=phyllocnistis-vitaceae-west>.

Adult. Forewing length 1.8–2.7 mm; wingspan 4.5–5.8 mm. Antenna silvery to black. Dorsal spot absent in 24 of 49 specimens; small/indistinct in most others; well-developed in five specimens. Costa with basal $\frac{1}{8}$ (rarely $\frac{1}{4}$) narrowly edged with black; in four specimens this is paler/narrower, and in two of these it is present only on the left wing. Dorsal strigula usually separate from second costal strigula, but in five specimens joining it to form an angulated, curved, or nearly straight fascia; in two specimens instead forming a more or less angulated fascia with the first costal strigula. In 20 specimens, there is no trace of a dark patch between the dorsal strigula and preapical line; the remaining 29 vary from having a small, faint vestige of this patch to (rarely) a well-developed gray patch. Preapical line complete or nearly so. Rarely there is a broad, gray to blackish median streak beginning near the middle of the forewing and extending to the apex of the first costal strigula (Fig. 8; Castroville 2021; James 2022; Fig. 4; James 2023). In the female, abdominal segment 7 is more strongly sclerotized than the preceding segments, with a thin, transverse line of particularly strong sclerotization near the anterior margin (Fig. 34).

Hosts. *Parthenocissus inserta* (A. Kern.) Fritsch, *Vitis arizonica* Engelm., *V. californica* Benth., *V. girdiana* Munson, *V. labrusca* L., *V. riparia* Michx., *V. vinifera* L.

Leaf mine. The mine (Fig. 85–90) may be on either leaf surface. Just as in *Phyllocnistis vitifoliella*, it initially resembles a snail trail, then alternates several times between this superficial appearance and a more distinct track before permanently settling into the latter. Upper-surface mines can be up to 1.7 mm wide; on the lower surface we measured 1.25 mm. The later portion of the mine is bright white with the frass deposited in a nearly continuous, very narrow, black central line, varying from approximately 0.05 mm to 0.2 mm wide. Rarely, the mine is broadly suffused with brown, but in such cases a narrow central line is evident intermittently (Fig. 90). As with *P. vitifoliella* the pupal chamber (Fig. 64) is usually formed away from the leaf margin.

Phenology. James (2022) reported mines in Washington beginning in May. The earliest records of larvae in iNaturalist observations are 22 April in Colorado (Wrens 2026), 3 May in California (Raspet 2026; aborted mine) and 17 May in Oregon (Hensley 2025). James (2022) reported larvae collected in Washington feeding for 7–10 days before forming pupal chambers, and stated that this species can develop from egg to adult in as little as 14 days. Adults have been reared in late June (Oregon), early August (Arizona), late August to early September (Nevada), and late September to early October (Washington). Adults surely overwinter as in the other species of the *P. vitegenella* complex.

Distribution. USA: AZ, CA, CO, ID, NM, NV, OR, TX, UT, WA. Mexico: Chihuahua.

DNA barcoding. A larva (CSE6499) and pupa (CSE6528) obtained from upper-surface mines on *Parthenocissus* in Nevada are assigned to BIN BOLD:AED7708, as are partially emerged adults obtained from upper- (CSE6612) and lower-surface (CSE6625) mines on *Vitis vinifera* in Washington. The latter two specimens are included as paratypes of *Phyllocnistis occidentalis*. This BIN also includes a paratype reared by D.R. Davis from *V. arizonica* in Arizona (Fig. 14), plus 12 specimens caught in Malaise traps at Dye Creek Preserve, Tehama Co., California (40.101, –122.054), in August and October, 2022 and 2023. The Arizona specimen was misidentified by D.R. Davis as *P. vitegenella*, and the California specimens were misidentified accordingly based on the barcode match.

The nearest neighbor of BIN BOLD:AED7708 (1.76% difference) is BOLD:AFR8637. This BIN comprises 10 sequences of adults from Malaise traps in Riverside Co., California (all collected at the Whitewater Preserve in 2023; some between 11 and 18 April, others between 12 and 19 July, and one between 8 and 15 August). In the absence of evidence to the contrary, we consider these specimens to represent *P. occidentalis*, but we hope that larvae or pupae from leaf mines found at this site can be sequenced to confirm that this population consists of Vitaceae feeders with the mine characteristics described above. BIN BOLD:AFR8637 is also the nearest neighbor of BIN BOLD:AAI3014, which includes all sequenced specimens of *P. vitifoliella*, but differs from it by 3.55%.

A 307 bp sequence was obtained from a pupa we extracted from a mine on *Parthenocissus* collected in Colorado (CSE6475, RMNH.INS.31520). This has not been assigned to a BIN, but it perfectly matches sequences in BOLD:AAZ8318, the BIN that includes the only sequences of correctly identified *P. vitegenella*. The nearest sequence in BIN BOLD:AED7708 differs by 5.59%, yet the leaf mine of this specimen clearly identifies it as *P. occidentalis*. As noted in the *P. vitegenella* species account, this barcode may be a result of contamination.

Parasitoids. We reared eulophid parasitoids from three different collections of *Phyllocnistis occidentalis* mines on *Vitis arizonica* in Arizona. These included an undetermined cirrospiline (CSE8464; Eiseman 2025e), two *Closterocerus* sp. adults that emerged from pupal chambers (CSE8413; Eiseman 2025f), and another *Closterocerus* sp. (CSE8375; Eiseman 2025g). All are deposited in the CNC. A *Closterocerus* sp. was also reared from mines of *P. occidentalis* on *V. vinifera* in Washington (James 2022).

Gates et al. (2002) listed a number of parasitoids reared from upper-surface serpentine mines of “*Phyllocnistis* sp.” on *Vitis californica* in California. We are not aware of any insect other than *Phyllocnistis* spp. that produces serpentine mines on *Vitis* in California, and since *P. occidentalis* is much more common there than *P. vitegenella*, it is likely the species from which they reared the parasitoids. These are Braconidae: *Hormius* sp.; Eulophidae: *Chrysocharis walleyi* Yoshimoto, *Cirrospilus* sp., *C. cinctithorax* (Girault), *Neochrysocharis arizonensis* (Crawford), *Pnigalio levis* Yoshimoto, and *Zagrammosoma* sp.

Notes. We believe the first reference to this species in the literature is Chambers’ (1875b) report of having found *P. ampelopsiella* in Colorado; he gave no information beyond “Manitou up to 8000 feet or more.” Chambers (1877) reported *P. ampelopsiella* as “Common in Kentucky, altitude 400 feet, and in Colorado, altitude 6,000 feet.” Since he made no mention of having reared adults, we presume that he simply saw lower-surface *Phyllocnistis* mines on *Parthenocissus* in Colorado and assumed that they represented the same species he had described from Kentucky. We have seen no evidence that *P. ampelopsiella* occurs west of the Great Plains.

Phyllocnistis occidentalis is also surely the species that Powell and Opler (2009) referred to when they wrote, “*Phyllocnistis vitifolia* Chambers (Plate 3.52, Plate 3.53 [for larger images see Powell (2010a, 2010b)]) mines leaves of grape (*Vitis*, Vitaceae). It was originally described from Kentucky but has been found in desert wild grape (*V. girdiana*) in Riverside County, California, and recently in a greenhouse in Davis.” We have seen no evidence that *P. vitifoliella* occurs west of the Great Plains, and although *P. vitegenella* is present but rare in the west, *P. occidentalis*

is much more common, and we take the determination of *P. vitifoliella* to mean that the observed mines had a distinct frass line, as in *P. vitifoliella* and *P. occidentalis*, rather than resembling snail trails as in *P. vitegenella*. No further details were given for the Riverside County record, which is of interest given that this locality is the source of the only specimens in BIN BOLD:AFR8637, but the data for both of the figured specimens are: Yolo Co., Davis, 18.iii.1989, em. 25.iii.1989, De Benedictis, ex *Vitis*, JP 89C16 (EMEC). John De Benedictis (in litt. to CSE, 7 November 2025) recalls that these specimens were reared from leaf mines (which were not preserved) on heavily infested grapevines in a University of California greenhouse. He suspects that “[D.L.] Wagner likely identified the moths for me and probably sight unseen on the basis of the hostplant.” At the time, De Benedictis was working on grape phylloxera (Hemiptera: Phylloxeridae: *Daktulosphaira vitifoliae* (Fitch)) and visited vineyards throughout California, but mostly in the wine country of Napa and Sonoma counties; he also surveyed wild grapes to some extent. He never noticed mines anywhere except in the greenhouse, but was not specifically looking for them. The UC Davis employee who alerted him to the mines subsequently destroyed the vines because he thought the moth might become a significant pest if it escaped the greenhouse (De Benedictis in litt. to CSE, 7 November 2025).

We acquired the Nevada paratypes as a result of an inquiry by L. Hearon on 1 June 2020 (in litt. to CSE, on behalf of A. Jeton) regarding “a Virginia creeper laden pergola. Every year for the last couple of years, some sort of miner has infested the entire canopy, leading to foliar dieback starting in about mid-June and by August more or less the entire canopy has been destroyed.”

In September 2020, mines of *P. occidentalis* were discovered on cultivated grapevines in the Tri-Cities area of eastern Washington (James 2020). James (2022) found that a commercial pheromone developed for population monitoring of *P. citrella* was effective for *P. occidentalis*, trapping almost 600 adults in three traps over seven days. Following this discovery, in July–September 2021, pheromone-baited white sticky traps were deployed in single vineyards in eleven American Viticultural Areas (AVAs) in eastern Washington. Adults were caught at six sites, mostly in small numbers (1–20), except in Columbia Valley where the original detection occurred. The two vineyards where leaf mines had been found most abundantly in 2020 were monitored throughout 2021. Although the traps at one of these vineyards “routinely caught hundreds of leafminer adults every week during the season, with a maximum of almost 1500 in late June. . . the number of mined leaves remained fairly low, never exceeding 12 per sampling (10 vines)” (James 2022). James (2022) concluded that mining by *P. occidentalis* appears likely to remain mainly a cosmetic issue, not causing economic damage to mature grapevines. The species still is not causing a problem as of this writing, and D. James (in litt. to CSE, 24 September 2025) now rarely receives reports about it.

Our impression from the above records is that *P. occidentalis* is a native North American species that mostly occurs in low densities but occasionally has population outbreaks in anthropogenic habitats (residential yards, greenhouses, vineyards), presumably due to a reduced presence of parasitoids in these environments.

Etymology. The species epithet (Latin adjective—*occidentalis*, western) refers to the fact that this moth only occurs in western North America.

***Phyllocnistis toparcha* Meyrick, 1918**

(Fig. 16–20, 29, 30, 95–99, 111, 112)

Phyllocnistis toparcha Fletcher 1917: 235. Unavailable [Nomen nudum].

Phyllocnistis toparcha Meyrick 1918: 182. Holotype ♂, INDIA: [Tamil Nadu], Coimbatore, ex larvae on *Vitis vinifera*, T.B.F.[letcher] bred 2.16, BMNH(E)1480633 [Abdomen missing] (NHMUK) [photo examined].

Phyllocnistis toparcha. Fletcher 1920: 164; Ayyar 1920: 323; Fletcher 1921: 173; Kuroko 1982a: 203; Ermolaev 1987: 37, 40; Zhang 1994: 390; Posenato et al. 1997: 75; Robinson et al. 2001: 326; De Prins and De Prins 2005: 261; De Prins and Kawahara 2009: 113; Kobayashi and Hirowatari 2013: 155; Kirichenko et al. 2018b: 95, 111.

Phyllocnistis pachyscia Meyrick 1931: 167. Holotype, JAPAN, [Honshu] Iwawakisan, 24.x.[19]20, S. Issiki, BMNH(E)1480841 (NHMUK) [photo examined]. Synonymized by Kuroko 1982b.

Phyllocnistis pachyscia. Kuroko 1982a: 203 [as synonym]; Kuroko 1982b: 193 [synonymy]; De Prins and De Prins 2005: 261 [as synonym]; Kobayashi and Hirowatari 2013: 155 [as synonym].

Phyllocnistis sp. 2. Kirichenko et al. 2018b: 85, 111, 112, 113.

Diagnosis. The forewing pattern of this species differs from those of the *Phyllocnistis vitegenella* complex in having a fifth costal strigula that touches the apical dot, and in having a yellow to orange longitudinal fascia in the basal half of the wing, more or less distinctly edged with black above and below, although this is sometimes reduced to a short stripe or spot in the middle of the wing. *Phyllocnistis vitella*, from far eastern Russia, is doubtfully distinct; see its species account below for further discussion. In the Javan *P. temperator*, the fifth costal strigula is very short and does not reach the apical dot. The leaf mine of *P. toparcha* resembles that of *P. vitegenella*, except that it can be on either leaf surface and the pupal chamber is often away from the leaf margin.

Material examined. **INDIA. MAHARASHTRA:** Mumbai, Sanjay Gandhi National Park, 9.ix.2025, one_in_a_million_learners, occupied mine on *Ampelocissus latifolia* (iNat 342922384); **TAMIL NADU:** Coimbatore, “20. II.16. From grape vine leaves. Insectary garden. Y.R. Coll. / *Phyllocnistis toparcha*, Meyr., Duplic. of this, Meyrick det. 1916, PARATYPE” (1 adult, BMNH(E) 1411973, NHMUK) [photograph examined; this specimen not mentioned by Meyrick (1918)]. **JAPAN.** Hokkaido: Sapporo-shi, Kita-ku, Hokkaido Univ., 4.viii.2022, em. 14.viii.2022, M. Sawada, ex *Parthenocissus tricuspidata*, MaS-0105 (1♀, SEHU; leaf mine [photographs sent to CSE]); Teine-ku, Mt. Teine, 43.083744, 141.203072, 26.vii.2022, em. 2.viii.2022, M. Sawada, ex *Vitis coignetiae*, MaS-0102 (1♀, SEHU [photograph sent to CSE]); Honshu: Kinki, Kawati-Nagano, 14.ix.1954, S. Issiki (1 adult, USNMMENT01276962, <http://n2t.net/ark:/65665/m3c9f12820-cc17-4cd8-9692-cc1e5db3b66c>); same but em. 4.x.1954 [no other date indicated] (1 adult, USNMMENT01276963, <http://n2t.net/ark:/65665/3a265704a-5c50-46da-9590-8e1796f6a2ff>); same but 5.x.1954 [not reported as an emergence date] (1 adult, USNMMENT01276964, <http://n2t.net/ark:/65665/3fb8361d2-391b-4ddf-b5c5-e746ce9eed2b>); Honshu: Kyoto pref., Ashu, Exp. Forest Kyushu Univ., 35.30987, 135.71507, 2.x.2014, em. 12.x.2014, E.J. van Nieukerken, ex *Parthenocissus tricuspidata*, EvN2014140 (1 adult, RMNH.INS.30389 [DNA extracted destructively]; 2♀, RMNH.INS.35817, RMNH.INS.35818, genitalia slides EvN5721, EvN5720; pressed mines, RMNH.INS.1739368, RMNH.INS.1739369); Kyushu: Hikosan, 7.vi.1957, T. Kumata, ex *Parthenocissus tricuspidata* (♂ genitalia, slide # PII-10, SEHU).

Adult. *Phyllocnistis toparcha* was described from a single male from India with a wingspan of 4 mm (Meyrick 1918). The “shining white” forewing has a yellow longitudinal fascia, finely edged with fuscous on either side. The postmedian transverse line, composed of the fused dorsal and second costal strigulae, is slightly outwardly angulated, with broad yellow proximal edging along the dorsal strigula. The yellow apical area is proximally tinged fuscous. There is a fifth costal strigula, touching the apical dot, and there is a “dorsal blotch of fuscous suffusion” near the base of the wing. The hindwings are white.

Phyllocnistis pachyscia was described from a single female from Japan with a wingspan of 5 mm, which Meyrick (1931) noted was “perhaps allied to *toparcha*.” The markings are essentially as described for *P. toparcha*, but with a medial “bar of dark grey suffusion” along the longitudinal fascia, no fuscous tinge in the yellow apical area, and with the postmedian transverse line being curved and the dorsal spot being slightly tinged yellowish. The hindwings are gray.

Kuroko (1982a) considered *P. pachyscia* to be the autumn form of *P. toparcha*, implying that typical *P. toparcha* is the summer form. He wrote that the “ground color of the forewings of the summer generation is silvery white, but the autumn generation has bold dark strigulae and scattered dark scales on the dorsal margin near the base.” This seems to imply, contrary to Meyrick’s (1918) description, that typical *P. toparcha* lacks a dorsal spot. Kobayashi and Hirowatari (2013), who stated the wingspan is 4.0–5.5 mm, repeated Kuroko’s (1982a) statement that *P. pachyscia* is the autumn form of *P. toparcha*, differing from the summer form in being darker overall with the dorsal margin of the forewing being black near the base. They illustrated the two forms; their Fig. 4-08-35 generally matches the original description of *P. toparcha* except for the lack of a dorsal spot, and their Fig. 4-08-36 generally matches the original description of *P. pachyscia* except for an extensive dark patch in the apical area. In the darker (latter) specimen the preapical line is complete, but in the paler specimen the two strigulae are well separated. Kirichenko et al. (2018b) reported collecting adults of *P. toparcha* with a dark dorsal spot and a darker patch in the lower half of the apical portion (i.e., matching the original description) in summer in Japan. Conversely, of the three USNM specimens, although the one collected on 5 October has a dorsal spot, those collected or reared on 14 September and 4 October lack this spot, and all three are closer to Fig. 4-08-35 in Kobayashi and Hirowatari (2013) in the boldness of the dark edging on the longitudinal fascia. On the September specimen, the dorsal and second costal strigulae are separate. The two specimens reared in the first half of August by M. Sawada

are essentially identical with the pale specimen illustrated by Kobayashi and Hirowatari (2013), except in both of Sawada's specimens the whole basal half of the forewing is immaculate white apart from the first costal strigula and the narrow black edging at the base of the costa: the longitudinal fascia is reduced to a short stripe adjacent to the postmedian fascia. In the *Vitis*-reared specimen, the postmedian fascia is broken into separate dorsal and second costal strigulae, the entire wing pattern thus matching Ermolaev's (1987) illustration of *P. vitella*.

To our knowledge the genitalia of *P. toparcha* have not been illustrated or described previously. The available slide of a male reared from *Parthenocissus* in Japan shows genitalia that appear to match our slides of species of the *Phyllocnistis vitegenella* complex in all details (Fig. 29, 30). Two available slides of females reared from *Parthenocissus* in Japan show genitalia slightly different from the Nearctic species: the signa appear smaller and the ornamentation of the bursa wall comprises structures that seem narrower, but as the preparations were stained differently, this may be partly an effect of the staining (Fig. 111, 112).

Hosts. *Ampelocissus latifolia* (Roxb.) Planch. (photographed mine), *Ampelopsis glandulosa* var. *heterophylla* (Thunb.) Momiy. (Kuroko 1982a, as “ノブドウ”), *Causonis japonica* (Thunb.) Raf. (Kobayashi and Hirowatari 2013, as “ヤブガラシ”), *Parthenocissus tricuspidata* (Siebold and Zucc.) Planch. (Kuroko 1982a, as “ツタ”; Kobayashi and Hirowatari 2013, as “ナツヅタ”), *Vitis coignetiae* Pulliat ex Planch. (new rearing record), *V. ficifolia* Bunge (Kobayashi and Hirowatari 2013, as “エビヅル”), *V. flexuosa* Thunb. (Kuroko 1982a, as “ギョウジャノミズ”; Kobayashi and Hirowatari 2013, as “サンカクヅル”), *V. vinifera* L. (Meyrick 1918). The Latin names of the hosts reported by Kuroko (1982a) and Kobayashi and Hirowatari (2013) were first listed by Kirichenko et al. (2018b), but the only references they cited in connection with their host list were Meyrick (1931), who gave no host information, and Kuroko (1982a). The record of *Citrus* sp. (Rutaceae) in Robinson et al. (2001) is based on a misreading of Fletcher (1921); see below.

Leaf mine. The mine is a superficial “snail trail” with no visible frass. Of the mines we examined on nine pressed leaves of *Parthenocissus tricuspidata* from Japan (some leaves with more than one mine), and the one photographed on the same host by M. Sawada, all are on the upper leaf surface. The mine at first usually follows veins, later becoming very contorted and sometimes completely covering part of the leaf. The final mine often has a rather wavy outline and can reach a width of 2–2.5 mm. The pupal chambers are close to the leaf margin, but not formed by a fold of the leaf margin. The larva photographed mining a leaf of *Ampelocissus latifolia* in India (oneinamillionlearners 2026), which likely belongs to this species, has a yellow tint, though not as pronounced as in full-grown larvae of *P. vitegenella*.

Meyrick (1918) gave no description of the mine. Fletcher (1917, 1921) stated that *P. toparcha* mines grape leaves in India “much in the same way as *P. citrella* mines in *Citrus*,” and this is the source of the erroneous record of *Citrus* as a host for *P. toparcha* in Robinson et al. (2001). According to Ayyar (1920), mines of *P. toparcha* on grape are “seen in the form of glistening wavy lines on the leaf.” Kobayashi and Hirowatari (2013) stated that mines of *P. toparcha* are on the upper surface, or rarely the lower surface, of grape leaves, and M. Sawada (in litt. to CSE) likewise reports that mines occur on both leaf surfaces in Japan. Based on his observations (M. Sawada, in litt.), it is fairly common for pupal chambers to be located away from the leaf margin in mines of *P. toparcha* on *Parthenocissus* and *Vitis* in Japan.

Phenology. The holotype of *P. toparcha* was reared in February in southern India (Meyrick 1918), and a larva was recently found in Mumbai in early September (oneinamillionlearners 2026). In Japan, larvae appear several times a year from early summer to autumn (Kobayashi and Hirowatari 2013), with adults emerging in every month from July to November (Kuroko 1982a; this study).

Distribution. India (Meyrick 1918); Japan (Meyrick 1931, as *Phyllocnistis pachyscia*; Kuroko 1982a). Leaf mines possibly representing this species have been found on grape leaves in South Korea (Scott 2026) and the Philippines (Dizon 2026).

DNA barcoding. The sequenced specimen reared from *Parthenocissus* is the sole member of BIN BOLD:ACY3695. However, just before submitting the revision of this manuscript, we obtained barcodes of the two reared females, which are almost identical to the earlier sequence (respectively 99.85% and 99.39% similarity). The nearest neighbor, differing by 7.69%, is BIN BOLD:AFE1644, comprising unidentified specimens from Bangladesh, Thailand, and Vietnam; they almost certainly belong to *Phyllocnistis*. Kirichenko et al. (2018b) gave the barcode of the

Parthenocissus specimen (as *Phyllocnistis* sp. 2) as the closest neighbor to the *Cornus*-feeding *Phyllocnistis* group, with a distance of 8.9% to *P. verae* Kirichenko, Triberti and Lopez-Vaamonde. This was before specimens belonging to BOLD:AFE1644 were sequenced.

Parasitoids. None recorded.

Notes. The name *Phyllocnistis toparcha* was first used by Fletcher in the proceedings of a meeting (Fletcher 1917). Although one could argue that this record is “almost” an available description with its comparison to *P. citrella*, we consider this to be a nomen nudum (no description) and refrain from changing the authorship, as for more than a century the current authorship has been accepted, and it was never Fletcher’s intention to name the species.

Although our sequenced specimen was reported as an undescribed species, “*Phyllocnistis* sp. 2,” in Kirichenko et al. (2018b) (a tentative identification by EvN and C. Doorenweerd), we have no reason to doubt that it is conspecific with other moths that have been identified as *P. toparcha* in Japan. What is unclear is to what extent Kuroko (1982a, 1982b) compared Japanese and Indian material before concluding that *P. pachyscia* is synonymous with *P. toparcha*, but it is possible that he had examined the holotype and “paratype” in London. We see no reason to doubt the synonymy at this point, but *Phyllocnistis* material from vitaceous hosts collected throughout Asia—including the type localities of *P. toparcha* (India: Tamil Nadu), *P. pachyscia* (Japan: Osaka), *P. temperator* (Indonesia: Java), and *P. vitella* (Russia: Primorsky Krai)—should be compared with respect to DNA barcodes and leaf mine characteristics to assess how many species are truly present. It is quite possible that BOLD:AFE1644 represents the “real” *P. toparcha*, in which case the Japanese species is most likely different. Existing DNA barcodes already indicate the presence of two distinct species in Japan; see *Phyllocnistis* sp. “*Ampelopsis*Japan” below.

Ramakrishna Ayyar (in Fletcher (1920)) reported that *P. toparcha* “was found at Coimbatore in grape-vine leaves. Although not in large numbers, yet it may be put down as a minor pest.” In Japan, Kuroko (1982a) stated that the larvae sometimes cause damage to cultivated grapes. Kobayashi and Hirowatari (2013) also say it is known as a pest of grapevines. Since we have seen no further documentation of this species as a pest, it may be that the “damage” is mainly cosmetic.

***Phyllocnistis temperator* Meyrick, 1936**

(Fig. 21)

Phyllocnistis temperator Meyrick 1936: 31–32. 2 syntypes, INDONESIA: Java, Telawa, vii.[19]35, Dr. L.G. Kalshoven (1♂, BMNH(E) 1480281, NHMUK) [photos of 1 syntype examined].

Phyllocnistis temperator. Robinson et al. 2001: 326; De Prins and De Prins 2005: 260.

Diagnosis. This is the only *Phyllocnistis* known to use *Leea* as a host. The adult differs from those of the North American Vitaceae feeders in having a suggestion of a yellow-orange longitudinal fascia in the basal half of the wing; the dark costal edging of this fascia is distinct, but the medial edging is faint and the yellow-orange coloring is only present at the distal end. The fifth costal strigula, which is present in the other Asian Vitaceae feeders and absent in the North American species, is very short and does not reach the apical dot (this marking was not mentioned by Meyrick (1936) and whether it occurs in both syntypes is unknown).

Material examined. Photos of syntype (see above).

Adult. The wingspan is 4 mm according to Meyrick (1936). The oblique first costal strigula is contiguous with the narrow black edging at the base of the costa, and near the middle of the wing it forms the edging of a small, indistinct yellow-orange patch. There is a faint suggestion of a parallel median line that borders this patch on the other side. The second costal strigula joins the dorsal strigula to form a transverse fascia that is straight on the left wing and inwardly angulated on the right wing. The fourth costal strigula on the left wing forms a complete preapical line with the arcing dorsal strigula, but on the right wing the two strigulae are well separated. There is a suggestion of a short fifth costal strigula associated with, but not reaching, the apical dot. There is no dorsal spot at the base of the wing, and there is an indistinct gray patch in the apical area.

Host. *Leea* D. Royen (Meyrick 1936).

Leaf mine. Not described.

Phenology. The only known specimens were reared in July (Meyrick 1936).

Distribution. Indonesia: Java (Meyrick 1936).

Notes. This species was described from two specimens reared by L.G. Kalshoven, but just one syntype is at NHMUK (D. Lees in litt. to CSE, 4 November 2025). Unfortunately the other syntype also could not be found in RMNH, where much of the Kalshoven collection is deposited, including specimens studied by Meyrick.

Phyllocnistis vitella Ermolaev, 1987

Phyllocnistis vitella Ermolaev 1987: 37–40. Holotype ♂, RUSSIA: South Primorye, Gornotaezhnoe, ex l. *Vitis amurensis* Rupr. 5.viii.1982 (Ermolaev) [not examined].

Phyllocnistis vitella. Baryshnikova 2002: 212–213; De Prins and De Prins 2005: 262; Bodor 2014: 17; Kirichenko et al. 2018b: 111; Sinev 2019: 43.

Diagnosis. The adult is smaller than those of the North American Vitaceae feeders (wingspan 3.8–4.0 mm vs. 4.3–5.8 mm), and its forewing pattern differs in having a fifth costal strigula (touching the apical dot) as well as a median yellow patch on the proximal side of the first costal strigula (as illustrated by Ermolaev (1987), this is not immediately adjacent to the strigula, whereas any yellow-orange proximal to the first costal strigula in the *P. vitegenella* complex is in the form of narrow edging along its length). Ermolaev (1987) distinguished this species from *P. toparcha* based on the absence of a basal longitudinal strigula, the separation of the dorsal strigula from the opposing costal strigulae, and the structure of the basal part of the valva; however, we have seen Japanese specimens of putative *P. toparcha* with the same wing characters, and we are skeptical of the genitalic difference.

Material examined. None available.

Adult. Illustrated by Ermolaev (1987: Fig. 3, 4). According to Ermolaev (1987), the wingspan is 3.8–4.0 mm. There is no dorsal spot, and the only vestige of a basal longitudinal fascia is a yellow patch near the end of the first costal strigula. The first and second costal strigulae are separate from the dorsal strigula. There is not a complete preapical line, and there is a fifth costal strigula that touches the apical dot. Ermolaev (1987) mentioned yellow scales in the apical third of the forewing, but there is apparently no dark patch in this area. In the male genitalia, he described a small outgrowth near the base of the upper edge of the valva. He stated, without elaborating, that *P. vitella* differs from *P. toparcha* in the structure of the basal part of the valva. Based on our observations, all Vitaceae-feeding *Phyllocnistis* species have three lobes at the base of the valva, and the appearance of these can vary substantially depending on how they are flattened in the slide preparation. We see no clear difference in Ermolaev's drawing from Kumata's slide of *P. toparcha* or from our slides of species of the *P. vitegenella* complex.

Host. *Vitis amurensis* Rupr. (Ermolaev 1987).

Leaf mine. In Ermolaev's (1987) key to *Phyllocnistis* leaf mines occurring in far eastern Russia that precedes the description of *P. vitella*, he described the mine of *P. vitella* as being long, silvery-white, without frass, on the upper leaf surface.

Phenology. The two known specimens were reared in early August (Ermolaev 1987).

Distribution. Russia: Primorsky Krai (Ermolaev 1987).

DNA barcoding. No data available.

Parasitoids. None known.

Notes. Ermolaev (1987) stated that the holotype is deposited in ZIN and the paratype is in his personal collection, but according to Baryshnikova (2002), neither specimen is at ZIN. Kirichenko et al. (2018b) concluded that Ermolaev's collection has disappeared. Ermolaev's (1987) concept of *P. toparcha* was based on Japanese material provided by Kuroko.

Phyllocnistis sp. “AmpelopsisJapan”

(Fig. 100–103)

Diagnosis. Only mines known (see below); distinguished from *P. toparcha* based only on the DNA barcode.

Material examined. **JAPAN.** Honshu: Wakayama pref., Kozagawa, Experimental forest, 33.66745, 135.65923, 28.ix.2014, E.J. van Nieukerken & C. Doorenweerd, ex *Ampelopsis brevipedunculata*, EvN no 2014110-M (2 leaf mines, RMNH.INS.1739370, 1 parasitized larva in ethanol, RMNH.INS.30331; barcoded larva, RMNH.INS.30330; slide of larval skin, RMNH.INS.30330.P). **TAIWAN.** Nantou County, 13 km E Puli, valley nr Nan Shan, 24.01805, 121.08852, 13.x.2012, C. Doorenweerd & E.J. van Nieukerken, ex *Ampelopsis brevipedunculata*, EvN no 2012258-2K (2 leaf mines, rearing failed, RMNH.INS.49380).

Adult. Unknown.

Host. *Ampelopsis glandulosa* var. *brevipedunculata* (Maxim.) Momiy.

Leaf mine. Four unfinished leaf mines were examined. Each forms a “snail trail” on the upper leaf surface, contorted and partly following veins, with no visible frass. The mines are very similar to those of *P. toparcha*, up to 1.8 mm wide, but all mines are unfinished. Those from Taiwan are even narrower, up to 0.9 mm wide. The pupation site is unknown.

Phenology. Mines were found in September and October.

DNA barcoding. One parasitized larva from Japan was barcoded, the only representative of BIN BOLD:ACY3638. Its nearest neighbor, at a distance of 8.0%, is BOLD:AGD4881, which comprises a single Malaise trapped specimen from Thailand.

Distribution. Japan: Honshu; Taiwan.

Notes. The identification of the Taiwanese mines is only based on the similar host plant and superficial similarity of the leaf mines. The very different DNA barcode from the specimen identified as *P. toparcha* (reared from *Parthenocissus*) shows that there are at least two species of Vitaceae-feeding *Phyllocnistis* in Japan. Therefore the identity of “*P. toparcha*” reared from *Ampelopsis* and maybe other hosts needs to be reexamined.

Phyllocnistis sp. “*Rhoicissus* SouthAfrica”

(Fig. 104–109)

Phyllocnistis sp. Van Nieukerken and Geertsema 2015: 88.

Diagnosis. Only mines known; see below.

Material examined. **SOUTH AFRICA.** Mpumalanga: Blyde River Canyon, 16.ix.2021, V. Zverev, *Rhoicissus tomentosa* (1 leaf mine, RMNH.INS.49014); Western Cape, Swellendam E, Zuurbraak, –34.00212, 20.6292, 17.i.2013, E.J. van Nieukerken & H. Geertsema, *Rhoicissus tomentosa*, EvN no 2013007-H (many vacated and unfinished leaf mines and pupal folds, RMNH.INS.40650, RMNH.INS.40651).

Adult. Unknown.

Host. *Rhoicissus tomentosa* (Lam.) Wild and R.B. Drumm.

Leaf mine. Mines may be on either the upper or the lower leaf surface, and often occur on both surfaces of the same leaf. They are silvery, much contorted, and do not typically follow veins. Frass is sometimes weakly visible as arcs. The mines are up to about 1.1–1.3 mm wide and end in a partially folded pupal chamber at the leaf margin, or in one case along a vein in the middle of the leaf. Mines on the lower surface are much less visible than upper-surface mines due to the heavy indumentum of the leaf. The leaf mine from Mpumalanga is much straighter, partly following veins.

Phenology. Vacated leaf mines were found in January (summer), suggesting that the larvae were present in December, with adults possibly flying in January. The mine from Mpumalanga was found in November.

Distribution. South Africa (Western Cape and Mpumalanga).

DNA barcoding. No data available.

Parasitoids. None known.

Notes. These mines were briefly mentioned by van Nieukerken and Geertsema (2015), without further details. It is quite possible that more than one species is involved, with the mine collected in Mpumalanga in particular differing by its straighter courses that often follow veins.

***Phyllocnistis* sp. “Cissus Gabon”**

(Fig. 110)

Diagnosis. Only mines known; see below.

Material examined. GABON. Moyen-Ogooué, road Bifoun to Ndjolé, –0.21782, 10.54463, 5.xi.2015, J.J. Wieringa, Wieringa 8211, *Cissus leonardii* (1 leaf mine, RMNH.INS.39374).

Adult. Unknown.

Host. *Cissus leonardii* Dewit.

Phenology. The single aborted mine was found in early November.

Leaf mine. The mine is a silvery “snail trail” on the upper leaf surface, with a distinct, narrow frass line in the middle. Its maximum width is approximately 1.8 mm. The mine initially follows veins, and by turning back and following its earlier course it almost completely fills the space between two lateral veins, before finally crossing a vein. Since the mine is unfinished, the position of the pupal chamber is unknown.

Distribution. Gabon.

***Phyllocnistis* sp. “Apocissus Australia”**

Diagnosis. This is the only known Vitaceae-feeding *Phyllocnistis* in Australia.

Material examined. AUSTRALIA. Leaf mines have been documented in 36 iNaturalist observations from New South Wales and Queensland: <https://www.inaturalist.org/observations?verifiable=any&field:CSE%20leafminer%20code=phyllocnistis-apocissus-antarctica>.

Adult. See Luo (2024).

Host. *Apocissus antarctica* (Vent.) Jackes and Trias-Blasi.

Phenology. This species is multivoltine. Reared adults have emerged in late December, mid-April, and early to mid-June; one adult was collected on 10 February (Luo 2024).

Leaf mine. The mine resembles that of *Phyllocnistis vitegenella*: a “snail trail” on the upper leaf surface, with the pupal chamber in a small fold at the leaf margin. One leaf with typical upper-surface mines was also found to have a mine on the lower surface, with the frass partially in a distinct central line (Gavins 2024).

Distribution. Australia (New South Wales and Queensland).

Notes. This is one of 24 new Australian *Phyllocnistis* species described in a master’s thesis (Luo 2024), but there are currently no plans to pursue formal publication, and the proposed names are not available (Y. Luo in litt., May 2026).

Discussion

Considering only wing patterns, genitalia, and pupal morphology, it would be reasonable to conclude that the *Phyllocnistis vitegenella* complex represents a single species. Our investigation has shown that differences in larval color, host plant, and leaf mine characteristics such as depth (and resulting color/distinctness), position on the leaf (upper vs. lower surface), frass pattern, and pupation site are important in distinguishing species in this group. Based on the characteristics of *Phyllocnistis* leaf mines occurring on Vitaceae in North America, we hypothesized that all three previously named species, plus one until now unnamed, are distinct entities, each occurring on two or more host genera. Since morphology of the insects themselves provided little support for

these species concepts, DNA barcoding proved to be critical for validating them. The barcode of each species differs from those of the others by at least 3.5%. *Phyllocnistis vitifoliella* is represented by a single BIN. This is also true of *P. vitegenella*, although no barcode has yet been obtained from a western specimen of this species. Our own material of *P. occidentalis* likewise belongs to a single BIN; we have also assigned to this species a second BIN that differs by 1.76%, but this identification should be considered tentative until leaf mines can be associated with this barcode. Our assessment based on leaf mine characteristics and DNA barcodes is that *P. vitegenella*, *P. vitifoliella*, and *P. occidentalis* each feed on both *Parthenocissus* and *Vitis* species, with the first two also occurring on *Ampelopsis*. The situation with *P. ampelopsiella* is more complex. Our specimen collected from *Parthenocissus* in Vermont matched a BIN that is otherwise represented only by Canadian specimens, while our specimens collected from *Nekemias* in Alabama and from *Ampelopsis* in Mississippi belong to other BINs that differ by 2.06% and 2.21%, respectively. Further sampling from lower-surface mines on these hosts is needed to assess whether what we refer to as *P. ampelopsiella* is itself a species complex. As discussed above, another three BINs close to that of *P. ampelopsiella* are known from the eastern USA. One of these belongs to an undescribed species feeding on *Eubotrys* (Ericaceae), and hosts for the other two remain to be determined, but clearly cannot be assumed to be vitaceous. The *P. vitegenella* complex also includes the Altingiaceae leafminer *P. liquidambarisella* as well as unknown Costa Rican species assigned to three different BINs, which together form a cluster with *P. vitegenella* (Fig. 114). The leaf mines resembling those of *P. vitifoliella* found on grape in southern Mexico (annieliveoak 2023; TeamTzibim 2026) warrant further investigation, and in Mexico and Central America species of *Ampelocissus*, *Apocissus*, and *Cissus* should be searched for *Phyllocnistis* mines.

A similar barcoding study is needed in Asia, where *P. toparcha* (described from India) and *P. vitella* (described from eastern Russia) form apparently indistinguishable leaf mines on *Vitis* and are doubtfully distinct based on adult morphology. So far just two barcodes have been obtained from Asian Vitaceae feeders, and they provide evidence that a species forming narrow mines on *Ampelopsis* is distinct from one forming wider mines on *Parthenocissus*, but both of these are from Japan, and it is possible that neither is conspecific with Indian *P. toparcha*. Meanwhile, the leaf mine characteristics of the Javan *P. temperator* are completely unknown. Given that 18 genera of Vitaceae are native to Asia, there may be many additional *Phyllocnistis* species—or at least host associations—remaining to be discovered. Mines on (or adults reared from) five of these genera have been attributed to *P. toparcha*, but DNA barcodes should be obtained from *Vitis*-associated populations in India and compared with those from other hosts and localities to evaluate these identifications.

In Africa, our observations of leaf mines indicate there are at least two, and perhaps three, *Phyllocnistis* species on Vitaceae, but so far there are neither barcodes nor adult specimens associated with these. Mines have been found on two of the six Vitaceae genera native to the continent. A single undescribed Vitaceae-feeding *Phyllocnistis* species is known from Australia, where eight Vitaceae genera are native. None are yet known from South America, where four genera are native. Leaf mine surveys targeting vitaceous plants on these continents may prove fruitful.

Phylogeny. The Maximum Likelihood tree (Fig. 114) gives some indications of the relative phylogenetic position of the Vitaceae miners based on the partial COI sequence. The bootstrap values are generally low, and many groupings are not supported at all. The *P. vitegenella* complex forms a monophyletic group, not only including all Nearctic Vitaceae feeders, but also *P. liquidambarisella*, an unnamed species feeding on *Eubotrys*, and unknown entities potentially using other hosts. The species feeding on *Populus* form the sister group (as might be expected based on the similar wing pattern), but without bootstrap support.

Interestingly, the Asian barcodes do not group with the North American Vitaceae-feeding species, but with Asian species feeding on Cornaceae. A similar phenomenon may occur in North America; T.S. Feldman has reared adults externally consistent with the *P. vitegenella* complex from *Cornus amomum* Mill. in North Carolina. The mines are like those of *P. vitegenella*, but the pupal chambers are not in folds at the leaf margin (Feldman 2023; Eiseman 2025b). Coincidentally, species of the genus *Antispila* (Heliozelidae) also have hosts mainly in Vitaceae and Cornaceae, in both the Nearctic and Palearctic (van Nieukerken and Eiseman 2020). Also the Salicaceae-feeding *Phyllocnistis* species do not form a monophylum, but at least three clusters, with the *Populus* and *Salix* feeders forming separate clusters. Two Sapotaceae-feeding species form the earliest branches of the species in this analysis. Data for the Australian species are not available in BOLD, but Luo (2024) found that Australian

Phyllocnistis (including the undescribed species on *Apocissus*) form a well-supported monophyletic clade that is likely endemic to the continent.

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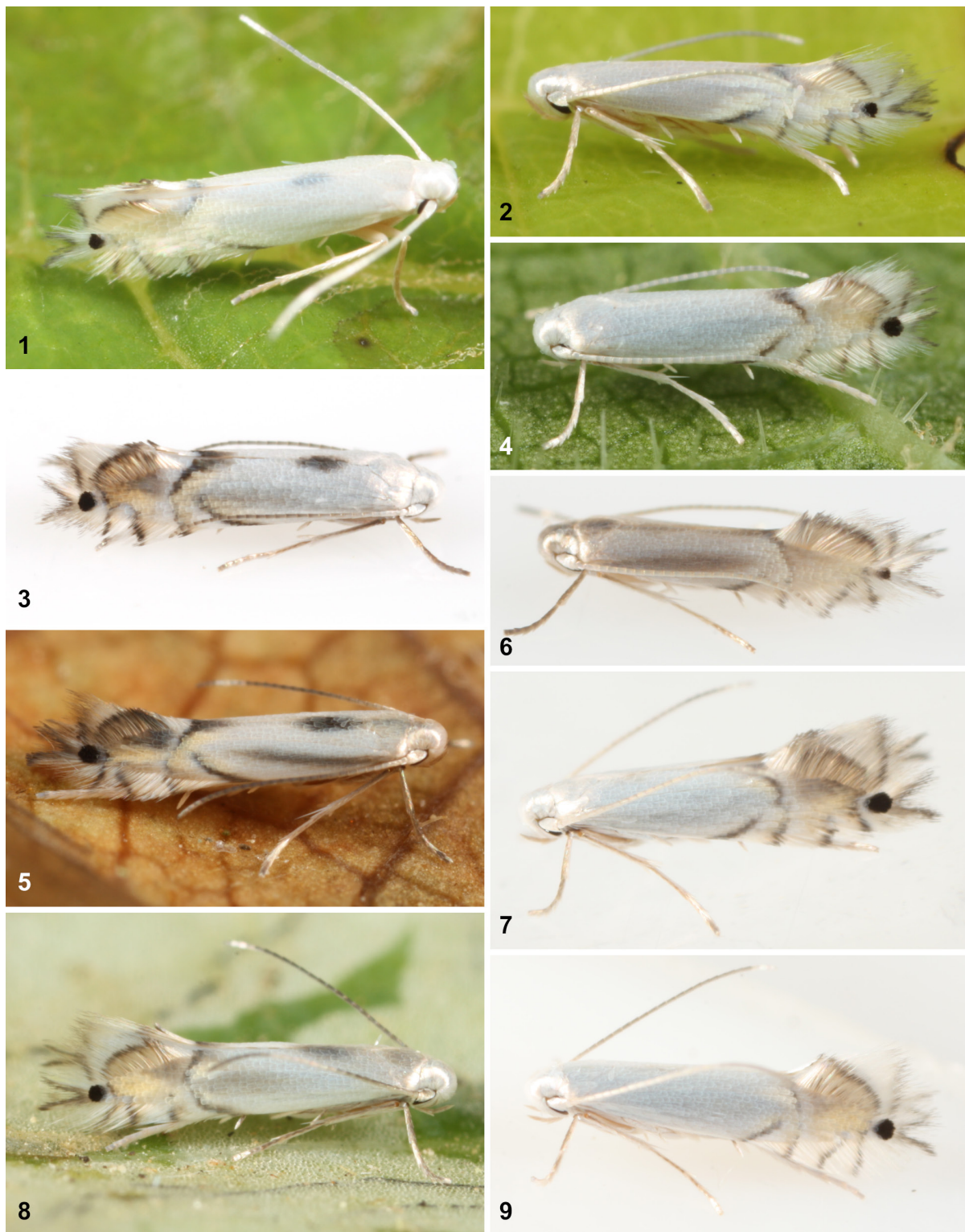
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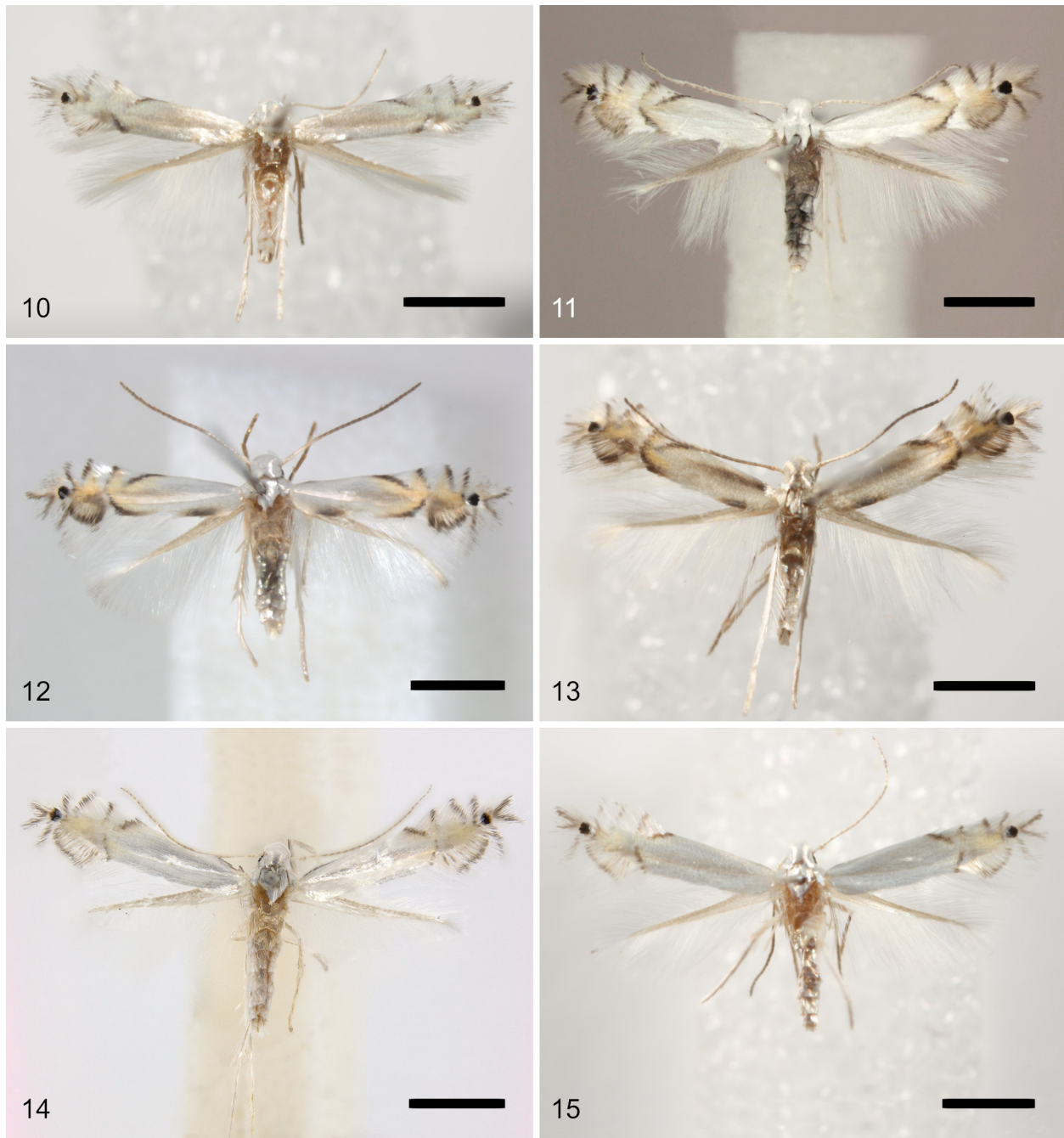
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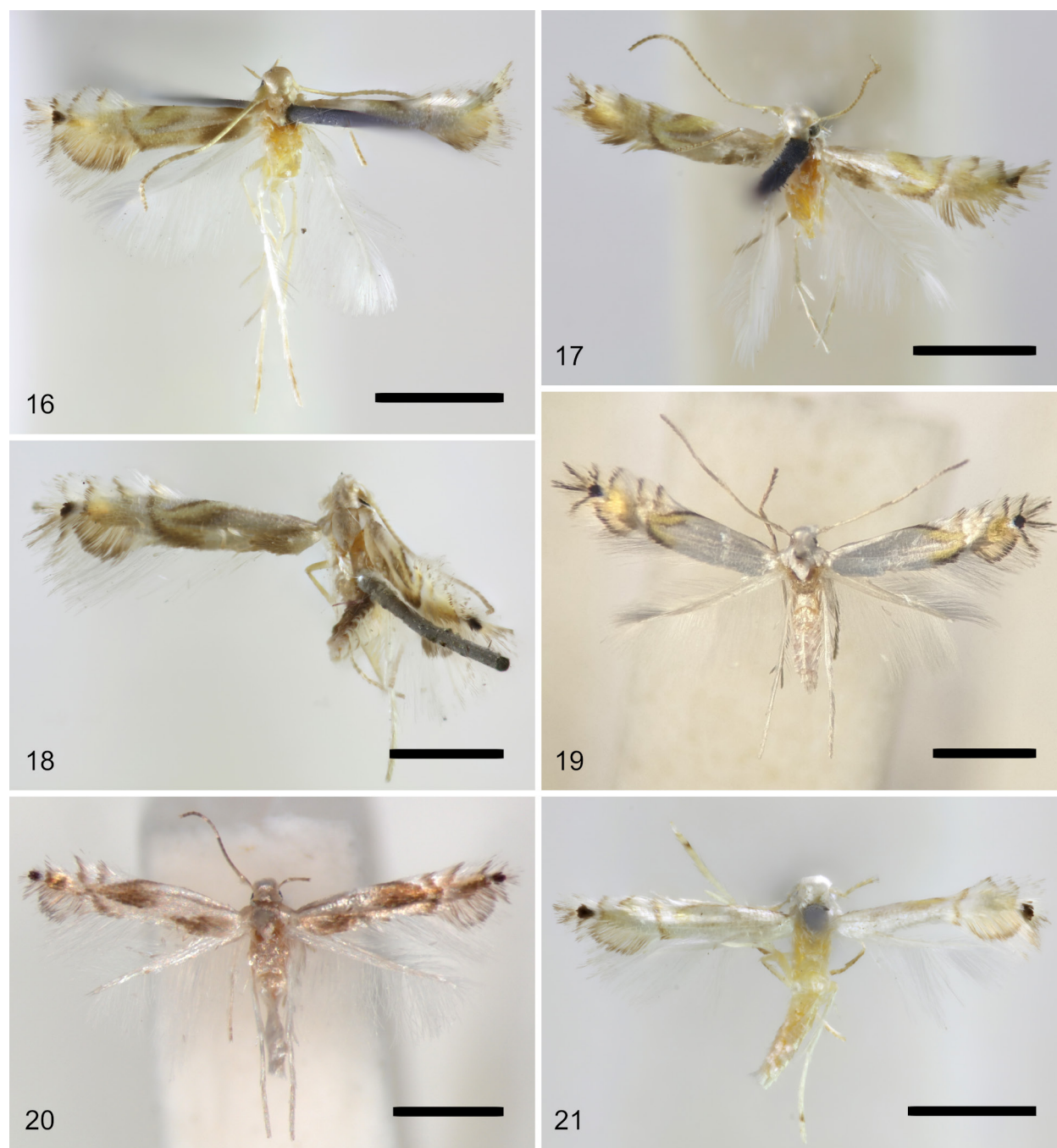
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Figures 1–9. Live adults of the *Phyllocnistis vitegenella* complex. 1) *P. vitegenella* reared from *Vitis labrusca* in Massachusetts (♂, CSE6403). 2) Same but from *V. riparia* (♀, CSE6391). 3) *P. vitifoliella* reared from *V. aestivalis* in Massachusetts (BG 877661). 4) Same but from *V. riparia* (CSE6290). 5) *P. ampelopsiella* reared from *Parthenocissus quinquefolia* in Massachusetts (♀, CSE868). 6) Same but in Florida (♂, CSE6017). 7) Same but in Ontario (♀, CSE4757). 8) *P. occidentalis* reared from *Parthenocissus* in Nevada (♂, CSE6509). 9) Same (CSE6564).



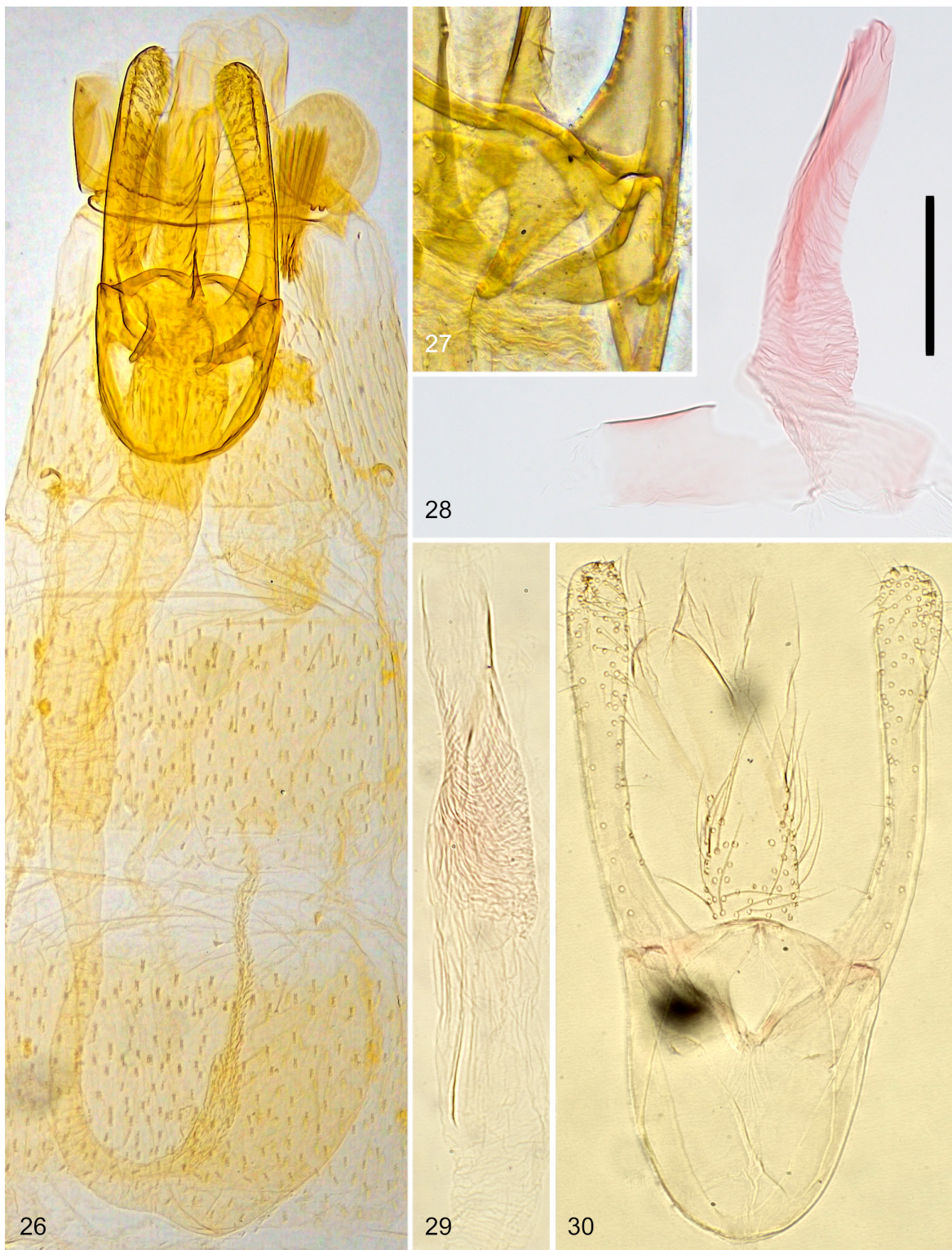
Figures 10–15. Adults of the North American Vitaceae-feeding *Phyllocnistis* species; scale bars = 1 mm. **10)** *P. vitegenella* reared from *Vitis riparia* in Massachusetts (♀, CSE9025). **11)** *P. vitifoliella* collected in Quebec (CNCLEP00027672; photo by Jean-François Landry). **12)** *P. vitifoliella* reared from *V. vulpina* in Mississippi (♂, RMNH.INS.544311; photo by Camiel Doorenweerd). **13)** *P. ampelopsiella* reared from *Parthenocissus* in Rhode Island (♀, CSE6588). **14)** *P. occidentalis* reared from *V. arizonica* in Arizona (paratype, USNMENT01736095; photo by CBG Photography Group). **15)** *P. occidentalis* reared from *Parthenocissus* in Nevada (holotype ♂, CSE6541).



Figures 16–21. Adults of the Asian Vitaceae-feeding *Phyllocnistis* species; scale bars = 1 mm. **16)** *P. toparcha* reared from *Vitis* in India (holotype ♂, BMNH(E) 1480633). **17)** Same (“paratype”, BMNH(E) 1411973). **18)** *P. toparcha* collected as adult in Japan (*P. pachyscia* holotype ♀, BMNH(E) 1480821). **19)** *P. toparcha* reared from *Vitis coignetiae* in Japan (♀, MaS-0102), matching Ermolaev’s (1987) illustration of *P. vitella*. **20)** *P. toparcha* reared from *Parthenocissus tricuspidata* in Japan (♀, RMNH.INS.35818). **21)** *P. temperatior* reared from *Leea* (syntype ♂, BMNH(E) 1480281). Photos in Fig. 16–18 and 21 by David Lees, © 2025 Trustees of NHMUK; Fig. 19 photo by Masayasu Sawada.



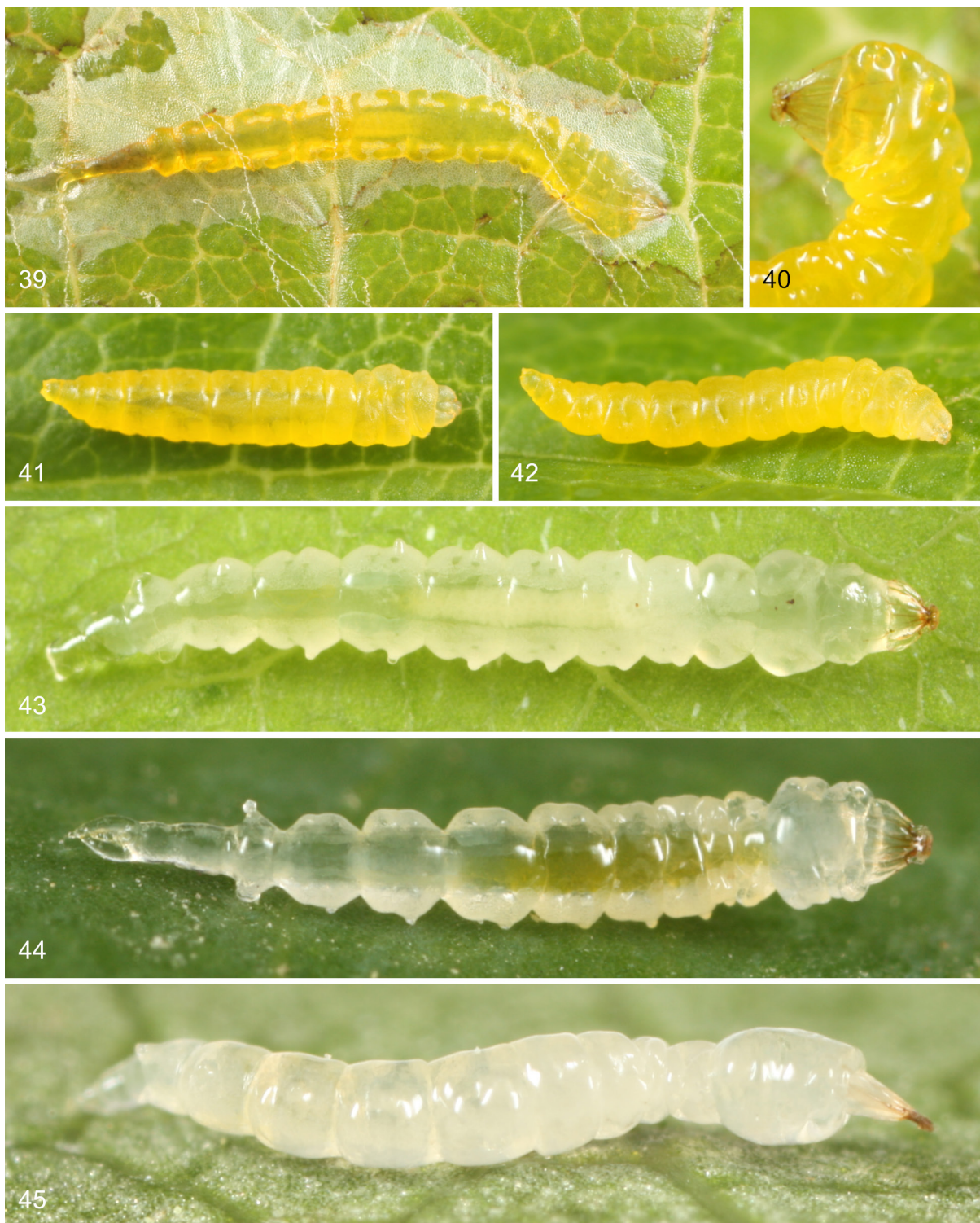
Figures 22–25. Male genitalia of the *Phyllocnistis vitigenella* complex; all images are at the same magnification. **22)** *P. vitigenella* reared from *Vitis labrusca* in Massachusetts (CSE1325, slide CE-2025-51). **23)** *P. vitifoliella* reared from *V. riparia* in Massachusetts (CSE6290, slide CE-2025-50). **24)** *P. ampelopsiella* reared from *Parthenocissus quinquefolia* in Massachusetts (CSE893, slide CE-2025-52). **25)** *P. occidentalis* reared from *V. vinifera* ‘Sangiovese’ in Washington (CSE6610, slide CE-2025-53).



Figures 26–30. *Phyllocnistis* male genitalia. **26)** *P. occidentalis* reared from *V. vinifera* ‘Sangiovese’ in Washington; complete genitalia, with phallobase extending to bottom of photo (CSE6610, slide CE-2025-53). **27)** *P. occidentalis* reared from *Parthenocissus* in Nevada; base of right valva in ventral view (CSE6536, slide CE-2025-49). **28)** *P. vitifoliella*, reared from *V. vulpina* in Mississippi; phallus (RMNH.INS.544311, slide CDGP0224; scale bar = 100 μ m). **29)** *P. toparcha*, reared from *Parthenocissus tricuspidata* in Japan; phallus (slide PII-10; photo by Masayasu Sawada). **30)** Same; genital capsule in ventral view.



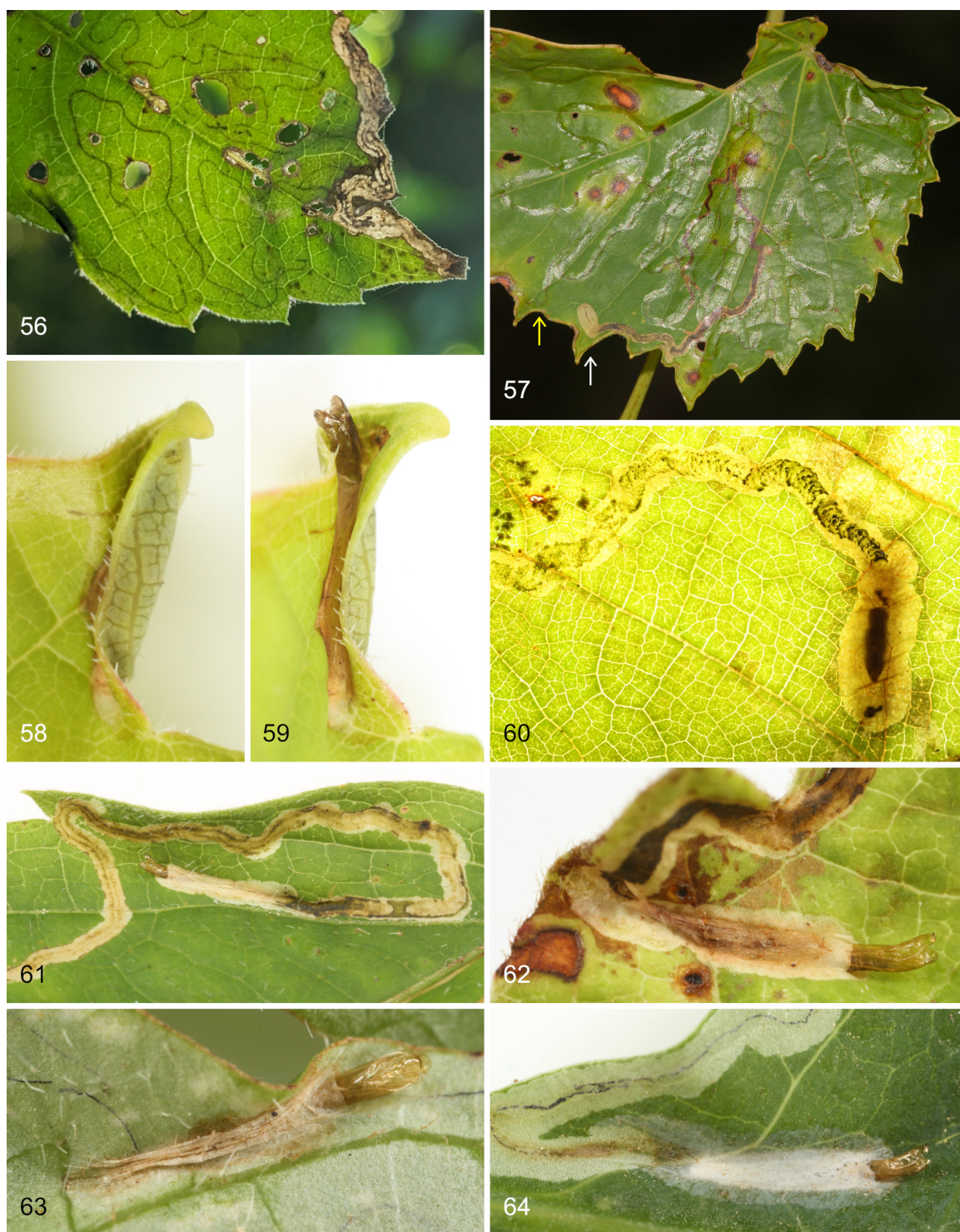
Figures 31–38. Female genitalia of the *Phyllocnistis vitegenella* complex: posterior abdominal segments (Fig. 31–34) and corpus bursae (Fig. 35–38; same slides as previous); all images are at the same magnification. **31)** *P. vitegenella* reared from *Vitis labrusca* in Massachusetts (CSE1325, slide CE-2025-58). **32)** *P. vitifoliella* reared from *V. riparia* in Massachusetts (CSE6290, slide CE-2025-56). **33)** *P. ampelopsiella* reared from *Parthenocissus quinquefolia* in Massachusetts (CSE895, slide CE-2025-57). **34)** *P. occidentalis* reared from *Parthenocissus* in Nevada (CSE6559, slide CE-2025-55). **35)** *P. vitegenella*. **36)** *P. vitifoliella*. **37)** *P. ampelopsiella*. **38)** *P. occidentalis*.



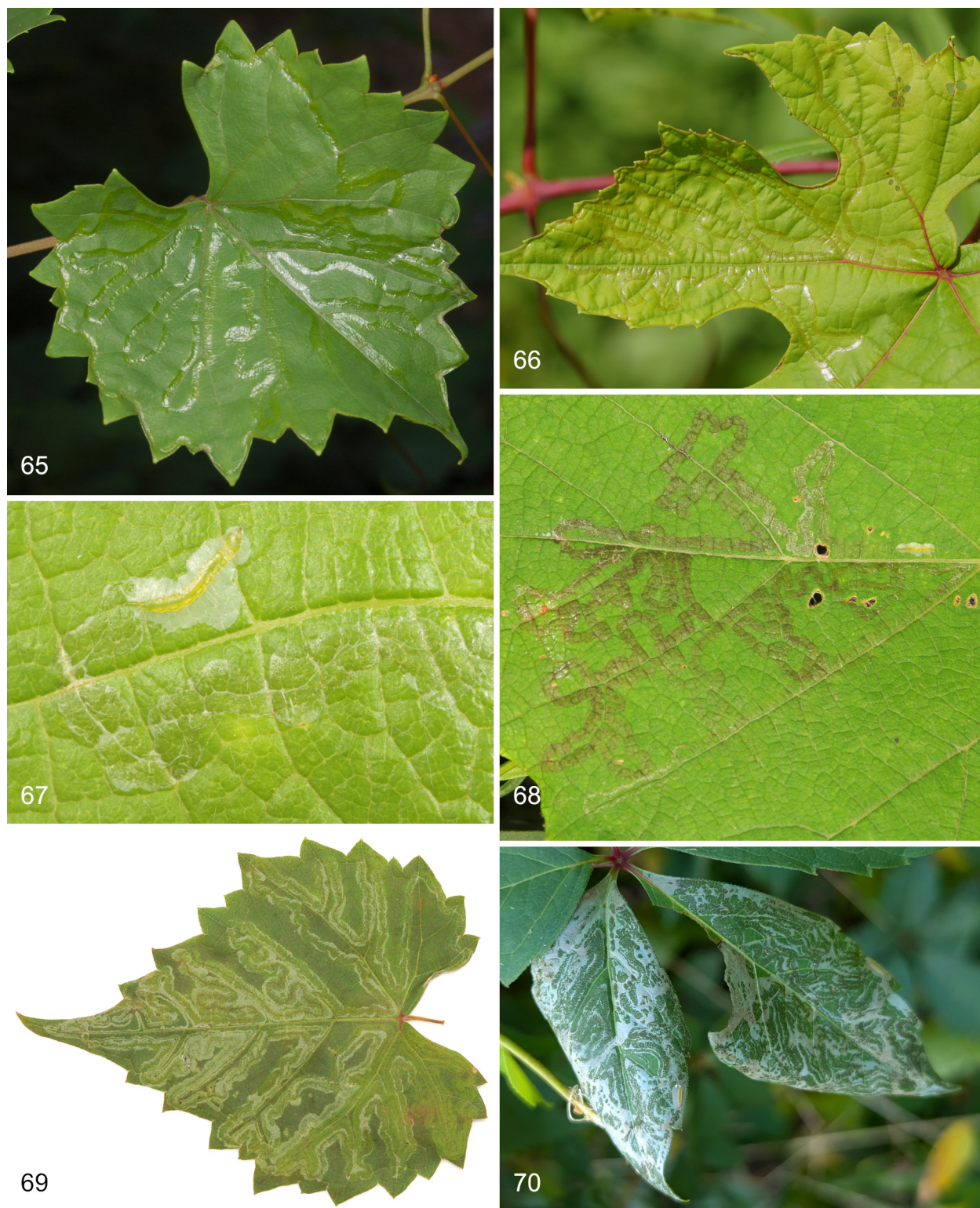
Figures 39–45. Larvae of the *Phyllocnistis vitegenella* complex; all are sap-feeding instars except Fig. 41–42. **39)** *P. vitegenella* ex *Vitis labrusca* in Massachusetts (CSE6364), dorsal view through epidermis of leaf mine. **40)** Same, removed from mine, detail of head and thorax. **41)** *P. vitegenella* ex *V. riparia* in Massachusetts (CSE6343), final, spinning instar, dorsal view. **42)** Same, dorsolateral view. **43)** *P. vitifoliella* ex *V. riparia* in Massachusetts (CSE6260), final sap-feeding instar removed from pupal chamber, dorsal view. **44)** *P. occidentalis* ex *Parthenocissus* in Nevada (CSE6516), dorsal view. **45)** Same (CSE6518), lateral view.



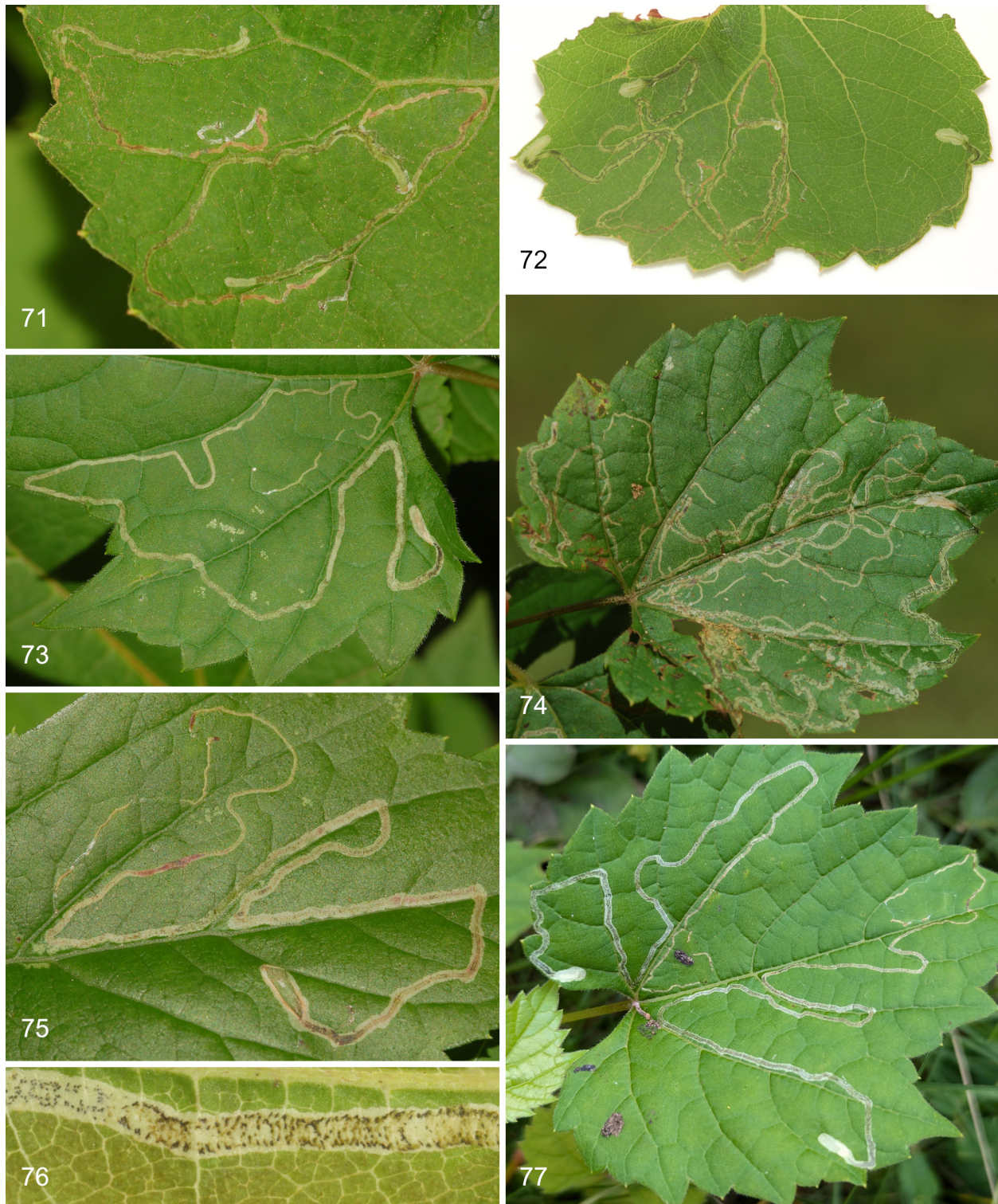
Figures 46–55. Pupae (Fig. 46–47) and pupal exuviae (Fig. 48–55) of the *Phyllocnistis vitegenella* complex. **46)** *P. vitegenella* ex *Vitis* in Pennsylvania (CSE6602). **47)** *P. ampelopsiella* ex *Parthenocissus quinquefolia* in Massachusetts. **48)** *P. vitegenella* ex *V. riparia* in Massachusetts (CSE6387). **49)** *P. vitifoliella* ex *V. aestivalis* in New York (CSE2187). **50)** *P. occidentalis* ex *V. vinifera* ‘Sangiovese’ in Washington (CSE6610). **51)** Cocoon cutter of *P. occidentalis* ex *Parthenocissus* in Nevada (CSE6532), lateral view. **52)** Cocoon cutter of *P. vitegenella* ex *V. riparia* in Massachusetts (CSE9025), ventral view. **53)** Cocoon cutter of *P. vitifoliella* (CSE2187), ventral view. **54)** Cocoon cutter of *P. ampelopsiella* ex *Parthenocissus* in Rhode Island (CSE6588), ventral view. **55)** Cocoon cutter of *P. occidentalis* (CSE6610), ventral view.



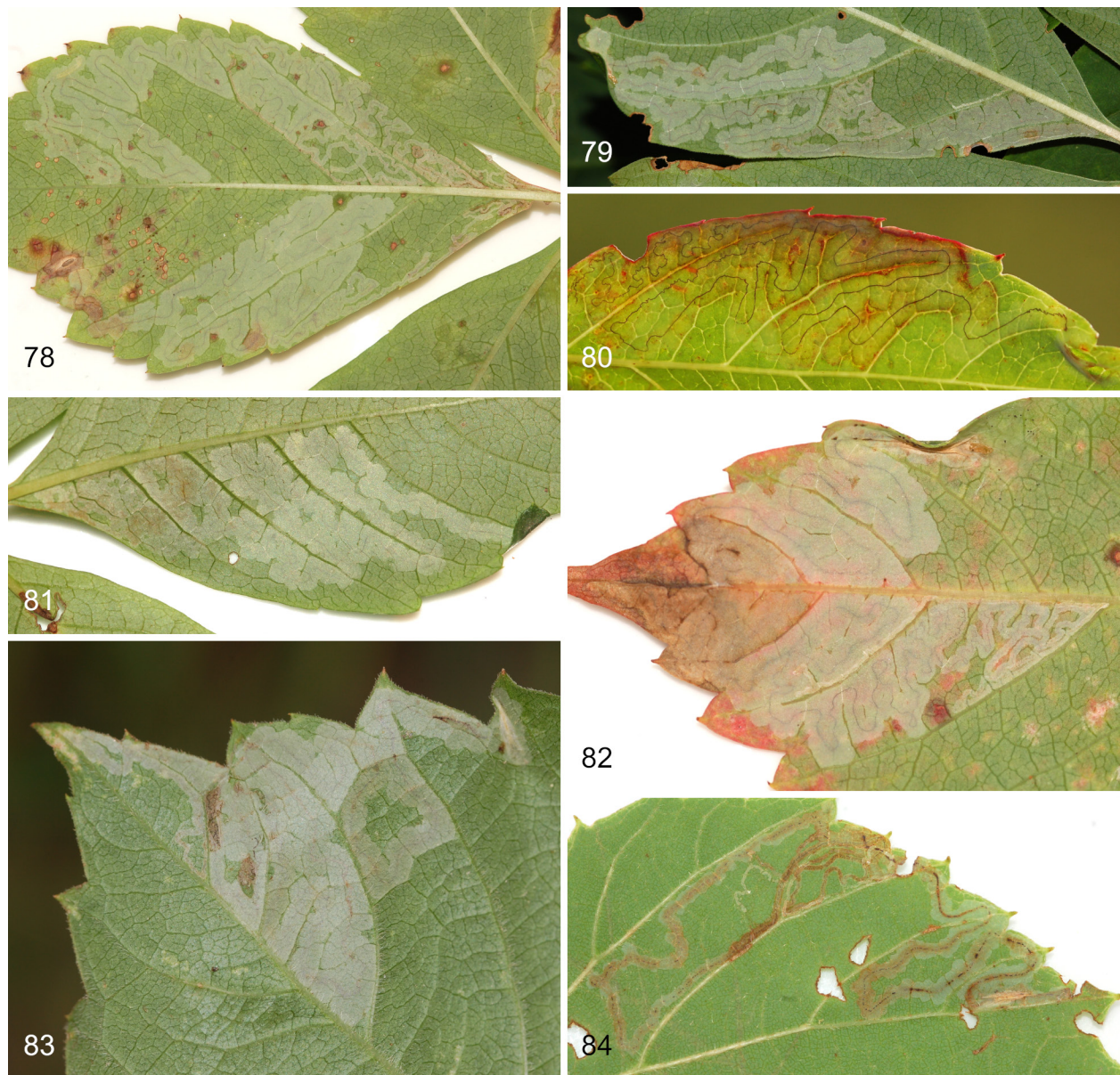
Figures 56–64. Leaf mines (Fig. 56, 57, 60, 61) and pupal chambers (Fig. 44–50). **56** Backlit *Parthenocissus* leaf with mine of *Phyllocnistis ampelopsiella* (pupal chamber at lower left); transparent mine of *Orchestomerus eisemani* at right (Ohio). **57** *Vitis* leaf with “snail trail” mine of *Ph. vitegenella* (yellow arrow) and more distinct mine of *Ph. vitifoliella* (larva at white arrow) (Ohio). **58** *Ph. vitegenella* on *V. riparia* (CSE6343, Massachusetts). **59** Same, after emergence of adult. **60** Backlit mine of *Ph. vitifoliella* on *Vitis*, with pupa of *Pnigalio* (CSE6603, CNC) in pupal chamber (Pennsylvania). **61** *Ph. vitifoliella* on *Parthenocissus quinquefolia* (CSE635, Vermont). **62** Same (CSE5402, Iowa). **63** *Ph. ampelopsiella* on *Pa. quinquefolia* (CSE6588, Rhode Island). **64** *Ph. occidentalis* on *Parthenocissus* sp. (CSE6509, Nevada).



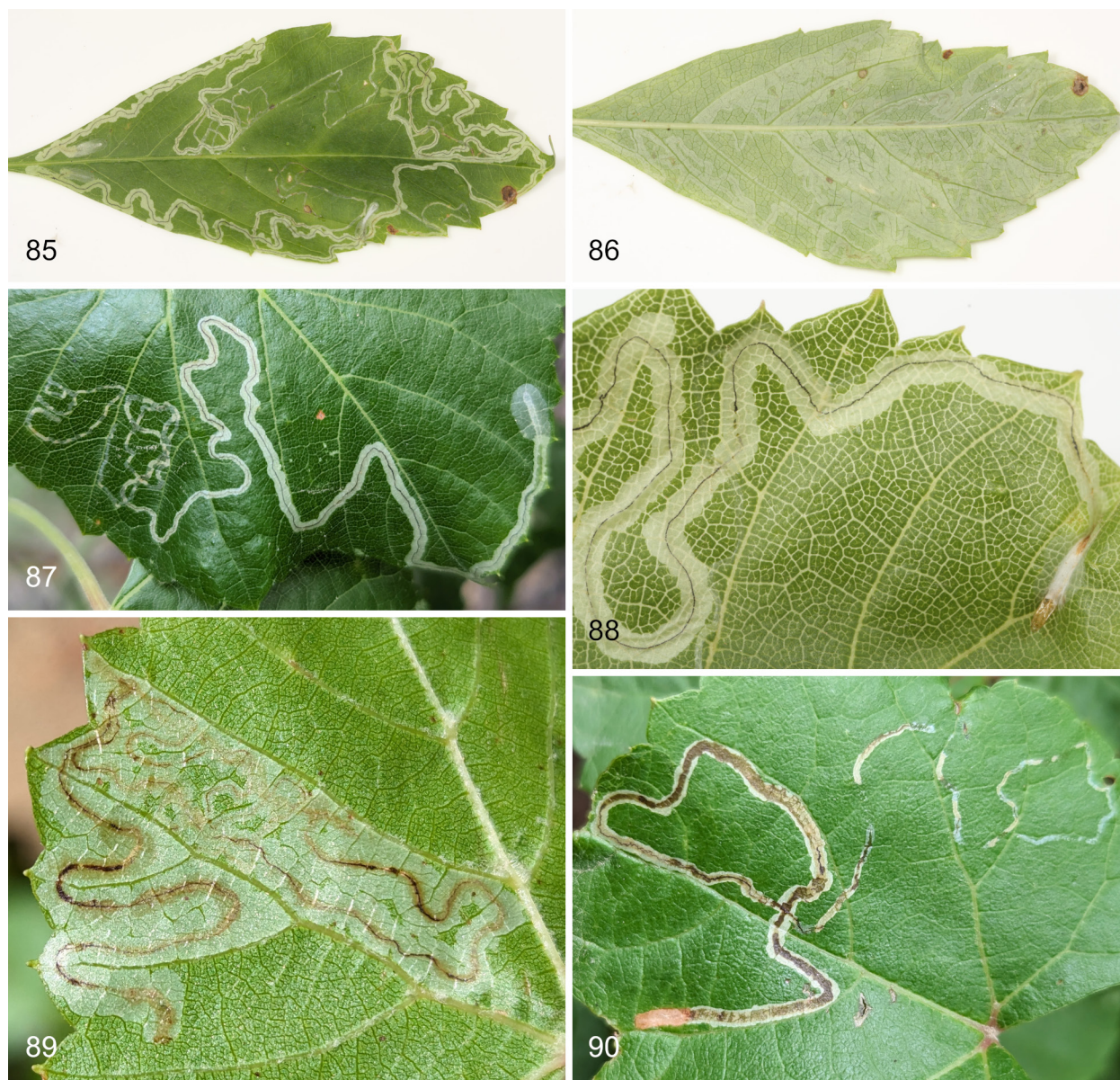
Figures 65–70. Leaf mines of *Phyllocnistis vitegenella*. **65)** On *Vitis* in North Carolina. **66)** On *V. riparia* in Massachusetts. **67)** On *V. labrusca* in Massachusetts. **68)** Same. **69)** On *Vitis* in Pennsylvania. **70)** On *Parthenocissus* in Massachusetts.



Figures 71–77. Leaf mines of *Phyllocnistis vitifoliella*. 71) Early mines of three larvae on *Vitis labrusca* in Massachusetts. 72) The same mines two days later, with larvae preparing pupal chambers. 73) On *V. aestivalis* in Massachusetts. 74) Same; multiple mines. 75) On *Parthenocissus quinquefolia* in Iowa. 76) On *V. riparia* in Massachusetts; detail of frass pattern. 77) Same; view of whole leaf, with two nearly completed mines (larvae preparing pupal chambers).



Figures 78–84. Leaf mines of *Phyllocnistis ampelopsiella*. **78)** On *Parthenocissus quinquefolia* in Massachusetts; larva at upper left. **79)** Same; vacated pupal chamber at far left. **80)** Same; transmitted light; damaged pupal chamber at lower right. **81)** Same; pupal chamber at far right. **82)** Same; vacated pupal chamber at upper right. **83)** On *P. quinquefolia* in Ontario; pupal chamber at upper right (CSE4757). **84)** On *Ampelopsis cordata* in Mississippi; pupal chamber at lower right (CSE6294).



Figures 85–90. Leaf mines of *Phyllocnistis occidentalis*. **85)** Three completed mines on upper surface of *Parthenocissus* leaflet in Nevada. **86)** Mines of additional larvae on lower surface of the same leaflet. **87)** On *Vitis arizonica* in Arizona; larva in pupal chamber at far right. **88)** Same; vacated pupal chamber at lower right (CSE8381). **89)** Same; aborted mine on lower surface. **90)** Same; mine on upper surface with unusually broad frass line, but note portion with narrow line at far left; pupal chamber at lower left.

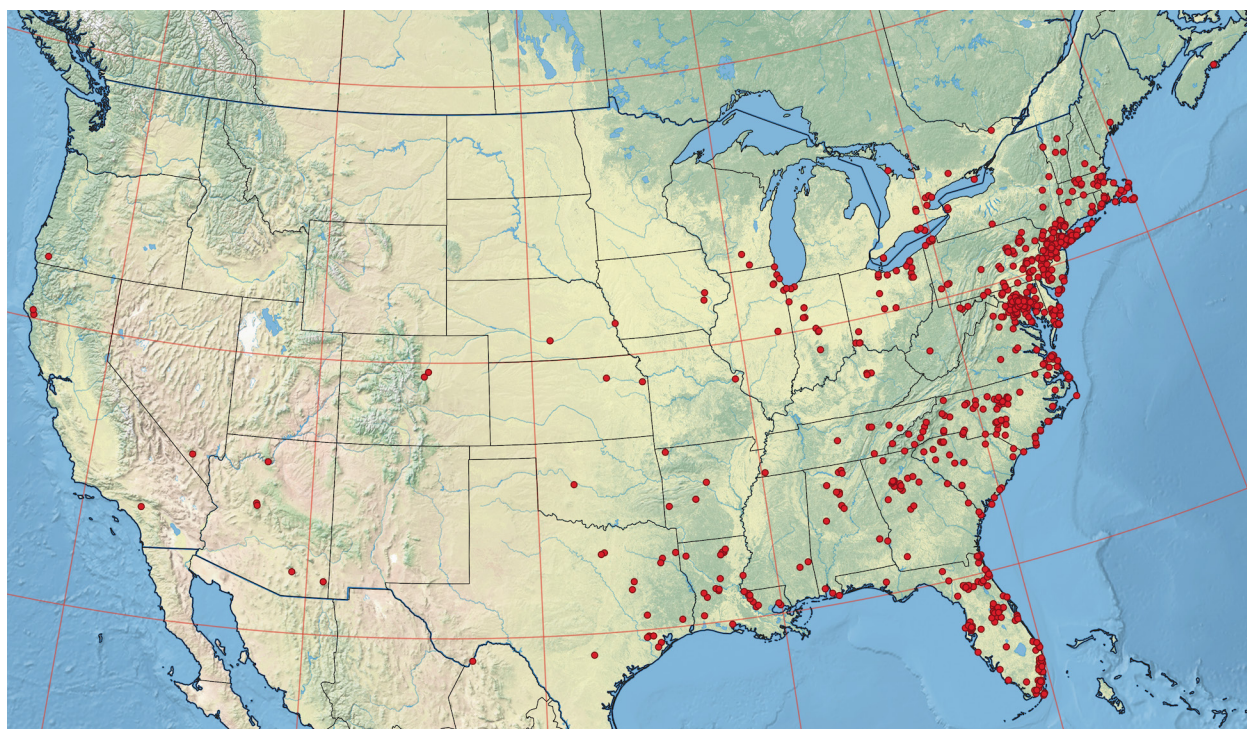


Figure 91. Distribution of *Phyllocnistis vitegenella*.

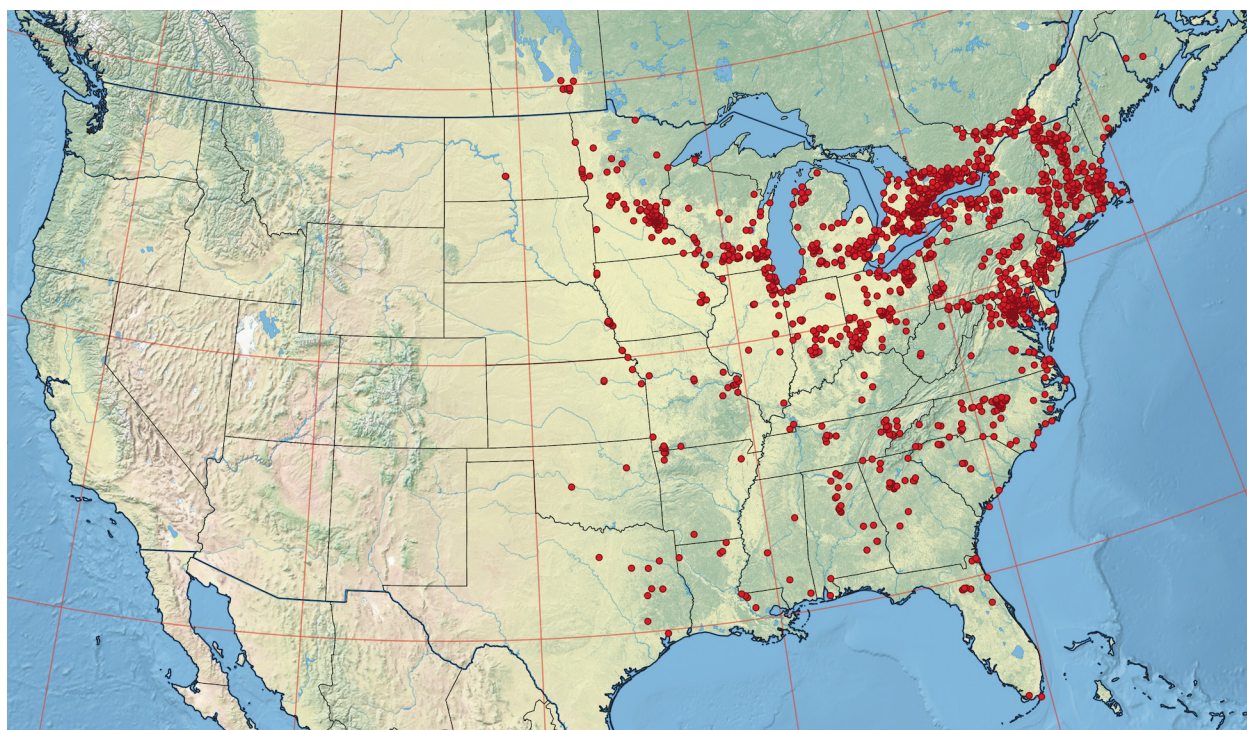


Figure 92. Native distribution of *Phyllocnistis vitifoliella*.

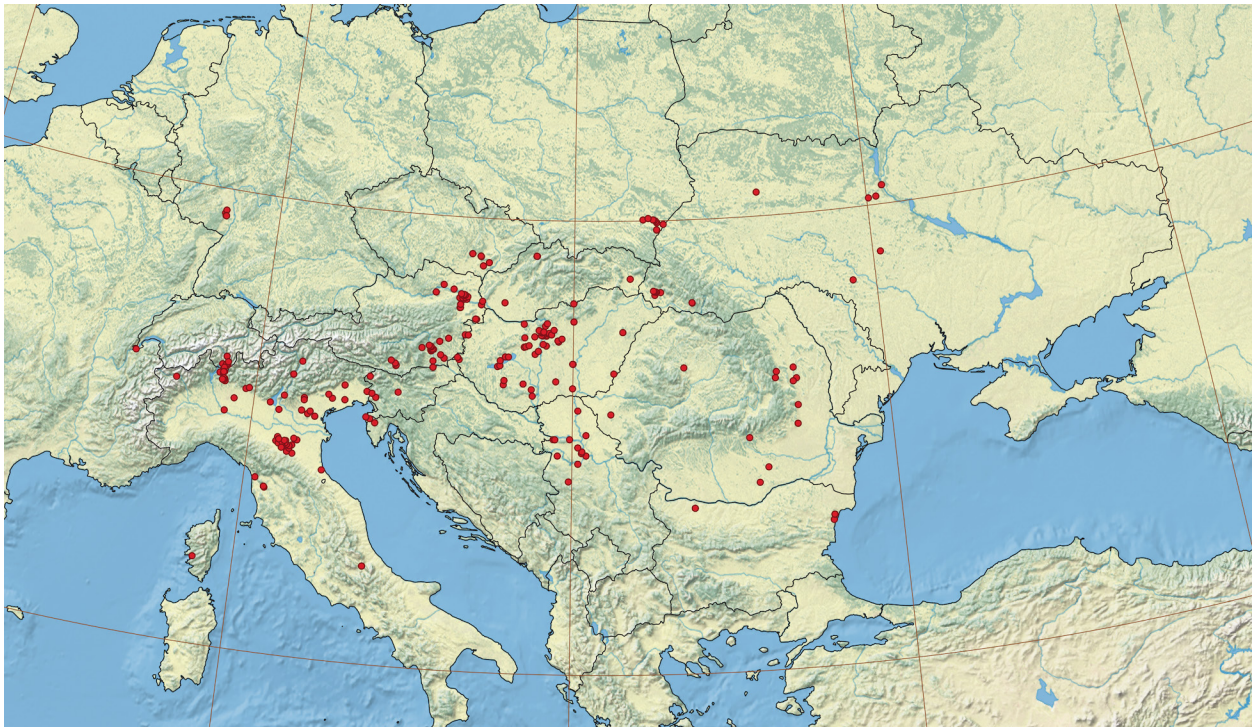


Figure 93. European distribution of *Phyllocnistis vitifoliella*.

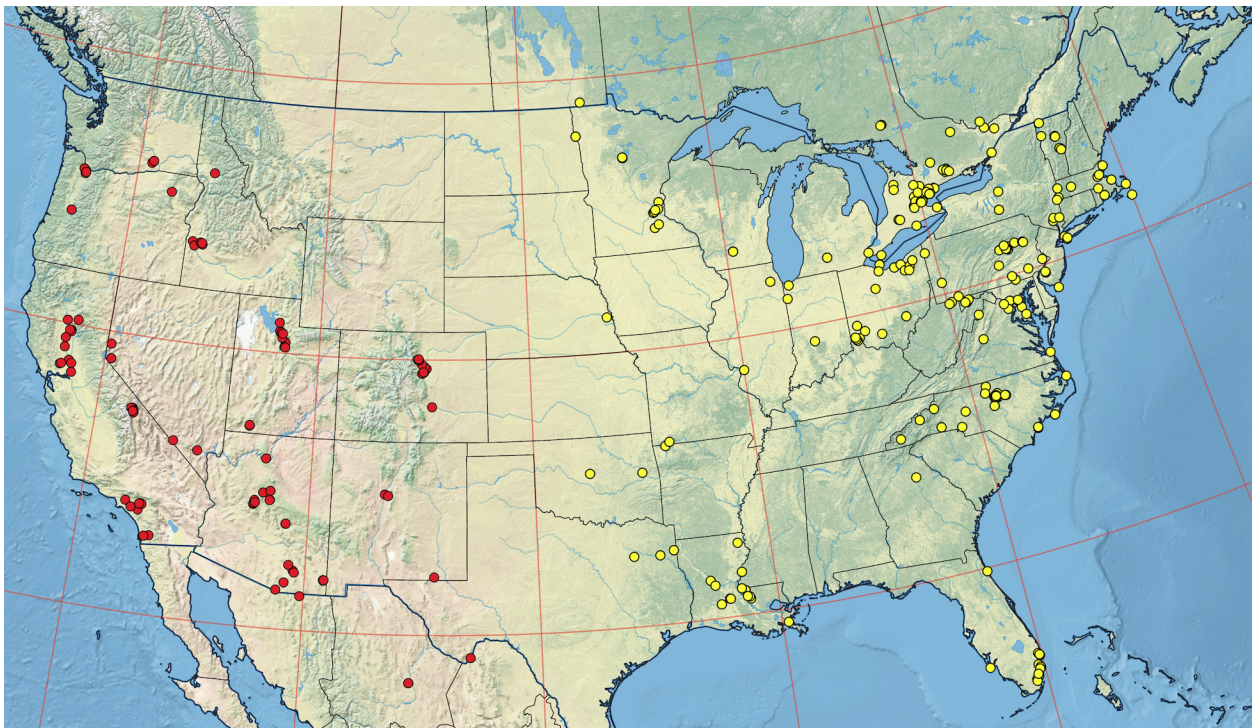
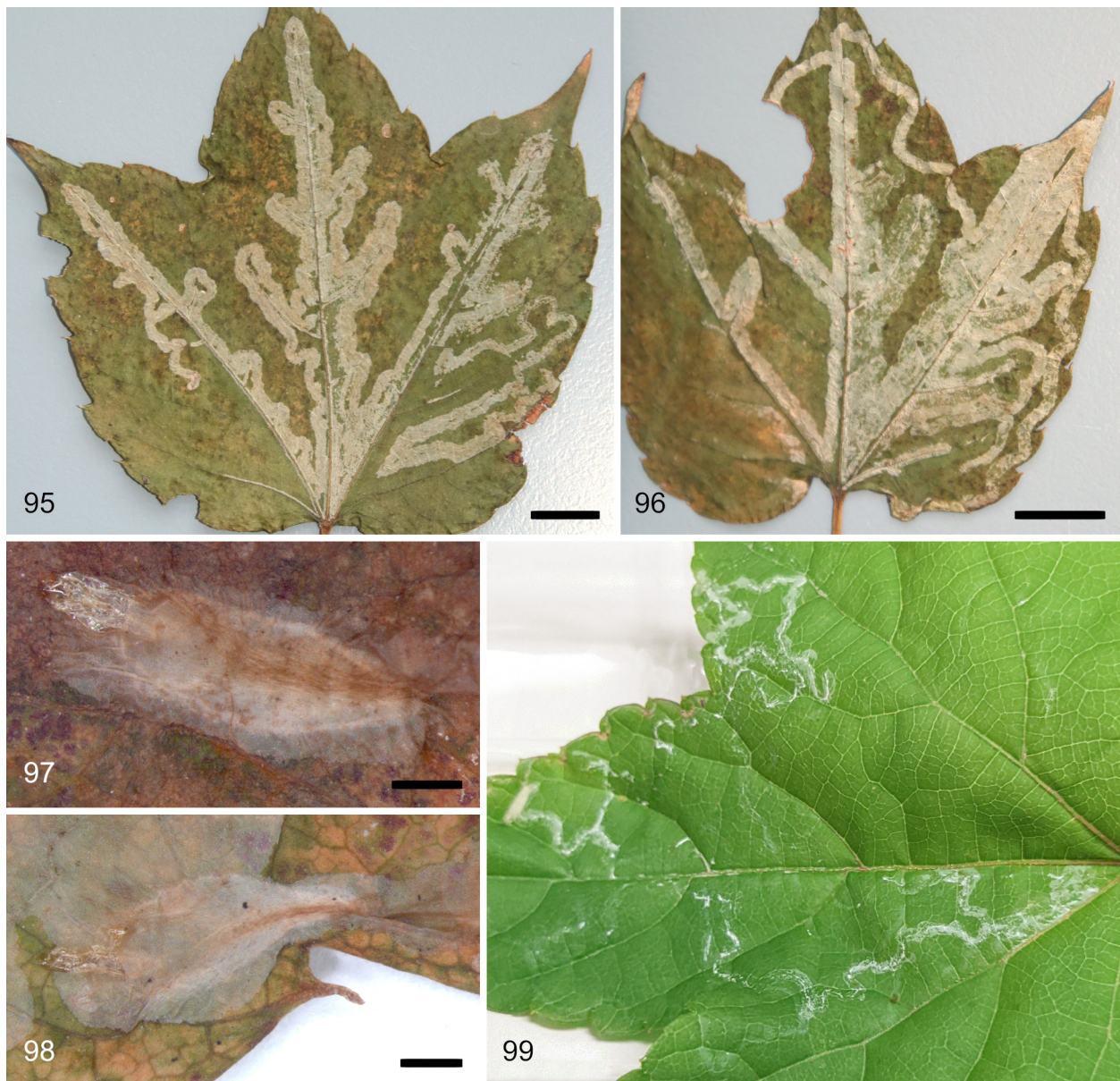
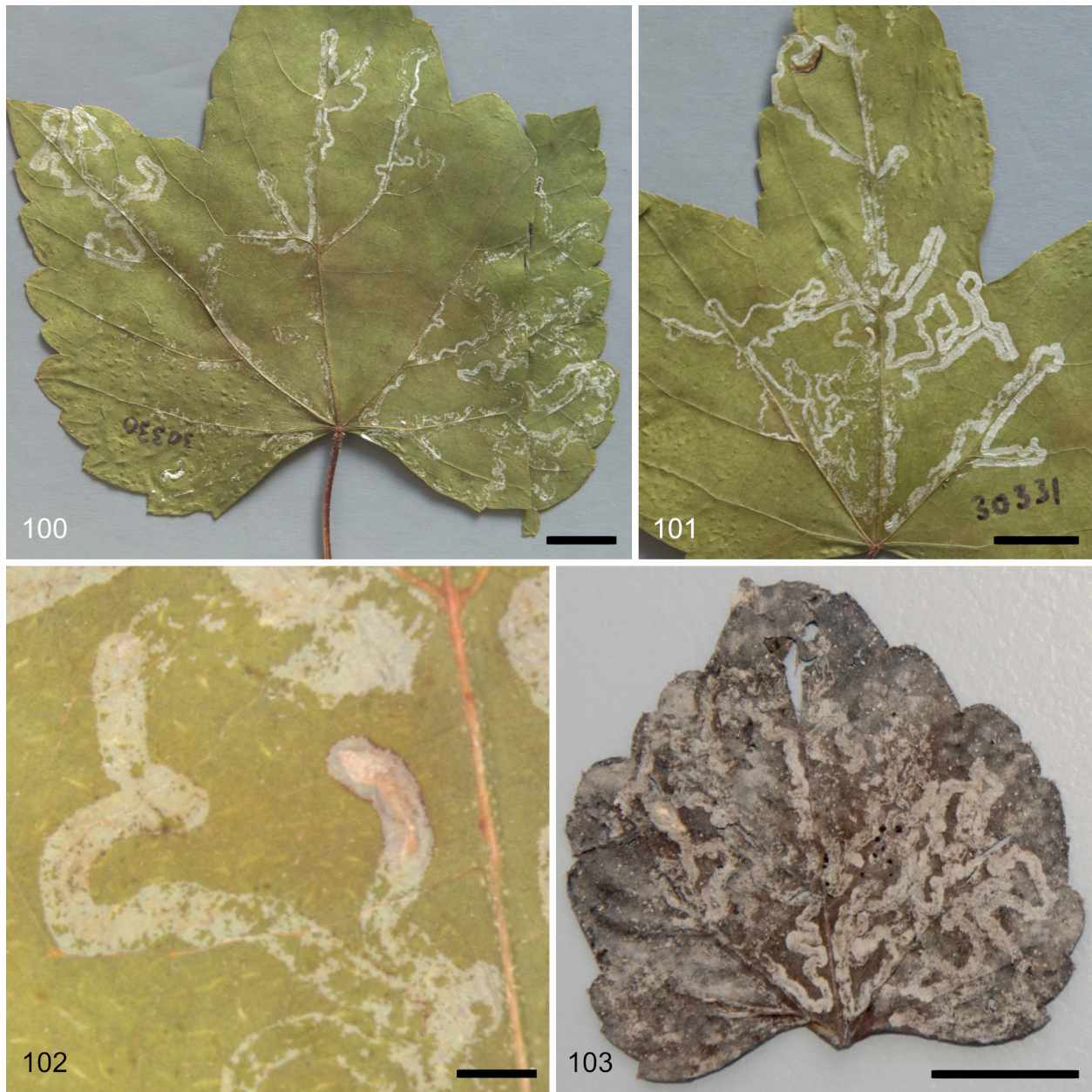


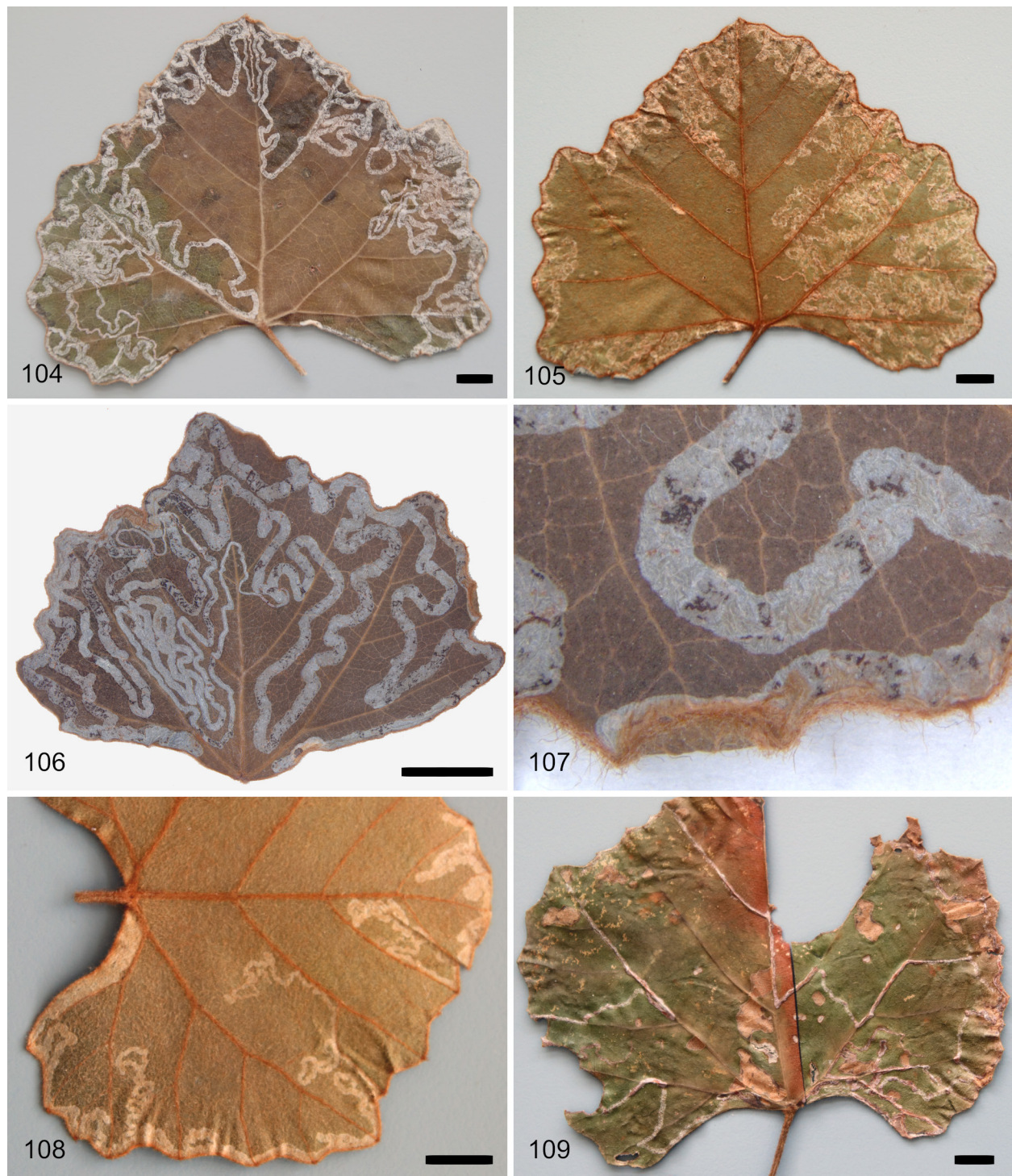
Figure 94. Distribution of *Phyllocnistis occidentalis* (red) and *P. ampelopsiella* (yellow).



Figures 95–99. Leaf mines of *Phyllocnistis toparcha* found on *Parthenocissus tricuspidata* in Japan. **95)** Preserved mine (RMNH.INS.1739368); scale bar = 1 cm. **96)** Same. **97)** Same, pupal chamber with exuviae at left (RMNH.INS.1739369); scale bar = 1 mm. **98)** Same. **99)** Fresh mine with pupal chamber at far left (photo by Masayasu Sawada).



Figures 100–103. Preserved *Phyllocnistis* leaf mines found on *Ampelopsis glandulosa* var. *brevipedunculata*. **100)** Leaf collected in Japan (RMNH.INS.1739370), from which the barcoded larva of *P.* “*AmpelopsisJapan*” was extracted (RMNH.INS.30330); scale bar = 1 cm. **101)** Same collection; parasitized larva extracted (RMNH.INS.30331); scale bar = 1 cm. **102)** Detail of middle of leaf in Fig. 101, showing larva at end of mine; scale bar = 1 mm. **103)** Leaf collected in Taiwan (RMNH.INS.49380); mine presumed to be made by the same species; scale bar = 1 cm.



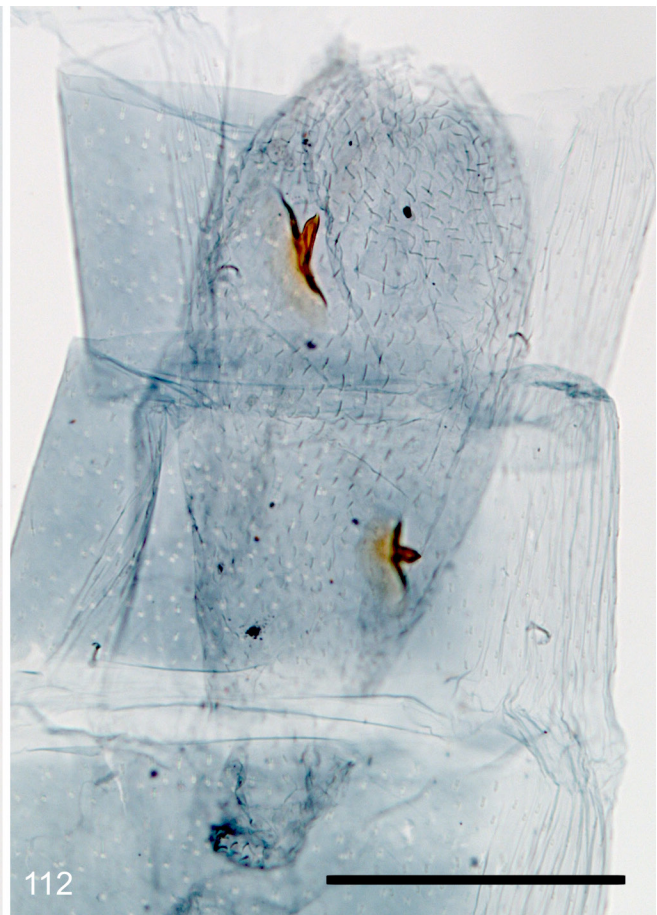
Figures 104–109. Preserved leaf mines of *Phyllocnistis* sp. “*Rhoicissus* SouthAfrica”, found on *Rhoicissus tomentosa* in South Africa. Scale bars = 1 cm. **104)** Upper surface of leaf from Western Cape (RMNH.INS.40651). **105)** Lower surface of same leaf. **106)** Upper surface of another leaf from same collection (RMNH.INS.40650). **107)** Same leaf, detail of frass and pupal chamber. **108)** Lower surface of a third leaf from same collection (RMNH.INS.40650). **109)** Upper surface of a leaf from Mpumalanga; mine possibly made by a different *Phyllocnistis* species (RMNH.INS.49014).



Figure 110. Preserved leaf mine of *Phyllocnistis* sp. “Cissus Gabon”, found on *Cissus leonardii* in Gabon (RMNH.INS.39374). Scale bar = 5 mm.



111



112

Figures 111–112. Female genitalia of *Phyllocnistis toparcha* reared from *Parthenocissus tricuspidata* in Japan (slide EvN5720); scale bars = 200 μ m. **111)** Posterior abdominal segments. **112)** Corpus bursae.

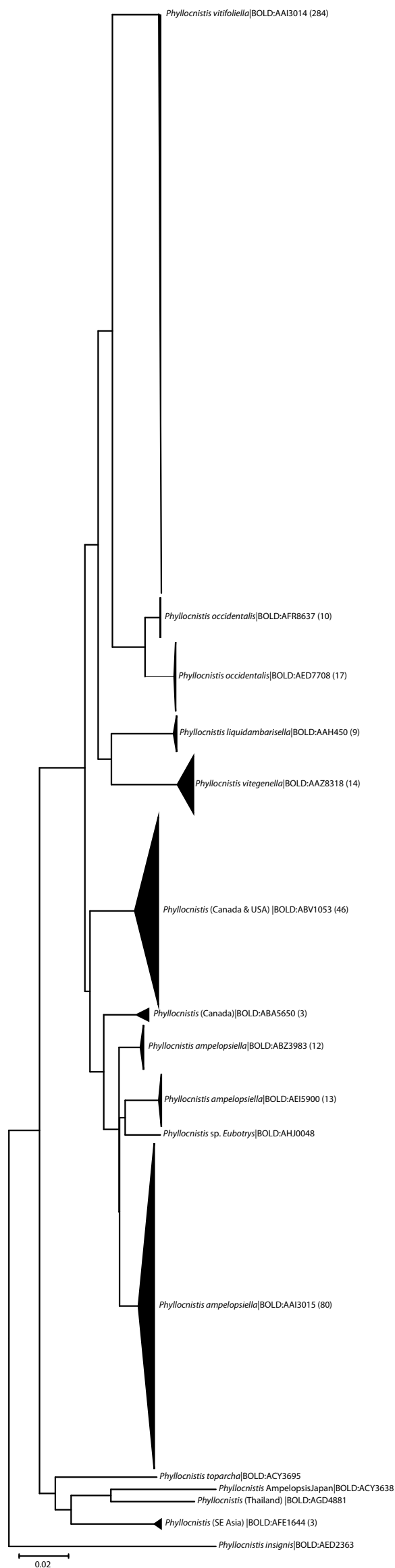


Figure 113. Neighbor Joining tree of the partial mt COI gene (DNA barcode) of the Vitaceae-feeding *Phyllocnistis* species and closest relatives, comprising 497 sequences, representing 16 BINs, made with the Pair-wise Distance Model. *Phyllocnistis insignis* Frey and Boll is used as outgroup for rooting the tree, based on the ML analysis in Fig. 114. The numbers after the BINs are the number of sequences in each BIN. Because of its size, only the lower half of the cluster of *Phyllocnistis vitifoliella* is presented.

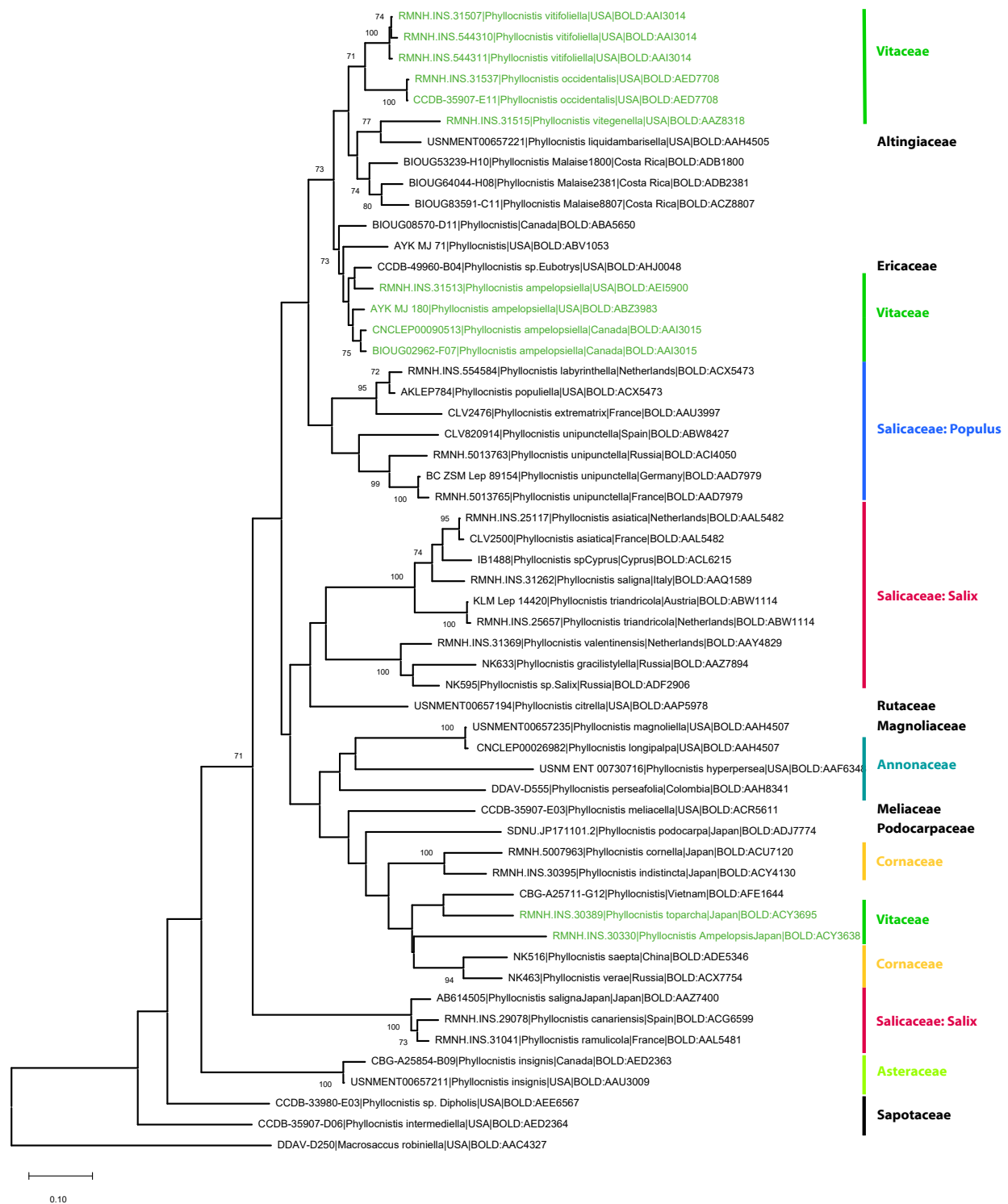


Figure 114. Maximum Likelihood tree of COI sequences (DNA barcodes) of most Holarctic species of *Phyllocnistis*. *Macrosaccus robiniella* (Clemens) (Gracillariidae: Lithocolletinae) is used as outgroup for rooting the tree. To the right the known host plant families are given. The records of Vitaceae feeders are set in green. The figures at the nodes are bootstrap values; only values over 70 are given.